

**Reconnaissance
Flora & Fauna Survey
Orelia Project
Prepared For
Echo Resources Limited**



**June 2018
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	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 EPA, DER and DoW), WA Government
Echo	Echo Resources Limited
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999, Australian Government.
ESA	Environmentally Sensitive Area.
Ha	Hectare (10,000 square meters).
IBRA	Interim Biogeographic Regionalisation for Australia.
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.
JAMBA	Japan Australia Migratory Bird Agreement 1981.
Km	Kilometer (1,000 meters).
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	Orelia Project.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.

Acronym	Description
WAM	Western Australian Museum, WA Government.
WC Act	Wildlife Conservation Act 1950, WA Government.

Executive Summary

Botanica Consulting (BC) was commissioned by Echo Resources Limited (Echo) to undertake a reconnaissance flora survey and fauna survey of the Orelia Project (referred to as the 'survey area'). The survey area is located within the Yandal Station Pastoral Lease, approximately 5 km west of the existing Bronzewing Gold mine, and 55 km north-east of Leinster. The survey was conducted in autumn (20th May 2018), covering an area of 1,816 ha.

Five vegetation types were identified within the survey area. These vegetation types were located within three different landform types and comprised of three major vegetation groups, which were represented by a total of 17 Families, 36 Genera and 102 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plain, rocky hillslopes and sand-loam plains.

Results of the literature review identified 33 mammals (including eight bat species), 104 birds, 87 reptiles and nine frog species that have previously been recorded in the general area, some of which have the potential to occur, subject to the identified habitats being suitable.

No Threatened Flora, Threatened Fauna, Migratory Fauna or Threatened Ecological Communities (TEC) as listed under the Western Australian *Wildlife Conservation (WC) Act 1950*¹ or Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* were identified within the survey area. No Priority Flora taxon as listed by the Department of Biodiversity, Conservation and Attractions (DBCA) were identified within the survey area. No Priority Fauna were recorded within the survey area.

A review of the EPBC Act threatened fauna list, DBCA's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a number of specially protected, migratory or priority fauna species as having been previously recorded or as being potentially present in the general vicinity of the survey area. However, no fauna of conservation significance is likely to be significantly impacted on by the proposed development. This conclusion is primarily based on the lack of suitable habitats, the known local extinction of some species, the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

No Priority Ecological Communities (PEC) were identified within the survey area. 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.

The survey area does not contain any Environmentally Sensitive Areas (ESA) or Schedule 1 Areas listed under the *Environmental Protection (EP) Act 1986*; The survey is not located within DBCA managed land. The closest conservation reserve is the Wanjarri Nature Reserve, which is located approximately 6.5 km west of the survey area.

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

¹ *Biodiversity Conservation Act 2016* received assent on 21 September 2016 with Parts of the Act coming into effect on 3 December 2016. Once fully enacted with enabling subsidiary regulations, it will replace the *Wildlife Conservation Act 1950*.

1 **Introduction**

1.1 **Project Description**

Botanica Consulting (BC) was commissioned by Echo Resources Limited (Echo) to undertake a reconnaissance flora and fauna survey of the Orelia Project (referred to as the 'survey area'). The survey area is located within the Yandal Station Pastoral Lease, approximately 5 km west of the existing Bronzewing Gold Mine and 55 km north-east of Leinster WA. The survey was conducted in autumn (20th May 2018), covering an area of 1,816 ha.

1.2 **Objectives**

The flora 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;
- 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.

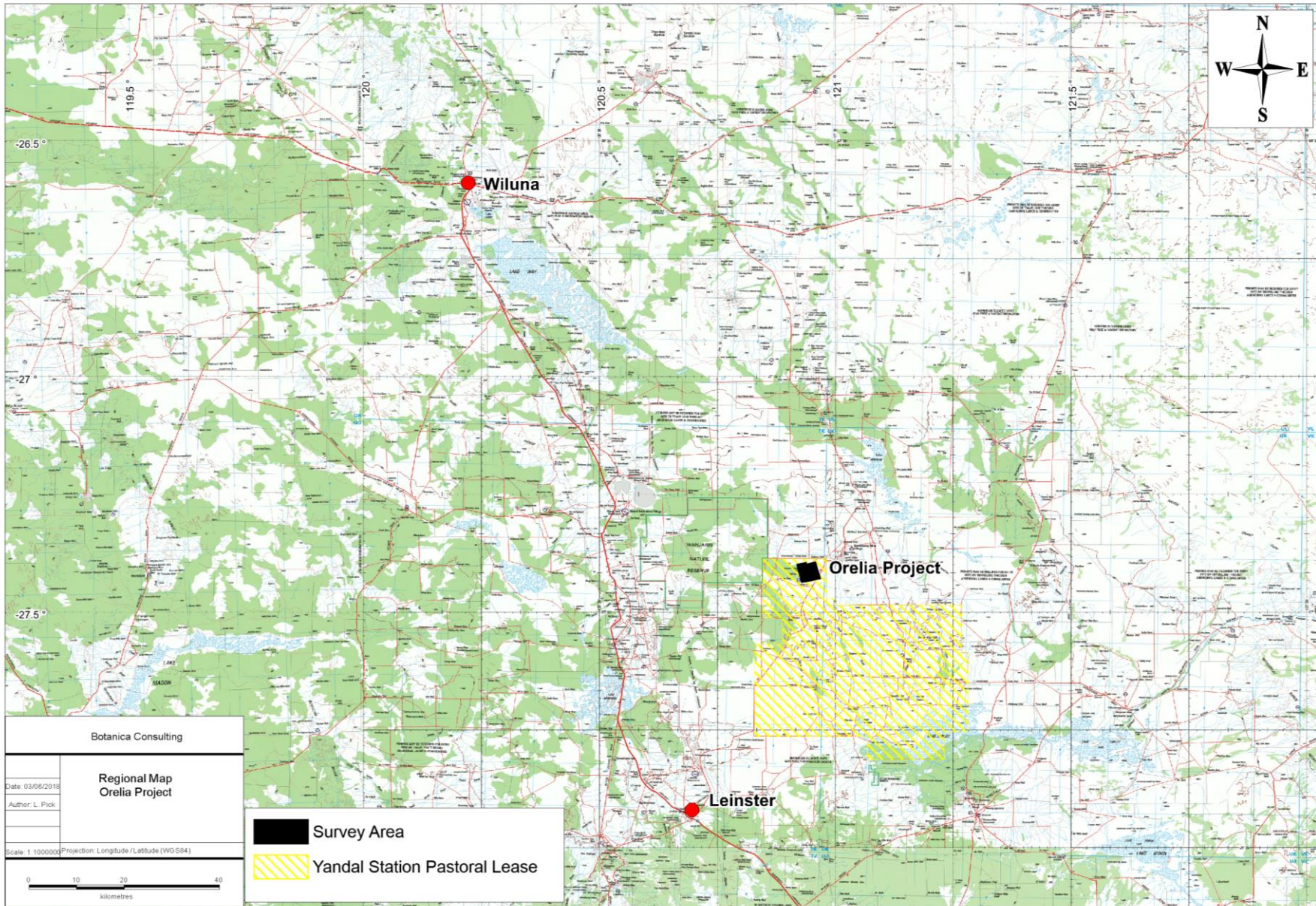


Figure 1-1: Regional map of the survey area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area lies within the Murchison Region of the Eremaean Province of WA in a region known as the Austin Botanical District. The Murchison Region is further divided into subregions, based on the Interim Biogeographic Regionalisation of Australia (IBRA), with the survey area located within the Eastern Murchison (MUR1) as shown in Figure 2-1.

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

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

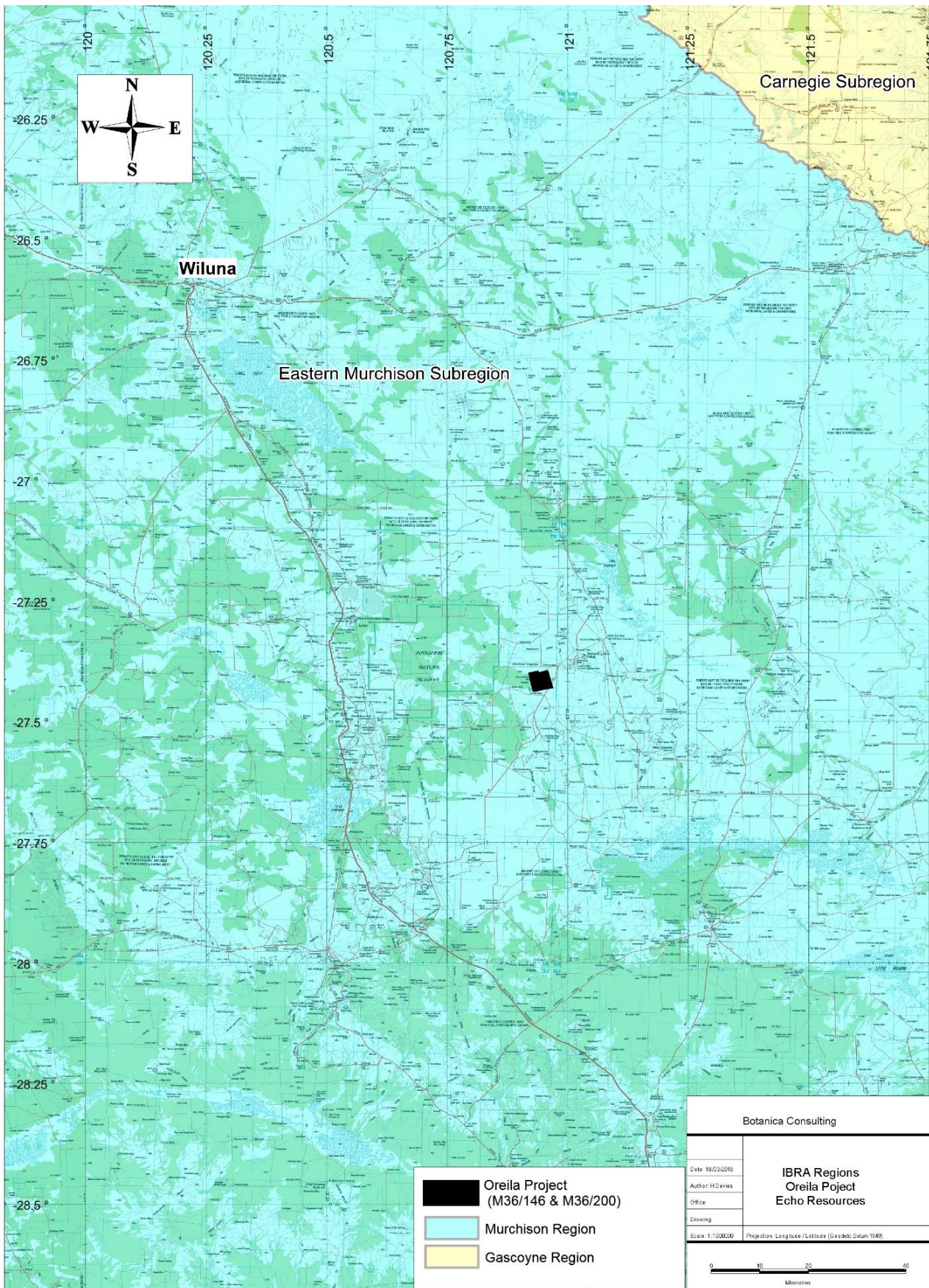


Figure 2-1: Map of IBRA Subregions in relation to the survey area

2.2 Soils and Landscape Systems

The survey area lies within the Murchison Province, which consists of Hardpan wash plains and sandplains (with some stony plains, hills, mesas and salt lakes) on the granitic rocks and greenstone of the Yilgarn Craton. The Murchison Province is located in the inland Mid-west and northern Goldfields between three Springs, the Gascoyne River, Wiluna, Cosmo Newberry and Menzies. Soil types are dominated by red loamy earths, red sandy earths, red shallow loams, red deep sands and red-brown hardpan shallow loams with some red shallow sands and red shallow sandy duplexes present. Vegetation communities are dominated by Mulga shrublands with spinifex grasslands and some bowgada shrublands, Eucalypt woodlands and halophytic shrublands (Tille, 2006).

The Murchison Province is further divided into seven soil-landscape zones, with the survey area located within the Salinaland Plains Zone (279). The Salinaland Plains Zone comprises of sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) of the Yilgarn Craton. Soils include red sandy earths, red deep sands, red shallow loams and red loamy earths with some red-brown hardpan shallow loams, salt lake soils and red shallow sandy duplexes. Vegetation is dominated by mulga shrublands with spinifex grasslands (and some halophytic shrublands and eucalypt woodlands). This zone is located in the northern Goldfields from Lakes Barlee and Ballard to Wiluna and Laverton (Tille, 2006). The Salinaland Plains Zone is further divided into soil landscape systems, with the survey area located within four soil landscape systems Table 2-1 and Figure 2-2 below.

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

Soil Landscape System	Mapping Unit Code	Description
Ararak System	279Ar	Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses.
Bullimore System	279Bu	Gently undulating sandplain with occasional linear dunes and stripped surfaces supporting spinifex grasslands with mallees and acacia shrubs.
Desdemona System	279De	Plains with deep sandy or loamy soils supporting mulga tall shrublands and wanderrie grasses.
Monk System	279Mk	Hardpan plains with occasional sandy banks supporting mulga tall shrublands and wanderrie grasses.

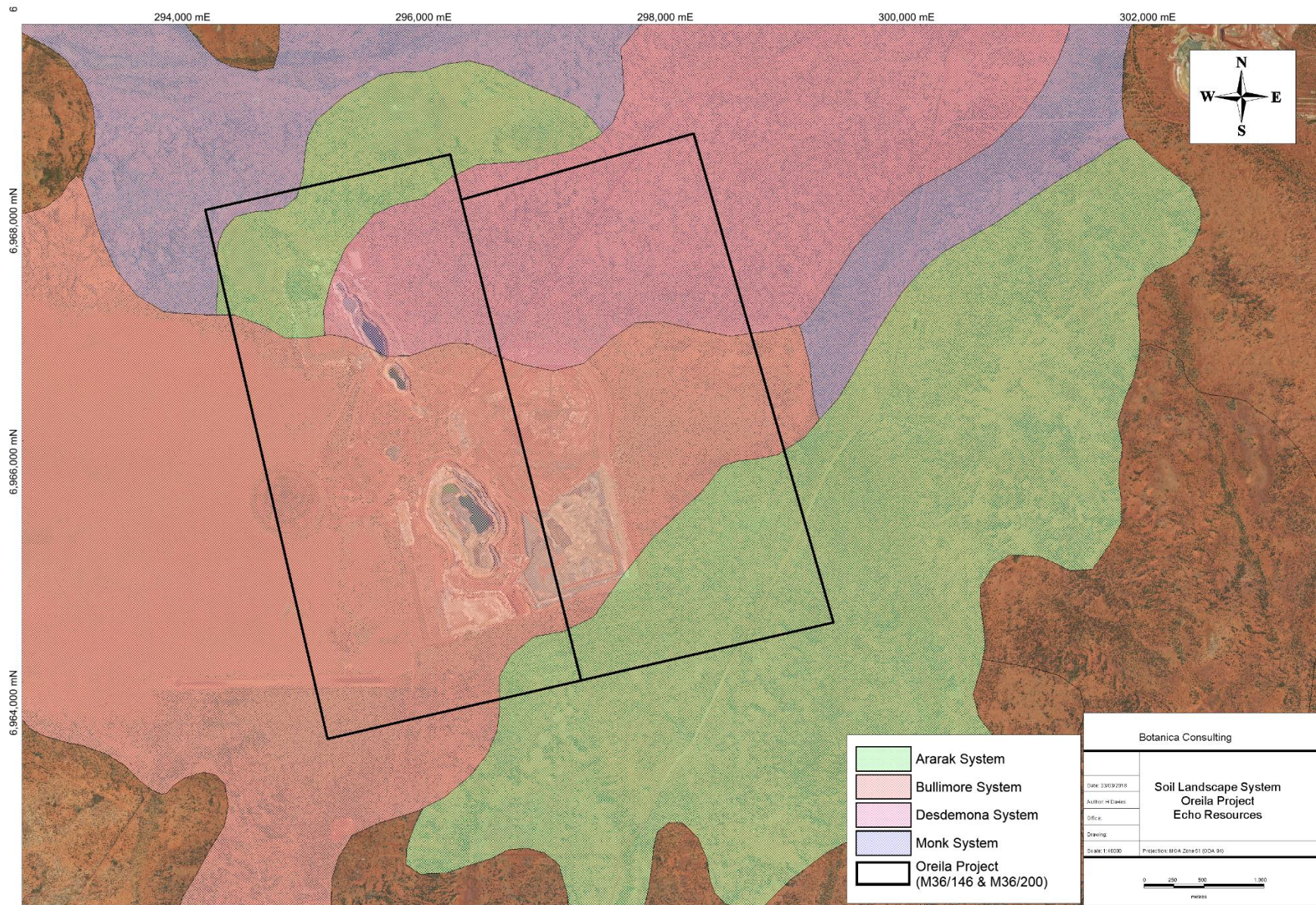


Figure 2-2: Map of Soil Landscape Systems within the survey area

2.3 Remnant Vegetation

The Orelia Project is situated in the Austin Botanical District within the Eremaean Botanical Province. This botanical district is predominantly Mulga low woodlands on plains, often rich in ephemerals, which reduce to scrub on hills. It is also characterised by hummock grasslands, Saltbush shrublands and Samphire shrublands, according to the DAFWA. The Eremaean Province is the largest of the three botanical provinces within Western Australia. The vegetation of the Austin Botanical District of the Murchison Region is predominantly low mulga (*Acacia aneura*) woodlands on plains and reduced to scrub on hills. This district is often associated with a tree steppe of *Eucalyptus* spp. and *Triodia basedowii* on sand plains.

The Department of Agriculture and Food Western Australia (DAFWA) GIS file (2011) indicates that the survey area is located within Pre-European Beard vegetation associations Wiluna 18 and Wiluna 107. The extent of these vegetation associations, as specified in the 2015 Statewide Vegetation Statistics (DPaW, 2015) is provided in Table 2-2 and Figure 2-3.

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered “endangered” (EPA, 2000). Development within the survey area will not significantly reduce the extent of pre-European vegetation.

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

Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Pre-European extent remaining (%)	% of Current extent within DPaW managed lands	Vegetation Description (Beard, 1990)
Wiluna 18	4273509.96	4256038.43	99.59	9.59	Low woodland; mulga (<i>Acacia aneura</i>)
Wiluna 107	2732464.56	2731073.14	99.95	1.70	Hummock grasslands, shrub steppe; mulga and <i>Eucalyptus kingsmillii</i> over hard spinifex

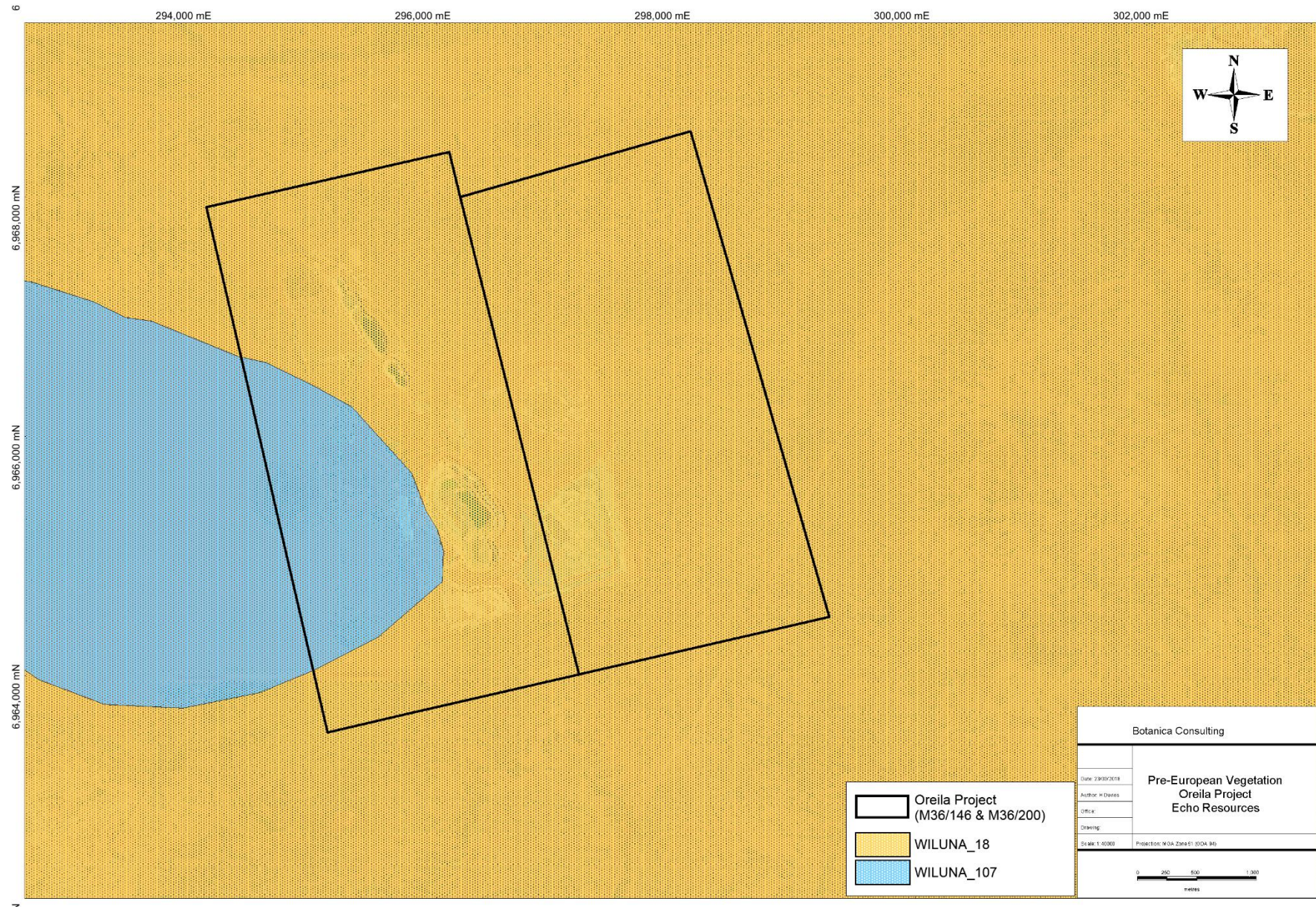


Figure 2-3: Pre-European Vegetation Associations within the survey area

2.4 Climate

The climate of the Eastern Murchison subregion is characterised as an arid climate with mainly winter rainfall and annual rainfall of approximately 200 mm (Beard, 1990; Cowan, 2001). Climate data for the Wiluna weather station (#13012) located approximately 73 km north-west of the survey area is shown in Figure 2-4 (BoM, 2018). Monthly mean maximum temperature at Wiluna ranges from 38°C during January to 19.4°C in July. Mean monthly rainfall ranges from 38 mm in February to 5 mm in September, whilst the mean annual rainfall is 263 mm.

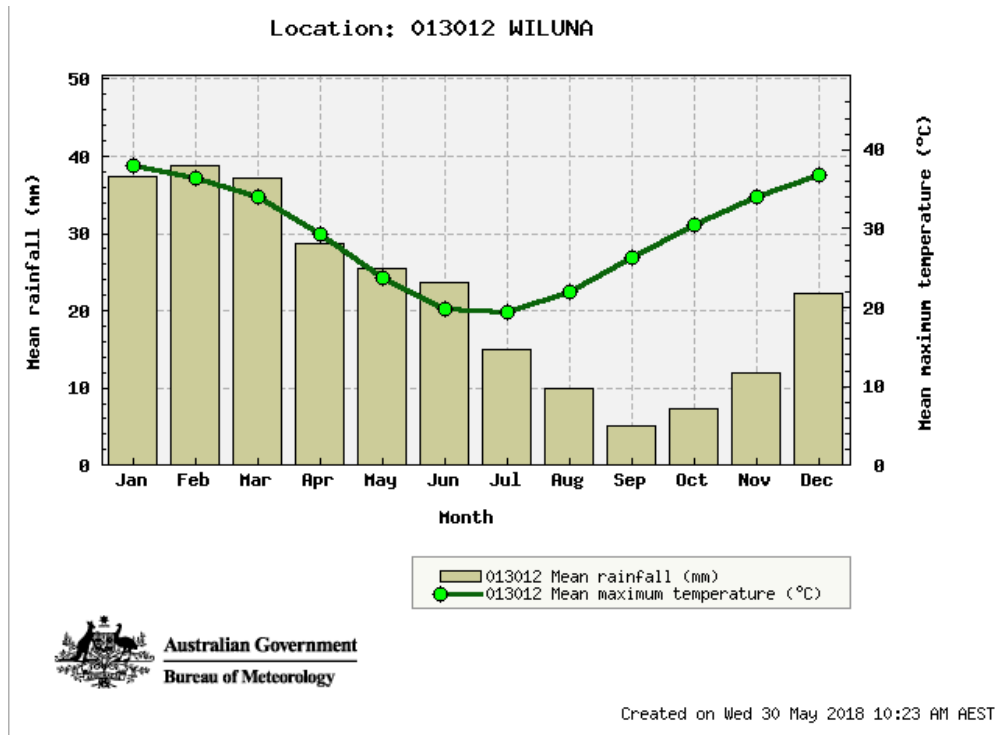


Figure 2-4: Mean monthly rainfall and maximum temperature (January 1898 to April 2018) for the Wiluna Aero weather station #13012 (BoM, 2018)

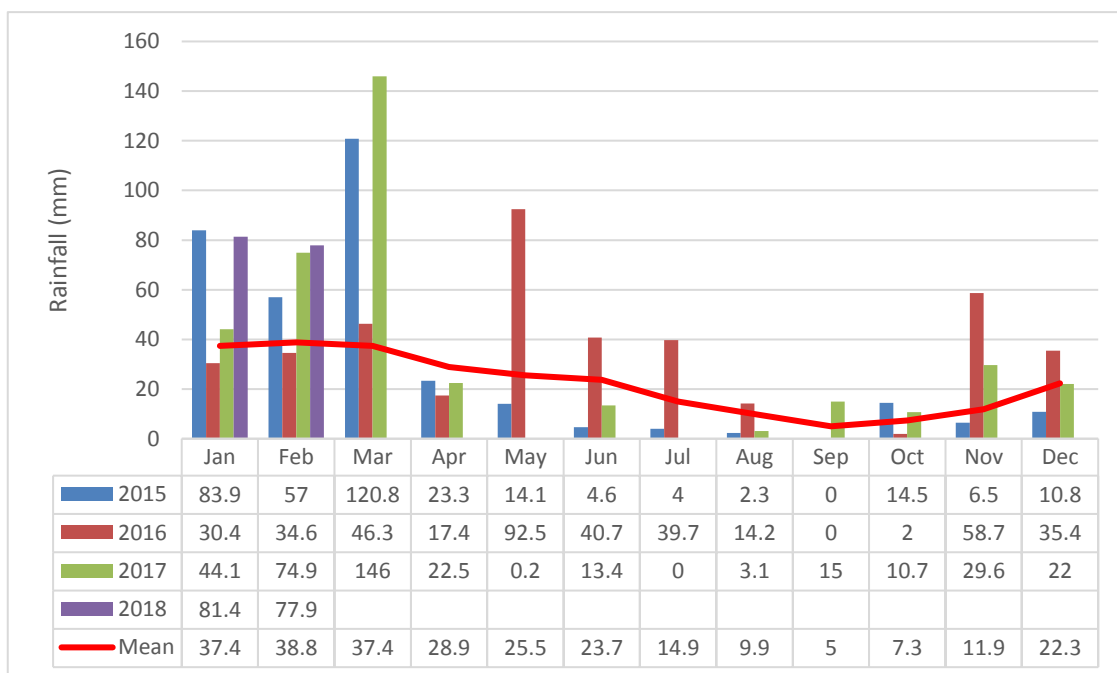


Figure 2-5: Wiluna rainfall (2015-2018), against the mean rainfall (1898 -2018), BOM station number #13012 (BOM 2018)

2.5 Hydrology

The survey area is situated on an alluvial plain on the north-west flank of the Bates Range. The area is of low relief with a slight east to west slope. The surface drainage system at Bronzewing – Mt McClure is fed from catchment areas to the west and drains eastwards into the northwest-southeast trending Lake Way/Lake Maitland/Lake Darlot systems.

There are no permanent surface water sources within the survey area. Surface drainage lines are dry for most of the year and only flow following periods of heavy rainfall. Usually runoff occurs only after heavy or prolonged rainfall which tends to be associated with tropical cyclones or thunderstorms of the summer months.

The Bates Creek is located 8 km to the north of the survey area (Figure 2-6). The closest inland water to the survey area is Lake Maitland located 34 km to the north-east. Lake Darlot, Lake Miranda and Lake Way are located approximately 45 km south-east, 45 km south-west and 74 km north-west of the survey area, respectively.

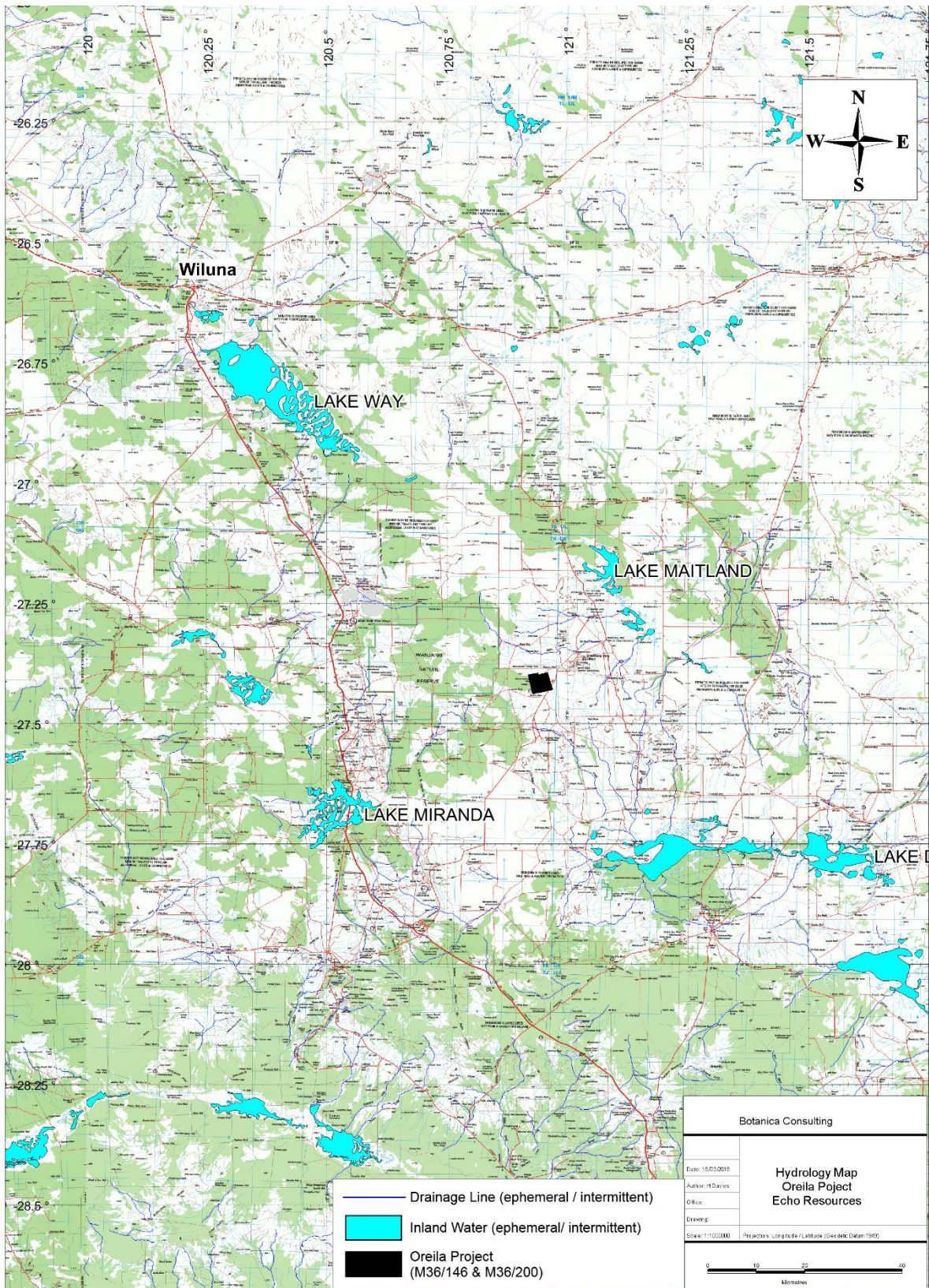


Figure 2-6: Hydrology of the survey area (data obtained from Geoscience Australia, 2001)

2.6 Land Use

The dominant land uses of the Eastern Murchison subregion include grazing native pastures (85.47%), unallocated crown reserves (11.34%), conservation (1.4%) and mining (1.79%) (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:

- Animal Plant Mineral (2015), Vegetation Clearing Permit Application, Matilda Gold Project, Support Information for Matilda Mine Site Native Vegetation Clearing (Purpose) Permit Application, October 2015.
- Biota Environmental Sciences (2004). Waterloo and Amorac Extension Fauna Site Inspection. Unpublished report for LionOre.
- Botanica Consulting (2014), Level 1 Flora and Vegetation Survey of the Thunderbox to Bannockburn Project.
- Botanica Consulting (2016), Level 1 Flora and Fauna Survey Julius Project, Prepared for Echo Resources Limited
- Engenium (2015). Lake Maitland - Level 2 Vertebrate Fauna and Targeted Reptile Survey Report. Unpublished report for Toro Energy Limited
- Hall, N.J., Newbey, K.R., McKenzie, N.L., Keighery, G.J., Rolfe, J.K & Youngson, W. K., (1993), *The Biological survey of the Eastern Goldfields of Western Australia Part 7: Sandstone-Sir Samuel. Laverton-Leonora study area*, West. Aust. Mus. Suppl. 47.
- Outback Ecology (2008a). Bronzewing – Mt McClure, Application for a Purpose Permit to Clear Native Vegetation at the Bronzewing – Mt McClure Project – Corboys Prospect M53/15, prepared for View Resources
- Outback Ecology (2008b). Bronzewing – Mt McClure, Report on the distribution of *Eremophila pungens* (P4) within the Bronzewing – Mt McClure Gold Project, prepared for View Resources
- Paul Armstrong and Associates, (2001) Rare Flora Search, and Flora and Vegetation Survey of the Exploration and Mine Lease of Thunderbox.
- Paul Armstrong and Associates, (2004) Rare Flora Search and Vegetation Survey at the Waterloo Prospects.
- Terrestrial Ecosystems (2011). Level 2 Fauna Risk Assessment for the Granny Deeps Project Area. Unpublished report. February 2011.
- Trudgen, M (1989). A Flora and Vegetation Survey of Part of the Cyprus Gold Mount McClure Gold Mining Leases. Report prepared for Cyprus Gold for inclusion in the Mt McClure Project Feasibility Study, Volume 2 Environmental Study

In addition to the literature review, 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, 2018a);
- DotEE Protected matters search tool (DotEE, 2018a); and
- DBCA's Threatened and Priority Flora search (DBCA, 2018b).

The searches were conducted for an area encompassing a 20 km radius of the centre coordinates – 120° 56' 29" E, 27° 24' 50" S. It should be noted that these lists are based on observations from a

broader area than the survey area (20km radius) and therefore may include taxon not present. The databases also often included 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.

Prior to the field survey, a combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2018b) was undertaken within a 20km radius of the survey area. These significant flora species were examined on the Western Australian Herbarium's (WAHERB) web page prior to the survey, to familiarise staff with their appearance. Locations of Threatened Flora and Priority Flora were overlaid on aerial photography of the area. Vegetation descriptions and available images of the Priority Flora were also obtained from Florabase.

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

- EPBC Act. Administered by the Australian Government (DotEE);
- WC Act. 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 (DBCA).

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).

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.

Table 3-1 and Table 3-2 below provide the definitions of conservation significant flora and fauna.

² Species listed under JAMBA are also specially protected under Schedule 5 of the WC Act.

Table 3-1: Definitions of Conservation Significant Flora

Code	Category
State categories of threatened and priority species	
T	Threatened Flora “flora that has been declared to be ‘likely to become extinct or is rare, or otherwise in need of special protection’, pursuant to section 23F (2) of the Wildlife Conservation Act.”
Schedule 1	Critically Endangered – Flora that are considered likely to become extinct or rare, as critically endangered flora
Schedule 2	Endangered – Flora that are considered likely to become extinct or rare, as endangered flora
Schedule 3	Vulnerable – Flora that are considered likely to become extinct or rare, as vulnerable flora
Schedule 4	Extinct-Flora presumed to be extinct
P1	Priority One – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as ‘rare flora’ but are in urgent need of further survey.”
P2	Priority Two – Poorly Known Taxa “Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but urgently need further survey.”
P3	Priority Three – Poorly Known Taxa “Taxa which are known from several populations and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as ‘rare flora’ but needs further survey.”
P4	Priority Four – Rare Taxa “Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.”
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
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.
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.
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.
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.
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;

Code	Category
	<p>(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;</p> <p>(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;</p> <p>(iv) cessation of the plan of management would adversely affect the conservation status of the species.</p>

Table 3-2: Definitions of Conservation Significant Fauna

Code	Category
State categories of threatened and priority species	
T	<p>Threatened Fauna “is that subset of ‘Specially Protected Fauna’ declared to be ‘likely to become extinct’ pursuant to section 14(4) of the Wildlife Conservation Act”.</p>
Schedule 1	Critically Endangered – Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2	Endangered – Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3	Vulnerable – Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5	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 the Bonn Convention, relating to the protection of migratory birds.
Schedule 6	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7	Fauna otherwise in need of special protection to ensure their conservation.
P1	<p>Priority One – Poorly Known Taxa Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Priority Two – Poorly Known Taxa Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
P3	<p>Priority Three – Poorly Known Taxa Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>

Code	Category
P4	<p>Priority Four – Rare, Near Threatened and other species in need of monitoring</p> <p>(a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>
Commonwealth categories of threatened species	
Extinct	Taxa where there is no reasonable doubt that the last member of the species has died.
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.
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.
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.
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.
Near Threatened	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A search of the DBCA PEC and TEC database was also conducted within a 20 km radius of the survey area (DBCA, 2018c). Table 3-3 represents the definitions of Threatened and Priority Ecological Communities.

Table 3-3: Definition of conservation significant communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PTD	<p>Presumed Totally Destroyed</p> <p>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:</p> <p>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.</p>
CE	Critically Endangered

Category Code	Category
	<p>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:</p> <p>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;</p> <p>The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;</p> <p>The ecological community is highly modified with potential of being rehabilitated in the immediate future.</p>
E	<p>Endangered</p> <p>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:</p> <p>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;</p> <p>The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area;</p> <p>The ecological community is highly modified with potential of being rehabilitated in the short-term future.</p>
V	<p>Vulnerable</p> <p>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:</p> <p>The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated;</p> <p>The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution;</p> <p>The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.</p>
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	<p>Critically Endangered</p> <p>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).</p>
E	<p>Endangered</p> <p>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).</p>
V	<p>Vulnerable</p> <p>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).</p>

Category Code	Category
Priority Ecological Communities (PEC)	
P1	<p>Poorly-known ecological communities</p> <p>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.</p>
P2	<p>Poorly-known ecological communities</p> <p>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.</p>
P3	<p>Poorly known ecological communities</p> <p>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:</p> <p>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;</p> <p>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.</p>
P4	<p>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.</p>
P5	<p>Conservation Dependent ecological communities</p> <p>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.</p>

3.2 Field Assessment

Botanica conducted a reconnaissance flora and fauna survey covering an area of 1,816 ha. The survey was conducted in Autumn 2018 (20th May 2018), with the area traversed on foot and 4WD by two staff members.

3.2.1 Flora Assessment

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

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

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

3.2.2 Fauna Assessment

Vegetation and landform units identified during the flora assessment 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 study 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 study area during the day while searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

3.2.3 Personnel involved

Jim Williams - Environmental Consultant/ Director (Diploma of Horticulture)
 Lauren Pick - Environmental Consultant (Bachelor of Science-Zoology/Conservation Biology)
 Greg Harewood - Zoologist (Bachelor of Science-Zoology)

3.2.4 Scientific licences

Table 3-4: Scientific Licences of Botanica Staff coordinating the flora survey

Licensed staff	Permit Number	Valid Until
Jim Williams	SL012116	27-05-19
Lauren Pick	SL012117	27-05-19

3.3 Survey limitations and constraints

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

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

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

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

Table 3-5: 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/ Zoologist: Jim Williams, Lauren Pick & Greg Harewood Data Interpretation: Jim Williams, Lauren Pick & Greg Harewood.

Variable	Potential Impact on Survey	Details
Timing of survey, weather & season	Not a constraint	Fieldwork was completed within the EPA's recommended primary survey time periods (i.e., 6-8 weeks post wet season (March – June) for the Eremaean Province. As a result of high rainfall preceding the survey (February 2018), there were several annual species present.
Area disturbance	Minor constraint	The western edge of the survey area has been subject to disturbance from fire within the last 15 years. The area has also been disturbed from historical mining and exploration. Cattle grazing was also evident.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a reconnaissance survey completed to identify vegetation types/fauna habitats and conservation significant species/communities.
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. Environmental assessments within the local region have been limited however BC was able to obtain information about the area from previous flora/fauna assessments conducted within the region 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 study 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 **Literature Review**

Flora and fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publicly available and could not be referenced. The most significant of those available have been used as the primary reference material for the current assessment (Table 4-1).

Table 4-1: Previous surveys within the surrounding area

Author and Year	Vegetation/Landforms/Fauna Habitats	Flora/Fauna of Conservation Significance
Trudgen (1989)	A total of 33 vegetation units were identified comprising of 130 native plant species, across 27 families.	No Threatened Flora or Priority Flora.
Hall, Newbey, McKenzie, Keighery, Rolfe, & Youngson (1993)	<p>Vegetation surveys of the Laverton-Leonora study area were conducted from 1980-1982 and 1987-1992. Twelve landform units were recognized within the Laverton-Leonora Study Area.</p> <p>The most extensive were identified as being Sandplains and Broad Valleys. Salt Lake Features, Calcareous Plains bordering salt lakes, and Undulating Plains. Small areas of Dunefields, Breakaways and Granite Exposures were scattered throughout the Study Areas while Hills and Drainage Lines occur largely within Undulating Plains.</p> <p>The main vegetation communities identified by this early survey were low woodlands of <i>Acacia aneura</i> (Mulga). <i>Eucalyptus</i> taxa with an understorey of hummock grasses (<i>Triodia</i>) were dominant on deep sands. Tall and low shrublands occurred in limited areas, generally in association with salt lakes and dunes.</p> <p>Vascular flora identified comprised of 7 taxa of ferns and 777 taxa of flowering plants, including 303 taxa recorded from Wanjarri Nature Reserve. Exhaustive floristic lists for 31 sample sites, representing most of the Study Areas surface lithologies. The survey recorded a combined total of 145 vertebrate species including the common sandpiper (Migratory).</p>	<p>No Threatened Flora.</p> <p>Four Priority Flora; <i>Calytrix praecipua</i> (P3), <i>Eremophila annosocaulis</i> (P3), <i>Eremophila mirabilis</i> (P2) and <i>Philotheca tubiflora</i> (P1).</p> <p>One Migratory fauna species recorded; Common Sandpiper.</p>
Armstrong (2001)	<p>Paul Armstrong and Associates (Armstrong) were commissioned by LionOre Australia Pty Ltd to conduct a Threatened and Priority flora search, and a vegetation and flora survey of the proposed Thunderbox gold mine. The survey was conducted over two, three days inspections, between 1st to the 3rd of September 2000 and 5th to the 7th February 2001.</p> <p>Six vegetation communities were encountered during the survey. These vegetation groups were:</p> <ol style="list-style-type: none"> 1. Vegetation of the flats; 2. Vegetation of the uplands; 3. Vegetation of the drainage lines; 4. Vegetation of the Spinifex sandplain; 5. Vegetation of the sand ridge; and 6. Vegetation of the pavements. <p>These communities were represented by a total of 39 Families, 78 Genera and 149 taxa were recorded within the survey area.</p>	<p><i>Sauropus</i> sp. Woolgorong (M. Officer s.n. 10/8/94) (P3)</p>
Armstrong (2004)	<p>Armstrong were commissioned by LionOre Australia Pty Ltd to conduct a Threatened and Priority flora search, and a vegetation and flora survey at proposed Waterloo prospect of the Wildara exploration project. The survey was conducted from the 10th to the 12th March 2004. Waterloo is located approximately 40km south-east of Leinster, and approximately 75km north-north-west of Leonora.</p> <p>Three vegetation communities were encountered during the survey. These vegetation groups were:</p> <ol style="list-style-type: none"> 1. <i>Acacia aneura</i> dominated vegetation of the plains; 2. <i>Acacia ramulosa</i> dominated vegetation of the plains; and 3. Vegetation of the drainage lines. 	<p><i>Sauropus</i> sp. Woolgorong (M. Officer s.n. 10/8/94) (P3)</p>
Biota (2004)	Biota were commissioned by LionOre Australia Pty Ltd to provide a	No Threatened or

Author and Year	Vegetation/Landforms/Fauna Habitats	Flora/Fauna of Conservation Significance
	<p>Preliminary assessment of any potential fauna issues associated with a proposal to extend its existing Thunderbox Mine to access the Waterloo and Amorac ore deposits. The site inspection revealed that there were three primary habitats for terrestrial fauna located within potential box cut sites and the proposed corridors. The broad habitat types were:</p> <p>1: Rocky Ridges 2: Spinifex Sandplains 3: Mulga flats.</p> <p>The survey recorded a combined total of 58 vertebrate fauna species from the area of the proposed extension. No stygofauna were detected.</p>	<p>Priority Fauna recorded.</p>
<p>Outback Ecology (2008a)</p>	<p>A total of 46 plant taxa (including subspecies and varieties) from 14 families and 19 genera were identified within the survey area. Dominant families included Mimosaceae (12 species), Poaceae (five species) and Myoporaceae (seven species). The most widespread species across the survey area included <i>Acacia aneura</i> variants, <i>Triodia basedowii</i> and <i>Eragrostis eriopoda</i>.</p>	<p>No Threatened Flora or Priority Flora.</p>
<p>Outback Ecology (2008b)</p>	<p>An estimated population of 4,500 plants of <i>Eremophila pungens</i> were identified north of the Venus Project, for which 774 plants are required to be cleared for the formation of the Venus Pit.</p>	<p>One Priority Flora; <i>Eremophila pungens</i> (P4)</p>
<p>Terrestrial Ecosystems (2011).</p>	<p>Terrestrial Ecosystems carried out a Level 2 fauna survey in the vicinity of the Granny Deeps Mine near Laverton.</p> <p>The survey recorded a combined total of 101 vertebrate species.</p>	<p>One Priority fauna species recorded; long-tailed dunnart (Priority 4).</p>
<p>BC (2014)</p>	<p>BC was commissioned by Saracen to conduct a Level 1 flora and vegetation survey of the Thunderbox to Bannockburn Project area. The fieldwork was conducted from the 16th to the 18th June 2014 and encompassed an area of 5,543 hectares.</p> <p>Eighteen broad vegetation communities were identified within the project area. These communities were represented by a total 32 Families, 74 Genera and 136 Taxa (including sub-species and variants).</p>	<p>No Threatened Flora or Priority Flora.³</p>
<p>Harewood (2015)</p>	<p>Greg Harewood was commissioned by Bullseye Mining Ltd to carry out a Level 1 fauna assessment of their Laverton Gold Project Area.</p> <p>The survey recorded a combined total of 86 vertebrate species.</p>	<p>No Threatened Fauna or Priority Fauna.</p>
<p>Engenium (2015)</p>	<p>Engenium was commissioned by Toro Energy Ltd to carry out a three-phase detailed fauna survey of their Lake Maitland Project Area.</p> <p>A total of 24 (18 native, six introduced) mammal, 94 bird, 53 reptile and three amphibian fauna species were recorded across the three phases of field survey.</p>	<p>One Specially Protected and one Priority fauna species recorded; peregrine falcon (Schedule 7) and the Brush-tailed Mulgara (Priority 4).</p>
<p>Botanica (2016)</p>	<p>Botanica Consulting were commissioned in 2016 to conduct a Level 1 flora and fauna survey of the Julius Project. A total of 17 families, 33 genera and 59 taxa were identified across two major vegetation groups.</p>	<p>No Threatened Flora or Priority Flora³</p>

³ *Calytrix uncinata* was identified which at the time of reporting was listed as Priority 3 Flora; however, this taxon is no longer listed as Priority Flora.

Author and Year	Vegetation/Landforms/Fauna Habitats	Flora/Fauna of Conservation Significance
	A total of 24 mammals, 100 birds, 85 reptiles and eight frog species were recorded.	

4.1.2 Flora of Conservation Significance

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2018b) and DotEE protected matters search recorded no Threatened Flora or Priority Flora within the survey area. No Threatened Flora and a total of seven Priority Flora taxa were listed on the databases as occurring within a 20km 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 (Table 4-2).

. 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 assessment.
- 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 assessment, 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 current or previous field surveys.

Table 4-2: Likelihood of occurrence for Flora of Conservation Significance within the survey area

Taxon	Conservation Code	Description (WAHERB, 2018)	Likelihood of Occurrence
<i>Austroparmelina macrospora</i>	P3	Lichen. Contains atranorin (minor), chloratranorin (major), ± scabrosin 4,4'-diacetate (trace) (photo at W.A. herbarium)	Unlikely
<i>Eremophila pungens</i>	P4	Erect, viscid shrub, 0.5-1.5 m high. Fl purple-violet, Jun to Aug, Sandy loam, clayey sand over laterite, plains, ridges, breakaways	Possible
<i>Euryomyrtus inflata</i>	P3	Shrub, 0.3 – 0.7 m high, leaves dull green, fruits erect, Fl white-pink, Jun-Jul. Deep red sand, Flat plain.	Unlikely
<i>Grevillea inconspicua</i>	P4	Intricately branched, spreading shrub, 0.6-2 m high. Fl. white/pink-white, Jun to Aug. Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	Unlikely
<i>Hemigenia exilis</i>	P4	Erect, multi-stemmed shrub, 0.5–2 m high. Fl. blue, purple, white, Apr/Sep–Nov. Laterite. Breakaways, slopes.	Possible

Taxon	Conservation Code	Description (WAHERB, 2018)	Likelihood of Occurrence
<i>Olearia mucronata</i>	P3	Densely branched, unpleasantly aromatic shrub, 0.6–1 m high. Fl. white, yellow, Aug–Jan. Schistose hills, along drainage channels	Unlikely
<i>Stenanthemum mediale</i>	P1	Erect shrub, ca 0.35 m high, leaves entire. Fl. Apr–Aug. Red clayey sand.	Unlikely

4.1.3 Fauna of Conservation Significance

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

- **Would Not Occur:** There is no suitable habitat for the species in the survey area and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
 - **Locally Extinct:** Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km 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 northern 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 4-3: Likelihood of Occurrence – Fauna Species of Conservation Significance

Species	Conservation Status			Potential Habitats Within Survey Area			Likelihood of Occurrence/Degree of Impact
	EPBC Act	WC Act	DBC Priority	Foraging Habitat	Breeding Habitat	Total Extent (ha)	
Malleefowl <i>Leipoa ocellata</i>	VU	S3	-	Clay-Loam Plains/ Sandy Loam Plains/ Rocky Hillslopes	None Identified	1,200 ha (66% of total area).	Unlikely to Occur. Breeding habitat absent. No recent, nearby records. Very occasional transients only/No impact anticipated.
Peregrine Falcon <i>Falco peregrinus</i>	-	S7	-	Air space above all habitats.	Mine Pit walls	1,816 ha (100% of total area).	Possibly Occurs but probably only rarely. Unlikely to breed in the area/Negligible impact anticipated.
Migratory Shorebirds (Various species)	Mig	S5	-	Flooded mine void	None Identified	<1 ha (0.02% of total area).	Unlikely to Occur. Very occasional vagrants only. Habitat very marginal and unsuitable for some species No impact anticipated.
Grey Wagtail <i>Motacilla cinerea</i>	Mig	S5	-	None Identified		0 ha	Would Not Occur. Never recorded in goldfields region/No impact anticipated.
Yellow Wagtail <i>Motacilla flava</i>	Mig	S5	-	None Identified		0 ha	Would Not Occur. Never recorded in goldfields region/No impact anticipated.
Oriental Plover <i>Charadis veredus</i>	Mig	S5	-	None		0 ha	Unlikely. Outside normal range. No previous records.
Night Parrot <i>Pezoporus occidentalis</i>	EN	S1	-	Clay-Loam Plains/ Sandy Loam Plains (with <i>Triodia</i>)	None Identified	1,164 ha (64% of total area).	Unlikely to Occur. No recent records nearby and possibly locally extinct. No impact anticipated.
Princess Parrot <i>Polytelis alexandrae</i>	VU	-	P4	Clay-Loam Plains/ Sandy Loam Plains/ Rocky Hillslopes	None Identified	1,200 ha (66% of total area).	Unlikely to Occur. Rarely recorded this far west and no recent records nearby/No impact anticipated.
Brush-tailed Mulgara <i>Dasycercus blythi</i>	-	-	P4	Clay-Loam Plains/ Sandy Loam Plains		1,164 ha (64% of total area).	Possibly Occurs though habitat in some areas appears marginal and limited in extent. Favoured habitat (sand plains) absent. No significant impact anticipated.

The current status of some species on site and/or in the general area is difficult to determine, however, based on the habitats present and, in some cases, direct observations or recent nearby records, the following species of conservation significance can be regarded as possibly utilising the survey area for some purpose at times, these being:

- **Peregrine Falcon *Falco peregrinus* – S7 (WC Act)**

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

- **Brush-tailed Mulgara *Dasycercus blythi* – P4 (DBCA Priority Species)**

This species preferred habitat (sand plains) is absent though it may occur on clay-loam and sand-loam plains. The actual status of this species in the survey area is difficult to determine though it has been recorded at Lake Maitland (Engenium (2015)). The proposal will result in the loss of some potential habitat but it is unlikely to have a significant impact on the species status in the wider area.

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.

A number of other species of conservation significance, while possibly present in the general area and/or the Murchison region are not listed as potential species due to the survey area being outside of their currently recognised range, a lack of suitable habitat or known/very likely local or regional extinction (and no subsequent recruitment from adjoining areas).

4.2 Field Assessment

4.2.1 Vegetation Types

Five vegetation types were identified within the survey area. These vegetation types were identified within three landform types and comprised of three major vegetation groups according to the NVIS, Major Vegetation Group (MVG) definition (Table 4-4). These vegetation types were represented by a total of 17 Families, 36 Genera and 102 Taxa as listed in Appendix 2. A map showing the vegetation types present in the survey area is provided in Figure 4-1.

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

Landform	Major Vegetation Group	Vegetation Code	Vegetation Type	Area (ha)	Area (%)
Clay-Loam Plain	Acacia Forests and Woodland (MVG 6)	CLP-AFW1	Low woodland of <i>Acacia incurvaneura</i> / <i>A. caesaneura</i> over low scrub of <i>Eremophila forrestii</i> subsp. <i>forrestii</i> / <i>E. margarethae</i> and low hummock/tussock grassland of <i>Triodia desertorum</i> / <i>Eriachne mucronata</i> / <i>Eragrostis eriopoda</i> on clay-loam plain	556	30.6
Sandy-Loam Plain	Acacia Forests and Woodland (MVG 6)	SLP-AFW1	Low woodland of <i>Acacia caesaneura</i> / <i>A. incurvaneura</i> over mid shrubland of <i>Senna artemisioides</i> subsp. <i>filifolia</i> and low hummock grassland of <i>Triodia desertorum</i> on sand-loam plain	464	25.6
	Mallee Woodlands and Shrublands (MVG14)	SLP-MWS1	Sparse mallee shrubland of <i>Eucalyptus youngiana</i> over low open shrubland of <i>Acacia ayersiana</i> and low hummock/tussock grassland of <i>Triodia desertorum</i> / <i>Eragrostis eriopoda</i> on sand-loam plain	143	7.9
Rocky Hillslope	Acacia Open Woodlands (MVG13)	RH-AOW1	Low woodland of <i>Acacia incurvaneura</i> over mid open chenopod shrubland of <i>Maireana convexa</i> and low open tussock grassland of <i>Eriachne mucronata</i> / <i>Eragrostis eriopoda</i> on rocky hillslope	10	0.6
	Acacia Forests and Woodland (MVG 6)	RH-AFW1	Low woodland of <i>Acacia incurvaneura</i> / <i>A. pruniocarpa</i> over mid sparse shrubland of <i>Senna artemisioides</i> subsp. <i>helmsii</i> / <i>Scaevola spinescens</i> and low sparse shrubland of <i>Ptilotus obovatus</i> / <i>Maireana georgei</i> on rocky hillslope	26	1.4
NA	NA	CV	Cleared Vegetation	617	34.0
Total				1,816	100

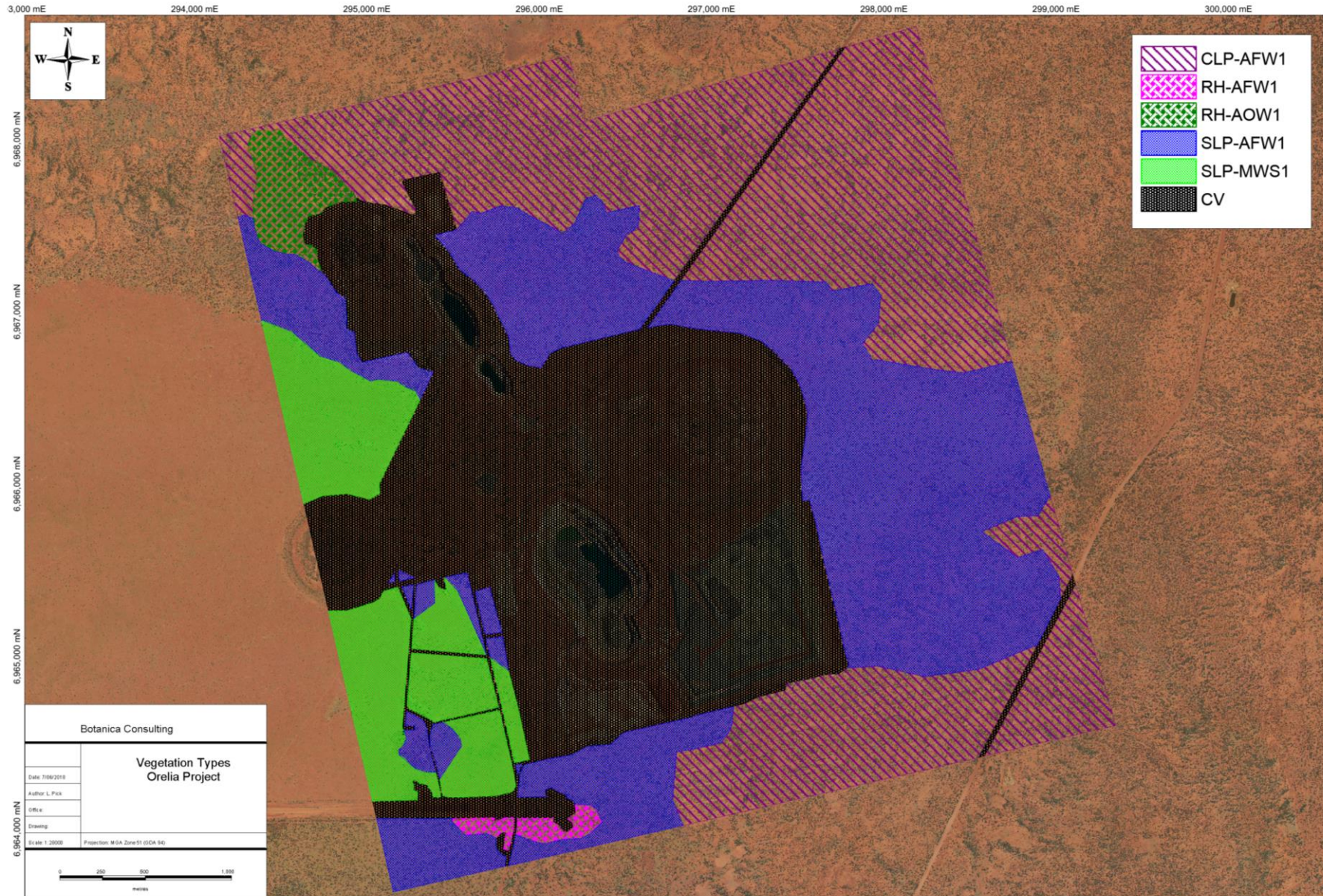


Figure 4-1: Vegetation types within the survey area

Clay Loam Plains: Acacia Forests and Woodlands

4.2.1.1 Low woodland of *Acacia incurvaneura*/ *A. caesaneura* over low scrub of *Eremophila forrestii* subsp. *forrestii*/*E. margarethae* and low hummock/tussock grassland of *Triodia desertorum*/ *Eriachne mucronata*/ *Eragrostis eriopoda* on clay-loam plain (CLP-AFW1)

The total flora recorded within this vegetation type was represented by a total of 16 Families, 31 Genera and 72 Taxa (Plate 4-1). Dominant taxa are shown in Table 4-5. According to the NVIS, this vegetation community is best represented by the MVG 6-Acacia Forests and Woodlands (DotEE, 2017b).

Table 4-5: Vegetation assemblage for Low woodland of *Acacia incurvaneura*/ *A. caesaneura* over low scrub of *Eremophila forrestii* subsp. *forrestii*/*E. margarethae* and low hummock/tussock grassland of *Triodia desertorum*/ *Eriachne mucronata*/ *Eragrostis eriopoda* on clay-loam plain (CLP-AFW1)

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 3-10m	30-70%	<i>Acacia incurvaneura</i> <i>Acacia caesaneura</i>
Shrub 1-2m	5-10%	<i>Eremophila forrestii</i> subsp. <i>forrestii</i> <i>Eremophila margarethae</i>
Hummock Grass <1m	30-70%	<i>Triodia desertorum</i>
Tussock Grass <1m	30-70%	<i>Eriachne mucronata</i> <i>Eragrostis eriopoda</i>



Plate 4-1: Low woodland of *Acacia incurvaneura*/ *A. caesaneura* over low scrub of *Eremophila forrestii* subsp. *forrestii*/*E. margarethae* and low hummock/tussock grassland of *Triodia desertorum*/ *Eriachne mucronata*/ *Eragrostis eriopoda* on clay-loam plain (CLP-AFW1)

Sandy Loam Plain: Acacia Forests and Woodlands

4.2.1.2 Low woodland of *Acacia caesaneura*/ *A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. *filifolia* and low hummock grassland of *Triodia desertorum* on sand-loam plain (SLP-AFW1)

The total flora recorded within this vegetation type was represented by a total of 14 Families, 23 Genera and 51 Taxa (Plate 4-2). Dominant taxa are shown in Table 4-6. According to the NVIS, this vegetation community is best represented by the MVG 6-Acacia Forests and Woodlands (DotEE, 2017b).

Table 4-6: Vegetation assemblage for Low woodland of *Acacia caesaneura*/ *A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. *filifolia* and low hummock grassland of *Triodia desertorum* on sand-loam plain (SLP-AFW1)

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree <10m	10-30%	<i>Acacia incurvaneura</i> <i>Acacia caesaneura</i>
Shrub 1-2m	5-10%	<i>Senna artemisioides</i> subsp. <i>filifolia</i>
Hummock Grass <1m	30-70%	<i>Triodia desertorum</i>



Plate 4-2: Low woodland of *Acacia caesaneura*/ *A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. *filifolia* and low hummock grassland of *Triodia desertorum* on sand-loam plain (SLP-AFW1)

Sandy Loam Plains: Mallee Woodlands and Shrublands

4.2.1.3 Sparse mallee shrubland of *Eucalyptus youngiana* over low open shrubland of *Acacia ayersiana* and low hummock/tussock grassland of *Triodia desertorum*/*Eragrostis eriopoda* on sand-loam plain (SLP-MWS1)

The total flora recorded within this vegetation type was represented by a total of 7 Families, 13 Genera and 24 Taxa (Plate 4-3). Dominant taxa are shown in Table 4-7. According to the NVIS, this vegetation community is best represented by the MVG 14 – Mallee Woodlands and Shrublands (DotEE, 2017b).

Table 4-7: Vegetation assemblage for Sparse mallee shrubland of *Eucalyptus youngiana* over low open shrubland of *Acacia ayersiana* and low hummock/tussock grassland of *Triodia desertorum*/*Eragrostis eriopoda* on sand-loam plain (SLP-MWS1)

Life Form/Height Class	Canopy Cover	Dominant taxa present
Shrub Mallee 3-10m	5-10%	<i>Eucalyptus youngiana</i>
Shrub 1-2m	5-10%	<i>Acacia ayersiana</i>
Hummock Grass <1m	30-70%	<i>Triodia desertorum</i>
Tussock Grass <1m	30-70%	<i>Eragrostis eriopoda</i>



Plate 4-3: Sparse mallee shrubland of *Eucalyptus youngiana* over low open shrubland of *Acacia ayersiana* and low hummock/tussock grassland of *Triodia desertorum*/*Eragrostis eriopoda* on sand-loam plain (SLP-MWS1)

Rocky Hillslope: Acacia Forest and Woodlands

4.2.1.4 Low woodland of *Acacia incurvaneura* over mid open chenopod shrubland of *Maireana convexa* and low open tussock grassland of *Eriachne mucronata*/*Eragrostis eriopoda* on rocky hillslope (RH-AFW1)

The total flora recorded within this vegetation type was represented by a total of 6 Families, 6 Genera and 7 Taxa (Plate 4-4). Dominant taxa are shown in Table 4-8. According to the NVIS, this vegetation community is best represented by the MVG 6 - Acacia Forests and Woodlands (DotEE, 2017b).

Table 4-8: Vegetation assemblage for Low woodland of *Acacia incurvaneura* over mid open chenopod shrubland of *Maireana convexa* and low open tussock grassland of *Eriachne mucronata*/*Eragrostis eriopoda* on rocky hillslope (RH-AFW1)

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 3-10m	10-30%	<i>Acacia incurvaneura</i>
Chenopod Shrub 1-2m	10-30%	<i>Maireana convexa</i>
Hummock Grassland <1m	30-70%	<i>Eriachne mucronata</i> <i>Eragrostis eriopoda</i>



Plate 4-4: Low woodland of *Acacia incurvaneura* over mid open chenopod shrubland of *Maireana convexa* and low open tussock grassland of *Eriachne mucronata*/*Eragrostis eriopoda* on rocky hillslope (RH-AFW1)

Rocky Hill: Acacia Open Woodlands

4.2.1.5 Low woodland of *Acacia incurvaneura*/ *A. pruniocarpa* over mid sparse shrubland of *Senna artemisioides* subsp. *helmsii*/*Scaevola spinescens* and low sparse shrubland of *Ptilotus obovatus*/*Maireana georgei* on rocky hillslope (RH-AOW1)

The total flora recorded within this vegetation type was represented by a total of 11 Families, 17 Genera and 45 Taxa (Plate 4-5). Dominant taxa are shown in Table 4-9. According to the NVIS, this vegetation community is best represented by the MVG 5 -Acacia Open Woodlands (DotEE, 2017b).

Table 4-9: Vegetation assemblage for Low woodland of *Acacia incurvaneura*/ *A. pruniocarpa* over mid sparse shrubland of *Senna artemisioides* subsp. *helmsii*/*Scaevola spinescens* and low sparse shrubland of *Ptilotus obovatus*/*Maireana georgei* on rocky hillslope (RH-AOW1)

Life Form/Height Class	Canopy Cover	Dominant taxa present
Tree 3-10m	10-30%	<i>Acacia pruinocarpa</i> <i>Acacia incurvaneura</i>
Shrub 1-2m	5-10%	<i>Senna artemisioides</i> subsp. <i>helmsii</i> <i>Scaevola spinescens</i>
Shrub <1m	5-10%	<i>Ptilotus obovatus</i> <i>Maireana georgei</i>



Plate 4-5: Low woodland of *Acacia incurvaneura*/ *A. pruniocarpa* over mid sparse shrubland of *Senna artemisioides* subsp. *helmsii*/*Scaevola spinescens* and low sparse shrubland of *Ptilotus obovatus*/*Maireana georgei* on rocky hillslope (RH-AOW1)



4.2.2 Vegetation Condition



Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 3), the five vegetation types were rated as 'good' (Table 4-13). 'Good' condition depicts that vegetation structure has been altered by obvious 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. Approximately 618 ha of the survey area (34% of the survey area) has been previously cleared for mining development including Waste Rock Landforms, Open Pits and various site infrastructure/transport corridors.

4.2.3 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 assessment. The extent of the identified fauna habitats and a summary description of each are provided in Table 4-10 below.

Table 4-10: Main Terrestrial Fauna Habitats within the survey area

Fauna Habitat Description	Example Image
<p><u>Clay-Loam Plains</u></p> <p>Acacia Forests and Woodlands (approximate area = 556 ha; 30.6%).</p>	
<p><u>Sand-Loam Plain</u></p> <p>Acacia Forests and Woodlands Mallee Woodlands and Shrublands (approximate area = 607 ha; 33.4%).</p>	

Fauna Habitat Description	Example Image
<p><u>Rocky Hillslopes:</u></p> <p>Acacia Forests and Woodlands Acacia Open Woodlands</p> <p>(approximate area = 36 ha; 2.0%).</p>	
<p><u>Existing Disturbed Areas (including WRLs, Open Pits).</u></p> <p>(approximate area = 617 ha; 34%).</p>	

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.

Table 4-11 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.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act* Threatened Fauna and Migratory species lists, DBCA NatureMap Fauna 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 Survey limitations and constraints**).

Table 4-11: 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	9	0	0	0
Reptiles	87	0	0	0
Birds	104	1	0	0
Non-Volant Mammals	25 ⁹	0	0	1
Volant Mammals (Bats)	8	0	0	0
Total	234⁹	1	0	1

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.

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 study area.

4.2.4 Introduced Species

No introduced species were recorded during the survey. According to NatureMap and Protected Matters database results (DBCA, 2018a; DotEE, 2018a), two introduced flora species potentially occur within the area; *Carrichtera annua* (Wards Weed) and *Cenchrus ciliaris* (Buffel Grass). No introduced fauna were observed during the survey however seven introduced fauna species potentially occur within the area including donkeys, camels, goats, feral cats, mice, rabbits and foxes (DBCA, 2018a; DotEE, 2018a).

4.2.5 Flora of Conservation Significance

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 flora of conservation significance 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 Fauna of Conservation Significance

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 was identified within the survey area.

4.2.7 Vegetation of Conservation Significance

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.

4.2.8 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.

4.2.9 Matters of State Environmental Significance

There are no wetlands of national importance (ANCA Wetlands) or conservation category wetlands within the survey area. The survey area does not contain any TEC as listed under the WC Act or EP Act. No Threatened taxa listed under the WC Act were recorded within the survey area. The survey area does not contain any ESA or Schedule 1 Areas listed under the EP Act. No DBCA managed lands are located within the survey area. The closest conservation reserve is the Wanjarri Nature Reserve, which is located approximately 6.5 km west of the survey area.

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

4.3 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 4-12).

Table 4-12: Assessment of development within the survey area against native vegetation clearing principles

Letter	Principle	Assessment	Outcome
	Native vegetation should not be cleared if it:		
(a)	comprises a high level of biological diversity.	Vegetation identified within the Project area is not considered to be of high biological diversity and is well represented in the local area.	Clearing is unlikely to be at variance to this principle
(b)	comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.	No significant fauna habitat identified within the project area. Fauna habitats are well represented outside of the survey area.	Clearing is unlikely to be at variance to this principle
(c)	includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to subsection (2) of section 23F of the WC Act 1950 and the EPBC Act 1999 were identified within the Project area.	Clearing is unlikely to be at variance to this principle
(d)	comprises the whole or part of or is necessary for the maintenance of a threatened ecological community (TEC).	No TEC listed under State and Commonwealth legislation occur within the Project area.	Clearing is unlikely to be at variance to this principle
(e)	is significant as a remnant of native vegetation in an area that has been extensively cleared	The Project area occurs within the pre-European Beard vegetation associations Wiluna 18 and Wiluna 107 which retain >99% of the original pre-European vegetation extent.	Clearing is unlikely to be at variance to this principle
(f)	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 defined drainage lines or inland waters (lakes/ playas) within the Project area. No riparian vegetation was identified within the Project area.	Clearing 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.	The Project area occurs within the pre-European Beard vegetation associations Wiluna 18 and Wiluna 107 which retain >99% of the original pre-European vegetation extent. Clearing within these vegetation associations is not likely to lead to land degradation issues such as salinity, water logging or acidic soils.	Clearing 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 any current or proposed Conservation Reserves managed by DBCA and listed by the EPA.	Clearing 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 defined drainage lines or inland waters (lakes/ playas) within the Project area. No riparian vegetation was identified within the Project area. Most rainfall is lost by evaporation or surface runoff. Only a small portion infiltrates the soil and	Clearing is unlikely to be at variance to this principle

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
		recharges the groundwater.	
(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 200mm and an evaporation rate of 2461mm. The region is not prone to flooding and does not contain riparian vegetation.	Clearing is unlikely to be at variance to this principle

5 Summary

Five vegetation types were identified within the survey area. These vegetation types were located within three different landform types and comprised of three major vegetation groups, which were represented by a total of 17 Families, 36 Genera and 102 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plain, rocky hillslopes and sand-loam plain.

Results of the literature review identified 33 mammals (including eight bat species), 104 birds, 87 reptiles and nine frog species that have previously been recorded in the general area, some of which have the potential to occur, subject to the identified habitats being suitable.

No Threatened Flora, Threatened Fauna, Migratory Fauna or TEC as listed under the WC Act or Commonwealth EPBC Act 1999 were identified within the survey area. No Priority Flora or Fauna as listed by DBCA were recorded within the survey area.

A review of the EPBC Act threatened fauna list, DBCA's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a number of specially protected, migratory or priority fauna species as having been previously recorded or as being potentially present in the general vicinity of the survey area. However, no fauna of conservation significance is likely to be significantly impacted on by the proposed development. This conclusion is primarily based on the lack of suitable habitats, the known local extinction of some species, the relatively small size of the impact footprint and the extensive habitat connectivity with adjoining areas. Impacts on fauna and fauna habitat are therefore anticipated to be localised, small/negligible and as a consequence manageable.

No PECs were identified within the survey area. 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 (ANCA Wetlands) or conservation category wetlands within the survey area.

The survey area does not contain any ESA or Schedule 1 Areas listed under the EP Act. The survey is not located within DBCA managed land. The closest conservation reserve is the Wanjarri Nature Reserve, which is located approximately 6.5 km west of the survey area.

All vegetation types were rated as in 'good condition'. No introduced taxa were identified within the survey area.

5.1 Recommendations

- Implement weed management/ vehicle hygiene procedures during clearing/ site access to prevent introduction/spread of invasive species.

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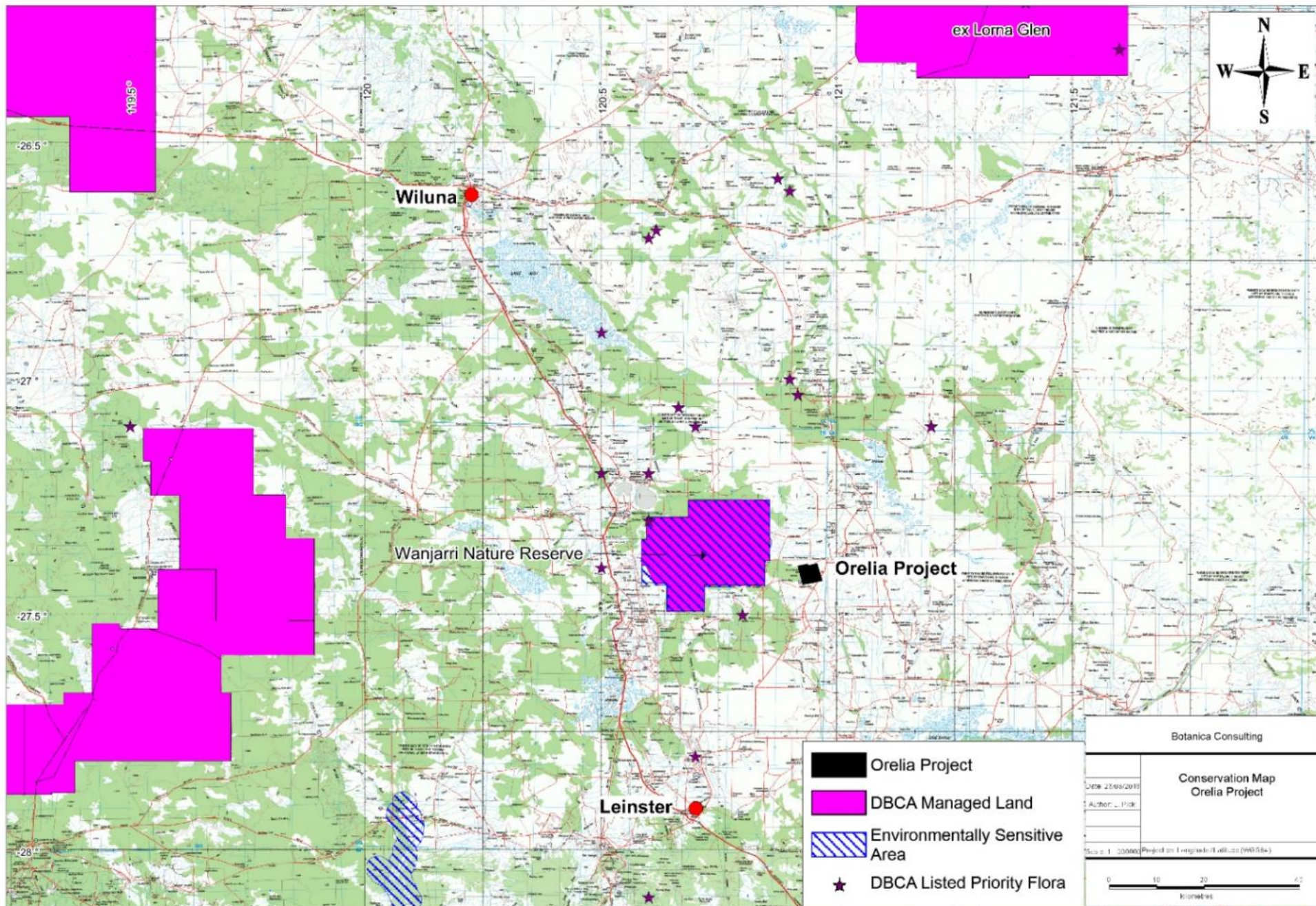
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Appendix 1: Regional map of the survey area including DBCA Flora of Conservation Significance and areas of Conservation Significance



Appendix 2: List of species identified within each vegetation type

Blue text-annual species; Green text-Introduced species (WAHERB, 2018)

Family	Genus	Taxon	CLP-AFW1	SLP-AFW1	SLP-MWS1	RH-AFW1	RH-AOW1
Amaranthaceae	<i>Ptilotus</i>	<i>aervoides</i> (A)					*
Amaranthaceae	<i>Ptilotus</i>	<i>gaudichaudii</i> subsp. <i>gaudichaudii</i> (A)	*	*			*
Amaranthaceae	<i>Ptilotus</i>	<i>helipteroides</i> (A)	*				*
Amaranthaceae	<i>Ptilotus</i>	<i>nobilis</i> (A)		*	*		*
Amaranthaceae	<i>Ptilotus</i>	<i>obovatus</i>	*	*	*		*
Amaranthaceae	<i>Ptilotus</i>	<i>schwartzii</i>	*	*			*
Apocynaceae	<i>Marsdenia</i>	<i>australis</i>				*	*
Chenopodiaceae	<i>Atriplex</i>	<i>bunburyana</i>	*				
Chenopodiaceae	<i>Enchylaena</i>	<i>lanata</i>	*	*			
Chenopodiaceae	<i>Enchylaena</i>	<i>tomentosa</i>	*	*			
Chenopodiaceae	<i>Maireana</i>	<i>amoena</i>					*
Chenopodiaceae	<i>Maireana</i>	<i>carnosa</i>	*	*		*	*
Chenopodiaceae	<i>Maireana</i>	<i>convexa</i>	*	*		*	
Chenopodiaceae	<i>Maireana</i>	<i>georgei</i>		*			*
Chenopodiaceae	<i>Maireana</i>	<i>thesioides</i>	*	*			
Chenopodiaceae	<i>Maireana</i>	<i>triptera</i>		*			*
Chenopodiaceae	<i>Rhagodia</i>	<i>eremaea</i>	*	*			
Chenopodiaceae	<i>Sclerolaena</i>	<i>cuneata</i>		*			*
Chenopodiaceae	<i>Sclerolaena</i>	<i>densiflora</i>					*
Chenopodiaceae	<i>Sclerolaena</i>	<i>diacantha</i>	*	*			
Chenopodiaceae	<i>Sclerolaena</i>	<i>euroides</i>					*
Convolvulaceae	<i>Bonamia</i>	<i>erecta</i>		*	*		
Convolvulaceae	<i>Convolvulus</i>	<i>remotus</i>	*				
Fabaceae	<i>Acacia</i>	<i>aptaneura</i>	*		*		*
Fabaceae	<i>Acacia</i>	<i>ayersiana</i>	*	*	*		*
Fabaceae	<i>Acacia</i>	<i>burkittii</i>	*				*
Fabaceae	<i>Acacia</i>	<i>caesaneura</i>	*	*	*	*	
Fabaceae	<i>Acacia</i>	<i>craspedocarpa</i>	*	*			
Fabaceae	<i>Acacia</i>	<i>desertorum</i>			*		
Fabaceae	<i>Acacia</i>	<i>effusifolia</i>			*		
Fabaceae	<i>Acacia</i>	<i>incurvaneura</i>	*	*	*	*	*
Fabaceae	<i>Acacia</i>	<i>ligulata</i>			*		
Fabaceae	<i>Acacia</i>	<i>mulganeura</i>	*				*
Fabaceae	<i>Acacia</i>	<i>pachyacra</i>	*		*		
Fabaceae	<i>Acacia</i>	<i>pruinocarpa</i>	*	*	*		*
Fabaceae	<i>Acacia</i>	<i>quadrimarginea</i>					*
Fabaceae	<i>Acacia</i>	<i>ramulosa</i> var. <i>ramulosa</i>	*		*		
Fabaceae	<i>Acacia</i>	<i>rhodophloia</i>					*
Fabaceae	<i>Acacia</i>	<i>tetragonophylla</i>	*	*			*
Fabaceae	<i>Leptosema</i>	<i>chambersii</i>			*		

Family	Genus	Taxon	CLP-AFW1	SLP-AFW1	SLP-MWS1	RH-AFW1	RH-AOW1
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. x <i>artemisioides</i>	*				
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>filifolia</i>		*	*		
Fabaceae	<i>Senna</i>	<i>artemisioides</i> subsp. <i>helmsii</i>	*				*
Fabaceae	<i>Senna</i>	<i>cardiosperma</i>					*
Fabaceae	<i>Senna</i>	sp. Meekatharra (E. Bailey 1-26)	*	*			*
Fabaceae	<i>Acacia</i>	<i>kempeana</i>					*
Goodeniaceae	<i>Scaevola</i>	<i>spinescens</i>	*	*			*
Lamiaceae	<i>Spartothamnella</i>	<i>teucriflora</i>	*	*			
Loranthaceae	<i>Amyema</i>	<i>fitzgeraldii</i>	*	*			
Malvaceae	<i>Abutilon</i>	<i>cryptopetalum</i>	*				*
Malvaceae	<i>Abutilon</i>	<i>otocarpum</i>	*				*
Malvaceae	<i>Androcalva</i>	<i>luteiflora</i>			*		
Malvaceae	<i>Seringia</i>	<i>velutina</i>			*		
Malvaceae	<i>Sida</i>	<i>calyxhymenia</i>	*	*			*
Malvaceae	<i>Sida</i>	<i>fibulifera</i>	*	*			
Malvaceae	<i>Sida</i>	sp. Excedentifolia (J.L. Egan 1925)	*				*
Malvaceae	<i>Sida</i>	sp. Golden calyces glabrous (H.N. Foote 32)	*				*
Malvaceae	<i>Sida</i>	sp. Golden calyces pubescent (G.J. Leach 1966)		*	*		
Malvaceae	<i>Sida</i>	sp. spiciform panicles (E. Leyland s.n. 14/8/90)			*		
Myrtaceae	<i>Eucalyptus</i>	<i>lucasii</i>	*	*			*
Myrtaceae	<i>Eucalyptus</i>	<i>youngiana</i>			*		
Myrtaceae	<i>Eucalyptus</i>	<i>kingsmillii</i>				*	
Myrtaceae	<i>Eucalyptus</i>	<i>eremicola</i>		*			
Pittosporaceae	<i>Pittosporum</i>	<i>angustifolium</i>	*				
Poaceae	<i>Aristida</i>	<i>contorta</i> (A)	*	*			*
Poaceae	<i>Cymbopogon</i>	<i>ambiguus</i>	*	*			*
Poaceae	<i>Enneapogon</i>	<i>caerulescens</i> (A)	*				*
Poaceae	<i>Eragrostis</i>	<i>dielsii</i> (A)	*	*			
Poaceae	<i>Eragrostis</i>	<i>eriopoda</i>	*	*	*		
Poaceae	<i>Eriachne</i>	<i>helmsii</i>	*				*
Poaceae	<i>Eriachne</i>	<i>mucronata</i>	*	*			*
Poaceae	<i>Eriachne</i>	<i>pulchella</i> (A)	*				*
Poaceae	<i>Monachather</i>	<i>paradoxus</i>	*		*		
Poaceae	<i>Paspalidium</i>	<i>clementii</i> (A)	*				
Poaceae	<i>Triodia</i>	<i>desertorum</i>	*	*	*		
Proteaceae	<i>Grevillea</i>	<i>berryana</i>	*	*			
Proteaceae	<i>Hakea</i>	<i>lorea</i>	*	*			
Pteridaceae	<i>Cheilanthes</i>	<i>sieberi</i> subsp. <i>sieberi</i>	*				*
Rubiaceae	<i>Psydrax</i>	<i>latifolia</i>	*	*			
Rubiaceae	<i>Psydrax</i>	<i>suaveolens</i>	*	*			
Scrophulariaceae	<i>Eremophila</i>	<i>clarkei</i>		*			

Family	Genus	Taxon	CLP-AFW1	SLP-AFW1	SLP-MWS1	RH-AFW1	RH-AOW1
Scrophulariaceae	<i>Eremophila</i>	<i>deserti</i>					
Scrophulariaceae	<i>Eremophila</i>	<i>drummondii</i>					
Scrophulariaceae	<i>Eremophila</i>	<i>falcata</i>					
Scrophulariaceae	<i>Eremophila</i>	<i>forrestii</i> subsp. <i>forrestii</i>	*				*
Scrophulariaceae	<i>Eremophila</i>	<i>georgei</i>	*	*			
Scrophulariaceae	<i>Eremophila</i>	<i>gilesii</i> subsp. <i>variabilis</i>	*	*			
Scrophulariaceae	<i>Eremophila</i>	<i>glabra</i>	*				
Scrophulariaceae	<i>Eremophila</i>	<i>jucunda</i> subsp. <i>jucunda</i>	*	*			
Scrophulariaceae	<i>Eremophila</i>	<i>latrobei</i> subsp. <i>glabra</i>	*	*			*
Scrophulariaceae	<i>Eremophila</i>	<i>latrobei</i> subsp. <i>latrobei</i>	*				
Scrophulariaceae	<i>Eremophila</i>	<i>platycalyx</i>	*	*			
Scrophulariaceae	<i>Eremophila</i>	<i>punctata</i>	*			*	
Scrophulariaceae	<i>Eremophila</i>	<i>serrulata</i>	*				
Scrophulariaceae	<i>Eremophila</i>	<i>shonae</i>	*				*
Scrophulariaceae	<i>Eremophila</i>	<i>margarethae</i>	*	*			
Solanaceae	<i>Nicotiana</i>	<i>rosulata</i> subsp. <i>rosulata</i> (A)	*			*	
Solanaceae	<i>Solanum</i>	<i>centrale</i>	*	*			
Solanaceae	<i>Solanum</i>	<i>lasiophyllum</i>	*	*			*
Solanaceae	<i>Solanum</i>	<i>nummularium</i>	*		*		
Solanaceae	<i>Solanum</i>	<i>orbiculatum</i>	*	*			
Solanaceae	<i>Solanum</i>	<i>terraneum</i>	*				

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

Species Potentially in Region of Survey Area

Orelia Project - Echo Resources Limited

Approximate centroid 27.41313°S and 120.93588°E

Compiled by Greg Harewood - June 2018

Recorded (Sighted/Heard/Signs) = X

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Class Family Species	Common Name	Conservation Status	Engenium 2015	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DBCA 2018
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Amphibia

Myobatrachidae

Ground or Burrowing Frogs

<i>Neobatrachus kunapalari</i>	Kunapalari Frog	LC					X	X	
<i>Neobatrachus sutor</i>	Shoemaker Frog	LC					X		X
<i>Neobatrachus wilsmorei</i>	Plonking Frog	LC							
<i>Notaden nichollsi</i>	Desert Spadefoot	LC	X						X
<i>Platyplectrum spenceri</i>	Centralian Burrowing Frog								X
<i>Pseudophryne occidentalis</i>	Western Toadlet	LC							

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Hylidae									
Tree or Water-Holding Frogs									
<i>Cyclorana maini</i>	Sheep Frog	LC	X				X	X	X
<i>Cyclorana platycephala</i>	Water-holding Frog	LC	X				X	X	X
<i>Litoria rubella</i>	Little Red Tree Frog	LC				X			X

Reptilia

Carphodactylidae

Knob-tailed Geckos

<i>Nephrurus laevis</i>	Smooth Knob-tail Gecko		X						
<i>Nephrurus laevisissimus</i>	Pale Knob-tail Gecko								
<i>Nephrurus vertebralis</i>	Midline Knob-tailed Gecko		X		X	X			X
<i>Nephrurus wheeleri</i>	Banded Knob-tailed Gecko		X		X	X			

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Class Family Species	Common Name	Conservation Status	Engenium 2015	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DBCA 2018
Diplodactylidae									
Geckoes									
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko		X		X			X	X
<i>Diplodactylus granariensis</i>	Western Stone Gecko					X	X		X
<i>Diplodactylus pulcher</i>	Western Saddled Ground Gecko		X		X	X	X		X
<i>Lucasium squarrosus</i>	Mottled Ground Gecko					X		X	
<i>Lucasium stenodactylus</i>	Sand-plain Gecko	LC	X		X	X			
<i>Rhynchoedura ornata</i>	Beaked Gecko		X		X	X	X	X	X
<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko								
<i>Strophurus elderi</i>	Jewelled Gecko		X		X			X	X
<i>Strophurus strophurus</i>	Ring-tailed Gecko		X					X	X
<i>Strophurus wellingtonae</i>	Western-shield Spiny-tailed Gecko	LC				X	X	X	X

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Gekkonidae									
Geckoes									
<i>Gehyra purpurascens</i>	Purple Arid Dtella		X		X			X	
<i>Gehyra variegata</i>	Variegated Dtella		X	X	X	X	X	X	X
<i>Heteronotia binoei</i>	Bynoe's Gecko		X		X	X	X	X	X
<i>Underwoodisaurus milii</i>	Barking Gecko		X					X	X
Pygopodidae									
Legless Lizards									
<i>Delma butleri</i>	Unbanded Delma							X	X
<i>Delma nasuta</i>	Long-nosed Delma		X		X			X	X
<i>Lialis burtonis</i>	Burton's Legless Lizard		X		X			X	X
<i>Pygopus nigriceps</i>	Hooded Scaly Foot		X						X

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Agamidae									
Dragon Lizards									
<i>Caimanops amphiboluroides</i>	Mulga Dragon					X	X		
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon					X			X
<i>Ctenophorus cristatus</i>	Bicycle Dragon			X					
<i>Ctenophorus fordi</i>	Mallee Sand Dragon							X	
<i>Ctenophorus isolepis</i>	Military Dragon		X	X	X	X		X	X
<i>Ctenophorus nuchalis</i>	Central Netted Dragon		X	X	X			X	X
<i>Ctenophorus reticulatus</i>	Western Netted Dragon							X	X
<i>Ctenophorus salinarum</i>	Salt Pan Dragon		X	X	X			X	X
<i>Ctenophorus scutulatus</i>	Lozenge-marked Bicycle Dragon		X	X	X	X		X	X
<i>Moloch horridus</i>	Thorny Devil		X		X			X	X
<i>Pogona minor</i>	Western Bearded Dragon		X		X			X	X
<i>Tympanocryptis cephalo</i>	Pebble Dragon						X		

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Class Family Species	Common Name	Conservation Status	Engenium 2015	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DBCA 2018
Varanidae Monitor's or Goanna's									
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor		X					X	X
<i>Varanus caudolineatus</i>	Stripe-tailed Pygmy Monitor		X			X	X	X	X
<i>Varanus eremius</i>	Pygmy Desert Monitor		X		X	X			X
<i>Varanus giganteus</i>	Perentie								X
<i>Varanus gouldii</i>	Sand Monitor		X	X	X			X	X
<i>Varanus panoptes</i>	Yellow-spotted Monitor		X	X	X	X	X		X
<i>Varanus tristis</i>	Racehorse Monitor								

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Class Family Species	Common Name	Conservation Status	Engenium 2015	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DBCA 2018
Scincidae Skinks									
<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink		X		X	X		X	
<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus								X
<i>Ctenotus atlas</i>	Southern Mallee Ctenotus		X		X				
<i>Ctenotus brooksi</i>	Central Wedge-snout Ctenotus								
<i>Ctenotus calurus</i>	Blue-tailed Skink		X						X
<i>Ctenotus dux</i>	Narrow-lined Skink								
<i>Ctenotus grandis</i>	Giant Desert Ctenotus		X		X				X
<i>Ctenotus greeri</i>	Greer's Ctenotus							X	
<i>Ctenotus hanloni</i>	Nimble Ctenotus								
<i>Ctenotus helenae</i>	Dusky Ctenotus		X		X			X	X
<i>Ctenotus leonhardii</i>	Leonhardi's Skink		X	X	X		X		X
<i>Ctenotus pantherinus</i>	Leopard Ctenotus		X		X			X	X
<i>Ctenotus piankai</i>	Pianka's Ctenotus								

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<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus		X						X
<i>Ctenotus schomburgkii</i>	Barred Wedge-snout Ctenotus		X	X	X	X		X	X
<i>Ctenotus severus</i>	Stern Rock Ctenotus		X		X				
<i>Ctenotus uber</i>	Spotted Ctenotus			X					X
<i>Cyclodomorphus melanops</i>	Eastern Slender Blue-tongue								
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink		X		X		X		X
<i>Egernia formosa</i>	Goldfields Crevice Skink								X
<i>Egernia inornata</i>	Desert Skink								
<i>Egernia striata</i>	Night Skink								
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer		X		X		X		X
<i>Lerista bipes</i>	Western Two-toed Slider		X		X				X
<i>Lerista desertorum</i>	Giant Desert Slider		X		X	X	X	X	X
<i>Lerista kingi</i>	Common Mulch Skink		X					X	X
<i>Lerista muelleri</i>	Common Mulch Skink		X		X	X			

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<i>Lerista timida</i>	Dwarf Three-toed Slider		X			X			X
<i>Menetia greyii</i>	Dwarf Skink		X		X	X	X	X	X
<i>Morethia butleri</i>	Woodland Dark-flecked Morethia		X				X	X	X
<i>Tiliqua multifasciata</i>	Central Blue-tongue		X		X		X	X	X
<i>Tiliqua occipitalis</i>	Western Bluetongue							X	X
Typhlopidae									
Blind Snakes									
<i>Anilius bicolor</i>	Dark-spined Blind Snake						X		
<i>Anilius hamatus</i>	Northern Hook-snouted Blind Snake		X			X		X	
<i>Anilius waitii</i>	Common Beaked Blind Snake								
Boidae									
Pythons, Boas									
<i>Antaresia stimsoni</i>	Stimson's Python		X						

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Elapidae									
Elapid Snakes									
<i>Brachyuropsis semifasciata</i>	Southern Shovel-nosed Snake		X						
<i>Demansia psammophis</i>	Yellow-faced Whipsnake								
<i>Furina ornata</i>	Moon Snake		X					X	X
<i>Parasuta monachus</i>	Monk Snake		X		X	X	X		X
<i>Pseudechis australis</i>	Mulga Snake							X	X
<i>Pseudechis butleri</i>	Spotted Mulga Snake								
<i>Pseudonaja mengdeni</i>	Western Brown Snake								X
<i>Pseudonaja modesta</i>	Ringed Brown Snake					X			X
<i>Simoselaps bertholdi</i>	Jan's Banded Snake		X			X		X	X
<i>Suta fasciata</i>	Rosen's Snake						X		X

Aves

Casuariidae

Emus, Cassowarries

<i>Dromaius novaehollandiae</i>	Emu	LC	X	X	X	X	X	X	X
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Class Family Species	Common Name	Conservation Status	Engenium 2015	Harewood 2015	Outback 2009	Ninox 2007	TE 2011	Hall et al. 1994	DBCA 2018
Accipitridae									
Kites, Goshawks, Eagles, Harriers									
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	LC	X		X	X			X
<i>Accipiter fasciatus</i>	Brown Goshawk	LC	X						X
<i>Aquila audax</i>	Wedge-tailed Eagle	LC		X	X	X	X	X	X
<i>Aquila morphnoides</i>	Little Eagle	LC		X	X			X	
<i>Circus assimilis</i>	Spotted Harrier	LC						X	X
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC	X	X	X				
<i>Haliastur sphenurus</i>	Whistling Kite	LC	X						X
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard	LC	X			X			X
<i>Milvus migrans</i>	Black Kite	LC	X		X				X

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Falconidae									
Falcons									
<i>Falco berigora</i>	Brown Falcon	LC	X	X	X	X	X	X	X
<i>Falco cenchroides</i>	Australian Kestrel	LC	X	X	X	X	X	X	X
<i>Falco longipennis</i>	Australian Hobby	LC	X		X			X	X
<i>Falco peregrinus</i>	Peregrine Falcon	S7 LC	X			X			X
Otididae									
Bustards									
<i>Ardeotis australis</i>	Australian Bustard	LC	X			X		X	X
Turnicidae									
Button-quails									
<i>Turnix velox</i>	Little Button-quail	LC				X			X
Burhinidae									
Stone Curlews									
<i>Burhinus grallarius</i>	Bush Stone-curlew	LC	X		X				X
Charadriidae									
Lapwings, Plovers, Dotterels									
<i>Vanellus tricolor</i>	Banded Lapwing	LC	X					X	X

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Columbidae									
Pigeons, Doves									
<i>Geopelia cuneata</i>	Diamond Dove	LC	X	X	X	X		X	X
<i>Ocyphaps lophotes</i>	Crested Pigeon	LC	X	X	X	X	X	X	X
<i>Phaps chalcoptera</i>	Common Bronzewing	LC	X	X	X	X	X	X	X
Psittacidae									
Parrots									
<i>Cacatua roseicapilla</i>	Galah	LC	X	X	X	X		X	X
<i>Cacatua sanguinea</i>	Little Corella	LC	X		X				
<i>Melopsittacus undulatus</i>	Budgerigar	LC	X	X	X	X		X	X
<i>Neophema bourkii</i>	Bourke's Parrot			X		X		X	
<i>Nymphicus hollandicus</i>	Cockatiel	LC	X	X	X			X	X
<i>Platycercus varius</i>	Mulga Parrot	LC	X	X	X	X	X	X	X
<i>Platycercus zonarius</i>	Australian Ringneck	LC	X	X	X	X	X	X	X

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Cuculidae									
Parasitic Cuckoos									
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	LC	X	X				X	X
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	LC		X		X			
<i>Cuculus pallidus</i>	Pallid Cuckoo	LC	X	X			X	X	
Strigidae									
Hawk Owls									
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC							
Tytonidae									
Barn Owls									
<i>Tyto alba</i>	Eastern Barn Owl	LC	X						X
Podargidae									
Frogmouths									
<i>Podargus strigoides</i>	Tawny Frogmouth	LC	X	X	X			X	X
Caprimulgidae									
Nightjars									
<i>Eurostopodus argus</i>	Spotted Nightjar	LC	X	X	X				X

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Aegothelidae									
Owlet-nightjars									
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	LC	X		X	X		X	X
Halcyonidae									
Tree Kingfishers									
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher	LC		X		X	X	X	
Meropidae									
Bee-eaters									
<i>Merops ornatus</i>	Rainbow Bee-eater	JA LC							X
Climacteridae									
Trecreepers									
<i>Climacteris affinis</i>	White-browed Trecreeper	LC		X				X	X
Maluridae									
Fairy Wrens, GrassWrens									
<i>Malurus lamberti</i>	Variigated Fairy-wren	LC	X	X	X			X	X
<i>Malurus leucopterus</i>	White-winged Fairy-wren	LC	X	X	X		X	X	X
<i>Malurus splendens</i>	Splendid Fairy-wren	LC	X	X	X	X	X		X
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren	LC	X						X

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Acanthizidae									
Thornbills, Geryones, Fieldwrens & Whitefaces									
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	LC	X	X		X	X	X	X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	LC	X	X		X	X	X	X
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill	LC	X	X	X	X	X		X
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	LC		X	X	X		X	X
<i>Aphelocephala leucopsis</i>	Southern Whiteface	LC		X		X	X	X	X
<i>Calamanthus campestris</i>	Rufous Fieldwren	LC	X						X
<i>Gerygone fusca</i>	Western Gerygone	LC	X						X
<i>Pyrrholaemus brunneus</i>	Redthroat	LC	X	X	X	X			X
<i>Smicrornis brevirostris</i>	Weebill	LC	X		X	X		X	X
Pardalotidae									
Pardalotes									
<i>Pardalotus striatus</i>	Striated Pardalote	LC					X	X	X

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Meliphagidae									
Honeyeaters, Chats									
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	LC		X	X	X	X	X	X
<i>Certhionyx niger</i>	Black Honeyeater	LC						X	
<i>Certhionyx variegatus</i>	Pied Honeyeater	LC	X	X			X	X	X
<i>Epthianura aurifrons</i>	Orange Chat	LC	X						X
<i>Epthianura tricolor</i>	Crimson Chat	LC	X	X	X	X	X	X	X
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater	LC			X				
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater	LC			X				
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater	LC	X		X				
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater	LC	X	X	X			X	
<i>Lichenostomus virescens</i>	Singing Honeyeater	LC	X	X	X	X	X	X	
<i>Lichmera indistincta</i>	Brown Honeyeater	LC	X		X			X	X
<i>Manorina flavigula</i>	Yellow-throated Miner	LC	X	X	X	X	X	X	X
<i>Phylidonyris albifrons</i>	White-fronted Honeyeater	LC	X	X				X	

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Petroicidae									
Australian Robins									
<i>Microeca fascinans</i>	Jacky Winter	LC						X	
<i>Petroica cucullata</i>	Hooded Robin	LC		X		X	X	X	
<i>Petroica goodenovii</i>	Red-capped Robin	LC	X	X	X	X	X	X	X
Pomatostomidae									
Babblers									
<i>Pomatostomus superciliosus</i>	White-browed Babbler	LC	X	X	X	X	X	X	X
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	LC	X	X		X			X
Cinclosomatidae									
Whipbirds, Wedgebills, Quail Thrushes									
<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush	LC		X		X			X
<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush	LC	X		X				
<i>Psophodes occidentalis</i>	Chiming Wedgebill	LC	X		X				X
Neosittidae									
Sittellas									
<i>Daphoenositta chrysoptera</i>	Varied Sittella	LC		X		X			X

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Pachycephalidae									
Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers									
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	LC	X	X	X	X	X	X	X
<i>Oreoica gutturalis</i>	Crested Bellbird	LC	X	X	X	X	X	X	X
<i>Pachycephala rufiventris</i>	Rufous Whistler	LC	X	X	X	X	X	X	X
Dicruridae									
Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo									
<i>Grallina cyanoleuca</i>	Magpie-lark	LC	X	X	X	X	X	X	X
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC							
<i>Rhipidura leucophrys</i>	Willie Wagtail	LC	X	X	X	X	X	X	X
Campephagidae									
Cuckoo-shrikes, Trillers									
<i>Coracina maxima</i>	Ground Cuckoo-shrike	LC	X			X	X	X	X
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC	X	X	X	X	X	X	X
<i>Lalage tricolor</i>	White-winged Triller	LC	X	X	X	X	X	X	X

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Artamidae									
Woodswallows, Butcherbirds, Currawongs									
<i>Artamus cinereus</i>	Black-faced Woodswallow	LC	X	X	X	X	X	X	X
<i>Artamus minor</i>	Little Woodswallow	LC				X	X		X
<i>Artamus personatus</i>	Masked Woodswallow	LC	X	X		X	X	X	X
Cracticidae									
Currawongs, Magpies & Butcherbirds									
<i>Cracticus nigrogularis</i>	Pied Butcherbird	LC	X	X	X	X	X	X	X
<i>Cracticus tibicen</i>	Australian Magpie	LC	X	X	X	X	X	X	X
<i>Cracticus torquatus</i>	Grey Butcherbird	LC	X	X	X	X	X	X	X
<i>Strepera versicolor</i>	Grey Currawong	LC				X		X	
Corvidae									
Ravens, Crows									
<i>Corvus bennetti</i>	Little Crow	LC	X		X	X	X	X	X
<i>Corvus orru</i>	Torresian Crow	LC	X	X		X	X		X

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Ptilonorhynchidae									
Bowerbirds									
<i>Ptilonorhynchus maculatus</i>	Western Bowerbird		X	X	X	X	X		X
Motacillidae									
Old World Pipits, Wagtails									
<i>Anthus australis</i>	Australian Pipit	LC	X	X	X	X	X	X	X
Estrilidae									
Grass Finches & Mannikins									
<i>Taeniopygia guttata</i>	Zebra Finch	LC	X	X	X	X	X	X	X
Dicaeidae									
Flowerpeckers									
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC				X	X	X	X
Hirundinidae									
Swallows, Martins									
<i>Cheramoeca leucosternus</i>	White-backed Swallow	LC	X		X	X	X	X	
<i>Hirundo ariel</i>	Fairy Martin	LC							
<i>Hirundo neoxena</i>	Welcome Swallow	LC	X	X	X	X	X		X
<i>Hirundo nigricans</i>	Tree Martin	LC	X				X	X	

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Sylviidae									
Old World Warblers									
<i>Cincloramphus cruralis</i>	Brown Songlark	LC	X					X	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC						X	
<i>Eremiornis carteri</i>	Spinifex-bird	LC	X						X

Mammalia

Tachyglossidae

Echidnas

<i>Tachyglossus aculeatus</i>	Echidna	LC	X	X	X	X		X	X
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Dasyuridae									
Carnivorans Marsupials									
<i>Antechinomys laniger</i>	Kultarr	LC				X	X		X
<i>Dasycercus blythi</i>	Brush-tailed Mulgara	P4 LC	X			X			X
<i>Ningai ridei</i>	Wongai Ningai	LC	X		X	X		X	X
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus	LC				X			X
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	LC	X					X	X
<i>Sminthopsis dolichura</i>	Little long-tailed Dunnart	LC				X	X		X
<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart	LC					X	X	X
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	LC	X		X	X	X	X	X
<i>Sminthopsis ooldea</i>	Ooldea Dunnart	LC	X		X			X	X
Macropodidae									
Kangaroos, Wallabies									
<i>Macropus robustus</i>	Euro	LC	X	X	X	X	X	X	X
<i>Macropus rufus</i>	Red Kangaroo	LC	X	X	X	X		X	X

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Emballonuridae									
Sheath-tailed Bats									
<i>Taphozous hilli</i>	Hill's Sheath-tail-bat	LC	X	X	X	X			
Molossidae									
Freetail Bats									
<i>Austronomus australis</i>	White-striped Freetail-bat	LC	X		X			X	
<i>Ozimops petersi</i>	Inland Freetail-bat	LC	X	X	X	X	X	X	
Vespertilionidae									
Ordinary Bats									
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	LC	X	X	X	X	X	X	X
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	LC	X		X	X		X	X
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	LC	X		X	X	X	X	X
<i>Vespadelus baverstocki</i>	Inland Forest Bat	LC							X
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat	LC	X	X	X	X	X		X

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Muridae									
Rats, Mice									
<i>Mus musculus</i>	House Mouse	Introduced	X		X	X	X	X	X
<i>Notomys alexis</i>	Spinifex Hopping-mouse	LC	X		X	X	X	X	X
<i>Pseudomys bolami</i>	Bolam's Mouse	LC							X
<i>Pseudomys desertor</i>	Desert Mouse	LC	X		X				X
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	LC	X		X	X	X	X	X
Canidae									
Dogs, Foxes									
<i>Canis lupus</i>	Dog/Dingo	Introduced	X	X	X	X			X
<i>Vulpes vulpes</i>	Red Fox	Introduced	X		X			X	
Felidae									
Cats									
<i>Felis catus</i>	Cat	Introduced	X	X	X	X	X	X	X

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Bovidae									
Horned Ruminants									
<i>Bos taurus</i>	European Cattle	Introduced	X	X	X	X			X
<i>Capra hircus</i>	Goat	Introduced		X					
<i>Ovis aries</i>	Sheep	Introduced	X		X				
Camelidae									
Camels									
<i>Camelus dromedarius</i>	Camel	Introduced		X		X		X	
Leporidae									
Rabbits, Hares									
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	X	X	X	X	X	X	X

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