

Appendix G

Level 1 Fauna Assessment (Coffey, 2013)



WEST ERREGULLA EXPLORATION PROGRAM

Warrego Energy

3D Seismic Survey

Level 1 Fauna Assessment



WEST ERREGULLA EXPLORATION PROGRAM (EP469 & EP419)

LEVEL 1 FAUNA ASSESSMENT

Warrego Energy

September 2013

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EXECUTIVE SUMMARY

Warrego Energy (Warrego) intends to undertake exploration activities at its West Erregulla Project, herein referred to as the Project, approximately 300 km north of Perth and 50 km southeast of Dongara, within the Geraldton Sandplains bioregion. The proposed exploration activities consist of a three dimensional seismic survey and appraisal drilling program within Exploration Permit (EP) 469 and a portion of EP 419. Exploration activities are scheduled to commence in the last quarter of 2013.

Coffey Environments was commissioned to undertake a Level 1 fauna assessment (fauna assessment) to identify the fauna ecological values of the survey area. The survey was undertaken in accordance with the Guidance for the Assessment of Environmental Factors No. 56 (EPA, 2004), Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA, 2002) and Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2010). Coffey Environments also undertook a Black Cockatoo habitat assessment in accordance with the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPac, 2012b).

Six fauna habitat types were identified within the survey area, comprising cleared land, mixed shrubland with/without woodland species, laterite breakaway, open Eucalyptus forest, minor drainage lines and planted Eucalypt habitats.

A total of 304 vertebrate fauna species, 20 of which are conservation significant, have previously been recorded within the region and so have the potential to occur within the survey area. Coffey Environments undertook an assessment to determine the likelihood of these species occurring within the survey area based on the availability of suitable habitat, known distribution of each species and currency of species records. Of the 20 species of conservation significance, only six were considered 'likely' to occur (Carnaby's Black Cockatoo, Peregrine Falcon, Australian Bustard, Rufous Fieldwren, Rainbow Bee-eater, Gilled Slender-Bluetongue and Western Carpet Python), and another six were considered as 'possibly' occurring within the survey area (White-browed Babbler, Fork-tailed Swift, Great Egret, Cattle Egret, Western Brush Wallaby and Woma).

It is Coffey Environments' assessment that the survey area may be considered to have high ecological functional value, given a large portion of habitat within the survey area was of Very Good quality (i.e., area of vacant crown land) and the presence of suitable foraging and roosting habitat for Carnaby's Black Cockatoo. Furthermore while remnant areas of habitat present within cleared land are unlikely to provide habitat for a fauna assemblage that would be typical of the region (i.e. before disturbance), it is likely that the Very Good quality habitat present within the vacant crown land supports a level of biodiversity value at the genetic, species and ecosystem level typical of the region.

Potential impacts of the Project on terrestrial fauna present within the survey area included; loss or degradation of fauna habitat; fauna injuries and mortalities from interactions with project vehicles, machinery and infrastructure; increased predation by introduced fauna; altered fauna behaviour associated with noise, vibration and light emissions and increased risk of fire.

Coffey Environments assessed the significance of these potential impacts on the Carnaby's Black Cockatoo to assist in determining whether the Project requires approval from the minister under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This involved consulting the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species

(DSEWPaC, 2012b) and the EPBC Policy Act Statement 1.1 Matters of National Environmental Significance (DEWHA, 2006).

In consideration of the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b) and given the Project is going to result in clearing of more than 1 ha of quality foraging habitat, the Project will require referral to the Department of Sustainability, Environment, Water, Populations and Communities for assessment under the EPBC Act.

The EPBC Policy Act Statement 1.1 (DEWHA, 2006) sets out a number of significant impact criteria for Critically Endangered or Endangered species. Coffey Environments determined that the Project only had a 'real chance or possibility' of triggering one of the nine criteria, specifically, 'adversely affecting habitat critical to the survival of the species', given that clearing of foraging (and potentially roosting) habitat is largely unavoidable. The impact of clearing on the species however, is believed to be of limited significance, given the:

- Availability of similar habitat in the local and regional area (i.e., to the west of the survey area and as approximately 17.67% of the sub region is held in conservation reserves).
- Scale (~150 ha or 2% of the survey area) and nature (e.g., width of clearing, coarse grid spacing) of the proposed clearing.

It is recommended that Warrego Energy refers the Project under the EPBC Act 1999 due to the impact to Carnaby's Black Cockatoo foraging (and potentially roosting) habitat. It is also recommended that Warrego consider the inclusion of the following management practices/recommendations, in the development of the Project and the preparation of their environmental management plan:

- Minimise clearing, with a particular focus on avoiding large habitat trees (particularly areas of open Eucalypt forest and planted Eucalypt habitats) as much as possible.
- Align the Project footprint with existing areas of disturbance, where possible.
- Maintain ecological linkages between areas of habitat to mitigate fragmentation impacts.
- Implement Project speed limits (i.e., maximum speed of 60 km/h off public thoroughfares).
- Restrict night-time vehicle movements.
- Restrict off-road driving.
- Design all excavations to incorporate effective fauna egress to avoid entrapment, injury and death of local fauna.
- Fence all excavations.
- Inspect all excavations regularly to identify any trapped fauna and provide assistance if necessary. Inspections are particularly useful early in the morning and prior to the commencement of backfilling to ensure that the excavations are clear of fauna.
- Record all fauna injuries and mortalities so that they can be reported in the environmental reports, where required.
- Develop an Environmental Education and Awareness induction for all staff, informing them of the conservation values present within the survey area and their management responsibilities.
- Undertake progressive rehabilitation as soon as possible.

- Utilise native flora species identified from the survey area in rehabilitation and revegetation.
- Manage domestic waste and water storages appropriately to minimise the proliferation of introduced fauna (e.g. store putrescible waste in closed bins and remove regularly from site).
- Develop and implement a feral animal control program in consultation with the DEC and pastoralists.
- Direct any lighting to working areas, where possible.
- Develop and implement a fire prevention and control strategy.
- Ensure appropriate fire response equipment and appropriately trained staff are available at all times during operation.
- Be aware of any 'harvest and vehicle movement bans' issued by local government during prohibited/restricted burning times (usually over the Summer period between October and April).
- Develop and implement a biosecurity management plan (including weeds and dieback).

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1. INTRODUCTION

1.1 Background

Warrego Energy (Warrego) intends to undertake exploration activities at its West Erregulla Project, herein referred to as the Project, approximately 300 km north of Perth and 50 km southeast of Dongara, within the Geraldton Sandplains bioregion. The proposed exploration activities consist of a three dimensional seismic survey and appraisal drilling program within Exploration Permit (EP) 469 and a portion of EP 419. Exploration activities are scheduled to commence in the last quarter of 2013.

Exploration activities will include drilling of an appraisal well and a 3D seismic survey, which involves traversing the exploration area in a grid pattern, sending, receiving and processing acoustic signals in order to map the underlying geology. The appraisal well and seismic survey will be used to collect data pertaining to the commercial potential of a tight-gas reserve. The Project is located approximately 20 km from both the Dampier-Bunbury and Parmelia pipelines, through which it is proposed that product will be transported (Woodman, 2012).

The Project is located within the Geraldton Sandplain Bioregion (Lesueur Sandplains sub-region) and overlies farmland and crown land consisting of remnant bushland. Vegetation known to be habitat for the Commonwealth Government listed (Endangered) Carnaby's Black Cockatoo exists within the area.

Warrego has contracted Coffey Environments (Coffey) to undertake a Level 1 vertebrate fauna assessment (fauna assessment) of the proposed seismic survey area, including a targeted assessment for Carnaby's Black Cockatoo.

1.2 Scope of Works

Coffey undertook a Level 1 fauna assessment to identify the fauna ecological values of the seismic survey area. The survey was undertaken in accordance with the Guidance for the Assessment of Environmental Factors No 56 (EPA, 2004), Terrestrial Fauna Surveys for Environmental Impact Assessment (EPA, 2002) and Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2010).

The Level 1 fauna assessment involved:

- Reviewing the DEC NatureMap online database to identify potential vertebrate fauna in the region.
- A search of the DEC's Threatened and Priority Species database to identify potential scheduled and threatened species within the region.
- A search of the Commonwealth's Government database of fauna of national environmental significance to identify species potentially occurring within the area that are protected under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* or international migratory bird agreements (JAMBA/CAMBA).
- A review of previous fauna surveys conducted in the area to provide a regional context and develop a list of species recorded previously in nearby surveys.
- A field investigation of the survey area to identify:

- The major fauna habitats present within the survey area.
- The likelihood for the occurrence of the predicted fauna assemblage based on desktop studies.
- The likely presence of conservation significant fauna.
- The presence of significant fauna habitat.
- Black Cockatoo habitat assessment in accordance with EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b) to identify foraging and roosting/breeding habitat.
- Identifying potential impacts/risks to fauna from vegetation clearing within the survey area.
- A risk assessment of the impacts of development on fauna assemblages and conservation significant fauna.
- Provide recommendations on:
 - Any additional species-specific searches that may be required for protected species.
 - Any follow-up fauna surveys required to identify species of conservation significance or faunal assemblages that are important and likely to be impacted upon by the clearing.
 - Strategies to minimise or prevent impact on significant fauna and fauna-habitat, including specially protected fauna.

The Level 1 fauna assessment does not include any trapping of fauna.

2 EXISTING ENVIRONMENT

2.1 Project Location

The Project is located within Western Australia's Northern Sandplains region, 50 km southeast of Dongara and 300 km north of Perth (Warrego, 2012; Woodman, 2012) (see Figure 1). The Project straddles two shire boundaries (Shire of Mingenew and the Shire of Three Springs) and overlies crown land and private farmland.

The Project will occur within permits EP 469 and EP 419 and the boundaries of the survey area defined in Figure 1.

The closest conservation areas to the Project are the Wilson Nature Reserve and the Yardanogo Nature Reserve, which are located approximately 20 km to the southeast and 25 km west of EP 469 respectively (Figure 1). The nearest residential property is located approximately 5 km to the west of the well site options.

The Project is located within the Lesueur Sandplain sub-region (GS3) of the Geraldton Sandplains bioregion under the Interim Biogeographic Regionalisation of Australia (IBRA) (Woodman, 2012).

2.2 Physical Environment

This section describes the climate, landforms, soil and geology of the survey area and surrounds.

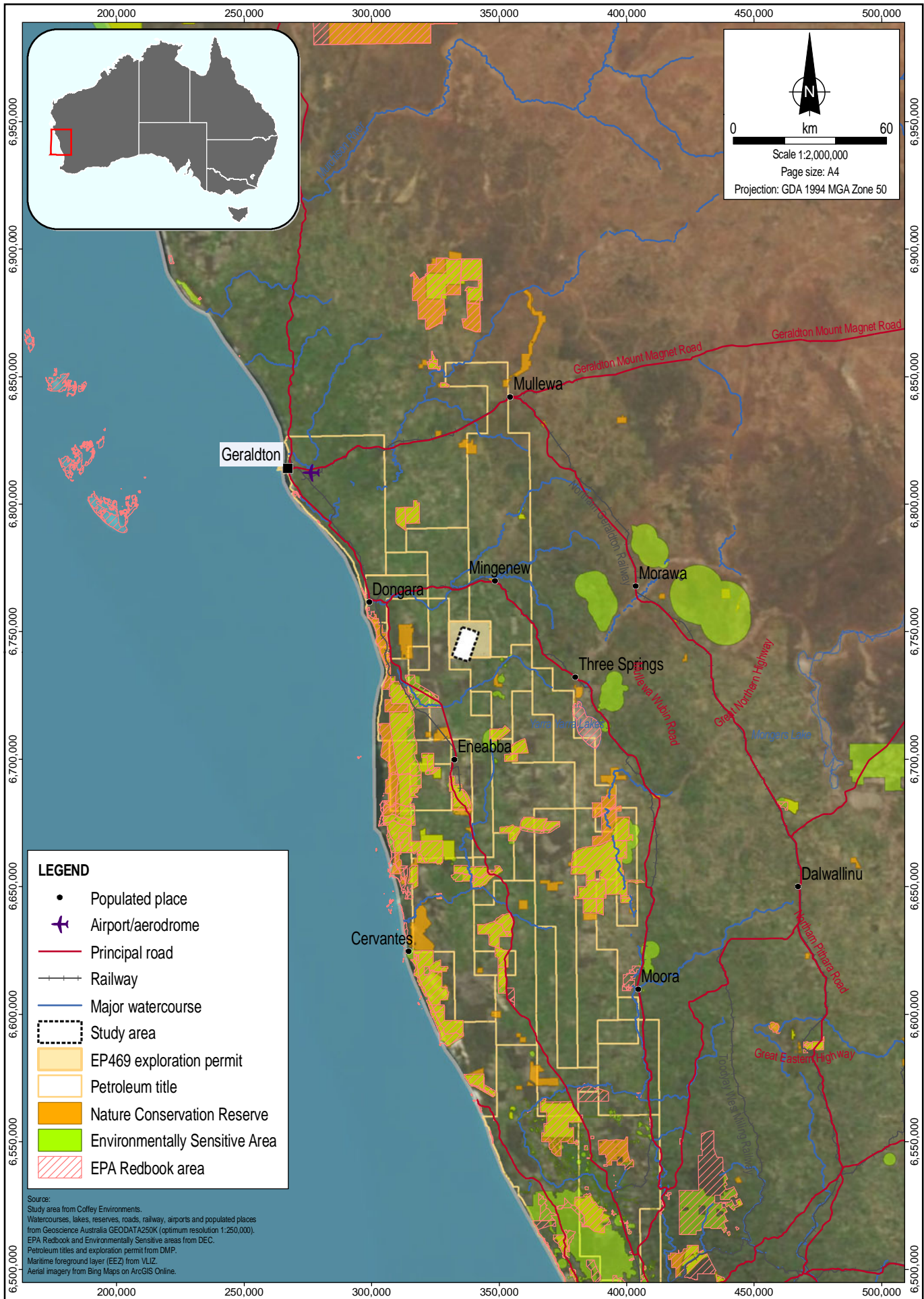
2.2.1 Climate

The climate of the region within which the Project occurs is classified as Mediterranean, with dry warm summers and cool wet winters (Woodman, 2012). The nearest weather station to the Project is located at Eneabba.

Climate data from Eneabba weather station, approximately 43 km south of the Project, shows the warmest period in the region is between December and March with average maximum temperatures (1972 to 2012) ranging from 33.6 to 36.3°C (Figure 2). The lowest minimum average temperature occurs between July and September, with average minimum temperatures ranging from 9.0 to 9.6°C during these months (BOM, 2012).

Average rainfall in the region (1964 to 2012) is highest during the cooler months between May and August. Mean monthly rainfall during these months ranges from 69.1 mm to 101.1 mm. The driest months are between November and March, with rainfall ranging from 7.3 mm to 14.4 mm. The overall average annual rainfall at Eneabba is 493.3 mm.

Figure 2 shows the seasonal average maximum and minimum temperatures and the rainfall data for Eneabba.



0 km 60

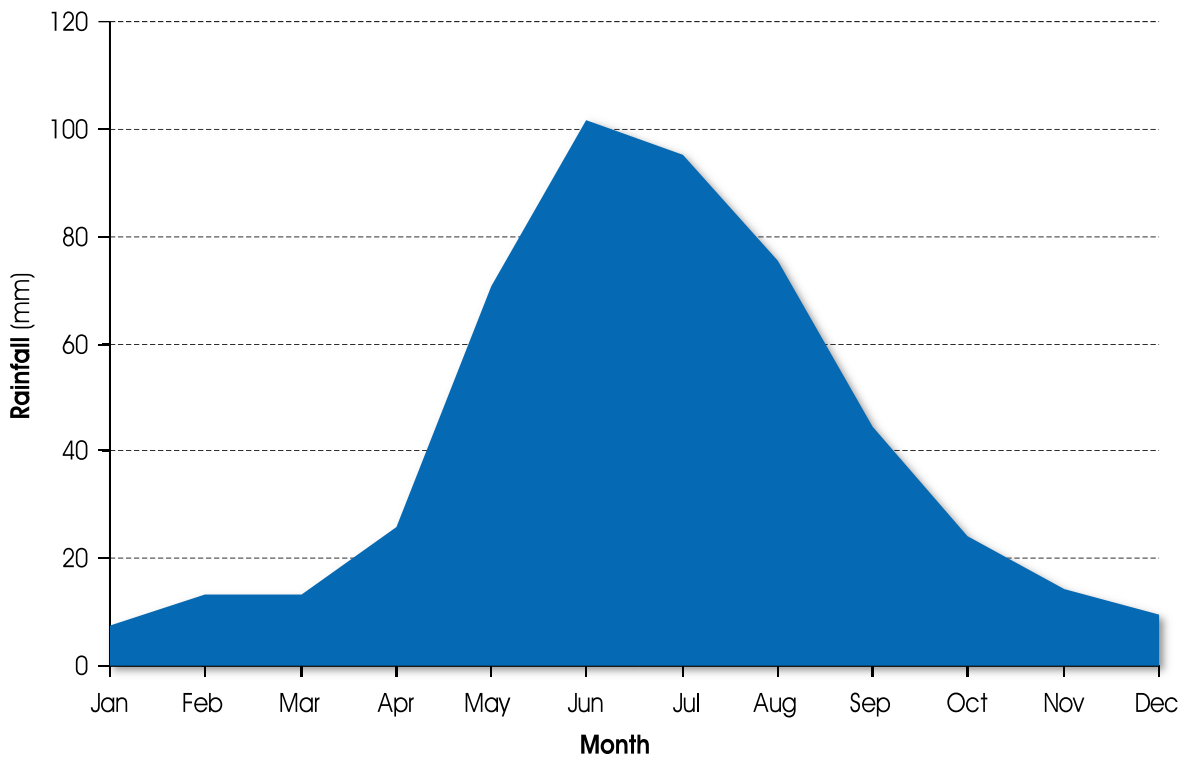
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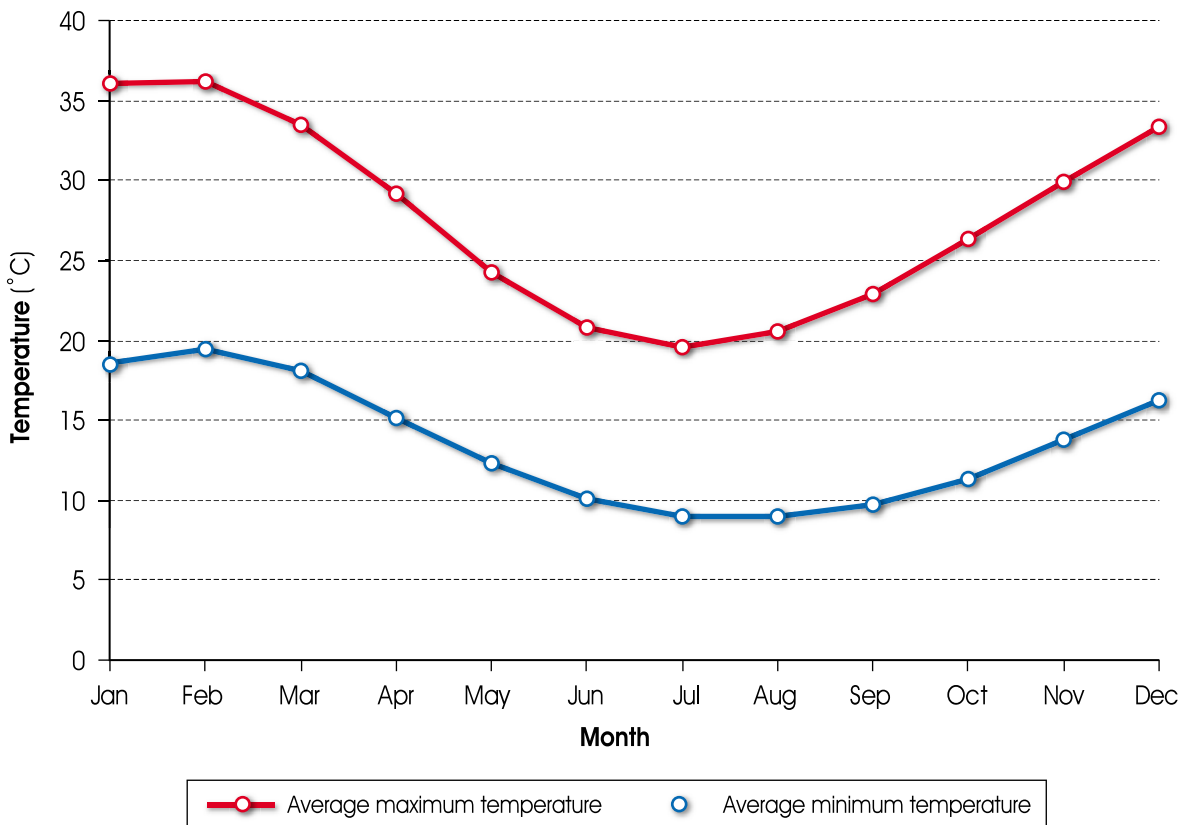
- Populated place
- ✈ Airport/aerodrome
- Principal road
- +— Railway
- Major watercourse
- ▭ Study area
- ▭ EP469 exploration permit
- ▭ Petroleum title
- ▭ Nature Conservation Reserve
- ▭ Environmentally Sensitive Area
- ▭ EPA Redbook area

Source:
Study area from Coffey Environments.
Watercourses, lakes, reserves, roads, railway, airports and populated places from Geoscience Australia GEODATA250K (optimum resolution 1:250,000).
EPA Redbook and Environmentally Sensitive areas from DEC.
Petroleum titles and exploration permit from DMP.
Maritime foreground layer (EEZ) from VLIZ.
Aerial imagery from Bing Maps on ArcGIS Online.

Average Monthly Rainfall Recorded for Eneabba Weather Station



Average Maximum and Minimum Temperatures Recorded at Eneabba Weather Station



2.2.2 Surface Hydrology

The northern and southern limits of the Project are bound by two regional drainage systems, the Irwin and Lockier Rivers to the north and the Arrowsmith River to the south. Numerous small watercourses also dissect the area that either drain westward from the Arrowsmith Region onto the Swan Coastal Plain, or north or south towards either of the two major drainage systems (RPS, 2011).

2.2.3 Geology, Soils and Landforms

The Lesueur Sandplain sub-region comprises coastal Aeolian and limestone, Jurassic siltstones and sandstones (often heavily lateritised) of central Perth Basin (Desmond and Chant, 2001).

The Project also lies in the Northern Sandplains Region (Irwin Botanical District) with yellow sands inland and leached sandy soils overlaying laterite near the coast, as described by Beard (1990). This region is almost completely underlain by sedimentary rocks of siliceous nature. The principal exception to this is a block of Proterozoic metamorphic rocks with some granite, between Greenough and Murchison Rivers (Beard, 1990). The sedimentary rocks form a series of plateaux, including the Dandaragan Plateau, on which the Project is located (Beard, 1990; Woodman, 2012). These plateaux have been eroded by the sea on the west and dissected by rivers, but substantial stretches of the plateau surfaces are still preserved and form extensive monotonous sandplains. Sandy soils are found throughout except upon Proterozoic rocks where red loams are found (Beard, 1990).

2.3 Biological Context of the Survey Area

This section describes the biological context of the survey area and surrounds

2.3.1 Bioregional Data

The Lesueur Sandplain sub-region is known to contain a large number of distinct, species rich and geographically restricted floristic communities (Mt Lesueur and Coomallo area), as well as a number of rare flora, vertebrates and stygofauna of cave communities in Beekeepers Nature Reserve. This area is known Australia-wide and internationally as having a particularly high floristic diversity and level of endemism (Desmond and Chant, 2001).

Approximately 17.67% of the sub region is in conservation reserves. One wetland of national significance (Lake – Louge Inoon System) and two wetlands of subregional significance (White and Green Lakes, Saline Lakes of Coolimba – Jurien) are located within the sub-region (Desmond and Chant, 2001).

The sub-region has been extensively cleared in the eastern portion of the region and has known salinity issues (Desmond and Chant, 2001).

2.3.2 Vegetation

The vegetation of the Lesueur Sandplain subregion consists mainly of shrub-heaths rich in endemics on a mosaic of lateritic mesas, sandplains, coastal sands and limestone, with heath on lateritised sandplains along the north-eastern margins of the subregion (Desmond and Chant, 2001; Woodman, 2012).

The vegetation of the Northern Sandplains Region is broadly described as scrub on heath on sandplains near the coast with *Acacia-Casuarina* thickets further inland and *Acacia* shrub with scattered trees of *Eucalyptus loxophleba* on hard-setting loams (Beard, 1990).

Woodman Environmental conducted a Level 2 flora survey in 2011 as part of the Environmental Impact Assessment process for the Project. The survey identified the presence of vegetation known to be utilised by the Endangered listed Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) for foraging (e.g., *Banksia* spp., *Hakea* spp., and *Grevillea* spp.) and breeding (e.g., *Eucalyptus loxophleba* subsp. *loxophleba*) (Woodman, 2012; DSEWPaC, 2012b).

2.3.3 Fauna Species of Conservation Significance

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC); Department of Environment and Conservation (DEC) and Western Australian Museum (WAM) have reported a number of fauna species at risk in the Lesueur Sandplain sub-region. This report assesses the potential for these species to be found in the survey area and the potential impact of the proposed development on these species.

2.3.4 Previous Biological Assessments

There have been numerous environmental assessments conducted within the area surrounding the Project. The findings from the following surveys and assessments have been utilised for this assessment:

- ATA, 2004. Fauna Assessment of Koolanooka South. ATA Environmental.
- ATA. 2006. Vertebrate Fauna Assessment, Shire of Greenough TPS No.1A Amendment No.4. Unpublished report by ATA Environmental for Bayform Holdings Pty Ltd.
- Bamford 2012. Fauna Assessment of Tiwest's Dongara Project. Bamford Consulting Ecologists.
- CALM, 1989. A spring reconnaissance survey of the flora and fauna of the Southern Beekeepers Reserve. Burbidge and Boscacci, Department of Conservation and Land Management.
- Dames and Moore Pty Ltd. 1993. Oakajee Proposed Industrial Site: flora and fauna assessment. Unpublished report for Landcorp.
- Desmond, A.J. and Heriot, S.M. 2002. Fauna monitoring of the Chapman River wildlife corridor, Geraldton. Department of Conservation and Land Management, Geraldton.
- Ecologia. 1994. Coastal Road Jurien to Green Head Biological Survey Report.
- Ecologia. 2002. Northwest Coastal Highway Geraldton Bypass: Fauna assessment survey. Unpublished report by Ecologia Environmental for the Department of Planning and Infrastructure, Western Australia.
- GHD. 2011. Report for Lots 3012 and 3013 Olive Street, Geraldton: Flora and Fauna Survey. Unpublished report Geraldton-Greenough.
- How, R.A., Pearson, D.J. and Dunlop, J.N. 1983. Herpetofauna of the Geraldton Region, Western Australia. Records of the Western Australian Museum 10: 215-234.
- RCCWA. 2009. Roadside vegetation and conservation values in the City of Geraldton-Greenough. Roadside Conservation Committee Western Australia.
- Skull, S. and Cockerton, G. (Landscape Services Pty Ltd) and Bamford, M. (Bamford Consulting Ecologists). 1998. Oakajee pipeline route flora and fauna study: desktop review.

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3. METHODOLOGY

This Level 1 fauna assessment was undertaken in accordance with the Environmental Protection Authority (EPA) Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002), Coffey Environments' interpretation of the EPA Guidance for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA, 2004) and EPA (2010) Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment.

Coffey Environments also undertook a Black Cockatoo habitat assessment in accordance with the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b).

This fauna assessment does not include a survey for short-range endemic (SRE) invertebrates. However, the site investigation confirmed that the survey area did not contain unique or locally uncommon habitats and so it is unlikely to support SRE fauna restricted to the survey area.

3.1 Desktop Assessment

A desktop search of the DEC Threatened Fauna Database and NatureMap database (35 km buffer) and the EPBC online database for protected matters were used to develop a list of potential bird, reptile, mammal and amphibian species in the general survey area. The NatureMap search area was used to eliminate results from the marine environments and to maximise the similarity in fauna habitats encompassed by the search area. General texts were also used to provide supplementary information including Tyler and Doughty (2009) for frogs, Storr *et al.* (1983, 1990, 1999, 2002) for reptiles, Johnstone and Storr (1998, 2004) and Storr and Johnstone (1988) for birds, Van Dyck and Strahan (2008) for mammals and consultant staff's personal experience.

A number of published and unpublished reports for fauna surveys conducted in the vicinity of the survey area were also used to develop the list of potential species present in the survey area, focussing where appropriate on fauna survey data from within 35 km of the survey area. Previous surveys are discussed in section 2.3.4.

3.2 Field Investigation

Dr Graeme Finlayson and Natassja Raymond undertook the first site assessment from 6 to 8 June 2012. The site assessment included an inspection of the major fauna habitats within the majority of the survey area and adjacent areas. The primary purpose of this survey was to identify fauna habitats and assess the potential for conservation significant terrestrial fauna species to occur within the survey area.

Habitat was assessed by traversing the area in a vehicle and by foot and recording a series of habitat reference points. At each reference point habitat type and condition was recorded. Habitat assessments were assisted by previous floristic community mapping conducted by Woodman (2012).

Following minor alterations to the survey area, a second site assessment was conducted by Natassja Raymond and Dr Paul Mitrovski from 3 to 4 December 2012 of additional survey areas to ensure habitats within any areas of the survey area that had not previously been visited could be classified and mapped.

3.3 Assessment of Fauna Habitat Quality

The fauna habitat quality was assessed based on the size of the habitat, the level of habitat connectivity, availability of specific resources (e.g., tree hollows) and overall vegetation quality. Coffey Environments rated the fauna habitat quality using the following criteria:

High quality fauna habitat (H) – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.

Very good fauna habitat (VG) – These areas show minimal signs of disturbance (e.g., grazing, clearing, fragmentation, and weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally effected by disturbance.

Good fauna habitat (G) – These areas showed signs of disturbance (e.g., grazing, clearing, fragmentation, and weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.

Disturbed fauna habitat (D) – These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing contain weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.

Highly degraded fauna habitat (HD) – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. There is limited or no fauna habitat connectivity. Faunal assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.

3.4 Limitations

A comprehensive (Level 2) fauna trapping survey has not been undertaken for this assessment. Conclusions and management recommendations have been made based on data collated from various surveys and reports for adjacent areas and the bioregion and Coffey Environments' assessment of the habitat value of the survey area.

Repeated surveys at multiple sites over several years are necessary to describe the spatial and temporal variations in the faunal assemblage within a survey area. However, it is Coffey Environments' opinion that given the nature of the proposed impact, previous anthropogenic activity on site and the availability of survey data within similar habitats within the bioregion, adequate data has been collected to assess any potential impacts of the Project on terrestrial vertebrate fauna.

The EPA Guidance for Assessment of Environmental Factors: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia*, No. 56 (EPA, 2004) suggests that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 1.

Table 1 Fauna assessment limitations and constraints

Possible Limitations	Constraint	Comment
Competency and experience of the consultant carrying out the survey	No	Zoologists undertaking this survey have appropriate training and experience in conducting Level 1 fauna assessments.
Scope	No	All components required for a Level 1 fauna assessment have been completed.
Proportion of fauna identified, recorded and/or collected	(N/A)	A fauna trapping survey has not been undertaken within the survey area and is not part of the scope of this Level 1 fauna assessment.
Sources of information	No	Information on fauna was available from appropriate database searches and both published and unpublished reports.
Proportion of the task achieved	No	The assessment fulfils all of the objectives.
Timing/weather/season/cycle	No	The field investigation was undertaken in weather conditions that were appropriate for this type of assessment.
Disturbances which affected results of the survey	No	No disturbances were identified in the survey area that were considered likely to impact this assessment.
Intensity of survey effort	No	The intensity of the assessment is sufficient for a Level 1 fauna assessment.
Completeness	No	All major habitat types were visited.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	No	Access to all areas was adequate.
Availability of contextual information for the region	No	DEC Threatened and Priority species lists, EPBC Act Protected Matters Search, NatureMap data and results of previous surveys in both the surrounding area and the bioregion were available to provide comparison at both a local and regional level in similar habitats.

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4. RESULTS

4.1 Fauna Habitats

The survey area (approximately 9,601 ha) contains six fauna habitat types comprising; cleared land (with and without scattered trees/shrubs) (33% of the survey area), low open shrubland with/without scattered woodland species (3 types) (64% of the survey area), laterite breakaway (1% of the survey area), open Eucalyptus forest (1% of the survey area), minor drainage (2% of the survey area) and planted Eucalypts (less than 1% of the survey area).

A description of each habitat is provided in Table 2, with the distribution shown in Figures 3a to 3e. The condition of the fauna habitat ranged from Highly Degraded to Very Good quality. Cleared land and planted Eucalypt habitats were Highly Degraded, while habitats present within the area of vacant crown land, which was largely undisturbed, were of Very Good quality. Areas of remnant habitat within cleared land generally had a lower quality than similar habitats within the vacant crown land, due to the level of connectivity and disturbance (including grazing pressure and presence of weeds).

The following plates are representative of the habitats available in the survey area. A description of each habitat, key aspects of the vegetation available and comment on the quality and value to vertebrate fauna species are recorded below. An assessment of the value of each habitat type to Carnaby's Black Cockatoo has also been discussed.

Table 2 Habitat types in the survey area


	<p>1. Cleared Land</p> <p>Agricultural land either crops or pasture. Highly Degraded fauna habitat quality.</p> <p>This habitat provides little value to native vertebrate fauna species.</p>
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Table 2 Habitat types in the survey area (cont'd)



	<p>2. Planted Eucalypts</p> <p>Isolated trees planted along roadsides. Highly Degraded fauna habitat quality.</p> <p>Given its isolated nature, this habitat has little value to native vertebrate fauna species, with the exception that it may provide suitable roosting habitat for the Carnaby's Black Cockatoo.</p>
	<p>3. Mixed shrubland with/without woodland species</p> <p>Mixed shrubland with or without low open woodland, on flats, in depressions and on slopes. Species comprising this habitat include <i>Eucalyptus tottiana</i>, <i>Eucalyptus conveniens</i>, <i>Allocasuarina humilis</i>, <i>Allocasuarina campestris</i>, <i>Banksia scabrella</i>, <i>Calothamnus sanguineus</i>, <i>Banksia dallanneyi</i>, <i>Banksia attenuate</i>, <i>Conostylis canteriata</i>, <i>Hakea trifurcate</i>, <i>Hakea circumalata</i>, <i>Grevillea biform</i> and <i>Melaleuca leuropoma</i>.</p>
	<p>This fauna habitat was of Very Good quality within areas of vacant crown land. However remnant areas of this habitat outside the vacant crown land (i.e., within/surrounded by cleared land) ranged from Highly Degraded to Good quality. This habitat contained a number of flora species that are foraging habitat for Carnaby's Black Cockatoo. The Eucalyptus species present would also provide suitable roosting habitat.</p>

Table 2 **Habitat types in the survey area (cont'd)**




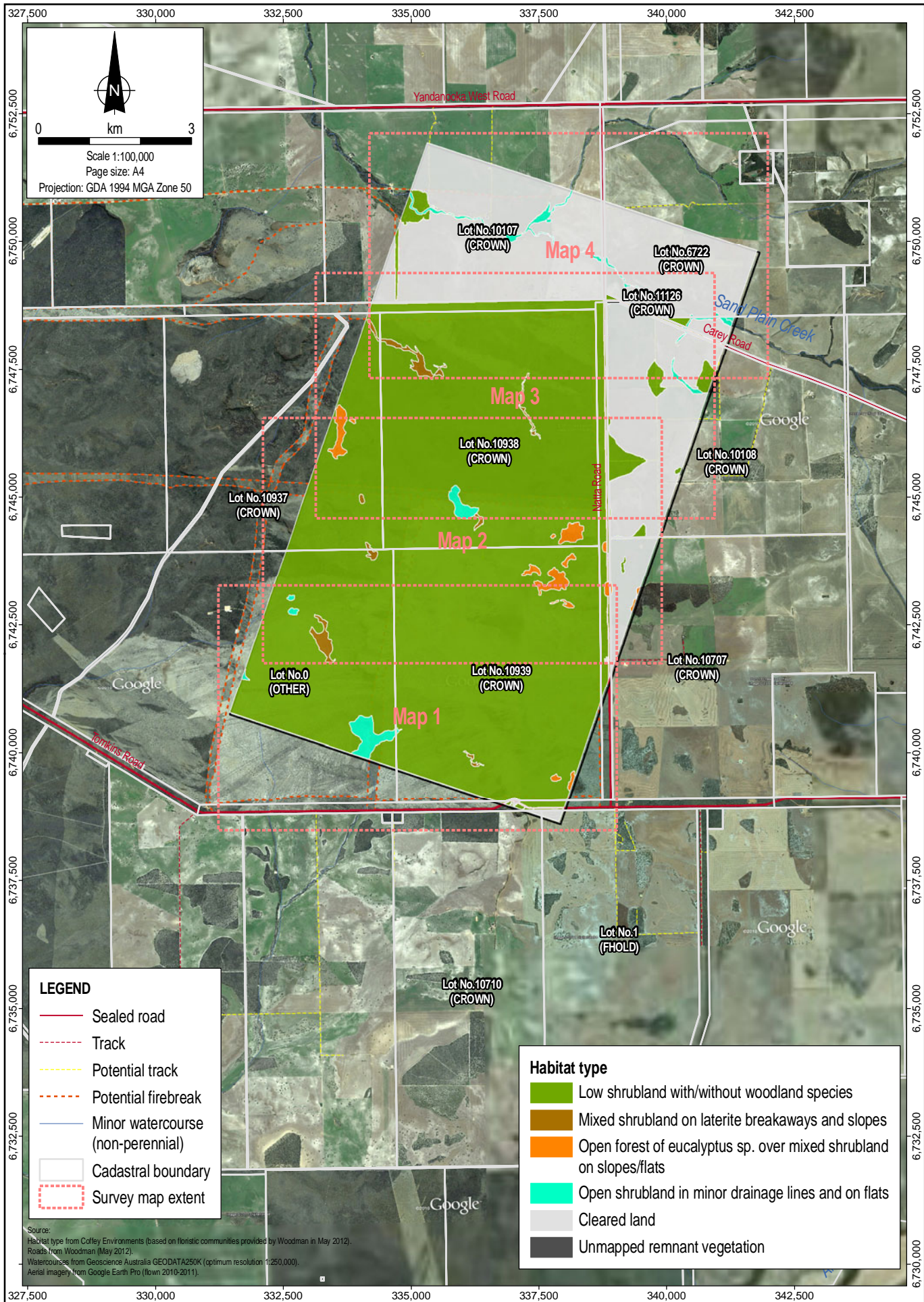
	<p>4. Laterite Breakaway</p> <p>The Laterite Breakaways contain a mixture of shrubland with/without open mallee woodland on clear rises or ridges in the landscape.</p> <p>This habitat was of Very Good quality and contains of Black Cockatoo foraging species (<i>Hakea auriculata</i>, <i>Banksia fraseri</i>).</p>
	<p>5. Open Eucalyptus Forest</p> <p>The Open Eucalypt Forest occurs as patches throughout the survey area with <i>Eucalyptus accedens</i> the dominant species.</p> <p>This fauna habitat was of Very Good quality within areas of crown land. However, remnant areas of this habitat outside the vacant crown land (i.e., within/surrounded by cleared land) ranged from Good to Highly Degraded quality.</p> <p>This habitat provides suitable roosting habitat for the Carnaby's Black Cockatoo. These younger age class trees may also provide suitable breeding habitat in the future.</p>

Table 2 **Habitat types in the survey area (cont'd)**

	<p>6. Minor Drainage</p> <p>Consisting of open shrubland in minor drainage lines and flats, this fauna habitat was of Very Good quality within the area of vacant crown land. However remnant areas of this habitat outside vacant crown land/within cleared land ranged from Good to Highly Degraded quality.</p> <p>This habitat included suitable foraging species for Carnaby's Black Cockatoos, including <i>Banksia carlinoides</i> and <i>Hakea lissocarpa</i>.</p>
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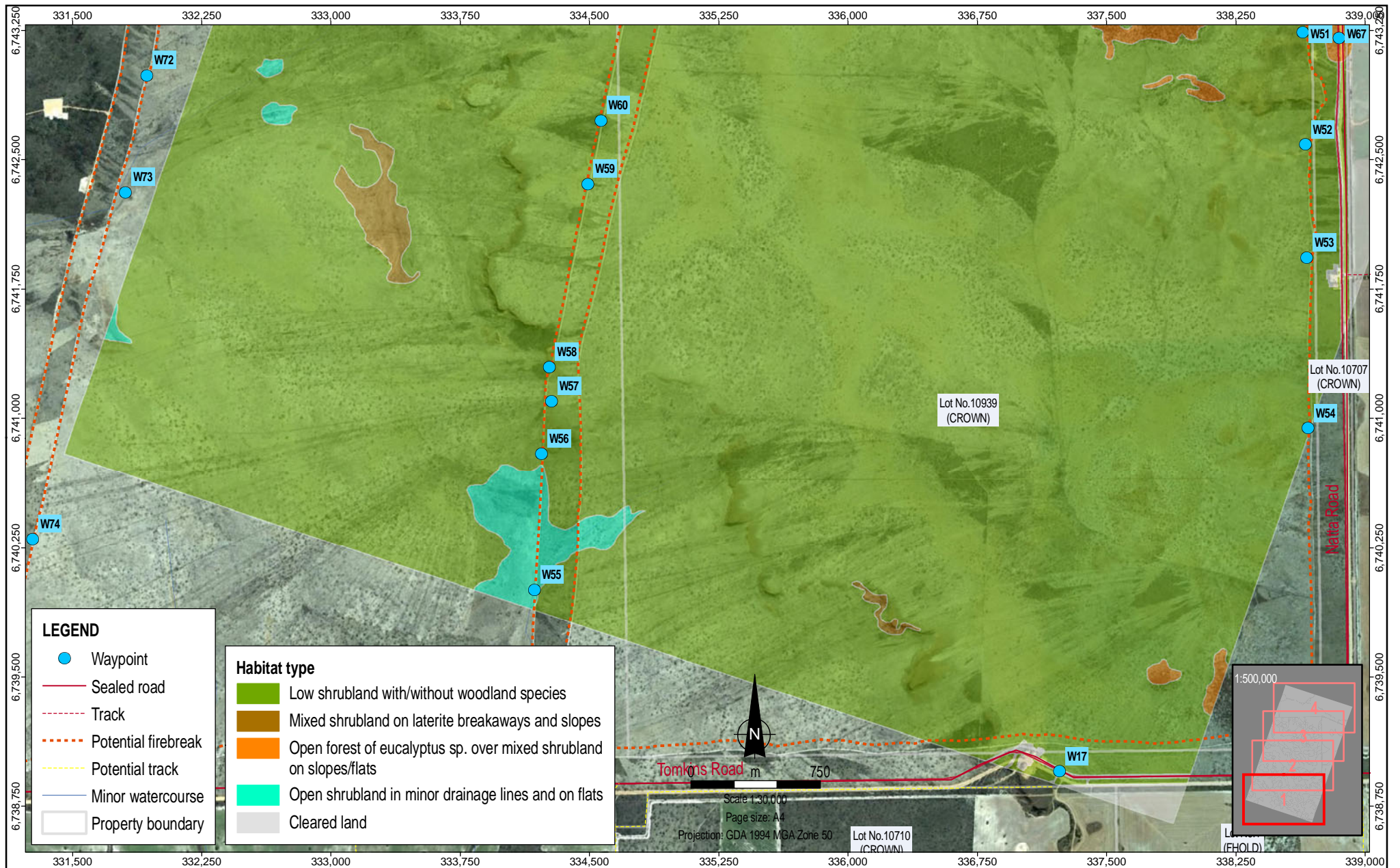
LEGEND

- Sealed road
- - - Track
- - - Potential track
- - - Potential firebreak
- Minor watercourse (non-perennial)
- Cadastral boundary
- Survey map extent

Habitat type

- Low shrubland with/without woodland species
- Mixed shrubland on laterite breakaways and slopes
- Open forest of eucalyptus sp. over mixed shrubland on slopes/flats
- Open shrubland in minor drainage lines and on flats
- Cleared land
- Unmapped remnant vegetation

Source:
 Habitat type from Coffey Environments (based on floristic communities provided by Woodman in May 2012).
 Roads from Woodman (May 2012).
 MXD: 2740AA_EP2012_097_GIS002_v0_2
 File Name: 2740AA_EP2012_097_F003_GIS



Source:
Habitat type from Coffey Environments (based on floristic communities provided by Woodman in May 2012).
Roads from Woodman (May 2012).
Watercourses from Geoscience Australia GEODATA250K (optimum resolution 1:250,000).
Aerial imagery from Google Earth Pro (flown 2005).

coffey environments

Date: 28.06.2012
MXD: 2740AA_EP2012_097_GIS003_v0_2
File Name: 2740AA_EP2012_097_F004_GIS

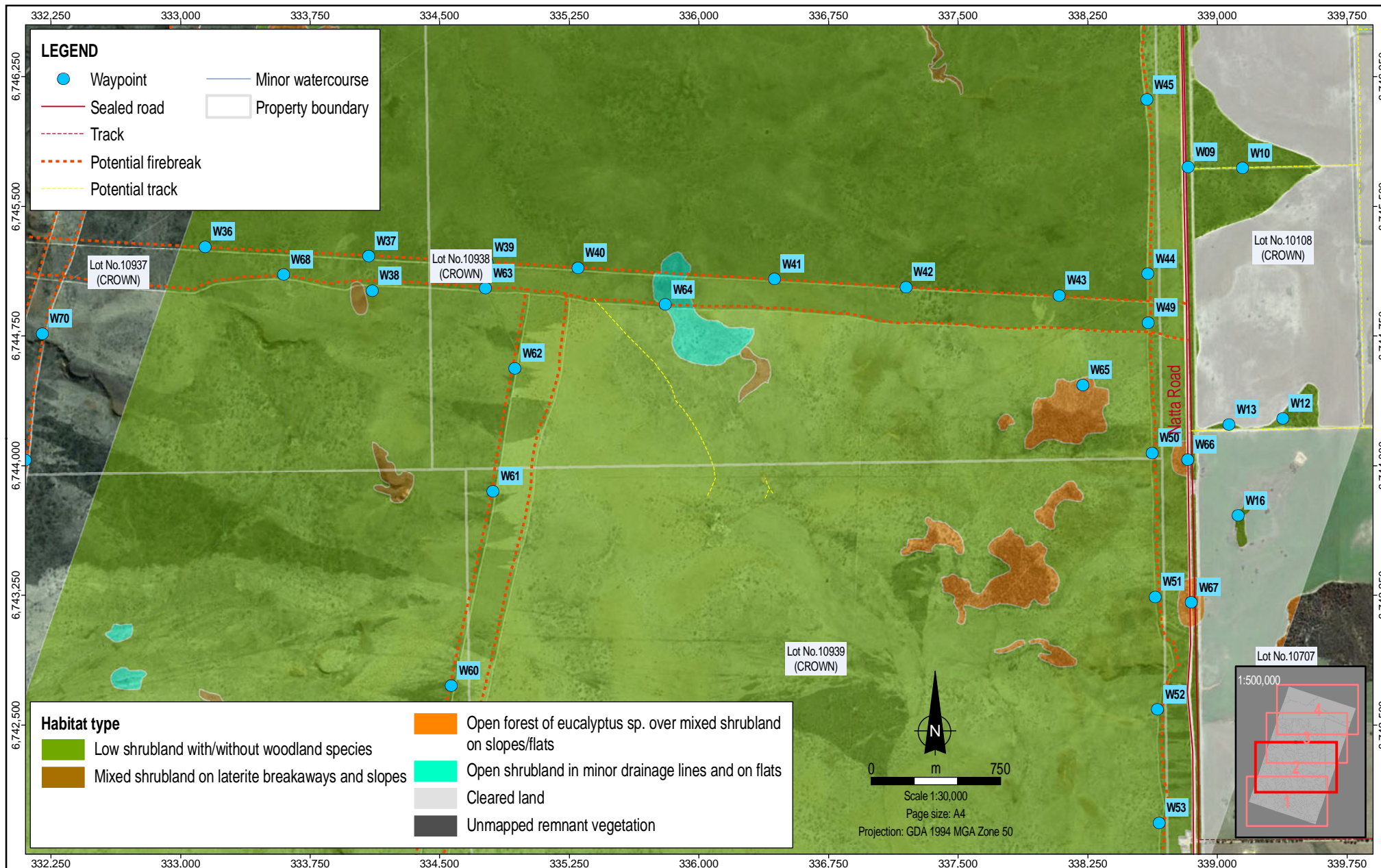
Warrego Energy

Level 1 Fauna Survey



Fauna habitat - Map 1 of 4

Figure No: **4**



Source:
Habitat type from Coffey Environments (based on floristic communities provided by Woodman in May 2012).
Roads from Woodman (May 2012).
Watercourses from Geoscience Australia GEODATA250K (optimum resolution 1:250,000).
Aerial imagery from Google Earth Pro (flown 2005).



Date:
28.06.2012
MXD:
2740AA_EP2012_097_GIS004_v0_2
File Name:
2740AA_EP2012_097_F005_GIS

Warrego Energy

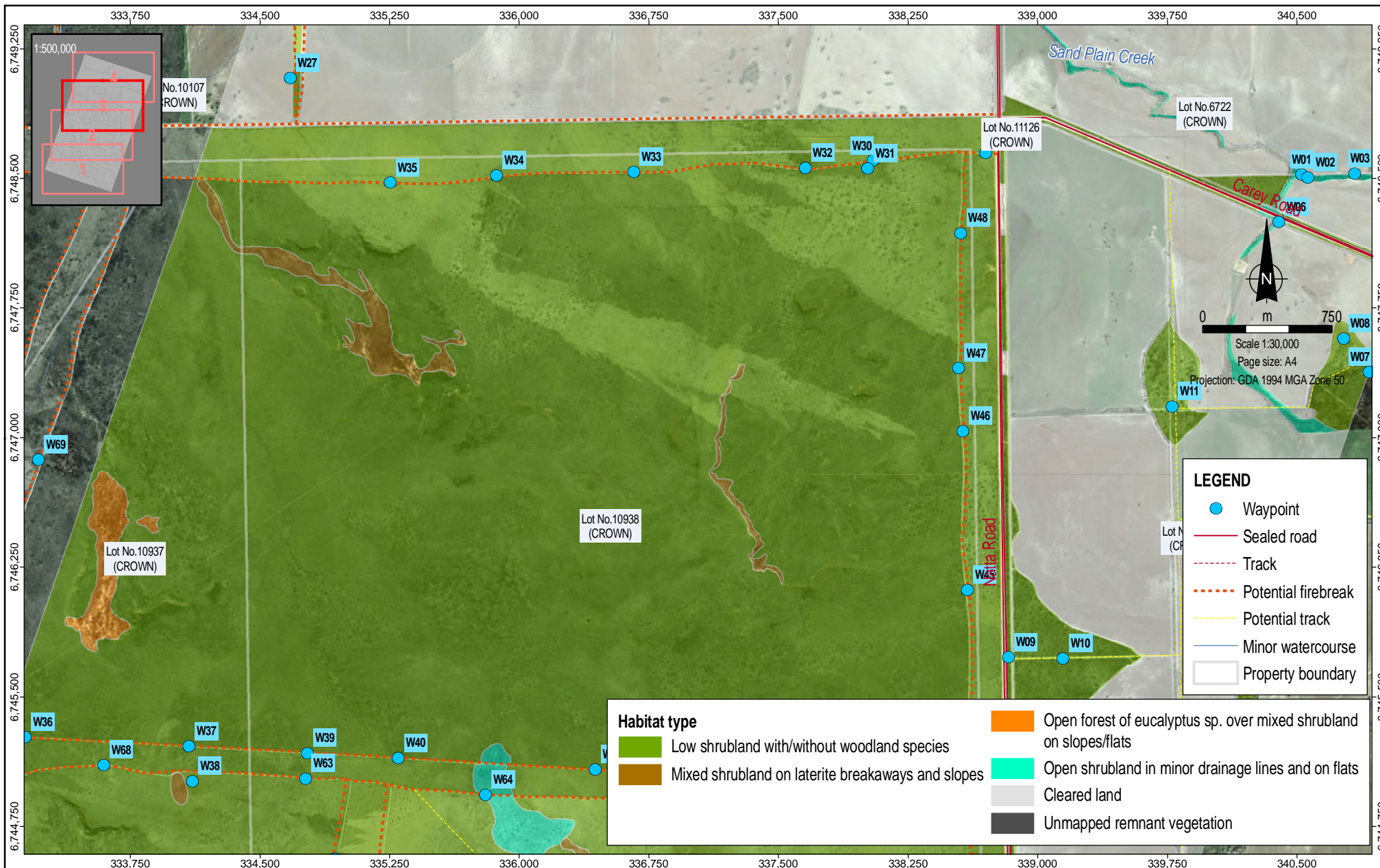
Level 1 Fauna Survey



Fauna habitat - Map 2 of 4

Figure No:

5



Source:
Habitat type from Coffey Environments (based on floristic communities provided by Woodman in May 2012).
Roads from Woodman (May 2012).
Watercourses from Geoscience Australia GEODATA250K (optimum resolution 1:250,000).
Aerial imagery from Google Earth Pro (flown 2005).



Date:
28.06.2012
MXD:
2740AA_EP2012_097_GIS005_v0_2
File Name:
2740AA_EP2012_097_F006_GIS

Warrego Energy

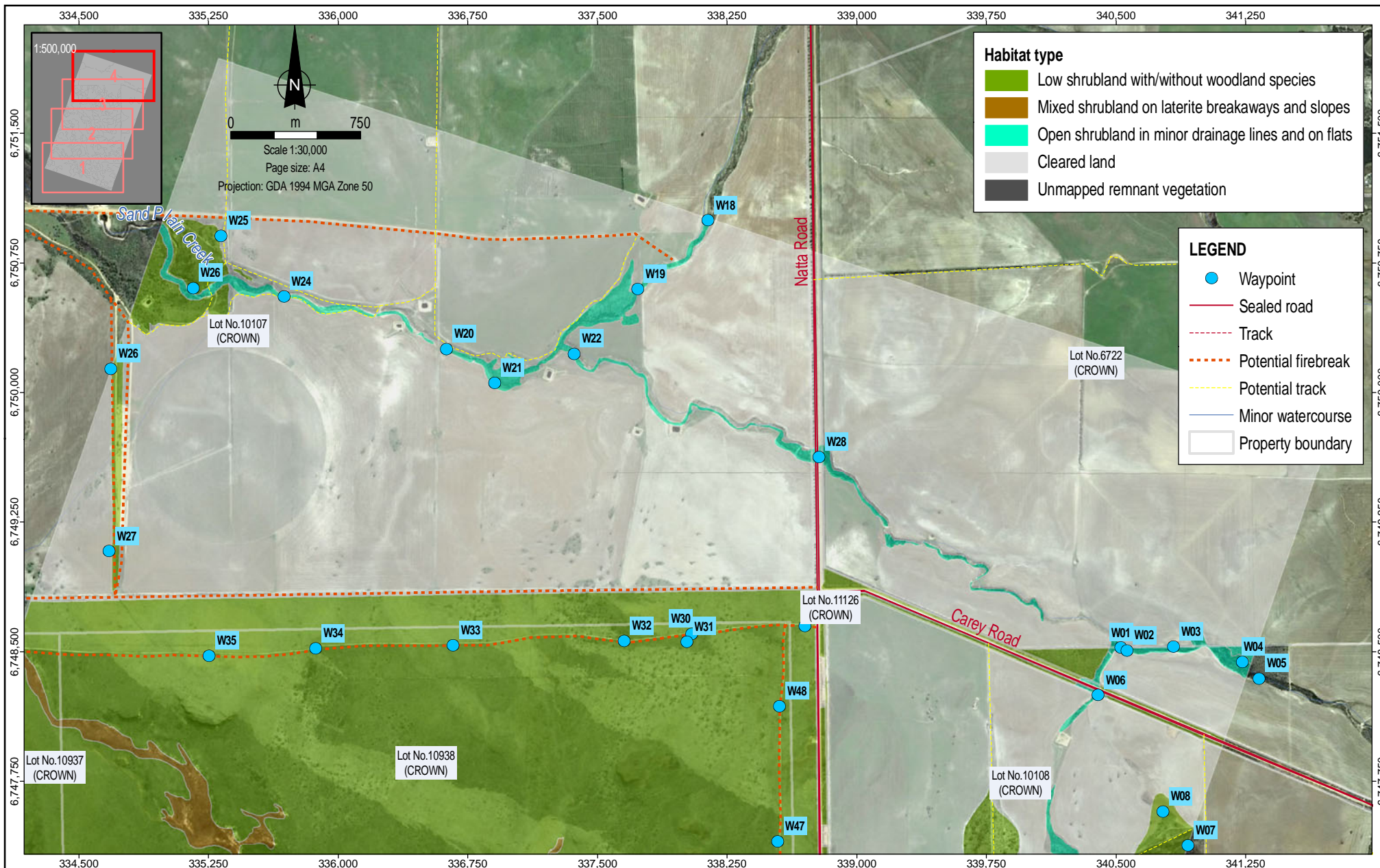
Level 1 Fauna Survey



Fauna habitat - Map 3 of 4

Figure No:

6



Source:
Habitat type from Coffey Environments (based on floristic communities provided by Woodman in May 2012).
Roads from Woodman (May 2012).
Watercourses from Geoscience Australia GEODATA250K (optimum resolution 1:250,000).
Aerial imagery from Google Earth Pro (flown 2005).



Date:
28.06.2012
MXD:
2740AA_EP2012_097_GIS006_v0_2
File Name:
2740AA_EP2012_097_F007_GIS

Warrego Energy
Level 1 Fauna Survey



Fauna habitat - Map 4 of 4

Figure No:
7

4.2 Potential Vertebrate Fauna in the Survey Area

The desktop assessment identified a total of 302 species that have previously been recorded in the region, comprising 168 birds, 29 mammals, 94 reptiles and 11 amphibians. This list included a number of exclusively marine birds that are not likely to exist within the survey area. Although these species have been included in the fauna species list in Appendix A, they will not be discussed in this report.

4.3 Fauna Observations

A number of opportunistic fauna sightings (or evidence of) were recorded during the field investigations including three amphibians, nineteen birds, ten mammals and one reptile (see Appendix A). Two of these species (i.e., Horse and the Yellow-billed Spoonbill) had not been identified during the desktop assessment, increasing the total potential species list to 304 species.

4.4 Conservation Significant Fauna

Based upon the results of the desktop assessment, a number of conservation significant species have been identified as potentially occurring within the vicinity of the survey area, comprising:

- Three species listed as Threatened under the EPBC Act
- Thirteen species scheduled under the *WA Wildlife Conservation Act 1950*.
- Nine species listed as Priority Fauna by DEC.
- Five species listed as migratory species under the EPBC Act.

Conservation significant fauna species potentially present in the survey area are listed in Table 3. A brief description of each conservation significant species, its ecology and distribution and the likelihood of occurrence are provided in Table 4. Conservation codes for Western Australian fauna are provided in Appendix B.

Table 3 Conservation significant fauna predicted to occur in the survey area

Common Name	WC Act/DEC Status	EPBC Act Status	Potential to Exist Within Survey Area ¹
Birds			
Baudin's Black Cockatoo (<i>Calyptorhynchus baudinii</i>)	Schedule 1	Vulnerable	Unlikely
Carnaby's Black Cockatoo (<i>Calyptorhynchus latirostris</i>)	Schedule 1	Endangered	Likely
Malleefowl (<i>Leipoa ocellata</i>)	Schedule 1	Vulnerable	Unlikely
Peregrine Falcon (<i>Falco peregrinus</i>)	Schedule 4	—	Likely
Australian Bustard (<i>Ardeotis australis</i>)	Priority 4	—	Likely
Rufous Fieldwren (<i>Calamanthus campestris</i> subsp. <i>Montanellis</i>)	Priority 4	—	Likely
White-browed Babbler (<i>Pomatostomus superciliosus</i> subsp. <i>ashbyi</i>)	Priority 4	—	Possible

Table 3 Conservation significant fauna predicted to occur in the survey area (cont'd)

Common Name	WC Act/DEC Status	EPBC Act Status	Potential to Exist Within Survey Area
Birds (cont'd)			
White-bellied Sea Eagle (<i>Haliaeetus leucogaster</i>)	Schedule 3	Migratory	Unlikely
Rainbow Bee-eater (<i>Merops ornatus</i>)	Schedule 3	Migratory	Likely
Fork-tailed Swift (<i>Apus pacificus</i>)	Schedule 3	Migratory	Possible
Great Egret (<i>Ardea alba</i>)	Schedule 3	Migratory	Possible
Cattle Egret (<i>Ardea ibis</i>)	Schedule 3	Migratory	Possible
Mammals			
Western Brush Wallaby (<i>Macropus irma</i>)	Priority 4	—	Possible
Reptiles			
<i>Egernia stokesii</i>	Schedule 1	—	Unlikely
Gilled Slender-Bluetongue (<i>Cyclodomorphus branchialis</i>)	Schedule 1	—	Likely
Woma (<i>Aspidites ramsayi</i>)	Schedule 4 Priority 1	—	Possible
<i>Lerista macropisthopus</i>	Priority 2	—	Unlikely
Black Striped Snake (<i>Neelaps calonotos</i>)	Priority 3	—	Unlikely
Lined skink (<i>Lerista lineate</i>)	Priority 3	—	Unlikely
Western Carpet Python (<i>Morelia spilota imbricata</i>)	Schedule 4 Priority 4	—	Likely

1. Likelihood of Occurrence:

- Present – Observed within the site during Level 1 Fauna Assessment.
- Likely – Suitable habitat present, species recently recorded in the region.
- Possible – Suitable habitat present, limited species records in the region.
- Unlikely – Absence of suitable habitat, known distribution outside the survey area.
- Absent – Species recognised as Extinct (Ex/S2), or locally extinct.

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
Birds				
Baudin's Black Cockatoo <i>Calyptorhynchus baudinii</i>	VU / S1	The Baudin's Black Cockatoo is similar to the Carnaby's Black Cockatoo however is distinguished as having a much longer bill which is finely curved and narrow and used to remove seeds from deep capsules of Marri trees and tearing wood to expose grubs.	The Baudin's Black Cockatoo is most common in the far southwest of WA where it breeds, from the southern forests north to Collie and east to Kojonup. Baudin's Cockatoo is typically found in vagrant flocks and utilises the taller, more open Jarrah and Marri woodlands, where it feeds mainly on Marri seeds and various Proteaceous species. When seasonally present on the coastal plain, This species is more likely to occur in the vicinity of eastern areas of the coastal plain.	The survey area is not within the range of the Baudin's Black Cockatoo as outlined by Morcombe (2004), Simpson and Day (2004), Pizzey and Knight (1997) and DSEWPac (2011). Records of the species appear in DEC database searches as occurring within 25 km of the survey area. However, as all these records were prior to 1980 and the Baudin's Black Cockatoo is difficult to distinguish from the Carnaby's Black Cockatoo, which is known to exist within the area. Baudin's Black Cockatoo is considered unlikely to occur within the survey area.
Carnaby's Black Cockatoo <i>Calyptorhynchus latirostris</i>	EN / S1	This large black cockatoo has white tail feather margins, white cheek patches and a short bill. Males have a black bill and a reddish eye-ring with less distinct feather margins than the female, which has a whitish bill and grey eye-ring.	This species inhabits the south-west of WA. Its preferred habitat is the woodland where it preferentially feeds on plants of the Proteaceae family. Preferred nesting trees include, the smooth-barked Salmon Gum (<i>Eucalyptus salmonophloia</i>), which contain deep hollows (Johnstone and Storr, 1998). Nesting also occurs in Marri (<i>C. calophylla</i>) and Tuart (<i>E. gomphocephala</i>).	Records of Carnaby's Black Cockatoo exist from the Southern Beekeepers Reserves (CALM, 1989), coastal areas between Jurien and Green Head (Ecologia, 1994), Dongara (Bamford and Metcalf, 2012) and from Mt Adams Road (DEC, 2012a), within 5 km of the survey area. Carnaby's Black Cockatoo are highly likely to occur within the survey area.

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area (cont'd)

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
<i>Birds (cont'd)</i>				
Malleefowl <i>Leipoa ocellata</i>	VU / S1	Malleefowl weigh 1.5 to 2.1 kg and can stand up to 67 cm tall. They have a grey neck, head and breast with a black stripe over crown to nape. Their upper parts are barred white; blotched brown, black and grey.	Malleefowl are restricted to mainly southern arid and semiarid zones mainly in scrubs and thickets of mallee and other dense litter-forming shrublands. Much of their range has been cleared for agriculture.	Malleefowl have been recorded at Koolanooka, near Morowa (ATA, 2004), approximately 50 km east of the survey area and appears in threatened species database searches within 25 km of the survey area. Given the survey area is on the edge of the Malleefowl's distribution and has a lack of suitable habitat, the survey area is unlikely to support Malleefowl.
Peregrine Falcon <i>Falco peregrinus</i>	S4	The Peregrine Falcon has a black head, white chin, which extends to a half collar, yellow legs and eye ring, slate coloured upper parts, while the underparts are white or buff and along with the wings have fine black barring.	The Peregrine Falcon inhabits areas near cliffs along coastlines or rivers and near ranges or wooded watercourses. This species of Falcon is found throughout the state with the exception of most deserts and the Nullarbor Plain.	This species has been recorded near Geraldton (Ecologia, 2002) and near Arrowsmith (DEC, 2012a) within 20 km of the survey area. As the species is nomadic, it is considered likely to occur within the survey area at least intermittently.
Australian Bustard <i>Ardeotis Australia</i>	P4	The Australian Bustard is a large, heavily built ground bird that weighs 3.4 to 4.1 kg in females and 7.3 kg in males. Males have head and long nape feathers that are black while their face and throat are white with fine black bars. Females have a blackish brown cap, which is narrower, and their black breast band is also narrower and often ill defined.	Australian Bustards are tall birds that live on open grassy plains and low shrubby areas in northern Australia. Although not flightless, Bustards spend the greater proportion of the time on the ground and tend to run from danger. They are omnivorous and tend to seek out foraging areas following rainfall, which may also herald breeding. Predation by introduced species, hunting, and habitat loss has caused the population to decline.	Records of this species exist from within 20 km of the survey area (DEC, 2012b), and from the wider region (Dames and Moore, 1993; Ecologia, 1994). As suitable habitat for the Australian Bustard exist within the survey area, the species is likely to occur.

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area (cont'd)

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
Birds (cont'd)				
Rufous Fieldwren <i>Calamanthus campestris</i> subsp. <i>Montanellis</i>	P4	Small grey-brown bird with fine dark streaks and a buff wash on forehead (Pizzey and Knight, 1997)	The Rufous Fieldwren inhabits mostly saltbush, bluebush, and scattered low shrubs on sandplain, gibber and saltmarsh in inland or dry country in southern and western Australia. The species is secretive, sedentary and has lot much habitat (Morcombe, 2004).	The Rufous Fieldwren was recorded in 2012 less than 10 km for the survey area (Bamford and Metcalf, 2012) and from between Dongara and Eneabba (DEC, 2012a). As potentially suitable habitat exist within the survey area the species is considered likely to exist within the survey area.
White-browed Babbler <i>Pomatostomus superciliosus</i> subsp. <i>ashbyi</i>	P4	Dull-brown in colour with a dark eye and a small white eyebrow, dark brown crown and a white throat that shades into brown lower underparts.	The White-browed Babbler tends to prefer a range of dry scrubby woodlands; mulga, other acacias, scrub along watercourses, saltbush.	Records of the White-browed Babbler exist near Mingenew (DEC, 2012a;b) approximately 25 km north-east of the survey area. It is possible that the species occurs within the survey area.
White-bellied Sea Eagle <i>Haliaeetus leucogaster</i>	M	The White-bellied Sea Eagle is a large eagle. Males grow 73 to 78 cm in length and weigh up to 2.2 kg while females grow 82 to 84 cm in length and weigh up to 3.3 kg. Adults have a head, neck, and terminal third of tail and underparts that is white. Back and most of wing is brownish grey or slaty grey.	White-bellied Sea Eagles are most commonly found around the coastline; however, they have been reported many kilometres inland, often along watercourses.	Records of these species in the vicinity of the survey area are predominantly in coastal parts. As the survey area is some distance from the coast it is unlikely that the White-bellies Sea Eagle occurs within the survey area.
Rainbow Bee-eater <i>Merops ornatus</i>	M	The Rainbow Bee-eater is a small bird weighing 20 to 25 g and growing up to 24 cm in length. Adults have a pale green forehead extending back as a line over the eye. The crown and nape are orange-brown or cinnamon rufous with the crown sometimes washed with green. A black stripe runs from the bill through eye to ear coverts bordered below with pale blue. Their lower back is pale blue and becomes darker on tail coverts. The tail is black.	The Rainbow Bee-eater is found across the better-watered parts of Western Australia. It prefers lightly wooded habitats, preferably on sandy soils near water. Rainbow Bee-eaters are scarce to very common across their range depending on suitable habitat conditions.	Numerous records of the Rainbow Bee-eater occur within the vicinity of the survey area. The species is found over a wide range of habitats especially on sandy soils and is therefore considered likely to occur within the survey area.

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area (cont'd)

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
<i>Birds (cont'd)</i>				
Fork-tailed Swift <i>Apus pacificus</i>	S3, M	The Fork-tailed Swift grows up to 19 cm in length and weighs 35 to 40 g. Adults are coloured blackish brown on the forehead, crown, hind neck, cheeks and ear coverts. The Fork-tailed Swift has a white rump.	This species breeds in the northeast and mid-east Asia and spends winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara in November and in the southwest land division in mid-December, and leaving by late April.	The Fork-tailed Swift has been recorded near Geraldton by GHD (2011) and RCCWA (2009). It is possible that the species occurs, within the survey area.
Great Egret <i>Ardea alba</i>	S3, M	The great egret is a large bird with all-white plumage that can reach one meter in height, weigh up to 950 g and a wingspan of 165 to 215 cm.	Egrets depend, to some extent upon surface water for foraging. The largest of the Australian egrets, the Great Egret is a large, white wader dependent upon floodwaters, rivers, shallow wetlands and intertidal mudflats.	The Great Egret has been recorded by GHD (2011) at Geraldton. As this is a migratory species, it is possible that the Great Egret pass over the survey area, or temporarily uses the area, however suitable habitat is scarce.
Cattle Egret <i>Ardea ibis</i>	S3, M	Cattle Egret is a stocky white bird with buff plumes in the breeding season. The species nests in colonies, usually near bodies of water and often with other wading birds. The nest is a platform of sticks in trees or shrubs.	The Cattle Egret is most widespread and common in north eastern Western Australia, across the Northern Territory, and in eastern Australia from Bundaberg, Queensland to Port Augusta, South Australia, including Tasmania. It occurs in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor.	The Cattle Egret has been recorded by GHD (2011) at Geraldton. As this is a migratory species, it is possible that the Cattle Egret pass over the survey area, or temporarily uses the area, however suitable habitat is scarce.

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area (cont'd)

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
Mammals				
Western Brush Wallaby <i>Macropus irma</i>	P4	The Western Brush Wallaby is generally gunmetal grey with a brownish tinge to the neck and back. A bold white stripe occurs from the mouth to ear and they have distinctive black gloves, toes and a black crest to the terminal half of their tail (Menkhorst and Knight, 2001).	The Western Brush Wallaby is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid. The optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets.	While preferred habitat is limited, the survey area exists within the range of the species. A record of the Western Brush Wallaby exists from the Beekeepers Nature Reserve (DEC, 2012b), approximately 25 km west of the survey area. It is possible that the species exist in the survey area.
Reptiles				
<i>Egernia stokesii</i>	VU	A moderately large skink (up to 27.5 cm). Black brown or reddish-brown with angular greyish-white spots on back, sides, base of tail and legs, arranged in irregular transverse bars. (Storr <i>et al</i> , 1999)	Inhabits arid and semiarid zones from Dirk Hartog Island and Peron Peninsula and the vicinity of Carnarvon in the north, and in the wheat belt from Mullewa south to Kellerberrin and east to Perenjori and Mukinbudin. This species is also found at Woolgorong Rock. Two different subspecies occur on the Houtman Abrolhos (<i>E.s. stokesii</i>) and on Baudin Island (<i>E. s. aethiops</i>). <i>E. s. stokesii</i> and <i>E. s. aethiops</i> inhabit low semiarid scrubs and shrub steepes, sheltering under slabs of limestone. <i>E. s. badia</i> inhabits semiarid scrubs and woodlands, sheltering un hollow logs and behind bark of fallen trees (Storr <i>et al</i> , 1999)	The nearest records of this species exist from Koolanooka, near Morowa (ATA, 2004), on the edge of the species distribution, approximately 50 km east of the survey area. Given the survey area is outside the known distribution of the species it is unlikely to support this species.
Gilled Slender Blue Tongue <i>Cyclodomorphus branchialis</i>	S1	Yellowish brown to greyish brown skink, with short, broad dark spots on many scales tending to align transversely, particularly on the tail and 3 prominent vertically elongate black bars on the sides of the neck (Wilson and Swan, 2010).	This species has a restricted distribution in semi arid shrublands from the Murchison River to near the Irwin River and is usually found in association with heavy red soils (Wilson and Swan, 2010).	The species is known from nearby records at the southern Beekeepers Reserves (CALM, 1989), from between Jurien and Green Head (Ecologia, 2004) and from Koolanooka (ATA, 2004). The species is considered likely to exist within the survey area.

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area (cont'd)

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
Reptiles (cont'd)				
Woma Python <i>Aspidites ramsayi</i>	S4, P1	Variable colouration but typically a yellowish brown to olive python with irregular darker bands.	The Woma Python is widely distributed in the interior of Australia but also includes an isolated population distribution in the south-west where decline is attributed to predation by feral animals and land clearing. Preferred habitat includes woodlands, heaths and shrublands, often with Spinifex.	The Woma has been historically recorded near Geraldton (How et al., 1983). It is possible this species occurs within the survey area, given the presence of suitable habitat and historic records.
<i>Lerista macropisthopus</i>	P2	<i>L. macropisthopus</i> is a large dark skink (up to 19 cm) with little or no pattern. Upper surface chocolate brown to greyish brown, without pattern except for slight darkening in loreal region and slight paling across back of head (Storr et al, 1999).	<i>L. macropisthopus</i> inhabits leaf litter beneath a wide variety of shrubs and trees on a wide variety of soils. The species has four sub-species all confined to WA which occur in the semi arid and arid south-western interior (<i>L. m. macropisthopus</i>), the arid central interior (<i>L. m. remota</i>), the arid and semiarid Midwest (<i>L.m. fusciceps</i>) and along and a little south of the lower Murchison (<i>L. m. galea</i>) (Storr et al, 1999).	The nearest record of <i>L. macropisthopus</i> to the survey area exists from near Geraldton (How et al., 1983). Based on the known distribution of the species, it is considered unlikely to occur with the survey area.
Black-striped Snake <i>Neelaps calonotos</i>	P3	A medium sized bright orange –red snake with cream centre to each scale, broad black crescent shaped band extending across next and black bar across head (Wilson and Swan, 2012).	Found in sandy coastal between Mandurah and Lancelin. Occurs on dunes and sand-plains vegetated with heath and eucalypt/Banksia woodlands (Wilson and Swan, 2012).	A record of this species exists from the Mt Adams road (DEC, 2012a) near survey area, however it has not been recorded in other surveys reviewed for this study and is generally confined to the coast. Therefore, it is considered unlikely to occur.
Lined skink (<i>Lerista lineata</i>)	P3	A small, slender skink (up 11 cm) with a brownish-grey back, darker and browner between black paravertebral lines. Wide black upper lateral stripe. Narrow greyish-white mid lateral stripe (Storr et al, 1999).	Inhabits white sands. Occurs on the lower west coast from Perth to Mandurah, also Busselton, Rottnest and Garden Island. Also occurs at Woodleigh Station. This species is confined to WA(Storr et al, 1999).	The species is known from few isolated populations. Based on the distribution outlines in Wilson and Swan (2012) and Storr (et al., 1999) <i>L. lineata</i> is unlikely to occur within the survey area. However a recent record of the species exists from Geraldton (GHD, 2011).

Table 4 Description of distribution, habitat and likelihood of conservation significant fauna occurring in the survey area (cont'd)

Species	Status	Description	Distribution and Habitat	Likelihood of Occurrence
Reptiles (cont'd)				
Carpet Python (<i>Morelia spilota imbricata</i>)	S4, P5	The Carpet Python is brown to blackish brown snake that grows up to 2.5. This species is covered with dark-edged pale patches, which have a tendency to be transversally elongated.	Collectively, all sub species of <i>Morelia spilota</i> , occupy the most diverse habitats of any Australian python (Wilson and Swan, 2010). The sub-species <i>M. s. imbricata</i> of the Carpet Python is limited to the south-western area of Western Australia, from Geraldton in the north to Esperance in the south and is also present on many off shore islands.	Records of the species are known from Geraldton (GHD, 2011; Desmond and Heriot, 2002); How <i>et al.</i> , 1983). The sub-species is known to inhabit sandy shrub and scrub habitats hence is considered likely to occur within the survey area.

4.5 Biodiversity Value

The EPA Position Statement No. 3 indicates an ecological assessment of a site must consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level (EPA, 2002). There is insufficient information available to assess biodiversity at the genetic level.

A number of introduced fauna species were recorded within the survey area or identified in the desktop assessment. As is the case with much of Australia, biodiversity within the survey area has been altered through predation and competition for resources by introduced fauna, primarily cats and foxes. Species of greatest abundance within the survey area are likely to be those that are more tolerant of disturbance and predation pressure, with those species that are less resilient being present only in low densities or being locally or even regionally extinct.

Other factors that may contribute to changes in species diversity and abundance include habitat disturbance, fragmentation and altered fire regimes. A large portion of fauna habitat in the survey area, namely the area of habitat within the vacant crown land was considered to be of Very Good quality with good connectivity to surrounding habitat of a similar condition to the west of the survey area. Areas of remnant vegetation within cleared land had a lower quality than similar habitats within the vacant crown land due to the level of disturbance and reduced connectivity.

It is Coffey Environments' assessment that while remnant areas of habitat present within cleared land are unlikely to provide habitat for an assemblage that would be typical of the region, it is likely that the area of vacant crown land supports a level of biodiversity value at the genetic, species and ecosystem level typical of the region.

4.6 Ecological Functional Value at the Ecosystem Level

While the vertebrate fauna assessment did not indicate that the terrestrial fauna assemblages present in the survey area were unique, no fauna trapping was conducted as part of this assessment. However, it could be assumed that the fauna assemblages present are likely to be present elsewhere within similar habitat of the surrounding landscape and not necessarily dependent on habitat of the survey area.

However, the survey area may be considered to have high ecological functional value, given:

- A large portion of habitat within the survey area was of Very Good quality (i.e., area of vacant crown land), showing minimal signs of disturbance, connectivity with other habitats and generally retaining many of the characteristics of the habitat had it not been disturbed.
- The presence of suitable Carnaby's Black Cockatoo habitat (including areas of remnant habitat within cleared land), including:
 - Foraging habitat: shrubland with/without woodland species, laterite breakaways and minor drainage habitats.
 - Roosting habitat: open Eucalyptus forest and planted Eucalypts habitats (planted roadside/property trees).

No suitable breeding habitat for Carnaby's was observed, although the open Eucalyptus forest and planted Eucalypts habitats contained younger age class trees which may provide suitable breeding habitat in the future. The Carnaby's Black Cockatoo is listed as an Endangered species under the Commonwealth EPBC Act. The decline of the Carnaby's Black Cockatoo is due

primarily to the loss and fragmentation of habitat, mainly for agricultural purposes during the 20th century (DSEWPaC, 2012a). The long-term survival of Carnaby's Black Cockatoo depends on the persistence of suitable breeding, roosting and foraging habitat capable of providing enough food to sustain the population (DSEWPaC, 2012a).

5. POTENTIAL IMPACTS

This section outlines the potential environment impacts of the Project on fauna within the survey area, relevant management currently being considered by Warrego and any additional management recommendations.

5.1 Loss or Degradation of Fauna Habitat

Loss or degradation of habitat associated with the Project will be the primary impact of the Project on terrestrial fauna within the survey area, potentially resulting in the direct loss of species and fragmentation effects and the associated change in assemblage structure. While the final Project footprint is still to be finalised, it is anticipated that it will not exceed 150 ha and that clearing within the Project footprint will be minimised.

The seismic survey involves the installation of source and receiver lines and traversing the survey area in a grid pattern using Vibroseis trucks to send receive and processes seismic signals in order to map the underlying geology. In addition to the potential clearing associated with the seismic survey, clearing will also be required for the location of the proposed appraisal well and associated infrastructure.

The extent of clearing required for the seismic survey lines is likely to vary across the survey area. The source lines generally require no vegetation at each source point to allow the Vibroseis trucks used during the survey to make effective contact with the ground. In some parts of the survey area, this may require clearing of the vegetation, while in other areas the trucks may be able to traverse the existing low level vegetation without direct clearing being required.

By minimising the width of clearing and using a coarse grid spacing, habitat fragmentation and edge effects can be minimised. Furthermore geophones along receiver lines could potentially be walked in rather than driven to minimise impacts to areas of environmental sensitivity.

In addition, Coffey Environments recommends the following mitigation measures:

- Minimise clearing, with a particular focus on avoiding large habitat trees (particularly areas of open Eucalypt forest and planted Eucalypts habitats) as much as possible.
- Align the Project footprint with existing areas of disturbance, where possible.
- Maintain ecological linkages between areas of habitat to mitigate fragmentation impacts.
- Refer the Project under the Commonwealth EPBC Act, given impacts to Carnaby's Black Cockatoo foraging habitat (and roosting habitat, where it can not be avoided).

5.2 Fauna Injuries and Mortalities from Interactions with Project Vehicles, Machinery and Infrastructure

The implementation of the Project will result in increased vehicle and machinery movements within the survey area, which may result in fauna injuries and mortalities. Ground dwelling, mobile or slow moving species are considered the most susceptible to impact, particularly reptile and small mammal taxa of the survey area. However, given the slow progression of the Vibroseis trucks, noise and vibration associated with the seismic survey is likely to assist in deterring animals away from the survey area and reduce the risk of fauna injuries and mortalities during the seismic survey.

The development of the appraisal well will also involve the establishment of a number of excavations, namely a turkeys nest (clean water), drill cutting sump and flare pit (in which any intercepted gas is ignited), which may incidentally trap fauna and lead to injuries and/or mortalities.

Coffey Environments recommends the following mitigation measures:

- Implement Project speed limits (i.e., maximum speed of 60 km/h off main/public thoroughfares).
- Restrict night-time vehicle movements.
- Design all excavations to incorporate effective fauna egress to avoid entrapment, injury and death of local fauna.
- Fence all excavations.
- Inspect all excavations regularly to identify any trapped fauna and provide assistance if necessary. Inspections are particularly useful early in the morning and prior to the commencement of backfilling to ensure that the excavations are clear of fauna.
- All fauna injuries and mortalities should be recorded so that they can be reported in the Annual Environment Report, where required.
- Develop an Environmental Education and Awareness induction for all staff, informing them of the conservation values present within the survey area and their management responsibilities.

5.3 Increased Predation by Introduced Fauna

An increase in human activity is often associated with an increase in the abundance of introduced species such as the house mouse (*Mus musculus*), feral cat (*Felis catus*) and fox (*Vulpes vulpes*). This increase may be due to a decline in habitat health, increased access, increased road kills and poor waste disposal practices.

The house mouse and cat have been recorded in fauna surveys previously conducted in the region and the fox was observed during this survey. The cat and fox are particularly damaging predators and any increase in their numbers could have a detrimental effect on local native fauna (Kinnear, 1993; Bamford, 1995).

Coffey Environments recommends the following mitigation measures:

- Undertake progressive rehabilitation as soon as possible.
- Manage domestic waste and water storages appropriately to minimise the proliferation of introduced fauna (e.g., store putrescible waste in closed bins and remove regularly from site).
- Develop and implement a feral animal control program in consultation with the DEC and pastoralists.

5.4 Altered Fauna Behaviour Associated with Noise, Vibration and Light Emissions

The implementation of the Project will result in noise, light and vibration emissions, which may adversely affect fauna behaviour. While these impacts can be very difficult to predict, they have

been known to force some animals to move out of the affected area/abandon habitats, affect communication, alter feeding behaviour and breeding patterns.

The seismic survey will only be undertaken during daylight hours and so no light emissions will be associated with this activity and vibration and noise emissions will be limited to daylight hours. The appraisal well is likely to operate 24 hours a day and so may have associated light and noise emissions.

Coffey Environments recommends the following mitigation measures:

- Direct light to working areas where possible.
- Restrict night-time vehicle movements.

5.5 Increased Risk of Fire

An increased human presence and use of vehicles and machinery in and around vegetation including cropped paddocks has an inherent risk of starting bushfires. Fires have the potential to cause serious degradation of fauna habitat and loss of individuals.

Coffey Environments recommends the following mitigation measures:

- Develop and implement a fire prevention and control strategy.
- Ensure appropriate fire response equipment and appropriately trained staff are available at all times during operation.
- Be aware of any 'harvest and vehicle movement bans' issued by local government during prohibited/restricted burning times (usually over the summer period between October and April).
- Restrict off-road driving.

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6. SIGNIFICANCE OF POTENTIAL IMPACTS ON CARNABY'S BLACK COCKATOO

Under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a matter of national environmental significance, which includes listed threatened species. The Carnaby's Black Cockatoo is listed as an Endangered species under the EPBC Act.

The survey area falls within the modelled distribution of the Carnaby's Black Cockatoo (both breeding and non-breeding range) and this species has been recorded on multiple occasions within the vicinity of the survey area (see Section 3.1). As discussed in Section 4.6, it is Coffey Environments' assessment that this species is likely to occur in the survey area given the presence of suitable habitat, including:

- Foraging habitat: shrubland with/without woodland species, laterite breakaways and minor drainage habitats (see Figures 3a to 3e).
- Roosting habitat: open Eucalyptus forest and planted Eucalypts habitats (planted roadside/property trees) (see Figures 3a to 3e).

While no suitable breeding habitat was observed during the field investigation, the open Eucalyptus forest and planted Eucalypts habitats contained younger age class trees which may provide suitable breeding habitat in the future.

While it is anticipated that Warrego will minimise clearing as much as possible, with a particular focus on avoiding roosting (and potentially future breeding) habitat, clearing of Carnaby's Black Cockatoo habitat is largely unavoidable given that all habitats in the survey area (with the exception of cleared land) contain suitable foraging and roosting species.

The Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) has prepared the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (2012b) to assist proponents in determining whether their proposed development needs to be referred to DSEWPaC for approval under the EPBC Act. In consideration of this guideline and given the Project is going to result in clearing of more than 1 ha of quality foraging (and potentially roosting) habitat, referral is recommended.

6.1 Assessment Against Significant Impact Criteria

In determining the significance of Project impacts, the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b) should be read in conjunction with the EPBC Policy Act Statement 1.1 Matters of National Environmental Significance (DEWHA, 2006), which sets out a number of significant impact criteria for Critically Endangered or Endangered species. Where an action has a '*real chance or possibility*' of triggering any of these criteria the action is considered to have a significant impact. These significant impact criteria have been assessed below.

1. Lead to a long-term decrease in the size of a population.

It is Coffey Environments' assessment that the Project has **no '*real chance or possibility*'** of leading to a long-term decrease in the size of a population, given the:

- Scale (~150 ha or 2% of the survey area) and nature of the proposed clearing (e.g., width of clearing, coarse grid spacing), as discussed in Section 5.1.
- Short-term nature of the Project. It is Coffey Environments understanding that both the seismic survey and appraisal well will operate for a period of three to six months.
- Absence of breeding habitat within the survey area.
- Availability of similar foraging and roosting habitat in the local and regional area (i.e., to the west of the survey area and as approximately 17.67% of the sub region is held in conservation reserves).

2. Reduce the area of occupancy of the species.

The survey area falls within the modelled distribution of the Carnaby's Black Cockatoo, including the north western extent of the modelled breeding range of the species (DSEWPaC, 2012b). To reduce the area of occupancy of this species the Project would have to significantly impact habitat on the edges of the species' known (breeding and/or non-breeding) distribution or impact a sufficiently large enough area leading to fragmentation effects.

It is Coffey Environments' assessment that the Project has **no 'real chance or possibility'** of reducing the area of occupancy of the species, given the:

- Scale (~150 ha or 2% of the survey area) and nature of the proposed clearing (e.g., width of clearing, coarse grid spacing) discussed in Section 5.1.
- Location of the survey area within the non-breeding modelled distribution of the species (which extends all directions from the survey area).
- Absence of breeding habitat within the survey area.

3. Fragment an existing population into two or more populations.

A large portion of habitat present within the survey area, namely the area of habitat within the vacant crown land, was considered to be of Very Good quality with good connectivity to surrounding habitat of a similar condition to the west of the survey area. While areas of remnant vegetation within cleared land had a lower quality than similar habitats within the vacant crown land, associated with their level of disturbance and reduced connectivity.

It is Coffey Environments' assessment that the Project has **no 'real chance or possibility'** of fragmenting an existing population into two or more populations, given the:

- Scale (~150 ha or 2% of the survey area) and nature of the proposed clearing (e.g., width of clearing, coarse grid spacing), discussed in Section 5.1.
- Aerial and highly mobile nature of the species. While little is known about the species home range, animals have previously been recorded traveling up to 1.4 and 2.5 km from their nest (DSEWPaC, 2012b).

This assessment would be further supported by the implementation of any of the following recommendations:

- Minimise clearing, with a particular focus on avoiding large habitat trees (particularly areas of open Eucalypt forest and planted Eucalypts habitats) as much as possible.
- Align the Project footprint with existing areas of disturbance, where possible.

- Maintain ecological linkages between areas of habitat to mitigate fragmentation impacts.

4. Adversely affect habitat critical to the survival of a species.

The Carnaby's Cockatoo Recovery Plan (DEC, 2012c) defines habitat critical for the recovery of the species as any identified breeding and nearby feeding habitat, former breeding habitat that has hollows intact, and vegetation that provides habitat for feeding, watering and regular night roosting.

No breeding habitat and thus known nesting trees nor known roosting trees are present within the survey area. However, the survey area contains suitable foraging and roosting habitat so clearing of critical habitat is largely unavoidable given all habitats (with the exception of cleared land) within the survey area contain suitable foraging and roosting species.

A large portion of habitat present within the survey area, namely the area of habitat within the vacant crown land, was considered to be of Very Good quality with good connectivity to surrounding habitat of a similar condition to the west of the survey area. While areas of remnant vegetation within cleared land had a lower quality than similar habitats within the vacant crown land, associated with their level of disturbance and reduced connectivity.

Given impacts to critical habitat are unavoidable, the Project will have an adverse affect on habitat critical to the survival of the species. However, it is Coffey Environments' assessment that these impacts will be of limited significance, given the:

- Availability of similar habitat in the local and regional area (i.e., to the west of the survey area and as approximately 17.67% of the sub region is held in conservation reserves).
- Scale (~150 ha or 2% of the survey area) and nature of the proposed clearing (e.g., width of clearing, coarse grid spacing), as discussed in Section 5.1.

This assessment would be further supported by the implementation of any of the following recommendations:

- Minimise clearing, with a particular focus on avoiding large habitat trees (particularly areas of open Eucalypt forest and planted Eucalypts habitats) as much as possible.
- Align the Project footprint with existing areas of disturbance, where possible.

5. Disrupt the breeding cycle of a population.

Whilst the survey area occurs within the modelled distribution of this species (both breeding and no-breeding range) no known nesting trees have been recorded within the survey area, nor was suitable breeding habitat observed during the field investigation. It is Coffey Environments' assessment that there is **no 'real chance or possibility'** that the Project will disrupt the breeding cycle of a population.

6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Clearing associated with the Project will result in the degradation and loss of Carnaby's Black Cockatoo habitat. The Project footprint is not expected to exceed 150 ha and not all of this area will be cleared, as discussed in Section 5.1.

In consideration of the scale (~150 ha or 2% of the survey area) and nature of the proposed clearing (e.g., width of clearing, coarse grid spacing) it is Coffey Environments' assessment that

there is **no 'real chance or possibility'** that the Project will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

This assessment would be further supported by the implementation of any of the following recommendations:

- Minimise clearing, with a particular focus on avoiding large habitat trees (particularly areas of open Eucalypt forest and planted Eucalypts habitats) as much as possible.
- Align the Project footprint with existing areas of disturbance, where possible.
- Maintain ecological linkages between areas of habitat to mitigate fragmentation impacts.
- Referral of the Project under the Commonwealth EPBC Act, given impacts to Carnaby's Black Cockatoo foraging habitat (and roosting habitat, where it cannot be avoided).

7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.

The feral cat and fox are already believed to be established, given both previous records from the region and observations of the fox during the field investigation.

Warrego could, however, mitigate an increase in the abundance of invasive species by implementing the following mitigation measures:

- Undertake progressive rehabilitation as soon as possible.
- Manage domestic waste and water storages appropriately to minimise the proliferation of introduced fauna (e.g., store putrescible waste in closed bins and remove regularly from site).
- Develop and implement a feral animal control program in consultation with the DEC and pastoralists.

It is Coffey Environments' assessment that there is **no 'real chance or possibility'** that the Project will result in the establishment of any other invasive species that may be harmful to the Carnaby's Black Cockatoo.

8. Introduce disease that may cause the species to decline.

The only threat of disease posed by the Project that may impact the Carnaby's Black Cockatoo, albeit indirectly (i.e., through habitat loss/degradation), is the introduction of Phytophthora dieback. Phytophthora dieback feeds on the roots of plants causing rot-root in susceptible species and plant death. The pathogen is spread through the movement of infested soil and mud, especially by vehicles and footwear. It also moves in free water and via root-to-root contact between plants.

Phytophthora dieback is a significant threat to vulnerable plants and plant communities in areas receiving at least 400 mm annual rainfall. Although more prevalent in higher rainfall zones (greater than 800 mm annual rainfall) it also spreads through 'water gaining' sites such as wetlands and rivers, in the 400 to 600 mm rainfall zone.

Given, the average annual rainfall at Eneabba (the closest weather station) is 493.3 mm, the survey area may be susceptible to Phytophthora dieback. A Phytophthora dieback assessment has been undertaken over the survey area, with results pending.

However, it is Coffey Environments' assessment that there is **no 'real chance or possibility'** that the Project will introduce disease that may cause the Carnaby's Black Cockatoo to decline, given:

- Where Phytophthora dieback is found to be present within the survey area, there are no other diseases the Project is likely to introduce that would impact this species.
- Where Phytophthora dieback is not found to be present within the survey area, Warrego is committed to developing and implementing a biosecurity management plan, including ensuring all vehicles and equipment arrive on site free of soil and mud.

9. Interfere with the recovery of the species.

The objective of the Carnaby's Cockatoo Recovery Plan (DEC, 2012c) is to stop further decline in the distribution and abundance of Carnaby's Black Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases.

The recovery plan will be deemed to **not** be successful if, within a ten-year period, any of the following performance criteria occur:

- a. The area of occupancy declines by more than 10% below 60,525 km² using a grid size of 15 x 15 km².
- b. The number of breeding pairs of Carnaby's cockatoos at monitored breeding sites across the breeding range decreases by more than 10% averaged over three consecutive years (or similar change in amended methodology).
- c. The estimated number of adult and proportion of juvenile Carnaby's cockatoos at known night roost sites decreases by more than 10% averaged over three consecutive years.
- d. The extent of nesting habitat (trees with nesting hollows), feeding habitat (as defined by vegetation complexes), and night roosting habitat (as identified through community survey) decreases by more than 10% throughout the species' range.

The Project is unlikely to contribute to the recovery plan performance criteria 'a', 'b' and 'c', given:

- The Project has **no 'real chance or possibility'** of reducing the area of occupancy of the species, as discussed against significant impact criteria 2 (above).
- No known nesting trees (i.e., breeding sites) have been recorded within the survey area, nor was suitable breeding habitat observed during the field investigation.
- No known roost sites have been recorded within the survey area (although suitable roosting habitat was present).

While the Project may contribute to performance criteria 'd' given clearing of critical habitat (i.e., foraging and roosting) is largely unavoidable (see discussion against significant impact criteria 4, above), it is Coffey Environments' assessment that there is **no 'real chance or possibility'** that the Project itself will interfere with the recovery of the Carnaby's Black Cockatoo.

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7. CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

The methodology used for this Level 1 fauna assessment adequately addresses the EPA Position Statement No. 3 Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA, 2002) and Coffey Environments' interpretation of the EPA Guidance for Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, No. 56 (EPA, 2004) and the EPA (2010) Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. Coffey also undertook a targeted Carnaby's Black Cockatoo habitat assessment in accordance with the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b)

The field investigation identified that six fauna habitat types were present within the survey area comprising; cleared land, mixed shrubland with/without woodland species, laterite breakaway, open Eucalyptus forest, minor drainage lines and planted Eucalypt habitats.

A total of 304 vertebrate fauna species, 20 of which are conservation significant, have previously been recorded within the region and so have the potential to occur within the survey area. Coffey Environments undertook an assessment to determine the likelihood of these species occurring within the survey area based on the availability of suitable habitat, known distribution of each species and currency of species records. Of the 20 species of conservation significance, only six were considered 'likely' to occur (Carnaby's Black Cockatoo, Peregrine Falcon, Australian Bustard, Rufous Fieldwren, Rainbow Bee-eater, Gilled Slender-Bluetongue and Western Carpet Python), and another six were considered as 'possibly' occurring within the survey area (White-browed Babbler, Fork-tailed Swift, Great Egret, Cattle Egret, Western Brush Wallaby and Woma).

It is Coffey Environments' assessment that the survey area may be considered to have high ecological functional value, given:

- A large portion of habitat within the survey area was of Very Good quality (i.e., area of vacant crown land), showing minimal signs of disturbance, connectivity with other habitats and generally retaining many of the characteristics of the habitat had it not been disturbed.
- The presence of suitable Carnaby's Black Cockatoo habitat (including areas of remnant habitat within cleared land), including:
 - Foraging habitat: shrubland with/without woodland species, laterite breakaways and minor drainage habitats.
 - Roosting habitat: open Eucalyptus forest and planted Eucalypts habitats (planted roadside/property trees).

Furthermore, while remnant areas of habitat present within cleared land are unlikely to provide habitat for a fauna assemblage that would be typical of the region (i.e., before disturbance), it is likely that the Very Good quality habitat present within the vacant crown land supports the same level of biodiversity value at the genetic, species and ecosystem level typical of the region.

Potential impacts of the Project on terrestrial fauna present within the survey area includes:

- Loss or degradation of fauna habitat.

- Fauna injuries and mortalities from interactions with project vehicles, machinery and infrastructure.
- Increased predation by introduced fauna.
- Altered fauna behaviour associated with noise, vibration and light emissions.
- Increased risk of fire.

Coffey Environments assessed the significance of these potential impacts on the Carnaby's Black Cockatoo to assist in determining whether the Project requires approval from the minister under the EPBC Act. This involved consulting the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b) and the EPBC Policy Act Statement 1.1 Matters of National Environmental Significance (DEWHA, 2006).

In consideration of the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSEWPaC, 2012b), given the Project is going to result in clearing of more than one hectare of quality foraging (and potentially roosting) habitat, referral is recommended.

The EPBC Policy Act Statement 1.1 (DEWHA, 2006) sets out a number of criteria for determining significant impacts on Critically Endangered or Endangered species. Coffey Environments determined that the Project only had a 'real chance or possibility' of triggering one of the nine criteria, specifically 'adversely affecting habitat critical to the survival of the species', given that clearing of foraging (and potentially roosting) habitat is largely unavoidable. The impact of clearing on the species however, is believed to be of limited significance, given the:

- Availability of similar habitat in the local and regional area (i.e., to the west of the survey area and as approximately 17.67% of the sub region is held in conservation reserves).
- Scale (~150 ha or 2% of the survey area) and nature of the proposed clearing (e.g., width of clearing, coarse grid spacing), as discussed in Section 5.1.

7.2 Recommendations

It is recommended that Warrego Energy refer the Project under the EPBC Act due to the Project's potential impact to Carnaby's Black Cockatoo foraging (and potentially roosting) habitat.

It is also recommended that Warrego considers the inclusion of the fauna management practices/recommendations outlined in this report in the development of the Project and the preparation of their environmental management plan, including:

- Minimise clearing, with a particular focus on avoiding large habitat trees (particularly areas of open Eucalypt forest and planted Eucalypts habitats) as much as possible.
- Align the Project footprint with existing areas of disturbance, where possible.
- Maintain ecological linkages between areas of habitat to mitigate fragmentation impacts.
- Implement Project speed limits (i.e., maximum speed of 60 km/h off public thoroughfares).
- Restrict night-time vehicle movements.
- Restrict off-road driving.
- Design all excavations to incorporate effective fauna egress to avoid entrapment, injury and death of local fauna.

- Fence all excavations.
- Inspect all excavations regularly to identify any trapped fauna and provide assistance if necessary. Inspections are particularly useful early in the morning and prior to the commencement of backfilling to ensure that the excavations are clear of fauna.
- Record all fauna injuries and mortalities so that they can be reported in the environmental reports, where required.
- Develop an Environmental Education and Awareness induction for all staff, informing them of the conservation values present within the survey area and their management responsibilities.
- Undertake progressive rehabilitation as soon as possible.
- Utilise native flora species identified from the survey area in rehabilitation and revegetation.
- Manage domestic waste and water storages appropriately to minimise the proliferation of introduced fauna (e.g. store putrescible waste in closed bins and remove regularly from site).
- Develop and implement a feral animal control program in consultation with the DEC and pastoralists.
- Direct any lighting to working areas, where possible.
- Develop and implement a fire prevention and control strategy.
- Ensure appropriate fire response equipment and appropriately trained staff are available at all times during operation.
- Be aware of any 'harvest and vehicle movement bans' issued by local government during prohibited/restricted burning times (usually over the Summer period between October and April).
- Develop and implement a biosecurity management plan (including weeds and dieback).

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Appendix A - Vertebrate fauna species recorded during previous surveys conducted in the vicinity of the survey area

Species	Common Name	Conservation Status			Database Search			1	2	3	4	5	6	7	8	9	10	11	12	Site Observations
		EPBC Act	WC Act	DEC	EPBC Protected Matters	DEC Threatened Species 25 km	NatureMap	GHD 2011	Desmond and Heriot 2002	Ecologia 2002	Bamford 1998	Dames and More 1993	RCCWA 2009	How et al 1983	ATA 2006	Bamford 2012	Calm 1989	Ecologia 1994	ATA 2004	
AMPHIBIAN																				
Hylidae																				
<i>Litoria moorei</i>	Motorbike Frog						X	X	X		X									
Limnodynastidae																				
<i>Heleioporus albopunctatus</i>	Western Spotted Frog						X		X				X	X						X
<i>Heleioporus eyrei</i>	Moaning Frog						X						X				X			X
<i>Heleioporus psammophilus</i>	Sand Frog						X						X							
<i>Limnodynastes dorsalis</i>	Western Banjo Frog						X	X	X	X		X	X				X			
<i>Neobatrachus kunapalari</i>	Kunapalari Frog						X													
<i>Neobatrachus pelobatooides</i>	Humming Frog						X	X	X				X							
<i>Neobatrachus sutor</i>	Shoemaker Frog												X							
Myobatrachidae																				
<i>Crinia pseudinsignifera</i>	Bleating Froglet						X							X						
<i>Myobatrachus gouldii</i>	Turtle Frog							X	X					X						
<i>Pseudophryne guentheri</i>	Crawling toadlet						X	X	X					X			X			X
BIRDS																				
Acanthizidae																				
<i>Acanthiza apicalis</i>	Inland Thornbill						X	X				X		X	X	X	X	X	X	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill						X	X		X		X			X	X			X	
<i>Acanthiza inornata</i>	Western Thornbill																X			
<i>Acanthiza robustirostris</i>	Slatybacked Thornbill																		X	
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill						X	X				X			X				X	
<i>Aphelocephala leucopsis</i>	Southern Whiteface						X													
<i>Aphelocephala leucopsis castaneiventris</i>							X													
<i>Calamanthus campestris subsp. Montanellus</i>	Rufous Fieldwren			P4		X	X								X					
<i>Gerygone fusca</i>	Western Greygong						X	X		X		X			X	X			X	
<i>Pyrrholaemus brunneus</i>	Redthroat						X								X	X			X	
<i>Sericornis frontalis</i>	White-browed Scrubwren						X	X		X		X			X	X	X	X	X	
<i>Smicromis brevirostris</i>	Weebill						X	X		X		X			X				X	
Accipitridae																				
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk						X	X		X					X	X				
<i>Accipiter fasciatus</i>	Brown Goshawk						X	X		X		X			X				X	
<i>Aquila audax</i>	Wedge-tailed Eagle						X	X		X		X			X				X	X
<i>Aquila morphnoides</i>	Little Eagle														X	X				
<i>Circus approximans</i>	Swamp Harrier						X	X												
<i>Circus assimilis</i>	Spotted Harrier											X								
<i>Elanus axillaris</i>	Black-shouldered Kite							X		X	X	X		X		X	X	X	X	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	M	S3		X		X		X		X	X								
<i>Haliastur sphenurus</i>	Whistling Kite						X		X		X	X		X	X					
<i>Hieraetus morphnoides</i>							X		X		X	X								
<i>Lophoictinia isura</i>	Square-tailed Kite														X					
<i>Pandion cristatus</i>	Eastern Osprey							X				X		X						
Aegothelidae																				
<i>Aegothales cristatus</i>	Australian Owlet-nightjar						X					X					X		X	
Anatidae																				
<i>Anas castanea</i>	Chestnut Teal						X													
<i>Anas gracilis</i>	Grey Teal							X			X								X	
<i>Anas superciliosa</i>	Pacific Black Duck						X	X		X				X		X	X	X		
<i>Biziura lobata</i>	Musk Duck							X												
<i>Chenonetta jubata</i>	Australian Wood Duck						X	X												
<i>Cygnus atratus</i>	Black Swan							X				X								
<i>Tadorna tadornoides</i>	Australian Shelduck						X	X									X	X		X
Anhingidae																				
<i>Anhinga novaehollandiae</i>	Australasian Darter											X								
Apodidae																				
<i>Apus pacificus</i>	Fork-tailed Swift	M	S3		X		X					X								
Ardeidae																				
<i>Ardea ibis</i>	Cattle Egret	M	S3		X		X													
<i>Ardea modesta</i>	Eastern Great Egret	M	S3		X		X													
<i>Ardea pacifica</i>	White-necked Heron						X	X												
<i>Egretta novaehollandiae</i>	White-faced Heron									X	X	X					X			
<i>Nycticorax caledonicus</i>	Nankeen Night Heron							X												
Artamidae																				
<i>Artamus cinereus</i>	Black-faced Woodswallow						X	X		X		X			X	X	X	X	X	
<i>Artamus personatus</i>	Masked Woodswallow						X													
<i>Artamus minor</i>	Little Woodswallow																			X
<i>Artamus personatus</i>	Masked Woodswallow						X													

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BIRDS (cont'd)																				
<i>Strepera versicolor</i>	Grey Currawong						X	X						X	X					
<i>Cracticus nigrogularis</i>	Pied Butcherbird						X	X						X	X	X				X
<i>Cracticus tibicen</i>	Australian Magpie						X	X						X	X	X				X
<i>Cracticus torquatus</i>	Grey Butcherbird						X	X						X	X	X				X
Cacatuidae																				
<i>Cacatua pastinator</i>	Western Corella						X					X			X		X	X		
<i>Cacatua sanguinea</i>	Little Corella						X													
<i>Calyptorhynchus banksii</i>	Red-tailed Black-Cockatoo																		X	
<i>Calyptorhynchus baudinii</i>	Baudin's Black-Cockatoo	VU	EN			X														
<i>Calyptorhynchus latirostris</i>	Carnaby's Black-Cockatoo	EN	EN		X	X								X	X	X	X			
<i>Eolophus roseicapillus</i>	Galah						X		X			X		X	X	X	X	X	X	X
<i>Nymphicus hollandicus</i>	Cockatiel						X													
Campephagidae																				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike						X	X		X	X	X		X	X	X	X	X	X	X
<i>Lalage sueurii</i>	White-winged Triller														X				X	
Caprimulgidae																				
<i>Eurostopodus argus</i>	Spotted Nightjar															x				
Casuariidae																				
<i>Dromaius novaehollandiae</i>	Emu											X	X		X	X	X			X
Charadriidae																				
<i>Charadrius australis</i>	Inland Dotterel						X													
<i>Charadrius leschenaultii</i>	Greater Sand Plover	M						X												
<i>Charadrius mongolus</i>	Lesser Sand Plover	M						X												
<i>Charadrius ruficapillus</i>	Red-capped Plover							X				X								
<i>Pluvialis fulva</i>	Pacific Golden Plover	M						X												
<i>Pluvialis squatarola</i>	Grey Plover	M						X												
<i>Vanellus tricolor</i>	Banded Lapwing						X					X			X	X	X			
Cincolomatidae																				
<i>Cincoloma castaneothorax</i>	Chestnut-breasted Quail-thrush																			X
<i>Psophodes occidentalis</i>	(Western Wedgebill)						X													
Columbidae																				
<i>Columba livia</i>	Rock Dove						X	X			X	X								
<i>Geopelia cuneata</i>	Diamond Dove						X	X												X
<i>Ocyphaps lophotes</i>	Crested Pigeon						X	X		X	X	X		X	X			X	X	X
<i>Phaps chalcoptera</i>	Common Bronzewing						X	X		X	X	X		X	X				X	X
<i>Phaps elegans</i>	Brush Bronzewing						X			X	X				X	X				
<i>Sterptopelia senegalensis</i>	Laughing Turtle-Dove							X		X	X	X		X	X					
Corvidae																				
<i>Corvus bennetti</i>	Little Crow						X	X								X				
<i>Corvus coronoides</i>	Australian Raven						X	X		X	X	X		X	X			X	X	X
<i>Corvus orru</i>	Torresian Crow							X												
Cuculidae																				
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo						X	X				X					X			
<i>Cacomantis pallidus</i>	Pallid Cuckoo									X							X			
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo									X	X				X	X				
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo						X									X				
<i>Chalcites osculans</i>	Black-eared Cuckoo																			X
Diomedidae																				
<i>Diomedae exulans</i>	Wandering Albatros	VU/M	VU					X												
<i>Thalassarche certeri</i>	Indian Yellow Nosed Albatross	M						X												
Estrildidae																				
<i>Taeniopygia guttata</i>	Zebra Finch						X	X		X		X			X					
Eurostopodidae																				
<i>Eurostopodus argus</i>	Spotted Nightjar											X								
Falconidae																				
<i>Falco berigora</i>	Brown Falcon						X					X			X	X			X	X
<i>Falco cenchroides</i>	Nankeen Kestrel						X	X		X	X	X		X	X	X	X	X		X
<i>Falco longipennis</i>	Australian Hobby						X	X							X	X				
<i>Falco peregrinus</i>	Peregrine Falcon		S4							X										
Halcyonidae																				
<i>Dacelo novaeguineae</i>	Laughing Kookaburra						X	X									X			
<i>Todiramphus sanctus</i>	Sacred Kingfisher						X	X		X		X								
Hirundinidae																				
<i>Cheramoeca leucosterna</i>	White-backed Swallow						X			X		X			X	X				
<i>Hirundo neoxena</i>	Welcome Swallow						X	X		X	X	X		X	X	X	X	X	X	X
<i>Petrochelidon ariel</i>	Fairy Martin						X													
<i>Petrochelidon nigricans</i>	Tree Martin							X		X		X			X					X

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BIRDS (cont'd)																				
Laridae																				
<i>Chroicocephalus novaehollandiae</i>	Silver Gull											X	X		X		X			
Maluridae																				
<i>Malurus lamberti</i>	Variegated Fairy-wren															X	X	X		X
<i>Malurus leucopterus</i>	White-winged Fairy-wren										X		X			X	X			
<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren													X						
<i>Malurus splendens</i>	Splendid Fairy-wren										X		X			X	X	X	X	X
Megaluridae																				
<i>Cincloramphus cruralis</i>	Brown Songlark								X				X			X				
<i>Cincloramphus mathewsi</i>	Rufous Songlark								X							X				
<i>Magalurus gramineus</i>	Little Grassbird																X			
Megapodiidae																				
<i>Leipoa ocellata</i>	Malleefowl	M/VU	VU		X	X	X												X	
Meliphagidae																				
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater							X				X				X			X	
<i>Acanthagenys superciliosus</i>	Western Spinebill							X									X			
<i>Anthochaera carunculata</i>	Red Wattle Bird							X								X	X	X		
<i>Anthochaera lunulata</i>	Western Little Wattlebird							X								X				
<i>Epthianura albifrons</i>	White-fronted Chat							X				X				X	x			
<i>Epthianura tricolor</i>	Crimson Chat							X								X				
<i>Lichenostomus leucotis</i>	White-eared Honeyeater									X										X
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater							X			X									
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater							X			X	X				X				
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater							X											X	
<i>Lichenostomus virescens</i>	Singing Honeyeater							X		X	X	X		X	X	X	X	X	X	X
<i>Lichmera indistincta</i>	Brown Honeyeater							X		X	X	X				X	X	X	X	X
<i>Manorina flavigula</i>	Yellow-throated Miner							X			X	X				X			X	
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater							X						X					X	
<i>Phylidonyris melanops</i>	Tawny-crowned Honeyeater							X								X	X	X		
<i>Phylidonyris niger</i>	White-Cheaked Honeyeater										X	X				X				
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater							X										X		
Meropidae																				
<i>Merops ornatus</i>	Rainbow Bee-eater	M			X		X			X		X		X	X					
Monarchidae																				
<i>Grallina cyanoleuca</i>	Magpie-lark						X	X		X	X	X	X		x	X		X	X	
Motacillidae																				
<i>Anthus novaeseelandiae</i>	Australasian Pipit							X				X	X		X	X	X			
Nectariniidae																				
<i>Dicaeum hirundinaceum</i>	Mistletoebird						X	X			X	X				X	X		X	
Neosittidae																				
<i>Daphoenositta chrysoptera</i>	Varied Sittella							X											X	
Otididae																				
<i>Ardeotis australis</i>	Australian Bustard			P4		X	X					X						X		
Pachycephalidae																				
<i>Colluricincla harmonica</i>	Grey Shrike-thrush						X			X	X		X			X	X	X	X	
<i>Oreoica gutturalis</i>	Crested Bellbird						X			X						X	X	X	X	X
<i>Pachycephala pectoralis</i>	Golden Whistler						X					X				X	X	X	X	
<i>Pachycephala rufiventris</i>	Rufous Whistler						X			X		X				X	X	X	X	
Pardalotinae																				
<i>Pardalotus punctatus</i>	Spotted Pardalote						X									X				
<i>Pardalotus rubricatus</i>	Red-browed Pardalote															X				
<i>Pardalotus striatus</i>	Striated Pardalote						X									X			X	
Petroicidae																				
<i>Drymodes brunneopygia</i>	Southern Scrub Robin						X												X	
<i>Eopsaltria georgiana</i>	White-breasted Robin						X					X				X	X			
<i>Eopsaltria griseogularis</i>	Western Yellow Robin																		X	
<i>Microeca fascinans</i>	Jacky Winter																		X	
<i>Petroica goodenovii</i>	Red-capped Robin						X					X				X			X	X
Phalacrocoracidae																				
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant											X								
<i>Phalacrocorax carbo</i>	Great Cormorant																X			
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant												X							
<i>Phalacrocorax varius</i>	Pied Cormorant																X			
Phasianidae																				
<i>Coturnix pectoralis</i>	Stubble Quail						X					X		X						
Podargidae																				
<i>Podargus strigoides</i>	Tawny Frogmouth						X					X				X	X			

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BIRDS (cont'd)																				
Podicipedidae																				
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe																			
Pomatostomidae																				
<i>Pomatostomus superciliosus</i>	White-browed Babbler										X								X	
<i>Pomatostomus superciliosus sunsp. Ashbyi</i>	White-browed Babbler			P4		X														
Psittacidae																				
<i>Barnardius zonarius</i>	Australian Ringneck																			X
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet																			
<i>Melopsittacus undulatus</i>	Budgerigar																			
<i>Neophema splendida</i>	Scarlet-chested Parrot																			
<i>Psephotus varius</i>	Mulga Parrot																			
<i>Platycercus elegans</i>	Elegant Parrot																			
Ptilonorhynchidae																				
<i>Ptilonorhynchus guttatus</i>	Western Bowerbird																			X
Rallidae																				
<i>Gallirallus ventralia</i>	Black tailed native hen																			X
<i>Porzana fluminea</i>	Australian Spotted Crake																			X
Recurvirostridae																				
<i>Himantopus himantopus</i>	Black-winged Stilt																			X
Rhipiduridae																				
<i>Rhipidura albiscapa</i>	Grey Fantail																			X
<i>Rhipidura leucophrys</i>	Willie Wagtail						X	X		X	X	X		X	X	X	X	X	X	X
Scolopacidae																				
<i>Actitis hypoleucos</i>	Common Sandpiper	M					X													
Strigidae																				
<i>Ninox novaeseelandiae</i>	Southern Boobook						X													X
Threskiornithidae																				
<i>Platalea flavipes</i>	Yellow-billed Spoonbill																			X
<i>Threskiornis spinicollis</i>	Straw-necked Ibis						X													
Timaliidae																				
<i>Zosterops lateralis</i>	Silvereeye						X													
Turnicidae																				
<i>Turnix varia varia</i>	Painted Button-quail																			X
Tytonidae																				
<i>Tyto abla</i>	Barn Owl																			
<i>Tyto javanica</i>	Eastern Barn Owl														X					X
MAMMALS																				
Bovidae																				
<i>Bos taurus*</i>	Cow*																			X
<i>Capra hircus*</i>	Goat*								X										X	X
<i>Ovis aries*</i>	Sheep*																			X
Canidae																				
<i>Canis lupus/familiaris*</i>	Dingo/Dog*						X	X	X		X									X
<i>Vulpes vulpes*</i>	Red Fox*						X	X	X		X			X	X	X	X	X	X	X
Dasyuridae																				
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart						X	X	X											
<i>Sminthopsis dolichura</i>	Little long-tailed Dunnart								X											X
<i>Sminthopsis granulipes</i>	White-tailed Dunnart																			X
Equidae																				
<i>Equus ferus caballus</i>	Wild Horse																			X
Felidae																				
<i>Felis catus*</i>	Feral Cat*						X	X	X		X	X		X	X	X	X	X	X	X
Leporidae																				
<i>Oryctolagus cuniculus*</i>	European Rabbit*							X	X	X	X	X		X	X	X	X	X	X	X
Macropodidae																				
<i>Macropus fuliginosus</i>	Western Grey Kangaroo						X	X	X	X	X	X		X	X	X	X	X	X	X
<i>Macropus irma</i>	Western Brush Wallaby			P4			X													
<i>Macropus robustus</i>	Euro							X												X
<i>Macropus rufus</i>	Red Kangaroo																			X
Molossidae																				
<i>Tadarida australis</i>	White-striped Free-tailed Bat						X	X												
Muridae																				
<i>Mus musculus*</i>	House Mouse*						X	X	X		X	X		X					X	X
<i>Pseudomys albocinereus</i>	Ashy-grey Mouse/Noodji																		X	X
<i>Rattus fuscipes</i>	Western bush Rat						X												X	X
<i>Rattus rattus*</i>	Rat*						X	X												X

Vertebrate Fauna Survey - West Erregulla Exploration Program
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Species	Common Name	Conservation Status			Database Search			1	2	3	4	5	6	7	8	9	10	11	12	Site Observations
		EPBC Act	WC Act	DEC	EPBC Protected Matters	DEC Threatened Species 25 km	NatureMap	GHD 2011	Desmond and Heriot 2002	Ecologia 2002	Bamford 1998	Dames and More 1993	RCCWA 2009	How et al 1983	ATA 2006	Bamford 2012	Calm 1989	Ecologia 1994	ATA 2004	
MAMMALS (cont'd)																				
Phalangeridae																				
<i>Trichosurus vulpecula</i>	Common Brish-tailed Possum							X				X								
Pteropodidae																				
<i>Pteropus scapulatus</i>	Little Red Flying-fox							X												
Suidae																				
<i>Sus scrofa</i>	Pig*							X				X								
Tachyglossidae																				
<i>Tachyglossus aculeatus</i>	Echidna							X	X	X	X	X		X	X	X	X	X	X	
Tarsipedidae																				
<i>Tarsipes rostratus</i>	Honey Possum						X	X								X				
Vespertilionidae																				
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat											X								
<i>Chalinolobus morio</i>	Chocolate Wattled Bat															X				
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat						X	X				X				X				
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat											X								
<i>Vespadelus regulus</i>	Southern Forest Bat						X									X	X			
REPTILES																				
Agamidae																				
<i>Amphibolurus longirostris</i>	Long-nosed Dragon												X							
<i>Ctenophorus maculatus maculatus</i>	Spotted Military Dragon						X	X				X	X	X	X					
<i>Ctenophorus nuchalis</i>	Central Netted Dragon						X						X							
<i>Ctenophorus reticulatus</i>	Western Netted Dragon						X	X				X	X						X	
<i>Ctenophorus scutulatus</i>	Lozenge Marked Dragon																		X	
<i>Moloch horridus</i>	Thorny Devil								X				X			X				X
<i>Pogona minor minor</i>	Dwarf Bearded Dragon						X	X	X			X	X	X	X	X	X		X	
<i>Rankinia adelaidensis</i>	Western Heath Dragon						X		X				X			X	X			
Carphodactylidae																				
<i>Nephurus milii</i>							X					X	X	X						
<i>Nephurus levis</i>	Western Knob-tailed							X					X							
Chelluidae																				
<i>Chelodina oblonga</i>	Long-necked Tortoise								X											
<i>Chelodina steindachneri</i>	Flat-shelled Turtle						X													
Diplodactylidae																				
<i>Crenadactylus ocellatus</i>	Clawless Gecko						X	X												
<i>Diplodactylus granariensis</i>	Western Stone Gecko						X						X	X						
<i>Diplodactylus ornatus</i>							X					X	X							
<i>Diplodactylus pulcher</i>	Beautiful Gecko											X	X							
<i>Diplodactylus squarrosus</i>												X	X							
<i>Strophurus spinigerus</i>	Soft Spiny-tailed Gecko						X					X	X	X		X	X			
<i>Strophurus strophurus</i>													X							
Elapidae																				
<i>Brachyurophis semifasciata</i>							X	X				X	X							
<i>Brachyurophis fasciolatus</i>													X							
<i>Demansia psammophis reticulata</i>	Yellow-faced Whipsnake						X	X	X			X	X	X					X	
<i>Echiopsis curta</i>	Bardick						X						X							
<i>Neelaps bimaculatus</i>	Black-naped Snake			P3			X	X	X					X	X					
<i>Neelaps calonotos</i>	Black-striped Snake			P3		X														
<i>Parasuta gouldii</i>	Gould's Hooded Snake												X			X				
<i>Parasuta monachus</i>	Monk Snake						X	X	X			X	X						X	
<i>Pseudechis affinis</i>	Dugite													X						
<i>Pseudechis australis</i>	Mulga Snake						X	X	X				X			X			X	
<i>Pseudonaja mengdeni</i>	Gwardar						X	X	X	X		X	X			X				
<i>Pseudonaja modesta</i>	Ringed Brown Snake												X						X	
<i>Pseudonaja nuchalis</i>	Northern Brown Snake						X													
<i>Simoselaps bertholdi</i>	Jan's Banded Snake						X	X					X			X				
<i>Simoselaps littoralis</i>	West Coast Banded Snake						X	X				X	X							
Gekkonidae																				
<i>Diplodactylus granariensis</i>	Western Stone Gecko															X			X	
<i>Diplodactylus pulcher</i>																			X	
<i>Gehyra variegata</i>							X	X					X	X	X	X		X	X	
<i>Heteronotia binoei</i>	Bynoe's Gecko							X				X	X						X	
<i>Lucasium alboguttatum</i>	White-spotted Ground Gecko											X	X			X				
<i>Strophurus spinigerus</i>	Soft Spiny-tailed Gecko															X				
Pygopodidae																				
<i>Aprasia repens</i>													X							
<i>Delma australis</i>												X	X						X	
<i>Delma fraseri</i>							X					X	X	X	X	X			X	
<i>Delma greyii</i>													X		X	X				

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		EPBC Act	WC Act	DEC	EPBC Protected Matters	DEC Threatened Species 25 km	NatureMap	GHD 2011	Desmond and Heriot 2002	Ecologia 2002	Bamford 1998	Dames and More 1993	RCCWA 2009	How et al 1983	ATA 2006	Bamford 2012	Calm 1989	Ecologia 1994	ATA 2004	
REPTILES (cont'd)																				
<i>Delma tinctoria</i>							X	X					X	X						
<i>Lialis burtonis</i>							X	X					X	X	X	X				
<i>Pletholax gracilis</i>													X							
<i>Pygopus lepidopodus</i>							X	X					X			X	X	X		
<i>Pygopus nigriceps</i>													X						X	
Pythonidae																				
<i>Antaresia stimsoni stimsoni</i>								X	X				X	X						
<i>Aspidites ramsayi</i>	Woma		S4	P1									X							
<i>Morelia spilota imbricata</i>	Western carpet python		S4	P4			X	X					X							
Scincidae																				
<i>Cryptoblepharus</i>	Fence Skink								X				X	X						
<i>Cryptoblepharus buechananii</i>							X						X	X						
<i>Cryptoblepharus carnabyi</i>							X						X						X	
<i>Cryptoblepharus plagioccephalus</i>							X						X		X	X			X	
<i>Ctenotus australis</i>													X	X						
<i>Ctenotus fallens</i>							X		X				X	X	X	X			X	
<i>Ctenotus impar</i>													X		X					
<i>Ctenotus mimetes</i>													X						X	
<i>Ctenotus pantherinus</i>	Leopard Skink						X						X			X			X	
<i>Ctenotus schomburgkii</i>													X						X	
<i>Ctenotus uber</i>													X						X	
<i>Cyclodomorphus branchialis</i>	Gilled slender-blue tongue		VU														X	X	X	
<i>Cyclodomorphus celatus</i>													X		X					
<i>Egernia depressa</i>																			X	
<i>Egernia kingii</i>	King's Skink													X						
<i>Egernia multiscutata</i>	Bull Skink													X						
<i>Egernia stokesii</i>			VU																X	
<i>Eremiascincus richardsonii</i>														X						X
<i>Hemiergisinitialis</i>																				X
<i>Lesrista christinae</i>														X		X				
<i>Lesrista distinguenda</i>														X						
<i>Lerista elegans</i>							X		X				X	X		X				
<i>Lerista gerrardii</i>													X	X					X	
<i>Lerista lineata</i>	Lined skink			P3				X												
<i>Lerista lineopunctulata</i>								X	X				X	X	X					
<i>Lerista macropisthopus</i>				P2									X							
<i>Lerista planiventralis decora</i>							X	X					X	X						
<i>Lerista praepedita</i>								X	X				X	X		X	X			
<i>Menetia greyii</i>								X	X				X	X	X	X			X	
<i>Menetia surda</i>													X							
<i>Morethia butleri</i>													X							
<i>Morethia lineocellata</i>								X	X				X	X	X				X	
<i>Morethia obscura</i>													X							
<i>Tiliqua occipitalis</i>	Western Bluetongue						X	X	X				X		X					
<i>Tiliqua rugosa rugosa</i>	Bobtail						X	X	X	X			X	X	X	X	X	X	X	
Typhlopidae																				
<i>Ramphotyphlops australis</i>	Australian Blind Snake						X	X	X				X	X	X					
<i>Ramphotyphlops hamatus</i>													X							
<i>Ramphotyphlops leptosoma</i>								X	X				X							
<i>Ramphotyphlops waitii</i>							X	X	X				X							
Varanidae																				
<i>Varanus caudolineatus</i>	Striped-tailed Monitor												X						X	
<i>Varanus gouldii</i>	Gould's Monitor						X	X	X	X	X		X	X	X	X			X	
<i>Varanus tristis</i>	Black-headed Monitor							X	X				X	X					X	

1. Conservation Status Key

*	Represents introduced species
X	Represents species present during survey or database searches
X?	Specimen identification that is not 100% verified
E	Endangered species under the EPBC Act 1999
V	Vulnerable species under the EPBC Act 1999
M	Migratory species under Wildlife Conservation Act 1950 (Schedule 3) and/or the EPBC Act 1999
S	Schedule species under Wildlife Conservation Act 1950 (Schedule 1, 2 and 4)
P	Priority species under Wildlife Conservation Act 1950 (P1, P2, P3 and P4)

Appendix A - Vertebrate fauna species recorded during previous surveys conducted in the vicinity of the survey area

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Appendix B

Conservation Codes for Western Australian Fauna

Wildlife Conservation Act (WC Act) conservation status definitions:

Schedule 1 (S1) Fauna that is rare or likely to become extinct.

Schedule 2 (S2) Fauna that is presumed to be extinct.

Schedule 3 (S3) Birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds.

Schedule 4 (S4) Fauna that is in need of special protection, otherwise than for the reasons mentioned above.

DEC Priority List:

In addition to the above classification, DEC also classifies fauna not listed as a scheduled species under five different codes.

Priority 1 (P1) Taxa that 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 that 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 that 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 that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands.

Priority 5 (P5) Taxa that 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.

EPBC Act conservation status definitions:

Endangered (EN) A taxon is Endangered when the best available evidence indicates that it is considered to be facing a very high risk of extinction in the wild.

Vulnerable (VU) A taxon is Vulnerable when the best available evidence indicates that it is considered to be facing a high risk of extinction in the wild.

Migratory (M) Species migrate to, over and within Australia and its external territories.