

Level 1 Vertebrate Fauna Risk Assessment for the Eundynie Project



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Prepared for:
Native Vegetation Solutions
PO Box 41
Kalgoorlie, WA 6430

By:
Terrestrial Ecosystems
10 Houston Place
Mt Claremont
WA 6010

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Front Cover: Fauna habitats in the project area

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EXECUTIVE SUMMARY

RNC Minerals Limited (RNC) is planning to expand exploration activities at Endynie South which is near existing mining operations in the southern Goldfields (i.e. project area). The project area is approximately 10km north south-east of the Higginsville mining operations (Figure 1).

The total assessed area was approximately 135ha but only a portion of this will be disturbed. There are three broad fauna habitats in the project area:

- open Salmon Gum woodland over sparse chenopods;
- eucalypt woodland over mixed shrubland and chenopod over scattered grasses of varying densities on a sandy-clay substrate; and
- mixed sclerophyll shrubland.

There are also areas devoid of vegetation from earlier exploration activity and these areas are of little value as fauna habitat.

The density of trees and shrubs in the relatively undisturbed areas varied across the project area. The fauna habitat quality varies from highly degraded to very good, with the more degraded areas due to recent exploration activity. There is one east-west haul road and a series of access tracks and exploration grid lines in the area. Apart from the haul road the tracks are narrow and do not overly impact on fauna habitat.

The area has been lightly grazed by cattle and there was extensive evidence of rabbits and other feral fauna in the area.

Potential impacts on vertebrate fauna associated with clearing vegetation in the project area in a landscape or bioregional context are likely to be low as there are vast tracts of similar habitat in adjacent areas. The proposed project is unlikely to significantly impact on a conservation significant species, so a referral under the *EPBC Act* is not recommended.

It is recommended that:

- an induction program that includes a component on managing fauna is a mandatory component of working on the Eundynie project;
- the impact of dust on adjacent vegetation and fauna habitat is managed and monitored against appropriate KPIs;
- pets are not permitted on site;
- all waste and rubbish is contained in bins and regularly removed from site or buried so it is unavailable to pest and feral species;
- feeding of native fauna should be actively discouraged;
- a log of all on-site drill holes be maintained detailing when they were capped, how and by whom;
- speed limits are implemented and enforced on-site. These should be determined based on the quality and condition of the roads, but be a maximum of 80km/h;
- signage is erected to indicate the maximum travelling speeds and the possible presence of wildlife crossing roads; and
- a feral and pest animal management program is implemented to reduce the predation risk on native fauna including Malleefowl in and near the project area. This program should concentrate on reducing the impacts of cats, foxes, wild dogs and rabbits.

1 INTRODUCTION

1.1 Background

RNC Minerals Limited (RNC) is planning to undertake additional exploration activities at the Eundynie project which is near the existing Higginsville mining operations in the southern Goldfields (i.e. project area). The project area is approximately 10km south-east of Higginsville east of the Goldfields Highway (Figure 1). The total assessed area was approximately 135ha but only a portion of this will be disturbed.

1.2 Project objectives and scope of works

Terrestrial Ecosystems was commissioned by Native Vegetation Solutions on behalf of RNC to undertake a Level 1 vertebrate fauna risk assessment and search of the project area for Malleefowl and their mounds. The purpose of this Level 1 fauna risk assessment was to provide information to the Department of Mines, Industry Regulation and Safety (DMIRS) and/or the Environmental Protection Authority (EPA) on the potential impacts on the vertebrate fauna assemblage in the project area to enable the proposed development to be adequately assessed. The methodology broadly follows that described in the Environmental Protection Authority (EPA) *Technical Guidance Terrestrial Fauna Surveys* (Environmental Protection Authority 2016) and the *Technical Guidance - Sampling methods for terrestrial vertebrate fauna* (Environmental Protection Authority 2016).

A Level 1 fauna risk assessment involves undertaking a desktop review and reconnaissance site visit. The objectives of this fauna risk assessment were to:

- provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, mammals and birds) on and near the project area, so that potential impacts on the fauna and fauna assemblage might be adequately assessed;
- identify the presence and/or potential risk of impacts on species of conservation significance that are present or likely to be present in the project area;
- assess the impact and environmental risks associated with the proposed development on the fauna assemblage;
- determine if any additional surveys are required to assess the potential impact on fauna assemblages in the project area including impacts on species of conservation significance; and
- make recommendations that avoid, mitigate or minimise potential impacts on resident fauna.

To achieve these objectives, Terrestrial Ecosystems:

- reviewed Terrestrial Ecosystems' database [includes Atlas of Living Australia and Department of Biodiversity, Conservation and Attractions (DBCA) records in NatureMap] to identify potential vertebrate fauna within the area;
- searched the DBCA's NatureMap for Threatened and Priority Species;
- searched the Commonwealth Governments 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);
- undertook a site reconnaissance survey and searched the area for active Malleefowl mounds;
- reviewed previous fauna surveys conducted near the project area;
- undertook an assessment of the potential risks to the fauna associated with clearing additional areas of native vegetation;
- discussed the likelihood of *EPBC Act 1999* and *Biodiversity Conservation Act 2016 (BC Act 2016)* listed species being present in the project area; and
- provided management recommendations to avoid, mitigate and minimise potential impacts on the fauna in the project area.

2 EXISTING ENVIRONMENT

2.1 Location of project area

The project area is within the Coolgardie (COO3-Eastern Goldfield) Interim Biogeographic Regionalisation of Australia (IBRA) subregion. This subregion is a gently undulating plain on the Yilgarn Craton with calcareous soil being dominant (Cowan 2002). The subregion supports a diverse eucalypt woodland around the salt lakes, on the low ranges and in the broad valleys and mallee and Acacia thickets and shrub heaths on the plains (Cowan 2002). The sub-region is rich in endemic Acacias (Cowan 2002).

2.2 Land use history

The dominant land uses in this bioregion are pastoralism, crown reserves and mining. Mining is evident in many areas around Kambalda, Higginsville, Widgiemooltha and Norseman, with numerous small abandoned and operational mines scattered throughout the landscape.

Many of the larger trees in the bioregion were removed decades ago to support the mining and power generation industries and these trees have often not been replaced by replanting programs.

2.3 Climate

The project area is characterised as semi-arid. Chart 1 shows the average mean monthly maximum and minimum temperatures and rainfall for Norseman, the closest weather station (~45km south). Temperatures are highest in December–February and most rain comes in winter. Winter rain is the result of low pressure cells that move in an easterly direction from the south-west of the state, whereas, summer rain is often from thunderstorms that move in from either the west or the north-west.

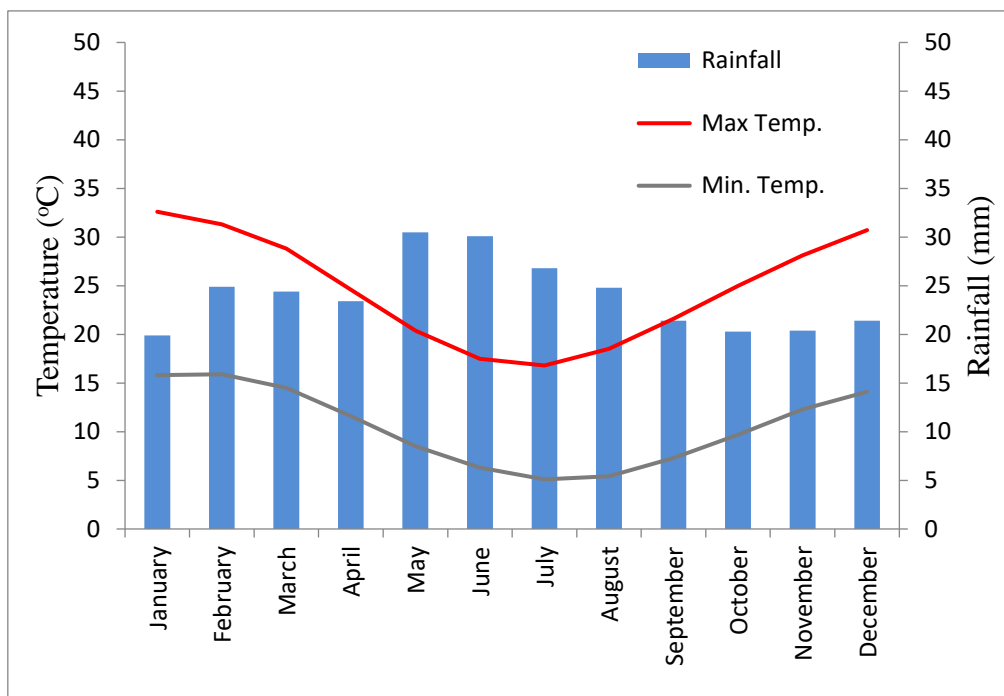


Chart 1. Mean monthly maximum and minimum temperatures and rainfall for Norseman (http://www.bom.gov.au/climate/averages/tables/cw_012065.shtml, downloaded January 2018)

2.4 Great Western Woodlands

The Eundynie project area is part of the Great Western Woodlands (Watson et al. 2008, pp. vi) in unallocated crown land. The Great Western Woodlands represents the largest and most intact eucalypt woodland remaining in southern Australia and one of the best examples of its type in the world. It is home to an impressive 3,000 flowering plant species, 20 per cent of Australia's known flora, as well as a diverse range of animals dependent on its varied habitats (Department of Environment and Conservation 2010).

The Wilderness Society argued the fauna and flora diversity in the area has evolved with the landscape during an unbroken biological lineage stretching back 250 million years.

2.5 Regional biological fauna context of project area

The frogs, reptiles, mammals and birds in the goldfields have been surveyed on many occasions for a variety of purposes and are therefore well known. Fauna surveys and assessments undertaken near the project area or with similar habitats that have been reviewed for this assessment include:

- ATA Environmental (2006a) *Fauna Assessment St Ives Cave Rocks Satellite Pit, Waste Dump and Haul Road*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Perth.
- ATA Environmental (2006b) *Vertebrate Fauna Assessment St Ives Gold Mine*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Perth.
- Bamford Consulting Ecologists (2010) *Gold Fields St Ives Gold Mine, Kambalda. Fauna Assessment: impacts of water discharge and general mining activity on vertebrate fauna*. Unpublished report to Gold Fields St Ives Gold Mine, Perth.
- Blythman, M., and G. Harewood. (2009) *Targeted Fauna Survey for Slender-billed Thornbill and Rainbow Bee-eater, Neptune Pistol Club Areas, Kambalda*. Unpublished report for Botanica Consulting.
- Botanica Consulting (2011) *66KW extension power line fauna assessment*. Unpublished report for Goldfields St Ives. Boulder.
- Chapman, A., Kealley, I., McMillan, D., McMillan, P. and Rolland, G. (1991b) Biological surveys of four Goldfields Reserves, *Landnote*, 1/91, 1-26
- Dames and Moore (1999) *Public Environmental Review Gold Mine Development on Lake Lefroy*. Unpublished report for St Ives Gold Mine; Kalgoorlie.
- Dell, J and How, R. (1984) Vertebrate fauna. In: *The Biological Survey of the Eastern Goldfields of Western Australia, Records of the Western Australian Museum, Supplement No 18*, 57-89.
- GHD (2010a) *Report for Chalice Project Area Desktop Biological Assessment and Broad Scale Vegetation Mapping*. Unpublished report for Avoca Resources Ltd, Perth.
- GHD (2010b) *Report for Higginsville Project Area Desktop Biological Assessment and Broad Scale Vegetation Mapping*. Unpublished report for Avoca Resources Ltd, Perth.
- GHD (2014) *Lake Cowan Project Area Desktop Assessment and Broad Scale Mapping*. Unpublished report for Metals X Ltd, Perth.
- GHD (2015a) *Musket Project Area Desktop Assessment and Broad Scale Mapping*. Unpublished report for Metals X Ltd, Perth.
- GHD (2015b) *Wills Project Area Desktop Assessment and Broad Scale Mapping*. Unpublished report for Metals X Ltd, Perth.
- Halpern Glick Maunsell (1998) *Lake Lefroy Environmental Assessment. Report ES4490C*. Unpublished Report commissioned by WMC Resources Ltd.
- Harewood, G. (2010b) *Terrestrial Fauna Survey (Level 1) of the proposed Diana Mine Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury.
- Harewood, G. (2010d) *Terrestrial Fauna Survey (Level 1) of the proposed West Idough Mine Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury.
- Harewood, G. (2011a) *Terrestrial Fauna Survey (Level 1) of Thunderer Mine Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury.
- Harewood, G. (2011b) *Terrestrial Fauna Survey (Level 1) of Workshop Project Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury.
- Harewood, G. (2013a) *Fauna Assessment of Idough Mine Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury
- Harewood, G. (2013b) *Fauna Assessment of Neptune Mine Area and Invincible Road St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury.

- Harewood, G. (2010c) *Terrestrial Fauna Survey (Level 1) of the proposed Pistol Club Mine Area - Kambalda*. Unpublished report for Botanica Consulting. Bunbury
- Harewood, G. (2010a) *Terrestrial Fauna Survey (Level 1) of the proposed Bellerophon Mine Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury
- Harewood, G. (2011c) *Wildlife sweep of Tailings Storage Facility (TSF) 4 -area to be cleared*. Bunbury.
- Harewood, G. (2010a) *Terrestrial Fauna Survey (Level 1) of the proposed Bellerophon Mine Area St Ives - Kambalda*. Unpublished report for Botanica Consulting. Bunbury
- Keith Lindbeck and Associates (2007) *St. Ives Gold Mining Company Tailings Storage Facility (No. 4) Spring Fauna Survey*. Unpublished report for St. Ives Gold Mining Company.
- McKenzie, N.L. and Hall, N.J. (1992) The biological survey of the eastern goldfields of Western Australia. Part 8: Kurnalpi - Kalgoorlie study area, *Records of the Western Australian Museum*, Supplement 41.
- McKenzie, N.L., Rolfe, J.K. and Youngson, W.K. (1992) IV Vertebrate fauna, *Records of the Western Australian Museum*, Supplement, No 41, 37-64.
- McKenzie, N.L., Rolfe, J.K., Hall, N.J. and Youngson, W.K. (1993) Vertebrate Fauna. In Hall, N.J. and McKenzie N.L. The Biological Survey of the Eastern Goldfields of Western Australia Part 9. Norseman - Balladonia. *Records of the Western Australian Museum*, Supplement No 42, 33-55.
- Newby, K.R., Dell, J., How, R.A. and Hnatiuk, R.J. (1984) The Biological Survey of the Eastern Goldfields of Western Australia - Part 2: Widgiemooltha – Zanthus Study Area. *Records of the Western Australian Museum, Supplement* 18, 21–158.
- Ninox Wildlife Consulting (1995) *Vertebrate Fauna Studies Kambalda Area (1993) Widgiemooltha Area (1994)*. Perth.
- Ninox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Randell Timber Reserve (1997 & 1998)*. Unpublished report for Mt Monger Gold Project Pty Ltd, Perth.
- Ninox Wildlife Consulting (2004a) *St Ives Gold Delta Island Vertebrate Fauna Assessment*. Unpublished Report Commissioned by St Ives Gold Mining Company Pty. Ltd.
- Ninox Wildlife Consulting (2004b) *St Ives Gold Mine Vertebrate Fauna Assessment 2004*. Unpublished report for St Ives Gold Mining Co Pty Ltd, Kalgoorlie.
- Phoenix Environmental Sciences (2018) *Terrestrial fauna survey for the St Ives Gold Mine Beyond 2018 Project*. Unpublished report for St Ives Gold Mining Company Pty Ltd. Perth.
- Terratree (2016) *Desktop Assessment of Environmental Constraints and Opportunities within Delta Island South and Incredible Project Areas*. Unpublished report for St Ives Gold Mine. Perth
- Terrestrial Ecosystems (2015a) *Level 1 Vertebrate Fauna Risk Assessment for the Baloo Project Area*. Unpublished report for Polar Metals Pty Ltd. Perth.
- Terrestrial Ecosystems (2015b) *Level 1 Vertebrate Fauna Risk Assessment for the Fairplay Pit and Waste Landform Expansion and Development*. Unpublished report for Native Vegetation Solutions, Perth.
- Terrestrial Ecosystems (2015c) *Level 1 Vertebrate Fauna Risk Assessment for the Musket Project*. Unpublished report for Native Vegetation Solutions, Perth.
- Terrestrial Ecosystems (2015d) *Level 1 Vertebrate Fauna Risk Assessment for the Wills Project*. Unpublished report for Native Vegetation Solutions, Perth.
- Terrestrial Ecosystems (2017a) *Level 1 Vertebrate Fauna Risk Assessment for the proposed Higginsville infrastructure corridor development*. Unpublished report for Native Vegetation Solutions, Perth.
- Terrestrial Ecosystems (2017b) *Level 1 Vertebrate Fauna Risk Assessment for the proposed Higginsville powerline*. Unpublished report for Native Vegetation Solutions, Perth.
- Terrestrial Ecosystems (2017c) *Level 1 Vertebrate Fauna Risk Assessment for the proposed Mitchell project area*. Unpublished report for Native Vegetation Solutions, Perth.
- Terrestrial Ecosystems (2018) *Level 1 Vertebrate Fauna Risk Assessment for the Proposed Musket Pipeline Project*. Unpublished report for Native Vegetation Solutions, Perth.
- Thompson, S. (2004) *Mine site rehabilitation index using reptile assemblage as a bio-indicator*, PhD thesis and additional surveys.
- Western Wildlife (2006) *St Ives Gold Fauna Survey; Spring 2005*. Perth.
- Western Wildlife (2013) *Mt Henry Study Area Baseline Fauna Survey: Level 2 Fauna Survey 2012 & 2013 - Final Report*. Unpublished report for Panoramic Resources Limited, Perth.

The most relevant fauna survey data come from the Western Australian Museum (WAM)/Department of Environment Conservation (DEC) eastern Goldfields survey of the Widgiemooltha-Zanthus survey area, the ATA Environmental (2006b), Bamford Consulting Ecologists (2010), Dames and Moore (1999), Keith Lindbeck and Associates (2007), Ninox Wildlife Consulting (2004b) and Western Wildlife (2006, 2013). The McKenzie *et al.* (1993) report is part of the WAM/DEC's Eastern Goldfields survey undertaken in the mid 1980's and the Chapman *et al.* (1991a) report is the results of fauna surveys of four timber reserves that are all nearby. All the GHD reports (2010b, a, 2014, 2015b, a) and Terrestrial Ecosystems reports (2015a, d, b, c, 2017b, c, a, 2018) are

desktop assessments of the vertebrate fauna. In addition, Terrestrial Ecosystems has included in the Thompson (2004) fauna survey data, data collected after Thompson's (2004) PhD was completed. Much of this work has been published or been presented at various workshops and conferences (Thompson 2001, Thompson and Thompson 2002, Thompson 2002, Thompson *et al.* 2003a, Thompson *et al.* 2003b, Thompson *et al.* 2003c, Thompson and Thompson 2003a, Thompson 2003c, a, b, Thompson and Thompson 2003b, Thompson and Thompson 2004a, Thompson 2004, Thompson and Thompson 2004b, Thompson and Thompson 2005a, Thompson and Thompson 2005c, b, Thompson *et al.* 2005a, b, Thompson and Thompson 2006a, Thompson and Thompson 2006c, b, Thompson and Thompson 2006e, d, Thompson and Thompson 2007a, b, Thompson and Thompson 2008).

Data in the Atlas of Living Australia and Western Australian Museum records has also been added to the information contained in Appendix B, and the compilation of the species lists for the project area.

The trapping effort employed during many of these surveys is now considered inadequate to assess species richness or assemblage structure, however, they provide useful contextual information concerning the project area and compiling a species list.

3 METHODOLOGY

3.1 Database searches

A review of the *EPBC* list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government. The search circle had a radius of 50km around a centre point coordinate of -31.7804°S and 121.81512°E (Appendix A). In addition, a desktop search of the Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in relevant sections of the bioregion near the project area. The DBCA threatened and priority species database was searched via the records in NatureMap.

Other more general texts were also used to provide supplementary information on vertebrates in the bioregion, including Tyler *et al.* (2000) for frogs; Storr *et al.* (1983, 1990, 1999, 2002) and Thompson and Thompson (2006e) for reptiles; Johnstone and Storr (1998b, 2004) for birds; and Van Dyck and Strahan (2008) for mammals.

Collectively these sources of information were used to create lists of species expected to utilise the project area and broader bioregion. It should be noted that these lists will include species that have been recorded in the general region but are possibly vagrants and they will not generally be found in the project area due to a lack of suitable habitat (e.g. water and shore birds). Vagrants can be recorded almost anywhere. Many of the records are historical and the species is no longer present in the area (e.g. Malleefowl, Bilby). Many of the bird, mammal, reptile and amphibian species have specific habitat requirements that may be present in the general area but not in the project area. Also, the ecology of many of these species is often not well understood and it can sometimes be difficult to indicate those species whose specific habitat requirements are not present in the project area. Therefore, many species will be included in the lists produced from database searches but will not be present in the actual project area.

There are errors in most databases, including NatureMap, Atlas of Living Australia and the WAM collection. These errors occur because of a misidentification of individuals, taxonomic name changes and incorrect coordinates being entered into the database. Terrestrial Ecosystems was unable to verify the primary records, so it has used the information provided. Readers should therefore appreciate that species lists and fauna surveys reported in the appendices may include these errors.

3.2 Reconnaissance survey

A site visit was undertaken on 27 June 2019 to assess fauna habitat types and condition in the project area. This fauna habitat assessment methodology required the assessor to stop at multiple locations within the project area and to assess a suite of data about the fauna habitat and its condition. This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire.

3.3 Fauna habitat assessment

The fauna habitat assessment was undertaken for the majority of the project area. This field assessment had two foci:

- assessing fauna habitat types and their condition; and
- assessing the possible presence of and recording evidence of conservation significant fauna so that mitigation and management strategies might be implemented to reduce potential impacts.

Dr Scott Thompson, who undertook the site assessment, stopped at multiple locations within the project area and recorded a suite of data about the fauna habitat and its condition. This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire. The following data were assessed at each location as part of the habitat assessment:

Observer's name

Coordinates of the location as UTM (GDA94)

Fire history – options

> 5 years

1-5 years

< 1 year

Landform – options

Beach	Lake / lake edge
Clay plain	Lower slope
Cliff	Mid slope
Creek line	Ridge
Dam	River
Drainage line	Rocky outcrop / breakaway
Dune crest	Salt lake
Dune slope	Sand dune
Dune swale	Sand plain
Escarpment	Stony plain
Flat	Swamp
Gorge	Undulating
Gully	Upper slope
Intertidal / mangrove	Wetland
	Water hole

Habitat quality – options

- *High quality fauna habitat* – 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* - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, 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* – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, 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*– 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, containing 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* – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or no fauna habitat connectivity. Fauna assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.

Habitat structure – combined into habitat description

Upper stratum

Tall open woodland	Scattered tall trees
Tall woodland	Scattered trees
Open woodland	Scattered low trees
Woodland	Low closed forest
Open forest	Low open forest
Closed forest	Low woodland
Tall closed forest	Low open woodland
Tall open forest	

Middle stratum

Shrubland	Open heath
Tall shrubland	Low closed heath
Tall open shrubland	Low open heath
Low shrubland	Tall closed scrub
Scattered low shrubs	Tall open scrub
Low open shrubland	Scattered tall shrubs
Scattered tall shrubs	Open shrubland
Closed heath	Scattered shrubs

Lower stratum

Closed hummock grassland	Closed tussock grassland / sedgeland / herbland
Mid-dense hummock grassland	Tussock grass land / sedgeland / herbland
Hummock grassland	Open tussock grassland / sedgeland / herbland

Open hummock grassland	Scattered tussock / grasses / sedges / herbs
Scattered hummock grassland	Very open tussock grassland / herbland

Soil Type – options

Sand	Clay loam
Loamy sand	Silty clay loam
Clayey sand	Clay
Sandy loam	Rock
Loam	Peat / organic
Silty loam	Stony
Sandy clay loam	

Soil Colour –options

Black	Red
Brown	White
Grey	Yellow
Orange	

Surface stones - options

None	Boulders (>250mm)
Pebbles (0-50mm)	Rocks
Cobbles (51-250mm)	

3.4 Survey and reporting staff

Dr Scott Thompson undertook the site investigation and fauna habitat assessment. The field work was completed with the assistance of Eren Reid from Native Vegetation Solutions. Dr Scott Thompson prepared this report and Dr Graham Thompson reviewed the report before it was sent to the client. Both senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments in the Goldfields, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages based on Goldfields surveys and are therefore appropriately trained and experienced for the task of preparing this assessment. Both Scott and Graham have undertaken multiple surveys and assessments within 50km of the project area and are familiar with the habitat in the project area.

3.5 Taxonomy and nomenclature

Taxonomy and nomenclature for fauna species used in this report are generally based on the WA Museum species list except for bats, which follow Churchill (2008) and birds which follow Christidis and Boles (2008). Terrestrial Ecosystems' has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data are correct and we have only corrected obvious records where the nomenclature was known to be incorrect.

3.6 Limitations

This Level 1 fauna risk assessment is based on information contained in the Commonwealth Government database and other published and unpublished fauna survey data for the bioregion and a site visit. It is acknowledged that multiple surveys conducted in different seasons, repeated over several years are necessary to fully appreciate the fauna assemblage in the project area.

The EPA's (2016) *Technical Guidance Terrestrial Fauna Surveys* suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 1.

Table 1. Fauna survey limitations and constraints

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Competency and experience of the consultant carrying out this assessment	No	The environmental scientists that undertook the site assessment, drafted and reviewed this report are familiar with the vertebrate fauna of this bioregion.
Scope	No	All aspects of the scope of works have been addressed.
Proportion of fauna identified, recorded and/or collected	No	Not applicable.
Accuracy of previous survey work	Yes, negligible	Terrestrial Ecosystems has reported fauna survey data recorded by various authors but is not able to vouch for the accuracy of much of this information. It is acknowledged that the taxonomy of Western Australian vertebrates is continually being revised and the nomenclature of some of the species listed in the appendices may have changed since publication by the authors.
Sources of information	Yes, negligible	Vertebrate fauna information was available from an on-line database and unpublished and published reports of surveys conducted in the bioregion in a variety of habitat types. Many of these surveys employed a low level of trapping effort which significantly impacts on the capacity of these data to represent the fauna assemblages in the areas surveyed.
Proportion of the task achieved	No	All tasks completed.
Timing/weather/season/ cycle	N/A	Weather was fine during the site visit.
Disturbances which affected results of the survey	No	Disturbances in the project area have been factored into this assessment.
Intensity of survey effort	N/A	
Completeness	No	All aspects of this assessment have been completed.
Resources	No	Adequate resources were available.
Remoteness and/or access problems	Yes, negligible	There were no access issues.
Availability of contextual information on the region	No	Fauna survey data are available for the general area and specifically fauna habitats accessed in the project area.

4 RESULTS

4.1 Fauna habitat

There are three broad fauna habitats in the project area:

- open Salmon Gum woodland over sparse chenopods (Plates 1 and 2);
- eucalypt woodland over mixed shrubland and chenopod over scattered grasses of varying densities on a sandy-clay substrate (Plate 3 and 4); and
- mixed sclerophyll shrubland (Plate 5).

There are also areas devoid of vegetation from earlier exploration activity and these areas are of little value as fauna habitat (Plate 6).

The density of trees and shrubs in the relatively undisturbed areas varied across the project area. The fauna habitat quality varies from degraded to good with the more degraded areas due to historical and recent exploration activity. There are a few access tracks and old exploration grid lines in the area, but these are narrow and mostly only wheel tracks.

The area has been grazed by cattle with some areas showing signs of degradation (i.e. cattle tracks, chewed bushes and shrubs, etc). There was extensive evidence of rabbits and other feral fauna in the area.



Plate 1. Open Salmon Gum woodland over sparse chenopods



Plate 2. Open Salmon Gum woodland over sparse chenopods



Plate 3. Eucalypt woodland over mixed shrubland and chenopod over scattered grasses of varying densities on a sandy-clay substrate



Plate 4. Eucalypt woodland over mixed shrubland and chenopod over scattered grasses of varying densities on a sandy-clay substrate



Plate 5. Mixed sclerophyll shrubland



Plate 6. Highly disturbed

4.2 Bioregional vertebrate fauna assemblage

Appendix B provides a summary of the fauna survey data that are available near the project area. There are appreciable differences in the recorded fauna assemblages within and among fauna surveys shown in Appendix B. These differences are partially due to the low survey effort deployed by some of the surveys and they also reflect variations in soils and vegetation as well as temporal variations in the fauna assemblages.

Tables 2-5 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey report results shown in Appendix B.

Table 2. Birds potentially found near the project area

Family	Species	Common Name
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite
	<i>Haliastur sphenurus</i>	Whistling Kite
	<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Aquila audax</i>	Wedge-tailed Eagle
Anatidae	<i>Hieraaetus morphnoides</i>	Little Eagle
	<i>Cygnus atratus</i>	Black Swan
	<i>Tadorna tadornoides</i>	Australian Shelduck
	<i>Chenonetta jubata</i>	Australian Wood Duck
	<i>Anas gracilis</i>	Grey Teal
Aegothelidae	<i>Anas superciliosa</i>	Pacific Black Duck
	<i>Aythya australis</i>	Hardhead
	<i>Aegotheles cristatus</i>	Australian Owllet-nightjar
	<i>Podargus strigoides</i>	Tawny Frogmouth
	<i>Dromaius novaehollandiae</i>	Emu
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover
	<i>Charadrius australis</i>	Inland Dotterel
	<i>Euseyornis melanops</i>	Black-fronted Dotterel
	<i>Erythrogomys cinctus</i>	Red-kneed Dotterel
	<i>Vanellus tricolor</i>	Banded Lapwing
Laridae	<i>Chroicocephalus novaehollandiae</i>	Silver Gull
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet
Scolopacidae	<i>Cladorhynchus leucocephalus</i>	Banded Stilt
	<i>Tringa nebularia</i>	Common Greenshank
Columbidae	<i>Streptopelia senegalensis</i>	Laughing Dove
	<i>Phaps chalcoptera</i>	Common Bronzewing
	<i>Phaps elegans</i>	Brush Bronzewing
Alcedinidae	<i>Ocyphaps lophotes</i>	Crested Pigeon
	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
	<i>Todiramphus sanctus</i>	Sacred Kingfisher
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
	<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo
Cuculidae	<i>Chalcites osculans</i>	Black-eared Cuckoo
	<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo
	<i>Cacomantis pallidus</i>	Pallid Cuckoo
	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo
	<i>Eurostopodus argus</i>	Spotted Nightjar
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel
	<i>Falco berigora</i>	Brown Falcon
	<i>Falco peregrinus</i>	Peregrine Falcon
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl

Family	Species	Common Name	
Rallidae	<i>Fulica atra</i>	Eurasian Coot	
Acanthizidae	<i>Sericornis frontalis</i>	White-browed Scrubwren	
	<i>Hylacola cauta</i>	Shy Heathwren	
	<i>Calamanthus campestris</i>	Rufous Fieldwren	
	<i>Pyrrholaemus brunneus</i>	Redthroat	
	<i>Smicromis brevirostris</i>	Weebill	
	<i>Gerygone fusca</i>	Western Gerygone	
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill	
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	
	<i>Acanthiza apicalis</i>	Inland Thornbill	
	<i>Aphelocephala leucopsis</i>	Southern Whiteface	
Artamidae	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	
	<i>Artamus personatus</i>	Masked Woodswallow	
	<i>Artamus cinereus</i>	Black-faced Woodswallow	
	<i>Artamus cyanopterus</i>	Dusky Woodswallow	
	<i>Cracticus torquatus</i>	Grey Butcherbird	
	<i>Cracticus nigrogularis</i>	Pied Butcherbird	
	<i>Cracticus tibicen</i>	Australian Magpie	
	<i>Strepera versicolor</i>	Grey Currawong	
	Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-Shrike
		<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike
<i>Lalage tricolor</i>		White-winged Triller	
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper	
Corvidae	<i>Corvus coronoides</i>	Australian Raven	
	<i>Corvus bennetti</i>	Little Crow	
	<i>Corvus orru</i>	Torresian Crow	
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch	
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow	
	<i>Hirundo neoxena</i>	Welcome Swallow	
	<i>Petrochelidon nigricans</i>	Tree Martin	
Maluridae	<i>Petrochelidon ariel</i>	Fairy Martin	
	<i>Malurus splendens</i>	Splendid Fairy-wren	
	<i>Malurus leucopterus</i>	White-winged Fairy-wren	
	<i>Malurus lamberti</i>	Variigated Fairy-wren	
	<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren	
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater	
	<i>Lichenostomus leucotis</i>	White-eared Honeyeater	
	<i>Lichenostomus flavicollis</i>	Yellow-throated Honeyeater	
	<i>Lichenostomus cratitius</i>	Purple-gaped Honeyeater	

Family	Species	Common Name
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater
	<i>Purnella albifrons</i>	White-fronted Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Anthochaera carunculata</i>	Red Wattlebird
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Epthianura albifrons</i>	White-fronted Chat
	<i>Sugomel niger</i>	Black Honeyeater
	<i>Gliciphila melanops</i>	Tawny-crowned Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater
	<i>Myiagra inquieta</i>	Restless Flycatcher
	<i>Grallina cyanoleuca</i>	Magpie-Lark
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit
Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Pachycephalidae	<i>Pachycephala inornata</i>	Gilbert's Whistler
	<i>Pachycephala pectoralis</i>	Golden Whistler
	<i>Pachycephala rufiventris</i>	Rufous Whistler
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush
	<i>Oreoica gutturalis</i>	Crested Bellbird
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote
	<i>Pardalotus striatus</i>	Striated Pardalote

Family	Species	Common Name
Petroicidae	<i>Microeca fascians</i>	Jacky Winter
	<i>Petroica goodenovii</i>	Red-capped Robin
	<i>Melanodryas cucullata</i>	Hooded Robin
	<i>Eopsaltria australis</i>	Eastern Yellow Robin
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin
	<i>Drymodes superciliosus</i>	Northern Scrub-robin
	<i>Drymodes brunneopygia</i>	Southern Scrub-robin
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Psophodidae	<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush
Rhipiduridae	<i>Rhipidura fuliginosa</i>	Grey Fantail
	<i>Rhipidura leucophrys</i>	Willie Wagtail
Timaliidae	<i>Zosterops lateralis</i>	Silvereye
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
Podicipedidae	<i>Polioccephalus polioccephalus</i>	Hoary-headed Grebe
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah
	<i>Nymphicus hollandicus</i>	Cockatiel
Psittacidae	<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet
	<i>Polytelis anthoepus</i>	Regent Parrot
	<i>Platycercus icterotis</i>	Western Rosella
	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Psephodus varius</i>	Mulga Parrot
	<i>Melopsittacus undulatus</i>	Budgerigar
	<i>Neophema splendida</i>	Scarlet-chested Parrot
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook

Table 3. Amphibians potentially found near the project area

Family	Species	Common Name
Limnodynastidae	<i>Limnodynastes dorsalis</i>	Western Banjo Frog
	<i>Neobatrachus albigipes</i>	White-footed Trilling Frog
	<i>Neobatrachus centralis</i>	
	<i>Neobatrachus kunapalari</i>	Kunapalari Frog
	<i>Neobatrachus pelobatoides</i>	Humming Frog

Family	Species	Common Name
	<i>Neobatrachus sutor</i>	Shoemaker Frog
Myobatrachidae	<i>Crinia pseudisignifera</i>	Bleating Froglet
	<i>Pseudophryne guentheri</i>	Crawling Toadlet
	<i>Pseudophryne occidentalis</i>	Western Toadlet

Table 4. Mammals potentially found near the project area

Family	Species	Common Name
Bovidae	<i>Capra hircus</i>	Goat
	<i>Ovis aries</i>	Sheep
Canidae	<i>Canis lupus familiaris</i>	Dog
	<i>Vulpes vulpes</i>	Red Fox
Felidae	<i>Felis catus</i>	House Cat
Molossidae	<i>Austronomus australis</i>	White-striped Free-tail Bat
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
	<i>Nyctophilus major</i>	Greater Long-eared Bat
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat
	<i>Vespadelus regulus</i>	Southern Forest Bat
Dasyuridae	<i>Ningauai ridei</i>	Wongai Ningauai
	<i>Ningauai yvonneae</i>	Mallee Ningauai
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart
	<i>Sminthopsis gilberti</i>	Gilbert's Dunnart

Family	Species	Common Name
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart
Burramyidae	<i>Cercartetus concinnus</i>	Southwestern Pygmy Possum
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo
	<i>Macropus irma</i>	Western Brush Wallaby
	<i>Macropus robustus</i>	Wallaroo or Euro
	<i>Macropus rufus</i>	Red Kangaroo
Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
Equidae	<i>Equus caballus</i>	Domestic Horse
Muridae	<i>Mus musculus</i>	House Mouse
	<i>Notomys alexis</i>	Spinifex Hopping Mouse
	<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse
	<i>Pseudomys albocinereus</i>	Ash-grey Mouse
	<i>Pseudomys bolami</i>	Bolam's Mouse
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse
	<i>Rattus fuscipes</i>	Bush Rat
	<i>Rattus rattus</i>	Black Rat

Table 5. Reptiles potentially found near the project area

Family	Species	Common Name
Agamidae	<i>Ctenophorus adelaidensis</i>	Southern Heath Dragon
	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon
	<i>Ctenophorus cristatus</i>	Bicycle Dragon
	<i>Ctenophorus fordi</i>	Mallee Sand Dragon
	<i>Ctenophorus isolepis</i>	Crested Dragon
	<i>Ctenophorus maculatus</i>	Spotted Military Dragon
	<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon
	<i>Ctenophorus salinarum</i>	Salt Pan Dragon
	<i>Ctenophorus scutulatus</i>	
	<i>Moloch horridus</i>	Thorny Devil
	<i>Pogona minor</i>	Bearded Dragon
	<i>Tympanocryptis cephalus</i>	Pebble Dragon

Family	Species	Common Name
Boidae	<i>Morelia spilota imbricata</i>	Carpet Python
Carphodactylidae	<i>Nephrurus laevisimus</i>	
	<i>Nephrurus vertebralis</i>	
	<i>Underwoodisaurus milii</i>	Barking Gecko
Diplodactylidae	<i>Crenadactylus ocellatus</i>	Clawless Gecko
	<i>Diplodactylus granariensis</i>	
	<i>Diplodactylus pulcher</i>	
	<i>Lucasium maini</i>	
	<i>Oedura reticulata</i>	
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko
	<i>Strophurus elderi</i>	
	<i>Strophurus intermedius</i>	
	<i>Strophurus strophurus</i>	
Elapidae	<i>Brachyurophis fasciolata</i>	

Family	Species	Common Name
	<i>Brachyuropis semifasciata</i>	
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake
	<i>Furina ornata</i>	Moon Snake
	<i>Neelaps bimaculatus</i>	Black-naped Snake
	<i>Parasuta gouldii</i>	
	<i>Parasuta monachus</i>	
	<i>Parasuta nigriceps</i>	
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudonaja affinis</i>	Dugite
	<i>Pseudonaja mengdeni</i>	Gwardar
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake
	<i>Simoselaps semifasciata</i>	
	<i>Suta fasciata</i>	Rosen's Snake
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko
	<i>Gehyra purpurascens</i>	
	<i>Gehyra variegata</i>	
	<i>Heteronotia binoei</i>	Bynoe's Gecko
	<i>Rhynchoedura ornata</i>	Beaked Gecko
Pygopodidae	<i>Delma australis</i>	
	<i>Delma butleri</i>	
	<i>Delma fraseri</i>	
	<i>Delma nasuta</i>	
	<i>Lialis burtonis</i>	
	<i>Pygopus lepidopus</i>	Common Scaly Foot
Scincidae	<i>Cryptoblepharus buchananii</i>	
	<i>Ctenotus atlas</i>	
	<i>Ctenotus leonhardii</i>	
	<i>Ctenotus mimetes</i>	
	<i>Ctenotus schomburgkii</i>	
	<i>Ctenotus severus</i>	
	<i>Ctenotus uber</i>	
	<i>Cyclodomorphus branchialis</i>	
	<i>Cyclodomorphus melanops</i>	Slender Blue-tongue
	<i>Egernia carinata</i>	
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink
	<i>Egernia formosa</i>	
	<i>Egernia multiscutata</i>	
	<i>Egernia richardi</i>	
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer
	<i>Hemiergis initialis</i>	
	<i>Hemiergis millewae</i>	
	<i>Hemiergis peronii</i>	
	<i>Lerista distinguenda</i>	
	<i>Lerista dorsalis</i>	
	<i>Lerista kingi</i>	
	<i>Lerista picturata</i>	
	<i>Lerista taeniata</i>	
	<i>Lerista terdigitata</i>	
	<i>Lerista tridactyla</i>	
	<i>Liopholis inornata</i>	
	<i>Menetia greyii</i>	
	<i>Morethia adelaidensis</i>	
	<i>Morethia butleri</i>	
	<i>Morethia obscura</i>	
	<i>Tiliqua occipitalis</i>	Western Bluetongue
	<i>Tiliqua rugosa</i>	Bobtail
Typhlopidae	<i>Anilius australis</i>	
	<i>Anilius bicolor</i>	
	<i>Anilius bituberculatus</i>	
	<i>Anilius hamatus</i>	
Varanidae	<i>Varanus caudolineatus</i>	
	<i>Varanus gouldii</i>	Bungarra or Sand Monitor
	<i>Varanus rosenbergi</i>	Heath Monitor
	<i>Varanus tristis</i>	Racehorse Monitor

4.3 Conservation significant fauna

Conservation significant fauna are protected by the Commonwealth *EPBC Act 1999*, and this list includes species covered by international treaties such as the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA) and the Western Australia (WA) *BC Act 2016*. The WA *BC Act 2016* provides for the publishing of the *Wildlife Conservation (Specially Protected Fauna) Notice* that lists species under multiple categories. In addition, DBCA maintains a list of fauna that require monitoring under four priorities based on the current knowledge of their distribution, abundance and threatening processes. The *EPBC Act 1999* and *BC Act 2016* imply legislative requirements for the management of anthropogenic impacts to minimise the effects of disturbances on species and their habitats. Priority species have no statutory protection, other than the DBCA wishes to monitor potential impacts on these species. Environmental consultants and proponents of developments are encouraged to avoid and minimise impacts on these species. Definitions of the significant fauna under the *BC Act 2016* are provided in Appendix C.

The fauna species that have special status in either State or Commonwealth government legislation or are on the DBCA Priority species list and are potentially present in the vicinity of the project area are listed in Table 6. Although they were recorded in the search of the MNES online database, migratory species that typically would be found around the edges of salt lakes, clay pans, estuaries and marshes have been excluded from Table 6 as there is no suitable habitat nearby.

Four threatened species of fauna and three migratory species of birds were identified under the *EPBC Act 1999* as potentially occurring in the project area or surrounds. There is one Schedule 7 species as listed under the *BC Act 2016* and three species listed on the DBCA's Threatened and Priority Fauna List that potentially occur in the project area or surrounds. The following is an assessment of the likelihood of each of the species listed in Table 6 being found in the project area and their potential to be impacted by clearing of vegetation.

Listed marine and shorebird species have been excluded from this list as there is no suitable habitat in the project area.

Table 6. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCA Schedule / Priority	Status under Commonwealth <i>EPBC Act</i>	Comment on the potential presence of a species
Arid Bronze Azure Butterfly <i>Ogyris subterrestris petrina</i>	Critically Endangered	Critically Endangered	Unlikely to be in the project area due to a lack of recent records and unsuitable habitat.
Night Parrot <i>(Pezoporus occidentalis)</i>	Critically Endangered	Endangered	Highly unlikely to occur in the project area.
Malleefowl <i>(Leipoa ocellata)</i>	Vulnerable	Vulnerable	No mounds recorded in the project area.
Chuditch <i>(Dasyurus geoffroii)</i>	Vulnerable	Vulnerable	Highly unlikely to occur in the project area.
<i>Jalmenus aridus</i> (butterfly)	Priority 1		Unlikely to be in the project area due to a lack of recent records and unsuitable habitat.
Western Rosella <i>Platycercus icterotis xanthogenys</i> (Mallee)	Priority 4		Potentially in the region.
Central Long-eared Bat <i>Nyctophilus major tor</i>	Priority 4		Potentially in the project area.
Oriental Plover <i>(Charadrius veredus)</i>	Migratory	Migratory	May infrequently be seen in the region.
Fork-tailed Swift <i>(Apus pacificus)</i>	Migratory	Migratory	May infrequently be seen in the region.
Grey Wagtail <i>(Motacilla cinerea)</i>	Migratory	Migratory	Highly unlikely to be seen in the project area.
Peregrine Falcon <i>(Falco peregrinus)</i>	Schedule 7		May infrequently be seen in the area.

Results of the Commonwealth *EPBC Act 1999* protected matters database search are provided in Appendix A.

Arid Bronze Azure Butterfly (*Ogyris subterrestris petrina*) – Critically endangered under the *BC Act 2016* and *EPBC Act 1999*

This butterfly is associated with colonies of the ant *Camponotus terebrans* in mallee vegetation on sandy soil, often near flood plains, and typically digs its nest at the base of eucalypts. Larvae hatching from eggs laid near ant nest entrances (often near the bases of various mallee eucalypts) are carried by the ants into their nest. Details of its biology and of any form of herbivory by the larvae are unknown; however, it is likely that the larvae are myrmecophagous (*Camponotus terebrans*). These butterflies fly close to the ground, and have been observed flying over agricultural lands near presumed breeding colonies. It is known from Lake Douglas, about 12kms south-west of Kalgoorlie (Field 1999) and in the Barbalin Nature Reserve (approximately 11km west of Mukinbudin) in the Avon Wheatbelt (Threatened Species Scientific Committee 2014) .

It is unlikely that this butterfly is in the project area as there are no records of it nearby. Terrestrial Ecosystems' assessment is that vegetation clearing in the project area is unlikely to have a significant impact on this species.

Night Parrot (*Pezoporus occidentalis*) – Critically endangered under the *BC Act 2016* and Endangered under the *EPBC Act 1999*

The Night Parrot is a small, arid-adapted, nocturnal, ground-feeding parrot (Johnstone and Storr 1998a, Threatened Species Scientific Committee 2016). Its length is 22-25cm with a body mass of approximately 104g (Threatened Species Scientific Committee 2016), although it was suggested that they were semi-nomadic, the Night Parrots in south-western Queensland appear to be sedentary (Murphy 2015).

The Night Parrot was probably originally distributed over much of semi-arid and arid Australia (Garnett et al. 2011, Threatened Species Scientific Committee 2016). Recordings in north-west and western Queensland in the early 1990-2000s were in a broad cross section of the habitats available (Garnett et al. 1993, Cupitt and Cupitt 2008, Boles et al. 2016). There have been recent sightings in the Pilbara in 1980, 2005 and 2017, central WA in 1979, north-eastern South Australia in 1979, western Queensland (including Pullen-Pullen-Mt Windsor-Diamantina population) in 1980, 1990, 1993, 2006 and 2013-17 (Davis and Metcalf 2008, Garnett et al. 2011, Charalambous 2016, Pickrell 2016, AG staff 2017, Palaszczuk and Miles 2017, Rykers 2017, AG staff 2018), Pilbara in 2017 (Jones 2017) and the northern Goldfields (Jackett et al. 2017). Garnett et al. (2011) suggested that there were between 50-250 mature individuals in less than 5% of its previous range.

Wilson's (1937) summary of observations provided information on the early records of Night Parrots' preferred habitat and breeding sites. Recent information indicates its preferred habitat appears to be in *Triodia* grasslands, chenopod shrublands, shrubby samphire and floristically diverse habitats dominated by large-seeded species (Threatened Species Scientific Committee 2016, McCarthy 2017, Murphy et al. 2017b). At Pullen Pullen Reserve it nests in large, more or less ring-shaped *Triodia*, and the nest consists of a tunnel (25-30° and 0° to the ground; 20-33cm long) through an apron of dead spinifex leaves that leads to a chamber under a live hummock, with a shallow depression (3-4cm) excavated into the gravelly/sandy soil (Murphy et al. 2017a). In the northern Goldfields the nest was again in a spinifex hummock, it was circular, with an excavated depression (~1.5-2.0cm) in sandy substrate (Hamilton et al. 2017, Jackett et al. 2017). The entrance tunnel was 62cm long, and was downward sloping (27°) with the entrance 28cm above the ground (Hamilton et al. 2017). It has clutches of two to four sub-elliptical, white eggs with a lustrous appearance (Murphy et al. 2017a). Breeding followed significant rains in March for the observations in Pullen-Pullen Reserve and in April in the northern Goldfields (Hamilton et al. 2017, Murphy et al. 2017a), but it is thought that breeding generally occurs between April and October (Murphy et al. 2017a).

Murphy et al. (2017b) placed a GPS tag on Night Parrots and reported that the two birds called at dusk from their diurnal roosts among spinifex hummocks and then flew to more floristically diverse habitats dominated by large-seeded, prolifically seeding species to feed.

There are no recent Night Parrot records near the project area, and there are no old large spinifex hummocks in the project area. As the preferred roosting and nesting sites for Night Parrots are not present in the project area, it is Terrestrial Ecosystems' assessment that Night Parrots are not present in the project area.

Malleefowl (*Leipoa ocellata*) – Vulnerable under the *BC Act 2016* and *EPBC Act 1999*

Malleefowl are large, ground-dwelling birds that rarely fly unless alarmed or are perching for the night. Historically, Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Prior to vegetation clearing for agriculture, Malleefowl were abundant in the WA Wheatbelt. Vegetation clearing for agriculture also opened adjacent bushland to predators, and in the south-west of WA, Malleefowl often only persist in isolated remnant patches of native vegetation. Sheep and other herbivores (e.g. goats, kangaroos) grazing in remnant vegetation removes or thins the undergrowth, and they also compete with Malleefowl for herbaceous foods and can cause changes to the structure and floristic diversity of foraging habitats (Benshemesh 2007).

Malleefowl and their eggs are vulnerable to predation by foxes, and newly hatched chicks are vulnerable to foxes, cats and raptors (Priddel and Wheeler 1990, 1997, Benshemesh and Burton 1999, Benshemesh 2007, Lewis and Hines 2014). Their abundance in the Goldfields is low and they are sparsely distributed, favouring those areas that are more densely vegetated. Malleefowl build distinctive nests that comprise a large mound of soil/rock covering a central core of leaf litter. These nest mounds range in diameter but can span more than five metres and may be up to one metre high. Malleefowl are generally monogamous and once breeding commences they pair for life. The presence of nest mounds provides an indication of the presence of Malleefowl in the area.

Malleefowl have been observed in the bioregion, however, there are no recent records of active breeding mounds in the vicinity of the project area. Open fauna habitat and presence of feral and pest species significantly reduce the probability of Malleefowl utilising the project area. As a consequence, Terrestrial Ecosystems' assessment is that vegetation clearing in the project area is unlikely to have any significant impact on this species.

Chuditch (*Dasyurus geoffroii*) – Vulnerable under the *BC Act 2016* and *EPBC Act 1999*.

The Chuditch is the largest extant carnivorous marsupial in WA. It is usually active from dusk to dawn. Formally known from over 70% of Australia, the Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of south-west WA and other isolated areas. Chuditch are solitary animals for most of their life and den in hollow logs, burrows, culverts, etc. and have also been recorded in tree hollows and rock cavities. Chuditch are opportunistic feeders, and forage primarily on the ground at night. Their diet can include other mammals, birds, lizards, bird and reptile eggs but the majority is a mixture of large invertebrates (e.g. spiders, scorpions and crickets).

How *et al.* (1988) reported Chuditch being found near the Norseman-Lake King Road and near Mount Holland. DBCA records show that one specimen was recorded in 1974 in Kambalda East. There are records south of Southern Cross and Marvel Loch and there have been other reported sightings east of Kambalda and near Norseman. It is therefore possible that this species is in the bioregion, and this could only be verified with an extensive trapping or camera trapping program. As the project area is north-east of the species known distribution it is unlikely that the Chuditch would be found in the project area. As a consequence, Terrestrial Ecosystems' assessment is that vegetation clearing in the project area is unlikely to have any significant impact on this species.

Jalmenus aridus - Priority 1 with the DBCA

Caterpillars of this butterfly are green with some red and white lines along the body, and it has a black head and tail. This species is known to feed on the foliage of *Senna* sp. and *Acacia tetragonophylla*. DBCA reported sightings of this species in the vicinity of Lake Douglas, west of Kalgoorlie. *Jalmenus aridus* is known from only a single colony, on a single *Acacia* tree. Subsequent searches have failed to reveal additional colonies.

It is Terrestrial Ecosystems' assessment that vegetation clearing of the project area is unlikely to have a significant impact on this species as it is highly unlikely to be in the project area.

Western Rosella (*Platycercus icterotis xanthogenys*) – Priority 4 with the DBCA

The mallee form of the Western Rosella is found mostly in eucalypt and *Casuarina* woodland and shrub lands, especially Wandoo, Flooded Gums and Salmon Gums. This species was sighted by Dames and Moore (1999) around Lake Lefroy, Outback Ecology Services (2009) at Randalls and it was reported by Dell and How (1984) in the

biological survey of Widgiemooltha. A search of NatureMap indicated that they have been recorded in the vicinity of Kalgoorlie.

It is possible that this species could be infrequently seen in the project area. However, given that the project area represents a very small fraction of similar habitat in adjacent areas, it is Terrestrial Ecosystems' assessment that vegetation clearing in the project area is unlikely to have a significant impact on this species.

Central Long-eared Bat (*Nyctophilus major tor*) – Priority 4 with the DBCA

This species is probably the species referred to by Churchill (2008) as the Central Long-eared Bat (*Nyctophilus major tor*). Records in the Atlas of Living Australia indicated this species has been found west of Kalgoorlie and in other areas in the Goldfields and the Wheatbelt. It roosts in tree cavities, foliage and under loose bark.

Given that project area represents a very small fraction of similar habitat in the general area, it is Terrestrial Ecosystems' assessment that vegetation clearing in the project area is unlikely to have a significant impact on this species.

Oriental Plover (*Charadrius veredus*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

A migrant species with patchy distribution in Australia, the Oriental Plover is sparsely distributed across arid and semi-arid Australia but avoids truly desert regions. Its preferred habitat is dry plains. The species is under threat because of habitat reduction due to agriculture and changing fire regimes. The Oriental Plover has not been recorded in the general area during any of the other regional surveys.

Terrestrial Ecosystems' assessment is that the Oriental Plover is unlikely to be seen in the project area, due to a lack of previous records in the general area.

Fork-tailed Swift (*Apus pacificus*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

This species breeds in the northeast and mid-east Asia and 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 is an almost exclusively aerial species, foraging and sleeping on the wing. It rarely comes to ground, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields.

Terrestrial Ecosystems' assessment is that the Fork-tailed Swift may infrequently be seen in the project area. However, the proposed vegetation clearing is unlikely to significantly impact on this species as it will move away to other areas if it is disturbed.

Grey Wagtail (*Motacilla cinerea*) - Migratory species under the *EPBC Act 1999* and *BC Act 2016*

The Grey Wagtail is a small yellow breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species as breeding in Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. Its preferred habitat in Australia is banks and rocks in fast-running fresh water including rivers, streams and creeks where it feeds on insects. The Atlas of Living Australia records two sightings on the south-coast of Western Australia and none around the project area.

It is highly unlikely to be seen in the project area due to a lack of records and suitable habitat.

Peregrine Falcon (*Falco peregrinus*) – Other specially protected fauna under the *BC Act 2016*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It favours hilly or mountainous country and open woodlands and may be an occasional visitor to the project area. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any

change in status in the last 50 years. A Peregrine Falcon was seen at the Randalls Timber Reserve (Ninox Wildlife Consulting 1998) and around St Ives mine (Dames and Moore 1999, Ninox Wildlife Consulting 2004b) and during the Widgiemooltha biological survey (Dell and How 1984), so they are in the region. It could therefore infrequently be seen in the project area.

It is Terrestrial Ecosystems' assessment that vegetation clearing in the project area is unlikely to have a significant impact on this species as the bird will readily move away from disturbance and there are abundant areas of similar habitat in the region.

5 DISCUSSION

5.1 Adequacy of the fauna survey data for fauna habitats represented in the project area

The EPA's (2016) *Technical Guidance on Terrestrial Fauna* indicated that a Level 2 fauna assessment is required for a disturbance area of in excess of 75ha in this bioregion. The project area is greater than 75ha, so the disturbance exceeds one of the criterion to require a Level 2 survey in the Coolgardie IBRA bioregion, however, fauna survey data provided by the Western Australian Museum (WAM)/Department of Environment Conservation (DEC) eastern Goldfields survey of the Widgiemooltha-Zanthus survey area, ATA Environmental (2006b), Bamford Consulting Ecologists (2010), Dames and Moore (1999), Keith Lindbeck and Associates (2007), Ninnox Wildlife Consulting (2004b) and Western Wildlife (2006, 2013) provide a good indication of the vertebrate fauna assemblage in the project area. The McKenzie *et al.* (1993) report is part of the WAM/DEC's Eastern Goldfields survey undertaken in the mid 1980's and the Chapman *et al.* (1991a) report is the results of fauna surveys of four timber reserves that are all nearby. In addition, Thompson (2004b) has provided in excess of 120,000 pit/funnel trap-nights of data in fauna habitats that are present in the project area, so the results of this survey alone are much more comprehensive than is typically undertaken for a Level 2 fauna assessment.

Although the project area is larger than 75ha, given the fauna survey data that are available nearby and the level of existing disturbance in the project area, there is sufficient information on the fauna assemblages to enable potential impacts to be assessed and additional on-the-ground surveys are not required. It is unlikely that a Level 2 vertebrate fauna survey in the project area will provide new species not previously identified for this area that would alter the assessment of potential impacts. However, as with all surveys, until it is completed the outcome is unknown.

5.1.1 Amphibians

Amphibians typically found in eucalypt woodlands in the Goldfields are listed in Table 3. Frogs are normally only detected immediately after rainfall or around semi-permanent pools. It is likely that *Cyclorana maini*, *Pseudophryne occidentalis*, *Neobatrachus kunapalari* and *Neobatrachus wilsmorei* would be found in the general area. These species, other than *P. occidentalis*, burrow into the ground and aestivate between rainfall events. *Pseudophryne occidentalis* find shelter under rocks and in crevices during the dry periods and enter temporary ponds to breed after major rainfall events. All four species have a wide-spread distribution and are abundant. Clearing vegetation is likely to result in a loss of individuals within the disturbed area, however, is unlikely to have a significant impact on these species when assessed in a regional context. There are no conservation significant amphibians in the Goldfields.

5.1.2 Reptiles

Reptile species richness in the project area will be comparable with similar eucalypt woodlands elsewhere in the bioregion. The list provided in Appendix B represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands would typically support up to 40 species of reptiles, but many of these would be in low abundance (see Table 5). Fauna habitats in the project area are likely to be similar to that in the adjacent areas, so the loss of reptiles during vegetation clearing is unlikely to be significant in a bioregional context.

Terrestrial Ecosystems' view is that the proposed clearing of the project area is unlikely to significantly impact on the reptile fauna of the bioregion.

5.1.3 Birds

Avian species richness in the Goldfields is influenced by rainfall and is generally higher in woodlands compared with chenopod shrublands and more sparsely vegetated areas. The list provided in Table 2 represents species likely to be found over a large area of diverse habitat types. Eucalypt woodlands would typically support up to 50-70 species of birds, but many of these would be in very low numbers (see Appendix B) and are only present after significant rainfall. Birds typically move from an area once vegetation clearing commences, so the impact is relatively low if the area is small. However, eggs and chicks in nests are often lost during the clearing process.

Predation by feral cats, foxes and wild dogs has significantly reduced the abundance of Malleefowl in the Goldfields and there are a few remaining small populations, mostly in areas of dense shrubland, as the dense vegetation provides the adult birds with some protection from predators. There are no active Malleefowl mounds in the project area.

The Peregrine Falcon will normally have a very large home range in the Goldfields and clearing a small section of the project area, particularly when similar habitat exists in the adjacent areas, is unlikely to significantly impact on this species.

Terrestrial Ecosystems' view is that the proposed clearing is unlikely to significantly impact on the avian fauna of the bioregion.

5.1.4 Mammals

The diversity of small terrestrial mammals potentially caught in the project area would be low due the sparsely vegetated habitat. Although, records of Numbats (*Myrmecobius fasciatus*), Burrowing Bettongs (*Bettongia lesueur*) and Bilbies (*Macrotis lagotis*) are shown in the Atlas of Living Australia and Western Australian Museum records (Appendix B), they are no longer present in this region, having been predated on by foxes, cats and dogs many years ago. None of the mammals potentially found in the project area are of conservation significance and the loss of small mammals during vegetation clearing is unlikely to be significant in a bioregional context.

It was noted during the site visit that there was evidence of rabbits, feral cats, foxes and dogs in the project area and surrounds.

5.2 Biodiversity value of the project area

An ecological assessment of a site should consider its biodiversity value at the genetic, species and ecosystem levels, and its ecological functional value at the ecosystem level. There are inadequate data to assess the ecological value at the genetic level.

Fauna habitat types represented in the project area are abundant and in similar condition in adjacent areas. Therefore, the fauna assemblage that is present in the project area will also be present and abundant in the adjacent areas. The available fauna survey data (Appendix B) provides a good indication of the vertebrate fauna that are potentially in the project area.

5.2.1 Ecological functional value at the ecosystem level

Much of the project area has been highly disturbed by previous mining or exploration activity, with the consequence that the project area will have a depleted vertebrate fauna assemblage. The most significant impact on vertebrate fauna in the project area and surrounds will have been feral cats, foxes and wild dogs. Goats have heavily grazed some areas, and this would have impacted the vertebrate fauna assemblages, but the recent increase in the wild dog population has reduced the abundance of feral goats.

5.2.2 Maintenance of threatened ecological communities

No threatened ecological fauna communities were identified in the project area.

5.2.3 Condition of fauna habitat

Some of the project area has been disturbed due to historical development activity (i.e. tracks, exploration and fences). There is also extensive evidence of disturbance by cattle and the presence of rabbits and cats. There is a large area of recent exploration which has degraded the habitat. The uncleared fauna habitat present in the project area is similar to many square kilometres of adjacent habitat; the clearing of vegetation is therefore unlikely to have a significant impact on the vertebrate fauna when considered in a bioregional context.

5.2.4 Ecological linkages

The project area does not provide an important ecological linkage or fauna movement corridor.

5.2.5 Size and scale of the proposed disturbance

The project area is a small proportion of similar habitat found in the adjacent area and region. Given the available fauna survey data for these habitat types, no additional surveys are warranted.

5.2.6 Abundance and distribution of similar habitat in the adjacent areas

Fauna habitats present in the project area are abundant in adjacent areas. It is therefore likely that the fauna assemblage in the project area is similar to the many square kilometres of similar habitat in adjacent areas and the bioregion.

5.2.7 Potential impacts on ecosystem function

Clearing native vegetation is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process. The few larger animals, such as kangaroos and large goannas, and most of the birds will move into adjacent areas once clearing commences. Shifting animals into adjacent areas will increase the pressure on resources in those areas and it is likely that there will be some disruption to the ecosystems in these areas for a period until a balance is restored.

Impacts associated with clearing vegetation in the project area in a landscape or bioregional context on the vertebrate fauna are likely to be low as the proposed disturbance area is small relative to the quantity of similar habitat in the bioregion.

6 POTENTIAL ENVIRONMENTAL IMPACTS

Clearing of vegetation will potentially affect vertebrate fauna in numerous ways, including death/injury of fauna during clearing, grading and impacts with vehicles and the loss of habitat.

Although there are anticipated short term impacts on fauna, they are not considered to result in significant impacts on fauna habitat and fauna assemblages in the long term. The overall impact on fauna species and species of conservation significance will be minimal provided the recommended management procedures are implemented and adhered to.

6.1 Direct impacts

Clearing vegetation and activities associated with the development will result in the loss of small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which may result in these individuals being adversely impacted when they attempt to escape. This loss of vegetation is unlikely to have a significant impact when considered in a bioregional context.

Clearing linear corridors and other large areas increases fauna habitat edges. Small mammals can respond both positively and negatively to edges depending on their ecological traits (Laurance 1991, 1994, Goosem and Marsh 1997, Goosem 2000). Edge and disturbance effects can lead to altered and most often higher levels of predation, restricting or increasing fauna movements and altering assemblage structure (Oxley et al. 1974, Paton 1994, Baker et al. 1998, Temple 1998, Luck et al. 1999, Goosem et al. 2001). Goldingay and Whelan (1997) and Clarke and Oldland (2007) reported that edge effects can extend up to 150-200m from the edge for some species, meaning the impact area on vertebrate fauna is likely to be larger than the cleared footprint.

Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area.

6.1.1 Animal deaths during the clearing process and displacement of fauna

Clearing vegetation and activities associated with the mining development will result in the loss of small fauna that retreat to burrows, such as reptiles and mammals. Nocturnal species are unlikely to be active when most of the land clearing and construction work is taking place which will inevitably result in these individuals being killed or injured in their burrows or as they attempt to escape. Larger terrestrial animals and avian species will most often move to adjacent areas. These species will be required to establish new activity areas and home ranges, and this could result in the temporary displacement of resident species, however, this loss of fauna is unlikely to have a significant impact when considered in a bioregional context.

6.1.2 Reduction or loss of activity areas and closure of burrows

Clearing vegetation and associated construction activities are likely to destroy reptile and mammal burrows or foraging habitat that are currently in use or could be used again. Clearing vegetation that forms part of the activity area of individuals has the potential to force these animals into adjacent areas. These areas may offer fewer resources placing individuals under survival pressure. It could also cause individuals to move into the territories of other individuals increasing competition for resources. Forced relocations could increase the possibility of predation.

6.2 Indirect impacts

In addition to the obvious impact of vegetation clearing there can be an equally significant or greater impact in the adjacent areas because of 'edge effects'. Edge effects can lead to the disruption of ecological processes such as predation and dispersal, animal movements and can change assemblage structure. The consequence is that the impact area will always be much larger than the cleared area. Vehicle tracks also have the propensity to develop weed infestations which can impact on natural fauna habitats. Cleared corridors can also provide improved predator access to areas, enhance the invasion of pest species into areas and may act as inhibitors or disrupt fauna migration and movement patterns.

There are numerous potential threats associated with vegetation clearing and the construction of infrastructure that could have an impact on the vertebrate fauna in the project area. Some of these are discussed below.

6.2.1 Habitat fragmentation

In addition to vegetation clearing, infrastructure including tracks, has the potential to fragment habitat. Cleared linear tracks of land are ‘unnatural’ in much of the habitat. These linear structures that partition existing activity areas, isolate sections of established communities and may alter long and medium-term patterns of movement around established home ranges particularly for small mammals and reptiles. A reduction in the population because of this development would be difficult to detect given our current knowledge of the spatial ecology for most of the small mammals known to be in the area.

6.2.2 Introduced fauna and weeds

An increase in habitat fragmentation and human activity is often associated with an increase in the abundance of introduced species such as the house mouse (*Mus musculus*), foxes (*Vulpes vulpes*), cat (*Felis catus*) and wild dogs (*Canis lupus*) (Raiter *et al.* 2018). This increase may be due to a decline in habitat health, increased road kills, poor disposal of waste and easier access to areas via tracks.

House mice, foxes, cats and wild dogs are known to be established in the area. In many situations they have become a ‘naturalised’ species in the Australian bush. Increases in fox, dog or cat numbers can have a detrimental impact on native fauna because they predate on and compete with native species, severely disrupting the natural balance. The cat is a particularly damaging predator on native fauna and any increase in their numbers could have a detrimental effect of local native fauna (Kinnear 1993, Bamford 1995, Woinarski *et al.* 2017, Woinarski *et al.* 2018, Murphy *et al.* 2019); hence it is important to ensure that populations of the feral predators, such as cats under control.

There are reliable reports that the population of wild dogs has significantly increased in response to the abundance of feral goats that were present on numerous mining tenements. The goat population has now been significantly reduced, so the wild dogs will turn their attention to predating of station cattle calves and sheep, and native animals.

Infrastructure known to support feral species, such as rubbish disposal sites and bins, should be managed to minimise increases in these populations.

Introduced plant species can successfully and rapidly invade areas of cleared native vegetation or otherwise disturbed by humans. Introduced plant species may replace native species that provide shelter or foraging areas for native fauna. Major changes to the structure of vegetation will alter the fauna habitat and consequently may influence fauna species composition. Preparing and implementing a weed management plan will largely reduce their threat to native fauna species.

6.2.3 Road fauna deaths

An increase in road fauna deaths is likely to occur where new roads / tracks are constructed or upgraded, in particular, affecting kangaroos, nocturnal birds and ground dwelling large carnivorous predators. Species such as goannas and raptors are attracted to carrion on road verges and therefore, there is an increased propensity for these species to be killed by vehicles.

6.2.4 Fire

Increased human activity is often associated with an altered fire regime which lead to a degradation of natural ecosystems. Fire has been identified as one of the threatening processes for some conservation significant species as a number of small mammal and bird species rely on long unburnt vegetation.

Large and widespread fires are unlikely to be a significant threat to native fauna species near the project area due to the sparseness of the vegetation and existing fragmentation.

6.2.5 Anthropogenic activity

Unnatural noises, vibrations, artificial light sources, and vehicle and human movement in an area may be sufficient to force individuals or fauna species to move from adjacent areas, or alter their activity periods. This form of disturbance is likely to occur during the vegetation clearing and when exploration or mining activity commences. The overall impact is likely to be confined to a relatively small area and is unlikely to be a significant impact.

6.2.6 Dust

Dust generated from shifting top soil and spoil and vehicle traffic can potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas may potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising impacts on fauna in areas adjacent to the mine. An effective dust management and monitoring program is required.

6.2.7 Uncapped drill holes

An ongoing potential risk to terrestrial fauna is the presence of uncapped drill holes within the project area. Small animals, particularly lizards and mammals, can become trapped in the drill holes and eventually die. Therefore drill holes that are open for periods of months or years can be particularly detrimental to small animal populations (Malnic 1997).

6.2.8 Rehabilitation of cleared areas

To minimise the long-term potential impacts, rehabilitation programs should be progressively implemented and evaluated. An emphasis should be placed on the establishment of near-natural, self-sustaining, functional ecosystems in rehabilitation planning, and this should be one of the focal criteria for assessing the success of rehabilitation programs.

7 RISK ASSESSMENT

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 7, 8 and 9 provide a summary of the risk assessment associated with this project.

Table 7. Fauna impact risk assessment descriptors

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 9.

Likelihood		
Level	Description	Criteria
A	Rare	The environmental event may occur, or one or more conservation significant species may be present in exceptional circumstances.
B	Unlikely	The environmental event could occur, or one or more conservation significant species could be present at some time.
C	Moderate	The environmental event should occur, or one or more conservation significant species should be present at some time.
D	Likely	The environmental event will probably occur, or one or more conservation significant species will be present in most circumstances.
E	Almost certain	The environmental event is expected to occur, or one or more conservation significant species is expected to be present in most circumstances.
Consequences		
Level	Description	Criteria
1	Insignificant	Insignificant impact on fauna of conservation significance or regional biodiversity, and the loss of individuals will be insignificant in the context of the availability of similar fauna or fauna assemblages in the area.
2	Minor	Impact on fauna localised and no significant impact on species of conservation significance in the project area. Loss of species at the local scale.
3	Moderate	An appreciable loss of fauna in a regional context or a limited impact on species of conservation significance in the project area.
4	Major	Significant impact on conservation significant fauna or their habitat in the project area and/or regional biodiversity and/or a significant loss in the biodiversity at the landscape scale.
5	Catastrophic	Loss of species at the regional scale and/or a significant loss of species categorised as ‘vulnerable’ or ‘endangered’ under the <i>EPBC Act (1999)</i> at a regional scale.
Acceptability of Risk		
Level of risk	Management Action Required	
Low	No action required.	
Moderate	Avoid if possible, routine management with internal audit and review of monitoring results annually.	
High	Externally approved management plan to reduce risks, monitor major risks annually with external audit and review of management plan outcomes annually. May a referral to the Commonwealth under the <i>EPBC Act 1999</i> .	
Extreme	Unacceptable, project should be redesigned or not proceed.	

Table 8. Levels of acceptable risk

		Likelihood				
		Rare or very low (A)	Unlikely or low (B)	Moderate (C)	Likely (D)	Almost certain (E)
Consequences	Insignificant (1)	Low	Low	Low	Low	Low
	Minor (2)	Low	Low	Low	Moderate	Moderate
	Moderate (3)	Low	Moderate	Moderate	High	High
	Major (4)	Moderate	Moderate	High	High	Extreme
	Catastrophic (5)	Moderate	High	High	Extreme	Extreme

Table 9. A risk assessment of the impact of ground disturbance activity on fauna

			Before Management			With Management			
Factor	Potential Impact		Inherent Risk			Risk Controls / Management	Residual Risk		
			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	B	2	Low				
	Inadequacy of comparative data	Limits on the availability of comparative data reduced the capacity to assess the uniqueness of the fauna assemblages in the project area.	B	2	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	2	Mod.				
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	B	1	Low				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	B	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	3	Low				
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity.	A	2	Low				
	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, high abundance and numerous top of the food chain predators.	A	2	Low				
Death or loss of conservation significant fauna	Malleefowl	Death or the reduced viability of Malleefowl.	A	3	Low				
	Peregrine Falcon	Death or the reduced viability of the Peregrine Falcon.	A	2	Low				
	Western Rosella	Death or the reduced viability of the Western Rosella.	A	2	Low				
	Central Long-eared Bat	Death or the reduced viability of the Central Long-eared Bat.	A	2	Low				
	Oriental Plover	Death or the reduced viability of the Oriental Plover.	A	2	Low				
	Fork-tailed Swift	Death or the reduced viability of Fork-tailed Swift.	A	2	Low				
Human impacts	Spread of weeds	Changed vegetation and a resulting loss of fauna habitat.	E	2	Mod.	Implementation of a weed management plan.	D	2	Low
	Road kills	Animals being killed by vehicles as they cross roads	E	1	Low	Limiting speeds	E	1	Low
	Increase in feral fauna, specifically the wild dog and feral cat	Increased predation on the native fauna	C	2	Low	Management of waste, implementing a feral animal control program and not-feeding feral animals.	B	2	Low

7.1 Native vegetation clearing principles as they pertain to vertebrate fauna

The *Environmental Protection Act (1986)* outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications which are also applicable for other assessments and approvals (Table 10). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

Table 10. Assessment of impact using the native vegetation clearing principles

Principle	Response
It comprises a high level of biological diversity.	Clearing vegetation will not comprise a high level of biodiversity.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Clearing the vegetation will not result in the loss of significant habitat for indigenous fauna.
It includes, or is necessary for the continued existence or, rare flora.	N/A
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological fauna community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant.
It is growing in, or in association with, an environment associated with a watercourse or wetland.	The area does not contain a wetland.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Clearing of vegetation is unlikely to impact on the environmental values of the bioregion.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	N/A
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	N/A

7.2 Referral under the EPBC Act

The proposed project is unlikely to significantly impact on a conservation significant vertebrate fauna species, so a referral under the *EPBC Act* is not recommended.

8 SUMMARY

The total assessed area is 135ha, but the development area is likely to be significant less. There are three broad fauna habitats in the project area:

- open Salmon Gum woodland over sparse chenopods;
- eucalypt woodland over mixed shrubland and chenopod over scattered grasses of varying densities on a sandy-clay substrate; and
- mixed sclerophyll shrubland.

There are also areas devoid of vegetation from earlier exploration activity and these areas are of little value as fauna habitat.

The density of trees and shrubs in the relatively undisturbed areas varied across the project area but was mostly sparse. The fauna habitat quality varies from degraded to good and the more degraded areas due to historical and recent exploration activity and cattle grazing. There are a few access tracks and exploration grid lines in the area, but these are narrow and mostly only wheel tracks of a stony red sand-clay substrate.

The area has been grazed by cattle with many areas showing degradation (i.e. cattle tracks, chewed bushes and shrubs, etc). There was extensive evidence of rabbits and other feral fauna (i.e. feral cats and dogs) in the area.

Clearing native vegetation is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the clearing process. The few larger animals, such as kangaroos and large goannas and snakes, and most of the birds will move into adjacent areas once clearing commences.

Development and vegetation clearing will have a minimal impact on the fauna in areas adjacent to those that will be cleared. There will be a small loss of native fauna to vehicle strikes on access tracks, but this will be low. Migrants increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

Impacts associated with clearing vegetation in the project area in a landscape or bioregional context on the vertebrate fauna are likely to be low as there are vast tracts of similar habitat in adjacent areas.

The proposed project is unlikely to significantly impact on a conservation significant species, so a referral under the *EPBC Act* is not recommended.

9 MANAGEMENT STRATEGIES

9.1 Induction and awareness

All contractors and people involved in vegetation clearing and development should be made aware of the possible presence and issues associated with terrestrial fauna in the area through the induction process.

Recommendation 1: An induction program that includes a component on managing fauna is a mandatory component of working on the Eundynie project.

9.2 Dust

Dust generated from the project could potentially degrade surrounding vegetation, reducing its ability to absorb sunlight and influencing photosynthetic rates. Degradation of these areas will potentially render habitat unsuitable for fauna. Dust suppression and management programs are an essential component of minimising mining impacts on fauna during the construction program.

Recommendation 2: The impact of dust on adjacent vegetation and fauna habitat is managed and monitored against appropriate KPIs.

9.3 Minimising secondary impacts to the habitat

Pets and feral animals have the potential to impact on fauna. Pets should not be permitted on site and feral and pest fauna numbers monitored and controlled. All rubbish likely to attract animals should be suitably contained and disposed of so as not to encourage the feeding of fauna around the site.

Recommendation 3: Pets are not permitted on site.

Recommendation 4: All waste and rubbish be contained in bins and regularly removed from site or buried so it is unavailable to pest species.

Recommendation 5: Feeding of native fauna should be actively discouraged.

9.4 Uncapped drill holes

Uncapped drill holes can pose a serious threat to small animals, including ground dwelling reptiles, frogs and small mammals. A log of all on-site drill holes should be maintained detailing when they were capped, how and by whom. All drill holes should be temporarily capped on completion of drilling and permanently capped or closed as soon as possible after exploration activities have ceased.

Recommendation 6: A log of all on-site drill holes be maintained detailing when they were capped, how and by whom.

9.5 Road fauna deaths

Increased activity will result in increased traffic and a consequential increase in the fauna deaths on tracks. Limiting vehicle speed on mine roads can reduce collisions with fauna, particularly larger animals such as kangaroos and emus. Dead animals on the road also have the propensity to attract raptors, goannas and even cattle, which are then likely to be killed.

Recommendation 7: Speed limits are implemented and enforced on-site. These should be determined based on the quality and condition of the roads, but be a maximum of 80km/h.

Recommendation 8: Signage is erected to indicate the maximum travelling speeds and the possible presence of wildlife crossing roads.

9.6 Feral fauna

Based on feral cat tracks and scats recorded in the project area it is highly probable that the project area currently supports a significant population of feral cats. Rabbits were also present in the project area. Reducing the impacts of feral cats and rabbits will reduce the stress on fauna and fauna assemblages in the area.

Recommendation 9: A feral and pest animal management program is implemented to reduce the predation risk on Malleefowl (and other fauna) in the project area. This program should concentrate on reducing the impacts of cats, foxes, wild dogs and rabbits.

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Figures

Vertebrate Fauna Assessment – Eundynie Project Area

Appendix A
Results of the *EPBC Act* Protected
Matters Search

Vertebrate Fauna Assessment – Eundynie Project Area

Appendix B
Vertebrate Fauna Recorded in Biological
Surveys in the Region

Vertebrate Fauna Assessment – Eundynie Project Area

Family	Species	Common Name	Survey																																				
			A																		Opportunistic																		
			Camp 1	Camp 1/1	Camp 1/10	Camp 1/11	Camp 1/12	Camp 1/13	Camp 1/2	Camp 1/3	Camp 1/4	Camp 1/5	Camp 1/6	Camp 1/7	Camp 1/8	Camp 1/9	Camp 2	Camp 2/15	Camp 2/16	Camp 2/18	Camp 2/19	Camp 2/20	Camp 2/23	Camp 2/24	Camp 2/25	Camp 2/26	Camp 2/27	Camp 2/28	Camp 4	Camp 4/1	Camp 4/12	Camp 4/14	Camp 4/15	Camp 4/4	Camp 4/5	Camp 4/6	Opportunistic		
	<i>Menetia greyii</i>		X			X										X	X	X	X	X				X	X		X												
	<i>Morethia butleri</i>		X	X		X				X							X	X	X	X				X	X			X											
	<i>Morethia obscura</i>		X	X													X	X					X					X											
	<i>Tiliqua occipitalis</i>	Western Bluetongue	X								X						X							X															
	<i>Tiliqua rugosa</i>		X	X								X																X											
Typhlopidae	<i>Ramphotyphlops australis</i>																X																						
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor	X								X	X					X		X																				
	<i>Varanus rosenbergi</i>	Heath Monitor	X		X																																		

A McKenzie, N.L., Rolfe, J.K., Hall, N.J. and Youngson, W.K. (1993) Vertebrate Fauna. In Hall, N.J. and McKenzie N.L. The Biological Survey of the Eastern Goldfields of Western Australia Part 9. Norseman - Balladonia. *Records of the Western Australian Museum*, Supplement No 42, 33-55.

X Presence Only

Family	Species	Common Name	Survey																																
			A																	B															
			Lake Finn Rd	Opportunistic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Argo Discharge	Beta Hunt Disturbance	Junction Discharge	Junction Reference	Neptune Disturbance	Neptune Reference	Opportunistic	Thunderer Disturbance	Thunderer Reference	West Dunes Reference	
	<i>Tiliqua rugosa</i>			1																															
Typhlopidae	<i>Ramphotyphlops australis</i>																										1								
	<i>Ramphotyphlops bicolor</i>																																		2
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor				2														1						2									
	<i>Varanus tristis</i>	Racehorse Monitor					1																												

A ATA Environmental (2006c) *Vertebrate Fauna Assessment St Ives Gold Mine*. Unpublished report for Jim's Seeds, Weeds and Trees, Ltd, Kalgoorlie.

B Bamford Consulting Ecologists (2010) *Gold Fields St Ives Gold Mine, Kambalda. Fauna Assessment: impacts of water discharge and general mining activity on vertebrate fauna*. Unpublished report to Gold Fields St Ives Gold Mine, Perth.

X Presence only

Family	Species	Common Name	Survey			B	C								D																						
			LF	LS	OM/T		St Ives	Opportunistic	Site 1a	Site 1b	Site 1c	Site 1d	Site 2a	Site 2b	Site 2c	Site 2d	Site 1	Site 2	Site 20	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	
	<i>Ctenotus uber</i>				X																	2	1														
	<i>Cyclodomorphus melanops</i>	Slender Blue-tongue						1						1																							
	<i>Egernia formosa</i>				X																4						1										
	<i>Egernia multiscutata</i>				X																																
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer																				4															
	<i>Hemiergis initialis</i>				X										X	1										1											
	<i>Lerista distinguenda</i>												1	4										1													
	<i>Lerista muelleri</i>			X	X																																
	<i>Lerista picturata</i>			X									1		2	1					5	1	3	1	1	2		1					3	3	1		
	<i>Lerista sp.</i>															4	4	2			4				2	2	5	1	3	5	3	2	4				
	<i>Liopholis inornata</i>								1				1	1									1														
	<i>Menetia greyii</i>		X	X	X			2															1		1		1	1		4	3	2					
	<i>Morethia adelaidensis</i>			X																																	
	<i>Morethia butleri</i>				X											2	2					1	1			2						1			2		
	<i>Morethia obscura</i>																								2	2			1								
	<i>Tiliqua occipitalis</i>	Western Bluetongue			X																																
	<i>Tiliqua rugosa</i>		X		X	1	1		1						X																				2		
Typhlopidae	<i>Ramphotyphlops australis</i>				X										1		1	1	2			1	1														
	<i>Ramphotyphlops bituberculatus</i>				X																																
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor			X	1				1	1				2																						

- A Dames and Moore (1999) *Public Environmental Review Gold Mine Development on Lake Lefroy*. Unpublished report for St Ives Gold Mine; Kalgoorlie.
- B Ninnox Wildlife Consulting (2004b) *St Ives Gold Mine Vertebrate Fauna Assessment 2004*. Unpublished report for St Ives Gold Mining Co Pty Ltd, Kalgoorlie.
- C Keith Lindbeck and Associates (2007) *St Ives Gold Mining Company Tailings Storage Facility (No. 4) Spring Fauna Survey*. Unpublished report for St. Ives Gold Mining Company.
- D Western Wildlife (2006) *St Ives Gold Fauna Survey; Spring 2005*. Unpublished report for Jim's Seeds, Weeds and Trees, Kalgoorlie.

Family	Species	Common Name	Survey														Dell and How (1984)													
			WZ13	WZ16	WZ16a	WZ18	WZ18a	WZ2	WZ22	WZ23	WZ24a	WZ25	WZ25a	WZ26	WZ27	WZ3	WZ32a	WZ33	WZ34	WZ34a	WZ37a	WZ40	WZ6	WZ7	WZ7a					
	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon																												
	<i>Ctenophorus cristatus</i>	Bicycle Dragon				1			3	2			6	5	1		1		1			1	1							
	<i>Ctenophorus fordi</i>	Mallee Sand Dragon																												
	<i>Ctenophorus isolepis gularis</i>	Central Military Dragon																10		5										
	<i>Ctenophorus maculatus</i>	Spotted Military Dragon																												
	<i>Ctenophorus mckenziei</i>	Dwarf Bicycle Dragon																												
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon																		5				1						
	<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon																												
	<i>Ctenophorus pictus</i>	Painted Dragon																												
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon									10						1													
	<i>Ctenophorus salinarum</i>	Salt Pan Dragon		4	12												10													
	<i>Ctenophorus scutulatus</i>										3																			
	<i>Diporiphora reginae</i>				1												1	6	3											
	<i>Moloch horridus</i>	Thorny Devil				1						1										1								
	<i>Pogona minor</i>	Bearded Dragon								3	2		3					1	2			1								
	<i>Tympanocryptis houstoni</i>	Nullabor Earless Dragon																												
Boidae	<i>Aspidites ramsayi</i>	Woma (southwest pop)																												
	<i>Morelia spilota imbricata</i>	Carpet Python																												
Carphodactylidae	<i>Nephrurus laevisissimus</i>																													
	<i>Underwoodisaurus milii</i>	Barking Gecko			2	5				2			2	3			1						1							
Diplodactylidae	<i>Crenadactylus ocellatus ocellatus</i>																													
	<i>Diplodactylus granariensis</i>					5				1	3	2					1													
	<i>Diplodactylus granariensis granariensis</i>																													
	<i>Diplodactylus pulcher</i>					1			1	7		2			2	1	1	4		2			1							
	<i>Lucasium damaeum</i>																													
	<i>Lucasium maini</i>		1		1	26			1	1		8			3	2														
	<i>Oedura reticulata</i>											21	10																	
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko																												
	<i>Strophurus elderi</i>																1	3		1										
	<i>Strophurus intermedius</i>					1										1														
	<i>Strophurus strophurus</i>																													
Elapidae	<i>Brachyuropsis fasciolata fasciolata</i>																													
	<i>Brachyuropsis semifasciata</i>																													
	<i>Demansia psammophis psammophis</i>																													
	<i>Demansia reticulata</i>																		1											
	<i>Echiopsis curta</i>	Bardick																												
	<i>Elapognathus coronatus</i>	Crowned Snake																												
	<i>Furina ornata</i>	Moon Snake																												
	<i>Neelaps bimaculatus</i>	Black-naped Snake																												
	<i>Parasuta gouldii</i>								1	3												1								

Family	Species	Common Name	Survey																						
			Dell and How (1984)																						
			WZ13	WZ16	WZ16a	WZ18	WZ18a	WZ2	WZ22	WZ23	WZ24a	WZ25	WZ25a	WZ26	WZ27	WZ3	WZ32a	WZ33	WZ34	WZ34a	WZ37a	WZ40	WZ6	WZ7	WZ7a
	<i>Egernia multiscutata</i>					1			1														1		
	<i>Egernia richardi</i>																								
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer			4																				
	<i>Hemiergus initialis</i>								3	12	5	6	1					1					2		
	<i>Hemiergus millewae</i>		8											2			6	2	14	11	14				
	<i>Hemiergus peronii peronii</i>																								
	<i>Lerista dorsalis</i>																								
	<i>Lerista muelleri</i>																								
	<i>Lerista picturata</i>								3	1	1	3							1						
	<i>Lerista sp.</i>					7			5	6	2	6	3		1			2	2		2	3	1		
	<i>Lerista taeniata</i>													1					2						
	<i>Lerista terdigitata</i>				1									1					2						
	<i>Lerista tridactyla</i>																								
	<i>Liopholis inornata</i>										4											2			
	<i>Liopholis striata</i>	Night Skink																							
	<i>Menetia greyii</i>				1	1								3	3	1	2	7	2	5		1	1		
	<i>Morethia adelaidensis</i>																								
	<i>Morethia butleri</i>				4		1		2			2	1		1		1							1	
	<i>Morethia obscura</i>								1					1											
	<i>Tiliqua occipitalis</i>	Western Bluetongue																							
	<i>Tiliqua rugosa</i>			3						1	2	1	1						1	2					
Typhlopidae	<i>Ramphotyphlops australis</i>																								
	<i>Ramphotyphlops bicolor</i>																								
	<i>Ramphotyphlops bituberculatus</i>				1											1									
	<i>Ramphotyphlops hamatus</i>																								
Varanidae	<i>Varanus gouldii</i>	Bungarra or Sand Monitor												1											
	<i>Varanus rosenbergi</i>	Heath Monitor																							
	<i>Varanus tristis tristis</i>																								

Dell, J and How, R. (1984) Vertebrate fauna. In The Biological Survey of the Eastern Goldfields of Western Australia, *Records of the Western Australian Museum*, Supplement No 18, 57-89.

Appendix B(5). Vertebrate fauna recorded in biological surveys in the region

Family	Species	Common Name	Survey B							
			Dordie Rock NR #1	Dordie Rock NR #2	Dordie Rock NR #3	Dordie Rock NR #4	Kurrawang NR #3	Kurrawang NR #4	Kurrawang NR #5	Kurrawang NR #6
Birds										
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite							X	
	<i>Accipiter fasciatus</i>	Brown Goshawk								
	<i>Aquila audax</i>	Wedge-tailed Eagle								
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	X						X	
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth							X	
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu	X							X
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing								
	<i>Ocyphaps lophotes</i>	Crested Pigeon								X
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater			X		X	X	X	
Cuculidae	<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo								
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar								
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel								X
	<i>Falco berigora</i>	Brown Falcon								
	<i>Falco longipennis</i>	Australian Hobby								
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl	X							
Otididae	<i>Ardeotis australis</i>	Australian Bustard								
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat		X						
	<i>Smicronis brevirostris</i>	Weebill	X	X			X	X	X	
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill						X	X	
	<i>Acanthiza apicalis</i>	Inland Thornbill		X						X
	<i>Aphelocephala leucopsis</i>	Southern Whiteface								
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	X	X				X	X	
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow								
	<i>Artamus cinereus</i>	Black-faced Woodswallow						X		
	<i>Artamus cyanopterus</i>	Dusky Woodswallow			X					
	<i>Cracticus torquatus</i>	Grey Butcherbird	X				X	X		X
	<i>Cracticus nigrogularis</i>	Pied Butcherbird			X		X	X		X
	<i>Cracticus tibicen</i>	Australian Magpie								X
	<i>Strepera versicolor</i>	Grey Currawong	X	X					X	X
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-Shrike								X
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-Shrike		X	X					X
Climacteridae	<i>Climacteris rufa</i>	Rufous Treecreeper			X					
Corvidae	<i>Corvus coronoides</i>	Australian Raven	X							
	<i>Corvus bennetti</i>	Little Crow	X							X
Eupetidae	<i>Cinlosoma castanotum</i>	Chestnut Quail-thrush			X			X	X	
Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow								
	<i>Hirundo neoxena</i>	Welcome Swallow								
	<i>Petrochelidon nigricans</i>	Tree Martin								
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren								X
	<i>Malurus leucopterus</i>	White-winged Fairy-wren								

		Survey	B								
Family	Species	Common Name	Dordie Rock NR #1	Dordie Rock NR #2	Dordie Rock NR #3	Dordie Rock NR #4	Kurrawang NR #3	Kurrawang NR #4	Kurrawang NR #5	Kurrawang NR #6	Kurrawang NR #7
	<i>Varanus tristis</i>	Racehorse Monitor									

Chapman A; Kealley I; McMillan D; McMillan and Rolland; G (1991b) Biological Surveys of Four Goldfields Reserves. *Landnote* 1/91; 1-238

Family	Species	Common name	W.A. Museum Surveys McKenzie and Hall (1992)										Thompson unpublished data set							Chapman et al. (1991b)								
			Qpv	Qqs	Qas	As	Agb	Qqz	Qps	Is	Tg	Crossroads	Dayhurst	Floodplains	Gimlet	Golden	Palace	Rose	Salmon Gums	Security	Spinifex	Wendy Gully	KNR #1	KNR #2	KNR #3	KNR #4	KNR #5	KNR #6
	<i>Gehyra purpurascens</i>										6	1																
	<i>Gehyra variegata</i>			3	1	2	3	6		1			6	38	1	37	28	45	37	14	39	23	12			X		
	<i>Heteronotia binoei</i>		2	6	1	6	3			1			1	16		9	12	28	13	10	24	24	8					X
	<i>Underwoodisaurus milli</i>																									X		
Pygopodidae	<i>Delma australis</i>					1								4		3	2	9	2				8	5				
	<i>Delma butleri</i>										2											4	2					
	<i>Delma fraseri</i>										1												1					
	<i>Delma nasuta</i>								4		1																	
	<i>Lialis burtonis</i>				2			1															5	3				
	<i>Pygopus lepidopus</i>												2		1				3		2	1						
Scincidae	<i>Cryptoblepharus plagiocephalus</i>				4			1					10		12	1	5	7	3	3								
	<i>Ctenotus atlas</i>				6			2	12	6							1			1	16	104				X		
	<i>Ctenotus leonhardii</i>						1																					
	<i>Ctenotus schomburgkii</i>				1			6		1											2	2				X		
	<i>Ctenotus uber</i>			7			2					27	29	13	48	5	3	6	44	46	25							
	<i>Cyclodomorphus branchialis</i>																									X		
	<i>Cyclodomorphus melanops elongatus</i>				1						1		1		2	6	2					24						
	<i>Egernia depressa</i>						X	4					57		68	2	2	3			27	15						
	<i>Egernia formosa</i>			1			1	3				1	8				1	14	4	8	1							
	<i>Egernia inornata</i>		1	1	1			1									8	71	4	2		2						
	<i>Egernia striata</i>																		2	9		1						
	<i>Eremiascincus richardsonii</i>										2	5		4	4				6	6	3	1						
	<i>Hemiergis initialis initialis</i>												4		5				1			12						
	<i>Lerista muelleri</i>			3	2	2		1					22		4	3	6	6	15		5	2						
	<i>Lerista picturata</i>			2		1						1	18		17	17	5	5	20		14	20						
	<i>Menetia greyii</i>					1						4	19		3	6	23	18	3	17	6	1						X
	<i>Morethia adelaidensis</i>			1																								
	<i>Morethia butleri</i>					2		1			1		14		1		6	17	7	4	4							
	<i>Tiliqua occipitalis</i>										3		1			2				3	5	4						X
	<i>Tiliqua rugosa</i>			2	3	7		5	2		2	1	3	1	1			1		2	2	1						X
Agamidae	<i>Caimanops amphiboluroides</i>							1		1										7								
	<i>Ctenophorus cristatus</i>			3				4				1	3		5	1	10	4			1							X
	<i>Ctenophorus femoralis</i>																											
	<i>Ctenophorus fordi</i>				4		1	4	5	4	1															X		
	<i>Ctenophorus isolepis citrinus</i>																											
	<i>Ctenophorus maculatus</i>																											
	<i>Ctenophorus nuchalis</i>																											
	<i>Ctenophorus ornatus</i>																											
	<i>Ctenophorus reticulatus</i>			5	3		7	8			4	6	4		11	18		18	3	29		3						
	<i>Ctenophorus salinarum</i>																											
	<i>Ctenophorus scutulatus</i>				8			9					2		1	3	1			3		12						
	<i>Moloch horridus</i>				1			2	1	3	2		5									17						X
	<i>Pogona minor</i>					1	1	2	4	1	2	21	11	2	3	14	3	2	2	14	13	23						
	<i>Tympanocryptis cephalo</i>														7							1						
Varanidae	<i>Varanus caudolineatus</i>				1		3	4				9	10		15	1		1	11	17	1	9						
	<i>Varanus gouldii</i>			2	1			1		1	1	2	10	1	9	9	3	7	8	1	5							
	<i>Varanus tristis</i>												5		1				3		3							
Typhlopidae	<i>Ramphotyphlops australis</i>											7	8		14		7	2	7		14	6						
	<i>Ramphotyphlops bicolor</i>														1						1	1						

Family	Species	Common Name	A																B						C
	<i>Gehyra purpurascens</i>																							X	
	<i>Gehyra variegata</i>		X					X									X			X	X	+	+	X	
	<i>Heteronotia binoei</i>									X									X	X	+	+	X		
	<i>Underwoodisaurus milli</i>			X													X		+					X	
Pygopodidae	<i>Delma australis</i>																								
	<i>Delma butleri</i>																			X			+	X	
	<i>Delma fraseri</i>																			+	+	+	+	X	
	<i>Lialis burtonis</i>																			+	+	+		X	
	<i>Pygopus lepidopodus</i>																				+			X	
	<i>Pygopus nigriceps</i>																					+	+		
Scincidae	<i>Cryptoblepharus carnabyi</i>																			+		+			
	<i>Cryptoblepharus plagiocephalus</i>						X													X		+		X	
	<i>Ctenotus atlas</i>																			X	X			X	
	<i>Ctenotus impar</i>																				+	+			
	<i>Ctenotus leonhardii</i>																			+		+	+	X	
	<i>Ctenotus pantherinus ocellifer</i>																			+		+			
	<i>Ctenotus schomburgkii</i>																						X	X	
	<i>Ctenotus uber</i>																						+	X	
	<i>Cyclodomorphus branchialis</i>																					+			
	<i>Egernia formosa</i>																							X	
	<i>Egernia inornata</i>												X									+			
	<i>Egernia multiscutata</i>																							X	
	<i>Eremiascincus richardsonii</i>																				+	+			
	<i>Hemiergis initialis initialis</i>																							X	
	<i>Lerista desertorum</i>																				+	+			
	<i>Lerista muelleri</i>											X									+	+	X	+	X
	<i>Lerista picturata</i>																				+	+	+	X	
	<i>Menetia greyii</i>							X													X	+	X	+	X
	<i>Morethia adelaidensis</i>																			+			X	+	
	<i>Morethia butleri</i>																						+	+	X
	<i>Morethia obscura</i>																						+	+	
	<i>Tiliqua occipitalis</i>						X																+	+	X
	<i>Tiliqua rugosa</i>																				X	+	+	+	X
Agamidae	<i>Ctenophorus clayi</i>																						+		
	<i>Ctenophorus cristatus</i>						X				X		X	X											X
	<i>Ctenophorus femoralis</i>																								
	<i>Ctenophorus fordi</i>																				X		+		X
	<i>Ctenophorus isolepis citrinus</i>																						+		
	<i>Ctenophorus maculatus</i>																				+				
	<i>Ctenophorus nuchalis</i>																							+	
	<i>Ctenophorus ornatus</i>						X																		
	<i>Ctenophorus reticulatus</i>																								X
	<i>Ctenophorus salinarum</i>																				+	X	X		X
	<i>Ctenophorus scutulatus</i>			X						X															
	<i>Moloch horridus</i>												X										+	+	X
	<i>Pogona minor</i>						X														X	+	+	+	X
	<i>Tympanocryptis cephalo</i>																								X
Varanidae	<i>Varanus caudolineatus</i>																						+		
	<i>Varanus eremius</i>																						+		
	<i>Varanus gouldii</i>													X							+	+	+	+	X

Family	Species	Common Name	A												B					C												
	<i>Varanus panoptes</i>																	+	+	+	+	+										
	<i>Varanus tristis</i>									X												+										
Typhlopidae	<i>Ramphotyphlops australis</i>																				+	+	X									
	<i>Ramphotyphlops bituberculatus</i>																					+	+	X								
Boidae	<i>Aspidites ramsayi</i>	Woma																				+	+									
	<i>Morelia spilota imbricata</i>	Carpet python								X													+	+								
Elapidae	<i>Acanthophis pyrrhus</i>	Desert death-adder																		+	+	+	+									
	<i>Brachyurophis fasciolata fasciolata</i>																							X								
	<i>Demansia psammophis psammophis</i>	Yellow-faced whipsnake																		+	+	+	+	X								
	<i>Echiopsis curtis</i>																						+									
	<i>Furina ornata</i>	Moon snake																					+	+								
	<i>Parasuta gouldii</i>	Gould's snake																						X								
	<i>Parasuta monachus</i>	Monk snake																						X								
	<i>Pseudechis australis</i>	Mulga snake									X												+	+	+							
	<i>Pseudonaja modesta</i>	Ringed brown snake																					+	+	+							
	<i>Pseudonaja nuchalis</i>	Gwardar																					+	+	+	X						
	<i>Simoselaps bertholdi</i>	Jan's banded snake																							X							
	<i>Vermicella bertholdi</i>			X																				+	+							
	<i>Vermicella fasciolata</i>																							+	+							
	<i>Vermicella semifasciatus</i>																							+	+							
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Echidna									X		2nd											+	+	X						
Dasyuridae	<i>Dasyurus geoffroyi</i>	Chuditch																						+	+							
	<i>Ningauai ridei</i>	Wongai Ningauai																						+								
	<i>Ningauai yvonneae</i>	Southern Ningauai																	X				X		X							
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart																					+	+	+	+	X					
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart	1	2								2											X		+	+	X					
Macropodidae	<i>Macropus fuliginosus</i>	Western Grey Kangaroo									X														+		X					
	<i>Macropus robustus</i>	Common Wallaroo, Euro									X													+	+	+	+	X				
	<i>Macropus rufus</i>	Red Kangaroo																						+	+	+	+	X				
Burramyidae	<i>Cercartetus concinnus</i>	Western Pygmy-possum										5												X		+	X					
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat																							+	+	+	+	+			
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat																								+	+	+	+	+		
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat																								+	+	+	+	+		
	<i>Nyctophilus timoriensis</i>	Greater Long-eared Bat																									+	+				
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat																										+	+			
	<i>Vespadelus regulus</i>	Southern Forest Bat																									+	+	+	+	+	
Molossidae	<i>Mormopterus planiceps</i>	Southern Freetail-bat																									+	+	+	+	+	
	<i>Tadarida australis</i>	White-striped Freetail-bat																									+	+	+	+	+	
Muridae	<i>Mus musculus</i>	House Mouse									1	3															+	X	X	X	+	
	<i>Notomys mitchellii</i>	Mitchell's Hopping-mouse	1	8	2																							+	+	+	+	
	<i>Pseudomys bolami</i>	Bolam's Mouse																										+				X
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse																										+	+	+	+	X
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit																										+	X	+	X	+
Bovidae	<i>Capra hircus</i>	Goat																										+	+	+	+	+
Canidae	<i>Vulpes vulpes</i>	Red Fox																										+	+	+	X	+
Felidae	<i>Felis catus</i>	Cat																										+	+	+	+	+

A - Chapman, A., I. Kealley, D. McMillan, P. McMillan, and G. Rolland. (1991b) Biological surveys of four Goldfields Reserves. Landnote 1/91:1-26.
B - Halpern Glick Maunsell.(1998) Lake Lefroy Environmental Assessment. Report ES4490C., Perth.
C - Ninox Wildlife Consulting. (2004a) St Ives Gold Delta Island Vertebrate Fauna Assessment. Perth.

Appendix C
Definitions of Significant Fauna under the
WA Biodiversity Conservation Act 2016 and
Priority Species

Vertebrate Fauna Assessment – Eundynie Project Area

ATTACHMENT C
DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WA *BIODIVERSITY CONSERVATION ACT 2016*

Threatened, Extinct and Specially Protected fauna or flora¹ are species² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*. Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T Threatened Species

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of ‘Specially Protected Fauna’ listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of ‘Rare Flora’ listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR Critically endangered species

Threatened species considered to be “*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*”.

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN Endangered species

Threatened species considered to be “*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*”.

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU Vulnerable species

Threatened species considered to be “*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*”.

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct Species

¹ The definition of flora includes algae, fungi and lichens

² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where “*there is no reasonable doubt that the last member of the species has died*”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that “*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially Protected Species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory birds protected under an international agreement

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependant fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations

P1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

P2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

P3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

P4 Priority 4: Rare, Near Threatened and other species in need of monitoring

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix D

Fauna habitat assessment results

Vertebrate Fauna Assessment – Eundynie Project Area