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FORTESCUE METALS GROUP LTD
INVESTIGATOR PROJECT
TERRESTRIAL VERTEBRATE FAUNA ASSESSMENT

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ACRONYMS

ANOSIM	Analysis of Similarity
BoM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement
DEC	Department of Environment and Conservation (now DPaW or DER)
DEWHA	Department of Environment, Water, Heritage and the Arts
DoE	Department of the Environment
DPaW	Department of Parks and Wildlife
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DoE)
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FMG	Fortescue Metals Group Limited
IBRA	Interim Biogeographical Regionalisation of Australia
IUCN	International Union for Conservation of Nature
JAMBA	Japan-Australian Migratory Bird Agreement
MDS	Multidimensional Scaling
MM	Michaelis-Menten (richness estimator)
NHMRC	National Health and Medical Research Council
SAC	Species Accumulation Curve
UCL	Unallocated Crown Land
WAM	Western Australian Museum
WC Act	*Wildlife Conservation Act 1950*

EXECUTIVE SUMMARY

Fortescue Metals Group commissioned *ecologia* Environment to undertake a Level 2 terrestrial vertebrate fauna assessment of the Investigator study area (the study area). The study area covers approximately 5,207 ha and it is located on the southern edge of the Chichester Ranges, north of the Fortescue River and approximately 85 km north-east of Tom Price. Previous regional surverys conducted within the study area and in its close proximity were reviewed and utilised in order to establish a survey design for the Level 2 vertebrate fauna assessment, the results of which are summarised in this document.

Several databases were consulted in the preparation of potential fauna (and conservation significant fauna) lists. In addition, 30 publications reporting on vertebrate fauna surveys conducted within 100 km of the study area were consulted. The database searches and review of publications reporting on 31 vertebrate fauna surveys resulted in a total of 40 native and nine introduced mammal, 173 bird, 114 reptile, nine amphibian and seven fish species potentially occurring in the study area. Of these, 24 species are of conservation significance (10 species of mammal, 21 species of bird, six species of reptile and one species of fish).

The Level 2 vertebrate fauna survey was conducted from 20 to 30 May 2013. During the survey, a total of six trapping sites were established in three different habitat types. The minor drainage line/river/creek habitat was not trapped due to its small extent within the study area (1.06%), and narrow, linear nature. Therefore trap sites could not be established entirely within this habitat type. Trap sites established within this habitat would have overlapped adjacent habitat types. Data from sites which incorporate multiple habitat types leads to ambiguous habitat analysis and obscures comparisons among habitat types. However, the habitat targeted during opportunistic searches to enable an assessment of the fauna values of this habitat. In addition to the six trapping sites, 31 opportunistic surveys were undertaken across all habitat types, including areas not suitable for trapping due to access limitations and/or difficulties in the establishment of pit-fall traps.

Survey effort expended during the Level 2 vertebrate fauna survey included the following:

- Systematic trapping grids (pit traps, funnels, Elliott traps and cage traps) were open for 1,764 trap-nights;
- 21 hours were spent surveying for birds;
- 22 hours were spent on opportunistic diurnal searching (across 24 sites);
- Seven hours were spent on opportunistic nocturnal searching; and
- 91 hours of SM2BAT recordings were analysed to determine bat assemblage and distribution.

The following survey effort targeting conservation significant fauna was included in the above totals:

- 91 hours of bat recordings were analysed to determine the presence of Ghost Bat and Pilbara Leaf-nosed Bat species;
- Seven hours of nocturnal searches using playback to search for the Bush Stone-curlew; and
- Six hours assessing potential habitat and conducting targeted searches for signs of Northern Quoll and Pilbara Olive Python in drainage line/river/creek (minor) habitat.

The vertebrate fauna assessment identified four broad scale fauna habitats from the study area:

- Plain (alluvial);
- Plain (stony gibber);
- Tussock grassland; and

- Drainage line/river/creek (minor).

A one-way ANOSIM tests and MDS plots of the trapping sites within the different habitat types were completed for data collected systematically for both birds and trapped terrestrial fauna. The results from these statistical analyses confirm a significant difference between the faunal assemblages in the different habitat types for the birds and trapped terrestrial fauna.

Survey effort was adequate in sampling all fauna habitat types within the study area. Analysis of the observed avifauna assemblage recorded during the Level 2 vertebrate fauna assessment suggested the survey had recorded a high percentage of the expected avifauna (85%). According to the SAC, 73% of trappable fauna were captured. The timing of the survey and prevailing weather are thought to have reduced the activity of reptiles.

During the survey, a total of 18 native and three introduced mammal species, 65 bird species, 26 reptile species and one amphibian species were recorded. One species of mammal was recorded by secondary evidence only.

Four species of conservation significance were recorded during the current survey, one of which was recorded from secondary evidence. The conservation significant species recorded were:

- Short-tailed Mouse (DPaW Priority 4);
- Western Pebble-mound Mouse (DPaW Priority 4, recorded from secondary evidence only);
- Australian Bustard (DPaW Priority 4); and
- Rainbow Bee-eater (EPBC Act Migratory, WC Act Schedule 3).

Based on previous records within the local region, a further five conservation significant vertebrate species are considered to have a medium or high likelihood of occurring within the study area.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Fortescue Metals Group Limited (Fortescue) commissioned *ecologia* Environment (*ecologia*) to undertake a Level 2 terrestrial vertebrate fauna assessment of the Investigator tenements (E 47/1436, M 47/0664 – M47/0672, the study area). This assessment will assist with environmental approvals and support potential future mining operations and development in the study area. The study area covers approximately 5,207 ha and it is located on the southern edge of the Chichester Ranges, north of the Fortescue River and approximately 85 km north-east of Tom Price (Figure 1.1).

A Level 1 fauna assessment was previously undertaken in the area by Coffey (2010) to identify the location and the extent of habitat types and areas that support conservation significant species. The survey undertaken by Coffey was part of an assessment for the Solomon Rail project and only covered a portion of the current study area. This information was reviewed and utilised to establish the survey design for the Level 2 vertebrate fauna assessment, results of which are summarised in this document.

1.2 LEGISLATIVE FRAMEWORK

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

- *The Precautionary Principle*

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

- *The Principle of Intergenerational Equity*

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

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

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

In addition to these principles, projects undertaken as part of the Environmental Impact Assessment (EIA) process are required to address guidelines produced by the Environmental Protection Authority (EPA), in this case:

- Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004b);
- principles outlined in EPA Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002); and
- the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010).

Native flora and fauna in Western Australia that are formally recognised as rare, threatened with extinction, or as having high conservation value are protected at a federal level under the

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and at a state level under the Western Australian *Wildlife Conservation Act 1950* (WC Act).

The EPBC Act also considers four international agreements related to migratory species, which include the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Japan-Australian Migratory Bird Agreement, the China-Australia Migratory Bird Agreement and the Republic of Korea-Australian Migratory Bird Agreement.

The EPBC Act was developed to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance, to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources, and to promote the conservation of biodiversity. The EPBC Act includes provisions to protect native species (and in particular to prevent the extinction and promote the recovery of threatened species) and to ensure the conservation of migratory species. In addition to the principles outlined in Section 4A of the EPBC Act, Section 3A of the EPBC Act includes a principle of ecologically sustainable development dictating that decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations. Schedule 1 of the EPBC Act contains a list of species that are considered Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable and Conservation Dependent.

The Western Australian *Wildlife Conservation Act 1950* (WC Act) provides for the conservation and protection of wildlife in Western Australia. Under Section 14 of this Act, all flora and fauna within Western Australia is protected; however, the Minister may, via a notice published in the *Government Gazette*, declare a list of fauna identified as rare, likely to become extinct, or otherwise in need of special protection (Appendix A). These species are considered Threatened Fauna. The current listing was gazetted in February 2012.

In addition, the Department of Parks and Wildlife (DPaW), previously the Department of Environment and Conservation (DEC), maintains a list of specially protected fauna, which includes Threatened Fauna and Priority Fauna, ranked in order of priority for conservation management. Threatened fauna that are listed as Schedule 1 under the WC Act are further ranked by the DPaW according to their level of threat using IUCN (International Union for Conservation of Nature) Red List categories and criteria. Priority Fauna are placed into five categories. The first three Priority Fauna categories are species that have not yet been adequately surveyed to be listed under Schedule 1 or 2. Species that are adequately known and are rare but not threatened, meet IUCN criteria for Near Threatened, or that have been recently removed from the Threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Species meeting criteria for the IUCN category of Conservation Dependent are placed in Priority 5.

Definitions of conservation categories as used by the DPaW and as defined in the EPBC Act and the WC Act are provided in Appendix A.

1.3 SURVEY OBJECTIVES

FMG commissioned *ecologia* to undertake a comprehensive biological survey of the terrestrial vertebrate fauna of the study area, to contribute to the environmental approval process for the project.

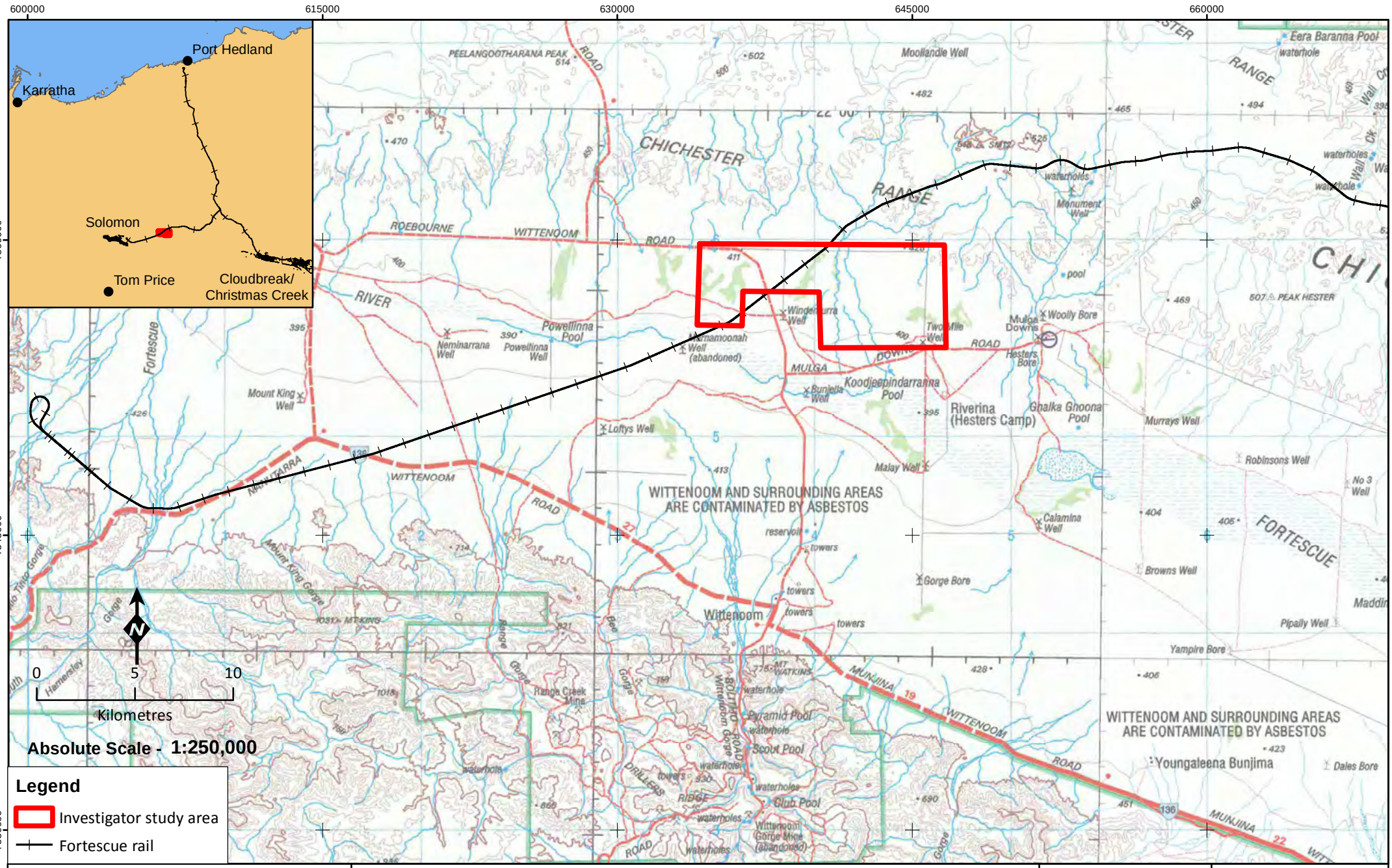
The EPA's objectives with regards to fauna management are to:

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

The aim of this study was to provide sufficient information to the EPA to assess the impact of the project on the vertebrate fauna populations that occur in the areas associated with the project, thereby enabling assessment against the relevant EPA objectives.

Specifically, the objectives were to undertake a survey that satisfies the requirements documented in *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, EPA Guidance Statement No. 56 and Position Statement No. 3, including:

- Review of background information (including literature and database searches);
- Inventory of vertebrate fauna species occurring in the study area, incorporating recent published and unpublished records;
- Discussion of the species of biological and conservation significance recorded or likely to occur within the study area and the surrounding region;
- Description of fauna habitats occurring in the study area;
- Description of the characteristics of the faunal assemblage;
- Appraisal of the current knowledge-base for the area, including a review of previous surveys conducted in the area that are relevant to the current study; and
- Review of regional and biogeographical significance, including the conservation status of species recorded or likely to occur in the study area.



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Location of the Investigator study area

Figure: 1.1
Project ID: 1518

Drawn: CK
Date: 26/09/2013

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK021

A4

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The study area is located in the Pilbara biogeographic region of Western Australia, where the climate is semi-arid to arid with two distinct seasons: a hot summer from October to April and a mild winter from May to September. Temperatures are generally high, with summer temperatures frequently exceeding 40°C. Light frosts occasionally occur inland during July and August (BoM 2013).

Rainfall is generally localised and unpredictable (some years have recorded zero rainfall), and temperatures are high, resulting in annual evaporation exceeding rainfall by as much as 500 mm per year. Most of the Pilbara has a bimodal rainfall distribution. Nearly 75% of the yearly rainfall is associated with thunderstorms and cyclonic activity between the months of December and March. Cold fronts continue to bring somewhat less rain to the region until June. Surface water can be found in some pools and springs in the Pilbara all year round, although watercourses generally flow intermittently due to the short wet season (Beard 1975).

The closest Bureau of Meteorology (BoM) weather station that is representative of the study area and documents a full set of meteorological records (including current and historical rainfall and temperatures) is Wittenoom (BoM station number 005026; 635019 mE, 75337784 mN), located approximately 15 km south from the southern section of the study area. The Wittenoom station provides climatic records dated from 1950 and provides climatic data closest to that experienced within the study area. The climate statistics for Wittenoom are summarised in Figure 2.1 (BoM 2014).

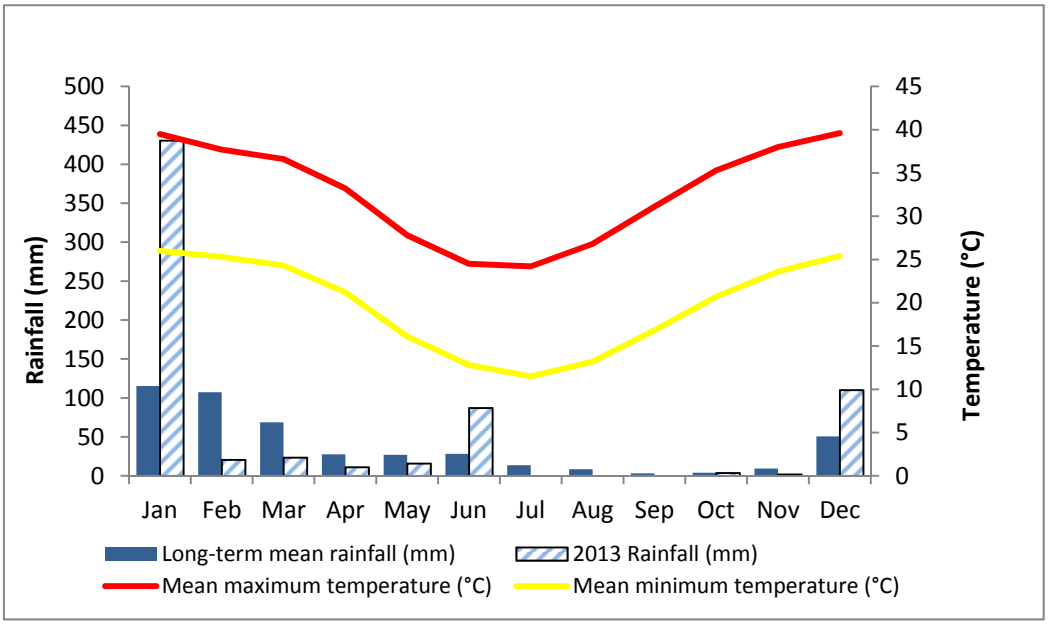


Figure 2.1 – Rainfall and temperature for the Wittenoom weather station (1950-2013, BoM 2014)

2.2 WEATHER DURING THE SURVEY

The weather conditions experienced during the fauna survey, as recorded by the Wittenoom weather station (BoM 2014), are listed in Appendix B.

The fauna assessment was conducted over a period of 11 days from 20 to 30 May 2013. The weather during this period was mild, with an average daily maximum of 26.2 °C and minimum of 15.9 °C (BoM 2014). Based on the mean climatic data (Figure 2.1), the temperatures experienced during the survey were within the normal range for that time of year.

Five millimetres of rainfall was recorded at Wittenoom weather station during the time of the survey (BoM 2014). For the three months preceding the survey (February-April 2013) Wittenoom weather station received 55.2 mm of rainfall, this is 150.8 mm below the average of 206 mm for the same period (BoM 2014). Conversely, above-average rainfall of 316.9 mm was recorded for the month of January. Rainfall dramatically influences the population dynamics of fauna through the increase or decrease in vegetation cover (Dickman *et al.* 1999a) and availability of resources (Dickman *et al.* 1999b; Masters 1993).

2.3 BIOGEOGRAPHY

The Interim Biogeographical Regionalisation for Australia (IBRA) classifies the Australian continent into regions (bioregions) of similar geology, landform, vegetation, fauna and climate characteristics (DSEWPaC 2013). Biogeographic regions each reflect a unifying set of major environmental influences which shape the occurrence of flora and fauna and their interaction with the physical environment across Australia. According to IBRA (version 7), the study area is located in the Pilbara bioregion.

Dominant limiting factors and constraints for the Pilbara bioregion listed by Thackway and Creswell (1995) include extinction of critical weight range animals, wildfire, feral animals, weeds and grazing or pastoral activities. The reservation status of the bioregion is 1-5%, which is relatively low (some bioregions have greater than 10% reservation status).

With an area of 179,287 km², the Pilbara bioregion is in the largest area class. Other bioregions vary from 2,372 to 423,751 km², most being between 14,000 and 200,000 km². The size of the Pilbara bioregion is fairly typical of bioregions situated in remote arid and semi-arid areas (Thackway and Cresswell 1995). The Pilbara bioregion is further divided into the Chichester, Fortescue Plains, Hamersley and Roebourne subregions.

The majority of the study area (99.6%) is contained within the Fortescue Plains subregion (PIL2), the remaining 0.4% lies within the Chichester subregion (PIL1) (Figure 2.2). The Fortescue Plains subregion covers approximately 11% of the Pilbara bioregion (Kendrick 2001). Dominant land uses for this subregion include native pasture grazing, UCL (Unallocated Crown Land) and Crown reserves, conservation and Aboriginal land lease (Kendrick 2001). The area is characterised by alluvial plains and river frontage with deeply incised gorge systems in the western margins and represents the northern extent of Mulga (Kendrick 2001). The Chichester subregion is the largest of the Pilbara subregions. It is characterised by undulating archaean granite and basalt plains with significant areas of basalt ranges (Kendrick and McKenzie 2001).

2.4 LAND SYSTEMS

Land systems are described using the biophysical characteristics of geology, landforms, vegetation and soils (van Vreeswyk *et al.* 2004). van Vreeswyk *et al.* (2004) undertook a regional inventory of the Pilbara region to document land systems present and the condition of each. The area surveyed by van Vreeswyk *et al.* (2004) covered 181,723 km², bounded by the Indian Ocean and Roebourne Plains to the north and west, extending to Broome in the north-east and the Ashburton River catchment in the south.

The study area contains six of the land systems mapped by van Vreeswyk *et al.* (2004). The land systems forming the largest proportion of the study area are Jurrawarrina (37.6%), Hooley (33.6%) and Jamindie (21.1%). The Jurrawarrina and Jamindie land systems are similar, characterised as hardpan plains supporting mulga shrublands with tussock and spinifex grasses (van Vreeswyk *et al.* 2004). The Hooley land system is described as alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands (van Vreeswyk *et al.* 2004). Other land systems of the study area include McKay (5.8%), Boolgeeda (1.2%) and Newman (0.4%) all of which typically consist of

shrublands and/or tussock and spinifex grasslands (Table 2.1). All land systems are well represented outside of the study area, with less than 1% of each land system described within the study area (Table 2.1).

Table 2.1 – Land systems of the Investigator study area (van Vreeswyk *et al.* 2004)

Land System	Description	Systematic survey sites	Total area in Western Australia (ha)	Total area in study area (ha)	Percentage of the study area (%)	Western Australian extent in the study area (%)
Land type 1 - Hills and ranges with spinifex grasslands						
Newman	Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands.	-	1,993,745	20.96	0.40	<0.01
McKay	Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands.	-	427,471	299.94	5.76	<0.01
Land type 8 - Stony plains with spinifex grasslands						
Boolgeeda	Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands.	INV S01	999,608	65.06	1.25	<0.01
Land type 12 - Wash plains on hardpan with groved mulga shrublands (sometimes with spinifex understorey)						
Jamindie	Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey.	INV S06	1,188,271	1100.55	21.13	<0.01
Jurrawarrina	Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses.	INV S02 INV S03 INV S05	660,224	1956.51	37.56	<0.01
Land type 15 - Alluvial plains with snakewood shrublands						
Hooley	Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands.	INV S04	59,081	1749.26	33.58	0.03

2.5 VEGETATION

The vegetation of Western Australia was originally mapped at the 1:1,000,000 scale by Beard (Beard 1975) and was subsequently reinterpreted and updated to reflect the National Vegetation Information System standards (Shepherd *et al.* 2002). The study area lies predominately in the Fortescue Botanical District within the larger Pilbara Botanical Province (Beard 1975). A total of four vegetation associations occur in the study area (Shepherd *et al.* 2001), these are described in Table 2.2 and displayed in Figure 2.4.

The study area lies predominantly in Beard's Fortescue Valley of the Fortescue Botanical District (99.95%). Beard defined the Fortescue Valley vegetation as four distinct landforms, sandplain, outwash plains, valley plains and flood-out zones (Beard 1975). The vegetation of the sandplains and outwash plains is characteristically shrub-steppe vegetation of *Triodia basedowii*, *Hakea subarea* and mallee *Eucalyptus gamophylla* (Beard 1975). The valley plains are typically covered in *Acacia aneura* low woodland. The vegetation of the flood-out zones are a tree savannah of scattered eucalypts and low chenopod shrublands (Beard 1975).

Four Beard (1975) vegetation associations have been mapped within the study area. The units are dominated by low woodland vegetation, with some areas of hummock grasslands and short bunch grasslands.

Table 2.2 – Beard vegetation associations of the Investigator study area

Shepherd Unit	Vegetation Description	Systematic survey sites	Total area in Western Australia (ha)	Total area in study area (ha)	Percentage of the study area (%)	Proportion of total vegetation unit (%)
29	Sparse low woodland; mulga, discontinuous in scattered groups	INV S02 INV S03 INV S04 INV S05	7,903,991	4354.31	83.60	0.06
173	Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt	-	1,421,375	2.71	0.05	<0.01
175	Short bunch grassland - savanna/grass plain (Pilbara)	-	524,861	68.39	1.32	0.01
562	Mosaic: Low woodland; mulga in valleys / Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana*	INV S01 INV S06	103,606	783.11	15.04	0.76

2.6 PREVIOUS SURVEYS

Several databases were consulted in the preparation of potential fauna (and conservation significant fauna) lists (Table 2.3). In addition, 30 publications reporting on vertebrate fauna surveys conducted within 100 km of the study area were consulted (Table 2.4). The results of all database searches and previous surveys are presented in Appendix E. The online NatureMap database (DPaW 2014) encompasses several datasets, including the Western Australian Museum (WAM), DPaW Threatened and Priority Fauna database and DPaW survey return database.

Table 2.3 – Fauna databases searched to determine the potential vertebrate fauna assemblage

Database	Custodian	Search Details
NatureMap	DPaW	40 km radius around the centre of the study area. Coordinate: 640388 E 755806 N Date accessed: 05/06/2013
EPBC Act Protected Matters Search	Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)	40 km radius around the centre of the study area. Coordinate: 640388 E 755806 N Date accessed: 09/05/2013
Birdata	Birdlife Australia	One square decimal degree (100 km^2) around the centre of the study area. Coordinate: 646270 E 7554630 N Date accessed: 05/06/2013
Threatened and Priority Fauna Database	DPaW	Study area with a 40 km buffer Coordinate: 634078 E 7555685 N 646632 E 7559728 N DPaW Reference: 4492 Request date: 10/04/2013

Table 2.4 – Previous biological survey reports within 100 km of the study area

Survey Location and Author(s)	Distance from study area (km)	Comments
ecologia internal database	20-75	Ten fauna assessments
Solomon Project - Rail Re-alignment (Ecoscape 2010b)	0-20	Level 1 fauna assessment
Solomon Project - Rail Camp Sites 1, 2 and 3 (Ecoscape 2010a)	0-40	Level 1 fauna assessment
Solomon Hub (*ecologia* 2014b)	0-40	Single phase Level 2 fauna assessment
Solomon Project - Rail (Coffey 2010)	0-60	Level 1 fauna assessment
Solomon Project - Rail Targeted Survey (Coffey 2011)	0-60	Targeted fauna assessment
Solomon Project - Rail Con Sig Monitoring (*ecologia* 2013c)	0-60	Targeted fauna assessment
Solomon Project - Mine Con Sig Monitoring (*ecologia* 2013b)	0-60	Targeted fauna assessment
Solomon Project - Solomon Mine(Coffey Environments 2008)	40	Single phase Level 2 fauna assessment
Solomon Project - Kings Area (*ecologia* 2010)	40	Single phase Level 2 fauna assessment
Solomon Project - Firetail Mining Area (Ecoscape 2010c)	45	Single phase Level 2 fauna assessment
Mt Macleod Vertebrate Fauna Survey (*ecologia* 2013a)	50	Single phase Level 2 fauna assessment
Mt Macleod West Fauna Assessment (Ecoscape 2013)	50	Level 1 fauna assessment
Mt Macleod Terrestrial Vertebrate Fauna Survey (Rapallo 2011)	50	Single phase Level 2 fauna assessment
Marandoo to Great Northern Hwy Rd (Kendrick 1995)	60	Two phase Level 2 fauna assessment
Hamersley Range (Muir 1983)	65	Regional assessment
Stingray Vertebrate Fauna Survey (*ecologia* 2013d)	65	Single phase Level 2 fauna assessment
Cloudbreak Vertebrate Fauna Survey (Bamford 2005)	75	Single phase Level 2 fauna assessment
Cloudbreak Vertebrate Fauna Survey (*ecologia* 2011c)	75	Single phase Level 2 fauna assessment
Central Pilbara Project - Mine (*ecologia* 2011b)	80	Two phase Level 2 fauna assessment
Central Pilbara Project - Rail (south only) (*ecologia* 2012a)	80	Two phase Level 2 fauna assessment
West Turner Section 10 (Biota 2009)	90	Two phase Level 2 fauna assessment

2.6.1 Results of the Literature Review

The database searches and review of publications reporting on 27 vertebrate fauna publications (Table 2.4) resulted in a total of 40 native and nine introduced mammal, 173 bird, 114 reptile, nine amphibian and seven fish species potentially occurring in the study area (Table 2.4). Of these, 24 species are of conservation significance (11 species of mammal, 21 species of bird, six species of reptile and one species of fish). Previous records of conservation significant fauna are mapped in Figure 2.5, Figure 2.6 and Figure 2.7 and discussed in greater detail in Section 5.3.

Table 2.5 – Number of species recorded during previous surveys and database searches

Source/Report	Mammals (Native/introduced)	Birds	Reptiles	Amphibians	Fish
ecologia internal database	30/7	99	85	5	0
Solomon Project - Rail Re-alignment (Ecoscape 2010b)	2/1	16	2	0	0
Solomon Project - Rail Camp Sites 1, 2 and 3 (Ecoscape 2010a)	1/1	14	6	0	0
Solomon Hub (*ecologia* 2014b)	19/4	80	68	3	4
Solomon Project – Rail (Coffey 2010)	0/0	0	0	0	0
Solomon Project – Rail Targeted Survey (Coffey 2011)	3/1	3	1	0	0
Solomon Project - Rail Con Sig Monitoring (*ecologia* 2013c)	18/3	1	2	0	0
Solomon Project - Mine Con Sig Monitoring (*ecologia* 2013b)	11/3	35	15	2	0
Solomon Project - Solomon Mine (Coffey Environments 2008)	21/3	63	72	3	0
Solomon Project - Kings Area (*ecologia* 2010)	21/3	75	51	2	0
Solomon Project - Firetail Mining Area (Ecoscape 2010c)	19/2	63	48	0	0
Mt Macleod Vertebrate Fauna Survey (*ecologia* 2013a)	18/1	63	28	2	0
Mt Macleod West Fauna Assessment (Ecoscape 2013)	3/3	34	11	1	0
Mt Macleod Terrestrial Vertebrate Fauna Survey (Rapallo 2011)	16/1	84	51	5	0
Marandoo to Great Northern Hwy Rd (Kendrick 1995)	3/14	67	49	3	0
Hamersley Range (Muir 1983)	22/1	134	77	5	0
Cloudbreak Vertebrate Fauna Survey (Bamford 2005)	19/6	99	28	1	0
Cloudbreak Vertebrate Fauna Survey (*ecologia* 2011c)	14/3	63	47	1	0
Stingray Vertebrate Fauna Survey (*ecologia* 2013d)	19/2	79	48	2	0
Central Pilbara Project - Mine (*ecologia* 2011b)	24/4	99	84	4	0
Central Pilbara Project - Rail (south only) (*ecologia* 2012a)	22/5	104	78	4	0
West Turner Section 10 (Biota 2009)	14(1)	57	24	0	0
NatureMap (DPaW 2014)	27/5	134	76	6	5
DPaW Threatened Fauna Database (DPaW 2013)	8/0	15	3	0	1
DSEWPaC Protected Matters Search	11/7	7	1	0	0
Birdlife Australia Birdata Search	-	142	-	-	-
Total	**49/12**	**172**	**113**	**9**	**7**

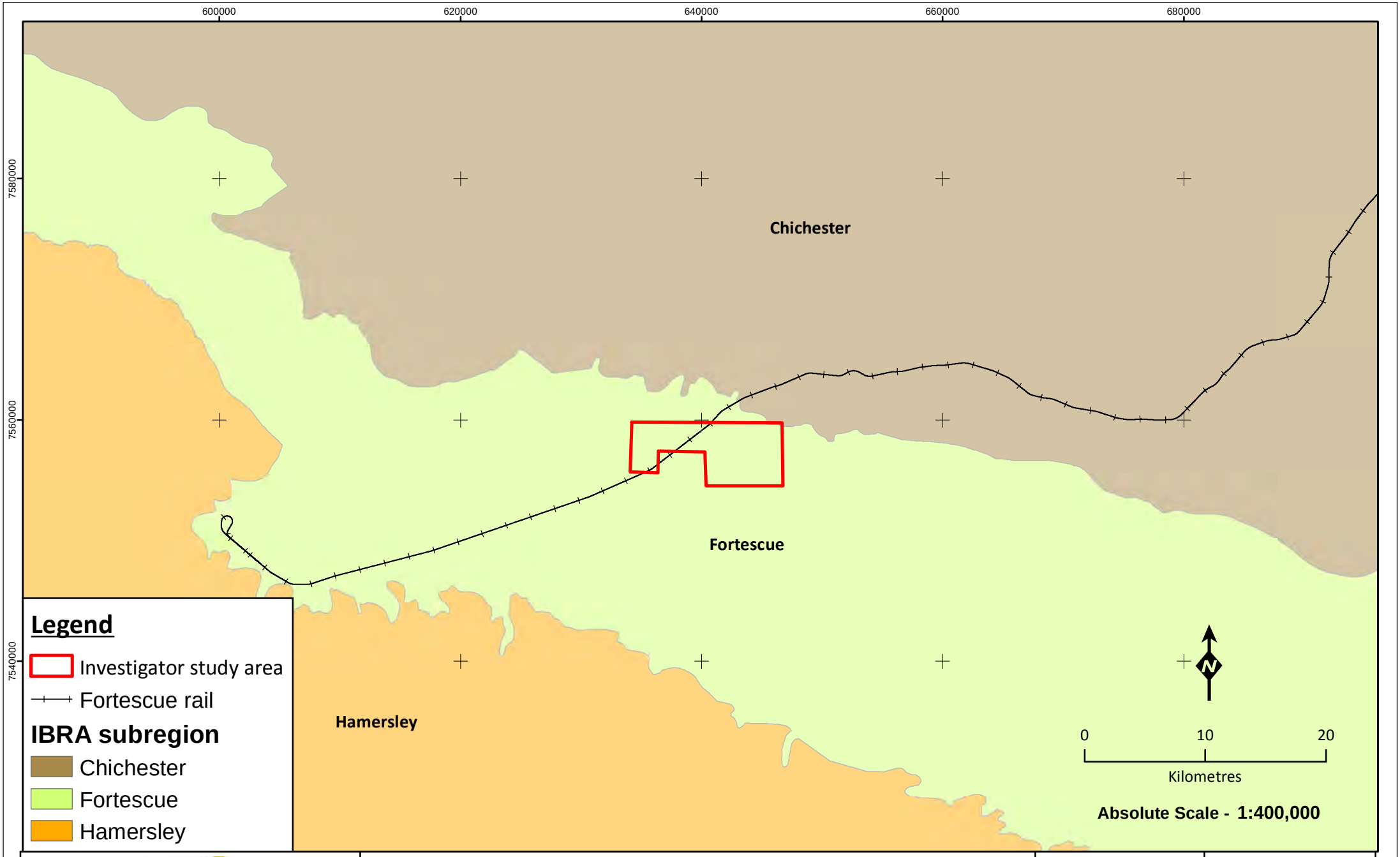
Due to the proximity of the study area to the Fortescue River and Karijini National Park, several waterbirds have been recorded in the wider region (within approximately 100 km). However, the water birds are not expected to occur within the study area on a regular basis. The habitats present are not suitable for these species due to the lack of the ability to hold surface water and therefore provide suitable wetland habitat. These species are therefore not included in this assessment due to a very low likelihood of occurrence (Table 2.6).

In addition, one species of fish (Fortescue Grunter) is known to occur along major rivers and large creeklines in the wider region but no suitable habitat is present within the study area. Therefore, this species is not included in this assessment.

The gecko *Diplodactylus fulleri*, is only know from a small area surrounding Lake Disappointment. This species has also been omitted from the results after discussions with the WAM herpetological curator, Paul Dougherty, and former curator Brad Maryan, suggesting that the Pilbara records of the species are likely to be misidentifications (P. Dougherty and B. Maryan, pers. comm. June 2013).

Table 2.6 – List of conservation significant species omitted from report

Species	Conservation Status		
	EPBC Act	WC Act	DPaW
Black Bittern *Ixobrychus flavicollis*	-	-	P3
Eastern Great Egret *Ardea modesta*	M	S3	-
Cattle Egret *Ardea ibis*	M	S3	-
Glossy Ibis *Plegadis falcinellus*	M	S3	-
Eastern Osprey *Pandion cristatus*	M	-	-
White-bellied Sea-Eagle *Haliaeetus leucogaster*	M	S3	-
Oriental Plover *Charadrius veredus*	M	S3	-
Common Sandpiper *Actitis hypoleucos*	M	S3	-
Common Greenshank *Tringa nebularia*	M	S3	-
Wood Sandpiper *Tringa glareola*	M	S3	-
Ruddy Turnstone *Arenaria interpres*	M	S3	-
White-winged Black Tern *Chlidonias leucopterus*	M	S3	-
A gecko *Diplodactylus fulleri*	-	-	P2
Fortescue Grunter *Leiopotherapon aheneus*	-	-	P4



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IBRA subregions of the study area

Figure: 2.2
Project ID: 1518

Drawn: CK
Date: 26/09/2013

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK022

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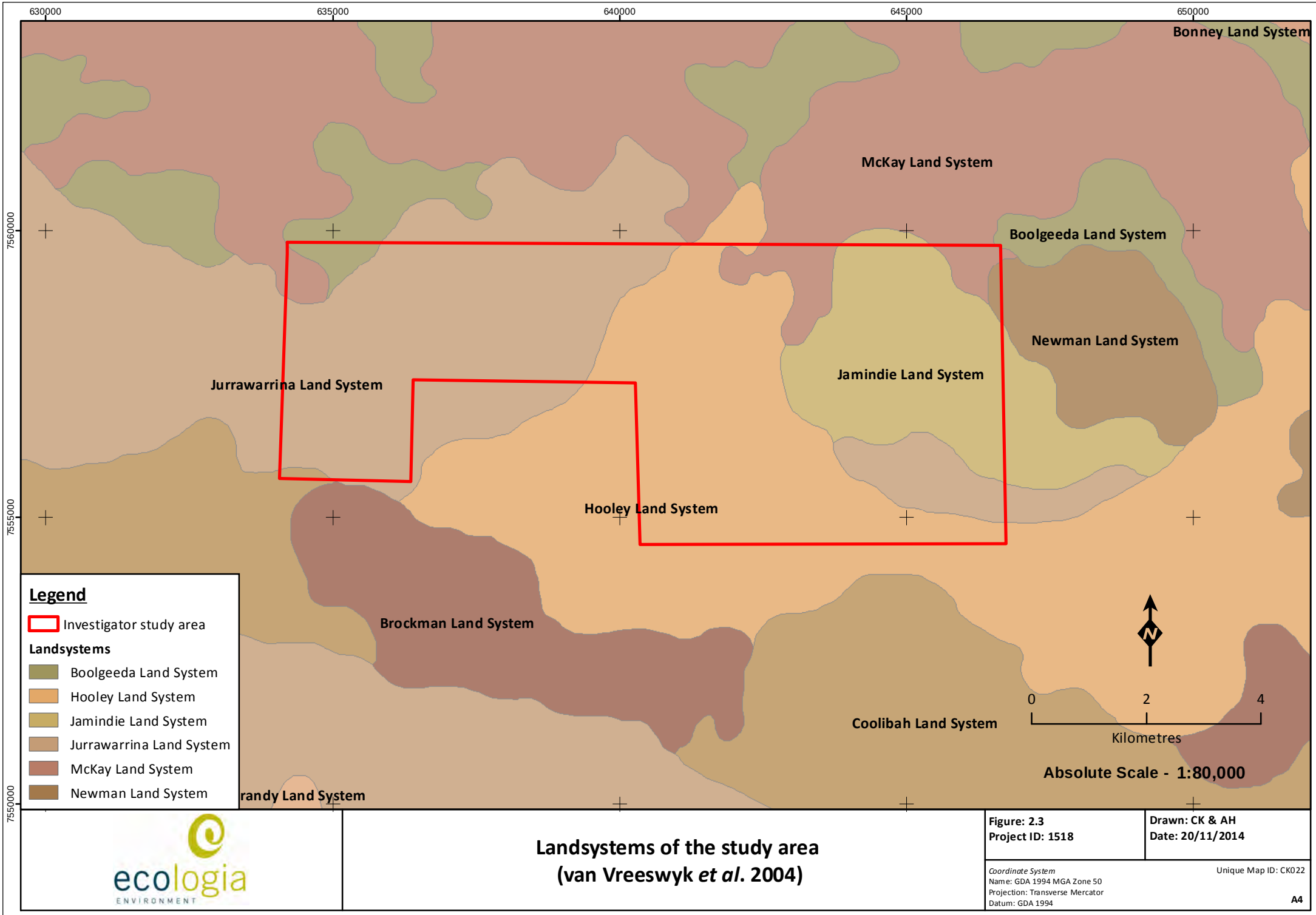

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Landsystems of the study area (van Vreeswyk *et al*. 2004)

Figure: 2.3
Project ID: 1518

Drawn: CK & AH
Date: 20/11/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK022

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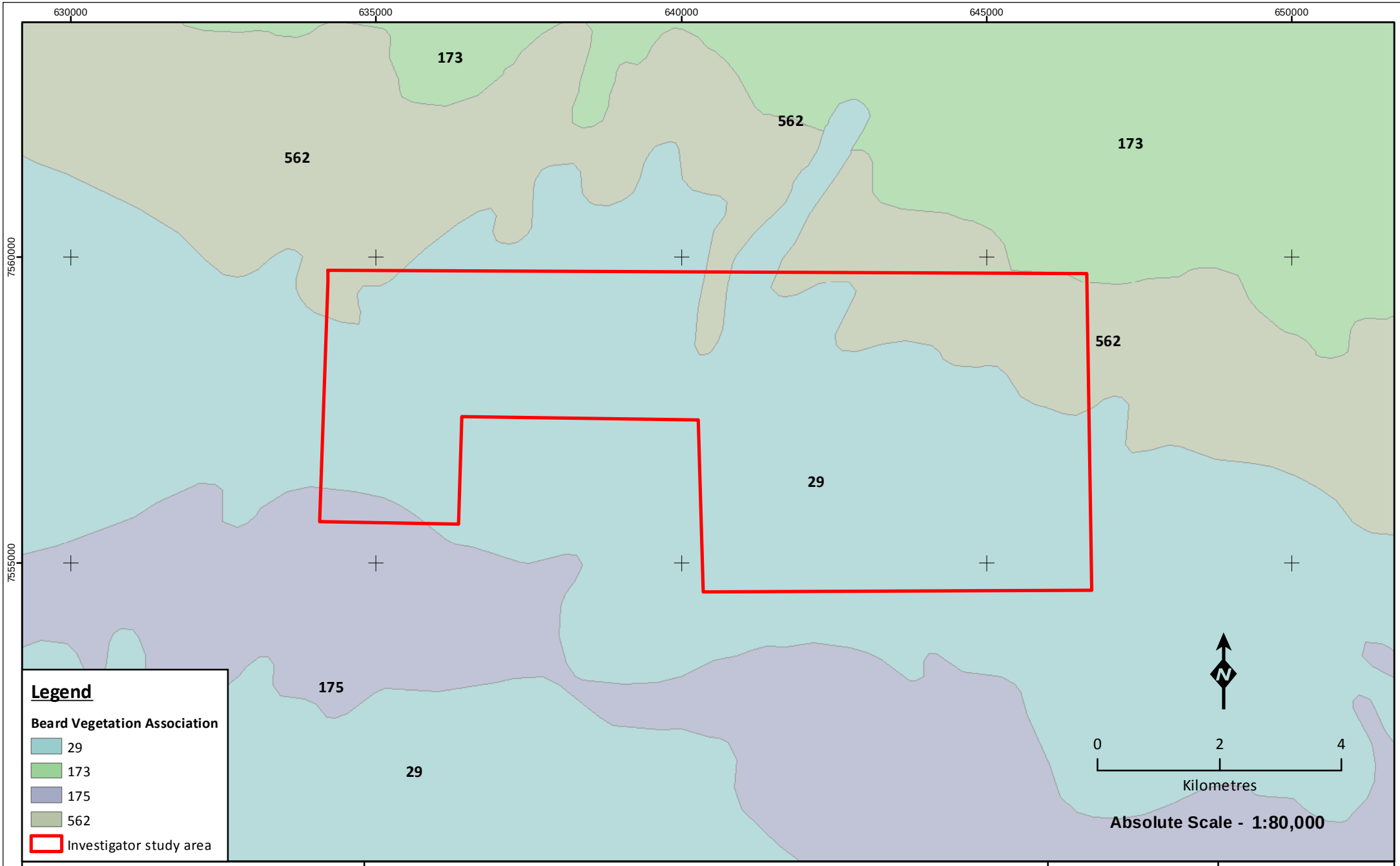

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Vegetation of the study area (Shepherd *et al*. 2002)

Figure: 2.4
Project ID: 1518

Drawn: CK & AH
Date: 20/11/2014

Coordinate System
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Projection: Transverse Mercator
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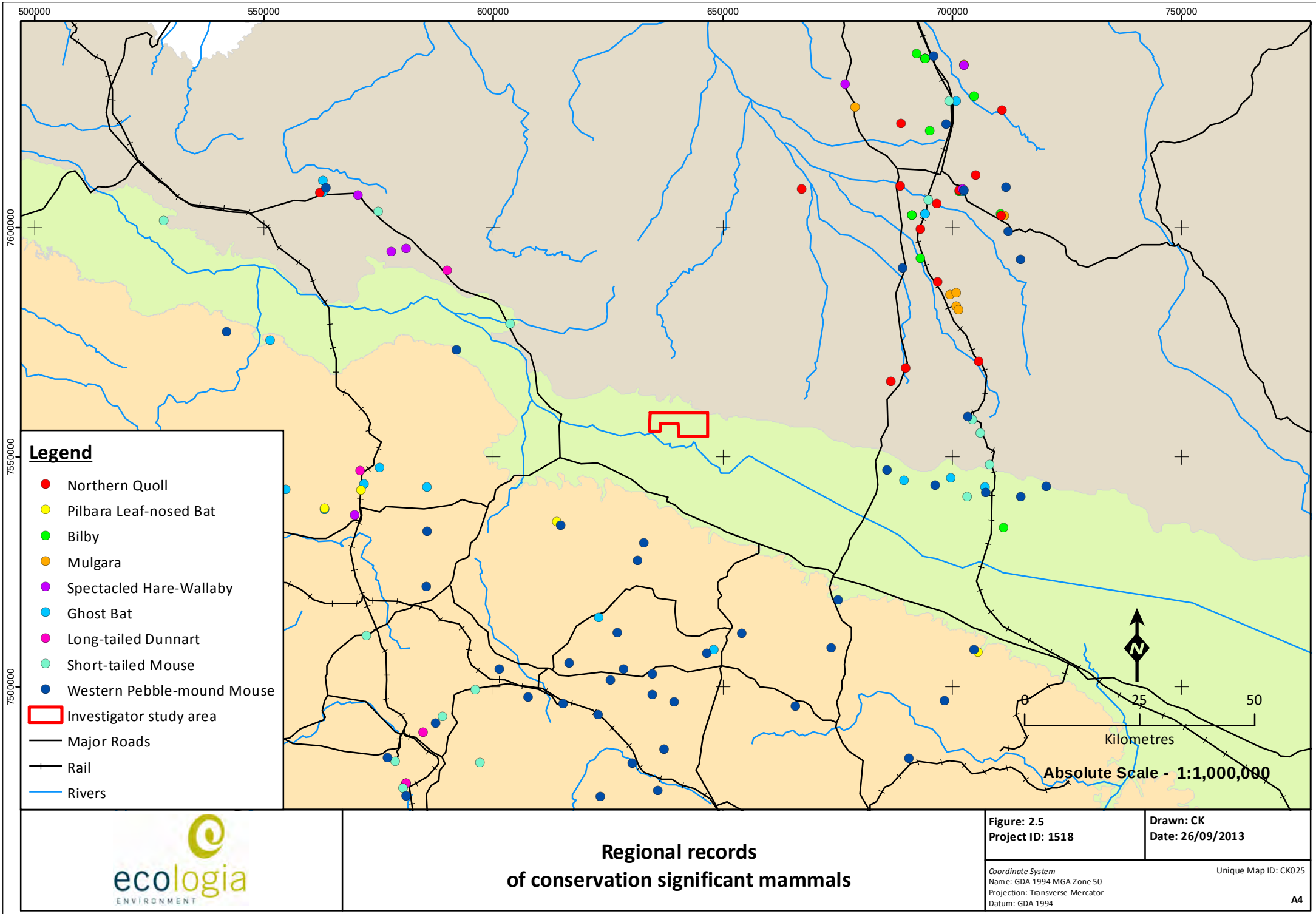

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Regional records of conservation significant mammals

Figure: 2.5
Project ID: 1518

Drawn: CK
Date: 26/09/2013

Coordinate System
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Projection: Transverse Mercator
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Unique Map ID: CK025

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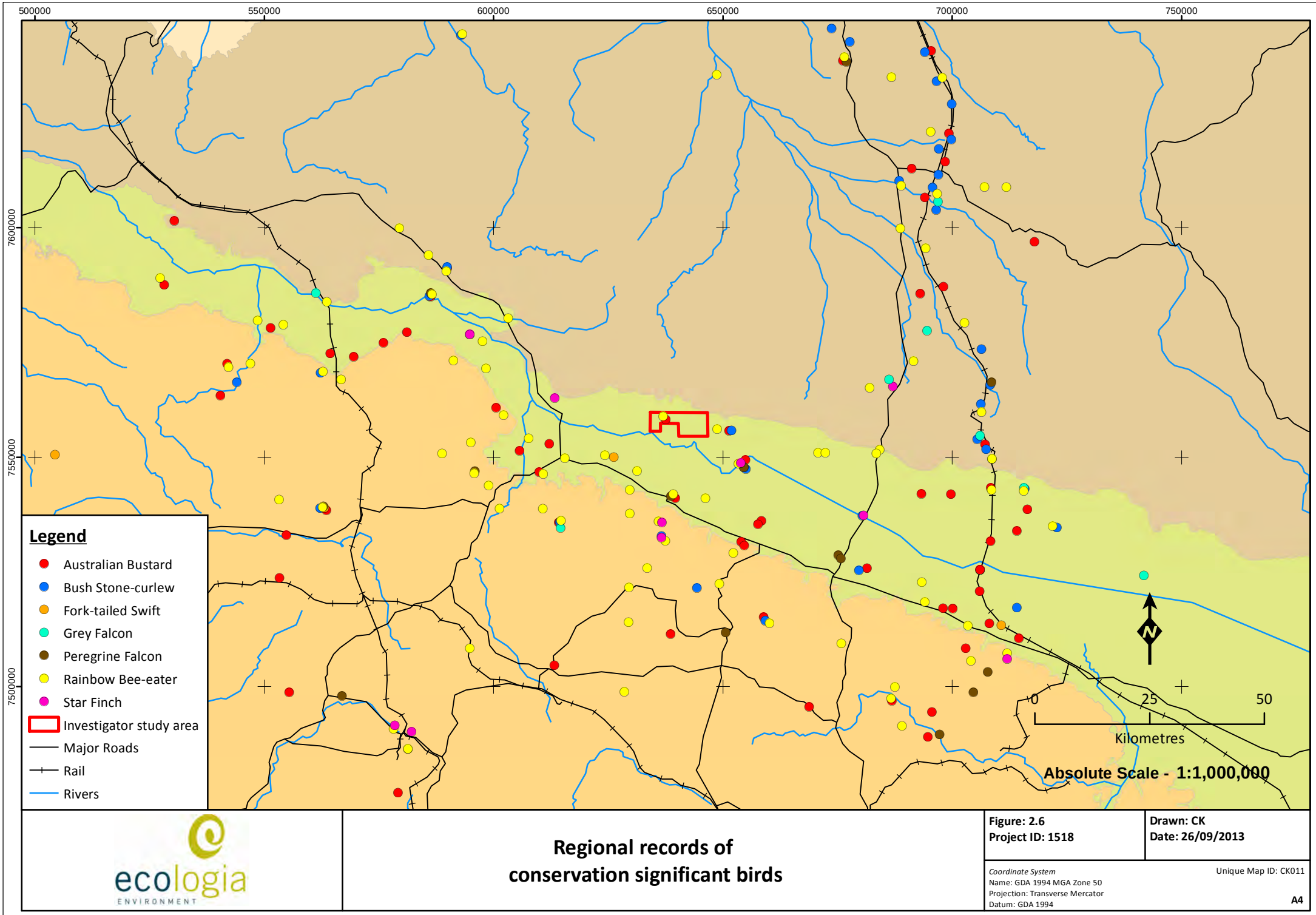

ecologia ENVIRONMENT

Regional records of conservation significant birds

Figure: 2.6
Project ID: 1518

Drawn: CK
Date: 26/09/2013

Coordinate System
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Projection: Transverse Mercator
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Unique Map ID: CK011

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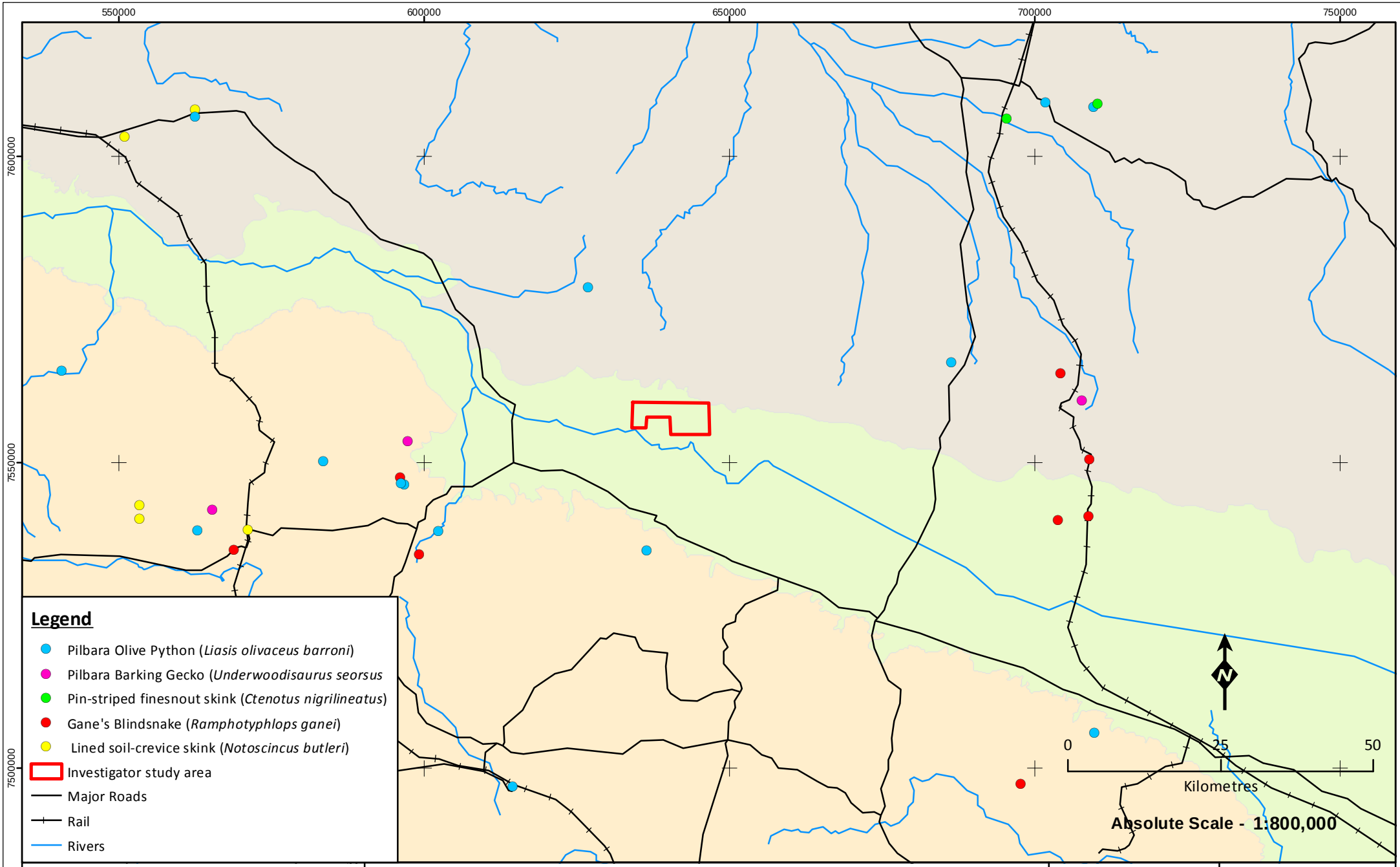

ecologia ENVIRONMENT

Regional records of conservation significant reptiles

Figure: 2.7
Project ID: 1518

Drawn: CK
Date: 26/09/2013

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK027

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3 METHODS

3.1 DETERMINATION OF SURVEY SAMPLING DESIGN AND INTENSITY

Prior to the development of field survey methods, a review was undertaken of factors likely to influence survey design and intensity (Table 3.1). Based on this review, it was deemed necessary for a Level 2 terrestrial vertebrate fauna assessment to be conducted within the study area. Due to the small size of the study area, it was determined that seven trapping sites should provide sufficient survey adequacy.

Table 3.1 – Factors likely to influence survey design (EPA 2004b)

Factor	Relevance
Bioregion – level of existing survey-knowledge of the region and associated ability to predict accurately.	The Pilbara bioregion (including the Fortescue subregion) has been well studied, and information was readily available.
Landform special characteristics/specific fauna/specific context of the landform characteristics and their distribution and rarity in the region.	The landforms associated with the study area are typical for the region and do not present any rare or special characteristics.
Life forms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present.	The best survey time for birds and amphibians is following seasonal rain events. Best survey timing for reptiles is from September to April. Survey timing for mammals is not constrained.
Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/area curves).	Twenty-seven previous terrestrial vertebrate fauna surveys have been carried out within 100 km of the study area. Regional and local knowledge for the area is available.
Number of different habitats or degree of similarity between habitats within a study area.	Four fauna habitat types were identified based on field observation, mapped land systems, vegetation units and habitat mapping previously conducted in the nearby area. These were: alluvial plain, stony gibber plains, tussock grasslands and drainage line/river/creek (minor).
Climatic constraints (e.g. temperature or rainfall that preclude certain sampling methods).	The Pilbara region experiences hot summers with occasional cyclonic rain events, followed by warm winters with little rain. Rainfall is highly unpredictable. No extreme or unusual weather events influenced the results of the survey.
Sensitivity of the environment to the proposed activities.	The study area contains habitat types which are well represented in the surrounding region.
Size, shape and location of the proposed activities.	The study area comprises the Investigator exploration tenement and covers an area of 5,207 ha.
Scale and impact of the proposal.	The scale and impact of the proposal was not known and did not influence the design of this survey.

3.2 SURVEY TIMING

The survey was conducted by four staff in autumn from 20 to 30 May 2013. The survey timing was determined as per guidelines (EPA 2004b; EPA and DEC 2010).

3.3 SAMPLING METHODS

The following survey methodology adopted by *ecologia* for the Level 2 vertebrate fauna and targeted conservation significant fauna assessment of the study area was in accordance with:

- EPA's Guidance statement No. 56 – *Guidance for the Assessment of Environmental Factors* (EPA 2004b)
- Position Statement No. 3 – *Terrestrial Biological Surveys as an element of Biodiversity* Protection (EPA 2002)
- Technical Guide – *Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA and DEC 2010).
- Survey Guidelines for Australia's Threatened Mammals, Reptiles Bats and Birds (DEWHA 2010; DSEWPaC 2011a, b, c); and
- Fortescue's *Terrestrial Vertebrate Fauna Assessment Guidelines* (FMG 2011).

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

3.3.1 Systematic Sampling

3.3.1.1 Terrestrial Mammals and Herpetofauna

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

Each trapping site consisted of the following (Figure 3.1):

- Pit-trap and drift fence: Five PVC pipe (16 x 50 cm) and five 20 L plastic buckets (30 x 40 cm) were established at each site. A 10 metre flywire drift fence (30 cm high) bisected the pits, directing fauna into the traps.
- Elliott box traps: Ten medium sized Elliott box traps (9 x 9 x 32 cm) were placed at each site, and baited with Universal Bait (a mixture of peanut butter, rolled oats and sardines). Each Elliott trap was placed between the pit trap setups. Elliott traps were shaded using Air Cell roof insulation.
- Funnel traps: Funnel traps (Ecosystematica Type III) were placed in association with drift fences. Twenty funnel traps were used per site, with a trap being placed at each end of the drift fence. Funnel traps were shaded using Air Cell roof insulation.
- Cage traps: Two Sheffield small animal traps (22 cm x 22 cm x 55 cm) were used per site with one trap placed at each end of the trap line. Traps were baited with Universal Bait.

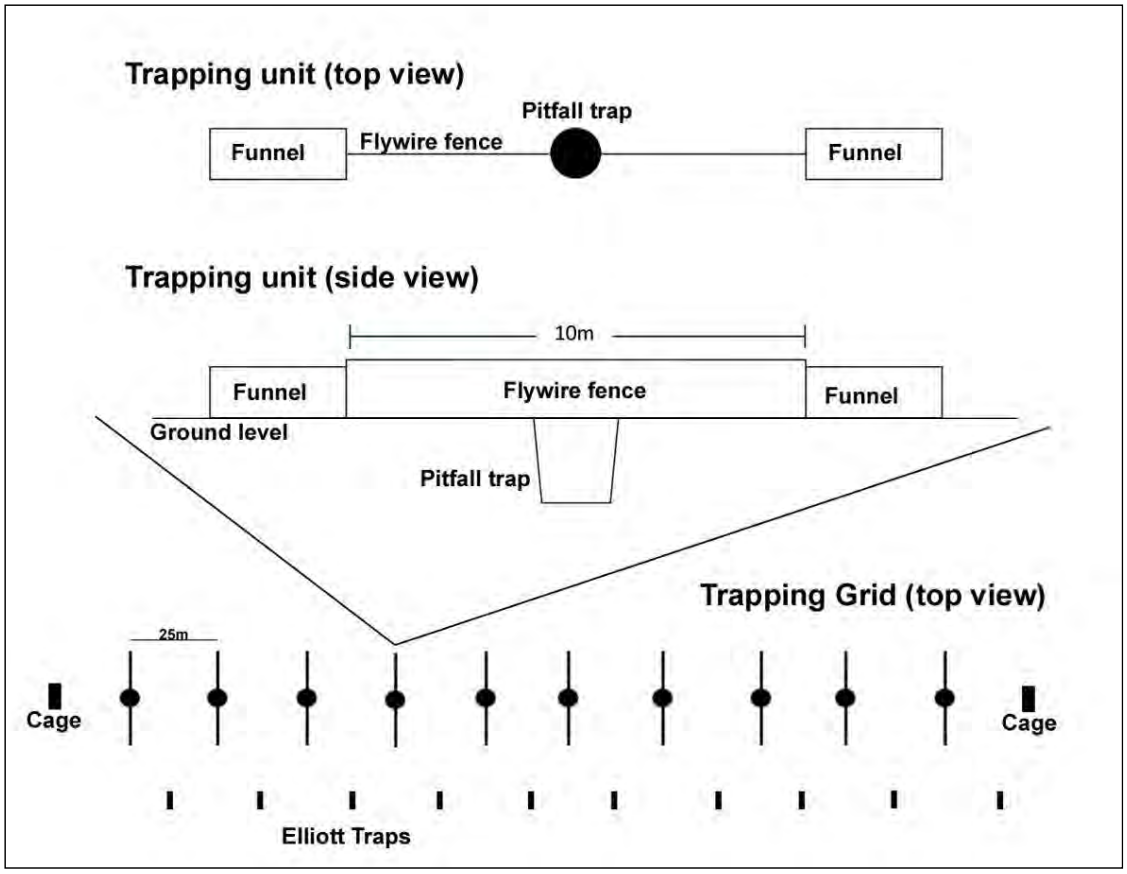


Figure 3.1 – Diagram of the systematic sampling trap arrangement

Figure 3.2 – Image of single *ecologia* trap point

3.3.1.2 Avifauna

Thirty minute set-time surveys were used to document the avifauna present at each of the systematic trapping sites. During each set-time survey an ornithologist recorded the number of individuals of each species positively identified (seen and/or heard) while actively searching similar habitat within 500 m of the survey site. This is aligned with survey methodology for the ongoing Birds Australia *Atlas of Australian Birds* project.

Survey effort was concentrated at survey sites within three hours of dawn, as this time is deemed to be the optimal times to record most bird species. Opportunistic surveys during the day and near dusk were also conducted, as they may yield species less frequently observed in the early morning, such as diurnal raptors.

3.3.1.3 Bats

Bat echolocation calls were recorded using SM2BAT 384 kHz long term passive recorder. The SM2BAT has a high sampling frequency, enabling the full spectrum of calls to be recorded without being transformed, allowing greater accuracy and sensitivity. The SM2BAT was programmed to record from dusk to dawn for each night that surveyed. The SM2BAT was programmed to record from dusk to dawn (approximately 720 minutes) for each night that was surveyed. At least one overnight recording was made at each systematic survey site (Figure 3.3, Table 3.3). One night of recording is sufficient to provide an accurate record of the bat assemblage found in the area, as experience from previous surveys indicates that the species of bats recorded tend to remain the same over multiple nights. SM2BAT bat recorders were set up at seven locations within the study area.

3.3.2 Opportunistic Data

3.3.2.1 Wet Pitfall Trapping

Simultaneous to the Investigator Level 2 terrestrial vertebrate assessment, *ecologia* undertook a targeted Short-range Endemic (SRE) survey consisting of wet pitfall traps. Eight wet pitfall trapping sites, each consisting of four wet pitfalls, were installed across the Investigator study area. Each wet-fall consisted of a PVC tube (25cm long) containing 700 ml of pitfall trapping solution (30% Propylene Glycol). The traps were dug into the ground so that the surface was flush with the ground level and had a cover fitted ~3 cm above the tube. Wet pitfall traps are designed to avoid the capture of vertebrate fauna, however as traps aim to capture large invertebrates such as mygalomorph spiders, small ground dwelling vertebrates are sometimes captured as bi-catch, and these results have been included as opportunistic data within this report. Traps were left open for 53 days.

3.3.2.2 Nocturnal Searching

Areas of the study area were searched at night using a combination of spotlighting whilst driving road transects, and opportunistic ground searches using head torches and hand held spotlights to uncover nocturnal species, including geckos, snakes, frogs and birds. The locations and details of each nocturnal search site are listed in Table 3.3 and shown in Figure 3.3.

3.3.2.3 Diurnal Searching

Both trapping and opportunistic sites were searched by hand for cryptic species, which comprised searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows and over-turning logs and stones. Sites were selected on the basis of fauna habitat (targeting uncommon habitats or habitats poorly represented by trapping sites) and

the possibility of their harbouring conservation significant fauna. The locations and details of each diurnal opportunistic search site are listed in Table 3.3 and shown in Figure 3.3.

Fauna were also recorded while searching, travelling and during trap establishment within the study area. Tracks, diggings, scats, burrows and nests were recorded where possible.

3.3.2.4 Camera Trapping

Motion sensor cameras were used in areas with a high likelihood of animal activity such as water sources to detect fauna species. The Bushnell Trophy Cam, model number 119415 was used at three locations within the study area. The camera is triggered by movement by a highly sensitive Passive Infra-Red motion sensor and functions day and night taking either video footage or photos (Bushnell Outdoor Products 2009). The location of each Motion Camera site is listed in Table 3.3 and shown in Figure 3.3.

3.3.2.5 Targeted Conservation Significant Fauna Survey

Prior to the commencement of survey activity, the preferred habitat of the conservation significant species that potentially occur in the study area was determined. These habitats were identified and targeted during survey activities using both systematic survey sites and opportunistic surveys.

3.4 SURVEY EFFORT

Survey effort expended during the surveys is presented in Table 3.5, and included the following:

- Systematic trapping grids (pit traps, funnels, Elliott traps and cage traps) were open for 1,764 trap-nights;
- 21 hours were spent surveying for birds;
- 22 hours were spent on opportunistic diurnal searching (across 31 sites);
- seven hours were spent on opportunistic nocturnal searching; and
- 91 hours of SM2BAT recordings were analysed to determine bat assemblage and distribution.

The following survey effort targeting conservation significant fauna was included in the above totals:

- 91 hours of bat recordings were analysed to determine the presence of Ghost Bat and Pilbara Leaf-nosed Bat species;
- Seven hours of nocturnal searches using playback to search for the Bush Stone-curlew; and
- Six hours assessing potential habitat and conducting targeted searches for signs of Northern Quoll and Pilbara Olive Python in drainage line/river/creek (minor) habitat.

Table 3.2 – Survey effort

Site	Trapping nights				Wet pitfall nights	Bird surveys (min)	Diurnal opportunistic searches (min)	Bat recording (min)	Nocturnal opportunistic searches (min)	Camera trapping (min)
	Pit Traps	Funnels	Elliotts	Cages						
INV S01	70	140	70	14	-	120	_	780	60	_
INV S02	70	140	70	14	-	120	_	780	60	_
INV S03	70	140	70	14	-	120	_	780	_	_
INV S04	70	140	70	14	-	120	_	780	_	_
INV S05	70	140	70	14	-	120	_	780	_	_
INV S06	70	140	70	14	-	120	_	780	_	_
INV SRE01	-	-	-	-	212	-	60	_	_	_
INV SRE02	-	-	-	-	212	30	60	-	-	-
INV SRE03	-	-	-	-	212	-	30	-	-	-
INV SRE04	-	-	-	-	212	30	60	-	-	-
INV SRE05	-	-	-	-	212	-	60	-	-	-
INV SRE06	-	-	-	-	212	-	60	-	-	-
INV SRE07	-	-	-	-	212	-	60	-	-	-
INV SRE08	-	-	-	-	212	15	30	-	-	-
INV OS01	-	-	-	-	-	30	60	-	-	-
INV OS02	-	-	-	-	-	30	60	780	60	2880
INV OS03	-	-	-	-	-	30	60	-	-	-
INV OS04	-	-	-	-	-	30	60	-	-	2880
INV OS05	-	-	-	-	-	30	60	-	-	-
INV OS06	-	-	-	-	-	30	60	-	-	-
INV OS07	-	-	-	-	-	30	60	-	-	-
INV OS08	-	-	-	-	-	30	30	-	-	-
INV O109	-	-	-	-	-	15	30	-	-	-
INV OS10	-	-	-	-	-	30	60	-	-	-
INV OS11	-	-	-	-	-	30	-	-	-	-
INV OS12	-	-	-	-	-	30	-	-	-	-
INV OS13	-	-	-	-	-	30	-	-	60	-

Site	Trapping nights				Wet pitfall nights	Bird surveys (min)	Diurnal opportunistic searches (min)	Bat recording (min)	Nocturnal opportunistic searches (min)	Camera trapping (min)
	Pit Traps	Funnels	Elliotts	Cages						
INV OS14	-	-	-	-	-	30	-	-	-	-
INV OS15	-	-	-	-	-	-	60	-	-	-
INV OS16	-	-	-	-	-	-	-	-	120	-
INV OS17	-	-	-	-	-	-	60	-	-	-
INV OS18	-	-	-	-	-	-	60	-	-	-
INV OS19	-	-	-	-	-	-	-	-	60	-
INV OS21	-	-	-	-	-	-	60	-	-	-
INV OS22	-	-	-	-	-	30	60	-	-	-
INV OS23	-	-	-	-	-	-	60	-	-	-
Total	420	840	420	84	1,696	1,230	1,320	5,460	420	5,760

3.5 SITE SELECTION

Habitat types previously mapped by Coffey (2010) were reviewed to assist with survey site selection, together with locations of access tracks, land systems, vegetation associations, the abundance of habitat types and areas not previously surveyed. Trapping sites were also selected based on the likelihood to support conservation significant fauna and a greater diversity of ground dwelling fauna i.e. stony gibber plains. Survey sites were selected to provide a good geographic spread over the study area and to be representative of the habitat types in the study area. Habitat types covering a larger proportion of the study area received greater systematic sampling effort than less represented habitat types.

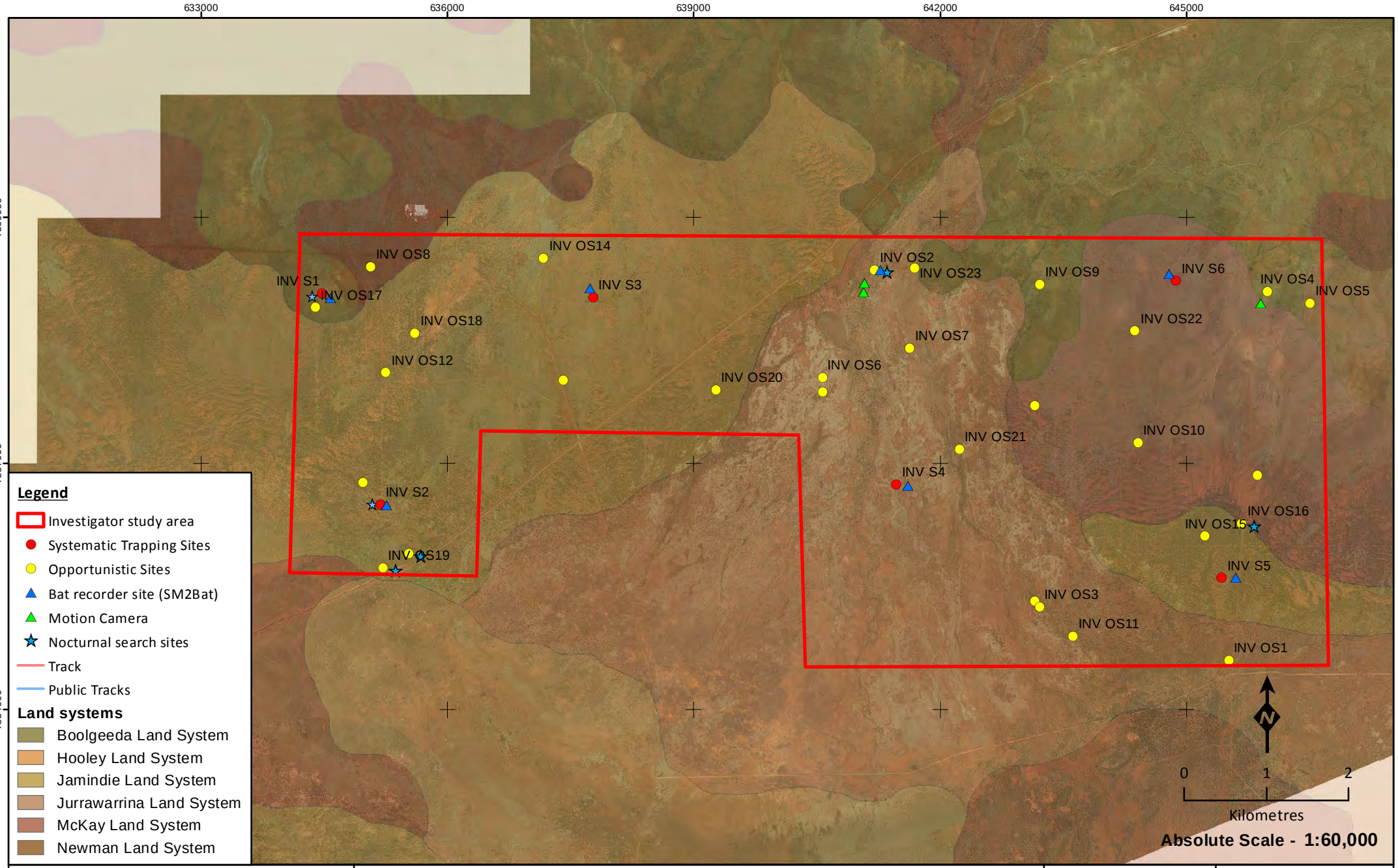
Four of the six trapping sites were installed in the largest two land systems Jurrawarrina and Hooley, which compose over 70% of the study area. Four of the six trapping sites were also located within the largest Beard/Shepherd vegetation unit (29), which covers over 83% of the study area (Table 2.1). Four of the six land systems occurring within the study area were sampled systematically by installing trapping sites. The remaining two land systems (Newman and McKay) occurred in small patches and covered only 6% of the study area. Geographic areas of the study area not systematically sampled were targeted in opportunistic searches (such as the minor drainage line/river/creek habitat). Locations and details of all survey sites sampled during the Level 2 survey are listed in Table 3.3 and mapped in Figure 3.3. Site photographs and descriptions are presented in Appendix C.

Table 3.3 – Survey site information

Site name	Site type	Location		Land system	Vegetation association
		Easting	Northing		
INV S01	Systematic Trapping Site	634467	7559074	McKay	562
INV S02	Systematic Trapping Site	635179	7556499	Jurrawarrina	29
INV S03	Systematic Trapping Site	637776	7559027	Jurrawarrina	29
INV S04	Systematic Trapping Site	641471	7556744	Hooley	29
INV S05	Systematic Trapping Site	645436	7555611	Jurrawarrina	29
INV S06	Systematic Trapping Site	644876	7559231	Jamindie	562
Bat rec 1	Bat recorder site (SM2Bat)	641605	7556723	Hooley	29
Bat rec 2	Bat recorder site (SM2Bat)	645603	7555604	Jurrawarrina	29
Bat rec 3	Bat recorder site (SM2Bat)	644795	7559310	Jamindie	562
Bat rec 4	Bat recorder site (SM2Bat)	641219	7559363	Hooley	29
Bat rec 5	Bat recorder site (SM2Bat)	635257	7556488	Jurrawarrina	29
Bat rec 6	Bat recorder site (SM2Bat)	645632	7555594	McKay	562
Bat rec 7	Bat recorder site (SM2Bat)	637740	7559135	Jurrawarrina	29
MC 1	Motion Camera	645905	7558956	Hooley	29
MC 2	Motion Camera	641076	7559218	Jurrawarrina	29
MC 3	Motion Camera	641083	7559214	Jurrawarrina	29
INV SRE01	Opportunistic/Foraging Site	634969	7556764	Jurrawarrina	29
INV SRE02	Opportunistic/Foraging Site	637412	7558016	Jurrawarrina	29
INV SRE03	Opportunistic/Foraging Site	635058	7559395	Boolgeeda	29
INV SRE04	Opportunistic/Foraging Site	643158	7555322	Hooley	29
INV SRE05	Opportunistic/Foraging Site	640572	7557875	Hooley	29
INV SRE06	Opportunistic/Foraging Site	643157	7557706	Jamindie	29
INV SRE07	Opportunistic/Foraging Site	645866	7556863	Jamindie	29

Site name	Site type	Location		Land system	Vegetation association
		Easting	Northing		
INV SRE08	Opportunistic/Foraging Site	643214	7559174	McKay	562
INV OS01	Opportunistic/Foraging Site	645600	7554462	Hooley	29
INV OS02	Opportunistic/Foraging Site	641202	7559360	Hooley	29
INV OS03	Opportunistic/Foraging Site	643211	7555250	Hooley	29
INV OS04	Opportunistic/Foraging Site	645991	7559090	Mckay	562
INV OS05	Opportunistic/Foraging Site	646511	7558957	Newman	562
INV OS06	Opportunistic/Foraging Site	640568	7558043	Hooley	29
INV OS07	Opportunistic/Foraging Site	641631	7558404	Hooley	29
INV OS08	Opportunistic/Foraging Site	635059	7559399	Boolgeeda	29
INV OS09	Opportunistic/Foraging Site	643213	7559185	Mckay	562
INV OS10	Opportunistic/Foraging Site	644414	7557252	Jamindie	29
INV OS11	Opportunistic/Foraging Site	643627	7554893	Hooley	29
INV OS12	Opportunistic/Foraging Site	635246	7558113	Jurrawarrina	29
INV OS13	Opportunistic/Foraging Site	635525	7555903	Jurrawarrina	29
INV OS14	Opportunistic/Foraging Site	637166	7559506	Jurrawarrina	29
INV OS15	Opportunistic/Foraging Site	645225	7556117	Jurrawarrina	29
INV OS16	Opportunistic/Foraging Site	645680	7556267	Jurrawarrina	29
INV OS17	Opportunistic/Foraging Site	634387	7558901	Boolgeeda	29
INV OS18	Opportunistic/Foraging Site	635604	7558586	Jurrawarrina	29
INV OS19	Opportunistic/Foraging Site	635211	7555734	Jurrawarrina	175
INV OS20	Opportunistic/Foraging Site	639270	7557893	Jurrawarrina	29
INV OS21	Opportunistic/Foraging Site	642235	7557170	Hooley	29
INV OS22	Opportunistic/Foraging Site	644379	7558616	Jamindie	562
INV OS23	Opportunistic/Foraging Site	641690	7559377	Hooley	562
INV S01 noc	Nocturnal spotlighting site (on foot)	634467	7559074	McKay	562
INV S02 noc	Nocturnal spotlighting site (on foot)	635179	7556499	Jurrawarrina	29
INV OS02 noc	Nocturnal spotlighting site (on foot)	641202	7559360	Hooley	29
INV OS13 noc	Nocturnal spotlighting site (on foot)	635525	7555903	Jurrawarrina	29
INV OS16 noc	Nocturnal spotlighting site (on foot)	645680	7556267	Jurrawarrina	29
INV OS19 noc	Nocturnal spotlighting site (on foot)	635211	7555734	Jurrawarrina	175

Datum: GDA 94 MGA Zone 50K



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Location of systematic and opportunistic fauna survey sites

Figure: 3.1
Project ID: 1518

Drawn: CK & AH
Date: 20/11/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK028

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3.6 CONSERVATION SIGNIFICANT FAUNA

After the results of the literature review, database searches and survey results were compiled, fauna species that are listed under current legislative frameworks were identified. Three conservation lists have been developed at national (EPBC Act) and state level (WC Act and DPaW priority list).

The likelihood of a conservation significant species being present within the project was determined by examining the following:

- Fauna habitats and their condition known to exist within the study area;
- Distance of previously recorded conservation significant species from the study area;
- Frequency of occurrence of conservation significant species records in the region; and
- Time passed since conservation significant species were recorded within, or surrounding, the study area.

Each conservation significant or biologically significant species potentially occurring in the study area was assigned a likelihood of occurrence based on the below category (Table 3.4). The level of available information for each species was also taken into consideration so that species are not allocated a low likelihood of occurrence because of insufficient survey information or cryptic behaviours and ecology, in accordance with the precautionary principle.

Table 3.4 – Likelihood of occurrence categories

RECORDED	Species recorded during current survey.
HIGH	Species recorded within, or in proximity to, the study area within 20* years; suitable habitat occurs in the study area.
MEDIUM	Species recorded within, or in proximity to, the study area more than 20 years ago. Species recorded outside study area, but within 50 km; suitable habitat occurs in the study area.
LOW	Species rarely or not recorded, within 50 km, and/or suitable habitat does not occur in the study area.

**ecologia* chooses to incorporate regional data from the last 20 years to assess a high likelihood of occurrence of species. Species that have previously been recorded from an area within the last 20 years and where high quality, suitable habitat still persists within an area are considered by *ecologia* to still have potential for a high likelihood of occurrence, following the precautionary principle.

3.7 FAUNA HABITAT MAPPING

A fauna habitat type broadly describes an area of habitat that is distinguishable in its vegetation and land features from its surroundings, and is likely to support a different fauna assemblage to that found in other fauna habitats. Particular attention is also paid to the likelihood that certain species are present which tend to be found only in that specific habitat. Fauna habitat types were identified, described and mapped with reference to the following information sources:

- Aerial imagery;
- Vegetation associations (Beard 1975; Shepherd *et al.* 2002); and
- Land systems (van Vreeswyk *et al.* 2004).

During the survey, other information was also collected, including:

- Landform;
- Vegetation type and structure;
- Soil characteristics (soil structure and substrate);

- Composition of terrestrial fauna species; and
- Condition assessment using the scale provided in Table 3.5 (based on Trudgen 1991).

These observations did not take into account any degradation as a result of exploration or other recent mining activities (e.g. drilling, clearing).

Table 3.5 – Condition assessment (based on Trudgen 1991)

Condition	Criteria
Excellent	Pristine or nearly so, no obvious sign of damage caused by modern humans or introduced fauna (cattle, feral cat, dog, rabbit). No signs of recent, extensive fires.
Very good	Some relatively slight signs of damage caused by the activities of modern humans. e.g. damage to tree trunks by repeated fires, no significant signs of introduced fauna or occasional vehicle tracks.
Good	More obvious signs of damage caused by the activities of modern humans, including some obvious impact to vegetation structure such as that caused by low levels of grazing or by selective logging. Some tracks or secondary evidence of introduced fauna. Some signs of recent fires.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of modern humans such as partial clearing or very frequent fires. Presence of introduced fauna.
Very poor	Severely impacted by grazing, introduced fauna, fire, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management.
Completely degraded	Areas that are completely or almost completely without vegetation communities and are heavily impacted by extensive fires and/or introduced species e.g. cow paddock

Note: Based on vegetation condition scale from Trudgen (1991, cited in Department of Environmental Protection 2000).

3.8 DATA ANALYSIS

3.8.1 Survey Adequacy

There are three general methods of estimating species richness from sample data: extrapolating species-accumulation curves (SACs), fitting parametric models of relative abundance, and using non-parametric estimators (Bunge and Fitzpatrick 1993; Colwell and Coddington 1994; Gaston 1996). In this report, the level of survey adequacy was estimated using SACs, which graphically illustrate the accumulation of new species as more individuals are recorded. Ultimately, the asymptote is reached at the level at which no new species are present. To eliminate features caused by random or periodic temporal variation, the sample order was randomised 1,000 times using EstimateS (version 8, Colwell 2009). In order to estimate the theoretical maximum for each fauna group, a Michaelis-Menten (MM) enzyme kinetic curve was calculated and used as a stopping rule technique.

Only the results of trapping are included in SAC analysis, as this form of analysis assumes a standard sampling effort. Therefore, species recorded through opportunistic methods are not included. Separate analyses were carried out for avifauna and terrestrial trappable fauna (mammals and reptiles). Analysis was not conducted on the amphibian fauna due to the paucity of results.

3.8.2 Habitat Assessment

Analysis of the fauna survey data was undertaken to determine the similarities in fauna communities and identify any unique fauna habitats. To analyse differences in species diversity between habitats, the data was subjected to log+1 transformation. To test whether the differences in species diversity between habitat types were significant, analyses of similarity (ANOSIM) (Clarke 1993) comparisons were made using one-way ANOSIM. ANOSIM was calculated using the Euclidean Similarity Index with 999 permutations. Non-metric multidimensional scaling (MDS) was also applied to the Euclidean similarity matrix. Resulting stress values below 0.20 were considered to indicate a good fit

of the scaling to the matrix. The dimensions that reduced the majority of the "raw stress" were chosen for the final scaling. Analysis was undertaken using the PAST software package (Hammer *et al.* 2001). Separate analyses were carried out for terrestrial fauna (mammal and reptile) and avifauna.

3.9 TAXONOMY AND NOMENCLATURE

Nomenclature for mammals, reptiles and amphibians within this report is as per *Western Australian Museum Checklist of the Vertebrates of Western Australia*, birds according to Christidis and Boles (2008). References used for fauna identification are listed in Table 3.6.

Table 3.6 – References used for identification

Fauna Group	Reference
Mammals	Menkhorst and Knight (2011), Van Dyck and Strahan (2008)
Bats	Churchill (2008), Menkhorst and Knight (2011)
Birds	Simpson and Day (2010)
Reptiles	Cogger (2000), Wilson and Swan (2010)
Geckos	Storr *et al*. (1990), Wilson and Swan (2010)
Skinks	Storr *et al*. (1999), Wilson and Swan (2010)
Dragons	Storr *et al*. (1983), Wilson and Swan (2010)
Varanids	Storr *et al*. (1983), Wilson and Swan (2010)
Legless Lizards	Storr *et al*. (1990), Wilson and Swan (2010)
Snakes	Storr *et al*. (2002), Wilson and Swan (2010)
Amphibians	Tyler and Doughty (2009), Cogger (2000)

3.10 ANIMAL ETHICS

The survey follows *ecologia*'s Animal Ethics Code of Practice, which conforms to Section 5 of the *Australian code of practice for the care and use of animals for scientific purposes* (NHMRC 2004).

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

3.11 SURVEY TEAM AND LICENCES

Field survey team members are listed in Table 3.7 and external consultants listed in Table 3.8. The survey was conducted under DEC (now DPaW) Regulation 17 Licence SF009237.

Table 3.7 – Field survey personnel

Survey Member	Expertise	Qualification	Experience
Dr Matthew Macdonald	Botany/Ecology	PhD	10
Dr Margot Oorebeek	Ornithology	PhD	4
Sean White	Invertebrates	BSc.	4
Chris Knuckey	Zoology/Ecology	BSc. (Hons)	3

Table 3.8 – External consultants

External Consultant	Institution	Relevant Experience
Bob Bullen	Bat Call WA	17 years – Bat call identifications

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4 RESULTS

4.1 FAUNA HABITATS

Fauna habitats within the Investigator study area were broadly mapped within the area during the Solomon Rail Corridor Fauna Risk Assessment (Coffey 2010). The survey conducted by Coffey (2010) only covered a portion of the current study area and included a greater area outside the current study area. The habitat types identified during the Coffey (2010) survey include: creekline/drainage line, shrubland over spinifex grassland/spinifex grassland, Woodland (open/closed), tussock grassland, acacia sp. woodland and bare ground. During the current Level 2 vertebrate fauna assessment, these habitats were reassessed with the use of vegetation mapping, land system mapping, aerial photographs and on-ground truthing. Based on the current survey, four broad fauna habitats are represented within the study area:

- Plain (alluvial);
- Plain (stony gibber);
- Tussock grassland; and
- Drainage line/River/Creek (Minor).

How these habitat types relate to those previously mapped (Coffey 2010) is presented in Table 4.1.

Table 4.1 – Previous and current habitat nomenclature

Coffey (2010)	current
Creekline/drainage line	Drainage line/River/Creek (Minor)
Plain (shrubland)	Plain (stony gibber)
Woodland (open/closed)	Plain (alluvial)
Tussock grassland	Tussock grassland
Bare ground	Bare ground

In addition to these habitats, there was a large area of land to the north west of the study area that had been cleared and ripped (Figure 4.6). Previous mapping in regards to the Solomon Hub project (*ecologia* 2014b) was also utilised for the presence and extent of each habitat type on a regional scale. The habitat condition, area of occupation within and outside the study area are shown in Table 4.2 and mapped in Figure 4.6 - Figure 4.8.

Table 4.2 – Summary of fauna habitats within study area

Fauna habitat	Habitat Condition	Total area (ha)	Percentage of total study area (%)	Total area within 20 km (Coffey 2010) (ha)	Percentage within 20 km (Coffey 2010) (%)	Total area within 20 km buffer (ha)	Percentage within 20 km buffer (%)
Plain (alluvial)	Good-very good	3,001.9	57.6	5,773.6	33.0	43,041.6	28.7
Plain (stony gibber)	Very good-excellent	1,373.3	26.4	8,405.5	48.1	100,610.2	67.0
Tussock grassland	Poor	719.5	13.8	2,913.3	16.7	5,550.4	3.7
Drainage line/River/Creek (Minor)	Good-very good	55.3	1.1	319.2	1.8	652.5	0.4
Cleared area	Completely degraded	53.8	1.0	67.6	0.4	270.2	0.2

Of the four habitat types identified during the current survey, three make up the great majority of the study area. The alluvial plain, stony gibber plains, and the tussock grasslands, each habitat type consists of 57.6%, 26.4% and 13.8% of the study area, respectively. All four of the habitat types are present in the surrounding area, and are not unique to the study area. The majority of the previosuly mapped habitats in the region (within 20 km) is occupied by stony gibber plain with 48.1% of Coffey's mapped habitats (Coffey 2010) and 67.0% of the habitats mapped in relation to the Solomon Hub project (*ecologia* 2014b). The alluvial plain and tussock grassland habitats were the second most common habitat types within 20 km of the study area with 33.0% (Coffey 2010) and 28.7% (Solomon Hub) for the alluvial plain and 16.7% (Coffey 2010) and 3.7% (Solomon Hub) for the Tussock grassland habitat, respectively (Table 4.2, Figure 4.7, Figure 4.8).

Notably, a portion of the mapped alluvial plain habitat and the tussock grassland habitat falls within the 3 km buffer of the DPaW Priority 1 listed PEC, 'freshwater claypans of the Fortescue Valley'. The PEC is repesented by Koodjeepindarranna Pool recognised as a important ecological community for waterbirds, invertebrates and some poorly collected plants. However, despite being within the buffer zone for this PEC the clay pan habitat type was not recorded from the Investigator study area.

Comparison of survey effort against the habitats within the study area is presented in Table 4.3. It shows that all of the major fauna habitats within the study area were adequately surveyed. The minor drainage line/river/creek habitat was not trapped due to its small extent within the study area (1.06%), the degraded and grazed understorey and the inability of trap sites being set-up entirely within this habitat type. Any trap site established within the drainage line habitat would have resulted in very low capture rates due to the very sparse understorey (Figure 4.1) or, if set-up within the adjacent areas with moderate understorey, the trap site would have crossed into adjacent habitat types which unables habitat analysis and comparison between habitat types; however, it was targeted adequately during opportunistic searches to enable an assessment of this habitat. Table 4.3 shows that all fauna habitats were adequately surveyed with relation to their percentage of the study area, through a combination of systematic and opportunistic methods.

Figure 4.1 – Degraded understorey of drainage line habitat within study area

Table 4.3 – Survey effort per fauna habitat type

Habitat type	Trapping nights				Bird survey's (min)	Diurnal opp searches (min)	Bat recording (min)	Nocturnal opp searches (min)	Camera trapping (min)
	Pit traps	Funnels	Elliott's	Cages					
Plain (alluvial)	140	280	140	28	450	600	1560	300	0
Plain (stony gibber)	210	420	210	42	540	420	2340	60	2880
Tussock grassland	70	140	70	14	180	120	780	0	0
Drainage line/river/creek (minor)	0	0	0	0	60	180	780	60	2880
Total	**420**	**840**	**420**	**84**	**1,230**	**1,320**	**5,460**	**420**	**5,760**

4.1.1 Plain (alluvial)

The alluvial plain habitat is the most widespread habitat occurring within the study area, covering ~3,030 ha (58%) (Figure 4.6, Table 4.2). The alluvial plain occurs on clay-loam soils, with a sparse to continuous bed of pebbles. Woodlands range from a dense overstorey of *Acacia aptaneura,* and in some areas *Eucalyptus* sp., and *A. tetragonophylla* to an open woodland with scattered trees and a dense tussock grass understorey (Figure 4.2). In many areas, particularly the southeast of the study area, the alluvial plain is arranged in a banded mulga formation. Large areas within the banded mulga are completely void of any vegetation and provide little microhabitats for fauna. Most of the alluvial plain habitat appears to be long unburnt and, in some areas, vegetation is reaching a senescent phase increasing habitat complexity. The alluvial plains contain a high amount of leaf litter, woody debris and termites and provide a variety of microhabitats for fauna particularly reptiles. Tussock grasses scattered amongst trees also provide cover for ground dwelling fauna. Disturbance within these areas was relatively low, thus the habitat condition was good to very good (Table 3.5).

Figure 4.2 – Alluvial plain habitat type within study area

4.1.2 Plain (stony gibber)

The stony gibber plain habitat is the largest habitat type within the study area, covering ~1,373 ha (26%) (Table 4.2). The stony gibber plain habitat consists of undulating plains and which occur throughout the northern section of the study area (Figure 4.6). Vegetation of the stony gibber plains is characterised by scattered *Eucalyptus leucophloia* subsp*. leucophloia* and *E. gamophylla* mallee over scattered to dense shrubs of *Acacia atkinsiana, A. aptaneura*, *Senna glutinosa* subsp. *glutinosa* over *Triodia* hummock grassland (Figure 4.3). Soils are clay-loam with a continuous mantle of small

pebbles and stone. Dominant microhabitats are mature hummocks of spinifex and flowering shrubs. Woody debris is relatively sparse except in areas with recent fire history, which contain fallen logs and branches. Leaf litter is relatively scarce but builds up in denser shrublands that had not been subject to fire. With little evidence of disturbance within this habitat, the condition was rated very good to excellent (Table 3.5).

Figure 4.3 – Stony gibber plain habitat type within study area

4.1.3 Tussock Grasslands

The tussock grassland habitat covers ~719 ha (14%) of the study area (Table 4.2). This habitat is particularly abundant in the southern section of the study area, within the Hooley land system (Figure 4.6). Often the tussock grasslands are located within or bordering alluvial plains of the study area, sometimes creating large ecotones between the two habitat types. The vegetation within the tussock grasslands is dominated by *Eragrostis* spp., *Themada* spp., and *Astrebla spp.,* with sparse *Acacia* sp. and **Vachellia farnesiana* shrubs and occasional *Eucalyptus* sp. and *Acacia* sp. trees (Figure 4.4). Soil within the area is relatively bare and contains almost no leaf litter and woody debris. The soil varies from weakly formed cracking clays to firm clay-loam. The tussock grassland habitat of the study area was heavily grazed by cattle, thus the habitat condition was assessed to be poor (Table 3.5).

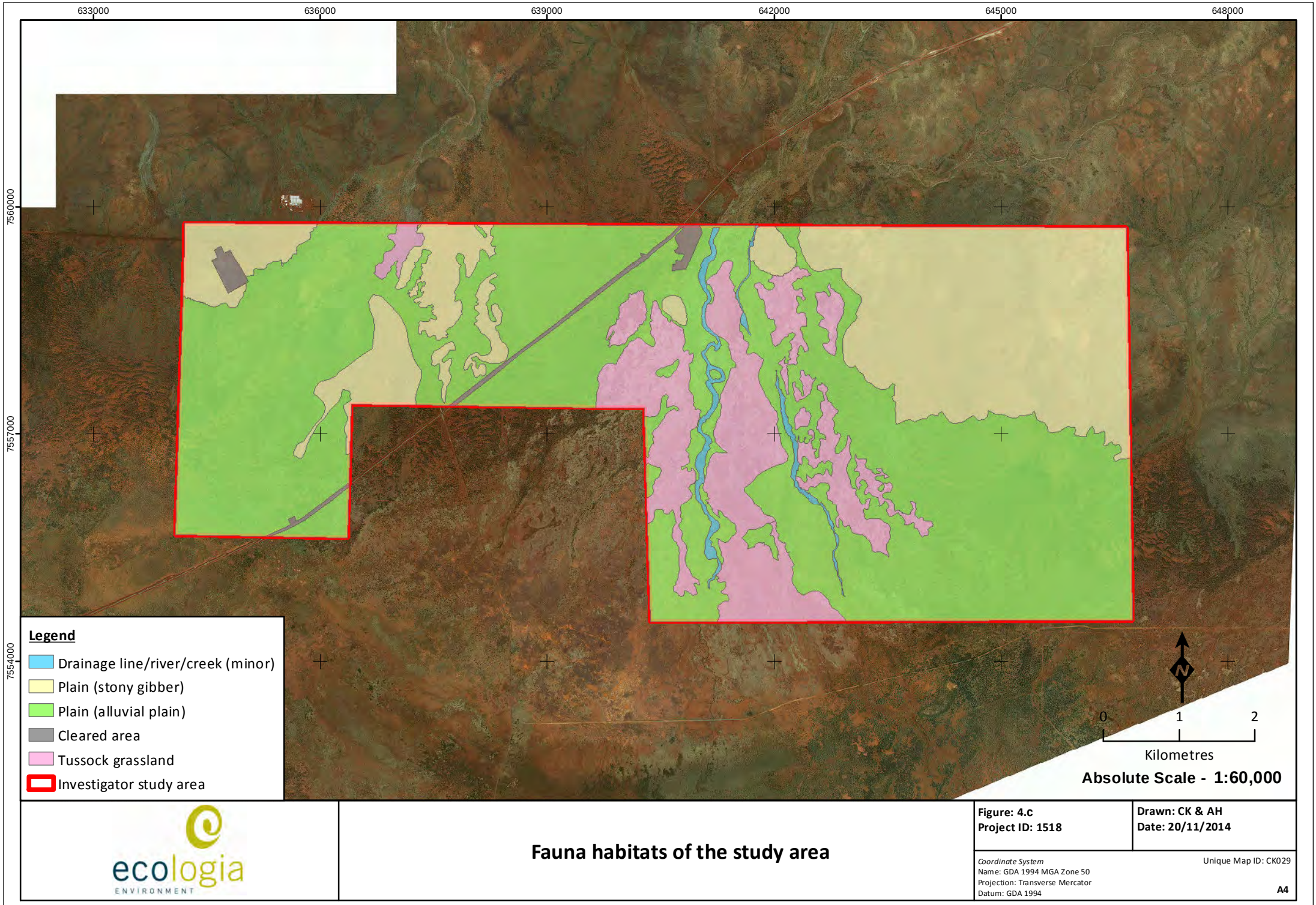
Figure 4.4 – Tussock grassland habitat type within study area

4.1.4 Drainage line/River/Creek (Minor)

The minor drainage line/river/creek habitat is the smallest fauna habitat occurring within the study area (55 ha, 1%) and is represented by two minor drainage lines running north-south (Figure 4.6, Table 4.2). The minor drainage line/river/creek is a tributary associated with the Fortescue River, which runs east-west to the south of the study area. The minor drainage line/river/creek habitat within the study area is ~5-15 m wide. The drainage line supports mature *Eucalyptus victrix* trees with patches of dense mixed Acacia sp. shrubs and tussock grasses such as *Themeda triandra*, *Chrysopogon fallax* and/or **Cenchrus ciliaris* lining the banks (Figure 4.5). The trees of the drainage line/river/creek (minor) habitat contain varying sized hollows and an abundance of woody debris. Leaf litter is abundant on the banks and under large trees. The substrate of the drainage line habitat is a clay-loam on the banks and a continuous bed of smooth river pebbles in larger area of the creek.

The disturbance within this habitat was limited to some grazing and impact by cattle, therefore the habitat condition was assessed to be good to very good.

Figure 4.5 – Drainage line/river/creek habitat type within study area



ecologia ENVIRONMENT

Fauna habitats of the study area

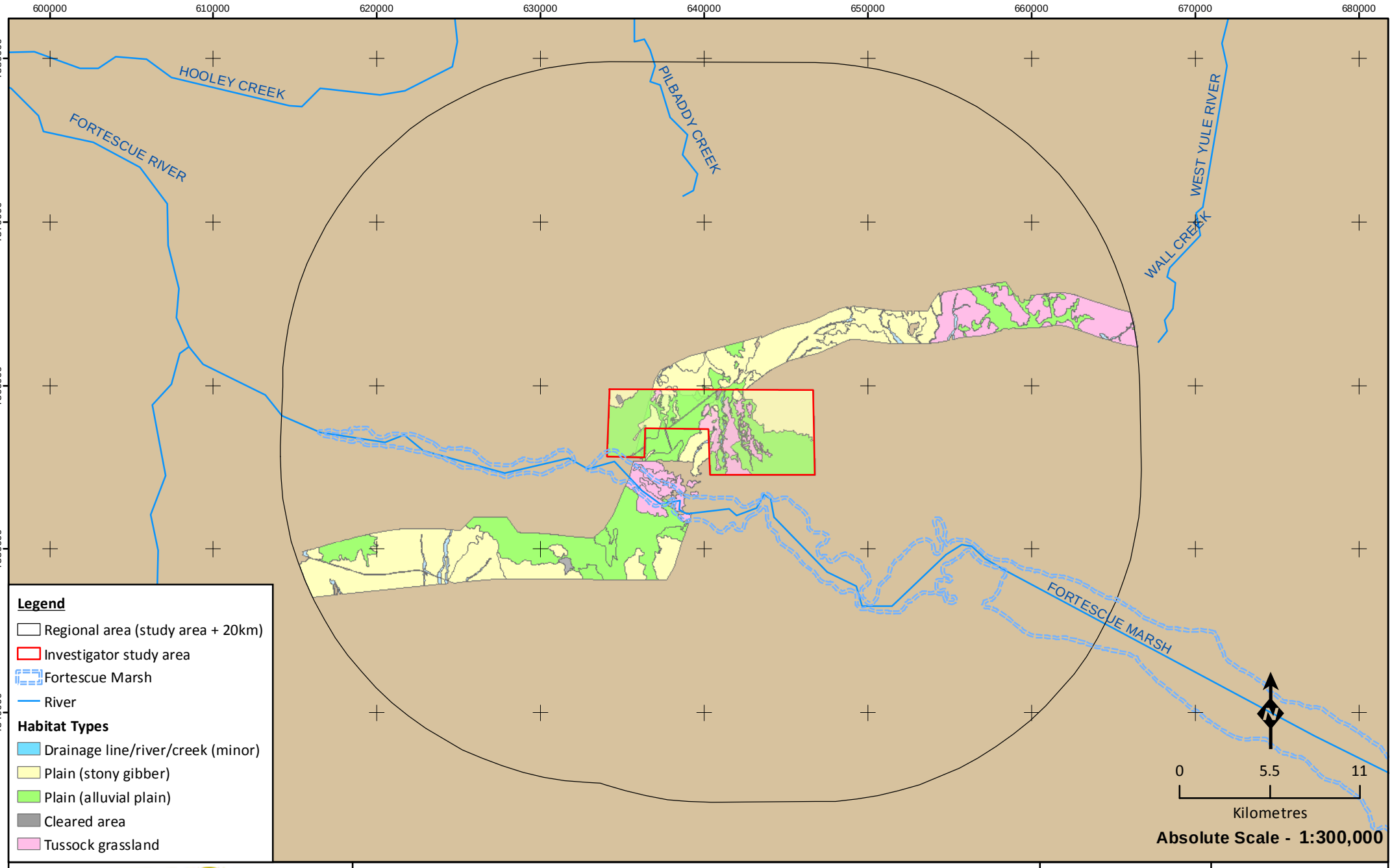
Figure: 4.c
Project ID: 1518

Drawn: CK & AH
Date: 20/11/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK029

A4



ecologia ENVIRONMENT

Regional fauna habitat within 20 km of the study area (Coffey 2010)

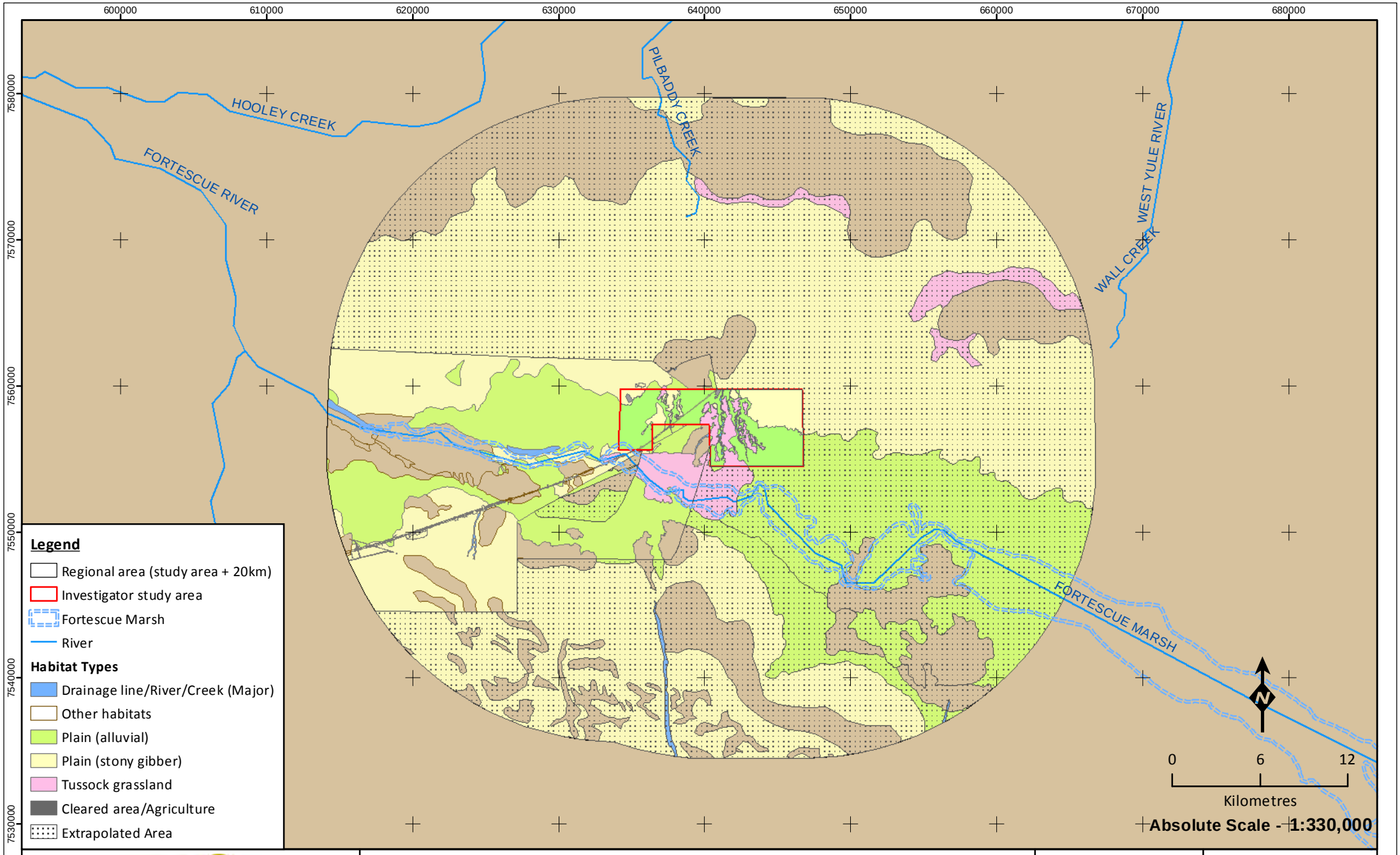
Figure: 4.7
Project ID: 1518

Drawn: CK & AH
Date: 20/11/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK029

A4



ecologia ENVIRONMENT

Regional fauna habitats (within 20 km)

Figure: 4.8
Project ID: 1518

Drawn: CK & AH
Date: 20/11/2014

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK029

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4.2 FAUNA HABITAT ANALYSIS

A one-way ANOSIM test and MDS plot of the trapping sites within the different habitat types was completed for data collected systematically for both birds and terrestrial trapped fauna. The results from these statistical analyses show a difference between the faunal assemblages in the different habitat types between birds and terrestrial trappable fauna. MDS plots for the analyses are shown in Figure 4.9 for terrestrial trapped data and Figure 4.10 for systematic avifauna data.

The one-way ANOSIM test when comparing terrestrial trapped fauna against the different habitat types determined an R value of 0.6858 (R value ranges from -1 to 1, with 1 indicating that the groups are dissimilar and -1 indicating that the groups are similar) and an overall p-value of 0.0001 (p-value of <0.05 indicating a significant difference). The R value close to 1 and the very low p value from this analysis suggest that differences between habitat types exist, and that the data collected are sufficient to make this analysis. The greatest different was between the tussock grasslands and stony gibber plains with an R value of 0.7968 indicating these two habitat types had the greatest difference in trapped fauna. The MDS plot for terrestrial trapped data provides a visual illustration, showing some overlap between habitats, but overall a difference between fauna assemblages recorded at different habitat types (Figure 4.9). A stress value of 0.1442 for this test indicates good fit of the scaling to the matrix, confirming differences in habitat types when comparing trapped fauna data. Figure 4.9 indicates that the fauna assemblage of the tussock grasslands and alluvial plain overlaps.

Results of the systematic avifauna data showed that there is a difference between the avifauna recorded at each habitat type. The one-way ANOSIM test determined an R value of 0.5252 confirming that the habitat types are statistically dissimilar from one another. A p value of 0.0001 suggests sufficient data was obtained to complete the analysis. The alluvial plain habitat and the tussock grassland were the most dissimilar habitat types sharing an R value of 0.9504 which is reflected in Figure 4.10. Visually, the MDS plot indicates a significant difference between all habitat types for the systematic avifauna data. A stress value of 0.1758 for this test indicates good fit of the scaling to the matrix.

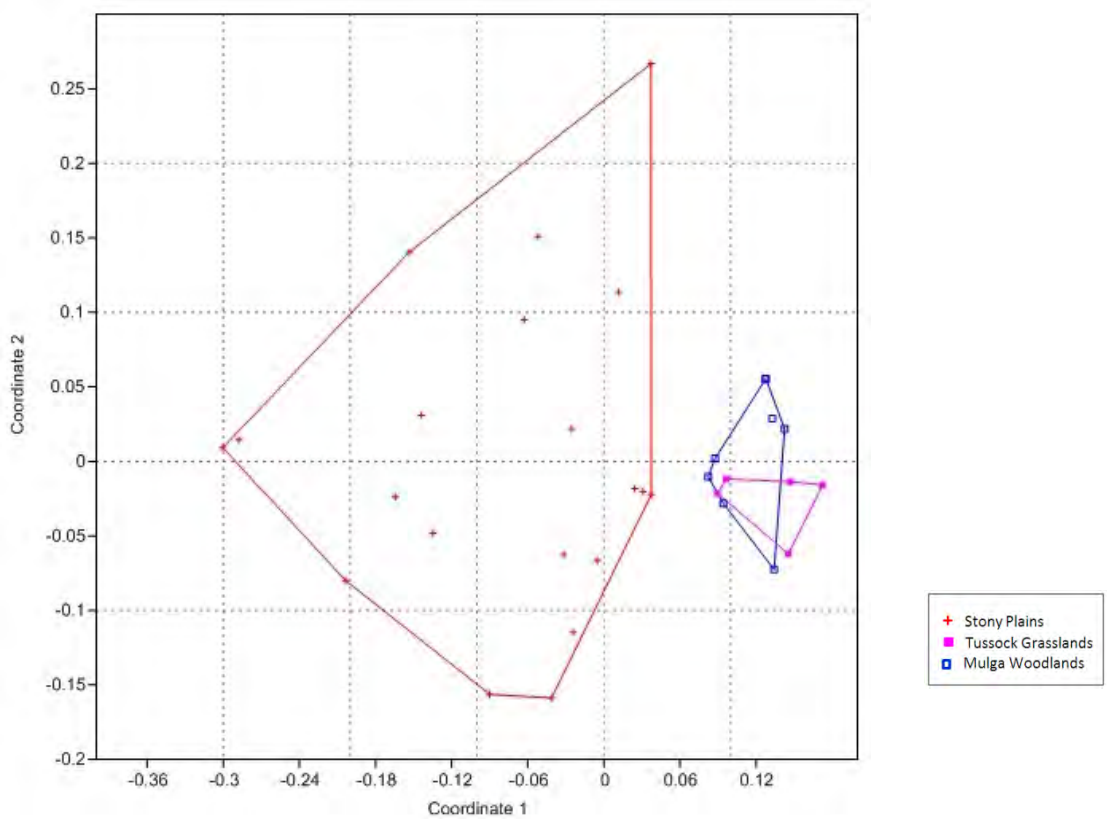


Figure 4.9 – Terrestrial trapped fauna MDS plot

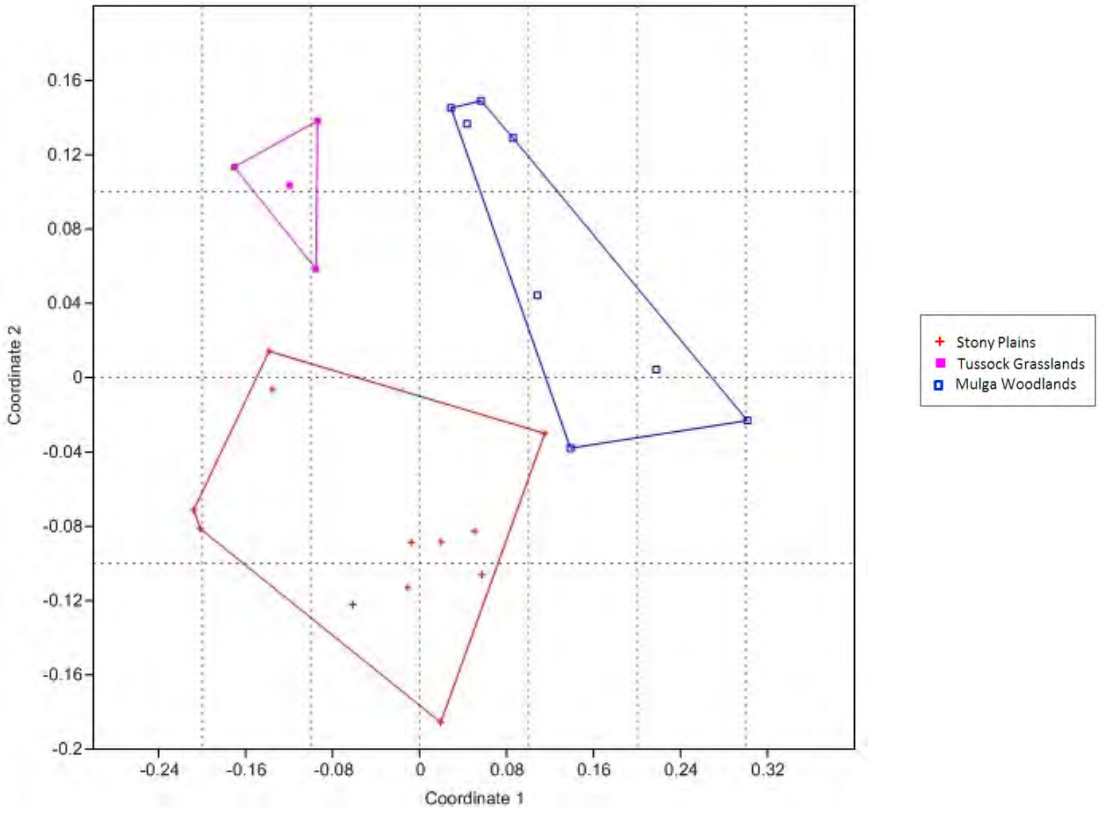


Figure 4.10 – Systemtic avifauna MDS plot

4.3 SURVEY ADEQUACY

Systematically obtained data (trapping results for terrestrial fauna and set-time surveys for birds, excluding opportunistic data) was analysed for survey adequacy. Mammal and reptile trapping data were combined for analysis as 'terrestrial fauna', as these fauna groups were sampled using the same methods.

Analysis of the terrestrial fauna trapping data produced a steady SAC, which had not yet reached an asymptotic plateau but showed to be nearing towards it (Figure 4.11). Extrapolation of the MM curve suggests that 73.65% of the theoretical total number of terrestrial fauna able to be trapped had been captured at the completion of the 42 trap nights of the Level 2 vertebrate fauna survey (Table 4.4). These results indicate that the majority of species were recorded during the survey.

Analysis of avifauna set-time survey dataset produced a steady SAC, almost reaching an asymptotic plateau (Figure 4.12). Used as a stopping rule, the MM estimator indicated that the survey was 87.96% adequate at the completion of 24 set-time surveys. The MM estimator generated a theoretical maximum of 51 species, whilst other richness estimates were as high as 54 (Table 4.4). Based on the MM estimator further survey effort may identify an additional five species (11% increase in species diversity).

Parametric analysis of systematically obtained survey data for terrestrial fauna suggests that increased survey effort would benefit species richness for the survey. Parametric analysis of systematically obtained survey data for avifauna revealed that overall survey effort was adequate. Table 4.4 provides a summary of the theoretical maximum number of species using seven different methods of estimating richness. The MM richness estimator provides the most accurate representation of the potential species number. This is compared against the actual number of species observed, with any inconsistencies smoothed by an algorithm (Mao Tau), which simulates an infinite number of randomisations of the sample order.

Table 4.4 – Mean estimates of total species richness of systematically sampled vertebrate fauna

Richness estimators	Total richness estimate	
	Terrestrial fauna	Birds
ACE	32	46
ICE	34	52
Chao-1	31	46
Jack-1	37	54
Jack-2	42	54
Bootstrap	31	50
Michaelis-Menten	37	51
Species Observed	**27**	**45**

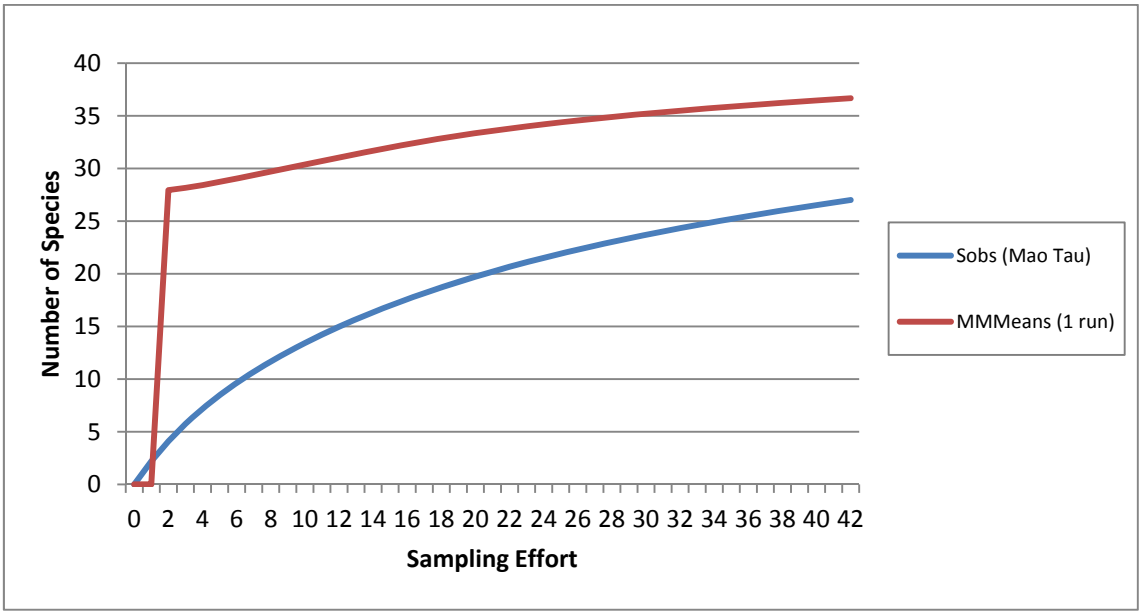


Figure 4.11 – Species accumulation curve for trapped terrestrial vertebrates

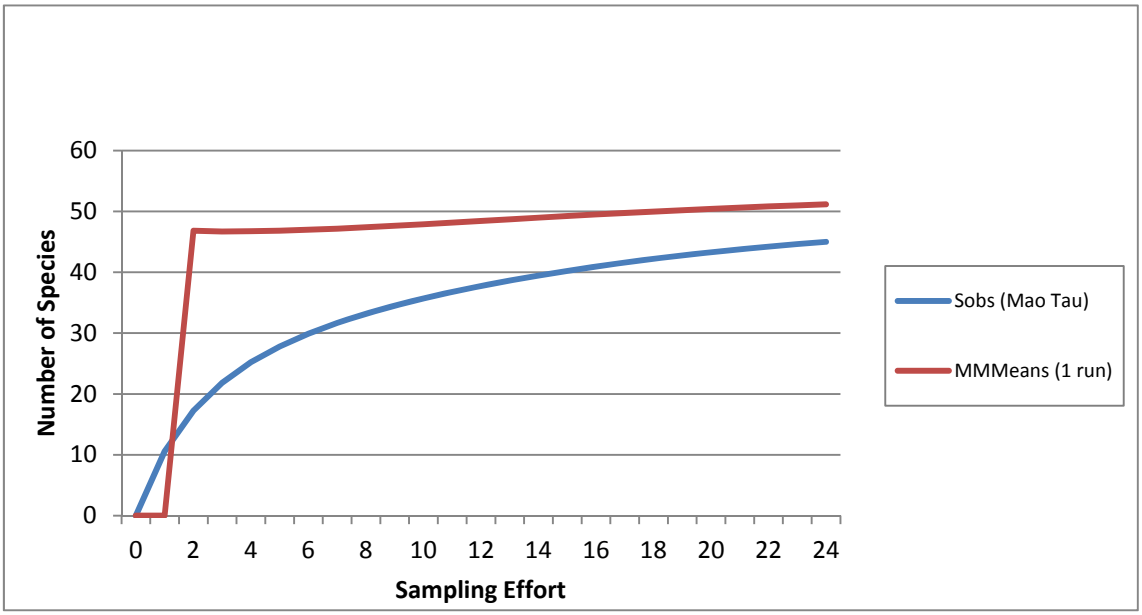


Figure 4.12 – Species accumulation curve for avifauna

4.4 SURVEY LIMITATIONS AND CONSTRAINTS

Limitations of the current survey are summarised in Table 4.5 below. No significant limitations were experienced during the surveys.

The only partial limitation experienced during the survey was the timing of the survey. The survey took place during late May, after the period of peak reptile activity and is likely to have result in a lower number of reptile captures than expected. To compensate, capture data from the survey was supplemented with species lists from surveys previously conducted within the surrounding areas to provide a potential reptile assemblage of the area. This allowed a comprehensive assessment of the fauna assemblage to be made.

Access within the study was good and allowed adequate surveying of the study area. Given no significant limitations were encountered the survey was considered comprehensive.

Table 4.5 – Summary of survey limitations

Limitation	Constraint (yes/no)	Comment
Competency/experience of the consultant carrying out the survey.	No	All members of the survey team were experienced in Pilbara fauna identification and fauna surveys.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	All faunal groups were adequately sampled.
Proportion of fauna identified, recorded and/or collected.	No	The majority of birds and mammals expected to occur within the study area were recorded. The number of reptile species recorded was slightly less than estimated (Section 5.4). All captured species were identified in the field. One specimen of *Diplodactylus galaxias* was vouchered with WAM.
Sources of information (previously available information as distinct from new data).	No	Twenty-seven biological surveys have been conducted within 100 km of the study area. Data from these surveys (in addition to standard databases) were included to provide a comprehensive regional context.
The proportion of the task achieved and further work which might be needed.	Minor	A single-phase Level 2 vertebrate fauna assessment was completed. Guidelines state that one or more phases of surveying are recommended in each season (EPA 2004a) with a recommendation of conducting repeat surveys (EPA and DEC 2010) which is likely to result in identifying further species for the study area. However, given the relatively large number of surveys conducted in close proximity to the study area, further work may not be necessary to assess the fauna assemblage of the study area.
Timing/weather/season/cycle.	Minor	The Level 2 fauna assessment was conducted shortly after the peak activity time for vertebrate fauna within the Pilbara region (particularly reptiles). However, over 73% of the expected terrestrial trappable fauna and 87% of expected avifauna were recorded.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	No	No major disturbances dramatically affected the survey.
Intensity (in retrospect was the intensity adequate).	No	The survey intensity was adequate, all habitat types were surveyed systematically or opportunistically, and a large proportion of the species expected to occur were recorded.
Completeness (e.g. was relevant area fully surveyed).	No	The study area was comprehensively surveyed.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	All field members were suitably qualified and experienced in identification of Pilbara fauna. There were no resource issues encountered.
Remoteness and/or access problems.	No	All areas were reasonably accessible by vehicle and/or on foot.
Availability of contextual (e.g. biogeographic) information on the region).	No	Sufficient contextual information was available on the Pilbara region and the study area.
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	No	Survey methods were suitable to record all terrestrial vertebrate fauna groups.

4.5 FAUNA ASSEMBLAGE

A total of 18 native and three introduced mammal, 65 bird, 26 reptile and one amphibian species were recorded within the study area during the current survey. Included in this total is one species of mammal (Western Pebble-mound Mouse), which was recorded by secondary evidence only. Of the species recorded, four were of conservation significance. A site by species matrix of species recorded during the Level 2 vertebrate fauna assessment can be seen in Appendix F.

4.5.1 Mammals

In total, 18 native and three introduced mammal species were recorded during the Level 2 vertebrate fauna assessment. The native mammal assemblage consisted of four dasyurids (small, carnivorous marsupials), two macropods (kangaroos and wallabies), eight bats and four murids (mice). Murids and dasyurids were captured in pitfall and Elliott traps at systematic trapping sites. Macropods were observed during diurnal and nocturnal opportunistic searches. Bats were identified from calls recorded on SM2BAT systems and during nocturnal opportunistic searches. One species, the Black Flying-fox (*Pteropus alecto*), was also recorded during the survey during nocturnal searches. There are no official records of this species having been recorded within 50 km of the study area. Furthermore there are no official records of the species from the inland Pilbara region since 1964 (DPaW 2014).

The most common terrestrial mammal species recorded included *Dasykaluta rosamondae* (19) *Pseudomys desertor* (5), *Planigale* sp. (3), *Ningaui timealeyi* (2) and *Pseudomys hermannsburgensis* (2). Of the eight bat species recorded during the survey, two species (*Chalinolobus gouldii* and *Vespadelus finlaysoni*) were abundant and recorded at all trapping sites.

Two species of conservation significant mammal were recorded during the survey: the Short-tailed Mouse (DPaW Priority 4) and the Western Pebble-mound Mouse (DPaW Priority 4), which was recorded from secondary evidence only (two active and six inactive mounds).

4.5.2 Birds

In total, 65 species of bird were recorded from 1,845 records within the study area during the Level 2 vertebrate fauna assessment. The species list of 65 species is composed from a 30 families. The most diverse families recorded included Accipitridae (Kites, Eagles and Hawks) and Meliphagidae (Honeyeaters).

High counts largely composed of common nomadic granivore species such as the Zebra Finch, Cockatiel and Budgerigar. Among the most common species were Zebra Finch (211) which were recorded at most sites, followed by Cockatiel (183), Budgerigar (160), White-plumed Honeyeater (108), Masked Woodswallow (88), Black-faced Woodswallow (82), Crested Pigeon (78) and Diamond Dove (76).

Two species of conservation significance were recorded: Rainbow Bee-eater (EPBC Act Migratory, WC Act Schedule 3) and Australian Bustard (DPaW Priority 4).

4.5.3 Herpetofauna

Twenty-six species of reptile and one species of amphibian were recorded during the Level 2 vertebrate fauna assessment. The reptile assemblage of the study area comprised three dragons (family Agamidae), six geckos (families Diplodactylidae and Gekkonidae), one pygopod (family Pygopodidae), eight skinks (family Scincidae), three goanna's (family Varanidae) and three elapids (family Elapidae). The amphibian assemblage comprised of one hylidae species, Main's Frog (*Cyclorana mainii*).

The most common species recorded were *Ctenophorus caudicinctus* (27), *Ctenotus pantherinus* (20), *Gehyra variegate* (17), *Ctenophorus isolepis* (7), *Amphibolurus longirostris* (5), *Diplodactylus conspicillatus* (5) and *Suta punctata*.

No herpetofauna species of conservation significance were recorded during the survey.

4.5.4 Conservation Significant Fauna

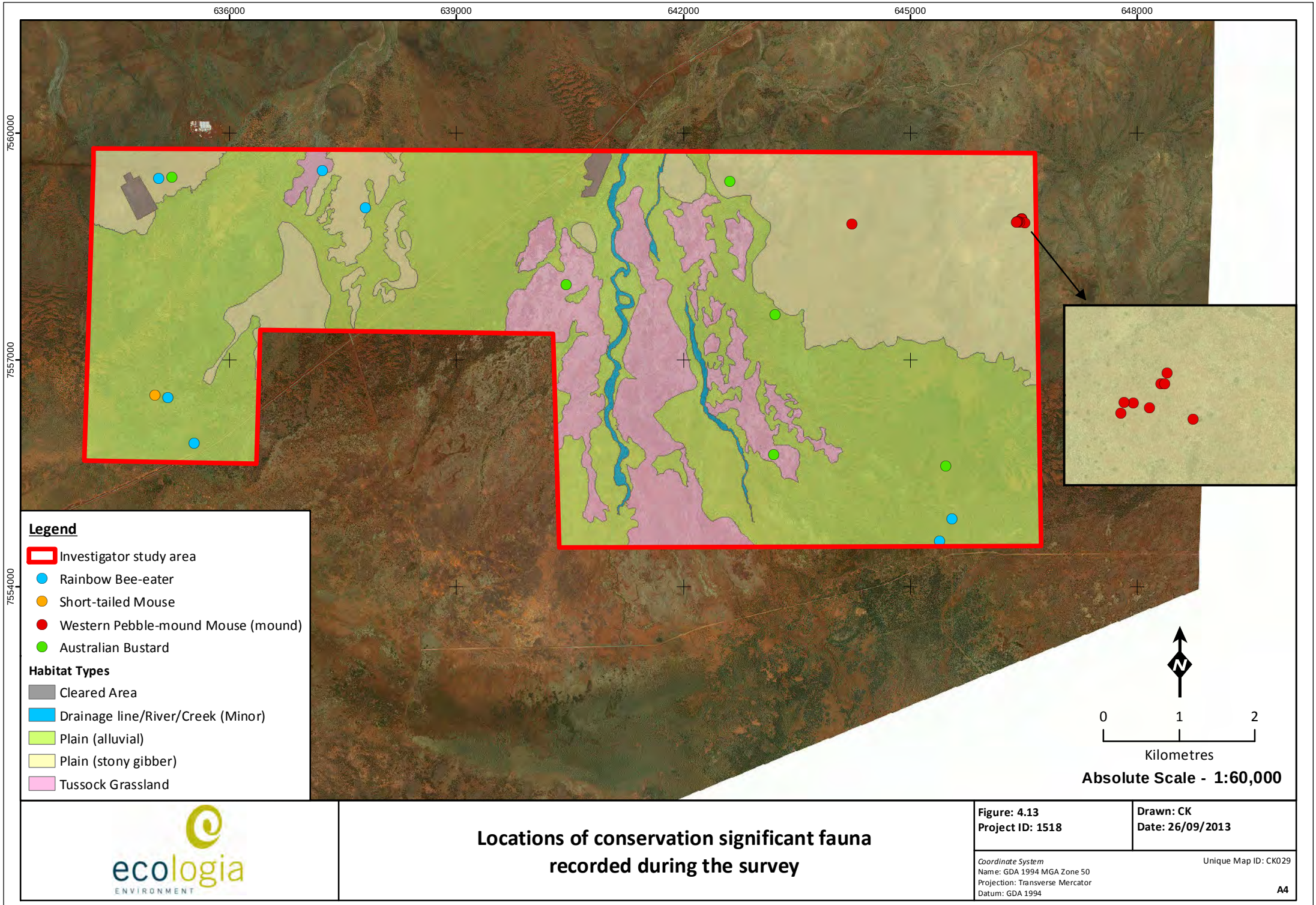
Based on database searches and the results of previous biological surveys in the surrounding region, 36 species (10 mammal, 21 bird, six reptile, and one fish) of conservation significance have been recorded within 100 km of the surrounding region and/or have the potential to occur in the study area. Of these 36 species, 14 species have been removed from further discussion due to the lack of habitat within the study area or because they represent erroneous records (see Table 2.6).

Four species of conservation significance (two mammals and two birds) were recorded from within the study area through direct and indirect evidence, these records are summarised in Table 4.6 and mapped in Figure 4.13. An additional fifteen conservation significant species are assessed as having a medium to high likelihood of occurrence, with the remaining 14 species assessed as having a low likelihood of occurrence. Conservation significant species that were recorded or have a medium to high likelihood of occurrence are described in greater detail in Section 5.3.

Table 4.6 – Conservation significant fauna recorded during the survey

Species	Location			Comments
	Easting	Northing	Site	
Mammals				
Short-tailed Mouse	635014	7556529	INV S02	One individual captured
Western Pebble-mound Mouse	644231	7558799	-	Inactive mound
Western Pebble-mound Mouse	646468	7558858	INV OS06	Active mound
Western Pebble-mound Mouse	646477	7558873	INV OS06	Inactive mound
Western Pebble-mound Mouse	646474	7558858	INV OS06	Inactive mound
Western Pebble-mound Mouse	646514	7558808	INV OS06	Active mound
Western Pebble-mound Mouse	646452	7558824	INV OS06	Recently inactive mound
Western Pebble-mound Mouse	646429	7558831	INV OS06	Recently inactive mound
Western Pebble-mound Mouse	646416	7558832	INV OS06	Inactive mound
Western Pebble-mound Mouse	646411	7558816	INV OS06	Inactive mound
Birds				
Australian Bustard	643198	7555748	-	Two individuals recorded
Australian Bustard	643210	7557603	-	One individual recorded
Australian Bustard	642612	7559362	-	Two individuals recorded
Australian Bustard	635059	7559399	-	Recorded through secondary evidence (scat)
Australian Bustard	640452	7557996	-	One individual recorded
Australian Bustard	645473	7555593	-	Recorded through secondary evidence (scat)
Rainbow Bee-eater	645519	7554462	INV OS01	Two individuals recorded
Rainbow Bee-eater	635059	7559399	INV OS08	One individual recorded
Rainbow Bee-eater	645554	7554894	-	Two individuals recorded
Rainbow Bee-eater	635525	7555903	INV OS13	Three individuals recorded
Rainbow Bee-eater	637166	7559506	INV OS14	One individual recorded
Rainbow Bee-eater	635179	7556499	-	Three individuals recorded
Rainbow Bee-eater	637776	7559027	-	Two individuals recorded

Datum: GDA1994 MGA Zone 50K



ecologia ENVIRONMENT

Locations of conservation significant fauna recorded during the survey

Figure: 4.13
Project ID: 1518

Drawn: CK
Date: 26/09/2013

Coordinate System
Name: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: CK029

A4

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5 DISCUSSION

5.1 HABITATS

5.1.1 Plain (alluvial)

The mammal species inhabiting the alluvial plain are generalist species that have a wide distribution throughout Western Australia (van Dyck and Strahan 2008). The Striped-face Dunnart (*Sminthopsis macroura*) and Red Kangaroo (*Macropus rufus*) are both common inhabitants of the alluvial plain habitat type.

The avifauna of the alluvial plain is usually most diverse after significant rainfall when mulga trees are flowering (Burbidge and Fuller 2007; Keast 1968).

The herpetofauna of the alluvial plain comprises generalist's species, such as the Tree Dtella (*Gehyra variegata*) and Yellow-faced Whipsnake (*Demansia psammophis*) in addition to a suite of species that were unique to this habitat type, such as the *Varanus bushi,* Central Netted Dragon (*Ctenophorus nuchalis*) and the Mulga Dragon (*Caimanops amphiboluroides*). As depicted in Figure 4.9, the fauna assemblage of this habitat type shows little difference to that of over other habitat types sampled systematically during the survey. While some species (such as the Mulga Dragon) are exclusive to this habitat type within the study area, these species are predominately "widespread species" that also occur in alluvial plain and shrublands in adjoining regions to the south and east of the Pilbara (Doughty *et al.* 2011).

The alluvial plain habitat is a common widespread habitat within the study area and occupies 33.0% of the previous habitat mapped by Coffey (2010) and 28.7% of the regional habitat within 20 km of the study area; as such, the fauna assemblage of this habitat consists of many common and widespread species. Conservation significant species including the Short-tailed Mouse (DPaW Priority 4), Rainbow Bee-eater (EPBC Act Migratory, WC Act Schedule 3) and Australian Bustard (DPaW Priority 4) were recorded from this habitat type. The Short-tailed Mouse was captured from a small patch (~0.5 ha) of gilgai soil situated within the alluvial plain habitat and the Short-tailed Mouse is expected to be restricted to patches of gilgai/cracking clays within this habitat type. The conservation significant species recorded from this habitat type are not thought to be restricted to the alluvial plain habitat type.

5.1.2 Plain (stony gibber)

The mammal species recorded from the stony gibber plain comprise a variety of northwest WA endemics such as the Little Red Kaluta (*Dasykaluta rosamondae*), the Pilbara Ningaui (*Ningaui timealeyi*) and widely distributed generalists such as the Planigale (*Planigale* sp.), Desert Mouse (*Pseudomys desertor*) and Sandy Inland Mouse (*Pseudomys hermannsburgensis*) (van Dyck and Strahan 2008).

Avifauna of this habitat was mostly composed of opportunistic granivores whereas the herpetofauna of the stony gibber plain comprises a list of wide-ranging species that shelter within spinifex clumps and vegetative debris.

The stony gibber plain habitat comprises suitable habitat for conservation significant species, the Western Pebble-mound Mouse (Anstee 1996, 1997) and the Australian Bustard (Ziembicki 2010). Both species were recorded within this habitat type and are well documented as occurring within this habitat type based on similar surveys within the surrounding areas (*ecologia* 2010, 2012a, b).

The stony gibber plain habitat was recorded throughout the local region and is with 48.1% (Coffey 2010) and 67.0% (regional within 20 km) the most common habitat recorded from the area. The habitat is not unique to the study area and therefore is not considered significant as such.

5.1.3 Tussock grasslands

Species diversity within tussock grasslands is limited to a relatively small number of species that specialise in this less common and relatively homogenous habitat.

Mammal species recorded from this habitat include the Red Kangaroo and Planigale. This habitat type also recorded a high number of Cattle. Within the Pilbara region, a feature of this habitat type has been recognised as core habitat for both the Short-tailed Mouse and Planigale and the Strip-faced Dunnart is commonly recorded here (*ecologia* 2012a; Gibson and McKenzie 2009).

The avifauna assemblage of this habitat is recognised of being unique (Burbidge *et al.* 2010; How *et al.* 1991), as demonstrated during this survey (Figure 4.10). Avifauna that can be found in this habitat include grassland species such as the Brown Songlark (*Cincloramphus cruralis*), Rufous Songlark (*Cincloramphus mathewsii*) and Australasian Pipit (*Anthus novaeseelandiae*) as well as common and widespread species such as the Crested Pigeon (*Ocyphaps iophotes*) and Cockatiel (*Nymphicus hollandicus*) (Johnstone *et al.* 2013; Johnstone and Storr 2004). This habitat type is often affiliated with small ground-dwelling omnivores and granivores (Burbidge *et al.* 2010).

The reptile diversity within this habitat was relatively low. One species of interest, a Pilbara endemic, was repeatedly caught within the tussock grassland: *Diplodactylus galaxias*. Its occurrence within this habitat is explained in greater detail in Section 4.5.3. Tussock grassland habitats within the Pilbara often contain species who prefer open habitats with compacted clayey soils and sparse plant cover such as *Diplodactylus pulcher, Tympanocryptis* sp. and the cracking clay Pilbara endemic *Diplodactylus mitchellii* (Doughty et al. 2011). However, none of these species were recorded during this survey.

Cracking clay soils are widespread throughout this habitat type. Based on literature and previous surveys, the cracking clays are the preferred habitat for the conservation significant Short-tailed Mouse (*Leggadina lakedownensis*) (ecologia internal database, *ecologia* 2012a, 2013d; van Dyck and Strahan 2008) and may also provide habitat for the highly nomadic Flock Bronzewing which have been recently recorded within the vicinity of the study area (Rapallo 2011). The Australian Bustard has a preference for open plains and was also commonly recorded within this habitat type (Ziembicki 2010).

The tussock grassland extends to the south of the study area towards the Fortescue Marsh (Figure 4.8). It is less common than the two previous habitat types. It occupies 16.7% of the habitats along the Hamersley line (Coffey 2010) and 3.7% of the previously mapped habitats within 20 km of the study area. The habitat has therefore no significant status on a regional scale.

5.1.4 Drainage line/river/creek (minor)

The drainage line/river/creek habitat was the smallest habitat type within the study area. Drainage lines are often well-vegetated and may contain small puddles of water, for this reason drainage lines are used as corridors by many species moving through the landscape.

Watercourses are an important habitat for many mammal species, particular larger species with high water intake requirements and microbats which feed on the abundance of insects inhabiting this habitat type (McKenzie and Bullen 2009). Mammal species recorded from this habitat only include the Red Kangaroo and the Black Flying-fox (*Pteropus alecto*). Introduced species such as the Cat and Cattle were also recorded from this habitat type.

Watercourses in arid environments are considered species rich for birds; they provide a broad array of feeding substrates and nesting sites compared to other Pilbara environments and often contain drinking sites which are utilised by individuals which occupy nearby habitats. For this reason drainage line are often unique and important to the avifauna assemblage (Burbidge *et al.* 2010).

Within the Pilbara, very few drainage lines have extensive well-developed reptile habitats that are distinct from surrounding areas and unlike mammals and birds, the reptile assemblage within this habitat type is rarely unique (Doughty *et al.* 2011). The herpetofauna of the drainage line/river/creek (minor) habitats consist of common species that prefer dense vegetation, associated leaf litter, and amphibians that utilise the presence of water. These include skinks such as *Carlia munda*, and the Robust Ctenotus (*Ctenotus robustus*). Other species include the Long-nosed Dragon (*Amphibolurus longirostris*), Monk Snake (*Parasuta monachus*), legless lizards and the Little Red Tree Frog (*Litoria rubella*).

One conservation significant species was recorded from within this habitat type, the Rainbow Bee-eater. The drainage line habitat may provide some breeding habitat for the species (Boland 2004a). In addition, the Bush Stone Curlew often inhabits watercourses and woodland habitat and may occur within this habitat type (Johnstone *et al.* 2013).

The drainage line habitat is the most restricted habitat within and outside the study area. It occupies 1.8% of the mapped habitat along the Hamersley line (Coffey 2010) and 0.4% of the regional habitats within 20 km of the study area. This is consistent with the low extent recorded within the study area (1.1%). Despite the small areas recorded in the region, the drainage line habitat is not exclusively found in the local region but is present throughout the local region and the Pilbara bioregion (*ecologia* 2014b; Shepherd *et al.* 2002). This habitat type is not thought to be significant on a regional scale.

5.2 ENDEMIC SPECIES AND SPECIES OF BIOLOGICAL SIGNIFICANCE

Three taxa endemic to the Pilbara region were recorded during the surveys the Pilbara Ningaui (*Ningaui timealeyi*), *Diplodactylus galaxias* and *Varanus bushi*.

Ctenotus robustus which occurs throughout the northern and eastern parts of Australia reaches its distributional extremity in the Pilbara region (DPaW 2014). The Pilbara population is isolated from other populations of the species and is believed to represent an undescribed species closely affiliated with *Ctenotus borealis* (WAM pers. comm.).

Additionally, one near-endemic species was recorded, the Little Red Kaluta (*Dasykaluta rosamondae*), only a small percentage of the species distribution extends beyond the Pilbara IBRA region boundary (van Dyck and Strahan 2008).

During the survey, one species was recorded that is not a Pilbara endemic but a species of biological significance: the Black Flying-fox. It was recorded from one individual during the survey. The species was not recorded during the database review. The Black Flying-fox is an adaptable fruit bat that is distributed across most of northern and eastern Australia. The nearest Naturemap record of the Black Flying-fox (DPaW 2014) is located ~70 km to the northeast of the study area dated from 1964. There are no Naturemap (DPaW 2014) records of the species located within the Pilbara bioregion from the past 20 years, the nearest recent records are located at Barrow Island and Cape Range >300 km east of the study area (DPaW 2014). Individuals of the species were also recorded ~50 km to the southwest by *ecologia* staff, just outside Foprtescue's Mt Macleod tenement in April 2013. The species is known to forage up to 50 km from their roosting location but usually remain within 20 km (Churchill 2008) suggesting that a roosting location is located within the vicinity of these two tenements.

5.3 CONSERVATION SIGNIFICANT FAUNA

Based on database searches and the results of previous biological surveys in the surrounding region, 10 mammal, nine bird and six reptile species of conservation significance could potentially occur in the study area. A total of nine conservation significant species (including four recorded during the

survey) were assessed as having a medium or high likelihood of occurrence within the Investigator study area. Information regarding conservation significant species are summarised in Table 5.1. Species of conservation significance with a high or medium likelihood of occurrence are reviewed in greater detail in section 5.3. Species assessed as low likelihood of occurrence are not discussed further.

Table 5.1 – Conservation significant fauna occurring or potentially occurring in the study area

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Mammals						
Northern Quoll *Dasyurus hallucatus*	EN	S1	EN	Typically rocky areas, but also eucalypt forest and woodland (Holmes and Miller 2005; Oakwood 2008).	Not recorded within the study area. The nearest NatureMap (DPaW 2014) record comes from 2012 near Wittenoom, located ~15 km south of the study area. The species has also been recorded 55 km to the south-west at Solomon study area (Coffey 2008), Kings Area (*ecologia* 2010), Firetail Mining Area (Ecoscape 2010c) and during the Solomon Mine and Rail Monitoring (*ecologia* 2013b, c).	**LOW** Species recently recorded within close proximity to the study area however the study area does not provide suitable habitat for the species.
Northern Marsupial Mole *Notoryctes caurinus*	EN	S1	EN	Longitudinal sand dunes, interdunal flats and possibly sandy soils along river flats (Benshemesh 2008).	Not recorded within the study area. The nearest NatureMap (DPaW 2014) record located >350 km east of study area.	**LOW** Species not recorded near study area and no suitable habitat exists
Bilby *Macrotis lagotis*	VU	S1	VU	Variety of habitats on soft soil including spinifex hummock grassland, acacia shrubland, open woodland and cracking clays (Johnson 2008).	Not recorded in study area. The nearest NatureMap (DPaW 2014) record from 1969 ~75 km northeast of study area. Most recent record within the vicinity of the study area comes from 1997 ~90 km east of study area (DPaW 2013).	**LOW** Few recent records of the species within the vicinity of study area. Suitable habitat is not present within the study area.
Pilbara Leaf-nosed Bat *Rhinonicteris aurantius*	VU	S1	VU	Roost in caves with high humidity (95%) and temperature (32 °C). Forage along waterbodies with fringing vegetation (Armstrong 2008).	Not recorded within the study area. Calls recorded from four locations at Central Pilbara Project (ecologia 2011b). Nearest NatureMap from 2013 and is record located ~30 km south of the study area at Wittenoom (2012) (DPaW 2014).	**LOW** Species recently recorded within the vicinity of the study area. The study area does not provide suitable roosting habitat for the species and the species is unlikely to travel to the study area to forage.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Long-tailed Dunnart *Sminthopsis longicaudata*			P3	Rocky, hilly areas, occasionally open areas with a stony, rocky mantle (Burbidge *et al.* 2008).	Not recorded within study area. Recorded from two locations within the Central Pilbara Project, ~78 km south-west of the study area (*ecologia* 2011b). Nearest NatureMap (DPaW 2014) record from Mount Florence Homestead ~45 km north-west from the study area.	**LOW** Species recently recorded within close proximity to the study area however the study area does not provide suitable habitat for the species.
Spectacled Hare-wallaby *Lagorchestes conspicillatus leichardti*			P3	Grasslands, open forests, open woodlands and tall shrublands; shelter during the day under tussocks of *Triodia* spp (Burbidge and Johnson 2008).	Not recorded within the study area. The nearest NatureMap (DPaW 2014) record is located ~60 km to the west of the study area from 1979. Nearest recent record (2003) located ~85 km to the north (DPaW 2014).	**LOW** There a very few recent records of the species located within the vicinity of the study area. The study area is unlikely to provide suitable habitat for the species.
Brush-tailed Mulgara *Dasycercus blythi*			P4	Sand plains and gibber plains with moderately dense spinifex with 'runways' between clumps (Woolley 2008).	Not recorded within the study area. The nearest NatureMap (DPaW 2014) record is located ~70 km to the north-east of the study area from 2011. Recorded during the Solomon Mine and Rail Monitoring (*ecologia* 2013c).	**LOW** Few recent records exist in the vicinity of the study area and suitable habitat not present within study area.
Ghost Bat *Macroderma gigas*			P4	Caves, rockpiles and abandoned mines. Will travel 2 km from roost to hunt. Can disperse up to 50 km during non-breeding season (Armstrong and Anstee 2000; Richards *et al.* 2008).	Not recorded within the study area. Calls recorded from six locations within the Central Pilbara Project (*ecologia* 2011b) and records from three locations at Solomon Project (Coffey 2008; *ecologia* 2010). The nearest NatureMap (DPaW 2014) record is located ~45 km south-west of the study area from 2013.	**LOW** Species recently recorded within close proximity to the study area. The study area does not provide suitable roosting habitat for the species and the species unlikely to travel to the study area to forage.
Short-tailed Mouse *Leggadina lakedownensis*			P4	Spinifex and tussock grassland on cracking clays. Also acacia shrubland, samphire, woodlands, and stony ranges (Moro and Kutt 2008).	Recorded from one location during the survey. The nearest NatureMap (DPaW 2014) record located ~25 km west of the study area near Mount Florence Homestead (2003). Recorded during the Central Pilbara Project located ~70 km south-east of the study area (*ecologia* 2011b).	**RECORDED** Species recorded from one location during the survey. Suitable habitat recorded from within the study area.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Western Pebble-mouse *Pseudomys chapmani*			P4	Spurs and rocky hills with many small pebbles vegetated by spinifex (Start 2008)	Two active and six inactive mounds recorded during the survey. Mounds recorded from almost all previous surveys in region (Bamford 2005; Coffey 2008; *ecologia* 2010, 2011b, 2012a; Ecoscape 2010c; Kendrick 1995) (Appendix E). The nearest NatureMap (DPaW 2014) record located 25 km to the west from 2012.	**RECORDED** (secondary evidence) Two active and six inactive mounds recorded during the survey.
Birds						
Night Parrot *Pezoporus occidentalis*	EN	S1	CR	Mostly ground-dwelling; spinifex grasslands or samphire and chenopod shrublands near waterbodies (Johnstone and Storr 1998; Simpson and Day 2010).	There is one NatureMap (DPaW 2014) record located ~110 km to the east of the study area from 2005 (Davis and Metcalf 2008).	**LOW** There are very few records from within the region and the species is generally rare and uncommon.
Fork-tailed Swift *Apus pacificus*	M			Almost entirely aerial, particularly associated with storm fronts (Johnstone and Storr 1998; Simpson and Day 2010).	Recorded from five locations at Central Pilbara Project and Solomon Project (ecologia 2010, 2011a), ~70 km south-west of the study area and at the Kings Area Solomon Project ~60 km south-west of the study area (ecologia 2010). The nearest NatureMap (DPaW 2014) record located ~15 km south of the study area from 2012.	**MEDIUM** The species has been recorded within the vicinity of the study area. The species may occur within the study area as an irregular summer migrant.
Rainbow Bee-eater *Merops ornatus*	M			Open country, most vegetation types, dunes, banks (Johnstone and Storr 2004; Simpson and Day 2010).	Species recorded at seven locations within the study area. Previously recorded within the study area and from most surveys throughout the region (DPaW 2014) (Appendix E).	**RECORDED** Species was recorded at seven locations throughout the study area. The study area provides suitable habitat for the species.
Grey Falcon *Falco hypoleucos*		S1	VU	Lightly wooded coastal and riverine plains (Johnstone and Storr 1998; Simpson and Day 2010)	Nearest NatureMap record is located ~35 km south of the study area and ~40 km to the east (DPaW 2014; *ecologia* 2014a). Five Individuals were recorded in 2012 near Wittenoom.	**MEDIUM** Species recorded outside the study area. Suitable habitat exists within the study area although the species is generally rare and uncommon.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Peregrine Falcon *Falco peregrinus*		S4		Coastal cliffs, riverine gorges and wooded watercourses (Johnstone and Storr 1998; Simpson and Day 2010).	One record from the Central Pilbara project (*ecologia* 2011b; ecologia internal database) and the Solomon Mine and Rail Monitoring (ecologia 2012). The nearest NatureMap (DPaW 2013) record was recorded ~25 km south of the study area near Wittenoom in 2001.	**MEDIUM** Species recorded outside the study area. Suitable foraging habitat exists within the study area.
Flock Bronzewing *Phaps histrionica*			P4	Sparsely wooded plains near water. Nomadic visitor to areas of suitable habitat (Johnstone and Storr 2004; Simpson and Day 2010)	The species has previously been recorded within the Mt Macleod North study area (Rapallo 2011), located ~42 km to the southwest. The nearest NatureMap record is located ~70 km to the east and north east of the study area from 2012 (DPaW 2014).	**MEDIUM** The species has recently been recorded within 50 km of the study area. The tussock grassland habitat of the study area provides suitable foraging habitat for the species. The study area represents the southern extent of the species distribution in the Pilbara. Given the nomadic nature of the species, there is a moderate likelihood that the species visits the study area.
Australian Bustard *Ardeotis australis*			P4	Open grasslands, chenopod flats and low heathland (Johnstone and Storr 1998; Simpson and Day 2010).	Species recorded at numerous locations within the study area. Previously recorded within the study area and from most surveys throughout the region (DPaW 2013).	**RECORDED** Species was recorded at six locations throughout the study area. The study area provides suitable habitat for the species.
Bush Stone-curlew *Burhinus grallarius*			P4	Lightly wooded country next to daytime shelter of thickets or long grass (Johnstone and Storr 1998; Simpson and Day 2010)	There are nine records from Central Pilbara Project Mine (*ecologia* 2011b) as well as the Central Pilbara Project Rail (*ecologia* 2012a), Firetail Mining Area (Ecoscape 2010c), Solomon Mine and Rail Monitoring (*ecologia* 2013b,c). The nearest NatureMap (DPaW 2013) record is located ~30 km east of the study area from 2001.	**HIGH** The species has not been recorded within the study area but 35 recent records within 100 km of the study area exist. The study area provides suitable habitat for the species.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Star Finch (western subspecies) *Neochmia ruficauda subclarescens*			P4	Vegetation around watercourses, particularly thick reed beds (Johnstone and Storr 2004; Simpson and Day 2010).	Recorded from the Solomon Rail Monitoring (*ecologia* 2013c) and the Central Pilbara Rail Project (*ecologia* 2012a). Species recorded 10 km to the west in the Fortescue River (2004) and areas surrounding Wittenoom and Tom Price (DPaW 2013).	**LOW** The study area provides very little suitable habitat for the species. The species has recently been recorded throughout the region; however these records are from habitats not represented in the study area.
Reptiles						
Pilbara Olive Python *Liasis olivaceus barroni*	VU	S1	VU	Watercourses and areas of permanent water in rocky gorges, escarpments and gullies (Pearson 2003; Wilson and Swan 2013).	Recorded from the ecologia internal database, Solomon Project's Kings Area (*ecologia* 2010), Firetail Mining Area (Ecoscape 2010), Solomon Mine and Rail Monitoring (*ecologia* 2014a, c), the Central Pilbara Project Rail (*ecologia* 2012a) and the Central Pilbara Project Mine (*ecologia* 2011b). Nearest NatureMap record recorded in 2013 ~25 km south of the study area near Wittenoom.	**LOW** Species recently recorded in the region. However the study area and the immediate surroundings of the study area provide very little suitable habitat for the species in the form of drainage line/river/creeks and no rocky gorges/escarpments.
Pilbara Barking Gecko *Underwoodisaurus seorsus*			P1	Rocky areas of the Hamersley Ranges, typically found on the top of hills and occasionally on lower slopes (Doughty and Oliver 2011).	Species not recorded within the study area. Nearest NatureMap record is located ~35 km to the west of the study area from 2008 (DPaW 2014) and 40 km west from the Solomon Mine monitoring program in early 2014 (*ecologia* 2014c). The species was also recorded from Fortescue's Central Pilbara Project and Firetail Mining Area (*ecologia* 2011b; Ecoscape 2010c).	**LOW** The species has recently been recorded from the Hamersley region within 35 km to the study area. However, due to the lack of suitable habitat within the study area the likelihood of this species to occur is low.
Pin-striped finesnout Ctenotus *Ctenotus nigrilineatus*			P1	Spinifex at the base of granite outcrops (Storr 1990).	Not recorded within study area. Nearest NatureMap record (DPaW 2014) located ~70 km north-east of the study area from 2012. WAM records also located south of Tom Price from 2012.	**LOW** Species has been recorded approximately 70 km from the study area. The study area does not provide habitat which is known to support the species.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Gane's blindsnake *Ramphotyphlops ganei*			P1	Variety of habitats; thought to prefer moist gorges (Wilson and Swan 2013)	Recorded from the ecologia internal database, Solomon Project's Kings Area (*ecologia* 2010) and the Central Pilbara Project Mine (*ecologia* 2011b). The nearest NatureMap (DPaW 2013) record located ~35 km south-west of the study area, recorded in 2010.	**LOW** The study area provides very little suitable habitat for the species. The species has recently been recorded throughout the region; however records located in habitats not represented in the study area.
Lined Soil-crevice Skink *Notoscincus butleri*			P4	Associated with stony/rocky, spinifex-dominated areas near creek and river margins.	Recorded from the Solomon study area (Coffey 2008), Central Pilbara Project Mine (*ecologia* 2011b) and the Central Pilbara Project Rail (*ecologia* 2012a). The nearest NatureMap (DPaW 2013) record is located ~57 km to the south-west, recorded in 2011.	**LOW** The study area provides very little suitable habitat for the species. The species has recently been recorded throughout the region; however records located in habitats not represented in the study area.

5.3.1 Mammals

5.3.1.1 Short-tailed Mouse (*Leggadina lakedownensis*)

Conservation Status: DPaW Priority 4.

Distribution and Habitat: Populations of this small, secretive rodent are distributed across northern Australia, but records have been sporadic (Moro and Kutt 2008). They occupy a diverse range of habitats from the monsoon tropical coast to semiarid climates, including spinifex and tussock grasslands, samphire and sedgelands, acacia shrublands, tropical eucalypt and melaleuca woodlands and stony ranges. Most habitats, however, are seasonally inundated on red or white sandy-clay soils (Moro and Kutt 2008).

Ecology: The diet of the Short-tailed Mouse consists primarily of invertebrates, with plants supplementing their water requirements (Moro and Kutt 2008). Populations fluctuate greatly in response to rainfall, sometimes reaching plague proportions. The species is nocturnal and solitary, spending the day in simple, single-chambered burrows (Moro and Kutt 2008).

Likelihood of Occurrence: Recorded. One individual Short-tailed Mouse was captured during the survey at site INV S02 (Table 4.6). The trap line was located through an area of alluvial plain habitat with small patches of cracking clays. While only one individual was captured during the survey, it is likely the species will occur within the tussock grassland habitat and small patches of cracking clay within the allvial plain habitat within the study area.

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

Conservation Status: DPaW Priority 4.

Distribution and Habitat: The Western Pebble-mound Mouse occurs across central and southern Pilbara and extends into the smaller ranges of the Little Sandy Desert (Start 2008). Abandoned mounds have been found in the Gascoyne and Murchison, indicating a recent decline in distribution. This decline is most likely attributable to foxes and exotic herbivores (Start 2008). However, the species appears relatively secure in its remaining range (Start 2008). The Western Pebble-mound Mouse inhabits gently sloping hills of rocky ranges where the ground is stony and vegetated by spinifex with a sparse overstorey of eucalypts and scattered shrubs of senna, acacia and *Ptilotus* spp.

Ecology: In suitable habitats, pebble mounds of this species can be found in large numbers, although not all of these mounds are active and occupied by Pebble-mound Mice at the same time. The demographic structure of the groups that inhabit the mounds and their patterns of movement around the mounds is still unknown (Anstee 1996; Anstee *et al.* 1997). Mounds can cover an area of 0.5 to 9.0 m^2, and a single mound can house up to 25 mice (Start 2008). Breeding occurs throughout the year with females producing several litters of four young per year (Start 2008).

Likelihood of Occurrence: Recorded via secondary evidence (Table 4.6, Figure 5.1). The species is widespread through the Pilbara and has been recorded during most surveys within the region (*ecologia* 2010, 2011b, 2013a). Two active mounds belonging to the Western Pebble-mound Mouse were recorded during the survey, six inactive mounds were also noted. Mounds were located upon the stony gibber plains which cover 26% of the study area.

Figure 5.1 – Active Pebble-mound Mouse mound recorded from study area

5.3.2 Birds

5.3.2.1 Fork-tailed Swift (*Apus pacificus*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3.

Distribution and Habitat: The Fork-tailed Swift is a small, insectivorous species with a white throat and rump, and a deeply forked tail (Morcombe 2000). It is distributed from central Siberia and throughout Asia, breeding in north-east and mid-east Asia, and wintering in Australia and south New Guinea. It is a relatively common trans-equatorial migrant from October to April throughout mainland Australia (Simpson and Day 2010). In Western Australia the species begins to arrive in the Kimberley in late September, the Pilbara in November and the South-west by mid-December (Johnstone and Storr 1998). In Western Australia the Fork-tailed Swift is considered uncommon to moderately common near the north-west, west and south-east coasts, common in the Kimberley and rare or scarce elsewhere (Johnstone and Storr 1998).

Ecology: Fork-tailed swifts are nomadic in response to broad-scale weather pattern changes. They are attracted to thunderstorms where they can be seen in flocks, occasionally of up to 2,000 birds. They rarely land, living almost exclusively in the air and feeding entirely on aerial insects, especially nuptial swarms of beetles, ants, termites and native bees (Simpson and Day 2010).

Likelihood of Occurrence: Medium. Fork-tailed Swifts were not observed during this survey but previous records exist from five locations at the Central Pilbara Project Mine and Solomon Project Kings Area (*ecologia* 2010, 2011b). Due to the transient and highly nomadic lifestyle of this species, there is a chance the species will occasionally fly through the study area.

5.3.2.2 Rainbow Bee-eater (*Merops ornatus*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3.

Distribution and Habitat: The Rainbow Bee-eater is scarce to common throughout much of Western Australia, except for the arid interior, preferring lightly wooded, preferably sandy country near water (Johnstone and Storr 1998).

Ecology: In Western Australia the Rainbow Bee-eater can occur as a resident, breeding visitor, post-nuptial nomad, passage migrant or winter visitor. It nests in burrows usually dug at a slight angle on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks (Simpson and Day 2010). Eggs are laid at the end of the metre-long tunnel from August to January (Boland 2004b). Rainbow Bee-eaters are most susceptible to predation during breeding, as it spends significantly more time on the ground in this period.

Likelihood of Occurrence: Recorded. The Rainbow Bee-eater was recorded from seven locations within the study area (Table 4.6). The species was recorded from the alluvial plain and drainage line/river/creek habitat within the study area. The Rainbow Bee-eater was recorded from the majority of previous surveys in the surrounding region (Appendix E). The species usually winters north of the Gascoyne between April and September (Johnstone and Storr 1998) however resident individuals are known from the region. The sandy banks within the drainage line/river/creek (minor) habitat of the study area provide suitable breeding habitat for the species.

5.3.2.3 Grey Falcon (*Falco hypoleucos*)

Conservation Status: DPaW Priority 4.

Distribution and Habitat: Grey Falcons are a rare, nomadic species sparsely distributed across much of arid and semi-arid Australia. In Western Australia, they are restricted to the northern half, occurring in a variety of habitats ranging from wooded drainage systems through to open spinifex plains. Grey Falcons once occurred across much of Western Australia, with sightings as far south as York and New Norcia during colonial times. However, the current distribution is now thought to be restricted to north of 26 °S (Johnstone and Storr 1998). Because the distribution of this species is scarce over an extremely large area, sightings of this species are very uncommon.

The Grey Falcon occurs in a wide variety of arid habitats, including open woodlands and open acacia shrubland, hummock and tussock grasslands and low shrublands, and may also be seen around swamps and waterholes that attract prey (Ehmann and Watson 2008).

Ecology: Like other falcons, this species preys primarily on birds such as parrots and pigeons, although reptiles and mammals are also taken (Ehmann and Watson 2008). Two to three eggs are laid in winter in the nests of other birds of prey and ravens, typically in tall eucalypt trees near water (Ehmann and Watson 2008; Garnett and Crowley 2000).

Likelihood of Occurrence: Medium. There have been a number of recent records of the species recorded within the vicinity of the study area, the nearest located ~35 km to the south and ~40 km to the east of the study area (DPaW 2014; *ecologia* 2014a). It is therefore possible that the species may utilise the stony gibber plain and drainage line/river/creek habitat within the study area for hunting although the species is not expected to be dependent on the habitats presented in the study area.

5.3.2.4 Peregrine Falcon (*Falco peregrinus*)

Conservation Status: WC Act Schedule 4, DPaW Specially Protected Fauna.

Distribution and Habitat: This nomadic or sedentary falcon is widespread in many parts of Australia and some of its continental islands, but absent from most deserts and the Nullarbor Plain. The species is considered to be moderately common in the Stirling Range, uncommon in the Kimberley,

Hamersley and Darling Ranges, and rare or scarce elsewhere (Johnstone and Storr 1998). The Peregrine Falcon occurs most commonly near cliffs along coasts, rivers and ranges, and around wooded watercourses and lakes.

Ecology: Peregrine Falcons feed almost entirely on birds, especially parrots and pigeons. They nest primarily on ledges on cliffs, granite outcrops and in quarries, but may also nest in tree hollows around wetlands. The Peregrine Falcon only occupies a small home range of 20-30 km^2 (BirdLife Australia 2012). Eggs are predominantly laid in September (Johnstone and Storr 1998; Olsen *et al.* 2006).

Likelihood of Occurrence: Medium. There are a number of recent records of the species located within the vicnity of the study area, the closest located ~25 km to the south of the study area (DPaW 2013). The species was also recorded from the Pilbara Project Mine and during the montioring program at the Solomon Mine (*ecologia* 2011b, 2014c). Most of the records are located in habitats not represented in the study area i.e. cliffs, ridges, gorges etc which the species often utalises for breeding. While the species may utalise stony gibber plain and drainage line/river/creek habitat within the study area for foraging, it is unlikely that the species is dependent on habitats represented in the study area.

5.3.2.5 Flock Bronzewing (*Phaps histrionica*)

Conservation Status: DPaW Priority 4.

Distribution and Habitat: Also known as the Flock Pigeon, the Flock Bronzewing is an irregular, non-breeding visitor to Australia. It is most common on the black-soil plains of the south-east Kimberley, but is also found in the adjacent north-eastern interior and the coastal and riverine plains between Port Hedland and Carnarvon. Its preferred habitat is treeless or sparsely wooded plains near water. It is not a frequent visitor to the state, but was recorded in flocks of up to 100,000 individuals in the 1980s and 1990s (Johnstone and Storr 1998).

Ecology: The Flock Bronzewing is gregarious, often feeding and drinking in groups, but is very wary of predators. During the day, the species has been seen resting on the ground in tussock grassland (Ayers *et al.* 1996). Nesting occurs on the ground in the cover of a bush, lower branch, grass tussock or in the dusty, bare ground around bores (Higgins and Davies 1996). It feeds on seeds of grasses and herbaceous plants (NSW National Parks and Wildlife Service 1999b).

Likelihood of Occurrence: Medium. The species was recently recorded within the Mt Macleod study area (~42 km southwest) by Rapallo (2011). The Flock Bronzewing is a nomadic species and was recorded utilising the area during a period of above average rainfall (BoM 2014). For this reason it is not expected that the Flock Bronzewing is a common visitor to the area. The tussock grassland habitat provides suitable foraging habitat for the species.

5.3.2.6 Australian Bustard (*Ardeotis australis*)

Conservation Status: DPaW Priority 4.

Distribution and Habitat: The Australian Bustard occurs Australia-wide and utilises a number of open habitats, including open or lightly wooded grasslands, chenopod flats, plains and heathlands (Johnstone and Storr 1998).

Ecology: It is a nomadic species, ranging over very large areas, and its abundance varies locally and seasonally from scarce to common, largely dependent on rainfall and food availability. The Australian Bustard has an omnivorous diet, feeding on grasses, seeds, fruit, insects and small vertebrates (Johnstone and Storr 1998; Simpson and Day 2010).

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

Likelihood of Occurrence: Recorded. The Australian Bustard was recorded at six locations throughout the study area and had previously been recorded within the study area and throughout the greater region (DPaW 2013). Much of the study area particularly the tussock grassland and stony gibber plain habitat and parts of the banded alluvial plains provide ideal habitat for the species.

5.3.2.7 Bush Stone-curlew (*Burhinus grallarius*)

Conservation Status: DPaW Priority 4.

Distribution and Habitat: The Bush Stone-curlew occurs across much of Australia, except the arid interior and central south coast, preferring lightly wooded country near thickets or long grass that acts as daytime shelter (Johnstone and Storr 1998). Historically, this species was widely distributed throughout most of WA, but has since declined, particularly in the southern part of the State. Recent estimates indicate an Australian population of 15,000 individuals (Garnett and Crowley 2000). The Bush Stone-curlew inhabits woodlands, dry and open grasslands, and croplands with cover nearby (NSW National Parks and Wildlife Service 1999a).

Ecology: The species is insectivorous, preying primarily upon beetles, although they will also eat seeds and shoots, frogs, lizards and snakes (Marchant and Higgins 1993; NSW National Parks and Wildlife Service 1999a). They are usually seen in pairs, although may occasionally flock together during the breeding season (August to January) and are generally nocturnal, being especially active on moonlit nights (NSW National Parks and Wildlife Service 1999a).

Since Bush Stone-curlews are a ground-dwelling and non-migratory species, they are quite susceptible to local disturbances by humans and to predation by cats and foxes (Frith 1976; Johnstone and Storr 1998). They are most common where land disturbance is minimal, and generally become rare or extinct around human settlements (Johnstone and Storr 1998).

Likelihood of Occurrence: High. The Bush Stone-curlew has been from 35 locations within 100 km of the study area (DPaW 2014), with the nearest Naturemap record located ~30 km to the east. The alluvial plain and minor drainage line/river/creek habitat of the study area provide suitable habitat for the species and it is likely that the species will occur within the study area.

5.4 SURVEY ADEQUACY

Survey effort expended within the study area is summarised in Table 3.2, which shows that considerable systematic and opportunistic sampling effort was undertaken. In addition, Table 4.3 shows survey effort was adequate in sampling all fauna habitat types within the study area. Table 4.3 shows that systematic trapping effort was low in two habitat types; the drainage line/river/creek habitat and tussock grasslands. To ensure adequate survey effort was expended in these habitat types, extra time was spent conducting opportunistic, diurnal and nocturnal searches, acoustic bat recordings and camera trapping in these areas.

Analysis of the observed avifauna assemblage recorded during the Level 2 vertebrate fauna assessment suggests the survey recorded a high percentage (85%) of the expected avifaunal assemblages (Table 4.4). Based on the shape of the species accumulation curve generated (Figure 4.12) a plateau has nearly been reached for the systematic avifauna data. Based on this analysis, additional survey effort may have had resulted in an additional five species only.

Analysis of the observed terrestrial fauna assemblage recorded during the Level 2 vertebrate fauna assessment suggests the majority of the fauna assemblage (73.65%) of the area was recorded. The number of terrestrial species recorded systematically was 27 compared to an estimated number of 31-42 (Figure 4.11).

Additional terrestrial species are considered likely to be present within the study area, particularly reptile species due to the survey timing being past the peak activity time for reptiles within this region which generally occurs between September and April (EPA and DEC 2010). However, systematic sampling effort from the current survey was supplemented with high opportunistic sampling effort (30 hours) and the completion of a comprehensive background desktop assessment An additional seven mammal species (four native, three introduced species), 17 birds and five reptile species were recorded from opportunistic searches only, supplementing the findings from the trapping techniques for the assessment of the fauna assemblage of the study area.

Through a combination of systematic trapping and census techniques, opportunistic surveys and a comprehensive desktop review an accurate and comprehensive assessment of the faunal assemblage within the study area has been made.

6 CONCLUSION

The main conclusions of the terrestrial vertebrate fauna assessment are as follows:

- Several databases and 31 fauna publications were consulted in the preparation of potential fauna (and conservation significant fauna) lists. The database searches and review resulted in a total of 40 native and nine introduced mammal, 173 bird, 114 reptile, nine amphibian and seven fish species potentially occurring in the study area. Of these, 24 species are of conservation significance (10 species of mammal, 21 species of bird, six species of reptile and one species of fish).
- The survey methods were consistent with *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*; Guidance Statement No. 56; Position Statement No. 3; and the EPBC Act *Survey Guidelines for Australia's Threatened Mammals, Reptiles, Bats and Birds*, as well as Fortescue Metals Group's *Terrestrial Vertebrate Fauna Assessment Guidelines*.
- During the current vertebrate fauna assessment, four main fauna habitat types based on vegetation assemblages, land systems and geographical features were identified; alluvial plain, tussock grassland, stony gibber plain and minor drainage line/river/creek.
- Three of the four fauna habitats within the study area were sampled with systematic trapping sites. A one-way ANOSIM test and MDS plot of the trapping sites within the different habitat types was completed for data collected systematically for both birds and trapped terrestrial fauna. The results from these statistical analyses confirm a significant difference between the faunal assemblages of habitat types for birds and trapped terrestrial fauna.
- Survey effort was adequate in sampling all fauna habitat types within the study area. Analysis of the observed avifauna assemblage recorded during the Level 2 vertebrate fauna assessment suggests the survey recorded a high percentage of the expected avifauna (85%). According to the SAC, 73% of trappable fauna were captured. The late timing of the survey is thought to have resulted in reduced activity of reptiles.
- During the survey, a total of 18 native and three introduced mammal species, 65 bird species, 26 reptile species, one amphibian species were recorded. All species could be identified in the field. One specimen of *Diplodactylus galaxias* was vouchered with the Western Australian museum.
- Four species of conservation significance were recorded during the current survey, one of which was recorded from secondary evidence. Those were:
  - Short-tailed Mouse (DPaW Priority 4);
  - Western Pebble-mound Mouse (DPaW Priority 4, recorded from secondary evidence);
  - Australian Bustard (DPaW Priority 4); and
  - Rainbow Bee-eater (EPBC Act Migratory, WC Act Schedule 3).
- Based on previous records and availability of suitable habitats within the study area, a further seven conservation significant vertebrate species are considered to have a medium or high likelihood of occurring within the study area.

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APPENDIX A EXPLANATION OF CONSERVATION CODES

Appendix A1

Definitions of categories under the *Environment Protection and Biodiversity Conservation Act 1999*

Category	Definition
Extinct (EX)	Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CR)	Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable (VU)	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Near Threatened (NT)	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent (CD)	Taxa which at a particular time if, at that time, the species is the focus of a specific conservation programme, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.
Data Deficient (DD)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Migratory (M)	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; • the agreement between the Government of Australian and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their environment (CAMBA); or • the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Appendix A2

Definition of Schedules under the *Wildlife Conservation Act 1950*

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

Appendix A3

Definition of DPaW Threatened and Priority Fauna Codes

Threatened	Definition
Critically Endangered (CR)	Considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Considered to be facing a high risk of extinction in the wild.
Priority	**Definition**
Priority 1 (P1)	*Taxa with few, poorly known populations on threatened lands.* Taxa which are known from few specimens or sight records from one or a few localities, on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 2 (P2)	*Taxa with few, poorly known populations on conservation lands.* Taxa which are known from few specimens or sight records from one or a few localities, on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 3 (P3)	*Taxa with several, poorly known populations, some on conservation lands.* Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 4 (P4)	*Taxa in need of monitoring.* Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could if present circumstances change. These taxa are usually represented on conservation lands.
Priority 5 (P5)	*Taxa in need of monitoring.* Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

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APPENDIX B DAILY WEATHER DATA DURING SURVEY

Date	Minimum Temperature (°C)	Maximum Temperature (°C)	Rainfall (mm)
20 May 2013	15.1	26.4	5.0
21 May 2013	14.1	26.1	0.0
22 May 2013	10.8	24.1	0.0
23 May 2013	13.9	23.7	0.0
24 May 2013	14.5	25.0	0.0
25 May 2013	16.4	26.8	0.0
26 May 2013	18.1	25.6	0.0
27 May 2013	18.0	28.0	0.0
28 May 2013	15.9	29.0	0.0
29 May 2013	19.5	28.9	0.0
30 May 2013	18.3	24.8	0.0
Average	15.9	26.2	0.5

Note: climate data recorded from Wittenoom weather station

APPENDIX C SITE DESCRIPTIONS

Vegetation and Fauna Habitat Description	Site Photo
Site: INV S01 **Habitat type:** Stony gibber plain **Description:** Low undulating plain. Vegetation, *Eucalyptus leucophloia* subsp. *leucophloia and Corymbia deserticola* subsp. *deserticola* open woodland over *Acacia atkinsiana, A. aptaneura* and *A. bivenosa* open shrubland over *Triodia epactia* open hummock grassland. Firm reddish sandy-clay soils with a continuous mantle of pebble. Relatively low levels of woody debris and leaf litter.	
Site: INV S02 **Habitat type:** Alluvial plain **Description:** Flat plain. *Acacia aptaneura* tall open shrubland over *Sida* sp. and *Abutilon otocarpum* isolated shrubs and *Enneapogon polyphyllus*, *Paspalidium clementii* and *Aristida contorta* sparse tussock grassland. Firm reddish-brown clay soils, with areas of gilgai/ crabholes. Scattered ironstone pebbles. High amounts of woody debris and leaf litter.	

Site: INV S03 **Habitat type:** Stony gibber plain **Description:** Gentle undulating plain. Vegetation, *Acacia aptaneura*, *A. pruinocarpa* and *A. tenuissima* tall open shrubland over *Triodia epactia* open hummock grassland. Sandy-clay soils with moderate to high covers of ironstone pebbles and stones. Moderate amounts of leaf litter and woody debris.	
Site: INV S04 **Habitat type:** Tussock Grassland **Description:** Flat plain. Vegetation, *Eragrostis eriopoda* and/or *E. falcata* and/or *E. xerophila* and/or *Astrebla elymoides* open tussock grasslands with scattered *Acacia synchronicia and Vachellia farnesiana* shrubs. Soils firm to loose with cracking clays and gilgai/ crabholes. Woody debris and leaf litter absent to very little.	

Site: INV S05 **Habitat type:** Alluvial plain **Description:** Flat plain. Vegetation, *Acacia aptaneura* and *A. pruinocarpa* tall open shrubland over *Enneapogon polyphyllus*, *Paspalidium clementii* and *Chrysopogon fallax* sparse tussock grassland. Soils sandy clay with moderate ironstone pebbles and stones, contained gilgai/crabhole surrounding vegetation. High amounts of woody debris and leaf litter.	
Site: INV S06 **Habitat type:** Stony gibber plain **Description:** Gentle undulating plain and Footslopes. Vegetation, *Eucalyptus leucophloia* subsp. *leucophloia* open woodland over *Acacia atkinsiana, A. aptaneura and A. ancistrocarpa* over *Triodia longiceps* and *T. epactia* open hummock grassland. Sandy clay soils with a continuous mantle of ironstone pebbles and stones. Low amounts of woody debris and leaf litter.	

APPENDIX D VOUCHER SPECIMENS LODGED WITH WA MUSEUM

WA Museum specimen no.	Site captured	Easting	Northing	Habitat	Species
WAM TS199	INV S04	641522	7556732	Plain of mixed *Eragrostis* spp. tussock grassland, with cracking clay soils.	*Diplodactylus galaxias*

APPENDIX E REGIONAL FAUNA DATA

Appendix E1

Regional Fauna Data – Mammals

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Project - Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Project – Rail (Coffee 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project - Rail Targeted Survey (Coffey 2011)	Solomon Project - Mine and Rail Con Sig Monitoring (ecologia 2012)	Solomon Project (Coffey 2008)	Solomon Project - Kings Area (ecologia 2010)	Firetail - Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (ecologia 2011)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DPaWRare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																					
TACHYGLOSSIDAE																									
Tachyglossus aculeatus	Short-beaked Echidna				●							●	●	●	●	●		●							
DASYURIDAE																									
Dasycercus blythi	Brush-tailed Mulgara			P4	●						●												●		
Dasykaluta rosamondae	Little Red Kaluta				●				●	●	●	●		●	●	●	●	●	●	●	●	●			●
Dasyurus hallucatus	Northern Quoll	EN	S1	EN	●						●	●	●	●									●	●	●	
Ningaui timealeyi	Pilbara Ningaui				●				●		●	●	●	●	●	●	●	●	●	●	●	●	●			●
Planigale sp.	Common Planigale				●				●		●	●	●	●	●	●	●	●	●	●	●	●	●			●
Pseudantechinus roryi	Rory's Pseudantechinus																●								
Pseudantechinus woolleyae	Woolley's False Antechinus				●							●	●							●		●			
Sminthopsis longicaudata	Long-tailed Dunnart			P4	●															●			●		
Sminthopsis macroura	Stripe-faced Dunnart				●				●			●	●	●	●	●	●	●	●	●	●	●			●
Sminthopsis ooldea	Ooldea Dunnart															●	●								

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Project - Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Project – Rail (Coffee 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project - Rail Targeted Survey (Coffey 2011)	Solomon Project - Mine and Rail Con Sig Monitoring (ecologia 2012)	Solomon Project (Coffey 2008)	Solomon Project - Kings Area (ecologia 2010)	Firetail - Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (ecologia 2011)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DPaWRare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																					
THYLACOMYIDAE																									
Macrotis lagotis	Bilby	VU	S1	VU														●				●		●	
NOTORYCTIDAE																									
Notoryctes caurinus	Northern Marsupial Mole	EN	S1	EN																				●	
MACROPODIDAE																									
Lagorchestes conspicillatus leichardti	Spectacled Hare-wallaby			P3																			●		
Macropus robustus	Euro				●	●					●	●	●	●		●		●	●	●	●	●			●
Macropus rufus	Red Kangaroo				●				●		●	●	●		●	●		●	●	●		●			●
Petrogale rothschildi	Rothschild's Rock Wallaby				●																	●			
PHALANGERIDAE																									
Trichosurus vulpecula arnhemensis	Northern Brushtail Possum													●							●	●			
PTEROPODIDAE																									
Pteropus alecto	Black Flying-fox								●																●
MEGADERMATIDAE																									
Macroderma gigas	Ghost Bat			P4	●							●	●				●			●			●		
HIPPOSIDERIDAE																									
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	VU	S1	VU	●						●									●		●		●	

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Project - Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Project – Rail (Coffee 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project - Rail Targeted Survey (Coffey 2011)	Solomon Project - Mine and Rail Con Sig Monitoring (ecologia 2012)	Solomon Project (Coffey 2008)	Solomon Project - Kings Area (ecologia 2010)	Firetail - Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (ecologia 2011)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DPaWRare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																						
EMBALLONURIDAE																										
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat				•				•			•	•	•			•	•	•	•	•	•			•
Taphozous georgianus	Common Sheathtail Bat				•				•			•	•	•			•	•		•	•	•			
Taphozous hilli	Hill's Sheattail Bat				•								•				•			•		•			
MOLOSSIDAE																										
Chaerophon jobensis	Northern Freetail Bat				•				•			•	•			•	•	•	•	•	•	•			•
Mormopterus beccarii	Beccari's Freetail Bat				•				•			•	•	•			•		•	•	•	•			•
Tadarida australis	White-striped Freetail Bat				•				•								•	•			•	•			•
VESPERTILIONIDAE																										
Chalinolobus gouldii	Gould's Wattled Bat				•				•			•	•	•		•	•	•	•	•	•	•			•
Nyctophilus arnhemensis	Northern Long-eared Bat																				•				
Nyctophilus daedalus	Northwestern Long-eared Bat				•												•								
Nyctophilus geoffroyi	Lesser Long-eared Bat				•												•	•	•	•	•	•			
Scotorepens greyii	Little Broad-nosed Bat				•				•			•	•	•			•	•	•	•	•	•			•

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Project - Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Project – Rail (Coffee 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project - Rail Targeted Survey (Coffey 2011)	Solomon Project - Mine and Rail Con Sig Monitoring (ecologia 2012)	Solomon Project (Coffey 2008)	Solomon Project - Kings Area (ecologia 2010)	Firetail - Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (ecologia 2011)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DPaWRare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																					
Vespadelus finlaysoni	Finlayson's Cave Bat				●				●			●	●	●		●	●	●	●	●	●	●			●
MURIDAE																									
Notomys alexis	Spinifex Hopping-mouse																●								
Leggadina lakedownensis	Short-tailed Mouse			P4	●				●						●						●		●		●
Pseudomys chapmani	Western Pebble-mound Mouse			P4	●							S	S	SA	S	●	●	**S**	**S**	S	●	●	●	SA	
Pseudomys delicatus	Delicate Mouse								●						●						●				
Pseudomys desertor	Desert Mouse				●				●	●	●	●	●	●	●			●		●	●	●			●
Pseudomys hermannsburgensis	Sandy Inland Mouse				●				●		●			●	●	●	●			●	●	●			●
Zyzomys argurus	Common Rock-rat				●				●		●	●	●	●	●	●	●	●		●	●	●			
CANIDAE																									
Canis lupus dingo	Dingo				●	●	●		S	●		●	●	●				●	**S**	●	●	●			●
INTRODUCED MAMMALS																									
Mus musculus	House Mouse				●				●		●	●	●		●	●	●	●		●	●	●		●	
Oryctolagus cuniculus	European Rabbit																							●	
Vulpes vulpes	Red Fox																							●	
Felis catus	Cat				●	●	●		●	●	●	●	●	●	●	●		●		●	●	●		●	●

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Project - Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Project – Rail (Coffee 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project - Rail Targeted Survey (Coffey 2011)	Solomon Project - Mine and Rail Con Sig Monitoring (ecologia 2012)	Solomon Project (Coffey 2008)	Solomon Project - Kings Area (ecologia 2010)	Firetail - Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (ecologia 2011)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DPaWRare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																					
Equus asinus	Donkey				●													●	●					●	●
Equus caballus	Horse				●													●		●	●	●		●	
Camelus dromedarius	Camel				●													S				●		●	
Bos taurus	European Cattle				●		●		●		●	●	●	●		●			●	●	●	●			●

Appendix E2

Regional Fauna Data – Birds

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
CASUARIIDAE																									
Dromaius novaehollandiae	Emu				●	●		●	●		●		●	●	●		●	●	●		●			●	
PHASIANIDAE																									
Coturnix pectoralis	Stubble Quail											●							●		●			●	
Coturnix ypsilophora	Brown Quail				●					●	●	●					●		●	●	●			●	●
ANATIDAE																									
Dendrocygna eytoni	Plumed Whistling-duck																	●	●	●	●			●	
Stictonetta naevosa	Freckled Duck																			●				●	
Cygnus atratus	Black Swan														●		●			●	●			●	
Tadorna tadornoides	Australian Shelduck																●				●				
Chenonetta jubata	Australian Wood Duck														●				●	●	●			●	
Malacorhynchus membranaceus	Pink-eared Duck														●		●				●			●	
Anas gracilis	Grey Teal														●		●	●	●	●	●			●	
Anas superciliosa	Pacific Black Duck														●		●	●	●	●	●			●	
Aythya australis	Hardhead														●						●			●	

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
PODICIPEDIDAE																									
Tachybaptus novaehollandiae	Australasian Grebe														●					●	●			●	
Poliocephalus poliocephalus	Hoary-headed Grebe														●										
COLUMBIDAE																									
Phaps chalcoptera	Common Bronzewing				●			●		●	●	●		●	●		●	●	●	●	●	●		●	●
Phaps histrionica	Flock Bronzewing									●	●				●					●		●			
Ocyphaps lophotes	Crested Pigeon				●	●		●		●	●	●	●	●	●		●	●	●	●	●	●		●	●
Geophaps plumifera	Spinifex Pigeon				●			●		●	●	●	●	●	●			●	●	●	●	●		●	
Geopelia cuneata	Diamond Dove				●			●		●	●	●	●	●	●	●	●	●	●	●	●	●		●	●
Geopelia striata	Peaceful Dove				●	●	●	●		●	●	●			●	●		●	●	●	●	●		●	●
PODARGIDAE																									
Podargus strigoides	Tawny Frogmouth				●					●	●	●		●	●		●		●		●	●		●	●
EUROSTOPODIDAE																									
Eurostopodus argus	Spotted Nightjar				●			●		●	●	●	●	●	●	●	●	●	●	●	●	●		●	
AEGOTHELIDAE																									
Aegotheles cristatus	Australian Owlet-nightjar				●			●			●	●		●	●		●		●	●	●	●		●	●
APODIDAE																									
Apus pacificus	Fork-tailed Swift	M	S3		●						●				●				●		●	●	●		

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
ANHINGIDAE																									
Anhinga novaehollandiae	Australasian Darter														●									●	
PHALACROCORACIDAE																									
Microcarbo melanoleucos	Little Pied Cormorant											●			●						●			●	
Phalacrocorax carbo	Great Cormorant														●						●			●	
Phalacrocorax sulcirostris	Little Black Cormorant																			●	●			●	
PELECANIDAE																									
Pelecanus conspicillatus	Australian Pelican														●						●			●	
ARDEIDAE																									
Ixobrychus flavicollis	Black Bittern			P3																	●			●	
Ardea pacifica	White-necked Heron				●			●			●		●		●	●	●		●	●	●			●	
Ardea modesta	Eastern Great Egret	M	S3												●					●	●	●	●	●	
Ardea intermedia	Intermediate Egret																			●					
Ardea ibis	Cattle Egret	M	S3																				●		
Egretta novaehollandiae	White-faced Heron				●				●				●		●		●		●	●	●			●	●
Egretta garzetta	Little Egret																			●				●	
Nycticorax caledonicus	Nankeen Night Heron														●						●	●		●	

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
THRESKIORNITHIDAE																									
Plegadis falcinellus	Glossy Ibis	M	S3																		●	●		●	
Threskiomis molucca	Australian White Ibis																				●			●	
Threskiornis spinicollis	Straw-necked Ibis														●		●			●	●			●	
Platalea regia	Royal Spoonbill																				●			●	
Platalea flaviceps	Yellow-billed Spoonbill																				●			●	
ACCIPITRIDAE																									
Pandion cristatus	Eastern Osprey	M													●										
Elanus axillaris	Black-shouldered Kite							●		●			●	●	●				●	●	●			●	●
Elanus scriptus	Letter-winged Kite																							●	
Lophoictinia isura	Square-tailed Kite				●						●									●				●	
Hamirostra melanosternon	Black-breasted Buzzard														●									●	
Haliaeetus leucogaster	White-bellied Sea-Eagle	M	S3																		●	●	●	●	
Haliastur sphenurus	Whistling Kite				●			●		●	●		●		●		●	●	●	●	●			●	●
Milvus migrans	Black Kite							●							●		●			●	●			●	
Accipiter fasciatus	Brown Goshawk				●			●		●	●	●	●		●				●	●	●			●	●
Accipiter cirrocephalus	Collared Sparrowhawk				●			●		●	●	●			●		●		●	●	●			●	●

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
Circus assimilis	Spotted Harrier				●			●					●	●	●	●	●		●	●	●			●	●
Circus approximans	Swamp Harrier																				●			●	
Aquila audax	Wedge-tailed Eagle				●			●		●	●		●	●	●		●		●	●	●			●	●
Hieraaetus morphnoides	Little Eagle				●			●							●		●			●	●			●	●
FALCONIDAE																									
Falco cenchroides	Nankeen Kestrel				●		●	●			●	●	●	●	●		●	●	●	●	●			●	●
Falco berigora	Brown Falcon				●	●	●	●		●	●	●	●	●	●		●	●	●	●	●			●	●
Falco longipennis	Australian Hobby				●	●	●	●			●			●	●		●			●	●			●	
Falco hypoleucos	Grey Falcon			P4	●									●			●				●	●			
Falco peregrinus	Peregrine Falcon		S4		●										●	●	●		●		●	●		●	
RALLIDAE																									
Porphyrio porphyrio	Purple Swamphen															●		●			●				
Gallirallus philippensis	Buff-banded Rail														●	●				●	●			●	
Porzana fluminea	Australian Spotted Crake														●				●						
Porzana tabuensis	Spotless Crake														●					●	●			●	
Tribonyx ventralis	Black-tailed Native-hen														●		●								
Fulica atra	Eurasian Coot														●			●			●			●	
OTIDIDAE																									
Ardeotis australis	Australian Bustard			P4	●	●	●	●		●	●		●		●	●	●	●	●	●	●	●		●	●

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
BURHINIDAE																									
Burhinus grallarius	Bush Stone-curlew			P4	●			●				●			●	●		●	●	●	●	●		●	
RECURVIROSTRIDAE																									
Himantopus himantopus	Black-winged Stilt														●						●			●	
CHARADRIIDAE																									
Charadrius ruficapillus	Red-capped Plover																				●				
Charadrius veredus	Oriental Plover	M	S3																	●			●		
Elseyornis melanops	Black-fronted Dotterel										●				●		●	●	●		●			●	●
Erythrogonys cinctus	Red-kneed Dotterel														●		●				●			●	
Vanellus tricolor	Banded Lapwing							●					●						●	●					
Vanellus cinereus	Masked Lapwing																				●				
SCOLOPACIDAE																									
Actitis hypoleucos	Common Sandpiper	M	S3												●					●		●			
Tringa nebularia	Common Greenshank	M	S3																			●			
Tringa glareola	Wood Sandpiper	M	S3												●							●			
Arenaria interpres	Ruddy Turnstone	M	S3																	●					
TURNICIDAE																									
Turnix velox	Little Button-quail				●			●	●	●	●	●	●	●	●	●	●		●	●	●			●	●
LARIDAE																									

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
Gelochelidon nilotica	Gull-billed Tern																							●	
Chlidonias hybrida	Whiskered Tern														●										
Chlidonias leucoptera	White-winged Black Tern	M	S3																				●		
CACATUIDAE (PSITTACIDAE)																									
Eolophus roseicapillus	Galah				●			●		●	●	●	●	●	●		●	●	●	●	●			●	●
Cacatua sanguinea	Little Corella				●			●		●	●	●	●	●	●		●	●	●	●	●			●	●
Nymphicus hollandicus	Cockatiel				●			●			●	●	●		●		●		●	●	●			●	●
PSITTACIDAE																									
Barnardius zonarius	Australian Ringneck				●	●		●		●	●	●	●	●	●		●	●	●	●	●			●	●
Psephotus varius	Mulga Parrot							●		●	●				●										
Melopsittacus undulatus	Budgerigar				●							●	●	●	●	●	●		●	●	●			●	●
Neopsephotus bourkii	Bourke's Parrot				●										●		●	●	●		●			●	
Neopsephotus elegans	Elegant Parrot																				●				
Pezoporus occidentalis	Night Parrot	EN	S1	CR													●						●		
CUCULIDAE																									
Centropus phasianinus	Pheasant Coucal				●					●	●	●							●	●	●			●	
Chalcites basalis	Horsfield's Bronze-Cuckoo				●					●	●	●		●	●	●	●	●	●	●	●			●	
Chalcites osculans	Black-eared Cuckoo														●										
Cacomantis pallidus	Pallid Cuckoo				●					●	●	●		●	●	●	●	●	●	●	●			●	

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
STRIGIDAE																									
Ninox connivens	Barking Owl														●										
Ninox novaeseelandiae	Southern Boobook				●					●	●	●	●		●	●	●		●	●	●			●	
TYTONIDAE																									
Tyto javanica	Eastern Barn Owl				●									●	●	●	●				●			●	
HALCYONIDAE																									
Dacelo leachii	Blue-winged Kookaburra				●			●		●	●	●			●	●	●	●	●	●	●			●	
Todiramphus pyrrhopygius	Red-backed Kingfisher				●			●		●	●	●	●	●	●	●	●	●	●	●	●			●	●
Todiramphus sanctus	Sacred Kingfisher				●					●	●	●		●	●	●		●	●	●	●			●	
MEROPIDAE																									
Merops ornatus	Rainbow Bee-eater	M	S3		●	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●	●	●
CLIMACTERIDAE																									
Climacteris melanura	Black-tailed Treecreeper				●									●	●				●	●	●			●	
PTILINORHYNCHIDAE																									
Ptilonorhynchus guttatus	Western Bowerbird				●			●				●	●		●				●	●	●			●	
MALURIDAE																									
Malurus splendens	Splendid Fairy-wren																							●	
Malurus leucopterus	White-winged Fairy-				●			●		●	●		●	●	●		●	●	●	●	●			●	●

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
	wren																								
Malurus lamberti	Variegated Fairy-wren				●	●	●	●		●	●	●		●	●	●	●	●		●	●			●	●
Stipiturus ruficeps	Rufous-crowned Emu-wren				●									●	●		●		●	●	●			●	
Amytornis striatus	Striated Grasswren				●			●		●	●	●			●				●	●	●			●	
ACANTHIZIDAE																									
Pyrrholaemus brunneus	Redthroat							●							●			●			●			●	
Smicrornis brevirostris	Weebill				●			●		●	●	●	●	●	●	●	●	●	●	●	●			●	●
Gerygone fusca	Western Gerygone				●			●			●	●	●	●	●		●		●		●			●	●
Acanthiza robustirostris	Slaty-backed Thornbill				●										●		●	●	●		●			●	
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				●	●	●					●		●	●									●	
Acanthiza uropygialis	Chestnut-rumped Thornbill				●			●						●	●		●	●	●		●			●	●
Acanthiza apicalis	Inland Thornbill				●			●						●	●				●		●			●	
Aphelocephala leucopsis	Southern Whiteface											●					●								
PARDALOTIDAE																									
Pardalotus rubricatus	Red-browed Pardalote				●			●		●	●	●	●		●			●	●	●	●			●	●
Pardalotus striatus	Striated Pardalote				●			●		●	●	●	●	●	●		●		●	●	●			●	●
MELIPHAGIDAE																									

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		EPBC Act	WC Act	DPaW																					
Certhionyx variegatus	Pied Honeyeater				●			●			●			●	●				●	●	●			●	
Lichenostomus virescens	Singing Honeyeater				●		●	●		●	●	●	●	●	●		●	●	●	●	●			●	●
Lichenostomus keartlandi	Grey-headed Honeyeater				●		●	●		●	●	●	●	●	●		●	●	●	●	●			●	●
Lichenostomus plumulus	Grey-fronted Honeyeater																●							●	
Lichenostomus penicillatus	White-plumed Honeyeater				●		●	●		●	●	●	●	●	●	●	●	●	●	●	●	●			●	●
Purnella albifrons	White-fronted Honeyeater														●							●				
Manorina flavigula	Yellow-throated Miner				●			●			●	●	●	●	●		●	●	●	●	●	●			●	●
Acanthagenys rufogularis	Spiny-cheeked Honeyeater				●			●		●	●	●	●	●	●		●	●	●	●	●	●			●	●
Conopophila whitei	Grey Honeyeater							●						●	●										●	
Epthianura tricolor	Crimson Chat				●			●					●	●	●				●	●	●				●	●
Epthianura aurifrons	Orange Chat														●		●									
Sugomel niger	Black Honeyeater				●						●				●				●	●	●				●	
Lichmera indistincta	Brown Honeyeater				●			●		●	●	●	●	●	●		●	●	●	●	●	●			●	●
Melithreptus gularis	Black-chinned Honeyeater				●			●		●	●	●		●	●		●	●	●	●	●	●			●	
POMATOSTOMIDAE																										
Pomatostomus temporalis	Grey-crowned Babbler				●			●		●		●	●	●	●	●	●	●	●	●	●	●			●	●

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
Pomatostomus superciliosus	White-browed Babbler				●												●	●			●			●	●
EUPETIDAE																									
Psophodes occidentalis	Chiming Wedgebill				●																			●	
NEOSITTIDAE																									
Daphoenositta chrysoptera	Varied Sittella														●		●	●	●		●			●	
CAMPEPHAGIDAE																									
Coracina maxima	Ground Cuckoo-shrike				●			●			●		●		●		●		●		●			●	●
Coracina novaehollandiae	Black-faced Cuckoo-shrike				●	●		●		●	●	●	●	●	●	●	●	●	●		●	●		●	●
Lalage sueurii	White-winged Triller				●			●		●	●	●	●	●	●		●		●	●	●			●	●
PACHYCEPHALIDAE																									
Pachycephala rufiventris	Rufous Whistler				●	●		●		●	●	●	●	●	●	●	●	●	●	●	●			●	●
Colluricincla harmonica	Grey Shrike-thrush				●			●		●	●	●	●	●	●	●	●	●	●	●	●			●	
Oreoica gutturalis	Crested Bellbird				●			●		●	●	●	●	●	●		●	●	●	●	●			●	●
ARTAMIDAE																									
Artamus personatus	Masked Woodswallow				●			●			●		●	●	●				●	●	●			●	●
Artamus cinereus	Black-faced Woodswallow				●			●		●	●	●	●	●	●		●	●	●	●	●			●	●
Artamus minor	Little Woodswallow				●			●		●	●	●		●	●	●			●	●	●			●	

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
Cracticus torquatus	Grey Butcherbird				●			●		●	●	●		●	●	●	●	●	●			●			●	●
Cracticus nigrogularis	Pied Butcherbird				●			●		●	●	●	●	●	●		●	●	●	●	●				●	●
Cracticus tibicen	Australian Magpie				●	●		●		●	●		●	●	●		●		●	●	●				●	●
RHIPIDURIDAE																										
Rhipidura albiscapa	Grey Fantail				●										●		●								●	
Rhipidura leucophrys	Willie Wagtail				●		●	●		●	●	●	●	●	●		●	●	●	●	●				●	●
CORVIDAE																										
Corvus bennetti	Little Crow				●		●	●						●	●		●	●	●		●				●	
Corvus orru	Torresian Crow				●	●		●		●	●				●	●	●	●	●	●	●				●	●
MONARCHIDAE																										
Grallina cyanoleuca	Magpie-lark				●	●		●		●	●	●	●	●	●	●	●	●	●	●	●				●	●
PETROICIDAE																										
Petroica goodenovii	Red-capped Robin				●									●	●		●	●	●		●				●	●
Melanodryas cucullata	Hooded Robin				●			●		●	●	●	●	●	●		●	●	●	●	●				●	●
ALAUDIDAE																										
Mirafra javanica	Horsfield's Bushlark				●			●					●		●		●	●	●	●	●				●	
ACROCEPHALIDAE																										
Acrocephalus australis	Australian Reed-Warbler														●	●				●	●				●	
MEGALURIDAE																										

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (*ecologia* 2012)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Birdata	Current Survey
		EPBC Act	WC Act	DPaW																					
Megalurus javanica	Little Grassbird																			●					
Cincloramphus mathewsi	Rufous Songlark				●			●		●			●	●	●	●			●	●	●			●	●
Cincloramphus cruralis	Brown Songlark				●					●					●		●		●	●	●			●	●
Eremiornis carteri	Spinifex-bird				●			●		●	●	●	●	●	●		●	●	●	●	●			●	●
HIRUNDINIDAE																									
Cheramoeca leucosterna	White-backed Swallow							●																	
Hirundo neoxena	Welcome Swallow																		●		●			●	
Petrochelidon ariel	Fairy Martin				●						●				●		S		●	●				●	
Petrochelidon nigricans	Tree Martin				●			●		●	●				●				●	●				●	●
NECTARINIIDAE																									
Dicaeum hirundinaceum	Mistletoebird				●			●		●	●	●	●		●		●		●	●	●			●	●
ESTRILDIDAE																									
Taeniopygia guttata	Zebra Finch				●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●	●
Neochmia ruficauda subclarescens	Star Finch (western)			P4									●	●	●	●	●			●	●	●		●	
Emblema pictum	Painted Finch				●			●		●	●	●	●	●	●		●	●	●	●	●			●	●
MOTACILLIDAE																									
Anthus novaeseelandiae	Australasian Pipit				●			●							●		●	●		●	●			●	

Appendix E3

Regional Fauna Data – Reptiles

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
CHELUIDAE																								
Chelodina steindachneri	Flat-shelled Turtle														●	●	●				●			
AGAMIDAE																								
Amphibolurus longirostris	Long-nosed Dragon				●				●	●	●	●	●	●	●	●	●		●	●	●			●
Caimanops amphiboluroides	Mulga Dragon				●		●								†				●					●
Ctenophorus caudicinctus	Ring-tailed Dragon				●			●	●	●	●	●	●	●	●		●		●	●	●			●
Ctenophorus isolepis	Military Dragon				●			●	●	●	●		●	●	●	●			●	●	●			●
Ctenophorus nuchalis	Central Netted Dragon															●				●	●			
Ctenophorus reticulatus	Western Netted Dragon				●				●				●		●	●					●			●
Diporiphora valens					●				●		●		●	●	●				●	●				
Pogona minor	Dwarf Bearded Dragon				●				●	●	●	●	●	●	●		●		●	●	●			
Tympanocryptis cephalus	Pebble Dragon				●				●								●		●	●	●			
DIPLODACTYLIDAE																								
Crenadactylus ocellatus	Clawless Gecko				●						●								●		●			
Diplodactylus conspicillatus	Fat-tailed Gecko				●				●	●	●		●		†	●	●		●	●	●			●
Diplodactylus fulleri				P2																	●			

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
Diplodactylus galaxias	Northern Pilbara Beak-faced Gecko								●											●	●			●
Diplodactylus mitchelli					●																			
Diplodactylus pulcher					●										†		●							
Diplodactylus savagei	Southern Pilbara Beak-faced Gecko				●				●	●		●			†		●	●	●	●	●			
Lucasium squarrosum															●									
Lucasium stenodactylum					●				●	●			●	●	●		●		●	●	●			●
Lucasium wombeyi					●				●	●	●	●			†		●	●	●	●	●			
Oedura marmorata	Marbled Velvet Gecko				●				●	●	●	●			●			●	●	●	●			
Rhynchoedura ornata	Western Beaked Gecko				●				●					●	†		●		●	●	●			
Strophurus elderi					●				●		●			●	●		●		●	●				
Strophurus jeanae									●												●			
Strophurus strophurus										●									●					
Strophurus wellingtonae					●				●	●	●	●	●				●		●	●	●			
CARPHODACTYLIDAE																								
Nephrurus wheeleri					●				●	●	●	●	●	●	●		●		●	●	●			
Underwoodisaurus seorsus	Pilbara Barking Gecko								●			●							●					
GEKKONIDAE																								
Gehyra pilbara					●					●			●	●	●			●	●	●	●			●
Gehyra punctata					●				●	●	●	●		●	●		●	●	●	●	●			
Gehyra purpurascens					●																			

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
Gehyra variegata					●				●	●	●	●	●	●	●	●	●	●	●	●	●			●
Heteronotia binoei	Bynoe's Gecko				●				●	●	●	●	●	●	●	●	●		●	●	●			●
Heteronotia spelea	Desert Cave Gecko				●					●	●				●	●	●	●	●	●				
PYGOPODIDAE																								
Delma butleri					●								●	●					●		●			
Delma elegans					●				●	●	●				●				●	●				
Delma nasuta					●				●	●	●	●	●	●	●				●	●				
Delma pax					●				●	●	●	●		●	†		●		●	●	●			
Delma tincta					●				●	●				●	●				●	●	●			
Lialis burtonis					●				●	●	●	●	●		●	●	●		●	●	●			
Pygopus nigriceps					●				●	●		●			●		●		●	●	●			●
SCINCIDAE																								
Carlia munda					●				●	●		●	●	●		●	●		●	●	●			●
Carlia triacantha					●				●	●	●	●	●	●	●		●		●	●	●			
Cryptoblepharus buchananii					●				●	◊					◊	◊	◊		●					●
Cryptoblepharus ustulatus					●					◊		●			◊	◊	◊		●	●	●			
Ctenotus duricola					●				●	●	●	●	●	●	●				●	●	●			
Ctenotus grandis					●					●	●		●	●				●	●	●	●			
Ctenotus hanloni									●															
Ctenotus helenae					●			●	●	●	●	●	●		●		●		●	●	●			●

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
Ctenotus leonhardii					●					●					†				●	●	●			
Ctenotus nigrilineatus																				●		●		
Ctenotus pantherinus	Leopard Ctenotus				●				●	●	●	●	●	●	●	●	●		●	●	●			●
Ctenotus robustus	Eastern Striped Skink									●			●						●	●				●
Ctenotus rubicundus										●		●		●	●	●			●	●	●			
Ctenotus rutilans					●				●	●				●	●				●					
Ctenotus saxatilis	Rock Ctenotus				●				●	●	●	●	●	●	●	●			●	●	●			●
Ctenotus schomburgkii					●					●				●	●				●	●				
Ctenotus serventyi															†				●	●				
Ctenotus uber									●				●								●			
Cyclodomorphus melanops	Slender Blue-tongue				●				●	●	●	●	●	●	●	●			●	●	●			●
Egernia cygnitos	Western Pilbara Spiny-tailed Skink (formally *E. depressa*)				●				●						†					●				
Egernia formosa					●						●				●		●		●		●			
Egernia pilbarensis	Pilbara Skink									●														
Eremiascincus fasciolatus	Narrow-banded Sand Swimmer				●						●							●	●					
Eremiascincus isolepis																				●				
Eremiascincus richardsonii	Broad-banded Sand Swimmer														●		●		●		●			
Lerista flammicauda					●				●												●			

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
Lerista jacksoni	(*L. muelleri* group)											●							●		●			
Lerista macropisthopus																	●							
Lerista muelleri					●					●	●			●	●	●	●		●	●	●			
Lerista timida	(*L. muelleri* group)								●											●				
Lerista verhmens	(*L. muelleri* group)									●														
Lerista zietzi										●		●							●		●			
Menetia greyii					●				●	●		●		●	†	●	●		●	●	●			
Menetia surda					●					●					●				●		●			●
Morethia ruficauda					●				●	●		●	●	●	●	●			●	●	●			
Notoscincus butleri				P4						●									●	●		●		
Notoscincus ornatus					●				●												●			
Proablepharus reginae									●	●			●	●	●					●				
Tiliqua multifasciata	Central Blue-tongue				●			●	●	●		●		●	●	●	●		●	●	●			
VARANIDAE																								
Varanus acanthurus	Spiny-tailed Monitor				●				●	●	●	●	●	●	●	●	●		●	●	●			●
Varanus brevicauda	Short-tailed Pygmy Monitor				●				●	●	●			●	●	●	●		●	●	●			
Varanus bushi	Pilbara Mulga Monitor				●		●	●	●	●	●	●					●		●	●	●			●
Varanus caudolineatus					●				●					●	●	●	●				●			
Varanus eremius	Pygmy Desert Monitor				●				●	●	●	●							●	●	●			●
Varanus giganteus	Perentie				●			●		●	●	●		●	●		●			●				
Varanus gouldii	Sand Monitor														●		●			●	●			

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
Varanus panoptes	Yellow-spotted Monitor				●	●			●	●	●	●		●	●	●	●		●	●	●			
Varanus pilbarensis	Pilbara Rock Monitor				●					●	●				●				●	●	●			
Varanus tristis	Racehorse Monitor				●				●	●	●	●		●	●	●	●	●	●	●				
TYPHLOPIDAE																								
Ramphotyphlops ammodytes					●					●						●	●		●	●				
Ramphotyphlops ganei				P1	●				●		●								●		●			
Ramphotyphlops grypus					●				●	●		●		●	●	●			●	●				
Ramphotyphlops hamatus															●									
Ramphotyphlops pilbarensis					●					●		●							●	●				
Ramphotyphlops waitii															●									
BOIDAE																								
Antaresia perthensis	Pygmy Python				●					●		●	●		●		●	●	●	●	●			
Antaresia stimsoni	Stimson's Python				●				●	●	●	●	●	●	●			●	●	●	●			
Aspidites melanocephalus	Black-headed Python				●					●	●		●	●	†	●		●	●	●				
Liasis olivaceus barroni	Pilbara Olive Python	VU	S1	VU	●						●	●			●			●	●	●	●	●	●	
ELAPIDAE																								
Acanthophis pyrrhus	Desert Death Adder														●									
Acanthophis wellsi	Pilbara Death Adder				●				●		●	●							●		●			
Brachyurophis approximans					●				●	●	●	●			●		●		●	●	●			

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (*ecologia* 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (*ecologia* 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (*ecologia* 2011)	Central Pilbara Project: Rail (south) (*ecologia* 2011)	NatureMap	DPaW Rare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
Demansia psammophis	Yellow-faced Whipsnake				●				●	●	●	●	●	●	●				●	●	●			●
Demansia rufescens	Rufous Whipsnake				●				●	●	●	●		●					●	●	●			
Furina ornata	Moon Snake				●				●	●	●	●		●	●		●		●	●	●			
Parasuta monachus					●				●	●	●		●	●	●				●	●	●			●
Pseudechis australis	Mulga Snake				●				●	●	●	●	●	●	●		●	●	●	●	●			
Pseudonaja mengdeni	Western Brown Snake				●				●	●	●	●	●	●	●		●		●	●	●			
Pseudonaja modesta	Ringed Brown Snake				●				●	●	●		●	●	●				●	●	●			
Simoselaps bertholdi	Jan's Banded Snake				●																			
Suta fasciata	Rosen's Snake								●	●			●	●	●				●	●	●			
Suta punctata	Spotted Snake				●				●				●		†					●	●			●
Vermicella snelli					●					●					●				●	●	●			

Appendix E4

Regional Fauna Data – Amphibians

Family and Species	Common name	Conservation Status			*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Mt Maclead & Stingray - Vertebrate Fauna Assessments (ecologia 2013)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Cloudbreak vertebrate fauna (Bamford 2005)	Cloudbreak vertebrate fauna (ecologia 2011)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DPaWRare Fauna	DSEWPaC Protected Matters Search	Current Survey
		EPBC Act	WC Act	DPaW																				
HYLIDAE																								
Cyclorana maini	Sheep Frog				●				●	●	●		●	●	●				●	●	●			●
Cyclorana platycephala	Water-holding Frog				●										†									
Litoria rubella	Little Red Tree Frog				●				●	●	●		●	●	●	●	●	●	●	●	●			
LIMNODYNASTIDAE																								
Neobatrachus aquilonius	Northern Burrowing Frog																				●			
Notaden nichollsi	Desert Spadefoot																			●				
Platyplectrum spenceri	Centralian Burrowing Frog				●									●	●						●			
MYOBATRACHIDAE																								
Pseudophryne douglasi	Gorge Toadlet														●				●		●			
Uperoleia russelli	Northwest Toadlet				●					●									●					
Uperoleia saxatilis	Pilbara Toadlet								●									●		●	●			

Appendix E5

Regional Fauna Data – Fish

Family and Species	Common name	EPBC Act	WC Act	DEC	*ecologia* Internal Database	Solomon Rail Corridor: Targeted (Coffey 2011)	Solomon Project - Rail Re-alignment (Ecoscape 2010)	Solomon Rail Camp 1,2,3 (Ecoscape 2010)	Solomon Hub (*ecologia* 2014)	Solomon Project Area (Coffey 2008)	Solomon Project: Kings Area (ecologia 2010)	Firetail Mining Area (Ecoscape 2010)	Maradoo to Great Northern Hwy Rd (Kendrick 1995)	Hamersley Range (Muir 1983)	Solomon Mine and Rail Con Sig Monitoring (ecologia 2012)	Central Pilbara Project: Mine (ecologia 2011)	Central Pilbara Project: Rail (south) (ecologia 2011)	NatureMap	DEC Rare Fauna	DSEWPaC Protected Matters Search	Current survey
CLUPEIDAE																					
Nematalosa erebi	Bony Bream																	●			
GOBIIDAE																					
Glossogobius giuris	Tank Goby																	●			
MELANOTAENIIDAE																					
Melanotaenia australis	Western Rainbowfish								●												
PLOTOSIDAE																					
Neosilurus hyrtlii	Hyrtl's Tandan								●									●			
TERAPONTIDAE																					
Amniataba percoides	Barred Grunter								●									●			
Leiopotherapon aheneus	Fortescue Grunter			P4														●	●		
Leiopotherapon unicolor	Spangled Perch								●												

APPENDIX F FAUNA SPECIES RECORDED DURING TRAPPING

Appendix F1

Fauna species recorded during sampling – Mammals

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC Act	WC Act	DPaW							
DASYURIDAE											
Dasykaluta rosamundae	Kaluta				3		7			9	
Ningaui timealeyi	Pilbara Ningaui				1		1				
Planigale sp.	Common Planigale							3			
Sminthopsis macroura	Stripe-faced Dunnart					1					
MACROPODIDAE											
Macropus robustus	Euro										2
Macropus rufus	Red Kangaroo				1	2					2
PTEROPODIDAE											
Pteropus alecto	Black Flying-fox										1
EMBALLONURIDAE											
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat								x		
MOLOSSIDAE											
Chaerephon jobensis	Northern Freetail Bat						x		x		
Mormopterus beccarii	Beccari's Freetail Bat					x					
Tadarida australis	White-striped Freetail Bat				x				x		
VESPERTILIONIDAE											
Chalinolobus gouldii	Gould's Wattled Bat				x	x	x	x	x	x	x
Scotorepens greyii	Little Broad-nosed Bat					x	x				x
Vespadelus finlaysoni	Finlayson's Cave Bat				x	x	x	x	x	x	
MURIDAE											
Leggadina lakedownensis	Short-tailed Mouse			P4		1					
Pseudomys chapmani	Western-pebble Mouse			P4							M
Pseudomys desertor	Desert Mouse						5				
Pseudomys hermannsburgensis	Sandy Inland Mouse									2	

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC Act	WC Act	DPaW							
INTRODUCED MAMMALS											
**Canis lupis*	Dog/dingo										
**Felis catus*	Cat										
**Bos taurus*	European Cattle										

Appendix F2

Fauna species recorded during sampling – Birds

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC	WCA	DPaW							
PHASIANIDAE											
Coturnix ypsilophora	Brown Quail										1
COLUMBIDAE											
Phaps chalcoptera	Common Bronzewing										1
Ocyphaps lophotes	Crested Pigeon					13	4	45			16
Geopelia cuneata	Diamond Dove				1	4					71
Geopelia striata	Peaceful Dove										1
PODARGIDAE											
Podargus strigoides	Tawny Frogmouth										1
AEGOTHELIDAE											
Aegotheles cristatus	Australian Owlet Nightjar										2
ARDEIDAE											
Egretta novaehollandiae	White-faced Heron										1
ACCIPITRIDAE											
Elanus axillaris	Black-shouldered Kite										1
Haliastur sphenurus	Whistling Kite							2	3	1	5
Accipiter fasciatus	Brown Goshawk					1					2
Accipiter cirrocephalus	Collared Sparrowhawk										1
Circus assimilis	Spotted Harrier					1				2	2
Aquila audax	Wedge-tailed Eagle							1	1		
Hieraaetus morphnoides	Little Eagle										2
FALCONIDAE											
Falco cenchroides	Nankeen Kestrel							1		2	2
Falco berigora	Brown Falcon					1					8
OTIDIDAE											

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC	WCA	DPaW							
Ardeotis australis	Australian Bustard			P4					1		7
CHARADRIIDAE											
Elseyornis melanops	Black-fronted Dotterel										1
TURNICIDAE											
Turnix velox	Little Button-quail										3
CACATUIDAE											
Eolophus roseicapillus	Galah				7		2	36	2	8	11
Cacatua sanguinea	Little Corella				2	23					15
Nymphicus hollandicus	Cockatiel				105		5	50			23
PSITTACIDAE											
Barnardius zonarius	Australian Ringneck							2			2
Melopsittacus undulatus	Budgerigar				40	39	19	17	4	6	35
HALCYONIDAE											
Todiramphus pyrrhopygius	Red-backed Kingfisher										1
MEROPIDAE											
Merops ornatus	Rainbow Bee-eater	M	S3			3	2				11
MALURIDAE											
Malurus leucopterus	White-winged Fairy-wren				5	12					
Malurus lamberti	Variegated Fairy-wren				12	5	12				43
ACANTHIZIDAE											
Smicrornis brevirostris	Weebill				19	4	3	2		7	24
Gerygone fusca	Western Gerygone					4	4		1		6
Acanthiza uropygialis	Chestnut-rumped Thornbill					23	4		22		15
PARDALOTIDAE											
Pardalotus rubricatus	Red-browed Pardalote										1
Pardalotus striatus	Striated Pardalote									1	3
MELIPHAGIDAE											
Lichenostomus virescens	Singing Honeyeater				3	5	10			17	33

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC	WCA	DPaW							
Lichenostomus keartlandi	Grey-headed Honeyeater										6
Lichenostomus penicillatus	White-plumed Honeyeater					28		5		7	68
Manorina flavigula	Yellow-throated Miner				37					13	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					6	8		1	4	16
Epthianura tricolor	Crimson Chat				7						18
Lichmera indistincta	Brown Honeyeater						6			12	20
POMATOSTOMIDAE											
Pomatostomus temporalis	Grey-crowned Babbler									1	
Pomatostomus superciliosus	White-browed Babbler										3
CAMPEPHAGIDAE											
Coracina maxima	Ground Cuckoo-shrike									6	
Coracina novaehollandiae	Black-faced Cuckoo-shrike					1	1				5
Lalage sueurii	White-winged Triller				12	6	1				9
PACHYCEPHALIDAE											
Pachycephala rufiventris	Rufous Whistler					5	3		6		13
Oreoica gutturalis	Crested Bellbird				4	4	5			2	6
ARTAMIDAE											
Artamus personatus	Masked Woodswallow										88
Artamus cinereus	Black-faced Woodswallow				15	14	5				48
Cracticus torquatus	Grey Butcherbird					4	3		1		
Cracticus nigrogularis	Pied Butcherbird							2		1	2
Cracticus tibicen	Australian Magpie									4	
RHIPIDURIDAE											
Rhipidura leucophrys	Willie Wagtail				4	4	2	4	5		13
CORVIDAE											
Corvus orru	Torresian Crow					2		1			4
MONARCHIDAE											
Grallina cyanoleuca	Magpie-lark				2			1			

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC	WCA	DPaW							
PETROICIDAE											
Peroica goodenovii	Red-capped Robin				11			6		8	
Melanodryas cucullata	Hooded Robin							2			
MEGALURIDAE											
Cincloramphus mathewsi	Rufous Songlark				1	3				2	
Cincloramphus cruralis	Brown Songlark										2
Eremiornis carteri	Spinifexbird									3	5
HIRUNDINIDAE											
Petrochelidon nigricans	Tree Martin				2						20
NECTARINIIDAE											
Dicaeum hirundinaceum	Mistletoebird							1			
ESTRILDIDAE											
Taeniopygia guttata	Zebra Finch				12	19	10	11	47		112
Emblema pictum	Painted Finch										2

Appendix F3

Fauna species recorded during sampling – Herpetofauna

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC	WCA	DPaW							
AGAMIDAE											
Amphibolurus longirostris	Long-nosed Dragon								1		4
Caimanops amphiboluroides	Mulga Dragon					1			1		3
Ctenophorus caudicinctus	Ring-tailed Dragon				9		6			4	8
Ctenophorus isolepis	Central Military Dragon						1				9
Ctenophorus reticulatus	Central Netted Dragon					2					1
DIPLODACTYLIDAE											
Diplodactylus conspicillatus	Fat-tailed Gecko						1			4	
Diplodactylus galaxias						1		3			
Lucasium stenodactylum	Sand-plain Gecko				1		1			2	
GEKKONIDAE											
Gehyra pilbara											1
Gehyra variegata	Tree Dtella					1				1	15
Heteronotia binoei	Bynoe's Gecko										3
PYGOPODIDAE											
Pygopus nigriceps	Western Hooded Scaly-foot								1		
SCINCIDAE											
Carlia munda										2	2
Cryptoblepharus buchanani											1
Ctenotus helenae							1			1	
Ctenotus pantherinus	Leopard Ctenotus				3		12			5	
Ctenotus robustus	Eastern Striped Skink							3			
Ctenotus saxatilis	Rock Ctenotus						1			3	
Cyclodomorphus melanops	Spinifex Slender Blue-tongue										2
Menetia surda						1			1	2	

Family and Species	Common Name	Conservation status			INV S1	INV S2	INV S3	INV S4	INV S5	INV S6	Opportunistic
		EPBC	WCA	DPaW							
VARANIDAE											
Varanus acanthurus	Spiny-tailed Monitor				1						1
Varanus bushi	Pilbara Monitor										3
Varanus eremius	Pygmy Desert Monitor						2				
ELAPIDAE											
Demansia psammophis cupreiceps	Yellow-faced Whipsnake							1	1	1	
Parasuta monachus	Monk Snake				1						1
Suta punctata	Rosen's Snake					1		1	3		
HYLIDAE											
Cyclorana maini	Sheep Frog					2	1				1

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