

# **Reconnaissance Flora/Vegetation & Fauna Survey Bulong Gold Project**



**August 2019  
Version 1**



**Prepared by:  
Botanica Consulting  
PO Box 2027  
Boulder WA 6432  
90930024**

## **Disclaimer**

This document and its contents are to be treated as confidential and are published in accordance with and subject to an agreement between Botanica Consulting (BC) and the client for whom it has been prepared and is restricted to those issues that have been raised by the client in its engagement of BC. Neither this document nor its contents may be referred to or quoted in any manner (report or other document) nor reproduced in part or whole by electronic, mechanical or chemical means, including photocopying, recording or any information storage system, without the express written approval of the client and/or BC.

This document and its contents have been prepared utilising the standard of care and skill ordinarily exercised by Environmental Scientists in the preparation of such documents. All material presented in this document is published in good faith and is believed to be accurate at the time of writing. Any person or organisation who relies on or uses the document and its contents for purposes or reasons other than those agreed by BC and the client without primarily obtaining the prior written consent of BC, does so entirely at their own risk. BC denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be endured as a consequence of relying on this document and its contents for any purpose other than that agreed with the client.

## **Quality Assurance**

An internal quality review process has been implemented to each project task undertaken by BC. Each document and its contents are carefully reviewed by core members of the Consultancy team and signed off at Director Level prior to issue to the client. Draft documents are submitted to the client for comment and acceptance prior to final production.

**Document Job Number:** 2019/73

**Prepared by:** Lauren Pick  
Senior Environmental Consultant  
Botanica Consulting

**Reviewed by:** Andrea Williams  
Director  
Botanica Consulting

**Approved by:** Jim Williams  
Director  
Botanica Consulting

Contents	Page No.
<b>1 Introduction</b>	<b>1</b>
1.1 Project Description .....	1
1.2 Objectives .....	1
<b>2 Regional Biophysical Environment</b>	<b>3</b>
2.1 Regional Environment.....	3
2.2 Great Western Woodlands .....	5
2.3 Soils and Landscape Systems.....	7
2.4 Vegetation.....	9
2.5 Climate .....	11
2.6 Hydrology .....	12
2.7 Land Use.....	12
<b>3 Survey Methodology</b>	<b>13</b>
3.1 Desktop Assessment .....	13
3.2 Field Assessment.....	15
3.2.1 Flora Assessment .....	15
3.2.2 Fauna Assessment .....	15
3.2.3 Personnel involved.....	16
3.2.4 Scientific licences.....	16
3.3 Survey limitations and constraints .....	16
<b>4 Results</b>	<b>18</b>
4.1 Desktop Assessment .....	18
4.1.1 Flora/Vegetation.....	18
4.1.2 Fauna .....	19
4.2 Field Assessment.....	21
4.2.1 Vegetation Types .....	21
4.2.2 Vegetation Condition.....	30
4.2.3 Introduced Flora .....	33
4.2.4 Fauna Habitat .....	34
4.2.5 Significant Flora .....	37
4.2.6 Significant Vegetation .....	38
4.2.7 Significant Fauna .....	38
4.3 Matters of National Environmental Significance .....	39
4.4 Matters of State Environmental Significance .....	39
<b>5 Native Vegetation Principles</b>	<b>40</b>
<b>6 Recommendations</b>	<b>43</b>
<b>7 Bibliography</b>	<b>43</b>

## Tables

Table 2-1: Soil Landscape Systems within the survey area .....	7
Table 2-2: Pre-European Vegetation Associations within the survey area .....	9
Table 3-1: Scientific Licences of Botanica Staff coordinating the survey.....	16
Table 3-2: Limitations and constraints associated with the survey .....	16
Table 4-1: Likelihood of occurrence for Threatened and Priority Flora within the survey area .....	18
Table 4-2: Likelihood of occurrence for Threatened and Priority Fauna within the survey area .....	20
Table 4-3: Summary of vegetation types within the survey area.....	21
Table 4-4: Low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low shrubland of <i>Atriplex vesicaria</i> / <i>Olearia muelleri</i> on clay-loam plain .....	23
Table 4-5: Forest of <i>Eucalyptus ravidia</i> over mid shrubland of <i>Atriplex nummularia</i> / <i>Eremophila scoparia</i> and low chenopod shrubland of <i>Atriplex vesicaria</i> on clay-loam plain .....	24
Table 4-6: Open low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low samphire shrubland of <i>Tecticornia disarticulata</i> on clay-loam plain .....	25
Table 4-7: Forest of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia tetragonophylla</i> and low open shrubland of <i>Dodonaea lobulata</i> on hillslope .....	26

Table 4-8: Forest of <i>Eucalyptus stricklandii</i> over mid shrubland of <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on hillslope .....	27
Table 4-9: Low woodland of <i>Eucalyptus lesouefii</i> / <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Acacia kalgoorliensis</i> and open low shrubland of <i>Ptilotus obovatus</i> / <i>Westringia rigida</i> on hillslope .....	28
Table 4-10: Tree mallee of <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Eremophila scoparia</i> and low hummock grassland of <i>Triodia scariosa</i> on hillslope .....	29
Table 4-11: Vegetation condition within the survey area .....	30
Table 4-12: Main terrestrial fauna habitats within the survey area .....	34
Table 4-13: Summary of Potential Vertebrate Fauna Species .....	37
Table 5-1: Assessment of clearing against native vegetation clearing principles .....	40

## Figures

Figure 1-1: Regional map of the survey area .....	2
Figure 2-1: Map of IBRA subregions in relation to the survey area .....	4
Figure 2-2: Location of survey area within the Great Western Woodlands (DBCA, 2011a) .....	6
Figure 2-3: Soil Landscape Systems within the survey area .....	8
Figure 2-4: Pre-European Vegetation Associations within the survey area .....	10
Figure 2-5: Monthly rainfall (Jan 2018 to July 2019) for the Kalgoorlie-Boulder Airport weather station #12038 (BoM, 2019) .....	11
Figure 2-6: Average Climate Data for the Kalgoorlie-Boulder Airport weather station #12038 (BoM, 2019) ..	11
Figure 2-7: Hydrology of the survey area (data obtained from Geoscience Australia, 2001) .....	12
Figure 4-1: Vegetation types within the survey area .....	22
Figure 4-2: Vegetation condition within the survey area .....	32
Figure 4-3: Fauna habitats within the survey area .....	36

## Plates

Plate 4-1: Low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low shrubland of <i>Atriplex vesicaria</i> / <i>Olearia muelleri</i> on clay-loam plain .....	23
Plate 4-2: Forest of <i>Eucalyptus ravida</i> over mid shrubland of <i>Atriplex nummularia</i> / <i>Eremophila scoparia</i> and low chenopod shrubland of <i>Atriplex vesicaria</i> on clay-loam plain .....	24
Plate 4-3: Open low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low samphire shrubland of <i>Tecticornia disarticulata</i> on clay-loam plain .....	25
Plate 4-4: Forest of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia tetragonophylla</i> and low open shrubland of <i>Dodonaea lobulata</i> on hillslope .....	26
Plate 4-5: Forest of <i>Eucalyptus stricklandii</i> over mid shrubland of <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on hillslope .....	27
Plate 4-6: Low woodland of <i>Eucalyptus lesouefii</i> / <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Acacia kalgoorliensis</i> and open low shrubland of <i>Ptilotus obovatus</i> / <i>Westringia rigida</i> on hillslope .....	28
Plate 4-7: Tree mallee of <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Eremophila scoparia</i> and low hummock grassland of <i>Triodia scariosa</i> on hillslope .....	29
Plate 4-8: Tailings dispersal within open depression .....	30
Plate 4-9: <i>Carrichtera annua</i> (Wards Weed) .....	33

## Appendices

Appendix 1: Conservation Significant Species/ Communities Categories (BC Act and EPBC Act) .....	46
Appendix 2: Regional map of conservation areas .....	50
Appendix 3: Species List .....	51
Appendix 4: Vegetation Condition Rating .....	54
Appendix 5: Potential Fauna List .....	55



## Glossary

Acronym	Description
ANCA	Australian Nature Conservation Agency.
BA	Birdlife Australia (Formerly RAOU, Birds Australia).
BAM Act	Biosecurity and Agriculture Management Act 2007, WA Government.
BC Act	Biodiversity Conservation Act 2016, WA Government.
Black Cat	Black Cat Syndicate Limited.
Botanica	Botanica Consulting.
BoM	Bureau of Meteorology.
CAMBA	China Australia Migratory Bird Agreement 1998.
DAFWA	Department of Agriculture and Food (now DPIRD), WA Government.
DBCA	Department of Biodiversity, Conservation and Attractions (formerly DPaW), WA Government.
DEC	Department of Environment and Conservation (now DBCA), WA Government.
DER	Department of Environment Regulation (now DWER), WA Government.
DMIRS	Department of Mines, Industry Regulation and Safety (formerly DMP), WA Government
DMP	Department of Mines and Petroleum (now DMIRS), WA Government.
DotEE	Department of the Environment and Energy (formerly DSEWPaC), Australian Government.
DoW	Department of Water (now DWER), WA Government.
DPaW	Department of Parks and Wildlife (now DBCA), WA Government.
DPIRD	Department of Primary Industries and Regional Development, WA Government
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DotEE,), Australian Government.
DWER	Department of Water and Environmental Regulation (formerly OEPA, DER and DoW), WA Government
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999, Australian Government.
ESA	Environmentally Sensitive Area.
Ha	Hectare (10,000 square metres).
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
JAMBA	Japan Australia Migratory Bird Agreement 1981.
Km	Kilometre (1,000 metres).
MVG	Major Vegetation Groups.
NVIS	National Vegetation Information System.
OEPA	Office of the Environmental Protection Authority (now DWER), WA Government.
PEC	Priority Ecological Community.
RAOU	Royal Australia Ornithologist Union.
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement 2007.
SRE	Short Range Endemic.
SSC	Species Survival Commission, International.

Acronym	Description
Survey Area	Bulong Gold Project
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.
WAM	Western Australian Museum, WA Government.
WC Act	Wildlife Conservation Act 1950, WA Government.

## **Executive Summary**

Botanica Consulting (Botanica) was commissioned by Black Cat Syndicate Limited (Black Cat) to conduct a reconnaissance flora/vegetation and fauna survey of the Bulong Gold Project (referred to as the 'survey area'). The survey was conducted on the 28<sup>th</sup> July 2019, covering an area of approximately 961 ha. The survey area is located approximately 25 km east of Kalgoorlie-Boulder.

Seven vegetation types were identified within the survey area. These vegetation types were identified within three different landform types and comprised of three major vegetation groups, which were represented by a total of 25 families, 46 genera and 91 taxa (including eight annual taxa and one introduced taxon). Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (ranging from 'pristine' to 'completely degraded'), vegetation ranged from 'good' to 'very good'.

The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plains, open depression and rocky hillslopes. Results of the literature review identified 38 mammals (including twelve bat species), 111 birds, 86 reptiles and five frog species that have previously been recorded in the general area, some of which have the potential to occur subject to the identified habitats being suitable.

No Threatened Flora, Migratory Fauna or Threatened Ecological Communities (TEC) as listed under the Western Australian *Biodiversity Conservation (BC) Act 2016* or Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* were identified within the survey area.

No Priority Fauna, Flora or Priority Ecological Communities (PEC) as listed by Department of Biodiversity, Conservation and Attractions (DBCA) were recorded within the survey area.

A review of the EPBC Act threatened fauna list, DBCA's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a small number of specially protected, migratory or priority fauna species as having been previously recorded or as being potentially present in the general vicinity of the survey area. Despite this, it is considered unlikely that any fauna species of conservation significance will be significantly impacted on by the proposed development. This conclusion is primarily based on the lack of suitable habitats, the known local extinction of some species, the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on flora and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

The survey area does not contain any world or national heritage places. There are no wetlands of international importance (Ramsar Wetlands), national importance (Australian Nature Conservation Agency (ANCA) Wetlands) or conservation category wetlands within the survey area. The survey area is not located within DBCA Managed Land and does not contain any Environmentally Sensitive Areas (ESA) listed under the *Environmental Protection (EP) Act 1986*.

## 1 **Introduction**

### 1.1 **Project Description**

Botanica Consulting (Botanica) was commissioned by Black Cat Syndicate Limited (Black Cat) to conduct a reconnaissance flora/vegetation and fauna survey of the Bulong Gold Project (referred to as the 'survey area'). The survey was conducted on the 28<sup>th</sup> July 2019, covering an area of approximately 961 ha. The survey area is located approximately 25 km east of Kalgoorlie-Boulder (Figure 1-1).

### 1.2 **Objectives**

The flora/ vegetation assessment was conducted in accordance with the requirements of a reconnaissance flora survey as defined in *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016a). The objectives of the assessment were to:

- gather background information on flora and vegetation in the target area (literature review, database and map-based searches);
- identify significant flora, vegetation/ecological communities and assess the potential sensitivity to impact;
- conduct a field survey to verify / ground truth the desktop assessment findings through survey;
- undertake floristic community mapping to a scale appropriate for the bioregion and described according to the National Vegetation Information System (NVIS) structure and floristics;
- undertake vegetation condition mapping;
- assess the project area's plant species diversity, density, composition, structure and weed cover, using NVIS classification system for vegetation description;
- assess Matters of National Environmental Significance (MNES) and indicate whether potential impacts on MNES as protected under the EPBC Act are likely to require referral of the project to the Commonwealth DotEE; and
- determine the State legislative context of environmental aspects required for the assessment.

The fauna assessment was conducted in accordance with the requirements of a reconnaissance terrestrial fauna survey as defined in *Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016b). The objectives of the assessment were to:

- Gather background information on fauna in the survey area (literature review, database and map-based searches);
- Delineate and characterise the faunal assemblages and fauna habitats present in the survey area;
- Document and map locations of any Threatened or Priority listed fauna species located; and
- Assess the regional and local conservation status of fauna species and fauna habitats within the survey area.



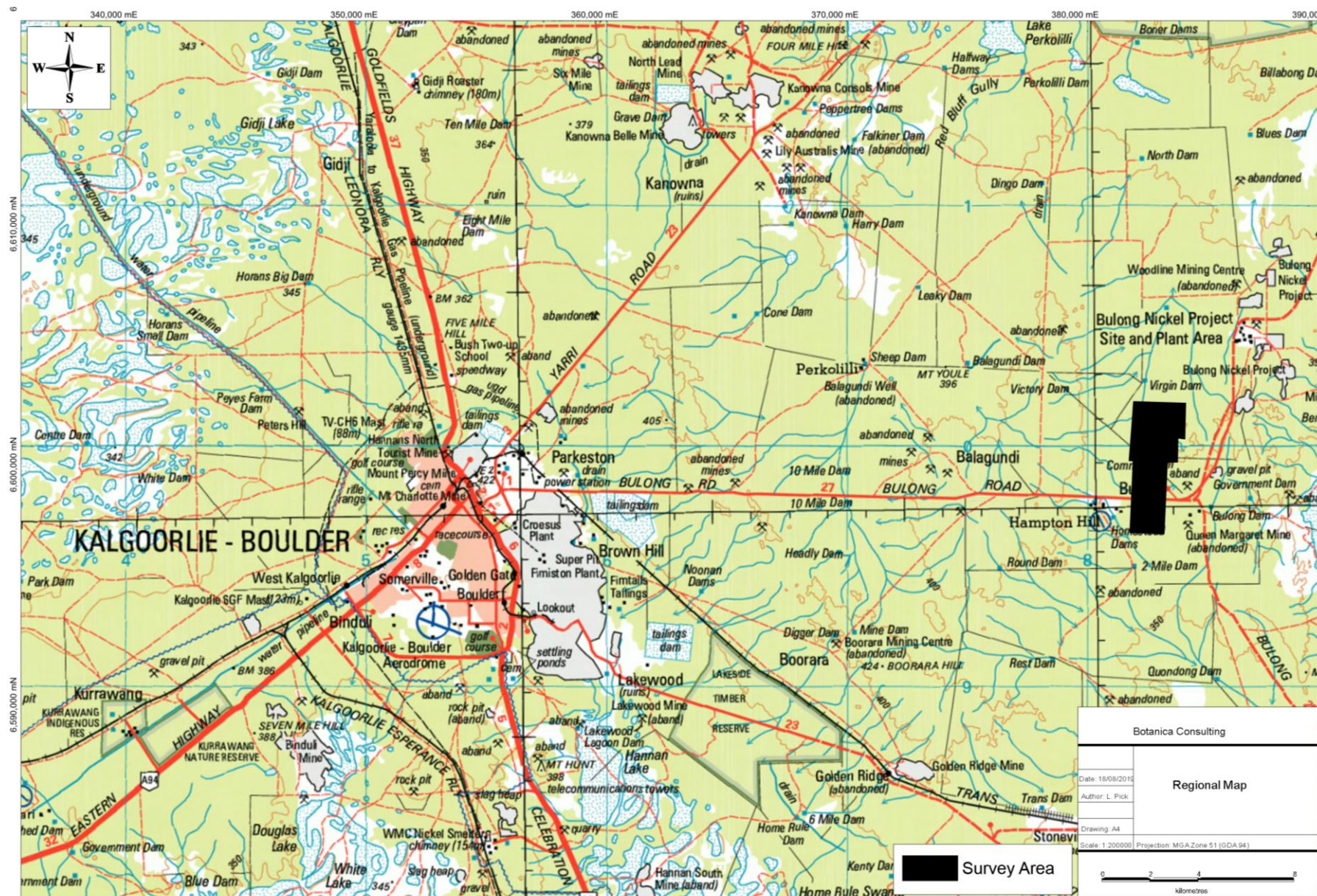


Figure 1-1: Regional map of the survey area



## **2 Regional Biophysical Environment**

### **2.1 Regional Environment**

The survey area lies on the boundary between the South-West Interzone and Eremaean Province of WA in the Coolgardie Botanical District and the Austin Botanical District. Based on the Interim Biogeographic Regionalisation of Australia (IBRA, Version 7) (DotEE, 2012) the survey area is located within the Coolgardie and Murchison Bioregion of WA. The Murchison and Coolgardie Bioregion are further divided into subregions with the survey area located within the Eastern Murchison subregion and the Eastern Goldfields subregion respectively (Figure 2-1).

The Coolgardie Bioregion is within the Yilgarn Craton. Its granite basement includes Archaean Greenstone intrusions in parallel belts. Drainage is occluded. The climate is arid to semi-arid warm Mediterranean with 250-300mm of mainly winter rainfall (McKenzie, May & McKenna, 2002). Diverse woodlands, rich in endemic eucalypts, occur on low greenstone hills, on alluvial soils on the valley floors, around the saline playas of the region's occluded drainage system, and on broad plains of calcareous earths (McKenzie, May & McKenna, 2002).

The Eastern Goldfields subregion comprises gently undulating plains interrupted in the west by low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying strata are eroded flat and covered with Tertiary sand and gravel soils, scattered exposures of bedrock, and plains of calcareous earths (Cowan, 2001).

The landscape of the Murchison bioregion comprises low hills, mesas of duricrust separated by flat colluvium and alluvial plains (Commonwealth Government, 2008). It is dominated by the Archaean (over 2500 million years ago) granite greenstone terrain of the Yilgarn Craton (Commonwealth Government, 2008). Alluvial soils and sands mantle the granitic and greenstone units of the Yilgarn Craton. These soils are shallow, sandy and infertile. Underlying the soils in low areas is a red-brown siliceous hard pan (Curry et al. 1994). The soils in the eastern half of the bioregion are typically red sands, lithosols, calcareous red earth soil, duplex soil and clays. There are 41 vegetation associations (hummock grasslands, succulent steppe or low woodlands) that have at least 85 per cent of their total area in the bioregion. The bioregion is rich and diverse in both its flora and fauna but most species are wide ranging and usually occur in adjoining regions (McKenzie, May and McKenna, 2002).

The Eastern Murchison subregion comprises the northern parts of the craton's Southern Cross and Eastern Goldfields Terrains and is characterised by internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. Salt Lake systems are associated with the occluded paleodrainage system. Broad plains of red-brown soils and breakaways complexes as well as red sandplains are widespread. Vegetation is dominated by Mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and Samphire shrublands (McKenzie *et. al.*, 2002). The Eastern Murchison subregion comprises diverse mulga woodlands, which occur on low greenstone belts. The sand plains have red loamy earths and red deep sands are found on the sandy banks.



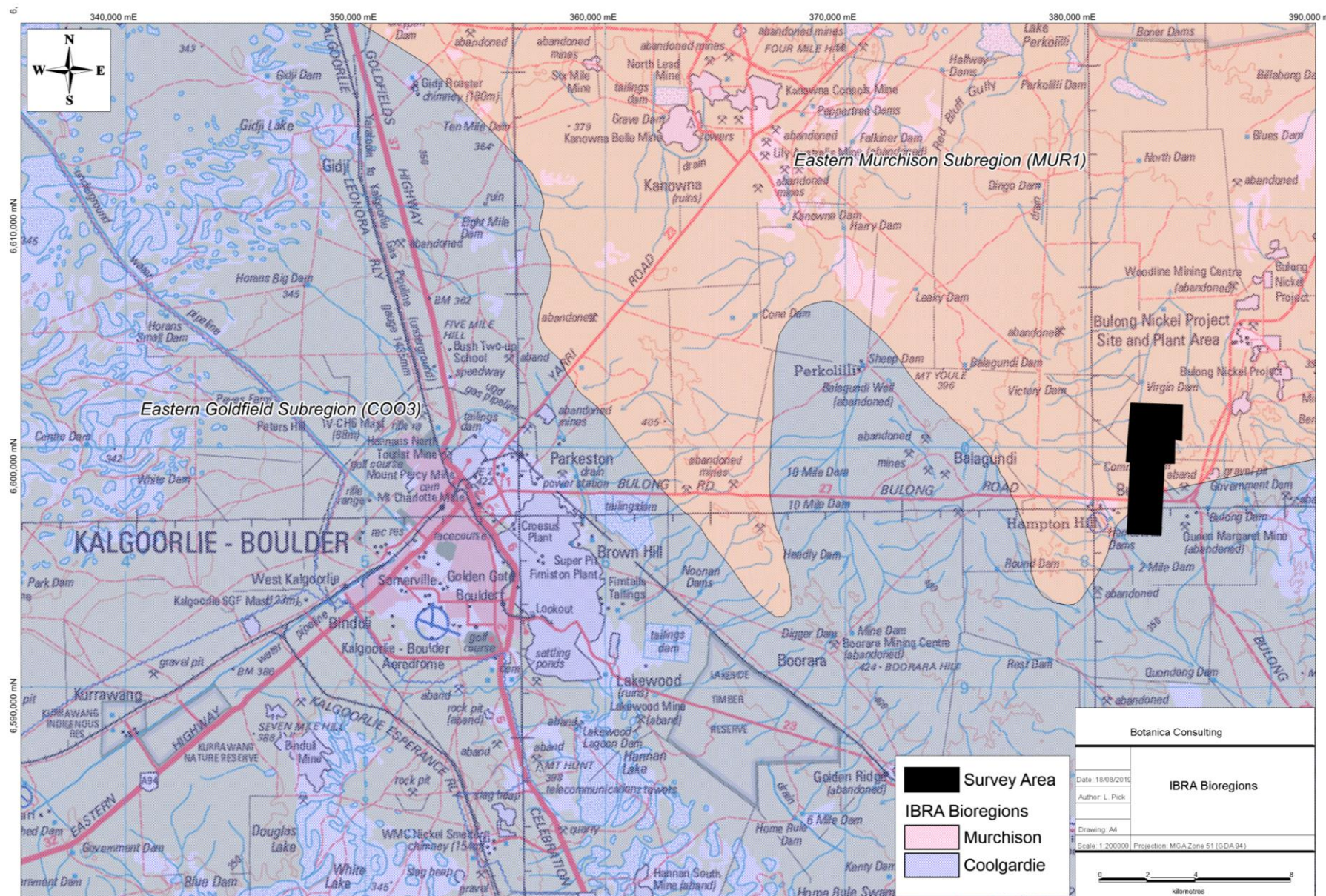


Figure 2-1: Map of IBRA subregions in relation to the survey area



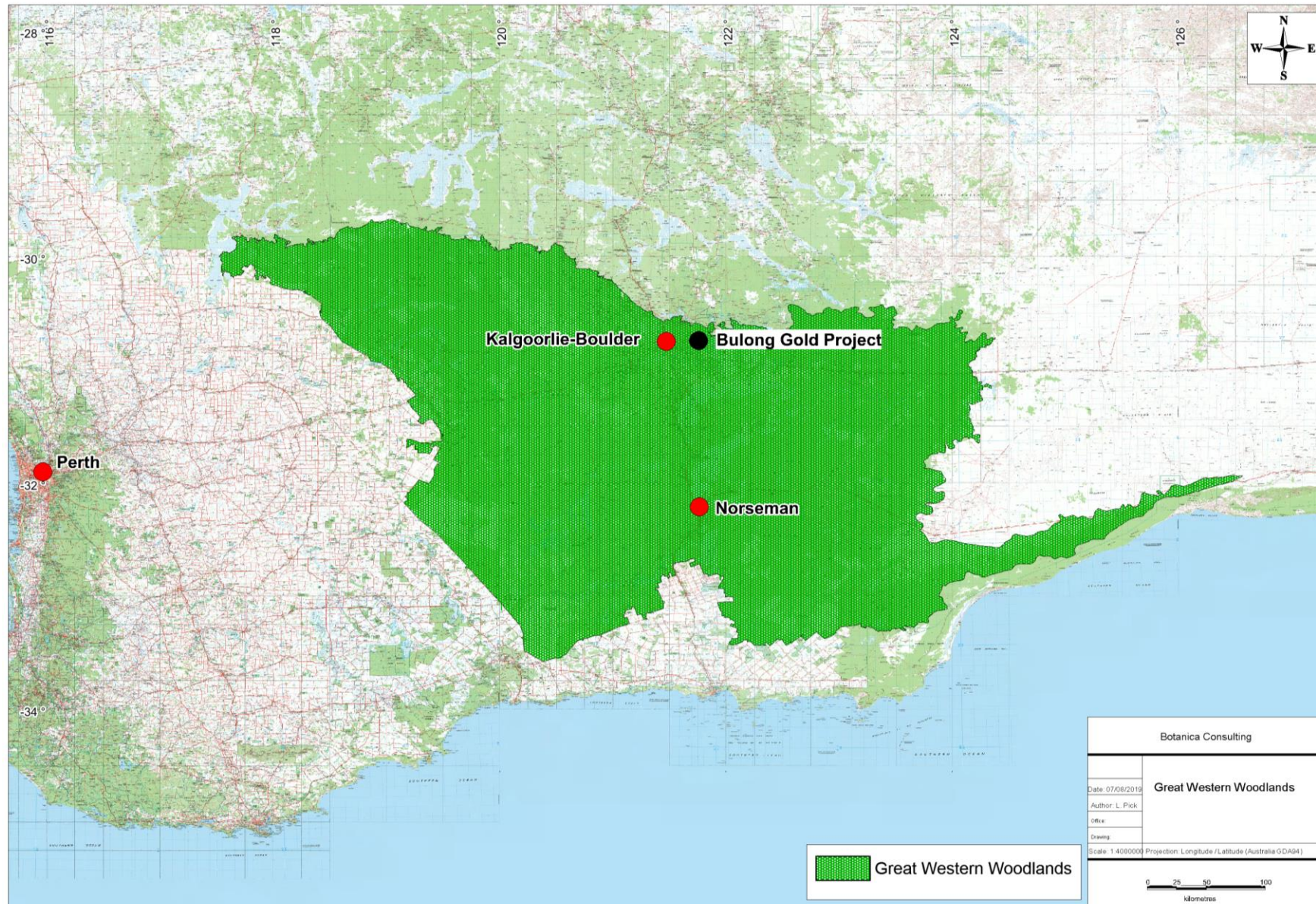
## 2.2 Great Western Woodlands

The survey area lies within the Great Western Woodlands, located approximately 120 km from the northern boundary. The Great Western Woodlands is considered by The Wilderness Society of WA to be of global biological and conservation importance as one of the largest and healthiest temperate woodlands on Earth, containing many endemic taxa. The region covers almost 16 million hectares (160,000 square kilometres), from the southern edge of the Western Australian Wheatbelt to the pastoral lands of the Mulga country in the north, the inland deserts to the northeast, and the treeless Nullarbor Plain to the east (Figure 2-2).

The Great Western Woodlands provides a connection between southwest forests and inland deserts (Gondwana Link) as well as linking the north-west passage to Shark Bay. The majority of the Great Western Woodlands is unallocated crown land (61.1%) with other interests including pastoral leases (20.4%), conservation reserves (15.4%) unallocated crown land, ex pastoral (2%) managed by the Department of Biodiversity, Conservation and Attractions (DBCA) and private land (approximately 1%) (Watson *et. al.*, 2008).

No specific management strategy or formal conservation status applies to the Great Western Woodlands. The Great Western Woodlands currently includes towns, highways, roads, railways, private property, Crown Reserves, agricultural activities and mining tenements.





**Figure 2-2: Location of survey area within the Great Western Woodlands (DBCA, 2011a)**

Note-survey area not to scale

### 2.3 Soils and Landscape Systems

The survey area lies within the Kalgoorlie Province, which consists of undulating plains (with some sandplains, hills and salt lakes) on granitic rocks and greenstone of the Yilgarn Craton. Soils comprise of calcareous loamy earths and red loamy earths with some salt lake soils, red deep sands, yellow sandy earths, shallow loams and loamy duplexes. Vegetation includes Eucalypt woodlands with some Acacia-Casuarina thickets, mulga shrublands, halophytic shrublands and spinifex grasslands. This Province is located within the southern Goldfields between Payne's Find, Menzies, Southern Cross and Balladonia (Tille, 2006).

The Kalgoorlie Province is located on the central eastern portion of the Yilgarn Craton, mostly overlying Archaean rocks of the Southern Cross Domain and the Eastern Goldfields Superterrane. To the north-west is the Murchison Domain. The basement rocks are a mix of granite, gneiss and greenstone. Even-grained porphyritic granitic rocks (intruded by quartz veins and dolerite dykes) are most common across the north as well as in the western half and the north-east. The largest areas of migmatite and gneiss are found in the south-west (Tille, 2006).

The Kalgoorlie Province is further divided into seven soil-landscape zones, with the survey area located within the Kambalda Zone (265). This zone is characterised by flat to undulating plains (with hills, ranges and some salt lakes and stony plains) on greenstone and granitic rocks of the Yilgarn Craton. Soils include calcareous loamy earths and red loamy earths with salt lakes soils and some red-brown hardpan shallow loams and red sandy duplexes. Vegetation includes red mallee blackbutt- salmon gum-gimlet woodlands with mulga and halophytic shrublands (and some spinifex grasslands). This zone is located in the south-eastern Goldfields between Menzies, Norseman and the Fraser Range (Tille, 2006). The Kambalda Zone is further divided into soil landscape systems with the survey area located within the landscape systems described in Table 2-1 and Figure 2-3 below.

**Table 2-1: Soil Landscape Systems within the survey area**

Landscape System Mapping Unit	Description
BB5	Rocky ranges and hills of greenstones-basic igneous rocks
Bevon System	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.
Gumland System	Extensive pediplains supporting eucalypt woodlands with halophytic and non-halophytic shrub understoreys.
Moriarty System	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.
Mx43	Gently undulating valley plains and pediments; some outcrop of basic rock





Figure 2-3: Soil Landscape Systems within the survey area



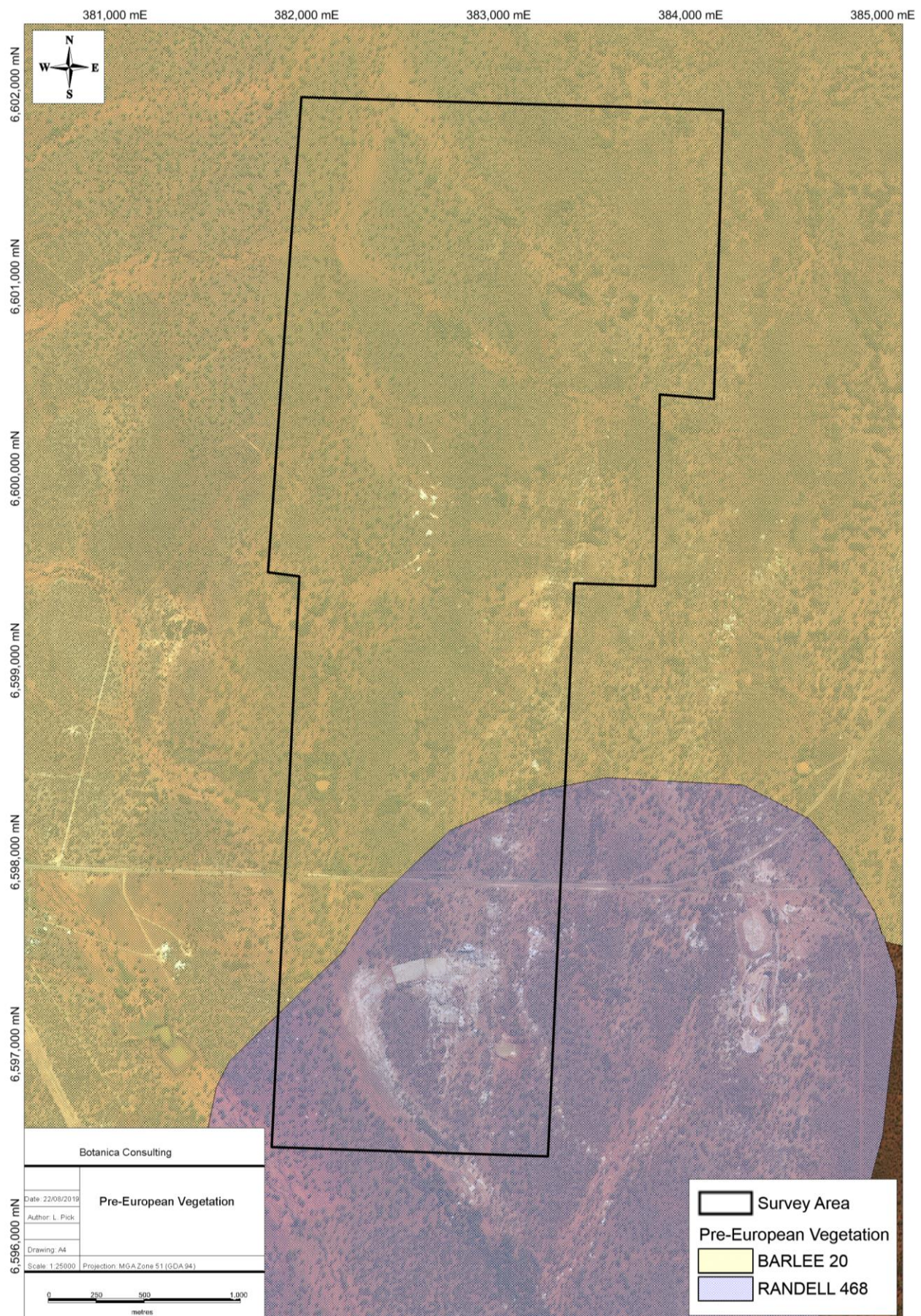
## 2.4 Vegetation

The vegetation of the Eastern Goldfields subregion consists of Mallees, *Acacia* thickets and shrub heaths on sandplains. Diverse *Eucalyptus* woodlands occur around salt lakes, on ranges, and in valleys (Cowan, 2001). The Department of Agriculture and Food Western Australia (DAFWA) GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation associations Barlee 20 of the Eastern Murchison subregion and Randell 468 of the Eastern Goldfields subregion. The extent of these vegetation associations, as specified in the 2017 Statewide Vegetation Statistics (DBCA, 2017) is provided in Table 2-2 and Figure 2-4.

**Table 2-2: Pre-European Vegetation Associations within the survey area**

Region	Pre-European extent remaining (ha)	Pre-European extent remaining (%)	% of Current extent within DBCA managed lands	Vegetation Description (Beard, 1990)
Barlee 20				
Eastern Murchison Subregion	1,169,909.21	99.78	8.9	Low woodland; mulga mixed with <i>Casuarina pauper</i> & <i>Eucalyptus</i> sp.
Western Australia	1,172,943.16	99.78	49.3	
Randell 468				
Eastern Goldfields Subregion	88,633.45	99.68	0	Medium woodland; salmon gum & goldfields blackbutt
Western Australia	88,978.05	99.69	0	





**Figure 2-4: Pre-European Vegetation Associations within the survey area**



## 2.5 Climate

The climate of the Eastern Goldfields subregion is characterised as an arid to semi-arid climate with annual rainfall of approximately 200-300 mm. The climate of the Eastern Murchison subregion is characterised as an arid climate with mainly winter rainfall and annual rainfall of approximately 200mm (Beard, 1990; Cowan, 2001). Rainfall data for the Kalgoorlie-Boulder Airport weather station (#12038), located approximately 25km west of the survey area, is shown in Figure 2-5 and the average climate data is shown in Figure 2-6 (BoM, 2019). Rainfall received in June 2019 (preceding the survey) was above average.

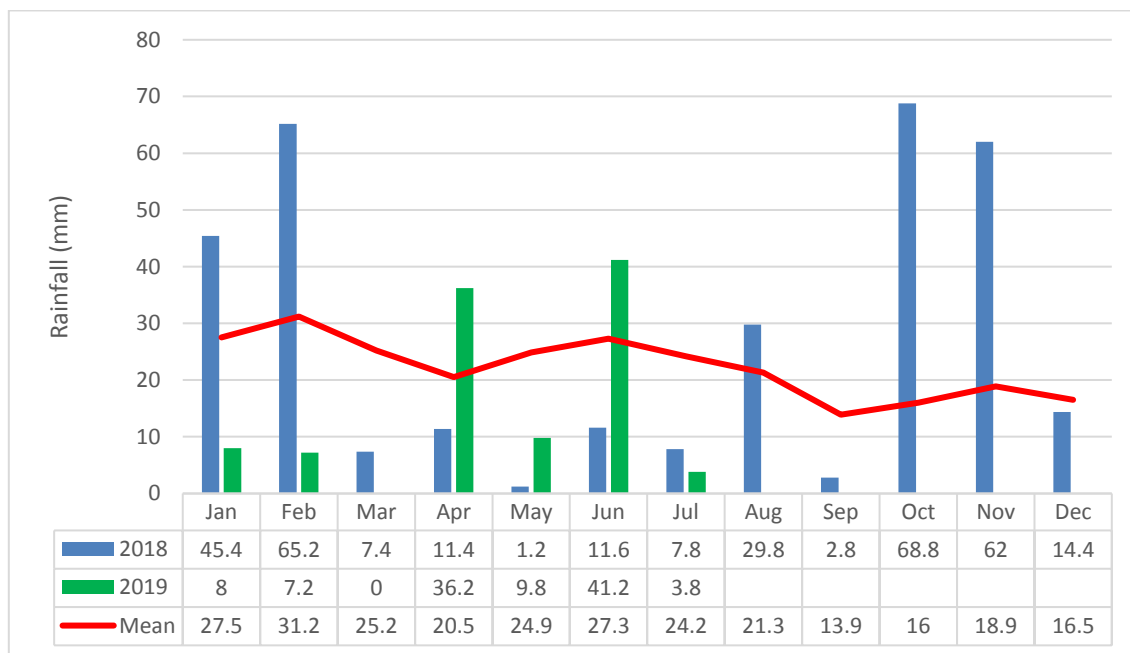


Figure 2-5: Monthly rainfall (Jan 2018 to July 2019) for the Kalgoorlie-Boulder Airport weather station #12038 (BoM, 2019)



Figure 2-6: Average Climate Data for the Kalgoorlie-Boulder Airport weather station #12038 (BoM, 2019)

## 2.6 Hydrology

According to the Geoscience Australia database (2001), there are no drainage lines or inland waters within the survey area. A map showing the drainage lines and inland waters in the local region is provided in Figure 2-7.

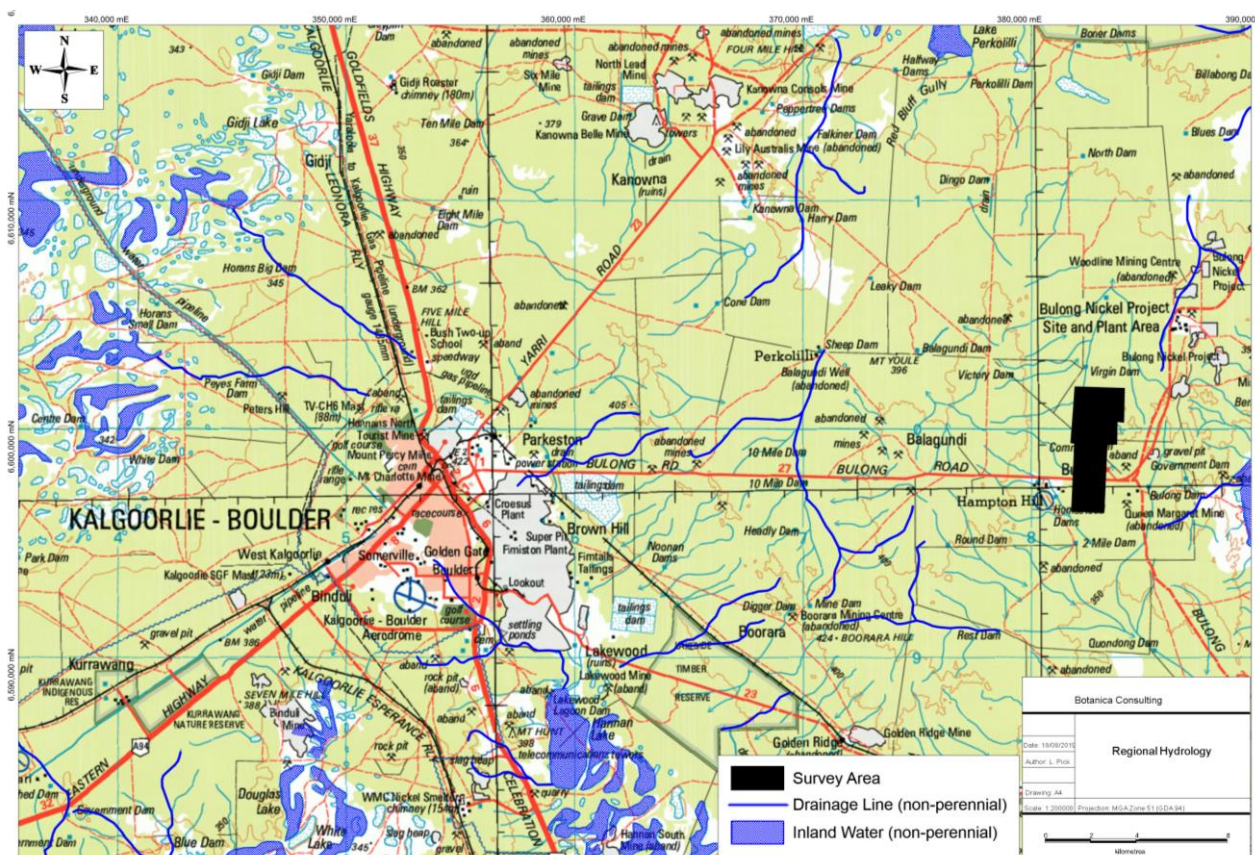


Figure 2-7: Hydrology of the survey area (data obtained from Geoscience Australia, 2001)

## 2.7 Land Use

The dominant land uses of the Eastern Goldfields subregion include Unallocated Crown Land and Crown Reserves, grazing-native pastures-leasehold, freehold, conservation and mining leases. The dominant land uses of the Eastern Murchison subregion include grazing native pastures, Unallocated Crown Land, Conservation and mining (Cowan, 2001). The survey area is located within the Hampton Hill Station Pastoral Lease.

### **3 Survey Methodology**

#### **3.1 Desktop Assessment**

Prior to the field assessment a literature review was undertaken of previous flora and fauna assessments conducted within the local region. Documents reviewed included:

- Barrick Gold Corporation (2011). Miscellaneous Fauna Survey Records 2006 - 2011. Kanowna Belle Area. Unpublished internal data. Acquired May 2011.
- Botanica Consulting (2009) Bellevue Flora and Vegetation Survey (M24/804, M24/231, M24/255, M24/403, M24/303).
- Botanica Consulting (2011a), Level 1 Flora and Vegetation Survey: Bullant,
- Botanica Consulting (2011b), Level 1 Flora and Vegetation Survey: Proposed Anthill open pit operation.
- Botanica Consulting (2011c), Level 2 Flora and Vegetation Survey: Kurnalpi Project.
- Botanica Consulting (2013a) Golden Flag Level 1 Flora and Vegetation survey.
- Botanica Consulting (2013b), Level 2 Flora and Vegetation Survey for the Castle Hill Project.
- Botanica Consulting (2014), Level 2 Flora and Vegetation Survey for the Burgundy Project survey area.
- Botanica Consulting (2015) Level 1 Flora and Vegetation Survey Racetrack, Mulgarrie Well & Mt Jewell Western/ Eastern Haul Road.
- Botanica Consulting (2016), Level 1 Flora & Vegetation Survey of the Carbine Mining Area.
- Botanica Consulting (2016), Level 1 Flora & Fauna Survey of the Glandore Project.
- Botanica Consulting (2018), Reconnaissance Flora & Fauna survey Kurnalpi Project. Prepared for KalNorth Gold Mines Limited
- GHD (2009) Paddington Gold Pty Ltd – Enterprise Development Activities Flora and Fauna Assessment
- Harewood G (2010a). Terrestrial Fauna Survey (Level 1) of the proposed Isabella Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.
- Harewood G (2010b). Terrestrial Fauna Survey (Level 1) of the proposed Golden Valley Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.
- Harewood G (2010c). Terrestrial Fauna Survey (Level 1) of the proposed Fenceline Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.
- Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) of the proposed Lignum Dam Mine Area. Unpublished report for Pioneer Resources Limited.
- Harewood, G. (2012). Terrestrial Fauna Survey (Level 1) of Proposed Powerline and Infrastructure Area, KCGM – Gidgi Operations. Unpublished report for KCGM Pty Ltd. January 2012.
- Harewood, G. (2012a). Terrestrial Fauna Survey (Level 1) of the Mt Jewel & Lindsay's Project Haul Road. Unpublished report for Carrick Gold Limited.
- Harewood, G. (2012b). Terrestrial Fauna Survey (Level 1) of the Kurnalpi Project. Unpublished report for Carrick Gold Limited.
- Harewood, G. (2013). Terrestrial Fauna Survey (Level 1) of the Arcoona Haul Road. Unpublished report for KalNorth Gold Mines Limited.
- Harewood, G. (2015a). Fauna Survey (Level 2 - Phase 1 and 2) Proposed Tails Storage Facility Expansion KCGM Pty Ltd Kalgoorlie. Unpublished report for KCGM.



- Harewood, G. (2015b). Fauna Assessment - 6 Mile Project Area. Unpublished report for Northern Star Resources.
- KLA (2009a). Barrick (Kanowna) Shamrock Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.
- KLA (2009b). Barrick (Kanowna) Crossroads Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.
- KLA (2009c). Barrick (Kanowna) Moonlight Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. March 2009.
- McKenzie, N.L. and Hall, N.J. (1992). The Biological Survey of the Eastern Goldfields of WA - Pt 8: Kurnalpi – Kalgoorlie study area. Records of the WAM, Supplement 41: 1 – 125.

Searches of the following databases were undertaken to aid in the compilation of a list of flora, vegetation and fauna taxa within the survey area:

- DBCA Priority/ Threatened Flora Database Search (DBCA, 2019a)
- DBCA Priority/ Threatened Ecological Communities Database Search (DBCA, 2019b)
- DBCA NatureMap Database (DBCA, 2019c);
- DotEE Protected Matters search tool (DotEE, 2019).

The NatureMap and Protected Matters Search were conducted for an area encompassing a 20 km radius of the centre coordinates – 121° 46' 32" E, 30° 43' 31" S. It should be noted that these lists are based on observations from a broader area than the assessment area (20 km radius) and therefore may include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

The conservation significance of flora/ vegetation and fauna taxa was assessed using data from the following sources:

- *Environment Protection and Biodiversity and Conservation (EPBC) Act 1999*. Administered by the Australian Government (DotEE);
- *Biodiversity Conservation (BC) Act 2016*<sup>1</sup>. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- Priority Flora/ Fauna list. A non-legislative list maintained by DBCA for management purposes (fauna list released 11<sup>th</sup> September 2018; flora list released 5<sup>th</sup> December 2018).

The EPBC Act also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)<sup>2</sup>;

<sup>1</sup> Prior to 1<sup>st</sup> January 2019, flora and fauna were protected under the *Wildlife Conservation Act 1950*

<sup>2</sup> Most but not all species listed under JAMBA are also specially protected under Specially Protected Species of the BC Act.

- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

Most but not all migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as Matters of National Environmental Significance (MNES) under the EPBC Act. Descriptions of conservation significant species and communities are provided in Appendix 1.

### **3.2 Field Assessment**

Botanica conducted a reconnaissance flora/vegetation and fauna survey. The survey was conducted on the 28<sup>th</sup> July 2019, covering an area of approximately 961 ha, with the survey area traversed on foot, ATV and by 4WD by two BC staff members.

#### **3.2.1 Flora Assessment**

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation communities identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between existing vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum;
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- GPS location, photograph and collection of flora of conservation significance if encountered.

Unknown specimens collected during the survey were identified with the aid of samples housed at the BC Herbarium and WAHERB. Vegetation was classified in accordance with the NVIS Vegetation Type classification.

#### **3.2.2 Fauna Assessment**

Vegetation and landform units identified during the flora survey have been used to define broad fauna habitat types across the site. This information has been supplemented with observations made during the fauna assessment.

The main aim of the fauna habitat assessment was to determine if it was likely that any species of conservation significance would be utilising the areas that maybe impacted on as a consequence of development at the site. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

As part of the desktop literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the field survey, the habitats within the survey area were assessed and specific elements identified, if present, to determine the likelihood of listed threatened species utilising the area and its significance to them. Opportunistic observations of fauna species were made during all field survey work which involved a series of transects across the survey area during the day.

### 3.2.3 Personnel involved

Jim Williams - Environmental Consultant/ Director (Diploma of Horticulture)

Lauren Pick - Environmental Consultant (Bachelor of Science-Zoology/Conservation Biology)

### 3.2.4 Scientific licences

**Table 3-1: Scientific Licences of Botanica Staff coordinating the survey**

Licensed staff	Permit Number	Valid
Jim Williams	FB62000108 (Licence to flora for scientific purposes)	27/05/2019-27/05/2022
Lauren Pick	FB62000109 (Licence to flora for scientific purposes)	27/05/2019-27/05/2022

### 3.3 Survey limitations and constraints

It is important to note that flora surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 3-5.

The conclusions presented in this report are based upon field data and environmental assessments and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. Also, it should be recognised that site conditions can change with time. Information not available at the time of this assessment which may subsequently become available may alter the conclusions presented.

Some species are reported as potentially occurring based on there being suitable habitat (quality and extent) within the survey area or immediately adjacent. The habitat requirements and ecology of many of the species known to occur in the wider area are however often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitats or microhabitats within the survey area. As a consequence of this limitation, the potential species list produced is most likely an overestimation of those species that actually utilise the survey area for some purpose.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any flora and fauna species that would possibly occur within the survey area (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the author, has been listed as having the potential to occur.

**Table 3-2: Limitations and constraints associated with the survey**

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot. Numerous tracks were located within the survey area, providing ease of access.
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. <b>Coordinating Botanist/ Zoologist:</b> Jim Williams, & Lauren Pick <b>Data Interpretation:</b> Jim Williams & Lauren Pick
Timing of survey, weather & season	Not a constraint	Fieldwork was completed within the EPA's recommended primary survey time periods (i.e., 6-8 weeks post wet season for the Eremaean Province but was outside of EPA's recommended primary survey time periods (i.e., September – November) for the South-West Interzone. The survey work was however conducted following above average rainfall

Variable	Potential Impact on Survey	Details
		received in June 2019, with annual species present during the survey.
Area disturbance	Not a constraint	Area has been disturbed by existing exploration/ mining and pastoralist activities. However, vegetation was mostly intact.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a reconnaissance survey completed to identify vegetation types/fauna habitat and areas of Conservation Significance
Availability of contextual information at a regional and local scale	Not a constraint	<p>Threatened flora database searches provided by the DBCA were used to identify any potential locations of Threatened/Priority taxa. BoM, DWER, DPIRD, DBCA and DotEE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region.</p> <p>BC were able to obtain information about the area from previous flora/ fauna assessments conducted within the region and previous reconnaissance surveys conducted by BC which provided context on the local environment.</p>
Completeness	Minor constraint	<p>In the opinion of BC, the survey area was covered sufficiently in order to identify vegetation assemblages. Few of the plants during the survey were in flower however annual species present. It is estimated that approximately 90% of the flora within the survey area were able to be fully identified.</p> <p>The vegetation types for this study were based on visual descriptions of locations in the field. The distribution of these vegetation communities/ fauna habitats outside the survey area is not known, however vegetation types identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS Major Vegetation Groups (DotEE, 2017b).</p>

## 4 Results

### 4.1 Desktop Assessment

#### 4.1.1 Flora/Vegetation

According to the results of the NatureMap search (DBCA, 2018a), a total of 100 flora taxa have been recorded within a 20 km radius of the survey area. Dominant genera include *Acacia*, *Eucalyptus*, and *Eremophila*. Results of database searches identified eleven introduced taxa as potentially occurring within a 20 km radius of the survey area:

1. *Alyssum linifolium* (Flax-leaf Alyssum)
2. *Argemone ochroleuca* subsp. *ochroleuca*
3. *Carrichtera annua* (Wards weed)
4. *Cenchrus ciliaris* (Buffel Grass)
5. *Cenchrus setaceus* (Fountain Grass)
6. *Datura ferox* (Fierce Thornapple)
7. *Heliotropium europaeum* (Common Heliotrope)
8. *Heliotropium supinum* (Prostrate Heliotrope)
9. *Lycium ferocissimum* (African Boxthorn)
10. *Proboscidea louisianica* (Purple Flower Devil's Claw)
11. *Sisymbrium irio* (London Rocket)

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2019b), NatureMap search and DotEE protected matters search recorded no Threatened or Priority Flora within the survey area. A total of two Threatened Flora and two Priority Flora were listed on the databases as occurring within a 20km radius of the survey area (map of flora locations provided in Appendix 2). These taxa were assessed and ranked for their likelihood of occurrence within the survey area. The rankings and criteria used were:

- Unlikely: Area is outside of the currently documented distribution for the species/no suitable habitat (type, quality and extent) was identified as being present during the field/desktop study.
- Possible: Area is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field/desktop study, supported in some cases by recent records being documented from within or near the area.
- Known to Occur: The species in question was positively identified as being present during previous field surveys.

Two Priority Flora taxa were ranked as 'possible' to occur within the survey area. The two Threatened Flora were ranked as 'unlikely' to occur (Table 4-1).

**Table 4-1: Likelihood of occurrence for Threatened and Priority Flora within the survey area**

Taxon	EPBC Act	WC Act	DBCA Priority	Description (WAHERB, 2018)	Likelihood of Occurrence
<i>Gastrolobium graniticum</i>	EN	EN		Erect, open shrub, to 2.5 m high. Fl. yellow& orange& red, Aug to Sep. Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.	Unlikely
<i>Eremophila praecox</i>			P1	Broom-like shrub, 1.5-3 m high. Fl. purple, Oct or Dec. Red/brown sandy loam. Undulating plains.	Possible
<i>Eremophila xantholaema</i>			P1	No description available	Possible
<i>Tecticornia flabelliformis</i>	VU		P1	Erect shrub, to 0.2 m high. Clay. Saline flats.	Unlikely

#### 4.1.2 Fauna

According to the results of the NatureMap search (DBCA, 2019c), a total of 135 vertebrate fauna taxa have been recorded within a 20 km radius of the survey area including 77 bird species, 3 amphibians, 19 mammals and 36 reptiles. Combined results of database searches identified nine introduced taxa as potentially occurring within the survey area, these being:

1. *Canis lupus familiaris* (Dog)
2. *Capra hircus* (Goat)
3. *Columba livia* (Rock Pigeon)
4. *Felis catus* (Cat)
5. *Mus musculus* (House Mouse)
6. *Oryctolagus cuniculus* (Rabbit)
7. *Streptopelia chinensis* (Spotted Turtle-Dove)
8. *Streptopelia senegalensis* (Laughing Turtle-Dove)
9. *Vulpes vulpes* (Red Fox)

Fauna of conservation significance identified during the literature review as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the survey area itself (Table 4-2). The rankings and criteria used were:

- **Would Not Occur:** There is no suitable habitat for the species in the survey area and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
  - **Locally Extinct:** Populations no longer occur within a small part of the species natural range, in this case within 10 or 20 km of the survey area. Populations do however persist outside of this area.
  - **Regionally Extinct:** Populations no longer occur in a large part of the species natural range, in this case within the southern and south-eastern goldfields region. Populations do however persist outside of this area.
- **Unlikely to Occur:** The survey area is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the site itself would not support a population or part population of the species
- **Possibly Occurs:** Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in literature from within or near the survey area. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.
- **Known to Occur:** The species in question has been positively identified as being present (for sedentary species) or as using the survey area as habitat for some other purpose (for non-sedentary/mobile species) during field surveys within or near the survey area. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. tracks, foraging debris, scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.



**Table 4-2: Likelihood of occurrence for Threatened and Priority Fauna within the survey area**

Taxon	Conservation Status			Habitat Description	Likelihood of Occurrence
	EPBC Act	WC Act	DBCA Priority		
Various Migratory Shorebirds	IA	IA	-	Generally, occur around inland waters, both salt and fresh waters (DotEE 2019)	Would not occur. No Suitable Habitat.
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	-	The Peregrine Falcon is found in most habitats, from rainforests to the arid zone, and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water, and may even be found nesting on high city buildings (Birdlife Australia, 2019).	Possibly Occurs aerially over survey area but unlikely to breed in the area.
Fork-tailed Swift <i>Apus pacificus</i>	IA	IA	-	Low to very high airspace over varied habitat from rainforest to semi desert (Birdlife Australia, 2019).	Unlikely to occur. Very occasional transients only.
Grey Wagtail <i>Motacilla cinerea</i>	IA	IA	-	Running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Morecombe 2004)	Would not occur. No Suitable Habitat.
Malleefowl <i>Leipoa ocellata</i>	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species (DotEE 2019)	Possibly occurs however habitat appears marginal/unsuitable for breeding. Transient individuals only.
Night Parrot <i>Pezoporus occidentalis</i>	EN	CR	-	Found in arid and semi-arid zones of Australia (DotEE 2019)	Would not occur. No Suitable Habitat. Never recorded in this area of Goldfields.
Hooded Plover <i>Thinornis rubricollis</i>			P4	Often recorded on ocean beaches, but they are just as likely to be seen foraging at salt lakes, sometimes hundreds of kilometres from the coast (Birdlife Australia, 2019).	Would not occur.. Outside of normal range and no Suitable Habitat
Chuditch <i>Dasyurus geoffroii</i>	VU	VU	-	Occurring in a variety of habitats including deserts, woodlands and shrublands (DotEE 2019)	Would not occur. No recent records nearby and very likely to be locally extinct.
Western Spiny-tailed Skink <i>Egernia stokesii</i> subsp. <i>badia</i>				Occurs in open eucalypt woodlands and <i>Acacia</i> -dominated shrublands in semi-arid to arid areas of south-western WA (Geraldton Sandplains and Yalgoo IBRA) (DEC, 2012)	Would not occur. (current distribution indicates this record is a database error). Never recorded in this area of Goldfields.
Central Long-eared Bat <i>Nyctophilus major tor</i>	-	-	P4	Appears to prefer heavy eucalypt woodlands and tall woodlands with a tall shrub understorey. Less common in open woodlands.	Possibly Occurs though lack of records suggests it is uncommon.

## 4.2 Field Assessment

### 4.2.1 Vegetation Types

Seven broad vegetation types were identified within the survey area (Table 4-3). These vegetation types were identified within three different landform types and comprised of three major vegetation groups, which were represented by a total of 25 families, 46 genera and 91 taxa (including eight annual taxa and one introduced taxa) (Appendix 3). A map showing the vegetation types present in the survey area is provided in Figure 4-1.

**Table 4-3: Summary of vegetation types within the survey area**

Landform	NVIS Vegetation Group	Vegetation Code	Vegetation Type	Area (Ha)	Area (%)
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	CLP-EW1	Low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low shrubland of <i>Atriplex vesicaria</i> / <i>Olearia muelleri</i> on clay-loam plain	255	27
		CLP-EW2	Forest of <i>Eucalyptus ravida</i> over mid shrubland of <i>Atriplex nummularia</i> / <i>Eremophila scoparia</i> and low chenopod shrubland of <i>Atriplex vesicaria</i> on clay-loam plain	60	6
Open Depression	Eucalypt Woodlands (MVG 5)	OD-EW1	Open low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low samphire shrubland of <i>Tecticornia disarticulata</i> on clay-loam plain	254	26
Hillslope	Casuarina Forests and Woodlands (MVG 8)	HS-CFW1	Forest of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia tetragonophylla</i> and low open shrubland of <i>Dodonaea lobulata</i> on hillslope	18	2
	Eucalypt Woodlands (MVG 5)	HS-EW1	Forest of <i>Eucalyptus stricklandii</i> over mid shrubland of <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on hillslope	27	3
		HS-EW2	Low woodland of <i>Eucalyptus lesouefii</i> / <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Acacia kalgoorliensis</i> and open low shrubland of <i>Ptilotus obovatus</i> / <i>Westringia rigida</i> on hillslope	277	29
	Mallee Woodlands and Shrublands (MVG 14)	HS-MWS1	Tree mallee of <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Eremophila scoparia</i> and low hummock grassland of <i>Triodia scariosa</i> on hillslope	40	4
N/A	N/A	CV	Cleared Vegetation	30	3
<b>TOTAL</b>				<b>961</b>	<b>100</b>



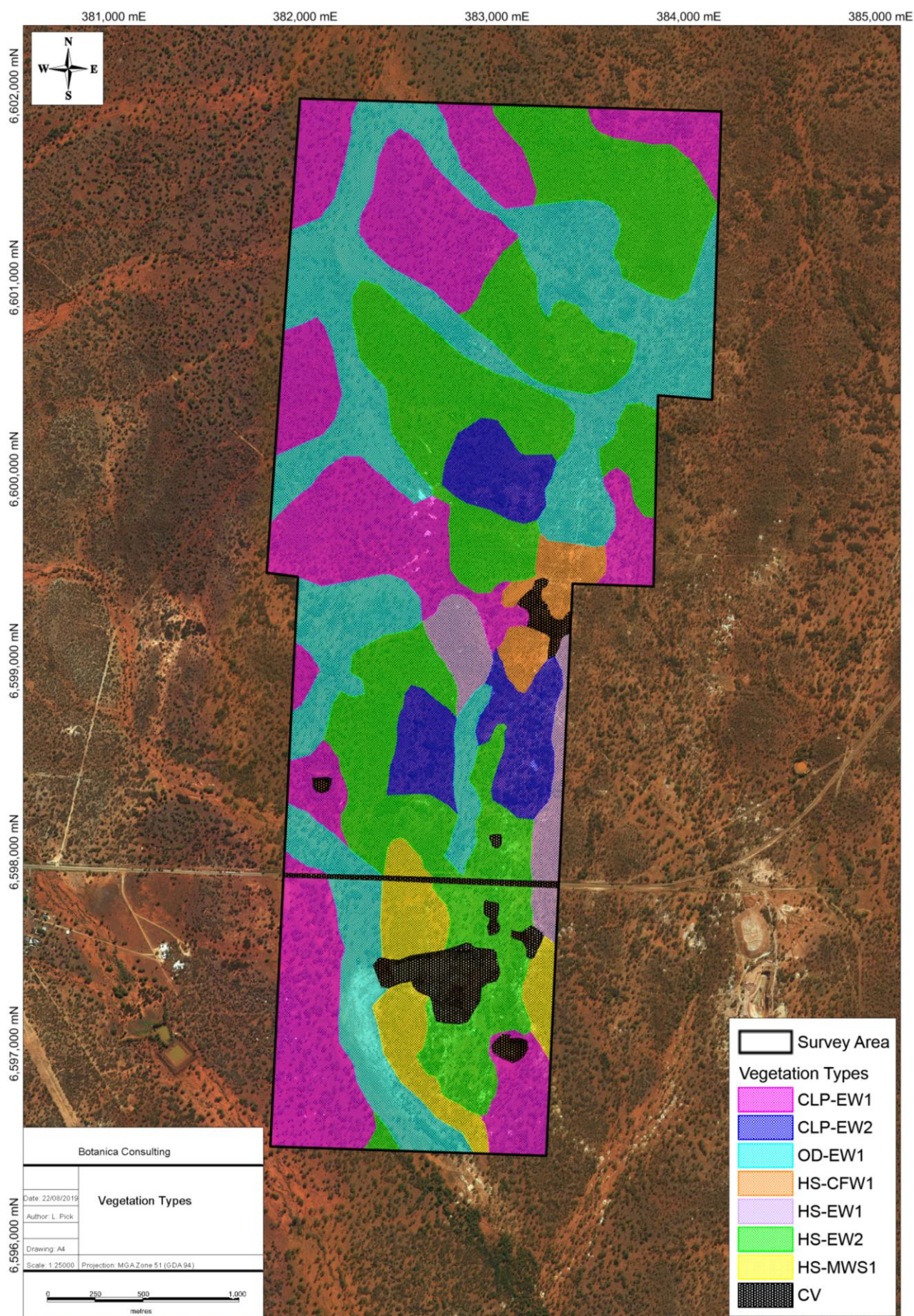


Figure 4-1: Vegetation types within the survey area



## **Clay-Loam Plain: Eucalypt Woodlands**

### **4.2.1.1 Low woodland of *Eucalyptus salmonophloia* over mid shrubland of *Eremophila scoparia* and low shrubland of *Atriplex vesicaria*/ *Olearia muelleri* on clay-loam plain (CLP-EW1)**

The total flora recorded within this vegetation type was represented by a total of 13 Families, 22 Genera and 31 Taxa (Plate 4-1). Dominant taxa are shown in Table 4-4. According to the NVIS, this vegetation type is best represented by MVG 5 -Eucalyptus Woodland (DotEE, 2017b).

**Table 4-4: Low woodland of *Eucalyptus salmonophloia* over mid shrubland of *Eremophila scoparia* and low shrubland of *Atriplex vesicaria*/ *Olearia muelleri* on clay-loam plain**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree >10m	10-30%	<i>Eucalyptus salmonophloia</i>
Shrub 1-2m	30-70%	<i>Eremophila scoparia</i>
Chenopod Shrub <1m	30-70%	<i>Atriplex vesicaria</i>
Shrub <1m	10-30%	<i>Olearia muelleri</i>



**Plate 4-1: Low woodland of *Eucalyptus salmonophloia* over mid shrubland of *Eremophila scoparia* and low shrubland of *Atriplex vesicaria*/ *Olearia muelleri* on clay-loam plain**

#### 4.2.1.2 Forest of *Eucalyptus ravid* over mid shrubland of *Atriplex nummularia*/*Eremophila scoparia* and low chenopod shrubland of *Atriplex vesicaria* on clay-loam plain (CLP-EW2)

The total flora recorded within this vegetation type was represented by a total of 10 Families, 14 Genera and 23 Taxa (Plate 4-2). Dominant taxa are shown in Table 4-5. According to the NVIS, this vegetation type is best represented by MVG 5 -Eucalyptus Woodland (DotEE, 2017b).

**Table 4-5: Forest of *Eucalyptus ravid* over mid shrubland of *Atriplex nummularia*/*Eremophila scoparia* and low chenopod shrubland of *Atriplex vesicaria* on clay-loam plain**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	30-70%	<i>Eucalyptus ravid</i>
Chenopod Shrub 1-2m	10-30%	<i>Atriplex nummularia</i> subsp. <i>spathulata</i>
Chenopod Shrub <1m	30-70%	<i>Atriplex vesicaria</i>



**Plate 4-2: Forest of *Eucalyptus ravid* over mid shrubland of *Atriplex nummularia*/*Eremophila scoparia* and low chenopod shrubland of *Atriplex vesicaria* on clay-loam plain**



## **Open Depression: Eucalypt Woodlands**

### **4.2.1.3 Open low woodland of *Eucalyptus salmonophloia* over mid shrubland of *Eremophila scoparia* and low samphire shrubland of *Tecticornia disarticulata* on clay-loam plain (OD-EW1)**

The total flora recorded within this vegetation type was represented by a total of 7 Families, 10 Genera and 11 Taxa (Plate 4-3). Dominant taxa are shown in Table 4-6. According to the NVIS, this vegetation type is best represented by MVG 5 -Eucalyptus Woodland (DotEE, 2017b).

**Table 4-6: Open low woodland of *Eucalyptus salmonophloia* over mid shrubland of *Eremophila scoparia* and low samphire shrubland of *Tecticornia disarticulata* on clay-loam plain**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree >10m	5-10%	<i>Eucalyptus salmonophloia</i>
Shrub 1-2m	10-30%	<i>Eremophila scoparia</i>
Samphire Shrub <1m	30-70%	<i>Tecticornia disarticulata</i>



**Plate 4-3: Open low woodland of *Eucalyptus salmonophloia* over mid shrubland of *Eremophila scoparia* and low samphire shrubland of *Tecticornia disarticulata* on clay-loam plain**

## **Hillslope: Casuarina Forests and Woodlands**

### **4.2.1.4 Forest of *Casuarina pauper* over mid shrubland of *Acacia tetragonophylla* and low open shrubland of *Dodonaea lobulata* on hillslope (HS-CFW1)**

The total flora recorded within this vegetation type was represented by a total of 10 Families, 10 Genera and 12 Taxa (Plate 4-4). Dominant taxa are shown in Table 4-7. According to the NVIS, this vegetation type is best represented by MVG 8 – Casuarina Forests and Woodlands (DotEE, 2017b).

**Table 4-7: Forest of *Casuarina pauper* over mid shrubland of *Acacia tetragonophylla* and low open shrubland of *Dodonaea lobulata* on hillslope**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	30-70%	<i>Casuarina pauper</i>
Shrub >2m	30-70%	<i>Acacia tetragonophylla</i>
Shrub 1-2m	10-30%	<i>Dodonaea lobulata</i>



**Plate 4-4: Forest of *Casuarina pauper* over mid shrubland of *Acacia tetragonophylla* and low open shrubland of *Dodonaea lobulata* on hillslope**



## **Hillslope: Eucalypt Woodlands**

### **4.2.1.5 Forest of *Eucalyptus stricklandii* over mid shrubland of *Eremophila oldfieldii* subsp. *angustifolia* and low open shrubland of *Ptilotus obovatus* on hillslope (HS-EW1)**

The total flora recorded within this vegetation type was represented by a total of 11 Families, 14 Genera and 26 Taxa (Plate 4-5). Dominant taxa are shown in Table 4-8. According to the NVIS, this vegetation type is best represented by MVG 5 – Eucalypt Woodlands (DotEE, 2017b).

**Table 4-8: Forest of *Eucalyptus stricklandii* over mid shrubland of *Eremophila oldfieldii* subsp. *angustifolia* and low open shrubland of *Ptilotus obovatus* on hillslope**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	30-70%	<i>Eucalyptus stricklandii</i>
Shrub 1-2m	10-30%	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>
Shrub <1m	10-30%	<i>Ptilotus obovatus</i>



**Plate 4-5: Forest of *Eucalyptus stricklandii* over mid shrubland of *Eremophila oldfieldii* subsp. *angustifolia* and low open shrubland of *Ptilotus obovatus* on hillslope**

#### 4.2.1.6 Low woodland of *Eucalyptus lesouefii*/ *Eucalyptus griffithsii* over mid shrubland of *Acacia kalgoorliensis* and open low shrubland of *Ptilotus obovatus* / *Westringia rigida* on hillslope (HS-EW2)

The total flora recorded within this vegetation type was represented by a total of 17 Families, 27 Genera and 46 Taxa (Plate 4-6). Dominant taxa are shown in Table 4-9. According to the NVIS, this vegetation type is best represented by MVG 5 – Eucalypt Woodlands (DotEE, 2017b).

**Table 4-9: Low woodland of *Eucalyptus lesouefii*/ *Eucalyptus griffithsii* over mid shrubland of *Acacia kalgoorliensis* and open low shrubland of *Ptilotus obovatus* / *Westringia rigida* on hillslope**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	<i>Eucalyptus lesouefii</i> <i>Eucalyptus griffithsii</i>
Shrub >2m	30-70%	<i>Acacia kalgoorliensis</i>
Shrub <1m	30-70%	<i>Ptilotus obovatus</i> <i>Westringia rigida</i>



**Plate 4-6: Low woodland of *Eucalyptus lesouefii*/ *Eucalyptus griffithsii* over mid shrubland of *Acacia kalgoorliensis* and open low shrubland of *Ptilotus obovatus* / *Westringia rigida* on hillslope**



## **Hillslope: Mallee Woodlands and Shrublands**

### **4.2.1.7 Tree mallee of *Eucalyptus griffithsii* over mid shrubland of *Eremophila scoparia* and low hummock grassland of *Triodia scariosa* on hillslope (HS-MWS1)**

The total flora recorded within this vegetation type was represented by a total of 10 Families, 14 Genera and 20 Taxa (Plate 4-7). Dominant taxa are shown in Table 4-10. According to the NVIS, this vegetation type is best represented by the MVG 14 – Mallee Woodlands and Shrublands (DotEE, 2017b).

**Table 4-10: Tree mallee of *Eucalyptus griffithsii* over mid shrubland of *Eremophila scoparia* and low hummock grassland of *Triodia scariosa* on hillslope**

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree Mallee	10-30%	<i>Eucalyptus griffithsii</i>
Shrub 1-2m	10-30%	<i>Eremophila scoparia</i>
Hummock Grass <1m	30-70%	<i>Triodia scariosa</i>



**Plate 4-7: Tree mallee of *Eucalyptus griffithsii* over mid shrubland of *Eremophila scoparia* and low hummock grassland of *Triodia scariosa* on hillslope**



#### 4.2.2 Vegetation Condition

Based on the vegetation condition rating scale<sup>3</sup> adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 4), the vegetation ranged from poor to very good (Table 4-11). 'Very good' condition indicates some relatively slight signs of damage caused by human activities since European settlement (i.e. relatively non-aggressive weeds, or occasional vehicle tracks). 'Good' condition depicts more obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing. 'Poor' condition indicates vegetation still retains its basic structure or ability to regenerate it after very obvious impacts of human activities since European settlement (including heavy grazing, clearing/ historic mining). The open depression located directly west of a historic heap leach has been impacted by sedimentation/ tailings dispersal (Plate 4-8).



**Plate 4-8: Tailings dispersal within open depression**

A map showing the vegetation condition within the survey area is provided in Figure 4-2.

**Table 4-11: Vegetation condition within the survey area**

Landform	NVIS Vegetation Group	Vegetation Code	Vegetation Type	Health Rating
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	CLP-EW1	Low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low shrubland of <i>Atriplex vesicaria</i> / <i>Olearia muelleri</i> on clay-loam plain	Good-Very Good
		CLP-EW2	Forest of <i>Eucalyptus ravida</i> over mid shrubland of <i>Atriplex nummularia</i> / <i>Eremophila scoparia</i> and low chenopod shrubland of <i>Atriplex vesicaria</i> on clay-loam plain	Good

<sup>3</sup> As majority of the survey area is located within the Eastern Murchison subregion, condition rating was based on the Eremaean Province categories

Landform	NVIS Vegetation Group	Vegetation Code	Vegetation Type	Health Rating
Open Depression	Eucalypt Woodlands (MVG 5)	OD-EW1	Open low woodland of <i>Eucalyptus salmonophloia</i> over mid shrubland of <i>Eremophila scoparia</i> and low samphire shrubland of <i>Tecticornia disarticulata</i> on clay-loam plain	Poor-Very Good
Hillslope	Casuarina Forests and Woodlands (MVG 8)	HS-CFW1	Forest of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia tetragonophylla</i> and low open shrubland of <i>Dodonaea lobulata</i> on hillslope	Poor
	Eucalypt Woodlands (MVG 5)	HS-EW1	Forest of <i>Eucalyptus stricklandii</i> over mid shrubland of <i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i> and low open shrubland of <i>Ptilotus obovatus</i> on hillslope	Good
		HS-EW2	Low woodland of <i>Eucalyptus lesouefii</i> / <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Acacia kalgoorliensis</i> and open low shrubland of <i>Ptilotus obovatus</i> / <i>Westringia rigida</i> on hillslope	Poor-Very Good
	Mallee Woodlands and Shrublands (MVG 14)	HS-MWS1	Tree mallee of <i>Eucalyptus griffithsii</i> over mid shrubland of <i>Eremophila scoparia</i> and low hummock grassland of <i>Triodia scariosa</i> on hillslope	Poor-Good
N/A	N/A	CV	Cleared Vegetation	N/A





Figure 4-2: Vegetation condition within the survey area



### 4.2.3 Introduced Flora

One introduced taxon was identified during the field assessment; *Carrichtera annua* (Wards Weed). According to the DPIRD Declared Organisms database (DPIRD, 2019), this taxon is not listed as Declared Plant under the *Biodiversity and Agriculture Management (BAM) Act 2007*.

#### 4.2.3.1 *Carrichtera annua* (Wards Weed)

This taxon is described as an erect annual herb, which grows between 0.05-0.4 m high. It produces yellow flowers from September to November within semi-arid regions (WAHERB, 2019). This taxon was recorded within one vegetation type; Low woodland of *Eucalyptus ravidia* over mid shrubland of *Atriplex nummularia*/*Eremophila scoparia* and low chenopod shrubland of *Atriplex vesicaria* on clay-loam plain (CLP-EW2).





Plate 4-9: *Carrichtera annua* (Wards Weed)


#### 4.2.4 Fauna Habitat

Three broad scale terrestrial fauna habitat within the survey presented below are based on vegetation and associated landforms identified during the flora and vegetation survey. The extent of the identified fauna habitats and a summary description is provided in Table 4-12 below. A map of the fauna habitats is provided in Figure 4-3.

**Table 4-12: Main terrestrial fauna habitats within the survey area**

Fauna Habitat Description	Example Image
<p><u>Clay Loam Plain</u></p> <p>Eucalypt Woodlands</p> <p>Total Area = 315 ha (33%)</p>	
<p><u>Open Depression</u></p> <p>Eucalypt Woodlands</p> <p>Total Area = 254 ha (26%)</p>	



Fauna Habitat Description	Example Image
<p><u>Hillslope</u></p> <p>Casuarina Forest/ Eucalypt Woodlands/ Mallee Woodlands</p> <p>Total Area = 362 ha (38%)</p>	



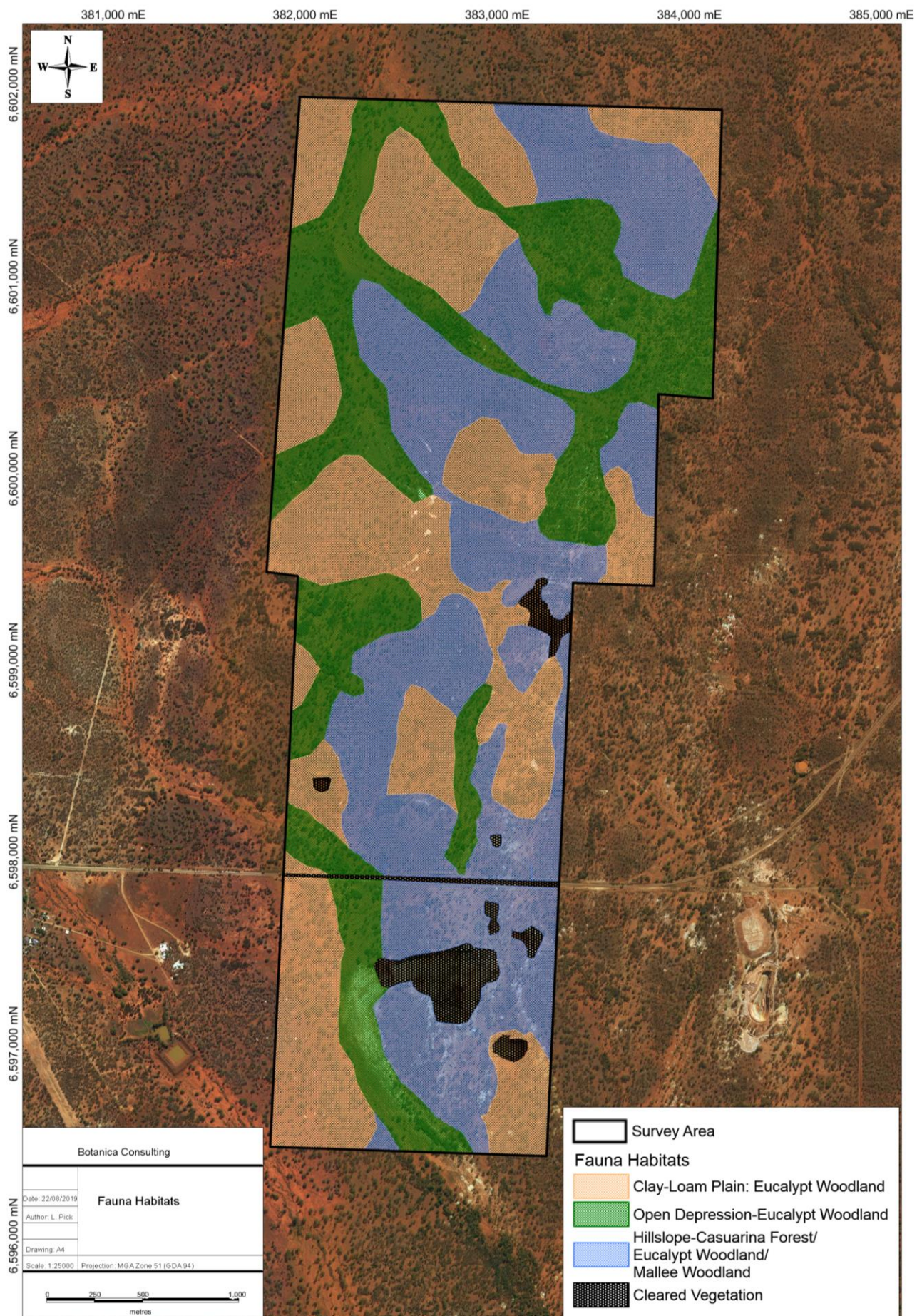


Figure 4-3: Fauna habitats within the survey area



Based on the habitats present within the survey area, a list of expected vertebrate fauna species likely to occur in the survey area was compiled from information obtained during the literature review and is presented in Appendix 5. The results of some previous fauna surveys carried out in the general area are also summarised in this species listing as are the DBCA NatureMap database search results.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. EPBC Act's Threatened Fauna and Migratory species lists, DBCA's NatureMap database and various publications) are considered likely to be present within the survey area. The list of potential fauna takes into consideration that firstly the species in question is not known to be locally/regionally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the survey area, though compiling an accurate list has limitations (see Section 3.3).

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the survey area (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time, only a subset of the listed potential species is likely to be present within the bounds of the survey area.

Table 4-13 summarises the numbers of potential species based on vertebrate class considered likely to be present in the general vicinity of the survey area based on the complete list held Appendix 5.

**Table 4-13: Summary of Potential Vertebrate Fauna Species**

Group	Total number of potential species	Potential number of Threatened/ specially protected species	Potential number of other specially protected/ migratory species	Potential number of priority species
Amphibians	5	0	0	0
Reptiles	86	0	0	0
Birds	111	2	0	0
Non-Volant Mammals	26 <sup>10</sup>	0	0	0
Volant Mammals (Bats)	12	0	0	1
<b>Total</b>	<b>240<sup>10</sup></b>	<b>2</b>	<b>0</b>	<b>1</b>

Superscript = number of introduced species included in the total. Note: Where a species state and federal conservation status is different, the highest category is used.

#### 4.2.5 Significant Flora

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant flora includes:

- flora being identified as threatened or priority species
- locally endemic flora or flora associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems)
- new species or anomalous features that indicate a potential new species
- flora representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids

- flora with relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

No Threatened Flora taxa listed under Commonwealth or State legislation were identified within the survey area. No Priority Flora taxa were identified within the survey area. No other significant flora (i.e. endemic, new or anomalous species, range extension, relictual or unusual species) were identified within the survey area.

#### 4.2.6 Significant Vegetation

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) significant vegetation includes:

- vegetation being identified as threatened or priority ecological communities
- vegetation with restricted distribution
- vegetation subject to a high degree of historical impact from threatening processes
- vegetation which provides a role as a refuge
- vegetation providing an important function required to maintain ecological integrity of a significant ecosystem.

No Threatened Ecological Communities listed under Commonwealth or State legislation were identified within the survey area. No Priority Ecological Communities were identified within the survey area. No significant vegetation was identified within the survey area. Vegetation types identified are well represented outside of the survey area and are not considered endemic/ restricted to the survey area.

#### 4.2.7 Significant Fauna

According to the EPA *Environmental Factor Guideline for Terrestrial Fauna* (EPA, 2016d) significant fauna includes:

- Fauna being identified as a threatened or priority species
- Fauna species with restricted distribution
- Fauna subject to a high degree of historical impact from threatening processes
- Fauna providing an important function required to maintain the ecological integrity of a significant ecosystem.

No significant fauna were confirmed as occurring within the survey area. The current status of some species on site and/or in the general area is difficult to determine, however, based on the habitats present and, in some cases, direct observations or recent nearby records, the following species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

- **Malleefowl *Leipoa ocellata* – Vulnerable (EPBC Act and BC Act)**

No evidence (i.e. individuals, nest mounds, footprints) of the species presence was observed during the field reconnaissance survey. Available information and habitats identified within the area suggests that a breeding population of this species is very unlikely to be present in the general area, though transient, non-breeding individuals may occasionally occur.

- **Peregrine Falcon *Falco peregrinus* –Other Specially Protected Species (BC Act)**

This species potentially utilises some sections of the survey area as part of a much larger home range, though records in this area are rare and therefore it is likely to be present occasionally. No potential nest sites observed.

- **Central Long-eared Bat *Nyctophilus major tor* – P4 (DBCA Priority Species)**

The survey area contains some suitable habitat for this species to use for foraging and possibly roosting. It would however appear to be uncommon given the lack of documented records in the general vicinity.

It should be noted that while habitats onsite for one or more of the species listed above are considered possibly suitable, some or all may be marginal in extent/quality and therefore the fauna species considered as possibly occurring may in fact only visit the area for short periods as infrequent vagrants.

#### **4.3 Matters of National Environmental Significance**

None of the following matters of national environmental significance as defined by the Commonwealth EPBC Act were identified within the survey area:

- world heritage properties
- national heritage places
- wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- nationally threatened species and ecological communities
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

#### **4.4 Matters of State Environmental Significance**

There are no wetlands of national importance (ANCA Wetlands) or conservation category wetlands within the survey area. The survey area does not contain any TEC as listed under the BC Act or EP Act. No Threatened species listed under the BC Act were recorded within the survey area. The survey area is not located within DBCA managed land and does not contain any ESA as listed under the EP Act.

A map showing areas of conservation significance in relation to the survey area is provided in Appendix 2.



## 5 Native Vegetation Principles

Based on the outcomes from flora and fauna surveys presented in this environmental assessment report, the native vegetation clearing principles, listed under Schedule 5 of the EP Act have been assessed (Table 5-1).

**Table 5-1: Assessment of clearing against native vegetation clearing principles**

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
(a)	comprises a high level of biological diversity.	<p>The survey area is located within the Eastern Murchison subregion of the Murchison Bioregion and the Eastern Goldfields subregion of the Coolgardie Bioregion. The Eastern Murchison subregion comprises the northern parts of the craton's Southern Cross and Eastern Goldfields Terrains and is characterised by internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. Salt Lake systems are associated with the occluded paleodrainage system. Broad plains of red-brown soils and breakaways complexes as well as red sandplains are widespread. Vegetation is dominated by Mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands and Samphire shrublands (McKenzie et. al., 2002).</p> <p>The Eastern Goldfields subregion comprises gently undulating plains interrupted in the west by low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying strata are eroded flat and covered with Tertiary sand and gravel soils, scattered exposures of bedrock, and plains of calcareous earths (Cowan, 2001). The region has an arid to semi-arid Warm Mediterranean climate (Cowan, 2001).</p> <p>The vegetation within the survey area is mapped as belonging to Beard vegetation associations Barlee 20 of the Eastern Murchison subregion and Randell 468 of the Eastern Goldfields subregion which retain over 99% of the original vegetation extent within Western Australia and the Eastern Murchison/ Eastern Goldfields subregion. A total of seven vegetation types were identified within the area. Vegetation identified within the survey area is not considered to be of high biological diversity and is well represented outside of the survey area.</p> <p>The survey area does not occur within any mapped Priority Ecological Communities (PECs), Threatened Ecological Communities (TECs) or associated buffer zones and does not contain any Banded Ironstone Formations.</p> <p>No Threatened Flora taxa listed under the BC Act and EPBC Act are located within the survey area. No Priority Flora taxa were identified within the survey area.</p>	Clearing is not likely to be at variance to this principle
(b)	comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	The vegetation within the survey area is mapped as belonging to Beard vegetation associations Barlee 20 of the Eastern Murchison subregion and Randell 468 of the Eastern Goldfields subregion which retain over 99% of the original vegetation extent within Western Australia and the Eastern Murchison/ Eastern Goldfields subregion. No unique fauna habitats (i.e. caves, rock outcrops overhangs or crevices) occur within the survey area.	Clearing is not likely to be at variance to this principle
(c)	includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to the BC Act and the EPBC Act are located within the survey area (none identified during previous flora/vegetation surveys or listed on DBCA database as occurring within the survey area).	Clearing is not at variance to this principle
(d)	comprises the whole or part of or is necessary for the maintenance	No Threatened Ecological Communities, pursuant to the BC Act and the EPBC Act are located within the survey area (none identified during previous flora/vegetation surveys or listed on DBCA database as occurring within the survey area).	Clearing is not at variance to this principle

Letter	Principle	Assessment	Outcome
	Native vegetation should not be cleared if it:		
	of a threatened ecological community (TEC).		
(e)	is significant as a remnant of native vegetation in an area that has been extensively cleared	<p>The vegetation within the survey area is mapped as belonging to Beard vegetation associations Barlee 20 of the Eastern Murchison subregion and Randell 468 of the Eastern Goldfields subregion which retain over 99% of the original vegetation extent within Western Australia and the Eastern Murchison/ Eastern Goldfields subregion. Development within the survey area will not reduce the extent of these vegetation associations below the 30% threshold.</p> <p>Vegetation within the survey area does not represent a significant remnant of native vegetation within an area that has been extensively cleared.</p>	Clearing is not at variance to this principle
(f)	is growing, in, or in association with, an environment associated with a watercourse or wetland	<p>According to the Geoscience Australia database (2001) there are no drainage lines or inland waters within the survey area. One vegetation type (OD-EW') was associated with a broad floodplain, which accounts for approximately 26% of the total survey area.</p>	Clearing may be at variance to this principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>The vegetation within the survey area is mapped as belonging to Beard vegetation associations Barlee 20 of the Eastern Murchison subregion and Randell 468 of the Eastern Goldfields subregion which retain over 99% of the original vegetation extent within Western Australia and the Eastern Murchison/ Eastern Goldfields subregion. Clearing within these vegetation associations is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.</p>	Clearing is not likely to be at variance to this principle
(h)	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	<p>The survey area is not located within or in close proximity to any conservation areas.</p>	Clearing is not at variance to this principle
(i)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	<p>According to the Geoscience Australia database (2001) there are no drainage lines or inland waters within the survey area. One vegetation type (OD-EW') was associated with a broad floodplain, which accounts for approximately 26% of the total survey area.</p> <p>The survey area is located in an arid to semi-arid environment with most rainfall lost by evaporation or surface runoff. Only a small portion infiltrates the soil and recharges the groundwater.</p>	Clearing is not likely to be at variance to this principle
(j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	<p>Rainfall of the eastern Murchison and Eastern Goldfields subregion has an average rainfall of 200-300mm and an evaporation rate of 2400 mm. The Murchison and Coolgardie region has an arid to semi-arid warm Mediterranean climate, receiving a majority of its rainfall during winter months. Rainfall data for Kalgoorlie-Boulder indicates that rainfall is spread throughout the year and rainfall events are unlikely to result in localised flooding. There are no permanent drainage lines within the survey area. Clearing within the survey area is not likely to</p>	Clearing is not likely to be at variance to this principle



Letter	Principle	Assessment	Outcome
	Native vegetation should not be cleared if it:		
		increase the incidence or intensity of flooding within the survey area or surrounds.	

## 6 **Recommendations**

Based on the findings of the survey, no further flora/ vegetation and fauna studies are required to progress to mining. Vehicle hygiene procedures are recommended to be implemented when conducting works in the area to prevent the introduction/ further spread of weeds.

## 7 **Bibliography**

Beard, J.S., (1990), *Plant Life of Western Australia*, Kangaroo Press Pty Ltd, NSW.

Barrick Gold Corporation (2011). Miscellaneous Fauna Survey Records 2006 - 2011. Kanowna Belle Area. Unpublished internal data. Acquired May 2011.

BoM, (2019), Kalgoorlie-Boulder weather station Climate Data, Bureau of Meteorology.

Available: <http://www.bom.gov.au/climate>

Accessed: 22<sup>nd</sup> August 2019

Botanica Consulting (2009) Bellevue Flora and Vegetation Survey (M24/804, M24/231, M24/255, M24/403, M24/303).

Botanica Consulting (2011a), Level 1 Flora and Vegetation Survey: Bullant,

Botanica Consulting (2011b), Level 1 Flora and Vegetation Survey: Proposed Anthill open pit operation.

Botanica Consulting (2011c), Level 2 Flora and Vegetation Survey: Kurnalpi Project.

Botanica Consulting (2013a) Golden Flag Level 1 Flora and Vegetation survey.

Botanica Consulting (2013b), Level 2 Flora and Vegetation Survey for the Castle Hill Project.

Botanica Consulting (2014), Level 2 Flora and Vegetation Survey for the Burgundy Project survey area.

Botanica Consulting (2015) Level 1 Flora and Vegetation Survey Racetrack, Mulgarrie Well & Mt Jewell Western/ Eastern Haul Road.

Botanica Consulting (2016), Level 1 Flora & Vegetation Survey of the Carbine Mining Area.

Botanica Consulting (2016), Level 1 Flora & Fauna Survey of the Glandore Project.

Botanica Consulting (2018), Reconnaissance Flora & Fauna survey Kurnalpi Project. Prepared for KalNorth Gold Mines Limited

Cowan, (2001a), *A Biodiversity Audit of Western Australia's 53 Biogeographical Region in 2001-Coolgardie Region (COO3-Eastern Goldfields)*, Department of Conservation and Land Management.

Cowan, (2001b), *A Biodiversity Audit of Western Australia's 53 Biogeographical Region in 2001-Murchison Region (MUR1-Eastern Murchison)*, Department of Conservation and Land Management.

DAFWA (2011), *Pre-European Vegetation - Western Australia (NVIS Compliant Version GIS file)*, Department of Agriculture and Food Western Australia

DAFWA (2014), *Soil Landscape System of Western Australia*, Department of Agriculture and Food Western Australia

DBCA (2017). *2017 Statewide Vegetation Statistics*. Department of Biodiversity, Conservation and Attractions

DBCA (2019a), *Threatened Flora Database search results*, Department of Biodiversity, Conservation and Attractions. Results obtained February 2019.

DBCA (2019b), *Threatened Flora Database search results*, Department of Biodiversity, Conservation and Attractions. Results obtained February 2019.

DBCA (2019c), *Nature Map Database search*, Department of Biodiversity, Conservation and Attractions

Available: <https://naturemap.dpaw.wa.gov.au/>

Accessed: 26<sup>th</sup> July 2019

DEC (2012), Western Spiny-tailed Skink (*Egernia stokesii*) Recovery Plan. Western Australian Wildlife Management Program No. 53. Department of Environment and Conservation.

DotEE, (2012), *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7*, Department of the Environment and Energy.

DotEE (2015b), *National Vegetation Information System (NVIS) Version 7*, Department of the Environment and Energy

DotEE (2019a), *Protected Matters Search Tool, Environment Protection and Biodiversity Conservation Act 1999*, Department of the Environment and Energy

Available: <http://www.environment.gov.au/epbc/protected-matters-search-tool>

Accessed: 26<sup>th</sup> July 2019

DotEE (2019b) Species Profiles and Threats Database, Department of Environment and Energy

Available: <http://www.environment.gov.au/sprat>

Accessed: 22<sup>nd</sup> August 2019

DPIRD (2019), *Declared Organism-database search*, Department of Primary Industries and Regional Development, Western Australia

Available: <https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>

Accessed: 22<sup>nd</sup> August 2019

EPA, (2016a), *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016*. Environmental Protection Authority

EPA, (2016b), *Technical Guidance - Terrestrial Fauna Surveys for Environmental Impact Assessment – December 2016*. Environmental Protection Authority

GHD (2009) Paddington Gold Pty Ltd – Enterprise Development Activities Flora and Fauna Assessment

Harewood G (2010a). Terrestrial Fauna Survey (Level 1) of the proposed Isabella Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.

Harewood G (2010b). Terrestrial Fauna Survey (Level 1) of the proposed Golden Valley Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.

Harewood G (2010c). Terrestrial Fauna Survey (Level 1) of the proposed Fenceline Mine Area. Unpublished report for Barrick (Kanowna) Ltd. January 2010.

Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) of the proposed Lignum Dam Mine Area. Unpublished report for Pioneer Resources Limited.

Harewood, G. (2012). Terrestrial Fauna Survey (Level 1) of Proposed Powerline and Infrastructure Area, KCGM – Gidgi Operations. Unpublished report for KCGM Pty Ltd. January 2012.

Harewood, G. (2012a). Terrestrial Fauna Survey (Level 1) of the Mt Jewel & Lindsay's Project Haul Road. Unpublished report for Carrick Gold Limited.

Harewood, G. (2012b). Terrestrial Fauna Survey (Level 1) of the Kurnalpi Project. Unpublished report for Carrick Gold Limited.

Harewood, G. (2013). Terrestrial Fauna Survey (Level 1) of the Arcoona Haul Road. Unpublished report for KalNorth Gold Mines Limited.



- Harewood, G. (2015a). Fauna Survey (Level 2 - Phase 1 and 2) Proposed Tails Storage Facility Expansion KCGM Pty Ltd Kalgoorlie. Unpublished report for KCGM.
- Harewood, G. (2015b). Fauna Assessment - 6 Mile Project Area. Unpublished report for Northern Star Resources.
- Hart, R.P. and Kitchener, D.J., (1986), *First Record of *Sminthopsis psammophila* (Marsupialia: Dasyuridae) from Western Australia*. Records of the Western Australian Museum 13(1): 139-144.
- KLA (2009a). Barrick (Kanowna) Shamrock Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.
- KLA (2009b). Barrick (Kanowna) Crossroads Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.
- KLA (2009c). Barrick (Kanowna) Moonlight Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. March 2009.
- McKenzie, N.L. and Hall, N.J. (1992). The Biological Survey of the Eastern Goldfields of WA - Pt 8: Kurnalpi – Kalgoorlie study area. Records of the WAM, Supplement 41: 1 – 125.
- McKenzie, N.L. May, J.E & McKenna, S (2002), *Bioregional summary of the 2002 Biodiversity Audit for Western Australia*. Department of Conservation and Land Management.
- NHT, Natural Heritage Trust (2007), *National manual for the malleefowl monitoring system*. Standards, protocols and monitoring procedures.
- Orell, P. And Morris, K. (1994), *Chuditch Recovery Plan 1992-2001*, Department of Conservation and Land Management, Como.
- Shepherd, D. P., Beeston, G. R. and Hopkins, A. J. M. (2002) *Native Vegetation in Western Australia. Extent, Type and Status*, Department of Agriculture, Western Australia
- Tille, P. (2006), *Soil Landscapes of Western Australia's Rangelands and Arid Interior*, Department of Agriculture and Food Western Australia
- WAHERB, (2019), *Florabase – Information on the Western Australian Flora*, Department of Biodiversity, Conservation and Attractions.  
Available: <https://florabase.dpaw.wa.gov.au/>  
Accessed 22<sup>nd</sup> August 2019

# Appendix 1: Conservation Significant Species/ Communities Categories (BC Act and EPBC Act)

## Definitions of Conservation Significant Species

Code	Category
<b>State categories of Threatened and Priority species</b>	
<b>Threatened Species (T)</b>	
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).	
CR	<p><b>Critically Endangered</b></p> <p>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”.</p> <p>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.</p>
EN	<p><b>Endangered</b></p> <p>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”.</p> <p>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.</p>
VU	<p><b>Vulnerable</b></p> <p>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”.</p> <p>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.</p>
<b>Extinct species</b>	
Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	<p><b>Extinct</b></p> <p>Species where “<i>there is no reasonable doubt that the last member of the species has died</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).</p> <p>Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.</p>
EW	<p><b>Extinct in the Wild</b></p> <p>Species that “<i>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</i>”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).</p> <p>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.</p>
<b>Specially protected species</b>	
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.	
IA	<p><b>International Agreement/ Migratory</b></p> <p>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).</p> <p>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 <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (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.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
CD	<b>Species of special conservation interest</b>

Code	Category
	<p>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).</p> <p>Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
OS	<p><b>Other specially protected species</b></p> <p>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).</p> <p>Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.</p>
<p><b>Priority species</b></p> <p>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.</p> <p>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.</p> <p>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.</p>	
P1	<p><b>Priority 1: Poorly-known species</b></p> <p>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.</p>
P2	<p><b>Priority 2: Poorly-known species</b></p> <p>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.</p>
P3	<p><b>Priority 3: Poorly-known species</b></p> <p>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.</p>
P4	<p><b>Priority 4: Rare, Near Threatened and other species in need of monitoring</b></p> <p>(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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
<b>Commonwealth categories of Threatened species</b>	
EX	<p><b>Extinct</b></p> <p>Taxa where there is no reasonable doubt that the last member of the species has died.</p>
EW	<p><b>Extinct in the Wild</b></p> <p>Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.</p>
CR	<p><b>Critically Endangered</b></p> <p>Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.</p>
EN	<p><b>Endangered</b></p> <p>Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.</p>
VU	<p><b>Vulnerable</b></p>



Code	Category
	Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	<b>Conservation Dependent</b> Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

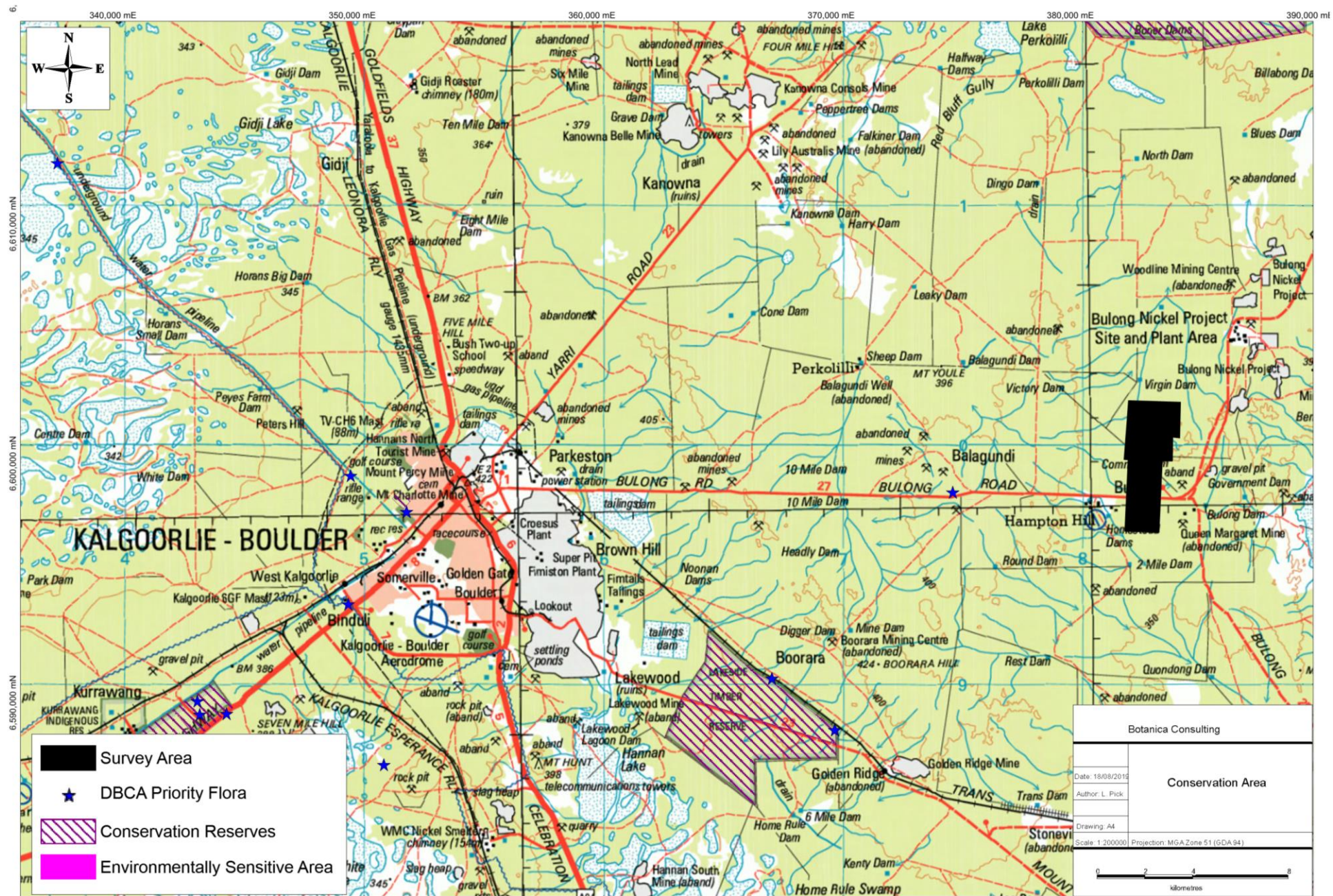
### Definitions of conservation significant communities

Category Code	Category
<b>State categories of Threatened Ecological Communities (TEC)</b>	
PD	<b>Presumed Totally Destroyed</b> An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: <ul style="list-style-type: none"> <li>records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or;</li> <li>all occurrences recorded within the last 50 years have since been destroyed.</li> </ul>
CR	<b>Critically Endangered</b> An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	<b>Endangered</b> An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short-term future, or is unlikely to be substantially rehabilitated in the short-term future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the short-term future.
VU	<b>Vulnerable</b> An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Category Code	Category
<b>Commonwealth categories of Threatened Ecological Communities (TEC)</b>	
CE	<b>Critically Endangered</b> If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
EN	<b>Endangered</b> If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
VU	<b>Vulnerable</b> If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium-term future (indicative timeframe being the next 50 years).
<b>Priority Ecological Communities (PEC)</b>	
P1	<b>Poorly-known ecological communities</b> Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	<b>Poorly-known ecological communities</b> Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	<b>Poorly known ecological communities</b> Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	<b>Ecological communities that are adequately known, rare but not threatened</b> or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	<b>Conservation Dependent ecological communities</b> Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.



## Appendix 2: Regional map of conservation areas





### Appendix 3: Species List

Blue text and shading denotes annual taxa; Green text and shading denotes introduced taxa (WAHERB, 2019)

Family	Genus	Taxon	CLP-EW1	CLP-EW2	OD-EW1	HS-CFW1	HS-EW1	HS-EW2	HS-MWS1
Amaranthaceae	<i>Ptilotus</i>	<i>aeroides</i> (A)				*		*	
Amaranthaceae	<i>Ptilotus</i>	<i>holosericeus</i> (A)		*				*	
Amaranthaceae	<i>Ptilotus</i>	<i>obovatus</i>	*	*		*	*	*	
Amaranthaceae	<i>Ptilotus</i>	<i>exaltatus</i> (A)		*	*		*	*	
Apocynaceae	<i>Alyxia</i>	<i>buxifolia</i>	*					*	
Apocynaceae	<i>Marsdenia</i>	<i>australis</i>		*			*		
Asparagaceae	<i>Thysanotus</i>	<i>manglesianus</i>					*		
Asteraceae	<i>Erymophyllum</i>	<i>ramosum</i> (A)	*	*				*	
Asteraceae	<i>Waitzia</i>	<i>fitzgibbonii</i> (A)	*			*			
Asteraceae	<i>Rhodanthe</i>	<i>floribunda</i> (A)	*					*	
Asteraceae	<i>Cratystylis</i>	<i>conocephala</i>		*		*			*
Asteraceae	<i>Cratystylis</i>	<i>microphylla</i>	*						*
Asteraceae	<i>Olearia</i>	<i>muelleri</i>	*		*	*	*	*	*
Asteraceae	<i>Olearia</i>	<i>pimeleoides</i>						*	
Asteraceae	<i>Senecio</i>	<i>glossanthus</i>	*		*				
Boraginaceae	<i>Halgania</i>	<i>andromedifolia</i>	*			*		*	
Brassicaceae	<i>Carrichtera</i>	<i>annua</i> (W)	*	*	*				
Casuarinaceae	<i>Casuarina</i>	<i>pauper</i>			*	*	*	*	*
Chenopodiaceae	<i>Atriplex</i>	<i>nummularia</i> subsp. <i>spathulata</i>		*		*	*	*	*
Chenopodiaceae	<i>Enchylaena</i>	<i>lanata</i>	*			*			
Chenopodiaceae	<i>Atriplex</i>	<i>holocarpa</i>	*		*				
Chenopodiaceae	<i>Atriplex</i>	<i>vesicaria</i>	*	*			*		
Chenopodiaceae	<i>Maireana</i>	<i>amoena</i>	*	*		*			
Chenopodiaceae	<i>Maireana</i>	<i>georgei</i>	*	*			*		
Chenopodiaceae	<i>Maireana</i>	<i>oppositifolia</i>	*	*			*		
Chenopodiaceae	<i>Maireana</i>	<i>pentatropis</i>				*			*
Chenopodiaceae	<i>Maireana</i>	<i>sedifolia</i>	*	*					*
Chenopodiaceae	<i>Maireana</i>	<i>trichoptera</i>	*	*		*	*	*	
Chenopodiaceae	<i>Maireana</i>	<i>triptera</i>	*		*		*		
Chenopodiaceae	<i>Rhagodia</i>	<i>eremaea</i>	*	*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>diacantha</i>	*	*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>drummondii</i>	*	*					*
Chenopodiaceae	<i>Sclerolaena</i>	<i>eriacantha</i>			*				*
Chenopodiaceae	<i>Sclerolaena</i>	<i>parviflora</i>		*					
Chenopodiaceae	<i>Tecticornia</i>	<i>disarticulata</i>	*				*		
Fabaceae	<i>Acacia</i>	<i>acuminata</i>	*						
Fabaceae	<i>Acacia</i>	<i>erinacea</i>		*		*			

Family	Genus	Taxon	CLP-EW1	CLP-EW2	OD-EW1	HS-CFW1	HS-EW1	HS-EW2	HS-MWS1
Fabaceae	<i>Acacia</i>	<i>hemiteles</i>	*	*				*	
Fabaceae	<i>Acacia</i>	<i>jennerae</i>	*					*	
Fabaceae	<i>Acacia</i>	<i>kalgoorliensis</i>				*	*	*	*
Fabaceae	<i>Acacia</i>	<i>oswaldii</i>	*					*	
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>	*	*		*			
Fabaceae	<i>Glycyrrhiza</i>	<i>acanthocarpa</i>	*					*	
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>filifolia</i>	*	*			*	*	
Frankeniaceae	<i>Frankenia</i>	<i>setosa</i>		*	*				
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>		*		*	*	*	*
Lamiaceae	<i>Prostanthera</i>	<i>grylloana</i>				*			
Lamiaceae	<i>Westringia</i>	<i>rigida</i>			*	*	*	*	*
Myrtaceae	<i>Eucalyptus</i>	<i>celastroides</i>	*	*			*	*	
Myrtaceae	<i>Eucalyptus</i>	<i>griffithsii</i>	*				*	*	*
Myrtaceae	<i>Eucalyptus</i>	<i>lesouefii</i>	*		*		*	*	
Myrtaceae	<i>Eucalyptus</i>	<i>ravida</i>	*	*	*				
Myrtaceae	<i>Eucalyptus</i>	<i>salmonophloia</i>	*	*	*				
Myrtaceae	<i>Eucalyptus</i>	<i>salubris</i>	*	*			*		*
Myrtaceae	<i>Eucalyptus</i>	<i>stricklandii</i>	*				*	*	
Myrtaceae	<i>Eucalyptus</i>	<i>torquata</i>					*	*	
Myrtaceae	<i>Eucalyptus</i>	<i>transcontinentalis</i>	*	*			*	*	
Myrtaceae	<i>Melaleuca</i>	<i>sheathiana</i>						*	
Myrtaceae	<i>Melaleuca</i>	<i>lateriflora</i>				*		*	*
Nyctaginaceae	<i>Boerhavia</i>	<i>coccinea</i>						*	
Pittosporaceae	<i>Pittosporum</i>	<i>angustifolium</i>	*	*					
Poaceae	<i>Austrostipa</i>	<i>elegantissima</i>	*	*				*	
Poaceae	<i>Aristida</i>	<i>contorta</i> (A)						*	
Poaceae	<i>Triodia</i>	<i>scariosa</i>					*	*	
Poaceae	<i>Enteropogon</i>	<i>ramosus</i>	*			*	*	*	
Portulacaceae	<i>Calandrinia</i>	<i>eremaea</i>				*	*		
Proteaceae	<i>Grevillea</i>	<i>acuaria</i>	*			*	*		*
Proteaceae	<i>Grevillea</i>	<i>nematophylla</i>	*	*			*	*	*
Rutaceae	<i>Philotheca</i>	<i>brucei</i>					*	*	
Santalaceae	<i>Exocarpos</i>	<i>aphyllus</i>	*	*			*	*	
Santalaceae	<i>Santalum</i>	<i>spicatum</i>	*	*		*		*	
Santalaceae	<i>Santalum</i>	<i>acuminatum</i>	*	*					
Sapindaceae	<i>Alectryon</i>	<i>oleifolius</i>	*				*	*	
Sapindaceae	<i>Dodonaea</i>	<i>lobulata</i>				*	*		*
Scrophulariaceae	<i>Eremophila</i>	<i>clarkei</i>	*			*		*	
Scrophulariaceae	<i>Eremophila</i>	<i>dempsteri</i>	*	*				*	

Family	Genus	Taxon	CLP-EW1	CLP-EW2	OD-EW1	HS-CFW1	HS-EW1	HS-EW2	HS-MWS1
Scrophulariaceae	<i>Eremophila</i>	<i>decipiens</i>	*	*	*		*		*
Scrophulariaceae	<i>Eremophila</i>	<i>glabra</i>		*					
Scrophulariaceae	<i>Eremophila</i>	<i>interstans</i> subsp. <i>virgata</i>	*	*				*	
Scrophulariaceae	<i>Eremophila</i>	<i>parvifolia</i>	*	*				*	
Scrophulariaceae	<i>Eremophila</i>	<i>scoparia</i>		*	*			*	*
Scrophulariaceae	<i>Eremophila</i>	<i>oldfieldii</i> subsp. <i>angustifolia</i>				*	*	*	*
Scrophulariaceae	<i>Eremophila</i>	<i>pustulata</i>				*	*	*	
Solanaceae	<i>Lycium</i>	<i>australe</i>	*		*				
Solanaceae	<i>Solanum</i>	<i>nummularium</i>	*		*				
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>	*				*		*
Solanaceae	<i>Solanum</i>	<i>plicatile</i>			*	*			
Zygophyllaceae	<i>Roepera</i>	<i>eremaea</i> (A)	*	*	*			*	
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>	*						*
Solanaceae	<i>Solanum</i>	<i>plicatile</i>			*				
Thymelaeaceae	<i>Pimelea</i>	<i>microcephala</i>	*						
Zygophyllaceae	<i>Roepera</i>	<i>eremaea</i> (A)	*	*				*	



#### Appendix 4: Vegetation Condition Rating

Vegetation Condition Rating	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor		Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

## Appendix 5: Potential Fauna List

# Fauna Potentially Present in Survey Area

## Bulong Project WA - Southern Gold Limited

A = Harewood G (2016). Level 1 Flora Fauna Survey of the Glandore Project. Unpublished report for Southern Gold Ltd.

B = Harewood G (2015). Fauna Survey (Level 2 - Phase 1 and 2). Proposed TSF Expansion KCGM Pty Ltd Kalgoorlie. Unpublished report for KCGM.

C = Terrestrial Ecosystems (2012a). Fauna Assessment for the Santa Project. Unpublished report for Integra Mining Limited.

D = Terrestrial Ecosystems (2012b). Level 2 Fauna Assessment for the Aldiss Area. Unpublished report for Integra Mining Limited.

E = Terrestrial Ecosystems (2010). Fauna Assessment for the Majestic Gold Project. Unpublished report for Integra Mining Limited.

F = Outback Ecology Services (2009). Integra Mining Limited Randalls Gold Project, Terrestrial Fauna Assessment. Unpublished report for Integra Mining Limited.

G = Ninox Wildlife Consulting (1998). A Vertebrate Fauna Survey of the Randell Timber Reserve (1997 and 1998).

H = McKenzie, N.L. and Hall, N.J. (1992). The Biological Survey of the Eastern Goldfields of WA - Pt 8: Kurnalpi – Kalgoorlie study area. Records of the WAM, Supplement 41: 1 – 125.

I = DBCA (2019). NatureMap Database search. "By Circle" 121° 46' 32" E, 30° 43' 31" S; Accessed 24/08/2019.

Compiled by Greg Harewood - Aug 2019

Recorded (Sighted/Heard/Signs) = X

Approximate centroid = 30.72528° S and 121.77556° E

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
----------------------------	----------------	------------------------	---	---	---	---	---	---	---	---	---

## Amphibia

### Myobatrachidae

Ground or Burrowing Frogs

<i>Neobatrachus kunapalari</i>	Kunapalari Frog	LC		X							X
<i>Neobatrachus pelobatoides</i>	Humming Frog	LC									
<i>Neobatrachus sutor</i>	Shoemaker Frog	LC		X						X	X
<i>Neobatrachus wilsmorei</i>	Plonking Frog	LC								X	X
<i>Pseudophryne occidentalis</i>	Western Toadlet	LC		X					X	X	

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Reptilia</b>											
<b>Carphodactylidae</b> Knob-tailed Geckos											
<i>Nephurus laevis</i>	Smooth Knob-tail								X		
<i>Nephurus milii</i>	Barking Gecko			X							
<b>Diplodactylidae</b> Geckoes											
<i>Crenadactylus ocellatus</i>	Clawless Gecko										
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko										
<i>Diplodactylus granariensis</i>	Western Stone Gecko				X	X	X	X	X	X	X
<i>Diplodactylus pulcher</i>	Western Saddled Ground Gecko			X	X	X	X	X	X	X	X
<i>Lucasium maini</i>	Main's Ground Gecko			X	X	X	X	X	X	X	
<i>Oedura reticulata</i>	Reticulated Velvet Gecko			X	X	X	X	X	X	X	
<i>Rhynchoedura ornata</i>	Beaked Gecko			X				X		X	X
<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko			X			X	X			
<i>Strophurus elderi</i>	Jewelled Gecko							X		X	
<i>Strophurus strophurus</i>	Ring-tailed Gecko										

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Gekkonidae</b> Geckoes											
<i>Christinus marmoratus</i>	Marbled Gecko										
<i>Gehyra purpurascens</i>	Purple Arid Dtella			X	X		X	X	X		
<i>Gehyra variegata</i>	Variegated Dtella			X	X	X	X	X	X	X	X
<i>Heteronotia binoei</i>	Bynoe's Gecko			X	X	X	X	X	X	X	X
<i>Nephurus milii</i>	Barking Gecko				X	X	X	X	X	X	
<b>Pygopodidae</b> Legless Lizards											
<i>Delma australis</i>	Marble-faced Delma			X	X	X	X	X	X	X	
<i>Delma butleri</i>	Unbanded Delma										X
<i>Delma fraseri</i>	Fraser's Legless Lizard										
<i>Lialis burtonis</i>	Burton's Legless Lizard							X		X	X
<i>Pygopus lepidopodus</i>	Common Scaly Foot					X					
<i>Pygopus nigriceps</i>	Hooded Scaly Foot										

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Agamidae</b> Dragon Lizards											
<i>Caimanops amphiboluroides</i>	Mulga Dragon									X	
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon			X				X			
<i>Ctenophorus cristatus</i>	Bicycle Dragon			X	X	X	X	X	X	X	X
<i>Ctenophorus fordi</i>	Mallee Sand Dragon							X		X	
<i>Ctenophorus isolepis</i>	Crested Dragon										
<i>Ctenophorus maculatus</i>	Spotted Military Dragon							X			
<i>Ctenophorus nuchalis</i>	Central Netted Dragon										
<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon										
<i>Ctenophorus reticulatus</i>	Western Netted Dragon				X	X	X	X	X	X	
<i>Ctenophorus salinarum</i>	Salt Pan Dragon										
<i>Ctenophorus scutulatus</i>	Lozenge-marked Bicycle Dragon								X	X	
<i>Moloch horridus</i>	Thorny Devil									X	
<i>Pogona minor</i>	Western Bearded Dragon				X	X	X	X	X	X	X
<i>Tympanocryptis cephalus</i>	Pebble Dragon					X					X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Varanidae</b>											
Monitor's or Goanna's											
<i>Varanus caudolineatus</i>	Stripe-tailed Pygmy Monitor			X					X	X	
<i>Varanus gouldii</i>	Bungarra or Sand Monitor			X	X	X	X	X		X	X
<i>Varanus tristis</i>	Racehorse Monitor				X	X			X		X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Scincidae</b> Skinks											
<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink			X	X	X	X	X	X	X	
<i>Ctenotus atlas</i>	Southern Mallee Ctenotus							X		X	
<i>Ctenotus impar</i>	Odd-striped Ctenotus										
<i>Ctenotus leonhardii</i>	Leonhardi's Skink								X	X	
<i>Ctenotus pantherinus ocellifer</i>	Leopard Skink										
<i>Ctenotus schomburgkii</i>	Barred Wedge-snout Ctenotus				X	X		X	X	X	
<i>Ctenotus severus</i>	Stern Rock Ctenotus										
<i>Ctenotus uber</i>	Spotted Ctenotus			X	X	X		X		X	X
<i>Cyclodomorphus melanops elongatus</i>	Eastern Slender Blue-tongue									X	
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink								X		X
<i>Egernia formosa</i>	Goldfields Crevice Skink				X	X			X	X	X
<i>Egernia multiscutata</i>	Bull Skink										
<i>Egernia richardi</i>	Woodland Crevice Skink										
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer				X	X					
<i>Hemiergis initialis initialis</i>	Sth Five-toed Mulch Skink			X			X		X		
<i>Hemiergis peronii peronii</i>	Four-toed Earless Skink										
<i>Lerista distinguenda</i>	SW Four-toed Lerista										

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<i>Lerista kingi</i>	King's Three-toed Slider					X					X
<i>Lerista muelleri</i>	Common Mulch Skink				X		X	X	X	X	
<i>Lerista picturata</i>	Goldfields Robust Lerista			X	X	X	X	X	X	X	X
<i>Lerista timida</i>	Dwarf Three-toed Slider										X
<i>Lerista timidia</i>	Dwarf Three-toed Slider			X							
<i>Lerista tridactyla</i>	Dark-backed Mulch Slider							X			
<i>Liopholis inornata</i>	Desert Skink						X	X		X	
<i>Menetia greyii</i>	Dwarf Skink			X	X	X	X	X	X	X	X
<i>Morethia adelaidensis</i>	Saltbush Flecked Morethia									X	
<i>Morethia butleri</i>	Woodland Dark-flecked Morethia				X	X	X	X	X	X	X
<i>Morethia obscura</i>	Shrubland Pale-flecked Morethia								X		X
<i>Tiliqua occipitalis</i>	Western Bluetongue			X							
<i>Tiliqua rugosa</i>	Bobtail			X	X	X	X	X	X	X	X
<b>Typhlopidae</b>											
Blind Snakes											
<i>Anilius australis</i>	Southern Blind Snake				X	X	X	X	X		
<i>Anilius bicolor</i>	Dark-spined Blind Snake						X				
<i>Anilius bituberculatus</i>	Prong-snouted Blind Snake				X		X	X	X		
<i>Anilius hamatus</i>	Northern Hook-snouted Blind Snake					X		X			

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Boidae</b> Pythons, Boas											
<i>Morelia spilota imbricata</i>	Southern Carpet Python	LC									
<b>Elapidae</b> Elapid Snakes											
<i>Brachyuropis fasciolata</i>	Narrow-banded Shovel-nosed Snake			X							
<i>Brachyuropis semifasciata</i>	Southern Shovel-nosed Snake				X		X	X			
<i>Demansia psammophis</i>	Yellow-faced Whipsnake			X							
<i>Furina ornata</i>	Moon Snake						X	X			
<i>Parasuta gouldii</i>	Gould's Hooded Snake								X	X	X
<i>Parasuta monachus</i>	Monk Snake				X	X			X	X	X
<i>Pseudechis australis</i>	Mulga Snake			X	X	X		X	X		X
<i>Pseudonaja modesta</i>	Ringed Brown Snake								X	X	X
<i>Pseudonaja nuchalis</i>	Gwardar			X			X			X	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake			X	X		X	X	X	X	X
<i>Suta fasciata</i>	Rosen's Snake				X				X		X
<b>Aves</b>											
<b>Casuariidae</b> Emus, Cassowaries											
<i>Dromaius novaehollandiae</i>	Emu	LC	X	X				X	X	X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Megapodiidae</b> Moundbuilders											
<i>Leipoa ocellata</i>	Malleefowl	S3 VU								X	X
<b>Anatidae</b> Geese, Swans, Ducks											
<i>Anas gracilis</i>	Grey Teal	LC		X	X					X	X
<i>Anas superciliosa</i>	Pacific Black Duck	LC		X			X				X
<b>Accipitridae</b> Kites, Goshawks, Eagles, Harriers											
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	LC						X	X		
<i>Accipiter fasciatus</i>	Brown Goshawk	LC				X			X	X	X
<i>Aquila audax</i>	Wedge-tailed Eagle	LC		X	X	X	X	X	X	X	X
<i>Aquila morphnoides</i>	Little Eagle	LC									
<i>Circus assimilis</i>	Spotted Harrier	LC								X	
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC		X							
<i>Haliastur sphenurus</i>	Whistling Kite	LC						X	X	X	
<i>Hamirostra isura</i>	Square-tailed Kite	LC				X					
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	LC									

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Falconidae</b> Falcons											
<i>Falco berigora</i>	Brown Falcon	LC		X	X	X	X	X	X	X	X
<i>Falco cenchroides</i>	Australian Kestrel	LC	X	X		X	X	X	X	X	X
<i>Falco longipennis</i>	Australian Hobby	LC		X		X			X		X
<i>Falco peregrinus</i>	Peregrine Falcon	S7 LC							X		
<b>Otididae</b> Bustards											
<i>Ardeotis australis</i>	Australian Bustard	LC	X			X	X				
<b>Charadriidae</b> Lapwings, Plovers, Dotterels											
<i>Vanellus tricolor</i>	Banded Lapwing	LC									
<b>Columbidae</b> Pigeons, Doves											
<i>Ocyphaps lophotes</i>	Crested Pigeon	LC		X	X	X			X	X	X
<i>Phaps chalcoptera</i>	Common Bronzewing	LC		X	X	X			X	X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Psittacidae</b> Parrots											
<i>Cacatua roseicapilla</i>	Galah	LC		X	X	X		X	X	X	
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	LC		X	X	X			X	X	
<i>Melopsittacus undulatus</i>	Budgerigar	LC				X				X	
<i>Neophema splendida</i>	Scarlet-chested Parrot	LC									
<i>Nymphicus hollandicus</i>	Cockatiel	LC							X	X	
<i>Platycercus varius</i>	Mulga Parrot	LC		X				X		X	X
<i>Platycercus zonarius</i>	Australian Ringneck	LC	X	X	X	X	X		X	X	X
<i>Polytelis anthopeplus</i>	Regent Parrot	LC				X		X			
<b>Cuculidae</b> Parasitic Cuckoos											
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	LC		X		X		X	X	X	X
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	LC					X			X	
<i>Cuculus pallidus</i>	Pallid Cuckoo	LC							X	X	
<b>Strigidae</b> Hawk Owls											
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC				X				X	
<b>Tytonidae</b> Barn Owls											
<i>Tyto alba</i>	Barn Owl	LC									

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Podargidae</b> Frogmouths											
<i>Podargus strigoides</i>	Tawny Frogmouth	LC		X	X	X		X	X	X	X
<b>Caprimulgidae</b> Nightjars											
<i>Eurostopodus argus</i>	Spotted Nightjar	LC				X					
<b>Aegothelidae</b> Owlet-nightjars											
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	LC			X					X	X
<b>Halcyonidae</b> Tree Kingfishers											
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher	LC		X					X	X	
<i>Todiramphus sanctus</i>	Sacred Kingfisher	LC						X			
<b>Meropidae</b> Bee-eaters											
<i>Merops ornatus</i>	Rainbow Bee-eater	JA LC		X			X		X	X	X
<b>Climacteridae</b> Treecreepers											
<i>Climacteris affinis</i>	White-browed Treecreeper	LC								X	
<i>Climacteris rufa</i>	Rufous Treecreeper	LC			X	X			X	X	

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Maluridae</b>											
Fairy Wrens, GrassWrens											
<i>Malurus leucopterus</i>	White-winged Fairy-wren	LC	X	X	X	X		X	X	X	X
<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren	LC									
<i>Malurus splendens</i>	Splendid Fairy-wren	LC		X							X
<b>Acanthizidae</b>											
Thornbills, Geryones, Fieldwrens & Whitefaces											
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	LC		X	X	X		X	X	X	X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	LC		X	X	X			X	X	X
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	LC		X	X	X		X	X	X	X
<i>Aphelocephala leucopsis</i>	Southern Whiteface	LC		X		X			X	X	X
<i>Calamanthus campestris</i>	Rufous Fieldwren	LC									
<i>Gerygone fusca</i>	Western Gerygone	LC									
<i>Hylacola cauta whitlocki</i>	Shy Heathwren (western)	LC									
<i>Pyrrholaemus brunneus</i>	Redthroat	LC	X	X	X	X		X	X	X	X
<i>Smicrornis brevirostris</i>	Weebill	LC	X	X	X	X		X	X	X	X
<b>Pardalotidae</b>											
Pardalotes											
<i>Pardalotus punctatus</i>	Spotted Pardalote	LC							X		
<i>Pardalotus striatus</i>	Striated Pardalote	LC		X	X	X		X	X	X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Meliphagidae</b> Honeyeaters, Chats											
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	LC	X	X	X	X		X	X	X	X
<i>Anthochaera carunculata</i>	Red Wattlebird	LC		X	X	X	X	X	X	X	X
<i>Anthochaera lunulata</i>	Western Little Wattlebird	LC									
<i>Certhionyx niger</i>	Black Honeyeater	LC				X		X			
<i>Certhionyx variegatus</i>	Pied Honeyeater	LC									
<i>Epthianura albigularis</i>	White-fronted Chat	LC						X	X		X
<i>Epthianura tricolor</i>	Crimson Chat	LC							X		
<i>Lichenostomus cratitius</i>	Purple-gaped Honeyeater	LC									
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	LC		X	X	X			X	X	X
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater	LC	X	X	X	X	X	X	X	X	
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater	LC		X						X	
<i>Lichenostomus virescens</i>	Singing Honeyeater	LC	X	X	X	X		X	X	X	
<i>Lichmera indistincta</i>	Brown Honeyeater	LC	X	X	X	X		X	X	X	X
<i>Manorina flavigula</i>	Yellow-throated Miner	LC		X	X	X		X	X	X	X
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	LC		X	X	X		X	X	X	X
<i>Phylidonyris albigularis</i>	White-fronted Honeyeater	LC		X	X	X			X	X	
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	LC								X	

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Petroicidae</b> Australian Robins											
<i>Drymodes brunneopygia</i>	Southern Scrub-robin	LC			X						
<i>Microeca fascians</i>	Jacky Winter	LC		X	X	X		X	X	X	X
<i>Petroica cucullata</i>	Hooded Robin	LC				X			X	X	
<i>Petroica goodenovii</i>	Red-capped Robin	LC		X	X	X			X	X	X
<b>Pomatostomidae</b> Babblers											
<i>Pomatostomus superciliosus</i>	White-browed Babbler	LC	X	X		X	X		X	X	X
<b>Cinclosomatidae</b> Whipbirds, Wedgebills, Quail Thrushes											
<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush	LC		X		X			X		
<b>Neosittidae</b> Sittellas											
<i>Daphoenositta chrysoptera</i>	Varied Sittella	LC		X		X		X	X	X	X
<b>Pachycephalidae</b> Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers											
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	LC		X	X	X		X	X	X	X
<i>Oreoica gutturalis</i>	Crested Bellbird	LC	X	X	X	X	X	X	X		X
<i>Pachycephala inornata</i>	Gilbert's Whistler	LC		X					X		X
<i>Pachycephala rufiventris</i>	Rufous Whistler	LC		X		X		X	X	X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Dicruridae</b>											
Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo											
<i>Grallina cyanoleuca</i>	Magpie-lark	LC		X			X	X	X	X	X
<i>Myiagra inquieta</i>	Restless Flycatcher	LC									
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC								X	
<i>Rhipidura leucophrys</i>	Willie Wagtail	LC	X	X	X	X	X	X	X	X	X
<b>Campephagidae</b>											
Cuckoo-shrikes, Trillers											
<i>Coracina maxima</i>	Ground Cuckoo-shrike	LC							X	X	X
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC		X	X	X	X	X	X	X	X
<i>Lalage tricolor</i>	White-winged Triller	LC		X						X	
<b>Artamidae</b>											
Woodswallows, Butcherbirds, Currawongs											
<i>Artamus cinereus</i>	Black-faced Woodswallow	LC	X		X	X			X	X	X
<i>Artamus cyanopterus</i>	Dusky Woodswallow	LC		X	X	X		X	X	X	X
<i>Artamus personatus</i>	Masked Woodswallow	LC				X					X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Cracticidae</b> Currawongs, Magpies & Butcherbirds											
<i>Cracticus nigrogularis</i>	Pied Butcherbird	LC		X	X		X	X	X	X	X
<i>Cracticus tibicen</i>	Australian Magpie	LC		X	X	X	X	X	X	X	X
<i>Cracticus torquatus</i>	Grey Butcherbird	LC	X	X	X	X			X	X	X
<i>Strepera versicolor</i>	Grey Currawong	LC		X		X	X	X	X	X	X
<b>Corvidae</b> Ravens, Crows											
<i>Corvus bennetti</i>	Little Crow	LC							X		X
<i>Corvus coronoides</i>	Australian Raven	LC	X	X	X	X		X	X	X	X
<i>Corvus orru</i>	Torresian Crow	LC									
<b>Motacillidae</b> Old World Pipits, Wagtails											
<i>Anthus australis</i>	Australian Pipit	LC		X	X	X	X	X	X	X	
<b>Estrilidae</b> Grass Finches & Mannikins											
<i>Taeniopygia guttata</i>	Zebra Finch	LC								X	
<b>Dicaeidae</b> Flowerpeckers											
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC		X		X			X	X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Hirundinidae</b> Swallows, Martins											
<i>Cheramoeca leucosternus</i>	White-backed Swallow	LC		X		X			X		
<i>Hirundo ariel</i>	Fairy Martin	LC			X						
<i>Hirundo neoxena</i>	Welcome Swallow	LC		X	X	X		X		X	X
<i>Hirundo nigricans</i>	Tree Martin	LC		X		X		X	X	X	
<b>Sylviidae</b> Old World Warblers											
<i>Cincloramphus cruralis</i>	Brown Songlark	LC					X				
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC							X		
<b>Zosteropidae</b> White-eyes											
<i>Zosterops lateralis</i>	Silvereye	LC							X		X
<b>Mammalia</b>											
<b>Tachyglossidae</b> Echidnas											
<i>Tachyglossus aculeatus</i>	Echidna	LC		X	X	X	X	X		X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC =Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Dasyuridae</b> Carnivorous Marsupials											
<i>Ningui ridei</i>	Wongai Ningui	LC			X					X	
<i>Ningui yvonneae</i>	Southern Ningui	LC						X			
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	LC			X			X	X	X	X
<i>Sminthopsis dolichura</i>	Little long-tailed Dunnart	LC		X	X		X		X	X	X
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart	LC			X	X					X
<i>Sminthopsis ooldea</i>	Ooldea Dunnart	LC		X							X
<b>Burramyidae</b> Pygmy Possums											
<i>Cercartetus concinnus</i>	Western Pygmy-possum	LC		X	X	X	X		X	X	X
<b>Macropodidae</b> Kangaroos, Wallabies											
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC	X	X	X			X	X	X	X
<i>Macropus robustus</i>	Euro	LC			X	X	X	X	X	X	
<i>Macropus rufus</i>	Red Kangaroo	LC		X	X	X			X		
<b>Emballonuridae</b> Sheath-tailed Bats											
<i>Taphous hilli</i>	Hill's Sheath-tail-bat	LC		X							

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>



Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Molossidae</b> Freetail Bats											
<i>Mormopterus planiceps</i>	Inland Freetail-bat	LC		X		X	X	X		X	
<i>Tadarida australis</i>	White-striped Freetail-bat	LC		X		X	X	X		X	
<b>Vespertilionidae</b> Ordinary Bats											
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	LC		X		X	X	X	X		X
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	LC		X			X	X	X	X	X
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	LC		X					X	X	X
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	LC								X	
<i>Nyctophilus major tor</i>	Central Long-eared Bat	P4									
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	LC		X			X			X	X
<i>Vespadelus baverstocki</i>	Inland Forest Bat	LC		X		X					X
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat	LC		X							X
<i>Vespadelus regulus</i>	Southern Forest Bat	LC		X					X	X	X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Muridae</b> Rats, Mice											
<i>Mus musculus</i>	House Mouse	Introduced		X	X	X	X		X	X	X
<i>Notomys alexis</i>	Spinifex Hopping-mouse	LC									
<i>Notomys mitchellii</i>	Mitchell's Hopping-mouse	LC								X	
<i>Pseudomys bolami</i>	Bolam's Mouse	LC		X				X	X	X	
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	LC			X	X				X	X
<b>Canidae</b> Dogs, Foxes											
<i>Canis lupus</i>	Dog/Dingo	Introduced	X	X		X	X				
<i>Canis lupus dingo</i>	Dingo	LC									
<i>Vulpes vulpes</i>	Red Fox	Introduced						X	X	X	
<b>Felidae</b> Cats											
<i>Felis catus</i>	Cat	Introduced		X	X	X	X		X		
<b>Equidae</b> Horses											
<i>Equus caballus</i>	Horse	Introduced							X		

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I
<b>Bovidae</b> Horned Ruminants											
<i>Bos taurus</i>	European Cattle	Introduced		X							X
<i>Capra hircus</i>	Goat	Introduced		X	X	X		X	X		
<i>Ovis aries</i>	Sheep	Introduced		X			X	X			
<b>Camelidae</b> Camels											
<i>Camelus dromedarius</i>	Dromedary Camel	Introduced									
<b>Leporidae</b> Rabbits, Hares											
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	X	X	X	X	X	X			X

BC Act Status - S1 to S7, EPBC Act Status - CR = Critically Endangered, EN = Endangered, VU = Vulnerable, EX = Extinct, Mig = Migratory, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, IUCN Red List Category Definitions - LC = Least Concern, see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>