Reconnaissance Flora/Vegetation & Fauna Survey Greenfields Mill-Borrow Pit Prepared For FMR Investments Pty Ltd

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Version 1

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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.
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.
FMR	FMR Investments Pty Ltd.
Ha	Hectare (10,000 square metres).
IBRA	Interim Biogeographic Regionalisation for Australia.

Acronym	Description
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.
Survey Area	Borrow Pit.
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 FMR Investments Pty Ltd to undertake a reconnaissance flora/vegetation and fauna survey of the Greenfields Mill-Borrow Pit (referred to as the 'survey area'). The survey covered an area of 7 ha and was conducted on the 15th June 2019. The survey area is located approximately 3 km north-east of Coolgardie and 28km south-west of Kalgoorlie-Boulder, Western Australia.

Three vegetation types were identified within the survey area. These vegetation types were located within three different landform types and comprised of two major vegetation groups, which were represented by a total of 16 Families, 22 Genera and 42 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plain, open depression, and rocky hillslope.

No Threatened Flora, Threatened Fauna, 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 Flora or Fauna or Ecological Communities as listed on the Department of Biodiversity, Conservation and Attractions (DBCA) database were identified within the survey area.

Results of the literature review identified 31 mammals (including 9 bat species), 109 birds, 79 reptiles and five frog species as having been previously recorded in the general area, some of which have the potential to occur within the survey area itself subject to the identified habitats being suitable.

The survey area does not contain any world or national heritage places and does not occur within a Bush Forever site. 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. No Groundwater Dependent Ecosystems are located within the survey area.

The survey area is not located within any Conservation Reserves/ DBCA Managed Land, does not contain any Environmentally Sensitive Areas (ESA). The survey area is however located within a Schedule 1 Area as listed under the *Environmental Protection (EP) Act 1986*.

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (ranging from 'pristine' to 'completely degraded'), all three vegetation types were rated as 'good'. No introduced flora were identified within the survey area.

1 Introduction

1.1 Project Description

Botanica Consulting (Botanica) was commissioned by FMR Investments Pty Ltd (FMR) to undertake a reconnaissance flora/vegetation and fauna survey of the Greenfields Mill proposed borrow pit (referred to as the 'survey area'). The survey covered an area of 7 ha, located approximately 3 km north-east of Coolgardie and 28km south-west of Kalgoorlie-Boulder, Western Australia. (Figure 1-1). The survey was conducted on 15th June 2019.

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 within the South-West Interzone of WA in a region known as the Coolgardie Botanical District. Based on the Interim Biogeographic Regionalisation of Australia (IBRA, Version 7 (DotEE, 2012) the survey area is located within the Coolgardie Bioregion of WA. The Coolgardie Bioregion is further divided into three subregions; Mardabilla (COO1), Southern Cross (COO2) and Eastern Goldfields (COO3) subregion with the survey area located within the Eastern Goldfields subregion (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).

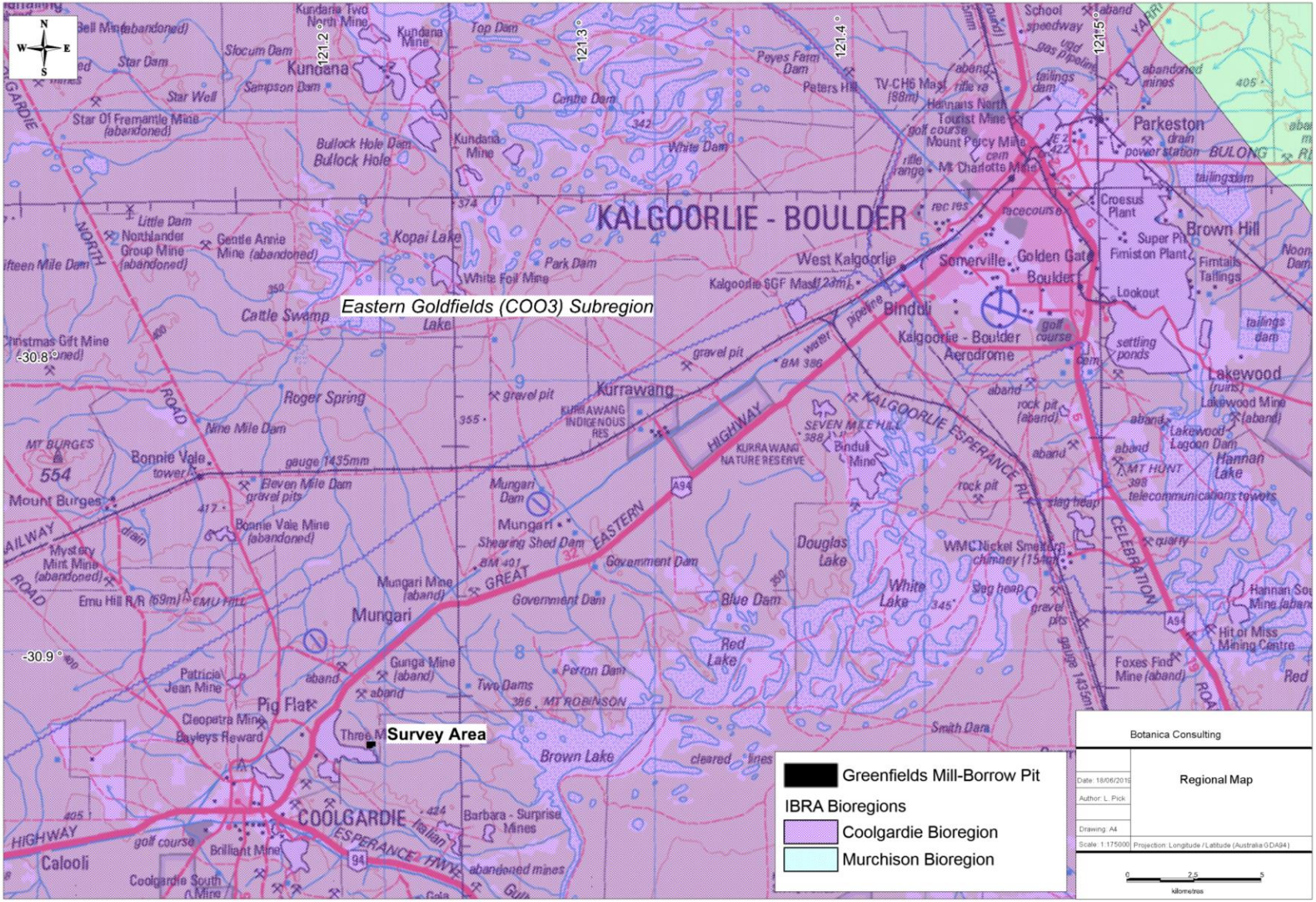


Figure 2-1: Map of IBRA bioregions in relation to the survey area

2.2 Great Western Woodlands

The survey area lies within the Great Western Woodlands, located approximately 60 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.

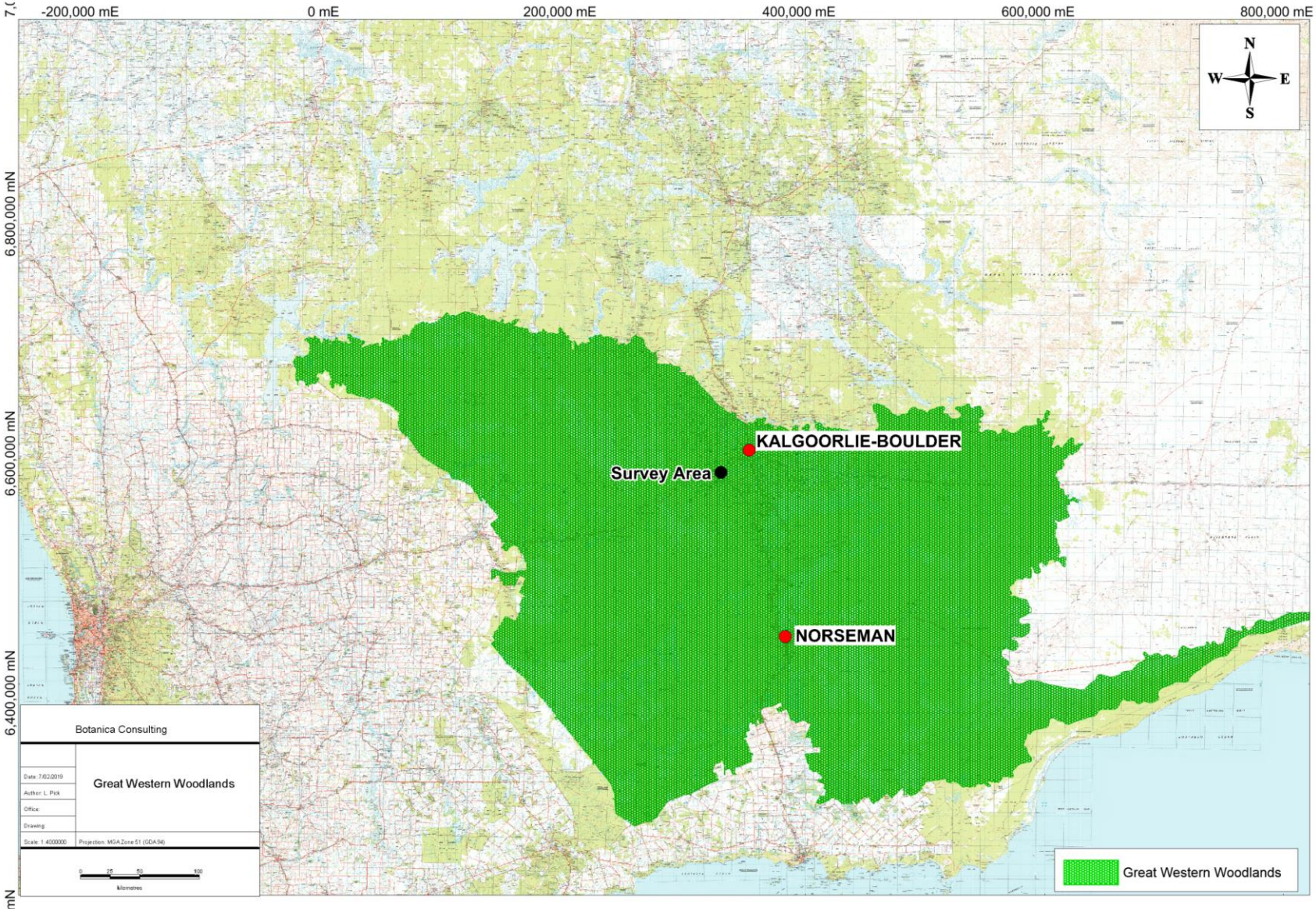


Figure 2-2: Location of survey area within the Great Western Woodlands (DBCA, 2011a)

Note-survey area not to scale

2.3 Soils and Landscape Systems

The 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). Elevations in the Coolgardie area range from 400m to 450m above sea level.

Based on geographic information provided by DAFWA (2014), the survey area is located within the Norseman Zone 266 of the Kalgoorlie Province (26). The Kalgoorlie Province is characterised by undulating plains (with some sandplains, hills and salt lakes) on the granitic rocks and greenstone of the Yilgarn Craton. Soils include calcareous loamy earths and red loamy earths with some Salt Lake soils, red deep sands, yellow sandy earths, shallow loams and loamy duplexes. Vegetation is dominated by Eucalypt woodlands with some Acacia-Casuarina thickets, mulga shrublands, halophytic shrublands and spinifex grasslands. This Province is located in the southern Goldfields between Paynes Find, Menzies, Southern Cross and Balladonia (Tille, 2006).

The Norseman Zone is characterised by undulating plains and uplands (with some sandplains and salt lakes) on granitic rocks of the Yilgarn Craton. Soils include calcareous loamy earths, yellow sandy and loamy earths, red loamy earths, red deep sands and salt lake soils. Vegetation comprises of Salmon gum-redwood-merrit-red mallee-gimlet woodland with Acacia/Casuarina thickets (and some mulga shrublands and spinifex grasslands). This zone is located in the southern Goldfields between Koolyanobbing, Menzies, Zanthus (Trans-Australian Railway), Norseman and Lake Hope (Tille, 2006). The Norseman Zone is further divided into soil landscape systems, with the Project area located within the BB5 landscape system which is characterised by rocky ranges and hills of greenstones-basic igneous rocks (DAFWA, 2014).

The Coolgardie goldfields are dominated by calcareous earths which cover much of the plains and greenstone areas (Cowan 2001). According to the Atlas of Australian Soils (2001) soils of the Project area are comprised of calcareous shallow loam & calcareous loamy earth.

2.4 Vegetation

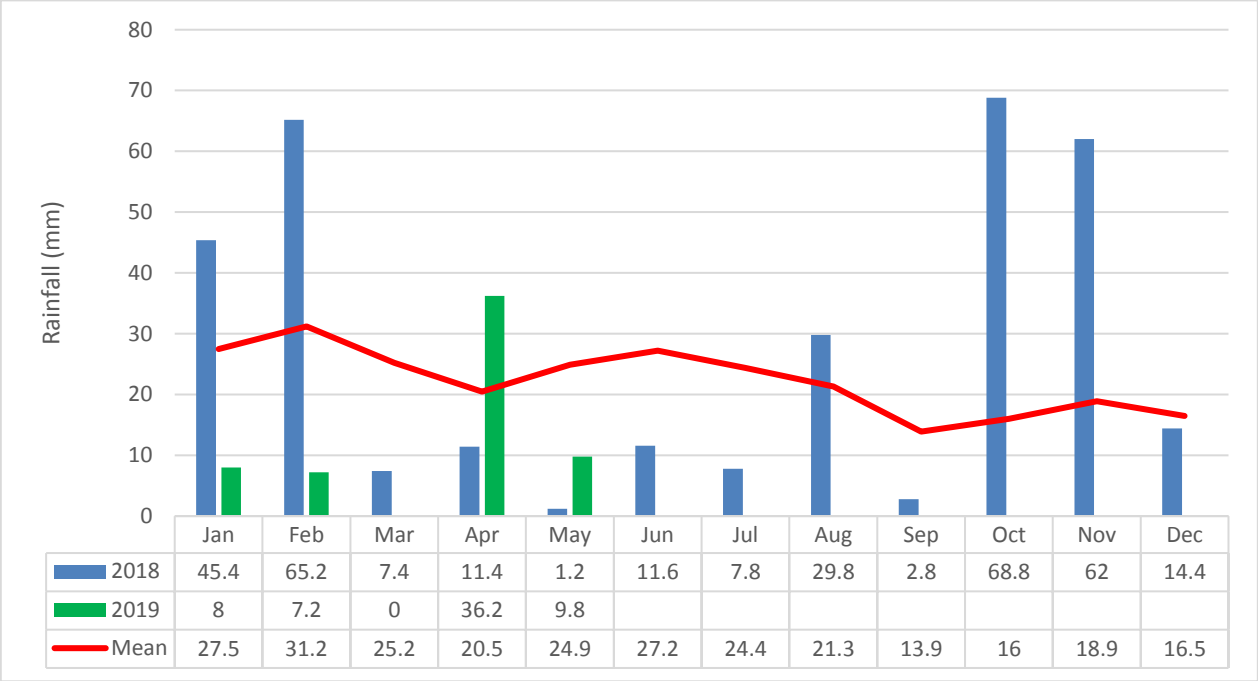
The vegetation of the Eastern Goldfields subregion consists of Mallees, Acacia thickets and shrub heaths on sandplains. Diverse Eucalyptus woodlands occur around salt lakes, on ranges, and in valleys (Cowan, 2001). The Department of Agriculture and Food Western Australia (DAFWA) GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation association Coolgardie 9. The extent of this vegetation association, as specified in the 2017 Statewide Vegetation Statistics (DBCA, 2017) is provided in Table 2-2.

Table 2-1: Pre-European Vegetation Association within the survey area

Vegetation association	Pre-European extent remaining (%)	% of Current extent within DBCA managed lands	Vegetation Description (Beard, 1990)
Coolgardie 9	96.88	11.32	Medium woodland; coral gum (*E. torquata*) & Goldfields blackbutt (*E. lesouefii*)

2.5 Climate

The climate of the Eastern Goldfields subregion is characterised as an arid to semi-arid climate with annual rainfall of approximately 200-300mm (Beard, 1990; Cowan, 2001). Rainfall data for the Kalgoorlie-Boulder Airport weather station (#12038), located approximately 28 km north-east of the survey area, is shown in Figure 2-3 and the average climate data for Kalgoorlie-Boulder is shown in Figure 2-4 (BoM, 2018). Rainfall in the month preceding the survey (May 2019) was below average, however rainfall received in April 2019 was above average.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	45.4	65.2	7.4	11.4	1.2	11.6	7.8	29.8	2.8	68.8	62	14.4
2019	8	7.2	0	36.2	9.8							
Mean	27.5	31.2	25.2	20.5	24.9	27.2	24.4	21.3	13.9	16	18.9	16.5

Figure 2-3: Monthly rainfall (Jan 2018 to May 2019) for the Kalgoorlie – Boulder Airport weather station (#12038) (BoM, 2019)

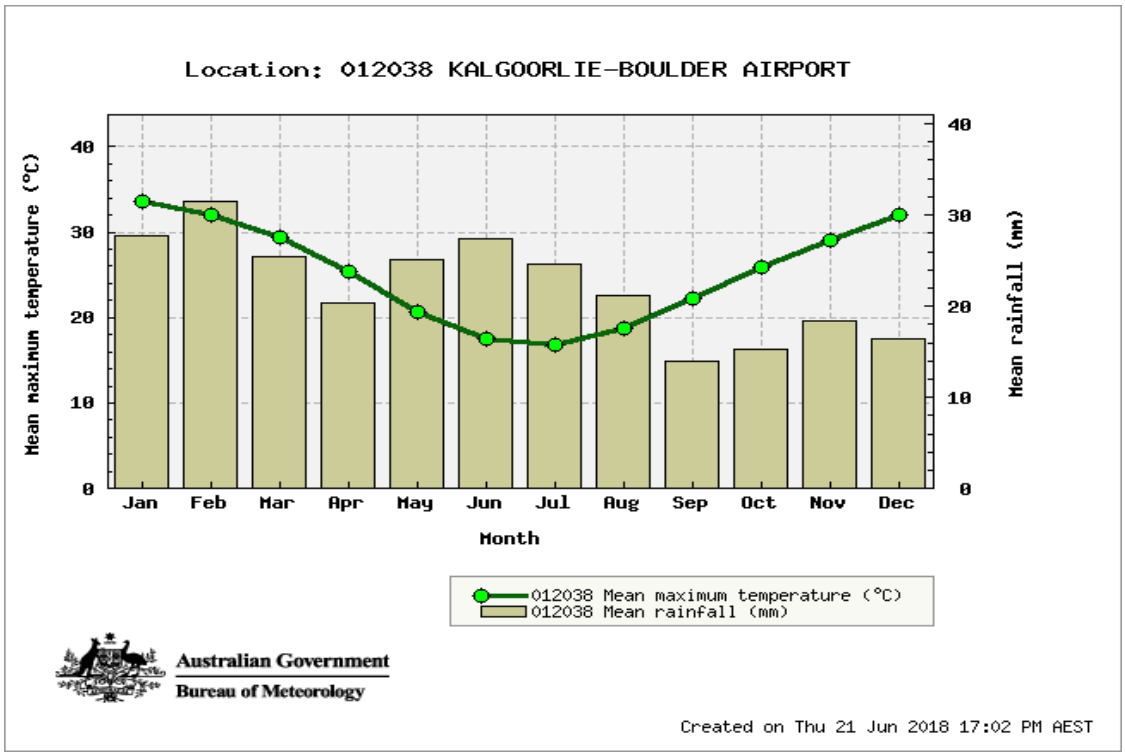


Figure 2-4: Average Climate Data for the Kalgoorlie – Boulder Airport weather station (BoM, 2018)

2.6 Hydrology

According to the Geoscience Australia database (2001), there are no drainage lines or inland waters within the survey area. According to the Bureau of Meteorology (2018b) *Groundwater Dependent Ecosystem Atlas,* there are no groundwater dependent aquatic or terrestrial ecosystems within the survey area. A map showing the regional surface hydrology and potential GDEs in the local region is provided in Figure 2-5.

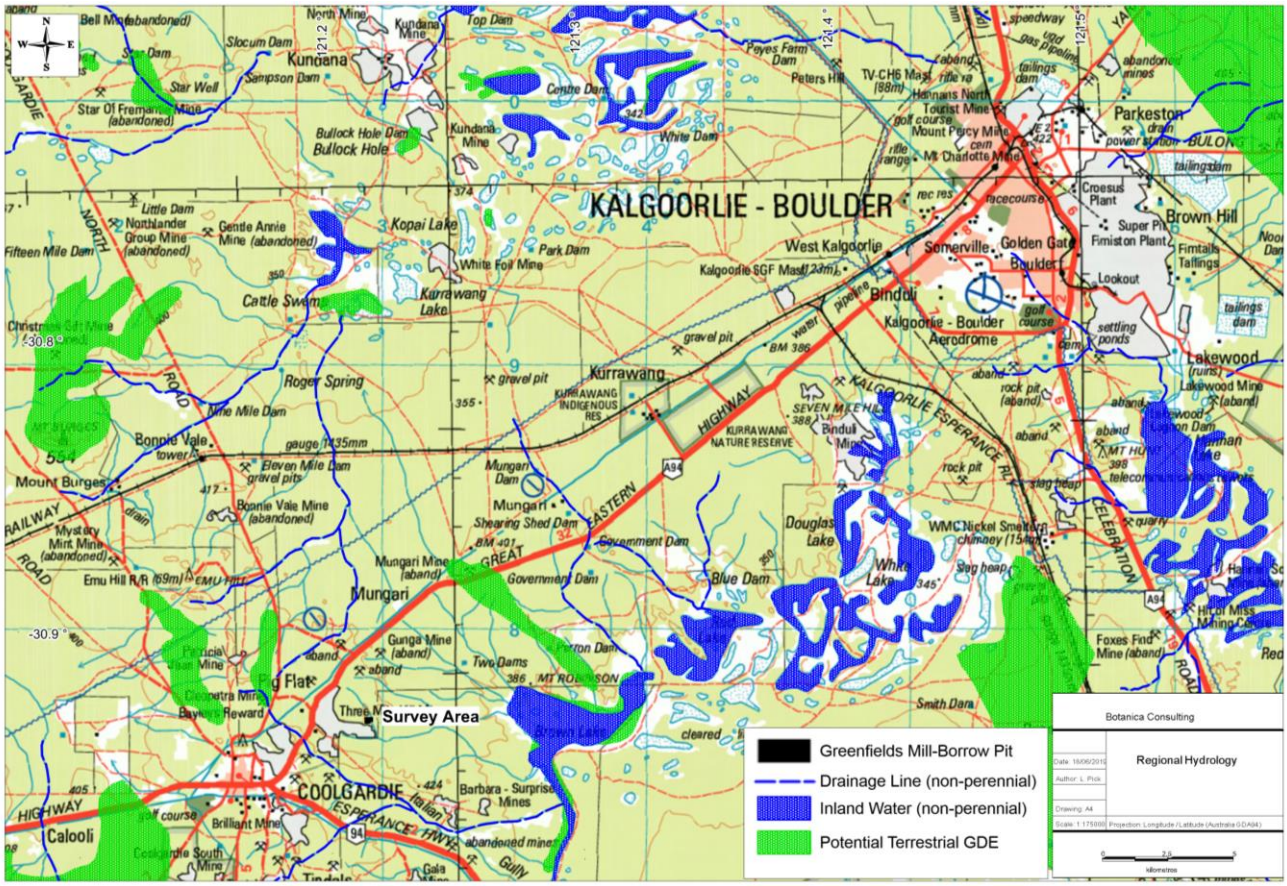


Figure 2-5: Hydrology of the survey area (data obtained from Geoscience Australia, 2001)

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 (Cowan, 2001).

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:

- Dell, How, Newbey & Hnatiuk (1985), The Biological survey of the Eastern Goldfields of Western Australia. Part 3: Jackson-Kalgoorlie Study Area. Western Australian Museum 1995.
- Bamford, M., Davies, S.J.J.F. and Ladd, P.G. (1991) *Biological survey of Kangaroo Hills and Calooli Timber Reserves, Coolgardie, Western Australia.*
- Botanica Consulting, (2013a), Level 2 Flora & Vegetation Survey for the Red Dam Project, Prepared for Phoenix Gold Ltd
- Botanica Consulting (2013b), Level 2 Flora & Vegetation Survey for the Castle Hill Project, Prepared for Phoenix Gold Ltd
- Botanica Consulting (2014), Level 2 Flora & Vegetation Survey for the Kintore Extension, Prepared for Phoenix Gold Ltd.
- Botanica Consulting (2016). Biological Assessment Spargoville Material Pit Extension. Prepared for Main Roads Western Australia
- Meissner & Coppen (2014), Flora and vegetation of the greenstone ranges of the Yilgarn Craton: Kangaroo Hills and surrounding area.
- Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) of Cave Rocks Project Area Kambalda. Prepared for Gold Fields - St Ives Gold Mine
- Harewood, G. (2014). Malleefowl (*Leipoa ocellata*) Assessment. Bullabulling Gold Project. Prepared for Bullabulling Gold Ltd.
- Harewood, G. (2015). Fauna Survey (Level 2 - Phase 1 and 2) of Proposed Tails Storage Facility Expansion. Unpublished report for KCGM Pty Ltd. June 2015.

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

- DBCA's NatureMap Database (DBCA, 2019a);
- DotEE Protected matters search tool (DotEE, 2019a); and
- DBCA's Threatened and Priority Flora search (DBCA, 2018b).

A search of the DBCA Priority Ecological Communities (PEC) and Threatened Ecological Communities (TEC) database was also conducted within a 30 km radius of the survey area (DBCA, 2018b).

The NatureMap and Protected Matters Search were conducted for an area encompassing a 10km radius of the centre coordinates – 121° 12' 54'' E,30° 55' 55'' S. It should be noted that these lists are based on observations from a broader area than the assessment area (10km 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 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*[1]. 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 11th September 2018; flora list released 5th 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)[2];
- 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 Table 3-1 and Table 3-2.

Table 3-1: **Definitions of Conservation Significant Species**

Code	Category
State categories of threatened and priority species	
Threatened Species (T) 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	**Critically Endangered** Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	**Endangered** Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

[1] Prior to 1st January 2019, flora and fauna were protected under the *Wildlife Conservation Act 1950*
[2] Most but not all species listed under JAMBA are also specially protected under Specially Protected Species of the BC Act.

Code	Category
VU	**Vulnerable** Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	**Extinct** Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
EW	**Extinct in the Wild** Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no Threatened fauna or Threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as Threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
IA	**International Agreement/ Migratory** Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
CD	**Species of special conservation interest** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as Threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
OS	**Other specially protected species** Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

Code	Category
Priority species Possibly Threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of Priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.	
P1	**Priority 1: Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	**Priority 2: Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	**Priority 3: Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	**Priority 4: Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Commonwealth categories of threatened species	
EX	**Extinct** Taxa where there is no reasonable doubt that the last member of the species has died.
EW	**Extinct in the Wild** 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.
CR	**Critically Endangered** 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.
EN	**Endangered** 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.
VU	**Vulnerable** 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.

Code	Category
CD	**Conservation Dependent** 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.

Table 3-2: Definition of conservation significant communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PD	**Presumed Totally Destroyed** 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: • records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; • all occurrences recorded within the last 50 years have since been destroyed.
CR	**Critically Endangered** 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	**Endangered** 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	**Vulnerable** 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;

Category Code	Category
	The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	**Critically Endangered** 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	**Endangered** 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	**Vulnerable** 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).
Priority Ecological Communities (PEC)	
P1	**Poorly-known ecological communities** 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	**Poorly-known ecological communities** 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	**Poorly known ecological communities** 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	**Ecological communities that are adequately known, rare but not threatened** or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** 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.

3.2 Field Assessment

Botanica conducted a reconnaissance flora and fauna survey covering an area of 7 ha. The survey was conducted on 15th June 2019, with the area traversed on foot and by 4WD.

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 (BSc-Conservation Biology/ Zoology)

3.2.4 Scientific licences

Table 3-3: 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 3-4.

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 3-4: 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. **Coordinating Botanist:** Jim Williams **Data Interpretation:** Jim Williams & Lauren Pick
Timing of survey, weather & season	Not a constraint	Fieldwork was completed outside the EPA's recommended primary survey time periods (i.e., September – November) for the South-West Interzone; However, given the small size of the survey area and Botanica's previous experience with flora/ vegetation in the region, this was not a constraint.
Area disturbance	Minor constraint	The area has been disturbed from exploration and pastoral activities.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a reconnaissance survey completed to identify

Variable	Potential Impact on Survey	Details
		vegetation types/fauna habitat and areas of Conservation Significance
Availability of contextual information at a regional and local scale	Not a constraint	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. 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.
Completeness	Minor constraint	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. 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).

4 Results

4.1 Desktop Assessment

4.1.1 Flora/Vegetation

According to the results of the NatureMap search (DBCA, 2018a), a total of 342 flora taxa have been recorded within a 10km radius of the survey area. Dominant genera include *Eucalyptus, Acacia, Eremophila, Grevillea* and *Maireana.* Results of database searches identified twenty-four introduced taxa as potentially occurring within the survey area:

1. *Acacia pycnantha (Golden Wattle)*
2. *Brassica tournefortii (Mediterranean Turnip)*
3. *Carrichtera annua (Ward's weed)*
4. *Conyza bonariensis (Flaxleaf Fleabane)*
5. *Conyza sumatrensis*
6. *Cylindropuntia tunicata*
7. *Eragrostis curvula (African Lovegrass)*
8. *Erodium cicutarium (Common Storksbill)*
9. *Glandularia aristigera*
10. *Helianthus annuus (Sunflower, Common Sunflower)*
11. *Heliotropium europaeum (Common Heliotrope)*
12. *Limonium sinuatum (Perennial Sea Lavender)*
13. *Lythrum hyssopifolia (Lesser Loosestrife)*
14. *Monoculus monstrosus*
15. *Opuntia elata*
16. *Papaver hybridum (Rough Poppy)*
17. *Phalaris paradoxa (Paradoxa Grass)*
18. *Salvia reflexa (Mintweed)*
19. *Salvia verbenaca (Wild Sage)*
20. *Schinus molle* var. *areira*
21. *Sisymbrium orientale (Indian Hedge Mustard)*
22. *Spergularia diandra (Lesser Sand Spurry)*
23. *Urochloa panicoides*
24. *Vicia monantha* subsp. *triflora*

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2018b), NatureMap search and DotEE protected matters search recorded no Threatened Flora or Priority Flora within the survey area. One Threatened Flora and eight Priority Flora were listed by on the databases as occurring within a 10km radius of the survey area (map of flora locations provided in Appendix 1). 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 the field survey.

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

Taxon	Conservation Status			Description (WAHERB, 2019)	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA Priority		
Acacia websteri			P1	Shrub, 1.2-5 m high, bark fibrous. Fl. yellow. Red sand, clay or loam. Low-lying areas, flats	Possible
Chrysocephalum apiculatum subsp. *norsemanense*			P3	No description available	Possible
Eremophila caerulea subsp. *merrallii*			P4	Spreading or sprawling shrub, to 0.35 m high, to 0.8 m wide. Fl. blue-purple, Oct to Dec. Sand, clay or loam. Undulating plains.	Possible
Gastrolobium graniticum	EN	VU		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
Grevillea georgeana			P3	Erect to widely spreading shrub, 1-3 m high, up to 4 m wide. Fl. red/red & pink & cream, Jan or Mar or Sep to Nov. Stony loam/clay. Ironstone hilltops & slopes.	Unlikely
Lepidium merrallii			P2	Erect to spreading annual (possibly ephemeral), herb, 0.03-0.15 m high. Clay loam	Possible
Phlegmatospermum eremaeum			P3	Prostrate to spreading annual, herb, 0.02-0.1(-0.2) m high. Fl. white-cream, Jun or Aug to Oct. Stony loam.	Possible
Thryptomene sp. Coolgardie (E. Kelso s.n. 1902)			P1*	No description available	Possible
Thryptomene sp. Londonderry (R.H. Kuchel 1763)			P1	No description available	Possible

*also endemic to the area

4.1.2 Fauna

According to the results of the NatureMap search (DBCA, 2019a), a total of 136 vertebrate fauna taxa have been recorded within a 10km radius of the survey area including four amphibians, 96 bird species, 10 mammals and 26 reptiles.

Combined results of database searches (DBCA 2019a and DotEE 2019) identified ten introduced taxa as potentially occurring within the survey area, these being:

1. *Camelus dromedaries* (Camel)
2. *Canis lupus familiaris* (Dog)
3. *Capra hircus* (Goat)
4. *Columba livia* (Domestic Pigeon)
5. Equus asinus (Donkey)
6. *Felis catus* (Cat)
7. *Mus musculus* (House Mouse)
8. *Oryctolagus cuniculus* (Rabbit)
9. *Streptopelia senegalensis* (Laughing Dove)
10. *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 10km 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-western 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 – Fauna Species of Conservation Significance

Taxon	Conservation Status			Habitat Description	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA Priority		
Malleefowl *Leipoa ocellata*	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species (DotEE 2019b).	Possibly Occurs but probably only rarely. Habitat very marginal/unsuitable. No recent, nearby records. Occasional transients only.
Curlew Sandpiper *Calidris ferruginea*	CR	CR	-	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland (DotEE, 2019b).	Would Not Occur. No Suitable Habitat.
Migratory Shorebirds	MI	IA	-		Would Not Occur. No Suitable Habitat.
Grey Wagtail *Motacilla cinerea*	MI	IA	-	Running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Morecombe 2004).	Would Not Occur. Never recorded in goldfields region/No impact anticipated.
Fork-tailed Swift *Apus pacificus*	MI	IA	-	In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999).	Unlikely to Occur. Very small number of old records in vicinity.
Night Parrot *Pezoporus occidentalis*	EN	CR	-	Broad habitat requirements include areas of old-growth spinifex (*Triodia*) for roosting and nesting, together with foraging habitats that are likely to include various native grasses and herbs, and may or may not contain shrubs or low trees. (DPaW, 2017).	Would Not Occur. No suitable habitat or previous records.
Chuditch *Dasyurus geoffroii*	VU	VU	-	Historically, chuditch inhabited a wide range of habitats, but today it survives mostly in Jarrah *Eucalyptus marginata* forests and woodlands, mallee shrublands and heathlands (DBCA, 2017).	Unlikely to Occur. Very small number of old records in vicinity.

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, 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 (individuals, nest mounds, tracks or feathers) of this species was found during the field survey though this species appears to be occasionally recorded in the general area, though documented records are relatively old (DBCA 2019a). There also does not appear to be any recent records of this species breeding in the area. Available information therefore 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.

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.

4.2 Field Assessment

4.2.1 Vegetation Types

Three broad vegetation types were identified within the survey area. These vegetation types were identified within three landform types and comprised of two major vegetation groups according to the NVIS, Major Vegetation Group (MVG) definition (Table 4-3). These were represented by a total of 16 Families, 22 Genera and 42 Taxa as listed in Appendix 2. 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	Major Vegetation Group	Vegetation Code	Vegetation Type	Area (ha)	Area (%)
Open Depression	Mallee Woodlands and Shrublands (MVG 14)	OD-MWS1	Sparse mallee shrubland of *E. griffithsii* over mid open shrubland of *Eremophila scoparia* and low open chenopod shrubland of *Atriplex vesicaria* in open depression	2.2	32
Clay-Loam Plain	Mallee Woodlands and Shrublands (MVG 14)	CLP-MWS1	Open mallee shrubland of *E. griffithsii* over mid open shrubland of *Dodonaea lobulata/ Eremophila scoparia* and low open chenopod scrub of *Atriplex nummularia/ A. vesicaria* in clay-loam plain	2.7	39
Hillslope	Eucalypt Woodlands (MVG 5)	HS-EW1	Low woodland of *Eucalyptus torquata* over mid open shrubland of *Eremophila interstans* subsp. *virgata* and low open chenopod shrubland of *Atriplex vesicaria* on hillslope	2.0	29
Total				**7**	**100**

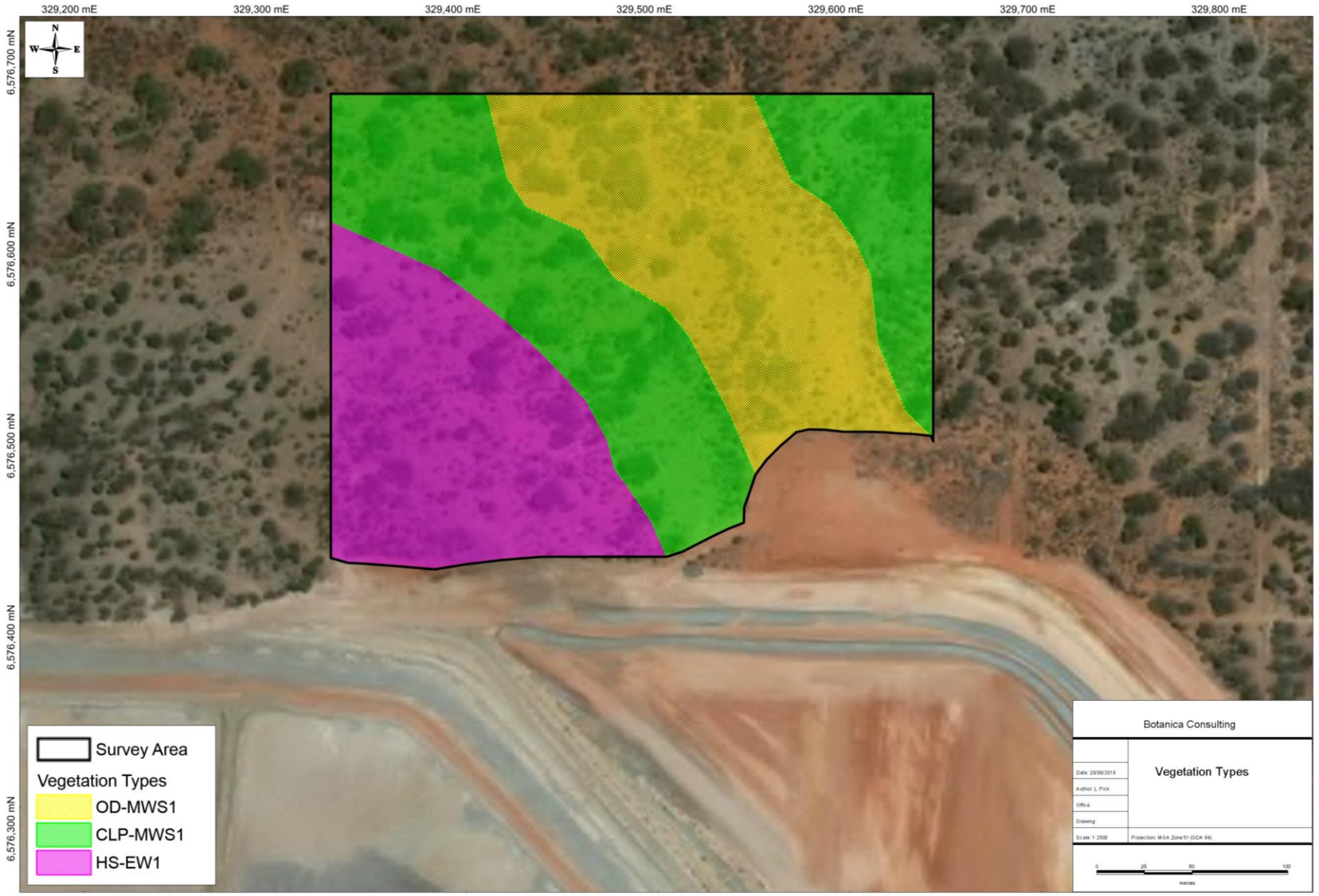


Figure 4-1: Vegetation types within the survey area

Open Depression: Mallee Woodlands and Shrublands

4.2.1.1 Sparse mallee shrubland of *E. griffithsii* over mid open shrubland of *Eremophila scoparia* and low open chenopod shrubland of *Atriplex vesicaria* in open depression (OD-EW1)

The total flora recorded within this vegetation type was represented by a total of 16 Families, 22 Genera and 35 Taxa (Plate 4-1). Dominant taxa are shown in Table 4-4. According to the NVIS, this vegetation type is best represented by the MVG 14 -Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 4-4: Low woodland of Sparse mallee shrubland of *E. griffithsii* over mid open shrubland of *Eremophila scoparia* and low open chenopod shrubland of *Atriplex vesicaria* in open depression

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub Mallee 3-10m	5-10%	*Eucalyptus griffithsii*
Shrub 1-2m	10-30%	*Eremophila scoparia*
Chenopod Shrub <1m	10-30%	*Atriplex vesicaria*

Plate 4-1: Sparse mallee shrubland of *E. griffithsii* over mid open shrubland of *Eremophila scoparia* and low open chenopod shrubland of *Atriplex vesicaria* in open depression

Clay-Loam Plain: Mallee Woodlands and Shrublands

4.2.1.2 Open mallee shrubland of *E. griffithsii* over mid open shrubland of *Dodonaea lobulata/ Eremophila scoparia* and low open chenopod scrub of *Atriplex nummularia/ A. vesicaria* in clay-loam plain (CLP-MWS1)

The total flora recorded within this vegetation type was represented by a total of 16 Families, 22 Genera and 35 Taxa (Plate 4-2). Dominant taxa are shown in Table 4-5. According to the NVIS, this vegetation type is best represented by the MVG 14 -Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 4-5: Open mallee shrubland of *E. griffithsii* over mid open shrubland of *Dodonaea lobulata/ Eremophila scoparia* and low open chenopod scrub of *Atriplex nummularia/ A. vesicaria* in clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub Mallee 3-10m	10-30%	*Eucalyptus griffithsii*
Shrub 1-2m	10-30%	*Dodonaea lobulata* *Eremophila scoparia*
Chenopod Shrub <1m	10-30%	*Atriplex nummularia* var. *spathulata* *Atriplex vesicaria*

Plate 4-2: Open mallee shrubland of *E. griffithsii* over mid open shrubland of *Dodonaea lobulata/ Eremophila scoparia* and low open chenopod scrub of *Atriplex nummularia/ A. vesicaria* in clay-loam plain

Hillslope: Eucalypt Woodlands

4.2.1.3 Low woodland of *Eucalyptus torquata* over mid open shrubland of *Eremophila interstans* subsp. *virgata* and low open chenopod shrubland of *Atriplex vesicaria* on hillslope (HS-EW1)

The total flora recorded within this vegetation type was represented by a total of 13 Families, 15 Genera and 26 Taxa (Plate 4-3). Dominant taxa are shown in Table 4-6. According to the NVIS, this vegetation type is best represented by the MVG 5 -Eucalyptus Woodland (DotEE, 2017b).

Table 4-6: Low woodland of *Eucalyptus torquata* over mid open shrubland of *Eremophila interstans* subsp. *virgata* and low open chenopod shrubland of *Atriplex vesicaria* on hillslope

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	*Eucalyptus torquata*
Shrub 1-2m	10-30%	*Eremophila interstans* var. *virgata*
Shrub <1m	10-30%	*Atriplex vesicaria*

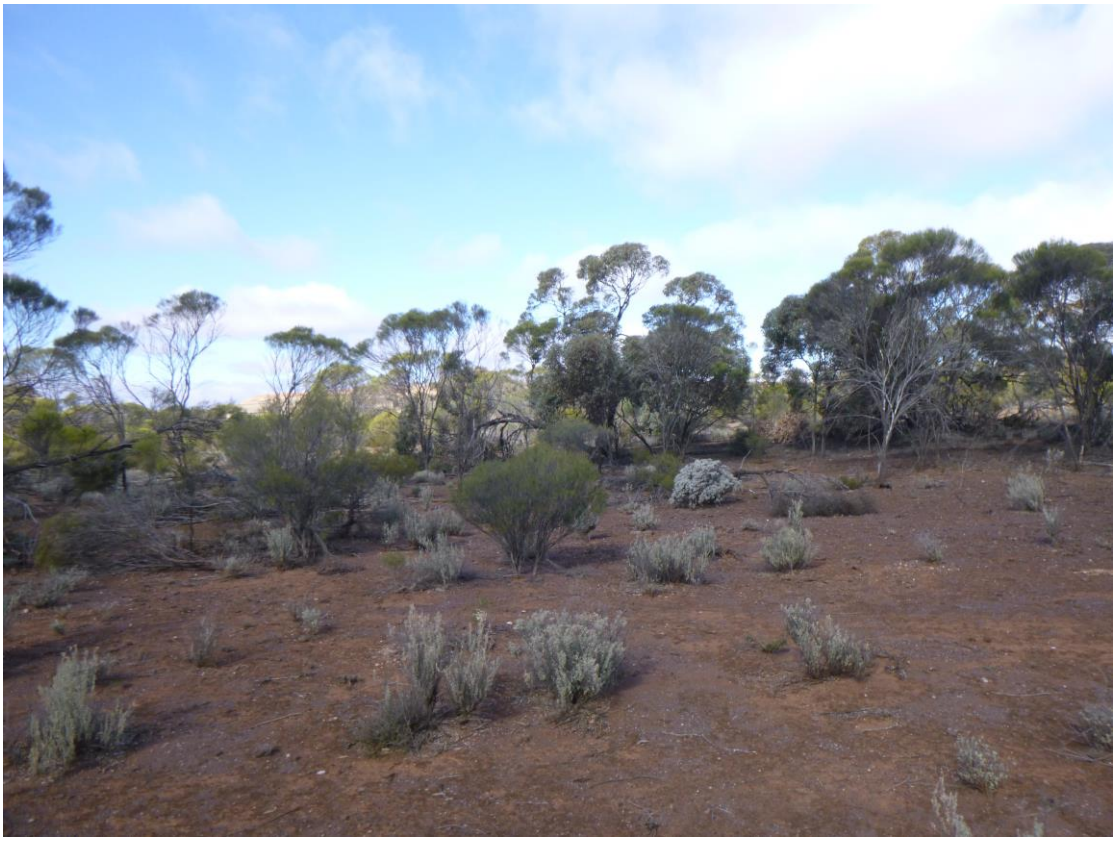


Plate 4-3: Low woodland of *Eucalyptus torquata* over mid open shrubland of *Eremophila interstans* subsp. *virgata* and low open chenopod shrubland of *Atriplex vesicaria* on hillslope

4.2.2 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 3), all three vegetation types had a vegetation condition rating of 'Good', which depicts that vegetation structure significantly altered by very obvious signs of multiple disturbances but retains its basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by partial clearing and grazing.

4.2.3 Introduced Plant Species

No introduced species were identified during the survey.

4.2.4 Fauna Habitat

The broad scale terrestrial fauna habitats within the survey area 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 of each are provided in Table 4-7 below.

Table 4-7: Main Terrestrial Fauna Habitats within the Survey Area

Code	Fauna Habitat Description	Example Image
OD-MWS1	Open Depression Mallee Woodland Total Area = ~2.2 ha (~32%)	
CLP-MWS1	Clay-Loam Plain Mallee Woodland Total Area = ~2.7 ha (~39%)	

Code	Fauna Habitat Description	Example Image
HS-EW1	Hillslope Eucalypt Woodland Total Area = ~2.0 ha (~29%)	

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 4. 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 4-8 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 4.

Table 4-8: Summary of Potential Vertebrate Fauna Species

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species
Amphibians	5	0	0	0
Reptiles	79	0	0	0

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species
Birds	109	1	0	0
Non-Volant Mammals	22[7]	0	0	0
Volant Mammals (Bats)	9	0	0	0
Total	**224[7]**	**1**	**0**	**0**

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) flora of conservation significance 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 significant flora were identified within the survey area. A map showing regional Threatened and Priority Flora known records in relation to the survey area is provided in Appendix 1.

4.2.6 Significant Fauna

According to the EPA *Environmental Factor Guideline for Terrestrial Fauna* (EPA, 2016d) fauna of conservation significance 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 fauna of conservation significance were confirmed as occurring within the survey area.

4.2.7 Significant Vegetation

According to the EPA *Environmental Factor Guideline for Flora and Vegetation* (EPA, 2016b) vegetation of conservation significance 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 vegetation of conservation significance was identified within the survey area.

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 or Threatened Species as listed under the BC Act or EP Act. The survey area does not contain any ESA listed under the EP Act; however, the survey area is located within a Schedule 1 Area as listed under the EPA Act. The survey area is not located within any DBCA Managed Land/ Conservation Reserves.

A map showing areas of conservation significance in relation to the survey area is provided in Appendix 1.

4.5 Native Vegetation Clearing Principles

Based on the outcomes from the survey undertaken, as presented in this report, Botanica provides the following comments regarding the native vegetation clearing principles listed under Schedule 5 of the EP Act (Table 4-9).

Table 4-9: Assessment of development within the survey area against native vegetation clearing principles

Letter	Principle	Assessment	Outcome
(a)	Native vegetation should not be cleared if it comprises a high level of biological diversity.	Vegetation identified within the survey area is not considered to be of high biological diversity and is well represented outside of the proposed impact area.	Development within the survey area is unlikely to be at variance to this principle
(b)	Native vegetation should not be cleared it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	No significant fauna habitat identified within the project area. Fauna habitats are well represented outside of the project area. No significant fauna were observed within the survey area.	Development within the survey area is unlikely to be at variance to this principle
(c)	Native vegetation should not be cleared if it includes or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to the BC Act and the EPBC Act were identified within the survey area.	Development within the survey area is unlikely to be at variance to this principle

Letter	Principle	Assessment	Outcome
(d)	Native vegetation should not be cleared if it comprises the whole or part of or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under the EPBC Act or by the BC Act occur within the survey area.	Development within the survey area is unlikely to be at variance to this principle
(e)	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation association Coolgardie 9, which retains approximately >96% of the original vegetation extent.	Development within the survey area is unlikely to be at variance to this principle
(f)	Native vegetation should not be cleared if it is growing, in, or in association with, an environment associated with a watercourse or wetland.	According to the Geoscience Australia database (2001), there are no drainage lines or inland waters within the survey area. On vegetation type was identified as occurring within an open depression, however no riparian vegetation was identified within the survey area.	Development within the survey area is unlikely to 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.	According to DAFWA (2011), the survey area occurs in pre-European Beard vegetation association Coolgardie 9, which retains approximately >96% of the original vegetation extent. Clearing within this vegetation association is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.	Development within the survey area is unlikely 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.	The survey area is not located within a Conservation Area/ DBCA Managed Land. The closest Conservation Area to the survey area is the Kangaroo Hills Timber Reserve which is located approximately 8km south-west of the survey area. Given the distance from the Project and small scale of development proposed (borrow pit) impacts to the Timber Reserve are unlikely.	Development within the survey area is unlikely to be 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.	According to the Geoscience Australia database (2001), there are no drainage lines or inland waters within the survey area. On vegetation type was identified as occurring within an open depression, however no riparian vegetation was identified within the survey area. 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.	Development within the survey area is unlikely 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	Rainfall is unreliable and highly variable with an average rainfall of 200-300mm and an evaporation rate of 2400 mm. The region is not prone to flooding and does not contain riparian vegetation.	Development within the survey area is unlikely to be at variance to this principle

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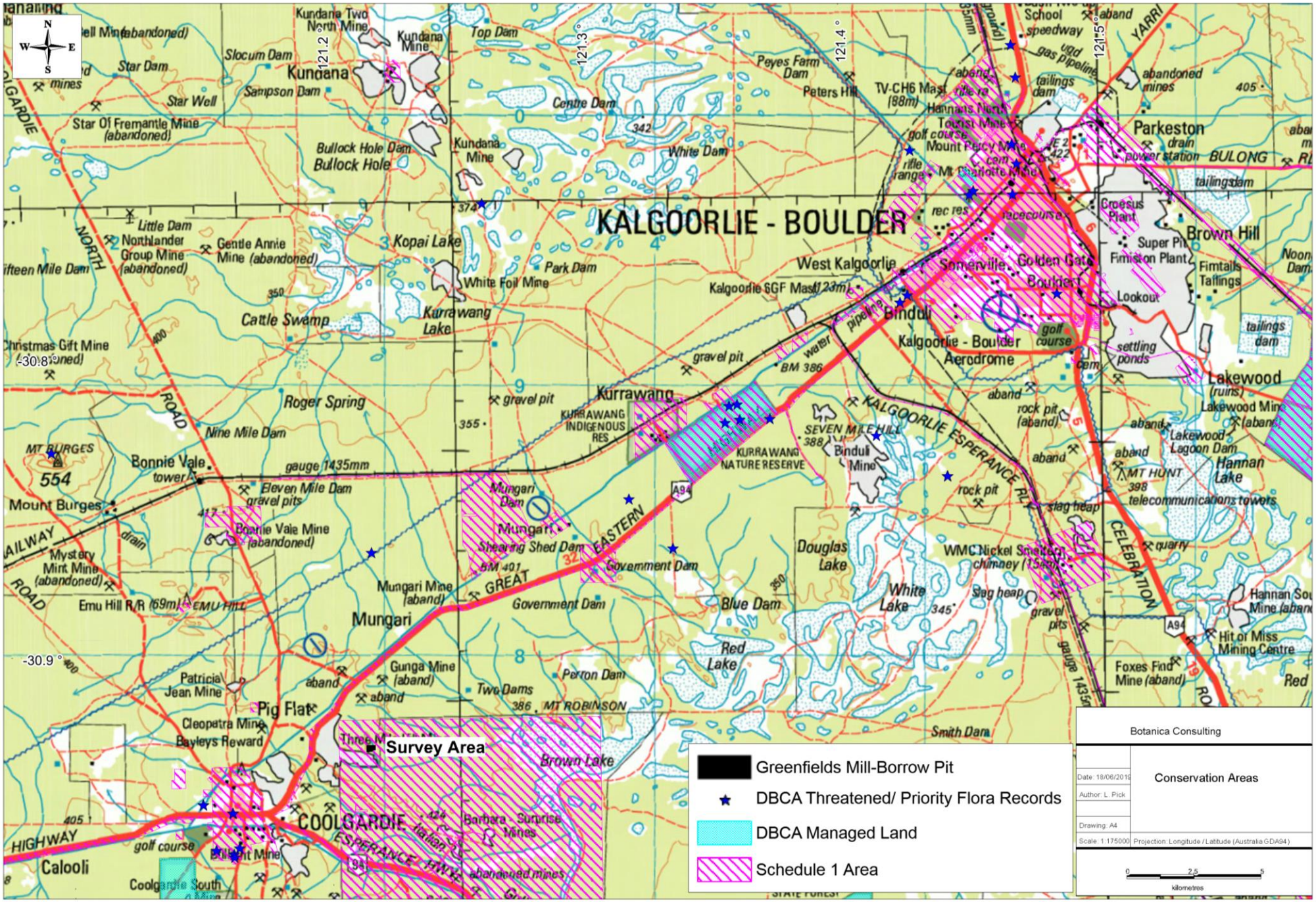
Appendix 1: Regional map of conservation areas



Appendix 2: Species List

Blue text (A)-annual species (WAHERB, 2019)

Family	Genus	Taxon	OD-MWS1	CLP-MWS1	HS-EW1
Amaranthaceae	*Ptilotus*	*obovatus*	*	*	*
Apocynaceae	*Alyxia*	*buxifolia*	*	*	*
Asteraceae	*Olearia*	*muelleri*	*	*	*
Chenopodiaceae	*Atriplex*	*nummularia* subsp. *spatulata*	*	*	*
Chenopodiaceae	*Atriplex*	*vesicaria*	*	*	*
Chenopodiaceae	*Enchylaena*	*tomentosa*	*	*	
Chenopodiaceae	*Eriochiton*	*sclerolaenoides*	*	*	
Chenopodiaceae	*Maireana*	*georgei*			*
Chenopodiaceae	*Maireana*	*pentatropis*	*	*	*
Chenopodiaceae	*Maireana*	*sedifolia*			*
Chenopodiaceae	*Maireana*	*trichoptera*	*	*	
Chenopodiaceae	*Maireana*	*triptera*	*	*	
Chenopodiaceae	*Sclerolaena*	*drummondii*	*	*	
Fabaceae	*Acacia*	*erinacea*	*	*	*
Fabaceae	*Acacia*	*hemiteles*	*	*	*
Fabaceae	*Acacia*	*tetragonophylla*	*	*	
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*	*	*	*
Fabaceae	*Senna*	*artemisioides* subsp. x *artemisioides*	*	*	*
Goodeniaceae	*Scaevola*	*spinescens*	*	*	*
Lamiaceae	*Westringia*	*rigida*	*	*	*
Myrtaceae	*Eucalyptus*	*clelandiorum*			*
Myrtaceae	*Eucalyptus*	*griffithsii*	*	*	
Myrtaceae	*Eucalyptus*	*salmonophloia*	*	*	
Myrtaceae	*Eucalyptus*	*torquata*			*
Myrtaceae	*Eucalyptus*	*yilgarnensis*	*	*	
Poaceae	*Austrostipa*	*elegantissima*			*
Poaceae	*Austrostipa*	*nitida*	*	*	*
Proteaceae	*Grevillea*	*acuaria*	*	*	*
Santalaceae	*Exocarpos*	*aphyllus*	*	*	*
Santalaceae	*Santalum*	*spicatum*	*	*	
Sapindaceae	*Dodonaea*	*lobulata*	*	*	*
Sapindaceae	*Dodonaea*	*stenozyga*	*	*	*
Scrophulariaceae	*Eremophila*	*alternifolia*	*	*	
Scrophulariaceae	*Eremophila*	*georgei*	*	*	
Scrophulariaceae	*Eremophila*	*glabra*	*	*	*
Scrophulariaceae	*Eremophila*	*interstans* subsp. *interstans*			*
Scrophulariaceae	*Eremophila*	*interstans* subsp. *virgata*	*	*	
Scrophulariaceae	*Eremophila*	*oldfieldii* subsp. *angustifolia*	*	*	*
Scrophulariaceae	*Eremophila*	*parvifolia*			*
Scrophulariaceae	*Eremophila*	*pustulata*	*	*	
Scrophulariaceae	*Eremophila*	*scoparia*	*	*	
Zygophyllaceae	*Zygophyllum*	*eremaeum* (A)	*	*	

Appendix 3: 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 4: Potential Fauna Species List

Fauna Potentially in Region of Survey Area

Greenfields Mill - Borrow Pit

Approximate centroid - 30.932155°S and 121.215201°E

Compiled by Greg Harewood - June 2019

Recorded (Sighted/Heard/Signs) = X

A = Botanica (2016). Biological Assessment Spargoville Material Pit Extension. Unpublished report for MRWA.
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J = DBCA (2019). NatureMap Database search. "By Circle" 121° 12' 54" E, 30° 55' 56" S (plus 40km buffer). 20 June 2019.

Class / **Family** / *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Amphibia												
Myobatrachidae Ground or Burrowing Frogs												
Neobatrachus kunapalari	Kunapalari Frog	LC				X			X		X	X
Neobatrachus pelobatoides	Humming Frog	LC				X			X			X
Neobatrachus sutor	Shoemaker Frog	LC			X	X			X			X
Neobatrachus wilsmorei	Plonking Frog	LC			X							X
Pseudophryne occidentalis	Western Toadlet	LC		X	X	X	X	X	X		X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Reptilia												
Carphodactylidae Knob-tailed Geckos												
Nephrurus laevissimus	Smooth Knob-tail					X	X	X	X		X	
Diplodactylidae Geckoes												
Crenadactylus ocellatus	Clawless Gecko					X	X	X				
Diplodactylus conspicillatus	Fat-tailed Gecko											
Diplodactylus granariensis rex	Western Stone Gecko			X	X	X	X	X				
Diplodactylus pulcher	Western Saddled Ground Gecko			X	X	X	X	X				X
Lucasium maini	Mains Ground Gecko			X	X	X	X	X	X	X		X
Oedura reticulata	Reticulated Velvet Gecko				X	X	X	X				
Rhynchoedura ornata	Beaked Gecko				X							X
Strophurus assimilis	Goldfields Spiny-tailed Gecko			X			X	X		X	X	X
Strophurus elderi	Jewelled Gecko				X		X	X			X	X
Strophurus strophurus	Ring-tailed Gecko											

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

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

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

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Scincidae Skinks												
Cryptoblepharus buchananii	Buchanan's Snake-eyed Skink			X	X	X	X	X	X			X
Ctenotus atlas	Southern Malle Ctenotus				X	X	X	X	X	X	X	X
Ctenotus impar	Odd-striped Ctenotus											
Ctenotus leonhardii	Leonhardi's Skink				X	X					X	X
Ctenotus pantherinus ocellifer	Leopard Skink			X								
Ctenotus schomburgkii	Barred Wedge-snout Ctenotus				X	X	X	X	X		X	X
Ctenotus severus	Stern Rock Ctenotus									X		
Ctenotus uber	Spotted Ctenotus				X		X	X				X
Cyclodomorphus melanops elongatus	Eastern Slender Blue-tongue			X	X		X	X				
Egernia depressa	Pygmy Spiny-tailed Skink							X				X
Egernia formosa	Goldfields Crevise Skink				X	X	X	X				X
Egernia inornata	Desert Skink			X	X		X	X		X	X	
Egernia multiscutata	Bull Skink					X						
Egernia richardi	Woodland Crevice Skink											X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Eremiascincus richardsonii	Broad-banded Sand Swimmer						X	X				X
Hemiergis initialis initialis	Sth Five-toed Mulch Skink					X	X	X				
Hemiergis peronii peronii	Four-toed Earless Skink											
Lerista distinguenda	SW Four-toed Lerista						X	X			X	
Lerista kingi	King's Three-toed Slider											X
Lerista muelleri	Common Mulch Skink			X	X	X	X	X	X			X
Lerista picturata	Goldfields Robust Lerista				X	X	X	X				X
Lerista taeniata	Ribbon Slider											
Menetia greyii	Dwarf Skink			X	X	X	X	X	X	X	X	X
Morethia adelaidensis	Saltbush Flecked Morethia				X		X	X	X			X
Morethia butleri	Woodland Dark-flecked Morethia				X	X	X	X				X
Morethia obscura	Shrubland Pale-flecked Morethia			X			X	X			X	
Tiliqua occipitalis	Western Bluetongue			X		X						X
Tiliqua rugosa	Bobtail			X	X	X	X	X	X	X		X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Typhlopidae Blind Snakes												
Ramphotyphlops australis	Southern Blind Snake					X	X	X			X	
Ramphotyphlops bicolor	Dark-spined Blind Snake										X	
Ramphotyphlops bituberculatus	Prong-snouted Blind Snake					X						
Boidae Pythons, Boas												
Morelia spilota	Carpet Python			X			X					X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Elapidae Elapid Snakes												
Brachyurophis fasciolata	Narrow-banded Shovel-nosed Snake					X	X	X			X	
Demansia psammophis	Yellow-faced Whipsnake					X	X	X				X
Parasuta gouldii	Gould's Hooded Snake				X	X	X	X				X
Parasuta monachus	Monk Snake				X	X	X	X				X
Pseudechis australis	Mulga Snake			X			X	X		X		X
Pseudonaja modesta	Ringed Brown Snake				X		X	X				X
Pseudonaja nuchalis	Gwardar				X	X					X	X
Simoselaps bertholdi	Jan's Banded Snake			X	X	X	X	X				X
Suta fasciata	Rosen's Snake											X
Aves												
Casuariidae Emus, Cassowarries												
Dromaius novaehollandiae	Emu	LC		X	X	X	X	X	X	X	X	X
Megapodiidae Moundbuilders												
Leipoa ocellata	Malleefowl	S3 VU VU A2bce+3ce	X		X						X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Accipitridae Kites, Goshawks, Eagles, Harriers												
Accipiter cirrocephalus	Collared Sparrowhawk	LC		X		X		X				X
Accipiter fasciatus	Brown Goshawk	LC		X	X	X	X	X		X	X	X
Aquila audax	Wedge-tailed Eagle	LC		X	X	X	X			X	X	X
Aquila morphnoides	Little Eagle	LC		X		X						
Circus assimilis	Spotted Harrier	LC			X							X
Haliastur sphenurus	Whistling Kite	LC			X	X	X					X
Hamirostra isura	Square-tailed Kite	LC		X			X					
Hamirostra melanosternon	Black-breasted Buzzard	LC					X					
Falconidae Falcons												
Falco berigora	Brown Falcon	LC		X	X	X	X				X	X
Falco cenchroides	Australian Kestrel	LC		X	X	X	X					X
Falco longipennis	Australian Hobby	LC										X
Falco peregrinus	Peregrine Falcon	S7 LC				X			X			

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Otididae Bustards												
Ardeotis australis	Australian Bustard											X
Charadriidae Lapwings, Plovers, Dotterels												
Vanellus tricolor	Banded Lapwing	LC		X								X
Columbidae Pigeons, Doves												
Ocyphaps lophotes	Crested Pigeon	LC		X	X	X	X	X			X	X
Phaps chalcoptera	Common Bronzewing	LC		X	X	X	X	X		X	X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Psittacidae Parrots												
Cacatua roseicapilla	Galah	LC		X	X		X					X
Cacatua sanguinea	Little Corella	LC										X
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	LC		X	X	X	X	X	X		X	
Melopsittacus undulatus	Budgerigar	LC			X						X	X
Neophema splendida	Scarlet-chested Parrot	LC									X	
Nymphicus hollandicus	Cockatiel	LC			X							X
Platycercus varius	Mulga Parrot	LC		X	X						X	X
Platycercus zonarius	Australian Ringneck	LC		X	X	X	X	X	X	X	X	X
Polytelis anthopeplus	Regent Parrot	LC		X		X	X	X		X	X	X
Cuculidae Parasitic Cuckoos												
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	LC			X	X					X	X
Chrysococcyx osculans	Black-eared Cuckoo	LC			X	X						X
Cuculus pallidus	Pallid Cuckoo	LC			X	X			X			

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Strigidae Hawk Owls												
Ninox novaeseelandiae	Boobook Owl	LC		X	X		X					
Tytonidae Barn Owls												
Tyto alba	Barn Owl	LC								X		X
Podargidae Frogmouths												
Podargus strigoides	Tawny Frogmouth	LC		X	X	X	X					X
Caprimulgidae Nightjars												
Eurostopodus argus	Spotted Nightjar	LC		X								X
Aegothelidae Owlet-nightjars												
Aegotheles cristatus	Australian Owlet-nightjar	LC		X	X	X			X		X	X
Halcyonidae Tree Kingfishers												
Todiramphus pyrrhopygia	Red-backed Kingfisher	LC			X	X	X	X				
Todiramphus sanctus	Sacred Kingfisher	LC		X		X						X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Meropidae Bee-eaters												
Merops ornatus	Rainbow Bee-eater	JA LC		X	X	X	X	X		X	X	X
Climacteridae Treecreepers												
Climacteris affinis	White-browed Treecreeper	LC			X							
Climacteris rufa	Rufous Treecreeper	LC		X	X	X	X	X	X	X	X	
Maluridae Fairy Wrens, GrassWrens												
Malurus leucopterus	White-winged Fairy-wren	LC			X	X	X	X			X	X
Malurus pulcherrimus	Blue-breasted Fairy-wren	LC				X	X	X				X
Malurus splendens	Splendid Fairy-wren	LC		X								X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces												
Acanthiza apicalis	Broad-tailed Thornbill	LC		X	X	X	X	X	X	X	X	X
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	LC		X	X	X	X					X
Acanthiza robustirostris	Slaty-backed Thornbill	LC			X							X
Acanthiza uropygialis	Chestnut-rumped Thornbill	LC		X	X	X	X	X	X	X	X	X
Aphelocephala leucopsis	Southern Whiteface	LC			X							X
Calamanthus campestris	Rufous Fieldwren	LC					X					
Gerygone fusca	Western Gerygone	LC				X						X
Hylacola cauta whitlocki	Shy Heathwren (western)		X			X		X			X	
Pyrrholaemus brunneus	Redthroat	LC		X	X	X	X	X		X	X	X
Smicrornis brevirostris	Weebill	LC	X	X	X	X	X	X	X	X	X	X
Pardalotidae Pardalotes												
Pardalotus punctatus	Spotted Pardalote	LC										X
Pardalotus striatus	Striated Pardalote	LC		X	X	X	X	X	X	X	X	X

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

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Melithreptus brevirostris	Brown-headed Honeyeater	LC	X	X	X	X	X		X	X	X	X
Phylidonyris albifrons	White-fronted Honeyeater	LC	X	X	X	X	X		X	X	X	
Phylidonyris nigra	White-cheeked Honeyeater	LC			X							
Petroicidae Australian Robins												
Drymodes brunneopygia	Southern Scrub-robin	LC		X				X				X
Eopsaltria australis griseogularis	Western Yellow Robin	LC		X		X						
Microeca fascinans	Jacky Winter	LC		X	X	X	X		X			X
Petroica cucullata	Hooded Robin	LC			X				X			
Petroica goodenovii	Red-capped Robin	LC		X	X	X	X		X	X	X	X
Pomatostomidae Babblers												
Pomatostomus superciliosus	White-browed Babbler	LC	X	X	X	X	X	X		X		X
Cinclosomatidae Whipbirds, Wedgebills, Quail Thrushes												
Cinclosoma castanotus	Chestnut Quail-thrush	LC		X		X	X	X				
Neosittidae Sitellas												
Daphoenositta chrysoptera	Varied Sittella	LC			X	X	X				X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers												
Colluricincla harmonica	Grey Shrike-thrush	LC	X	X	X	X	X	X	X	X	X	X
Oreoica gutturalis	Crested Bellbird	LC	X								X	X
Pachycephala rufiventris	Rufous Whistler	LC	X		X	X						X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo												
Grallina cyanoleuca	Magpie-lark	LC		X	X	X	X					X
Myiagra inquieta	Restless Flycatcher	LC		X			X					
Rhipidura fuliginosa	Grey Fantail	LC			X							
Rhipidura leucophrys	Willie Wagtail	LC		X	X	X	X	X	X		X	X
Campephagidae Cuckoo-shrikes, Trillers												
Coracina maxima	Ground Cuckoo-shrike	LC		X	X	X			X			X
Coracina novaehollandiae	Black-faced Cuckoo-shrike	LC		X	X	X	X		X	X	X	X
Lalage tricolor	White-winged Triller	LC			X		X					X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Artamidae Woodswallows, Butcherbirds, Currawongs												
Artamus cinereus	Black-faced Woodswallow	LC		X	X	X	X		X	X		X
Artamus cyanopterus	Dusky Woodswallow	LC		X	X	X	X	X			X	X
Artamus personatus	Masked Woodswallow	LC		X					X		X	X
Cracticidae Currawongs, Magpies & Butcherbirds												
Cracticus nigrogularis	Pied Butcherbird	LC		X	X	X	X			X		X
Cracticus tibicen	Australian Magpie	LC		X	X	X	X	X			X	X
Cracticus torquatus	Grey Butcherbird	LC		X	X	X	X	X	X	X	X	X
Strepera versicolor	Grey Currawong	LC		X	X	X	X	X		X	X	X
Corvidae Ravens, Crows												
Corvus bennetti	Little Crow	LC		X		X						X
Corvus coronoides	Australian Raven	LC		X	X	X	X	X	X	X	X	X
Corvus orru	Torresian Crow	LC				X						X
Motacillidae Old World Pipits, Wagtails												
Anthus australis	Australian Pipit	LC		X	X	X					X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Estrilidae Grass Finches & Mannikins												
Taeniopygia guttata	Zebra Finch	LC			X							X
Dicaeidae Flowerpeckers												
Dicaeum hirundinaceum	Mistletoebird	LC			X	X	X				X	X
Hirundinidae Swallows, Martins												
Cheramoeca leucosternus	White-backed Swallow	LC				X	X		X		X	
Hirundo ariel	Fairy Martin	LC										
Hirundo neoxena	Welcome Swallow	LC			X		X					X
Hirundo nigricans	Tree Martin	LC		X	X	X	X			X	X	
Sylviidae Old World Warblers												
Cincloramphus cruralis	Brown Songlark	LC										
Cincloramphus mathewsi	Rufous Songlark	LC					X					
Zosteropidae White-eyes												
Zosterops lateralis	Silvereye	LC				X	X				X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Mammalia												
Tachyglossidae Echidnas												
Tachyglossus aculeatus	Echidna	LC		X	X	X	X	X			X	X
Dasyuridae Carnivorous Marsupials												
Ningaui ridei	Wongai Ningaui	LC			X		X					
Ningaui sp.	Ningaui	LC						X				
Ningaui yvonneae	Southern Ningaui	LC		X		X	X		X	X	X	X
Sminthopsis crassicaudata	Fat-tailed Dunnart	LC		X	X	X	X	X				X
Sminthopsis dolichura	Little long-tailed Dunnart	LC		X	X	X	X	X	X	X		X
Sminthopsis gilberti	Gilbert's Dunnart	LC						X				X
Burramyidae Pygmy Possums												
Cercartetus concinnus	Western Pygmy-possum	LC		X	X	X	X	X	X	X	X	X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Macropodidae Kangaroos, Wallabies												
Macropus fuliginosus	Western Grey Kangaroo	LC	X	X	X	X	X				X	X
Macropus robustus	Euro	LC		X	X	X						
Macropus rufus	Red Kangaroo	LC				X	X			X		X
Molossidae Freetail Bats												
Austronomus australis	White-striped Freetail-bat	LC			X		X					
Ozimops petersi	Inland Freetail-bat	LC			X			X				
Vespertilionidae Ordinary Bats												
Chalinolobus gouldii	Gould's Wattled Bat	LC					X	X				X
Chalinolobus morio	Chocolate Wattled Bat	LC			X			X				X
Nyctophilus geoffroyi	Lesser Long-eared Bat	LC			X			X				X
Nyctophilus gouldi	Gould's Long-eared Bat	LC			X							
Nyctophilus major tor	Central Long-eared Bat	P4						X				
Scotorepens balstoni	Inland Broad-nosed Bat	LC			X			X				X
Vespadelus regulus	Southern Forest Bat	LC			X			X				X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Muridae Rats, Mice												
Mus musculus	House Mouse	Introduced		X	X		X	X	X		X	X
Notomys alexis	Spinifex Hopping-mouse	LC						X				
Notomys mitchellii	Mitchell's Hopping-mouse	LC		X	X		X	X			X	X
Pseudomys bolami	Bolam's Mouse	LC			X	X	X				X	X
Pseudomys hermannsburgensis	Sandy Inland Mouse	LC		X	X	X						X
Pseudomys sp.	Native Rodent	LC						X				
Canidae Dogs, Foxes												
Canis lupus dingo	Dingo	LC					X				X	
Canis lupus familiaris	Dog	Introduced										
Vulpes vulpes	Red Fox	Introduced			X							
Felidae Cats												
Felis catus	Cat	Introduced									X	X
Bovidae Horned Ruminants												
Capra hircus	Goat	Introduced										X

Class **Family** *Species*	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J
Camelidae Camels												
Camelus dromedarius	Dromedary, Camel	Introduced										
Leporidae Rabbits, Hares												
Oryctolagus cuniculus	Rabbit	Introduced					X		X		X	X