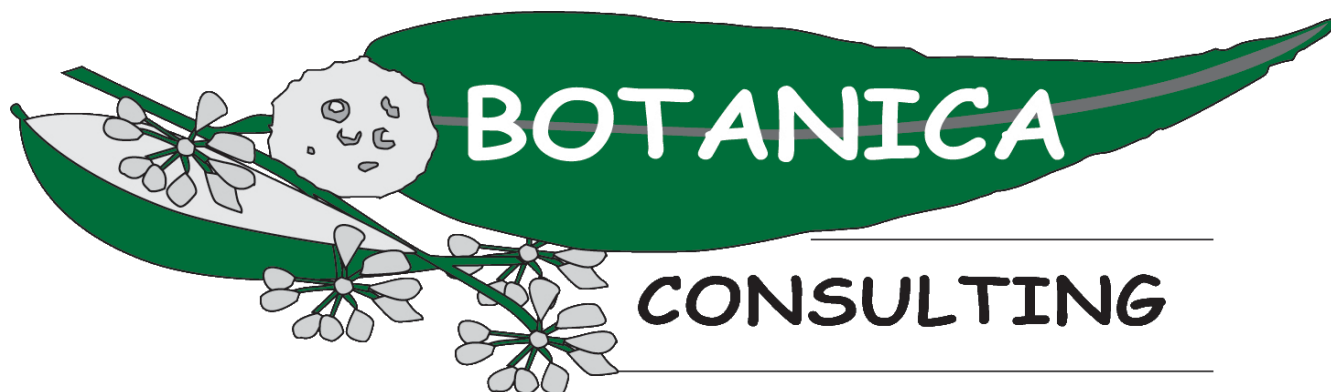




**Detailed Flora/ Vegetation Survey
& Basic Fauna Survey
Scotia Borefield
Prepared For
Bardoc Gold Limited**



**May 2021
Version 1**

**Prepared by:
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Glossary

Acronym	Description
ANCA	Australian Nature Conservation Agency.
BA	Birdlife Australia.
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i> , WA Government.
BC Act	<i>Biodiversity Conservation Act 2016</i> , WA Government.
Botanica	Botanica Consulting Pty Ltd.
BoM	Bureau of Meteorology.
CAMBA	<i>China Australia Migratory Bird Agreement 1998</i> .
DAFWA	Department of Agriculture and Food Western Australia (now known as DPIRD), WA Government.
DAWE	Department of Agriculture, Water and Environment, Australian Government.
DBCA	Department of Biodiversity, Conservation and Attractions, WA Government.
DMIRS	Department of Mines, Industry Regulation and Safety, WA Government
DotEE	Department of the Environment and Energy (now known as DAWE), Australian Government.
DPIRD	Department of Primary Industries and Regional Development, WA Government
DWER	Department of Water and Environmental Regulation, WA Government
EP Act	Environmental Protection Act 1986, WA Government.
EP Regulations	Environmental Protection (Clearing of Native Vegetation) Regulations 2004, WA Government.
EPA	Environmental Protection Authority, WA Government.
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> , 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	<i>Japan Australia Migratory Bird Agreement 1981</i> .
Km	Kilometer (1,000 meters).
MVG	Major Vegetation Groups.
NVIS	National Vegetation Information System.
PEC	Priority Ecological Community.
ROKAMBA	<i>Republic of Korea-Australia Migratory Bird Agreement 2007</i> .
SRE	Short Range Endemic.
SSC	Species Survival Commission, International.
TEC	Threatened Ecological Community.
WA	Western Australia.
WAHERB	Western Australian Herbarium.

Executive Summary

Botanica Consulting Pty Ltd (Botanica) was commissioned by Bardoc Gold Limited (Bardoc) to undertake a detailed flora/ vegetation survey and basic fauna survey of the Scotia Borefield (referred to as the 'survey area'). The survey area is located adjacent to the Goldfields Highway approximately 47km north of Kalgoorlie-Boulder, Western Australia. The survey area covers an approximate area of 2,670 ha, encompassing a 46 ha area containing the Scotia Borefield alignment (referred to as the 'target survey area') and a 500m radius of the target survey area. The survey was conducted between the 1st and the 9th September 2020.

Nine floristic groups were identified within the survey area. These vegetation units were located within four different landform types and comprised of four major vegetation groups, which were represented by a total of 132 Taxa. The broad scale terrestrial fauna habitats within the survey area have been identified as comprising a mosaic of clay-loam plains, open depressions, sand-loam plains and greenstone rocky hillslopes.

Results of the literature review identified 32 mammals (including 11 bat species), 108 birds, 75 reptiles and 5 frog species that have previously been recorded in the general area, some of which have the potential to occur, subject to the identified habitats being suitable.

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

One Threatened Fauna species listed under the BC Act and EPBC Act was identified within the survey area; Malleefowl (*Leipoa ocellata*). Three Malleefowl mounds were recorded within the survey area, with one mound identified as inactive and two mounds identified as active/ recently active.

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

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) listed under the *Environmental Protection (EP) Act 1986*. The survey area is not located within a gazetted conservation reserve or however DBCA managed land; ex. Goongarrie Station UCL (LR3068/801) is located approximately 74m north of the northern extremity of the survey area.

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 vegetation ranged from 'good' to 'very good'. Three introduced flora were identified within the survey area, none of which are listed as a Declared Plant under the *Biosecurity and Agriculture Management Act 2007*.

1 Introduction

1.1 Project Description

Botanica Consulting Pty Ltd (Botanica) was commissioned by Bardoc Gold Limited (Bardoc) to undertake a detailed flora/ vegetation survey and basic fauna survey of the Scotia Borefield (referred to as the 'survey area'). The survey area is located adjacent to the Goldfields Highway approximately 47km north of Kalgoorlie-Boulder, Western Australia (Figure 1-1). The survey area covers an approximate area of 2,670 ha, encompassing a 46 ha area containing the Scotia Borefield alignment (referred to as the 'target survey area') and a 500m radius of the target survey area (Figure 1-2). The survey was conducted between the 1st and the 9th September 2020.

1.2 Objectives

The flora assessment was conducted in accordance with *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016). The objectives of the assessment were to:

- Conduct a desktop review of available technical reports, relevant databases and spatial data to identify the potential flora and vegetation that may be present;
- Identify significant flora, vegetation/ecological communities potentially occurring in the area;
- Conduct a detailed flora and vegetation survey and targeted searches for populations of significant flora;
- 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;
- Review the local and regional significance of flora and vegetation within the survey area;
- Assess the survey area's plant species diversity, density, composition, structure and weed cover, using NVIS classification system for vegetation description; and
- 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 to the Commonwealth Department of Agriculture, Water and the Environment (DAWE).

The fauna assessment was conducted in accordance with the requirements of a basic terrestrial fauna survey as defined in *Technical Guidance – Terrestrial Fauna Surveys for Environmental Impact Assessment – June 2020* (EPA, 2020). 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.

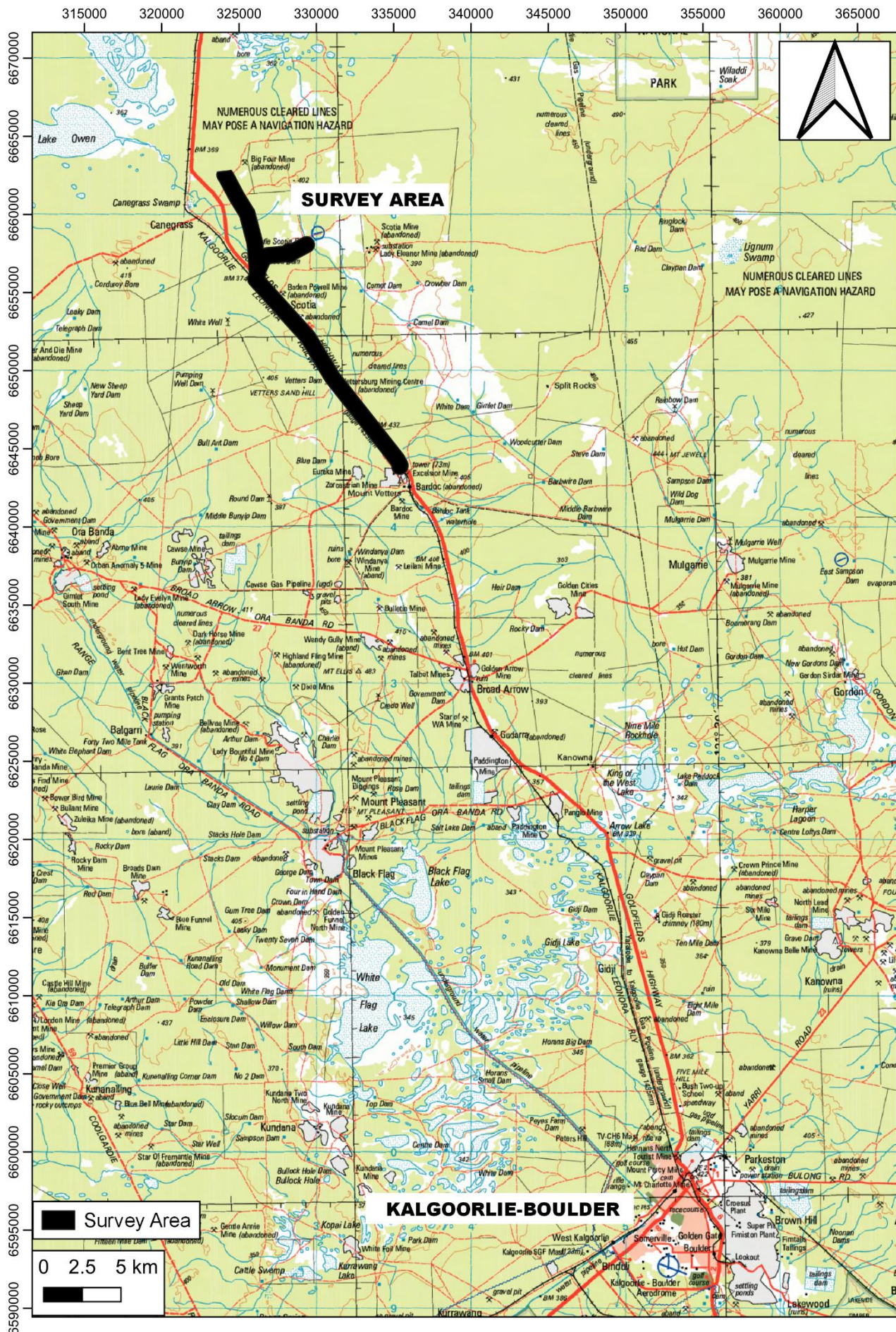


Figure 1-1: Regional map of the survey area



Figure 1-2: Survey Area

2 Regional Biophysical Environment

2.1 Regional Environment

The survey area is located near the boundary of the Coolgardie Bioregion of the South-West Interzone and the Murchison Bioregion of the Eremaean Province. The Coolgardie and Murchison Bioregions are further divided into subregions, based on the Interim Biogeographic Regionalisation of Australia (IBRA), with the survey area located within the Eastern Murchison (MUR1) subregion and approximately 9km north of the Eastern Goldfields (COO3) subregion as shown in Figure 2-1.

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

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

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



Figure 2-1: Map of Interim Biogeographic Regionalisation of Australia (IBRA)

2.2 Soils and Landscape Systems

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

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

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

Soil Landscape System	Description
Bevon System	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.
Bunyip System	Gilgaied drainage tract, draining greenstone hills supporting mixed halophytic shrublands occasionally with a black oak overstorey.
Campsite System	Alluvial plains supporting eucalypt woodlands with halophytic understoreys and acacia shrublands.
Doney System	Calcareous alluvial plains with eucalypt woodlands adjacent to salt lake systems.
Gundockerta System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.
Llaara System	Plains with ironstone gravel or calcrete mantles supporting eucalypt woodlands and mulga-casuarina shrublands.
Laverton System	Greenstone hills and ridges with acacia shrublands.
Leonora System	Low greenstone hills and stony plains supporting mixed chenopod shrublands.
Moriarty System	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.

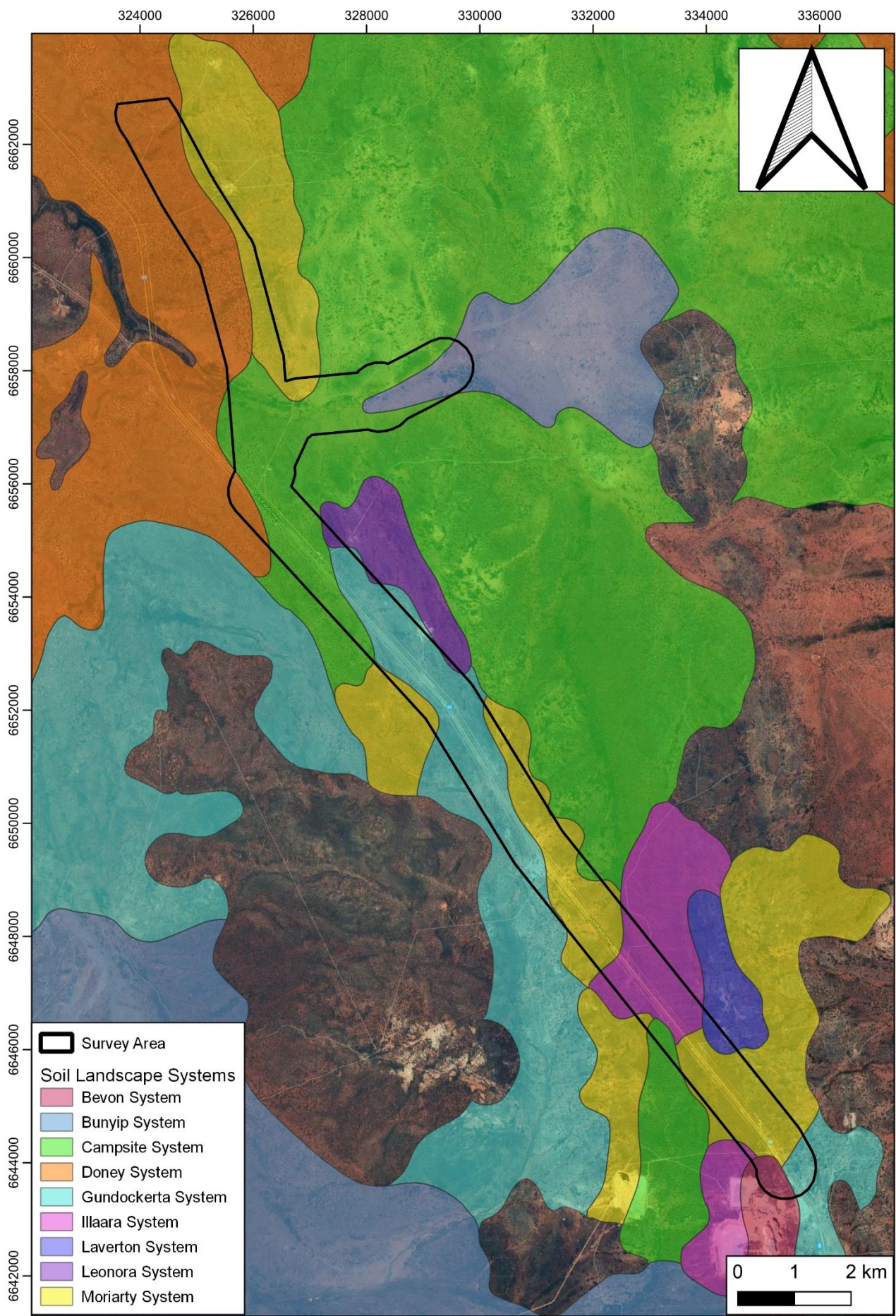


Figure 2-2: Map of Soil Landscape Systems within the survey area

2.3 Remnant Vegetation

The Department of Primary Industries and Regional Development GIS file (DPIRD, 2018) indicates that the survey area is located within the Barlee 10, 521 and 2903 vegetation associations (Figure 2-3). The remaining extent of these vegetation associations as reported in the *2018 Statewide Vegetation Statistics* (DBCA, 2019) is provided in Table 2-2.

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). Vegetation within the survey area retains >96% of its pre-European extent within Western Australia.

Table 2-2: Remaining Beard Vegetation Associations within the survey area (DBCA, 2019)

Region	Pre-European Extent (Ha)	Current Extent (Ha)	Pre-European extent remaining (%)	% of Current extent within DBCA managed lands
Barlee 10: Medium woodland; red mallee group				
Eastern Goldfields	0	0	0	0
Eastern Murchison	65,388	64,757	99.04	0
Western Australia	65,388	64,757	99.04	0
Barlee 521: Medium woodland; salmon gum & red mallee				
Eastern Goldfields	0	0	0	0
Eastern Murchison	11,712	11,712	100.00	0
Western Australia	11,712	11,712	100.00	0
Barlee 2903: Medium woodland; Salmon gum, goldfield blackbutt, gimlet & <i>Casuarina pauper</i>				
Eastern Goldfields	14	14	100.0	0
Eastern Murchison	28,295	27,317	96.5	0
Western Australia	28,309	27,331	96.5	0

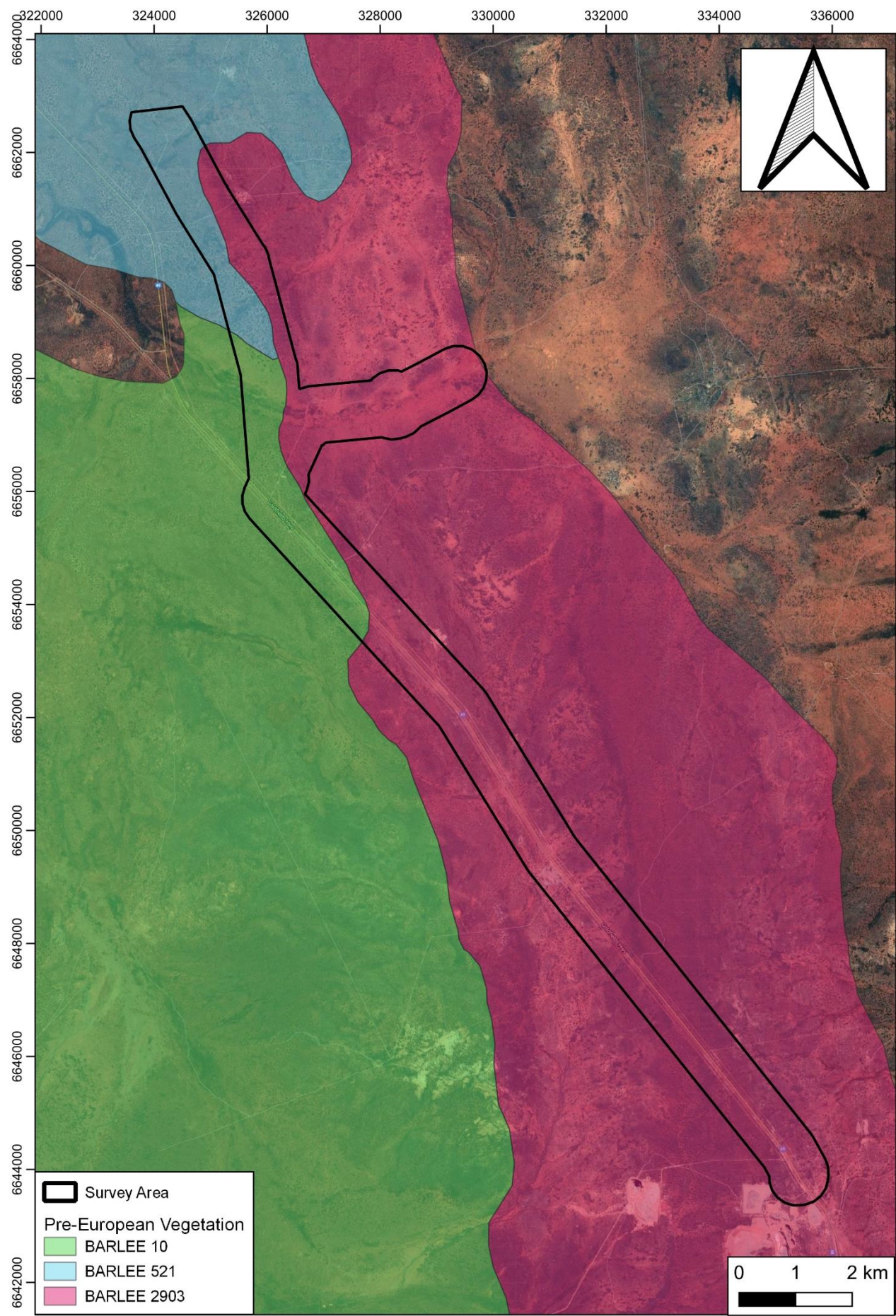


Figure 2-3: Pre-European Vegetation Associations within the survey area

2.4 Climate

The climate of the Eastern Goldfields subregion is characterised as an arid to semi-arid climate with annual rainfall of approximately 200-300 mm (Beard, 1990; Cowan, 2001a). The climate of the Eastern Murchison subregion is characterised as an arid climate (Beard, 1990; Cowan, 2001b). Rainfall data for the Kalgoorlie airport weather station (#12038) located approximately 47km south of the survey area is shown in Figure 2-4 (BoM, 2020a). Mean monthly rainfall ranges from 31.2 mm in February to 13.7 mm in September, whilst the mean annual rainfall is 266.1 mm. Rainfall has been below average since February 2020.

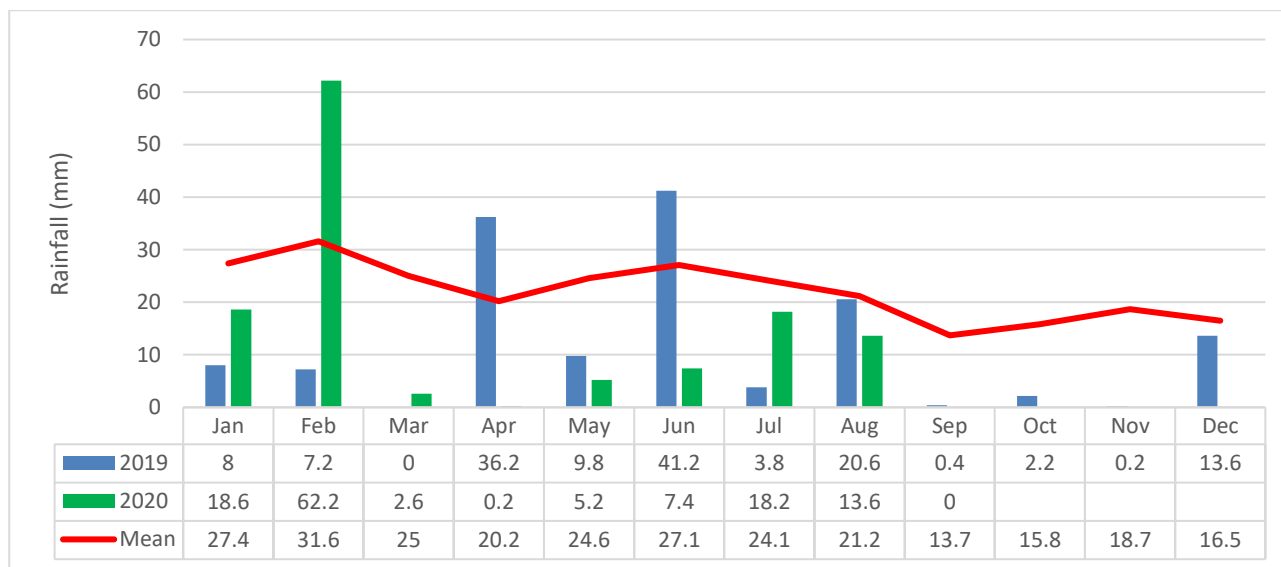


Figure 2-4: Monthly rainfall for the Kalgoorlie airport weather station #12038 (BoM, 2020a)

2.5 Hydrology

According to the Geoscience Australia database (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however multiple minor ephemeral drainage lines intersect the survey area (Figure 2-5). The northern extremity of the survey area is located approximately 2km south of Lake Goongarrie.

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or woodlands that use groundwater either opportunistically or as their primary water source. For the purposes of this report, a GDE is defined as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency. According to the BoM *Atlas of Groundwater Dependent Ecosystems* (BoM, 2020b) database, there are eight potential terrestrial GDEs which intersect the survey area, described below in Table 2-3 and spatially in Figure 2-5.

Table 2-3: Potential Terrestrial Groundwater Dependent Ecosystems (BoM, 2020b)

GDE Description	Potential GDE (according to BoM, 2020b)
Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.	Low potential GDE
Greenstone hills and ridges with acacia shrublands.	Low potential GDE
Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.	Low-Moderate potential GDE
Low greenstone hills and stony plains supporting mixed stony chenopod shrublands.	Moderate potential GDE
Plains with ironstone gravel or calcrete mantles supporting eucalypt woodlands and mulga-casuarina shrublands.	Moderate potential GDE
Alluvial plains, supporting eucalypt woodlands with halophytic understoreys and acacia shrublands.	High potential GDE
Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.	High potential GDE
Calcareous plains with eucalypt woodlands adjacent to salt lake systems.	High potential GDE

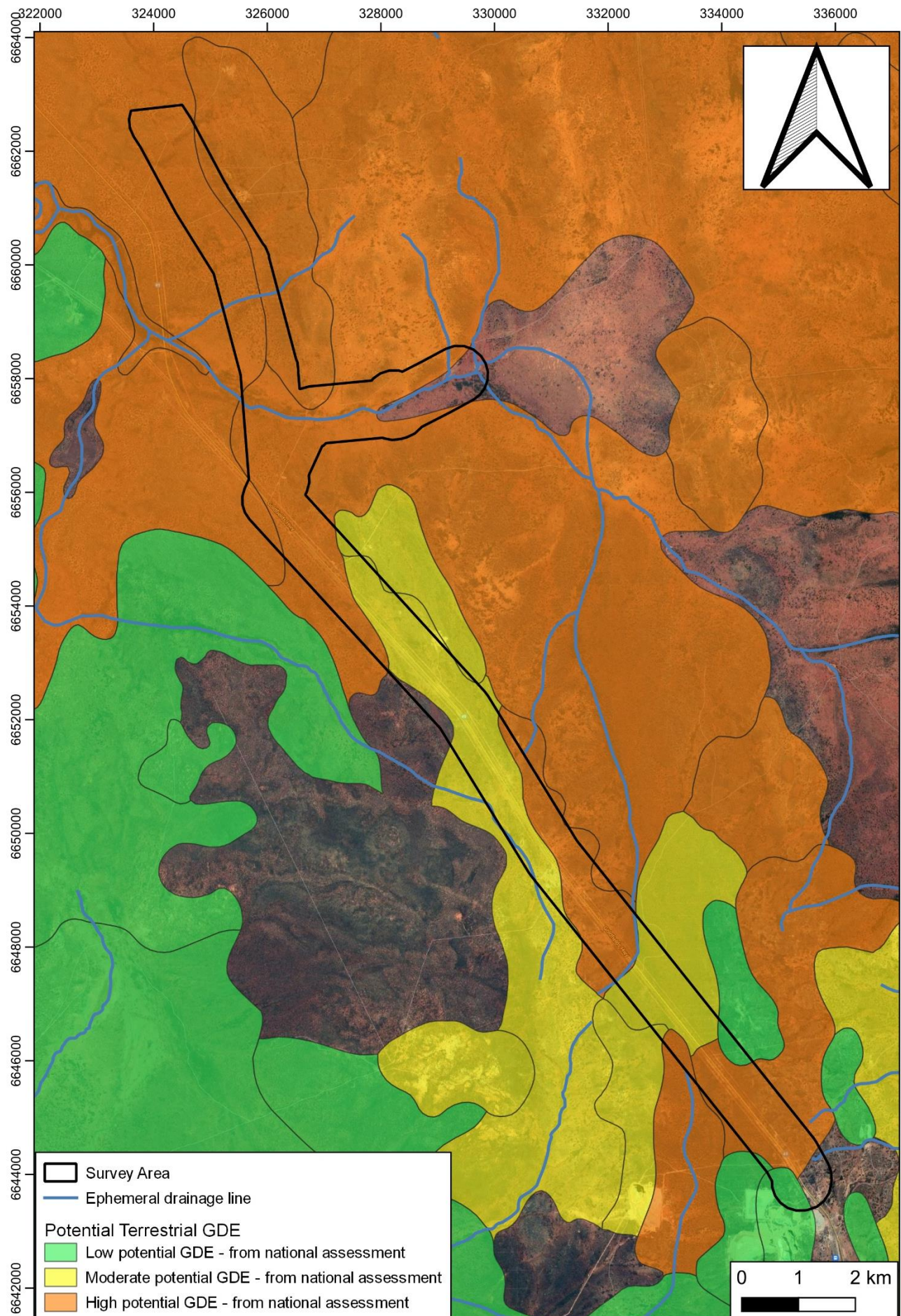


Figure 2-5: Hydrology of the survey area

2.6 Land Use

The dominant land uses of the Eastern Goldfields subregion include Unallocated Crown Land and Crown Reserves, grazing-native pastures-leasehold, freehold, conservation and mining leases (Cowan, 2001). The dominant land uses of the Eastern Murchison subregion include grazing native pastures (85.5%), unallocated crown reserves (11.3%), conservation (1.4%) and mining (1.8%) (Cowan, 2001). The survey area is located within the Mt Vettors Station Pastoral Lease.

3 Survey Methodology

3.1 Desktop Assessment

3.1.1 Literature Review

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

- Alexander Holm & Associates (2012). Environmental Assessment: Aphrodite Haul Road.
- Alexander Holm & Associates (2020a). Environmental Assessment: Goldfields Road and Rail Diversion.
- Alexander Holm & Associates (2020b). Environmental Assessment: Aphrodite to Bardoc Haul Road.
- Alexander Holm & Associates (2020c). Environmental Assessment: Aphrodite Haul Road.
- Bamford Consulting Ecologists (2012). Fauna Assessment of the Excelsior Gold Bardoc Project.
- Botanica Consulting (2011). Lignum Dam Tenement E24/146 Level 1 Flora and Vegetation Survey.
- Botanica Consulting (2012). Mt Jewel Haul road Level 2 Flora and Vegetation Survey.
- Botanica Consulting (2016). Level 1 Flora & Vegetation Survey of the Carbine Mining Area.
- Botanica Consulting (2020a), Reconnaissance Flora/ Vegetation & Fauna Survey Mulgarrie Project
- Botanica Consulting (2020b), Reconnaissance Flora & Fauna Survey Ora Banda Region.
- McKenzie, N.L. and Hall, N.J. (1992). The Biological Survey of the Eastern Goldfields of WA - Pt 8: Kurnalpi – Kalgoorlie study area. Records of the WAM, Supplement 41: 1 – 125.
- Woodman Environmental (2017). Aphrodite Gold Deposit Level 2 Flora and Vegetation Assessment.

3.1.2 Database Searches

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

- DBCA Priority/ Threatened Flora Database Search (DBCA, 2019a)
- DBCA Priority/ Threatened Ecological Communities Database Search (DBCA, 2019b)
- DBCA NatureMap Database (DBCA, 2020a)
- DAWE Protected Matters search tool (DAWE, 2020a).

The DBCA Priority/ Threatened Flora Database Search and Priority/ Threatened Ecological Communities Database Search were conducted within a 50km radius of the survey area (DBCA, 2019a; DBCA, 2019b).

The NatureMap and Protected Matters Search were conducted for an area encompassing a 40km radius of the centre coordinates -30.2414S 121.2219E. It should be noted that these lists are based on observations from a broader area than the assessment area (40km radius) and therefore may

include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct. Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

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

- *Environment Protection and Biodiversity and Conservation (EPBC) Act 1999*. Administered by the Australian Government (DAWE);
- *Biodiversity Conservation (BC) Act 2016*. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and
- Priority Flora/ Fauna list. A non-legislative list maintained by DBCA for management purposes (fauna list released January 2019; flora list released December 2018).

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

- Japan Australia Migratory Bird Agreement 1981 (JAMBA)¹;
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

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

¹ Most but not all species listed under JAMBA are also specially protected under Specially Protected Species of the BC Act.

3.2 Flora Field Assessment

Botanica conducted a detailed flora/ vegetation survey of the 2,670 ha survey area and a targeted flora survey of the area containing the Scotia Borefield alignment (approximately 46 ha) between the 1st to 9th September 2020.

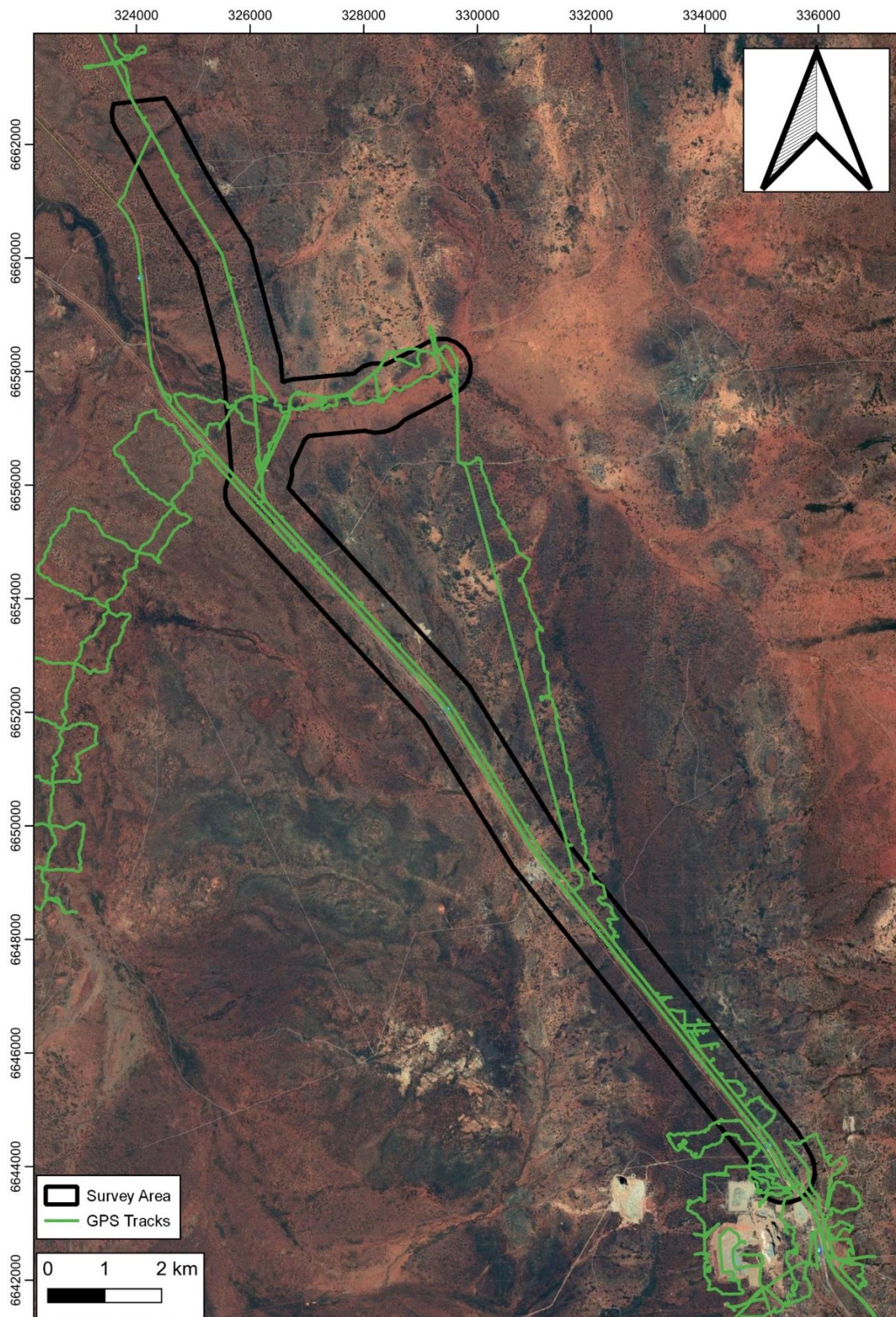


Figure 3-1: Survey area boundary and GPS tracks traversed throughout the survey area

3.2.1 Vegetation Mapping

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 vegetation communities. At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum (including height and percentage cover of dominant taxa);
- 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 significance if encountered.

Vegetation was mapped in accordance with existing vegetation mapping conducted by Alexander Hold & Associates, with vegetation types classified by floristic group in accordance with NVIS classifications.

3.2.2 Flora Identification

Unknown specimens collected during the survey were identified by Jim Williams with the aid of samples housed at the Botanica Herbarium and WA Herbarium.

3.2.3 Sampling Quadrats

A total of 91 quadrats (20m X 20m) were established within both the survey area and local area. A map of all quadrats included in the statistical analysis (including 34 quadrats located within the boundary of the survey area and 57 quadrats located outside of the survey area) is provided in Figure 3-1.

The quadrats were established by inserting metal pickets in each corner, and measuring the length of the resultant boundaries to verify the quadrats were 20 m x 20 m (square quadrats). Following their establishment and boundary verification, the location of each quadrat was recorded by GPS (Appendix 4) and photographed from the north-west corner of the quadrat (Appendix 7). All vascular plants within the quadrat were recorded (Appendix 6).

This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa. Unknown taxa were identified using Botanica's own reference herbarium and relevant taxonomical keys. Data on level of disturbance, presence of coarse fragments on surface, topographical position, elevation, aspect, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), soil types (colour, profile, field texture and surface type), and vegetation structure were collected from each quadrat (Appendix 6). Methods of recording data from these quadrats largely follow those outlined in CSIRO's *Australian Soil and Land Survey Field Handbook* (McDonald *et al.* 1998) and in accordance with current EPA Guidelines (2016).

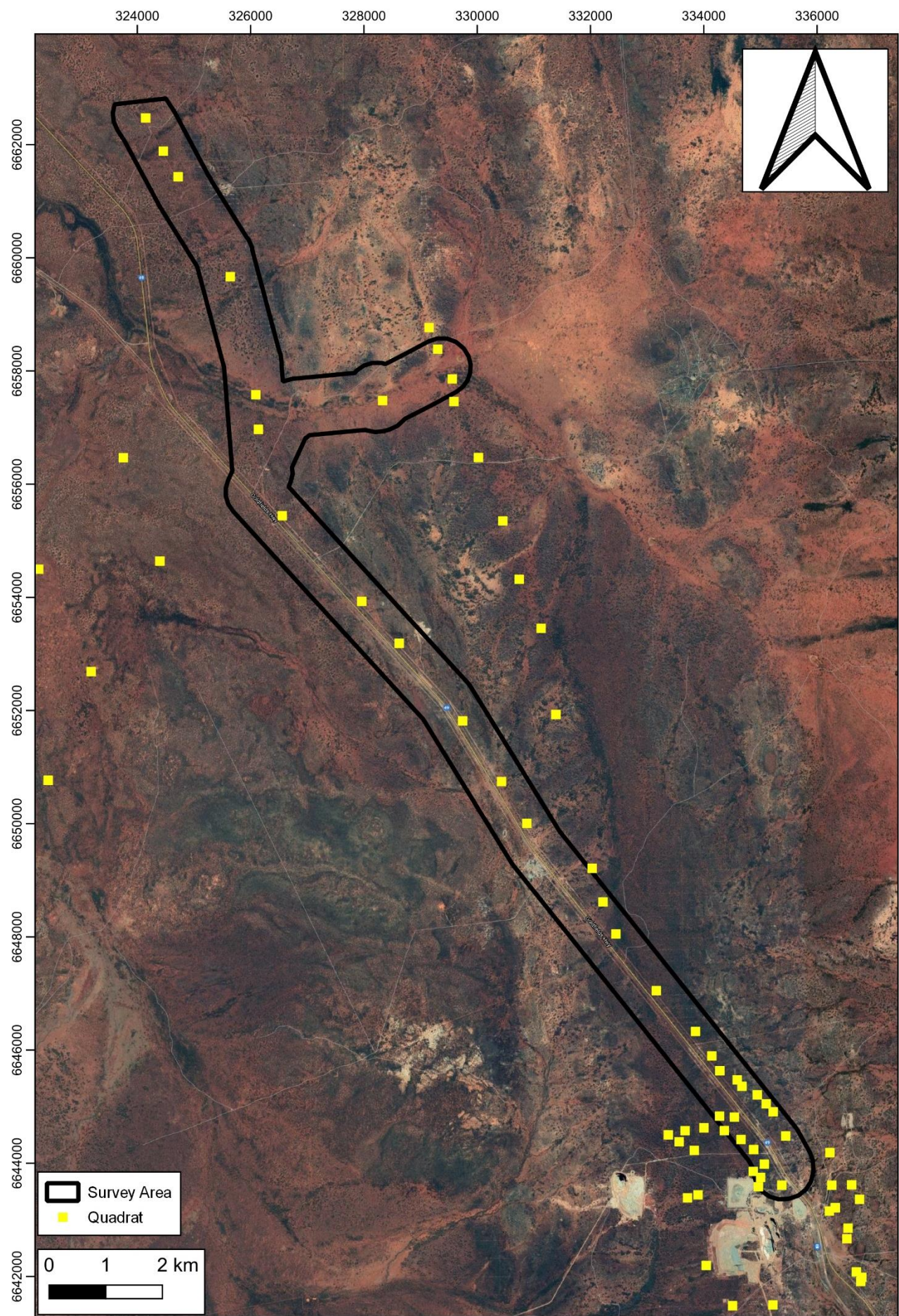


Figure 3-2: Location of quadrats in relation to the survey area

3.2.4 Targeted Searches

Suitable habitats for significant flora were systematically searched by Botanica staff members to identify and record the locations of Threatened and Priority Flora. Any locations of Threatened and Priority Flora were recorded using a hand-held GPS and a simple plant count (not differentiated between juvenile/mature plants, flowering or non-flowering plants) was conducted.

3.3 Data Analysis Tools

At the completion of the survey effort, the data obtained was analysed to generate a vegetation map (Figure 4-1) and complete list of flora species (Appendix 3). The statistical program PATN was used to assess species composition of the quadrats (Appendix 8).

3.3.1 PATN Analysis

The PATN software package was used to assess the similarities/ dissimilarities between quadrats based on presence/ absence of species.

Annual taxa were removed from the data prior to analysis (total of 6 annual taxa). Species reconciliation eliminated those sterile taxa that could not be fully identified from the analysis (4 taxa), and reconciled subsp. and/or variant taxa (2 taxa). Singleton taxa were included in the analysis. 112 perennial taxa were included in the final analysis.

The analysis produced a quantitative estimate of the relationship between species composition of each quadrat. The classifications were based upon a Bray-Curtis association matrix using a flexible Unweighted Pair Group Arithmetic Mean (UPGMA) method (with a beta value of -0.1) which standardises the data enabling the analysis to be completed. Semi-strong hybrid (SSH) ordination of the quadrat is then undertaken to show spatial relationships between groups and to elucidate possible environmental correlates with the classification.

The analysis also produced a stress value which is a measure of the 'strength' of the analysis (i.e. how well the quadrats are grouped together into the appropriate floristic groups). The lower the stress value the greater the strength of the analysis with a value of less than 0.3 showing that the analysis appropriately grouped quadrats. A stress value greater than 0.3 suggests that the analysis was unable to group quadrats appropriately due to extraneous variables (i.e. other factors influencing differences in floristic groups other than species composition e.g. fire, clearing disturbance etc.).

3.3.2 EstimateS

EstimateS software was used to estimate species richness present using the Chao2 richness estimator. For any number of samples, the estimator uses the existing pattern of species accumulation to estimate the true number of species at a site. The estimators tend to under-estimate species number when sample size is small, hence the estimated number of true species can be seen to increase with sample size. This software was also used to compute Coleman rarefaction curves estimates which were used to calculate species accumulation curves.

3.4 Fauna Field 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 including 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.

3.4.1 Targeted Fauna Survey

Suitable Malleefowl habitat within the survey area was systematically searched on foot and by ATV by two Botanica staff members to identify and record the locations of any Malleefowl activity (i.e. mounds, footprints and feathers). Any locations/ observations of Malleefowl activity were recorded using a hand-held GPS. Locations of existing Malleefowl mounds in the local area were also visited and motion sensor cameras were installed to assess any Malleefowl activity at existing mounds in the local area.

3.5 Personnel involved

Jim Williams	- Environmental Consultant/ Director (Diploma of Horticulture)
Greg Harewood	- Zoologist (BSc Zoology)
Lauren Pick	- Senior Environmental Consultant (BSc Zoology & Conservation Biology)
April Slater	- Graduate Environmental Consultant (BSc Conservation)

3.5.1 Scientific licences

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

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

3.6 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 3-2.

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

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

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

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

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot. Numerous tracks were located within the survey area, providing ease of access.
Competency/ Experience	Not a constraint	The BC personnel that conducted the survey were regarded as suitably qualified and experienced. Coordinating Botanist/ Zoologist: Jim Williams Data Interpretation: Jim Williams, Greg Harewood and Lauren Pick
Timing of survey, weather & season	Minor constraint	Fieldwork was not undertaken within EPA's recommended primary survey time period for the Eremaean Province (i.e., 6-8 weeks following winter rainfall) but was conducted during the EPA recommended timing for the South-West Interzone (i.e. September to November) and during optimal flowering period for Eucalypt Woodland vegetation. Rainfall for the Kalgoorlie-Boulder region has been below average since February 2020.
Area disturbance	Not a constraint	The area has been disturbed from pastoral land use, exploration, mining, road and rail development; however, vegetation was mostly intact and comprised of native vegetation.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/ significance of the area with a detailed flora/ vegetation survey and basic fauna survey completed to identify vegetation types/fauna habitats and conservation significant species/communities over the survey area.
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 DAWE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Botanica 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 Botanica, the survey area was covered sufficiently in order to identify vegetation assemblages and fauna habitats. Limited annual species were present during the survey and many of the plants were not in flower; However, previous species identification from previous surveys conducted supplemented the current assessment. 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. Vegetation types identified were categorised via comparison to vegetation distributions throughout WA specified in the NVIS Major Vegetation Groups (DotEE, 2017b).

4 Results

4.1 Desktop Assessment

4.1.1 Flora and Vegetation

According to the results of the NatureMap search (DBCA, 2020a), a total of 597 flora taxa have been recorded within a 40 km radius of the survey area. Dominant genera include *Acacia*, *Eremophila* and *Eucalyptus*.

Results of database searches/ literature review identified twenty-one introduced taxa as potentially occurring within a 40 km radius of the survey area (Table 4-1). According to the Department of Primary Industries and Regional Development Western Australian Organism List (DPIRD, 2020) two taxa are listed as a Declared Pest under the *Biosecurity and Agriculture Management (BAM) Act 2007*. One taxon is listed as a Weed of National Significance (WoNS) by the DAWE (DAWE, 2020b).

Table 4-1: Introduced flora potentially occurring within the survey area

Introduced Taxon	Common Name	WAOL Status	WoNS
<i>Agave americana</i>	Century Plant	Permitted - s11	
<i>Carrichtera annua</i>	Wards Weed	Permitted - s11	
<i>Carthamus lanatus</i>	Saffron Thistle	Permitted - s11	
<i>Cenchrus ciliaris</i>	Buffel Grass	Permitted - s11	
<i>Conyza bonariensis</i>	Flaxleaf Fleabane	Permitted - s11	
<i>Cucumis myriocarpus</i>	Prickly Paddy Melon	Permitted - s11	
<i>Dittrichia graveolens</i>	Stinkwort	Permitted - s11	
<i>Echium plantagineum</i>	Paterson's Curse	Declared Pest - s22(2)	
<i>Erodium aureum</i>		Permitted - s11	
<i>Erodium cicutarium</i>	Common Storksbill	Permitted - s11	
<i>Hypochaeris glabra</i>	Smooth Catsear	Permitted - s11	
<i>Malva parviflora</i>	Marshmallow	Permitted - s11	
<i>Oligocarpus calendulaceus</i>		Permitted - s11	
<i>Opuntia elata</i>	Prickly Pear	Declared Pest - s22(2)	Yes
<i>Ricinus communis</i>	Castor Oil Plant	Permitted - s11	
<i>Rostraria pumila</i>		Permitted - s11	
<i>Rumex hypogaeus</i>		Permitted - s11	
<i>Salvia verbenaca</i>	Wild Sage	Permitted - s11	
<i>Schismus arabicus</i>	Araby Grass	Permitted - s11	
<i>Solanum nigrum</i>	Black Berry Nightshade	Permitted - s11	
<i>Sonchus oleraceus</i>	Common Sowthistle	Permitted - s11	

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2019a), NatureMap search (DBCA, 2020a) and DAWE protected matters search (DAWE, 2020a) recorded no Threatened Flora or Priority Flora species within the survey area. Three Threatened flora and twenty-four Priority Flora were listed in the databases/literature review as occurring within a 50 km radius of the survey area (map of flora locations provided in Appendix 2). These taxa were assessed and ranked for their likelihood of occurrence² 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.

² Based on habitat descriptions provided by the WA Herbarium (Florabase) and habitat descriptions provided in previous records listed on the DBCA Threatened Flora Database (DBCA, 2019a)

Table 4-2: Threatened and Priority Flora within 50km of the survey area

Taxon	EPBC Act	BC Act	Priority Rating	Habitat Description-Florabase (WAHERB, 2020)	Habitat Description-DBCA Record (DBCA, 2019a)	Likelihood of Occurrence
<i>Acacia epedunculata</i>	-	-	P1	Yellow sand. Sandplains	No description available	Unlikely
<i>Acacia eremophila</i> var. <i>variabilis</i>	-	-	P3	Sandy or sandy loam.	N/A. No records on DBCA database search within 50km of survey area.	Possible
<i>Alyxia tetanifolia</i>	-	-	P3	Sandy clay, loam, concretionary gravel. Drainage lines, near lakes.	Brown sandy clay, between lake edge and gum belt.	Unlikely
<i>Angianthus prostratus</i>	-	-	P3	Red clay or loamy soils. Saline depressions.	Red loamy soil.	Unlikely
<i>Calandrinia quartzitica</i>	-	-	P1	No description available.	Lower slopes of hummocky quartz strewn hills and adjoining flats on lake edge. Scattered quartz stones-rocks. Brown silty-sandy clay	Unlikely
<i>Chrysocephalum apiculatum</i> subsp. <i>norsemanense</i>	-	-	P3	No description available.	N/A. No records on DBCA database search within 50km of survey area.	Not determined. No habitat description available
<i>Conostylis lepidospermoides</i>	EN	VU	-	Grey or yellow-brown sand over laterite.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely ³
<i>Elatine macrocalyx</i>	-	-	P3	Shallow sands over clay. Margins of playa lakes and clay pans.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
<i>Eleocharis papillosa</i>	VU	-	P3	Red clay over granite, open clay flats. Claypans.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
<i>Eremophila praecox</i>	-	-	P1	Red/brown sandy loam. Undulating plains.	Low plain. Moist red/brown loam.	Possible
<i>Eucalyptus educta</i>	-	-	P2	Shallow soils. Granite rocks.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely

³ Potential incorrect listing. Listed on NatureMap database but only known to occur within Mallee and Esperance IBRA bioregions (within Frank Hann National Park)

Taxon	EPBC Act	BC Act	Priority Rating	Habitat Description-Florabase (WAHERB, 2020)	Habitat Description-DBCA Record (DBCA, 2019a)	Likelihood of Occurrence
<i>Eucalyptus jutsonii</i> subsp. <i>jutsonii</i>	-	-	P4	Red to pale orange deep sands. Undulating areas and on dunes.	Red sandy soil.	Unlikely
<i>Eutaxia rubricarina</i>	-	-	P3	Gravelly sand, grey to pinkish-white sandy clay, red loam. Flats, slopes, valley floors, road verges.	N/A. No records on DBCA database search within 50km of survey area.	Possible
<i>Homalocalyx grandiflorus</i>	-	-	P3	Yellow sand. Sandplains.	Orange sand dune.	Unlikely
<i>Hysterobaeckea ochropetala</i> subsp. <i>cometes</i>	-	-	P3	No description available.	N/A. No records on DBCA database search within 50km of survey area.	Not determined. No habitat description available
<i>Newcastelia insignis</i>	-	-	P2	Red or yellow sandy soils.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
<i>Notisia intonsa</i>	-	-	P3	No description available.	Lake shore, moist red sand.	Unlikely
<i>Persoonia leucopogon</i>	-	-	P1	Yellow sand or sandy clay.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
<i>Philothea coateana</i>	-	-	P3	Red sand.	Breakaway.	Unlikely
<i>Ptilotus chortophytus</i>	-	-	P1	No description available.	Small quartz outcrop which is surrounded by a salt claypan.	Unlikely
<i>Ptilotus rigidus</i>	-	-	P1	No description available.	No description available	Not determined. No habitat description available
<i>Rhodanthe uniflora</i>	-	-	P1	Brown earth. Open eucalyptus woodland.	No description available	Possible
<i>Ricinocarpus brevis</i>	EN	EN	-	Rocky hillslopes, rock outcrops.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely ⁴
<i>Ricinocarpus digynus</i>	-	-	P1	No description available.	Rocky hillslope. Rocky surface. Red-brown sand-loam over felsic and mafic volcanics.	Possible

⁴ Currently only known from Diemals, Perrinvale and Windarling Range

Taxon	EPBC Act	BC Act	Priority Rating	Habitat Description-Florabase (WAHERB, 2020)	Habitat Description-DBCA Record (DBCA, 2019a)	Likelihood of Occurrence
<i>Sowerbaea multicaulis</i>	-	-	P4	Yellow-brown sand.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely
<i>Thryptomene eremaea</i>	-	-	P2	Red or yellow sand. Sandplains.	N/A. No records on DBCA database search within 50km of survey area.	Unlikely

4.1.2 Fauna

According to the results of the NatureMap search (DBCA, 2020a) a total of 225 vertebrate fauna taxa have been recorded within a 40 km radius of the survey area including 4 amphibians, 122 bird species, 26 mammals and 73 reptiles. Combined results of database searches (DBCA, 2020a and DAWE, 2020a) identified thirteen introduced taxa as potentially occurring within a 40 km radius of the survey area (Table 4-3).

Table 4-3: Introduced fauna potentially occurring within the survey area

Introduced Taxon	Common Name
<i>Camelus dromedarius</i>	Camel
<i>Canis lupus familiaris</i>	Dog
<i>Capra hircus</i>	Goat
<i>Columbia livia</i>	Rock Pigeon
<i>Equus asinus</i>	Donkey
<i>Equus caballus</i>	Horse
<i>Felis catus</i>	Cat
<i>Hemidactylus frenatus</i>	Asian House Gecko
<i>Mus musculus</i>	House Mouse
<i>Oryctolagus cuniculus</i>	Rabbit
<i>Streptopelia chinensis</i>	Spotted Turtle-Dove
<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove
<i>Vulpes vulpes</i>	Red Fox

The results of the literature review, NatureMap search (DBCA, 2020a) and DAWE protected matters search (DAWE, 2020a) recorded six Threatened fauna, one other specially protected fauna, four Priority Flora and various migratory birds as occurring within a 50 km radius of the survey area. These taxa were assessed and ranked for their likelihood of occurrence within the survey area. 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 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 4-4: Threatened and Priority Fauna within 50km of the survey area

Species	Conservation Status			Habitat Description	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA Priority		
Malleefowl <i>Leipoa ocellata</i>	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species (DAWE, 2020c).	Known to Occur. Three Malleefowl mounds previously recorded within the survey area.
Migratory Shorebirds (Various species)	MI	IA	-	Migratory shorebirds generally prefer muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, salt pans and hypersaline salt lakes inland (DAWE, 2020c).	Would not occur. No suitable habitat.
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	-	Diverse from rainforest to arid shrublands, from coastal heath to alpine. Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Birdlife Australia, 2020).	Possibly occurs however generally uncommon. Area may represent part of a larger home range used by individuals of this species.
Grey Falcon <i>Falco hypoleucos</i>	-	VU	-	The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter (DAWE, 2020c).	Unlikely to occur. Outside of current documented distribution.
Grey Wagtail <i>Motacilla cinerea</i>	MI	IA	-	Running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Morecombe 2004).	Would not occur. Never recorded in goldfields region.
Hooded Plover <i>Thinornis rubricollis</i>	-	-	P4	Densities are lowest on narrow, steep beaches, where there are few or no dunes, and where human activities are most intensive. In the south-west, they also occur on inland salt lakes (Birdlife Australia, 2020).	Would not occur. No suitable habitat.
Blue Billed Duck <i>Oxyura australis</i>	-	-	P4	Well vegetated freshwater swamps, large dams and lakes, winters on more open water. Occasionally salt lakes and estuaries freshened by floodwaters.	Would not occur. No suitable habitat. Outside of current documented distribution.
Princess Parrot <i>Polytelis alexandrae</i>	VU	-	P4	Inhabits sand dunes and sand flats in the arid zone of western and central Australia. It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of <i>Eucalyptus</i> (including <i>E. gongylocarpa</i> , <i>E. chippendalei</i> and mallee species), <i>Casuarina</i> or <i>Allocasuarina</i> trees; an understorey of shrubs such as <i>Acacia</i> (especially <i>A. aneura</i>), <i>Cassia</i> , <i>Eremophila</i> , <i>Grevillea</i> , <i>Hakea</i> and <i>Senna</i> ; and a ground cover dominated by <i>Triodia</i> species (DAWE, 2020c).	Would not occur. Preferred habitat absent. No records in central/southern goldfields region.
Night Parrot <i>Pezoporus occidentalis</i>	EN	CR	-	Broad habitat requirements include areas of old-growth spinifex (<i>Triodia</i>) for roosting and nesting, together with foraging habitats that are likely to include various native grasses and herbs, and may or may not contain shrubs or low trees. (DPaW, 2017).	Would not occur. Preferred habitat absent. No records in central/southern goldfields region.
Chuditch <i>Dasyurus geoffroii</i>	VU	VU	-	Occurring in a variety of habitats including deserts, woodlands and shrublands (DAWE, 2020c).	Would not occur. No recent records nearby and very likely to be locally extinct.

Species	Conservation Status			Habitat Description	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA Priority		
Central Long-eared Bat <i>Nyctophilus major tor</i>	-	-	P3	<i>Nyctophilus major</i> occurs in the high rainfall southwest region of Western Australia. The trees of the upperstory of its habitat are the large to very tall eucalypt species, karri <i>Eucalyptus diversicolor</i> , jarrah <i>E. marginata</i> , tuart <i>E. gomphocephala</i> , and marri <i>Corymbia calophylla</i> . Other woodland types inhabited by the bat include stands of melaleuca, banksia and sheoak trees of genus <i>Allocasuarina</i> , and include a dense understory.	Possibly occurs however this species is generally uncommon with very few records north of Kalgoorlie.
Arid Bronze Azure Butterfly <i>Ogyris subterrestris petrina</i>	CR	CR	-	At the two known extant locations within the Wheatbelt Region, vegetation is mature mixed <i>Eucalyptus salubris</i> / <i>E. salmonophloia</i> woodlands on red-brown loam soils, with an open understorey. In addition to gimlet and salmon gum, other smooth-barked eucalyptus at these sites which have basal ant colonies include <i>E. capillosa</i> subsp. <i>wandoo</i> , <i>E. loxophleba</i> subsp. <i>lissophloia</i> and <i>E. sheathiana</i> . The habitat at the locally extinct Lake Douglas site located within the Goldfields Region differs from the other sites but is also dominated by mature smooth-barked eucalypt woodland, particularly <i>E. concinna</i> . The most critical factor for habitat occupancy by the butterfly is the presence of large colonies of the host ant; <i>Camponotus</i> sp. nr. <i>terebrans</i> (DBCA, 2020b).	Possibly occurs. Direct observation of the Arid Bronze Azure Butterfly approximately 3km north of the northern extremity of the survey area within sand-loam plain habitat with a similar vegetation structure to the extinct Lake Douglas record (<i>E. concinna</i> mallee woodland).

4.2 Field Assessment

4.2.1 Vegetation Communities

Nine floristic groups were identified within the survey area. These vegetation units were located within four different landform types and comprised of four major vegetation groups, which were represented by a total of 132 Taxa (Appendix 3). A map showing the floristic groups present in the survey area is located in Figure 4-1 and a summary of floristic groups is presented in Table 4-5.

Table 4-5: Summary of floristic groups within the survey area

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Clay-Loam Plain	Casuarina Forest and Woodlands (MVG 8)	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia</i> spp. and low mixed shrubland on clay-loam plain	CLP-CFW1	477	17.9	
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of <i>Eucalyptus oleosa</i> / <i>E. salmonophloia</i> over mid shrubland of <i>Acacia</i> spp. and low mixed shrubland on clay-loam plain	CLP-EW1	199	7.5	

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of <i>Eucalyptus moderata</i> / <i>E. salmonophloia</i> over mid shrubland of <i>Acacia</i> / <i>Eremophila</i> spp. and low chenopod shrubland on clay-loam plain	CLP-EW2	537	20.1	
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of <i>Eucalyptus salubris</i> over mid shrubland of <i>Eremophila</i> / <i>Senna</i> spp. and low chenopod shrubland on clay-loam plain	CLP-EW3	200	7.5	

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Open Depression	Casuarina Forest and Woodlands (MVG 8)	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia</i> spp. and low chenopod shrubland in open depression	OD-CFW1	378	14.2	
Rocky Hillslope	Acacia Forest and Woodlands (MVG 6)	Low woodland of <i>Acacia acuminata</i> / <i>A. caesaneura</i> over mid shrubland of <i>Acacia</i> / <i>Melaleuca</i> spp. and low mixed shrubland on rocky hillslope	RS-AFW1	296	11.1	

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Rocky Hillslope	Casuarina Forest and Woodlands (MVG 8)	Low open woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia/ Senna</i> spp. and low open shrubland of <i>Ptilotus obovatus</i> on rocky hillslope	RS-CFW1	144	5.4	
Rocky Hillslope	Eucalypt Woodlands (MVG 5)	Low open woodland of <i>Eucalyptus clelandiorum/ E. griffithsii</i> over tall open shrubland of <i>Acacia</i> spp. and low mixed shrubland on rocky hillslope	RS-EW1	135	5.1	

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Area (Ha)	Area (%)	Image
Sand-Loam Plain	Mallee Woodland and Shrublands (MVG 13)	Mallee woodland of <i>Eucalyptus concinna</i> / <i>E. oleosa</i> over mid to low shrubland of <i>Acacia</i> / <i>Senna</i> spp. on sand-loam plain	SLP-MWS1	289	10.8	
N/A	N/A	Cleared Vegetation (mining only)	CV	15	0.6	No image available
Total				2,670	100	

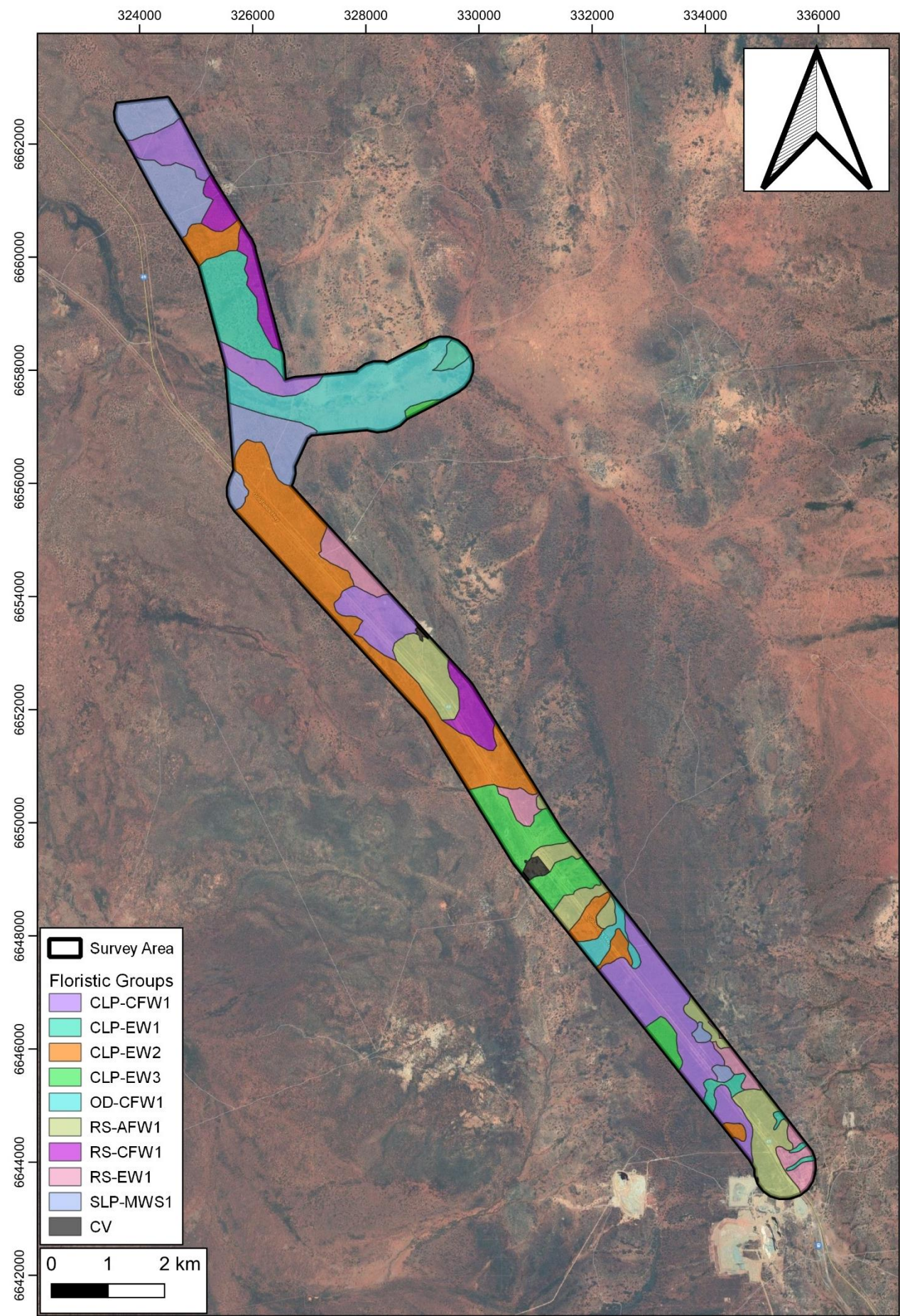


Figure 4-1: Floristic Groups within the survey area

4.2.2 Floristic Composition

PATN analysis was used to determine the similarities or differences between vegetation types identified within the survey area. Appendix 8 provides the dendrogram, two way-table (specifying species group) and ordination graph for all generated from the PATN statistical analysis. A list of the 66 quadrats and their respective vegetation communities are provided in Table 4-6 below. The PATN analysis produced a stress value of 0.2458.

Table 4-6: Floristic Groups identified within the survey area and corresponding quadrats

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Quadrat
Clay-Loam Plain	Casuarina Forest and Woodlands (MVG 8)	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia</i> spp. and low mixed shrubland on clay-loam plain	CLP-CFW1	AH4 AH8 AH10 KNGP3 KNGP13 KNGP15 KNGP16 SB11 SB14 SB22 SB24
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of <i>Eucalyptus oleosa</i> / <i>E. salmonophloia</i> over mid shrubland of <i>Acacia</i> spp. and low mixed shrubland on clay-loam plain	CLP-EW1	AH2 AH6 KNGP4 KNGP5 KNGP9 KNGP21 KNGP22 SB16 SB25 SB26 SB30
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of <i>Eucalyptus moderata</i> / <i>E. salmonophloia</i> over mid shrubland of <i>Acacia</i> / <i>Eremophila</i> spp. and low chenopod shrubland on clay-loam plain	CLP-EW2	AH11 AH12 KNGP10 KNGP11 KNGP14 SB3 SB4 SB6 SB8 SB12 B1 B3 B4 B5
Clay-Loam Plain	Eucalypt Woodlands (MVG 5)	Low woodland of <i>Eucalyptus salubris</i> over mid shrubland of <i>Eremophila</i> / <i>Senna</i> spp. and low chenopod shrubland on clay-loam plain	CLP-EW3	AH13 AH14 AH15 AH16 AH17 AH18 AH22 KNGP6 KNGP7 KNGP8

Landform	Major Vegetation Group	Floristic Group	Vegetation Code	Quadrat
				SB23
Open Depression	Casuarina Forest and Woodlands (MVG 8)	Low woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia</i> spp. and low chenopod shrubland in open depression	OD-CFW1	AH19 AH20 AH21 SB17 SB19 SB27
Rocky Hillslope	Acacia Forest and Woodlands (MVG 6)	Low woodland of <i>Acacia acuminata</i> / <i>A. caesaneura</i> over mid shrubland of <i>Acacia</i> / <i>Melaleuca</i> spp. and low mixed shrubland on rocky hillslope	RS-AFW1	KNGP1 KNGP12 KNGP19 SB10 B7 B8 B9 GHR3 GHR4 GHR5
Rocky Hillslope	Casuarina Forest and Woodlands (MVG 8)	Low open woodland of <i>Casuarina pauper</i> over mid shrubland of <i>Acacia</i> / <i>Senna</i> spp. and low open shrubland of <i>Ptilotus obovatus</i> on rocky hillslope	RS-CFW1	KNGP20 SB2 SB5 SB9 GHR1
Rocky Hillslope	Eucalypt Woodlands (MVG 5)	Low open woodland of <i>Eucalyptus clelandiorum</i> / <i>E. griffithsii</i> over tall open shrubland of <i>Acacia</i> spp. and low mixed shrubland on rocky hillslope	RS-EW1	AH1 AH3 AH5 KNGP2 KNGP17 KNGP18 KNGP23 SB1 SB7 SB31 B2 B6 B10 GHR2
Sand-Loam Plain	Mallee Woodland and Shrublands (MVG 13)	Mallee woodland of <i>Eucalyptus concinna</i> / <i>E. oleosa</i> over mid to low shrubland of <i>Acacia</i> / <i>Senna</i> spp. on sand-loam plain	SLP-MWS1	AH7 AH9 SB13 SB15 SB18 SB20 SB21 SB28 SB29

Three 'supergroups' were identified in the PATN analysis:

1. Clay-Loam Plain (*Casuarina* woodland and *Eucalyptus oleosa*/ *E. salmonophloia* woodland), Open Depression (*Casuarina* woodland), Sand-Loam Plain (*Mallee* woodland) and Rocky Hillslope (*Casuarina* woodland and *Eucalypt* woodland);
2. Clay-Loam Plain (*Eucalyptus moderata*/ *E. salmonophloia* woodland) and Rocky Hillslope (*Acacia* woodland); and
3. Clay-Loam Plain (*Eucalyptus oleosa*/ *E. salmonophloia* woodland) and Rocky Hillslope (*Acacia* woodland).

The first supergroup was divided into four floristic groups, comprising of quadrats from four different landform types (clay-loam plain, open depression, rocky hillslope and sand-loam plain) and three major vegetation groups (Casuarina woodlands, Eucalypt woodlands and Mallee woodlands). The first floristic group was intermixed including majority of the clay-loam plain Eucalypt woodland (*Eucalyptus oleosa*/ *E. salmonophloia*) and Casuarina woodland quadrats, majority of the sand-loam plain Mallee woodland quadrats and two hillslope Casuarina woodland quadrats.

The second floristic group comprised only of two quadrats; SB19: clay-loam plain *Eucalyptus salubris* quadrat and SB23: open depression (Casuarina woodland) quadrat.

The third floristic group comprised mostly of rocky hillslope Eucalypt (*Eucalyptus clelandiorum*/ *E. griffithsii*) woodland quadrats and individual clay-loam plain (Casuarina woodland) and rocky hillslope (Acacia woodland) quadrats. The fourth floristic group comprised of a single rocky hillslope (Casuarina woodland) quadrat (SB1).

All four floristic groups within this supergroup were mostly characterised by species group A and E (see two-way table in Appendix 8). As shown in the ordination graph (Appendix 8), floristic groups 3 and 4 were closely associated with each other.

The second supergroup was divided into four floristic groups (5 to 7), which were mostly characterised by species group A and B. Unlike the first supergroup, these floristic groups were more closely associated with each other, as shown in the ordination graph (Appendix 8). Floristic group 5 was intermixed including majority of the clay-loam plain *Eucalyptus moderata*/ *E. salmonophloia* woodland quadrats, rocky hillslope Acacia woodland quadrats and individual rocky hillslope *Eucalyptus clelandiorum*/ *E. griffithsii* woodland, clay-loam plain *Eucalyptus oleosa*/ *E. salmonophloia* and *Eucalyptus salubris* woodland quadrats.

Floristic group 6 included majority of the clay-loam plain *Eucalyptus salubris* quadrats and individual open depression/ clay-loam plain (Casuarina woodland) and sand-loam plain (Mallee woodland) quadrats. Floristic group 7 included only clay-loam plain *Eucalyptus salubris* quadrats.

The third supergroup included two floristic groups (8-9) which were mostly characterised by species group H. Floristic group 8 was intermixed including clay-loam plain *Eucalyptus oleosa*/ *E. salmonophloia* and *Eucalyptus moderata*/ *E. salmonophloia* woodland quadrats, rocky hillslope (Acacia/ Casuarina/ Eucalypt) quadrats and one sand-loam plain (Mallee woodland) quadrat.

Floristic group 9 comprised of a single rocky hillslope Acacia woodland quadrat (AH9) and rocky hillslope Acacia woodland quadrat (KNGP1). Compared to the other quadrats within their respective vegetation units, floristic group 9 had low species composition and was mostly characterised by species group H and I.

Based on the results of the PATN analysis, there was minimal heterogeneity in species composition within the vegetation units intermixed into floristic groups despite differences in both dominant stratum taxa and landform.

4.2.2.1 Species Richness and accumulation estimates

The Chaos 2 richness estimator provided an estimated species richness of 115 species in 100 sample sites (quadrats). Species richness recorded for the 91 quadrats was 123 species (including annuals) which indicates survey intensity was adequate.

A species accumulation curve was created to display the rate of species accumulation. The R^2 value (0.98) suggests that the data “fits” the species accumulation curve shown in Figure 4-2. The rate of species accumulation for the first 20 quadrats ranged from seven to two species per quadrat. The rate of species accumulation between 21-50 quadrats was one species per quadrat. Species accumulation reduced to ≤ 1 species per quadrat as quadrat number increased above 50. Botanica has determined that according to this data a sufficient number of quadrats were established in the survey area to adequately assess the floristic composition of the area.

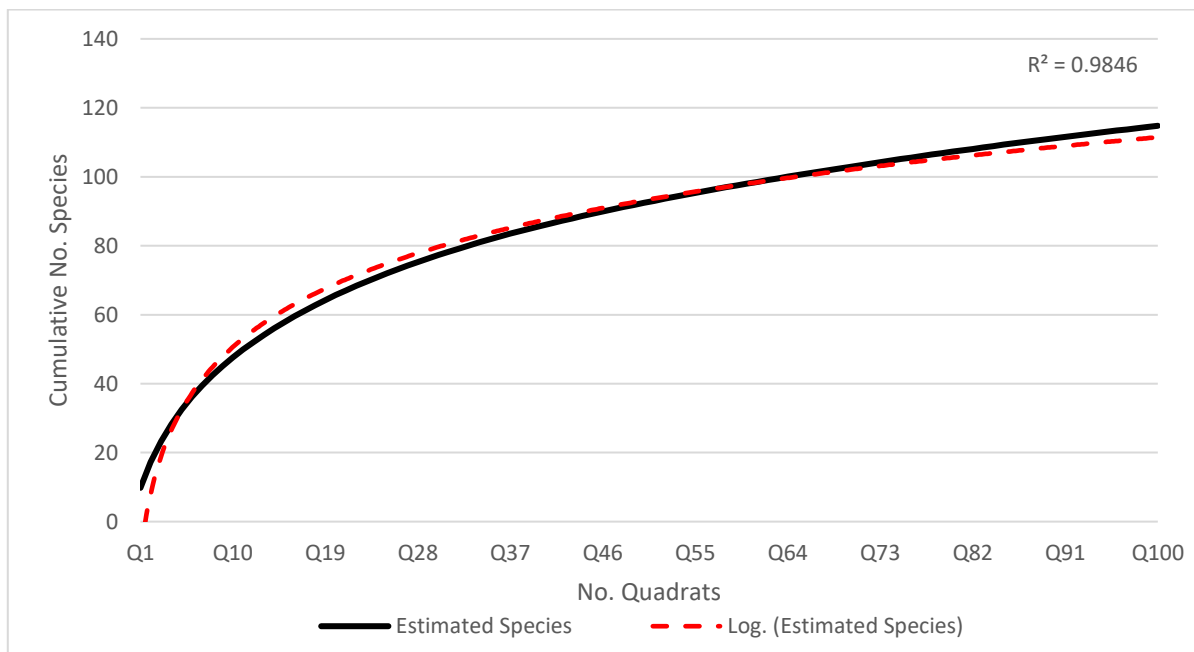


Figure 4-2: Species accumulation curve

4.2.3 Vegetation Condition

Based on the vegetation condition rating scale adapted from Keighery, 1994 and Trudgen, 1988 (Appendix 5), vegetation condition ranged from 'good' to 'very good' (Table 4-7). A map of the vegetation condition within the survey area is provided in Figure 4-3.

'Good' condition depicts that vegetation has been impacted by 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.

'Very Good' condition depicts that vegetation has 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.

Table 4-7: Vegetation Condition Rating of the survey area

Condition Rating	Area (ha)	Area (%)
Cleared Vegetation	15	0.6
Good	809	30.3
Good-Very Good	1753	65.7
Very Good	93	3.5

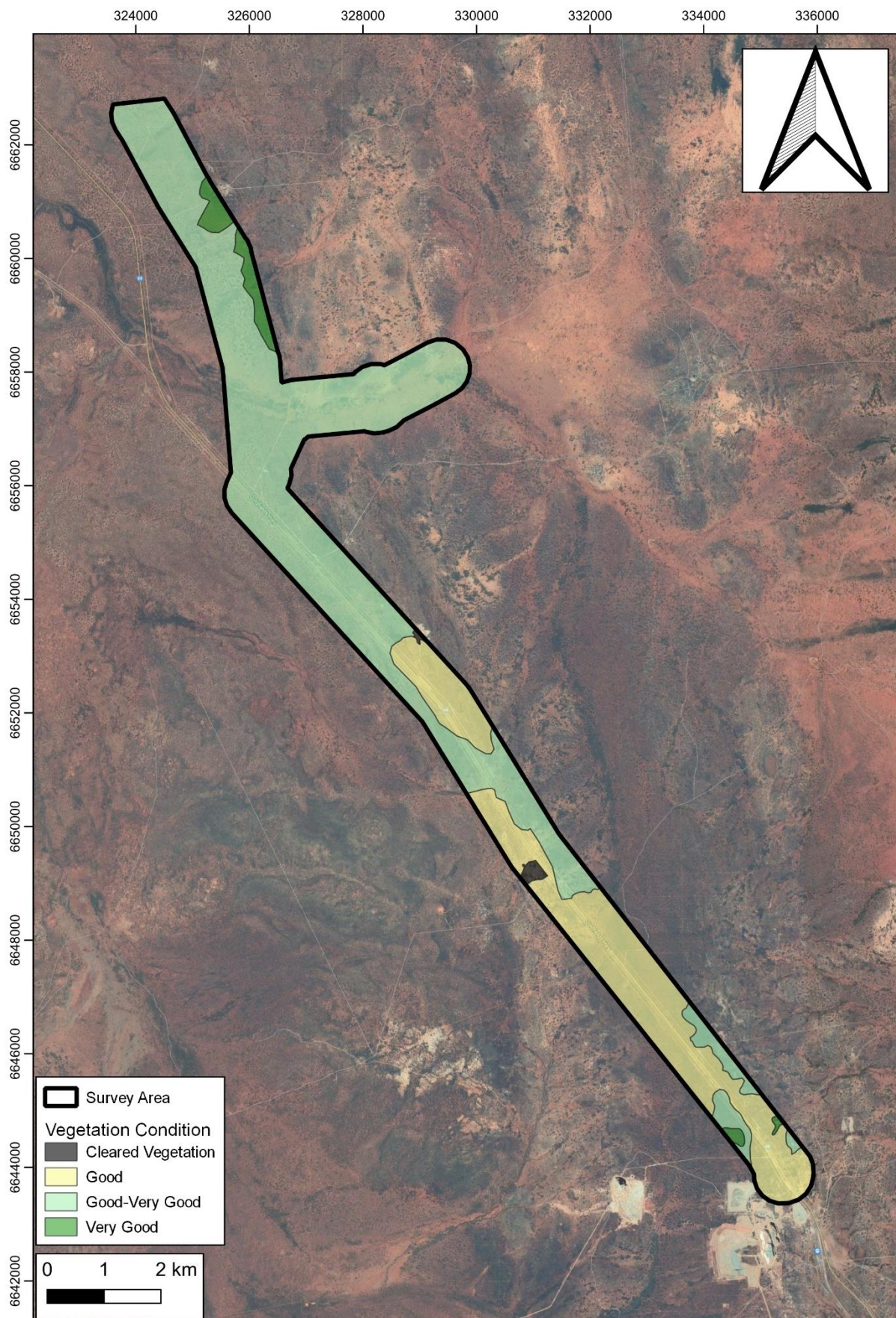


Figure 4-3: Vegetation Condition Rating of the survey area

4.2.4 Fauna Habitat

The broad scale terrestrial fauna habitats within the survey area presented below are based on vegetation and associated landforms identified during the flora and vegetation assessment. A total of four fauna habitat communities have been mapped for the survey area. The extent of the identified fauna habitats and a summary description of each are provided in Table 4-8 below.

Table 4-8: Main Terrestrial Fauna Habitats within the survey area

Fauna Habitat Description	Example Image
<u>Clay-Loam Plain</u> Casuarina Woodland/ Eucalypt Woodland (approximate area = 1,413 ha; 52.9%).	
<u>Open Depression</u> Casuarina Woodland (approximate area = 378 ha; 14.2%).	

Fauna Habitat Description	Example Image
<u>Rocky Hillslope</u> Acacia Woodland/ Casuarina Woodland/ Eucalypt Woodland (approximate area = 575 ha; 21.5%).	
<u>Sand-Loam Plain</u> Mallee Woodland (approximate area = 289 ha; 10.8%).	

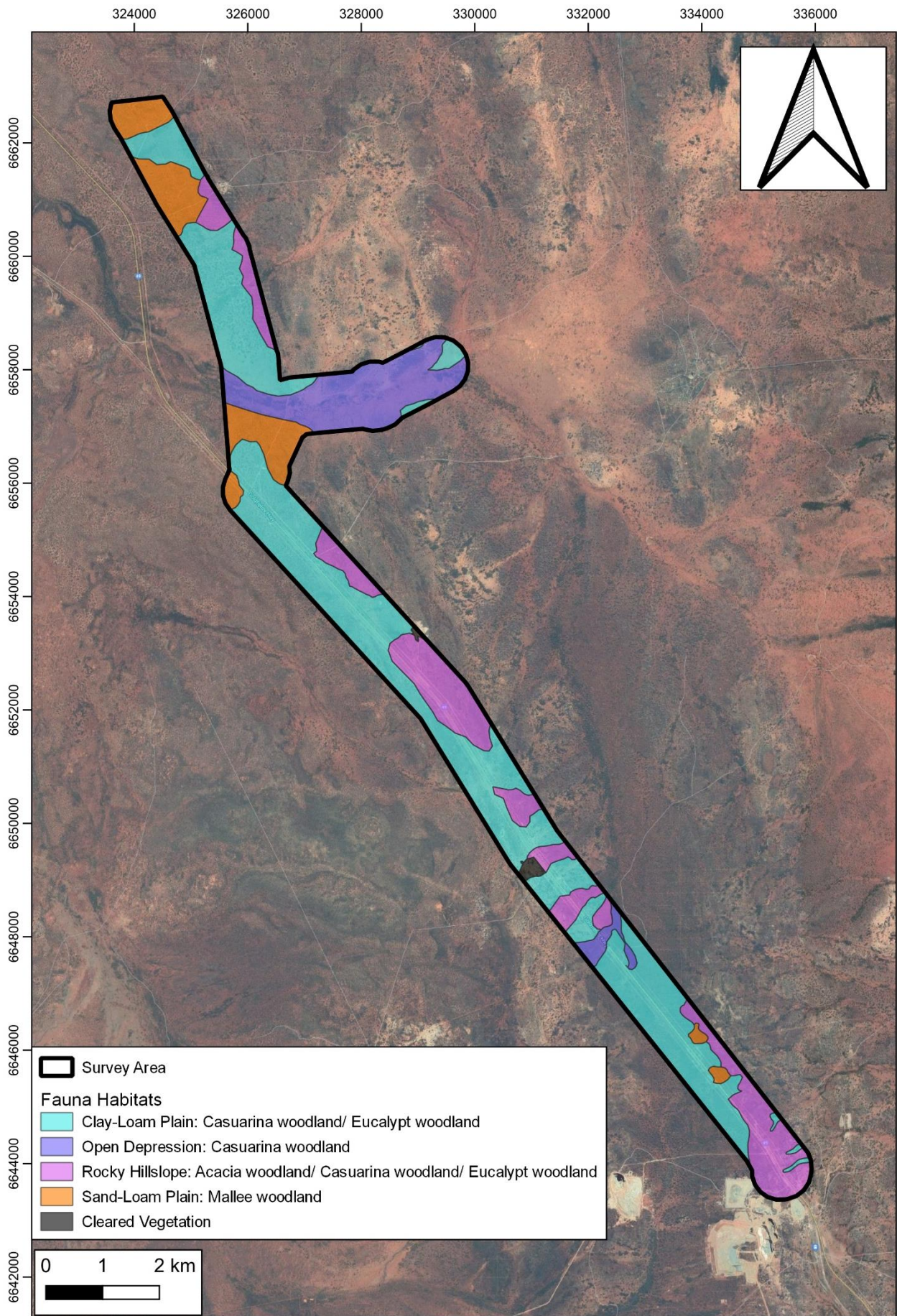


Figure 4-4: Main Terrestrial Fauna Habitats within the survey area

Based on the habitats present within the survey area, a list of expected vertebrate fauna species likely to occur in the survey area was compiled from information obtained during the literature review and is presented in Appendix 9. The results of some previous fauna surveys carried out in the general area are also summarised in this species listing as are the DBCA NatureMap database search results.

Not all species listed in existing databases and publications as potentially occurring within the region (i.e. *EPBC Act* 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 known occurrence locally/regionally extinct and secondly suitability of 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 3.6 Survey limitations and constraints**).

Table 4-9 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 9. This list has been developed based on the complete list provided in Appendix 9 and using a precautionary approach adopted for the assessment. At any one time, only a subset of the listed potential species is likely to be present within the bounds of the survey area.

Table 4-9: Summary of Potential Vertebrate Fauna Species

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species
Amphibians	5	0	0	0
Reptiles	75	0	0	0
Birds	108	2	0	0
Non-Volant Mammals	21 ⁸	0	0	0
Volant Mammals (Bats)	11	0	0	1
Total	220⁸	2	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.

4.2.5 Introduced Species

Three introduced flora have been previously identified by Alexander Holm & Associates (2020b) within the survey area (Figure 4-5); *Carrichtera annua* (Wards Weed), *Oligocarpus calendulaceus* and *Salvia verbenaca* (Wild Sage). None of these species are listed as a Declared Plant under the *Biosecurity and Agriculture Management Act 2007*. No additional introduced flora were identified during the current survey. Evidence of introduced fauna species (rabbits, goats and cattle) were identified in the survey area in the form of droppings and grazing.

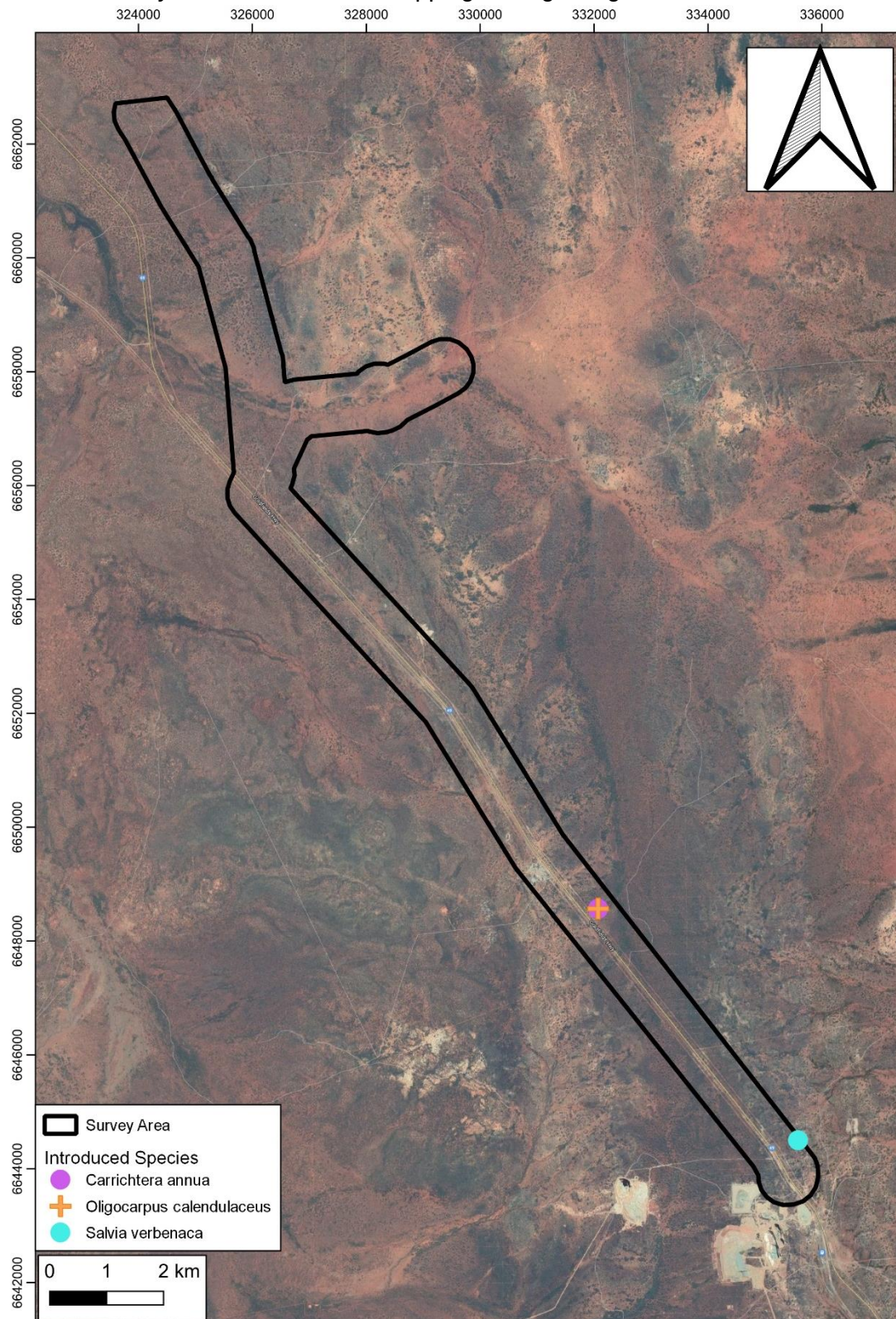


Figure 4-5: Introduced Flora identified within the survey area

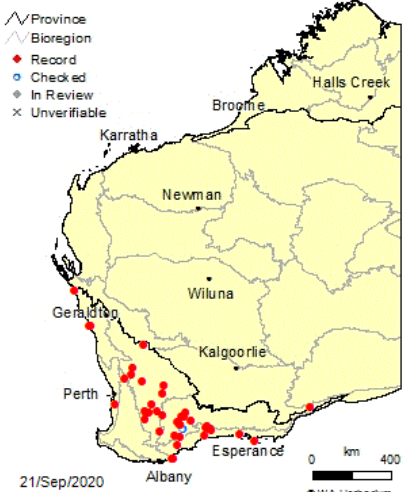
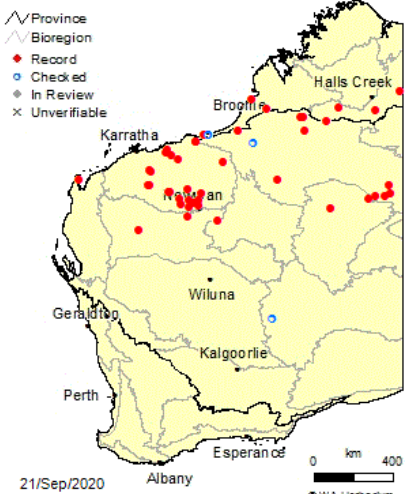
4.2.6 Significant Flora

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

- flora being identified as threatened or priority species;
- locally endemic flora or flora associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- flora representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- flora with relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

No Threatened Flora taxa listed under Commonwealth or State legislation were identified within the survey area. No Priority Flora listed by DBCA were recorded within the survey area. A map showing DBCA records of Threatened/ Priority Flora in relation to the survey area is provided in Appendix 2. Two range extension taxa have been previously identified by Alexander Holm & Associates (2020b) within the survey area; *Austrostipa exilis* and *Sida arenicola* (Table 4-10; Figure 4-6). No other significant flora were identified within the survey area.

Table 4-10: Range Extension Flora identified within the survey area

Taxon	Distribution (WAHERB, 2020)	Associated Vegetation
<i>Austrostipa exilis</i>	<i>Austrostipa exilis</i> 	One location recorded within the survey area. Identified within one floristic group; Low open woodland of <i>Eucalyptus clelandiorum</i>/ <i>E. griffithsii</i> over tall open shrubland of <i>Acacia</i> spp. and low mixed shrubland on rocky hillslope (RS-EW1).
<i>Sida arenicola</i>	<i>Sida arenicola</i> 	One location recorded within the survey area, identified within one floristic group; Low woodland of <i>Eucalyptus moderata</i>/ <i>E. salmonophloia</i> over mid shrubland of <i>Acacia</i>/ <i>Eremophila</i> spp. and low chenopod shrubland on clay-loam plain (CLP-EW2).

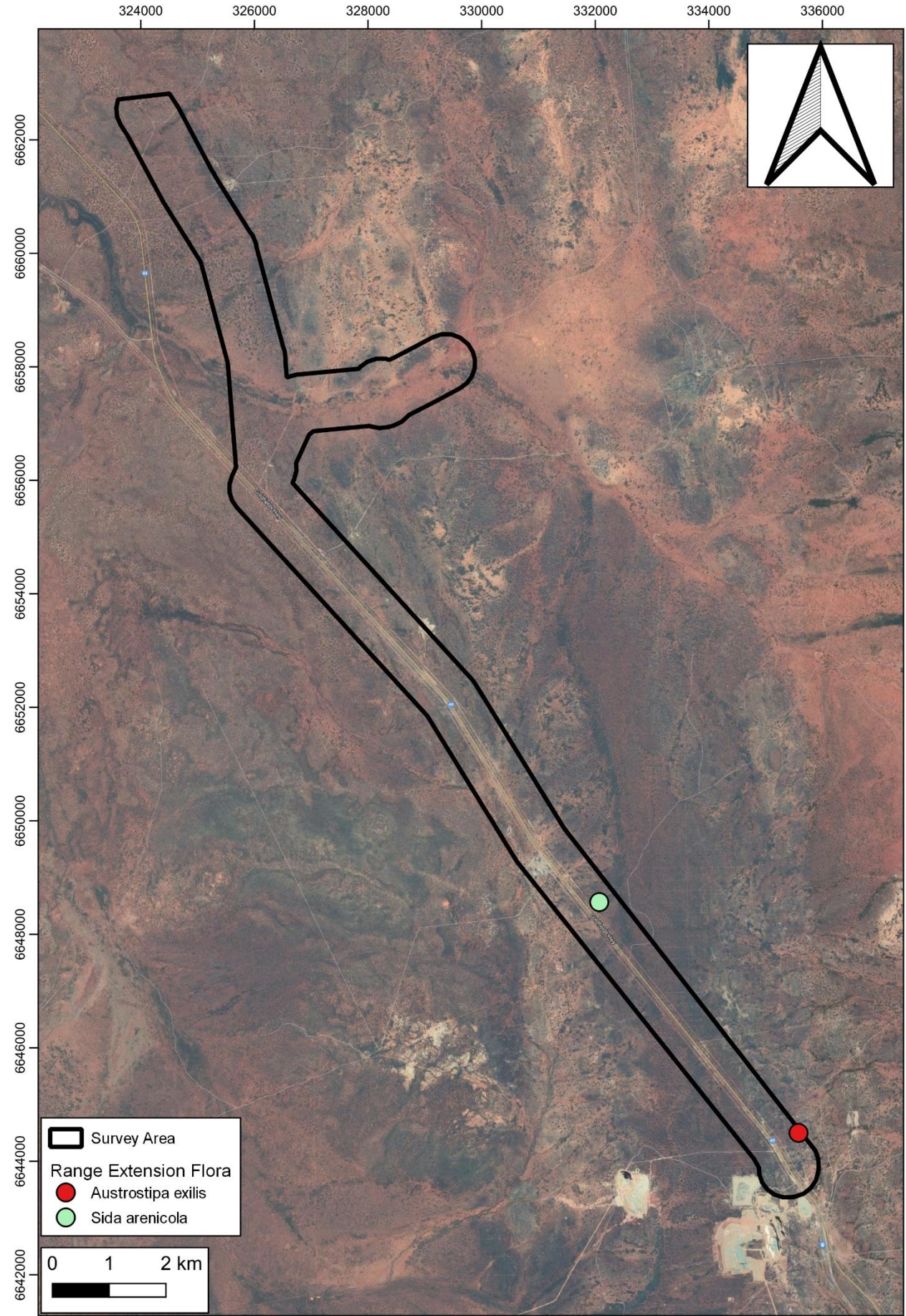


Figure 4-6: Range Extension Flora identified within the survey area

4.2.7 Significant Vegetation

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

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

No Threatened Ecological Communities (TEC) listed under State or Commonwealth legislation were recorded within the survey area. No Priority Ecological Communities (PEC) as listed by DBCA were identified within the survey area. The closest PEC is the Emu Land System Priority 3 Ecological Community which is located approximately 300m west of the survey area. A map showing DBCA records of Priority Ecological Communities in relation to the survey area is provided in Appendix 2. No other significant vegetation was identified during the survey.

4.2.8 Significant Fauna

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

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

One significant fauna was observed during the survey; Malleefowl (*Leipoa ocellata*) which is listed as Vulnerable under the EPBC Act and BC Act.

Three malleefowl mounds were recorded within the survey area (details provided in Table 4-11 and Figure 4-7). One of the mounds was identified as inactive however the two remaining mounds were identified as active/ recently active, with motion camera footage showing malleefowl actively working one of the mounds. Available information therefore suggests that a breeding population of this species is present in the survey area.

No other significant fauna (as described above) were identified within the survey area.

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

- **Arid Bronze Azure Butterfly *Ogyris subterrestris petrina* – CR (BC Act & EPBC Act)**
A direct observation of the Arid Bronze Azure Butterfly was made by Botanica approximately 3km north of the northern extremity of the survey area within sand-loam plain habitat with a similar vegetation structure to the extinct Lake Douglas record (i.e. *E. concinna* mallee woodland). This species was observed within the ex. Goongarrie Station UCL (LR3068/801) which is managed by DBCA.

- **Peregrine Falcon *Falco peregrinus* – OS (BC Act)**

This species potentially utilises some sections of the survey area as part of a much larger home range, though records in this area are uncommon. It is considered unlikely to breed within the survey area. Significant impact unlikely.

- **Central Long-eared Bat *Nyctophilus major tor* – P3 (DBCA Priority Species)**

Listed as a potential species however it is generally uncommon and rarely recorded north of Kalgoorlie. Significant impact unlikely.

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 Goldfields 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).

Table 4-11: Malleefowl mounds identified within the survey area

Malleefowl Mound ID	Status	Easting	Northing	Image
MF9	Inactive Mound (>20 years old)	333962	6646333	
MF10	Recently Active-no motion camera evidence of Malleefowl	334131	6646107	

Malleefowl Mound ID	Status	Easting	Northing	Image
MF11	Currently active-Dead chick observed at mound and motion camera footage of Malleefowl at the mound	333868	6646583	

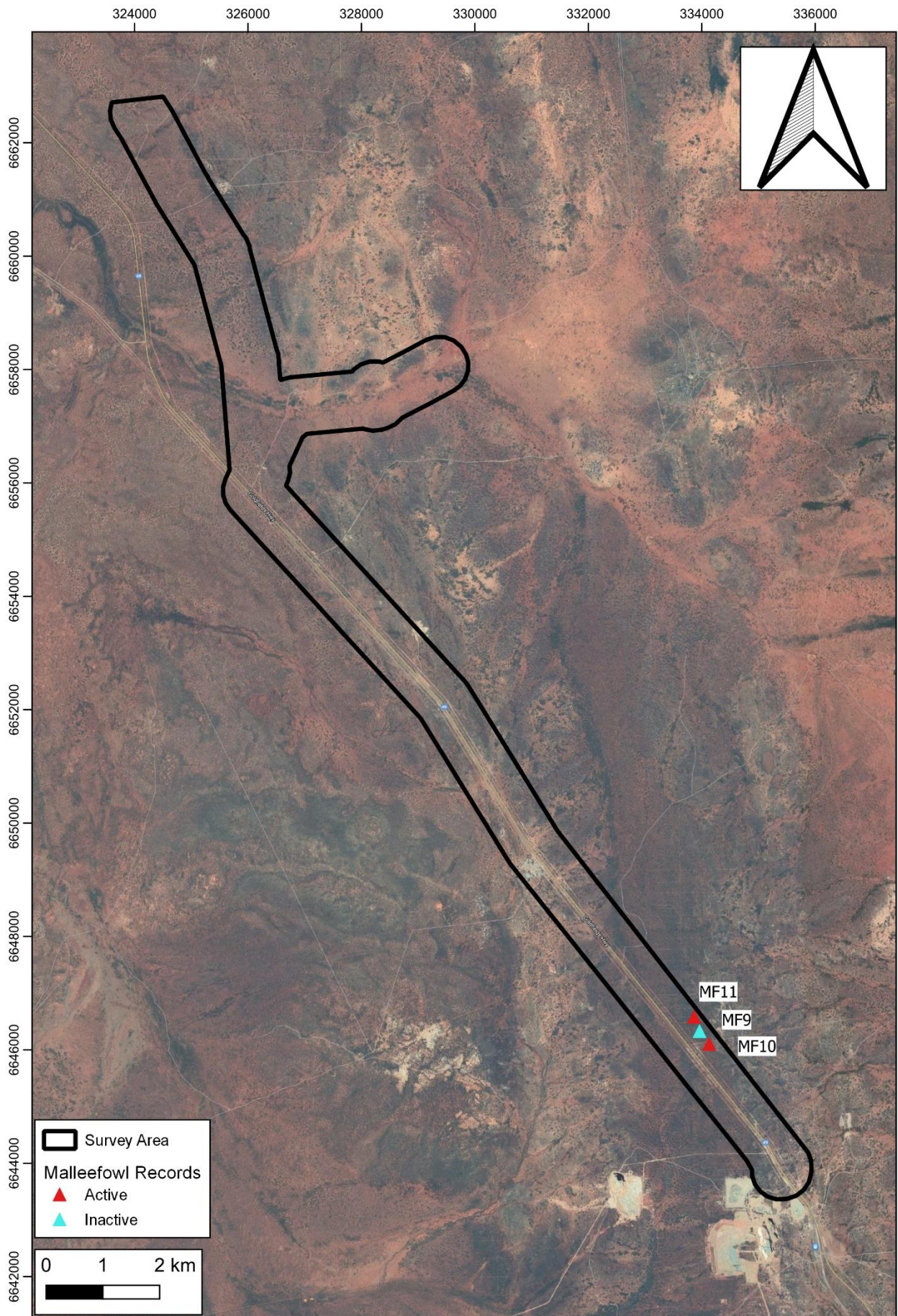


Figure 4-7: Malleefowl mounds identified within the survey area

4.3 Matters of National Environmental Significance

4.3.1 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act protects matters of national environmental significance, and is used by the Commonwealth DAWE to list threatened taxa and ecological communities into categories based on the criteria set out in the Act (www.environment.gov.au/epbc/index.html). The Act provides a national environmental assessment and approval system for proposed developments and enforces strict penalties for unauthorised actions that may affect matters of national environmental significance. Matters of national environmental significance as defined by the Commonwealth EPBC Act include:

- Nationally threatened flora species;
- 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 ecological communities;
- Commonwealth marine area;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mining) a water resource, in relation to coal seam gas development and large coal mining development.

One significant fauna was observed during the survey; Malleefowl (*Leipoa ocellata*) which is listed as Vulnerable under the EPBC Act.

4.4 Matters of State Environmental Significance

4.4.1 *Environmental Protection Act WA 1986*

The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The Act is administered by the Department of Water and Environment Regulation (DWER), which is the State Government's environmental regulatory agency.

Under Section 51C of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations (Regulations) WA 2004* any clearing of native vegetation in Western Australia that is not eligible for exemption under Schedule 6 of the *EP Act 1986* or under the Regulations 2004 requires a clearing permit from the DWER or DMIRS. Under Section 51A of the *EP Act 1986* native vegetation includes aquatic and terrestrial vegetation indigenous to Western Australia, and intentionally planted vegetation declared by regulation to be native vegetation, but not vegetation planted in a plantation or planted with commercial intent. Section 51A of the *EP Act 1986* defines clearing as "the killing or destruction of; the removal of; the severing or ringbarking of trunks or stems of; or the doing of substantial damage to some or all of the native vegetation in an area, including the flooding of land, the burning of vegetation, the grazing of stock or an act or activity that results in the above". Exemptions under Schedule 6 of the EP Act and the EP Regulations do not apply in ESAs as declared under Section 51B of the EP Act or TEC listed under State and Commonwealth legislation.

No evidence of the survey area containing any TEC or Threatened Flora was identified during the survey. The survey area is not located within an ESA.

4.4.2 Biodiversity Conservation Act 2016

This Act is used by the Western Australian DBCA for the conservation and protection of biodiversity and biodiversity components in Western Australia and to promote the ecologically sustainable use of biodiversity components in the State. Taxa are classified as 'Threatened' when their populations are geographically restricted or are threatened by local processes (see following sections for Threatened definitions). Under this Act all native flora and fauna are protected throughout the State. Financial penalties are enforced under this Act if threatened species are collected without an appropriate licence.

Under Section 54(1) of the BC Act, habitat is eligible for listing as critical habitat if:

- (a) it is critical to the survival of a threatened species or a threatened ecological community; and
- (b) its listing is otherwise in accordance with the ministerial guidelines.

One significant fauna was observed during the survey; Malleefowl (*Leipoa ocellata*) which is listed as Vulnerable under the BC Act.

4.4.3 Conservation Reserves

The survey area is not located within a gazetted conservation reserve. The closest gazetted conservation reserve is the Goongarrie National Park, which are located approximately 24 km east of the survey area. The northern extremity of the survey area is however located approximately 74m south of the ex. Goongarrie Station UCL (LR3068/801) which is managed by DBCA. A map showing areas of proposed and gazetted Conservation Reserves in relation to the survey area is provided in Appendix 2.

4.5 Native Vegetation Clearing Principles

Based on the outcomes from the survey, 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). The assessment has identified clearing is at variance with one principle (b) and may be at variance with two principles: (f) and (h).

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 survey 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.	The survey area comprises of broad fauna habitats that are typical of those in the wider region. No unique fauna habitats (caves, rocky outcrops/pools etc.) occur within the survey area. No water bodies (both perennial/ non-perennial) occur within the survey area. One significant fauna was observed during the survey; Malleefowl (<i>Leipoa ocellata</i>) which is listed as Vulnerable under the EPBC Act and BC Act. Exclusion zones are required to be implemented around each Malleefowl mound (200m exclusion zone around active Malleefowl mounds and 50m	Clearing is at variance to this principle

Letter	Principle	Assessment	Outcome
Native vegetation should not be cleared if it:			
		exclusion zone around native Malleefowl mounds).	
(c)	includes, or is necessary for the continued existence of rare flora.	No Threatened Flora taxa, pursuant to the BC Act and the EPBC Act were identified within the survey area (none listed as occurring on DBCA database and none identified during survey).	Clearing is not 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 the EPBC Act or by the BC Act occur within the survey area (none listed as occurring on DBCA database and none identified during survey).	Clearing is not at variance to this principle
(e)	is significant as a remnant of native vegetation in an area that has been extensively cleared	The survey area occurs within the pre-European Beard vegetation associations Barlee 10, 521 and 2903 which retain >96% 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 (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however multiple minor ephemeral drainage lines intersect the survey area, associated with floristic group OD-CFW1 which accounts for 14.2% of the total survey area.	Clearing may be at variance to this principle
(g)	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The survey area occurs within the pre-European Beard vegetation associations Barlee 10, 521 and 2903 which retain >96% 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 a gazetted conservation reserve. The northern extremity of the survey area is located approximately 74m south of the ex. Goongarrie Station UCL (LR3068/801).	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 (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however multiple minor ephemeral drainage lines intersect the survey area, associated with floristic group OD-CFW1 which accounts for 14.2% of the total survey area. Most rainfall is lost by evaporation or surface runoff. Only a small portion infiltrates the soil and recharges the groundwater.	Clearing is unlikely to be at variance to this principle
(j)	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	Rainfall is unreliable and highly variable with an average rainfall for Kalgoorlie-Boulder of 266.1mm and an evaporation rate of 2400mm. The region is not prone to flooding and does not contain perennial water sources.	Clearing is unlikely to be at variance to this principle

4.6 Conclusions and Recommendations

4.6.1 Conclusions

No Threatened Flora, Migratory Fauna or TECs as listed under State or Commonwealth legislation were identified within the survey area.

One Threatened Fauna listed under State and Commonwealth legislation was identified within the survey area; Malleefowl (*Leipoa ocellata*) which is listed as Vulnerable under the EPBC Act and BC Act.

No Priority Flora, Priority Fauna or PECs as listed by the DBCA were identified within the survey area.

The survey area does not contain any world or national heritage places, wetlands of international importance (Ramsar Wetlands), national importance (ANCA Wetlands) or conservation category wetlands. The survey area does not contain any ESAs or gazetted conservation reserves.

The assessment identified clearing is at variance with the following Native Vegetation Clearing Principle: (b) *comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to WA.*

One significant fauna was observed during the survey; Malleefowl (*Leipoa ocellata*) which is listed as Vulnerable under the EPBC Act and BC Act.

The assessment identified clearing may be variance with the following Native Vegetation Clearing Principle: (f) *vegetation is growing, in, or in association with, an environment associated with a watercourse or wetland.*

According to the Geoscience Australia database (2015), there are no perennial or ephemeral inland waters within the survey area. There are no perennial drainage lines within the survey area, however multiple minor ephemeral drainage lines intersect the survey area, associated with floristic group OD-CFW1 which accounts for 14.2% of the total survey area.

4.6.2 Recommendations

- Clearing within sand-loam plain *E. concinna* mallee woodland habitat be avoided or minimised where possible.
- Clearing within ephemeral drainage lines be avoided or minimised where possible.
- Clearing within 200m of active Malleefowl mounds and 50m radius of inactive Malleefowl mounds be avoided or minimised where possible.
- Vehicle hygiene/ weed management measures be implemented prior to any clearing to prevent introduction or spread of introduced species.
- Clearing of mature Eucalypts be avoided/ minimised where possible.

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Appendix 1: Significant Flora and Communities Conservation Categories

Definitions of Conservation Significant Species

Code	Category
State categories of threatened and priority species	
Threatened Species (T) Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the Biodiversity Conservation Act 2016 (BC Act).	
CR	Critically Endangered Threatened species considered to be “facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
EN	Endangered Threatened species considered to be “facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
VU	Vulnerable Threatened species considered to be “facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines”. Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.
Extinct species Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	Extinct Species where “ <i>there is no reasonable doubt that the last member of the species has died</i> ”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.
EW	Extinct in the Wild Species that “ <i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i> ”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
IA	International Agreement/ Migratory Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment

Code	Category
	Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
CD	Species of special conservation interest Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
Priority species Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.	
P1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority 3: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	Priority 4: Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
Commonwealth categories of threatened species	
EX	Extinct Taxa where there is no reasonable doubt that the last member of the species has died.
EW	Extinct in the Wild

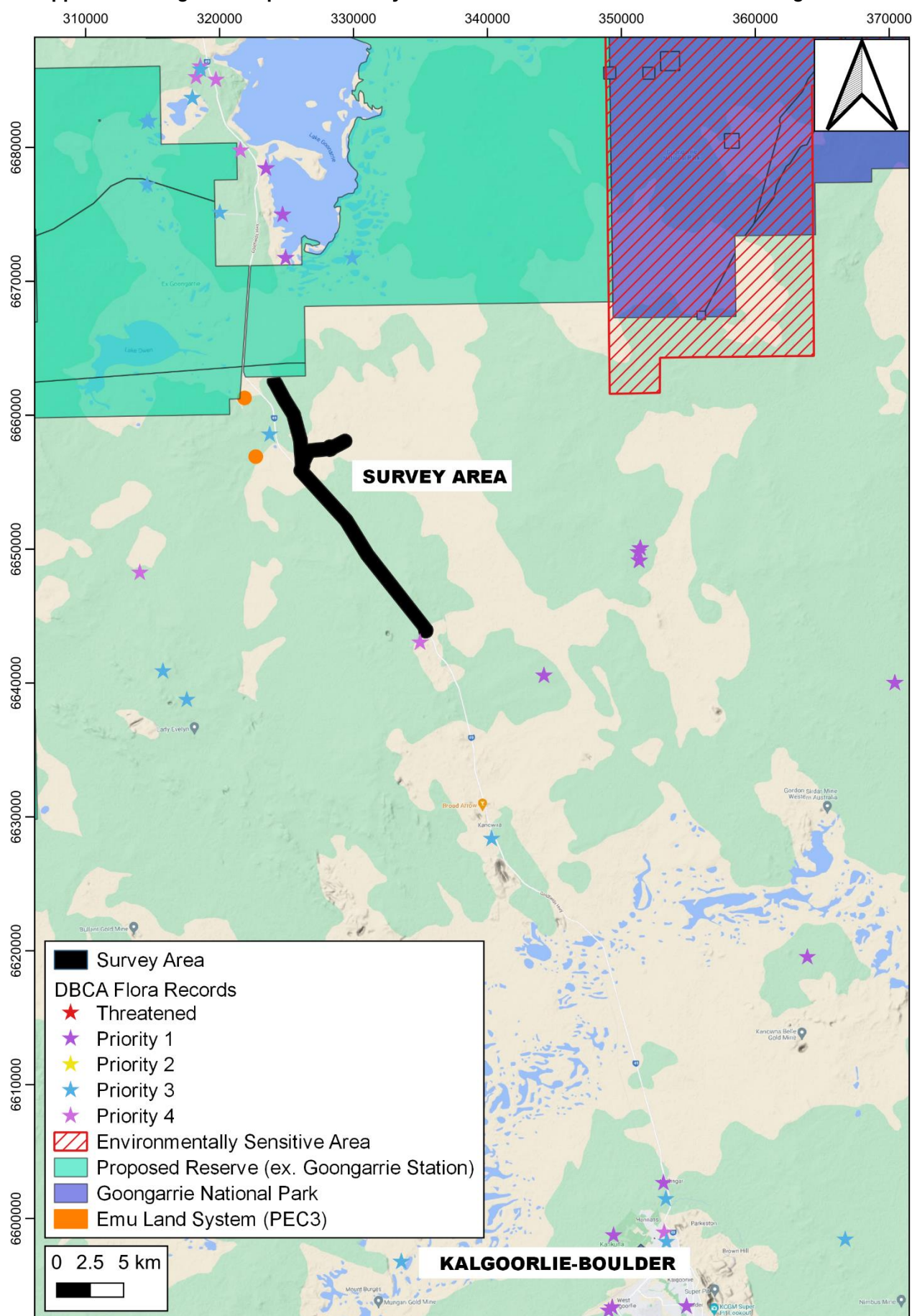
Code	Category
	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CR	Critically Endangered Taxa that are facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
EN	Endangered Taxa which are not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
VU	Vulnerable Taxa which are not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent Taxa which are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Definition of conservation significant communities

Category Code	Category
State categories of Threatened Ecological Communities (TEC)	
PD	Presumed Totally Destroyed An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: - records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; - all occurrences recorded within the last 50 years have since been destroyed.
CR	Critically Endangered An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	Endangered An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short-term future, or is unlikely to be substantially rehabilitated in the short-term future due to modification;

Category Code	Category
	The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; The ecological community is highly modified with potential of being rehabilitated in the short-term future.
VU	Vulnerable An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.
Commonwealth categories of Threatened Ecological Communities (TEC)	
CE	Critically Endangered If, at that time, an ecological community is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years).
EN	Endangered If, at that time, an ecological community is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
VU	Vulnerable If, at that time, an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium-term future (indicative timeframe being the next 50 years).
Priority Ecological Communities (PEC)	
P1	Poorly-known ecological communities Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	Poorly-known ecological communities Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	Poorly known ecological communities Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Ecological communities that are adequately known, rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

310000	320000	330000	340000	350000	360000	370000
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Appendix 3: Species List

(A) Blue text Denotes Annual species; (W) Green text Introduced Flora; (RE) Purple text Denotes Range Extension Flora

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	CLP-EW3	OD-CFW1	RS-AFW1	RS-CFW1	RS-EW1	SLP-MWS1
Amaranthaceae	<i>Ptilotus exaltatus</i> (A)	*		*						
Amaranthaceae	<i>Ptilotus helichrysoides</i>								*	
Amaranthaceae	<i>Ptilotus holosericeus</i>				*	*				
Amaranthaceae	<i>Ptilotus obovatus</i>	*	*	*	*	*	*	*	*	*
Amaranthaceae	<i>Ptilotus schwartzii</i>								*	
Apocynaceae	<i>Alyxia buxifolia</i>		*			*	*		*	
Apocynaceae	<i>Marsdenia australis</i>	*	*						*	
Asteraceae	<i>Cratystylis subspinescens</i>			*	*	*	*			
Asteraceae	<i>Oligocarpus calendulaceus</i> (W)			*						
Asteraceae	<i>Pterocaulon sphacelatum</i>				*					
Asteraceae	<i>Streptoglossa liatroides</i> (A)					*				
Asteraceae	<i>Olearia muelleri</i>	*	*	*	*			*	*	*
Asteraceae	<i>Vittadinia eremaea</i> (A)			*						
Boraginaceae	<i>Carrichtera annua</i> (W)			*						
Boraginaceae	<i>Halgania andromedifolia</i>								*	
Casuarinaceae	<i>Allocasuarina campestris</i>						*		*	
Casuarinaceae	<i>Casuarina pauper</i>	*	*	*	*	*	*	*	*	*
Chenopodiaceae	<i>Atriplex bunburyana</i>			*	*	*		*		
Chenopodiaceae	<i>Atriplex codonocarpa</i> (A)		*	*	*					
Chenopodiaceae	<i>Atriplex nummularia</i> subsp. <i>spathulata</i>		*	*				*	*	
Chenopodiaceae	<i>Atriplex stipitata</i>								*	
Chenopodiaceae	<i>Atriplex vesicaria</i>			*	*				*	
Chenopodiaceae	<i>Chenopodium curvispicatum</i>	*								
Chenopodiaceae	<i>Chenopodium</i> sp. (sterile)	*								
Chenopodiaceae	<i>Enchylaena tomentosa</i>			*	*					
Chenopodiaceae	<i>Maireana georgei</i>	*	*	*	*	*	*	*		*
Chenopodiaceae	<i>Maireana glomerifolia</i>				*					
Chenopodiaceae	<i>Maireana oppositifolia</i>			*						
Chenopodiaceae	<i>Maireana planifolia</i>							*		
Chenopodiaceae	<i>Maireana platycarpa</i>			*						
Chenopodiaceae	<i>Maireana pyramidata</i>	*		*	*	*				
Chenopodiaceae	<i>Maireana sedifolia</i>	*	*	*	*	*			*	*
Chenopodiaceae	<i>Maireana trichoptera</i>	*		*	*			*		*
Chenopodiaceae	<i>Maireana triptera</i>		*	*	*	*			*	
Chenopodiaceae	<i>Rhagodia eremaea</i>	*		*		*		*	*	*
Chenopodiaceae	<i>Sclerolaena cuneata</i>				*					
Chenopodiaceae	<i>Sclerolaena diacantha</i>	*	*	*	*	*	*	*	*	*
Chenopodiaceae	<i>Sclerolaena eurotioides</i>	*								
Chenopodiaceae	<i>Sclerolaena parviflora</i>				*					

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	CLP-EW3	OD-CFW1	RS-AFW1	RS-CFW1	RS-EW1	SLP-MWS1
Chenopodiaceae	<i>Sclerolaena uniflora</i>			*		*				*
Chenopodiaceae	<i>Tecticornia disarticulata</i>			*	*					
Fabaceae	<i>Acacia acuminata</i>	*	*		*	*	*		*	*
Fabaceae	<i>Acacia burkittii</i>	*								*
Fabaceae	<i>Acacia caesaneura</i>	*	*			*	*			*
Fabaceae	<i>Acacia collegialis</i>	*	*							
Fabaceae	<i>Acacia colletioides</i>	*		*		*				*
Fabaceae	<i>Acacia erinacea</i>	*	*	*	*		*	*	*	*
Fabaceae	<i>Acacia hemiteles</i>	*	*	*	*				*	*
Fabaceae	<i>Acacia incurvaneura</i>		*			*	*			
Fabaceae	<i>Acacia jennerae</i>	*		*				*	*	
Fabaceae	<i>Acacia kalgoorliensis</i>	*								
Fabaceae	<i>Acacia kempeana</i>	*					*			
Fabaceae	<i>Acacia ligulata</i>							*		
Fabaceae	<i>Acacia murrayana</i>								*	
Fabaceae	<i>Acacia oswaldii</i>	*								
Fabaceae	<i>Acacia quadrimarginea</i>	*	*			*			*	
Fabaceae	<i>Acacia ramulosa</i> var. <i>ramulosa</i>	*	*							
Fabaceae	<i>Acacia tetragonophylla</i>	*	*	*		*	*	*	*	
Fabaceae	<i>Hovea acanthoclada</i>								*	
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	*	*	*	*	*		*	*	*
Fabaceae	<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>									
Fabaceae	<i>Senna cardiosperma</i>		*	*				*	*	
Fabaceae	<i>Templetonia incrassata</i>			*	*					
Fabaceae	<i>Templetonia sulcata</i>				*					
Frankeniaceae	<i>Frankenia setosa</i>			*		*			*	
Goodeniaceae	<i>Dampiera</i> sp. (sterile)						*			
Goodeniaceae	<i>Scaevola spinescens</i>	*	*	*		*	*	*	*	*
Gyrostemonaceae	<i>Codonocarpus cotinifolius</i>	*							*	
Lamiaceae	<i>Prostanthera albiflora</i>						*			
Lamiaceae	<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>		*				*			
Lamiaceae	<i>Prostanthera campbellii</i>		*			*	*			
Lamiaceae	<i>Salvia verbenaca</i> (W)				*					
Lamiaceae	<i>Westringia cephalantha</i>								*	
Lamiaceae	<i>Westringia rigida</i>	*	*				*		*	
Loranthaceae	<i>Amyema preissii</i>	*	*							
Malvaceae	<i>Sida arenicola</i> (RE)			*						
Malvaceae	<i>Sida calyxhymenia</i>			*				*		
Myrtaceae	<i>Cryptandra aridicola</i>								*	
Myrtaceae	<i>Eucalyptus celastroides</i> subsp. <i>celastroides</i>		*		*				*	
Myrtaceae	<i>Eucalyptus clelandiorum</i>			*					*	

Family	Taxon	CLP-CFW1	CLP-EW1	CLP-EW2	CLP-EW3	OD-CFW1	RS-AFW1	RS-CFW1	RS-EW1	SLP-MWS1
Myrtaceae	<i>Eucalyptus concinna</i>		*			*			*	*
Myrtaceae	<i>Eucalyptus flavida</i>						*			
Myrtaceae	<i>Eucalyptus griffithsii</i>	*	*	*					*	
Myrtaceae	<i>Eucalyptus moderata</i>		*	*						
Myrtaceae	<i>Eucalyptus oleosa</i>	*	*				*			*
Myrtaceae	<i>Eucalyptus ravida</i>			*	*				*	
Myrtaceae	<i>Eucalyptus salmonophloia</i>		*	*	*					*
Myrtaceae	<i>Eucalyptus salubris</i>				*					
Myrtaceae	<i>Melaleuca hamata</i>						*			
Myrtaceae	<i>Melaleuca lateriflora</i>								*	
Pittosporaceae	<i>Pittosporum angustifolium</i>			*		*		*	*	*
Poaceae	<i>Austrostipa elegantissima</i>			*						
Poaceae	<i>Austrostipa exilis</i> (RE)								*	
Poaceae	<i>Eragrostis dielsii</i> (A)					*				
Poaceae	<i>Eragrostis eriopoda</i>						*			
Poaceae	<i>Tridodia</i> sp. (sterile)					*			*	
Proteaceae	<i>Grevillea acuaria</i>	*		*	*		*		*	
Proteaceae	<i>Grevillea juncifolia</i> subsp. <i>juncifolia</i>						*			
Proteaceae	<i>Grevillea nematophylla</i> subsp. <i>nematophylla</i>		*							
Proteaceae	<i>Grevillea</i> sp. (sterile)		*							
Proteaceae	<i>Hakea preissii</i>					*				
Rutaceae	<i>Philotheca brucei</i>		*				*			
Santalaceae	<i>Exocarpos aphyllus</i>	*	*	*	*				*	*
Santalaceae	<i>Santalum acuminatum</i>			*						
Santalaceae	<i>Santalum spicatum</i>	*	*	*	*	*	*		*	
Sapindaceae	<i>Alectryon oleifolius</i>			*	*	*				*
Sapindaceae	<i>Dodonaea lobulata</i>	*	*	*		*	*	*	*	
Sapindaceae	<i>Dodonaea rigida</i>	*	*				*		*	
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	*					*		*	
Scrophulariaceae	<i>Eremophila alternifolia</i>		*			*	*		*	*
Scrophulariaceae	<i>Eremophila caperata</i>					*				
Scrophulariaceae	<i>Eremophila clarkei</i>	*	*			*			*	
Scrophulariaceae	<i>Eremophila decipiens</i>				*	*				
Scrophulariaceae	<i>Eremophila dempsteri</i>			*	*					
Scrophulariaceae	<i>Eremophila gibbosa</i>		*						*	
Scrophulariaceae	<i>Eremophila glabra</i>			*			*		*	
Scrophulariaceae	<i>Eremophila interstans</i>	*	*						*	
Scrophulariaceae	<i>Eremophila ionantha</i>									*
Scrophulariaceae	<i>Eremophila latrobei</i>					*				
Scrophulariaceae	<i>Eremophila longifolia</i>					*				
Scrophulariaceae	<i>Eremophila maculata</i>					*				

[illegible]

Appendix 4: GPS coordinates of Flora Quadrat locations (GDA94)

Quadrat ID	Zone	Easting	Northing
AH1	51 J	335448	6644482
AH2	51 J	335226	6644910
AH3	51 J	335102	6645050
AH4	51 J	334946	6645209
AH5	51 J	334676	6645361
AH6	51 J	334591	6645474
AH7	51 J	334284	6645636
AH8	51 J	334143	6645896
AH9	51 J	333854	6646329
AH10	51 J	333163	6647050
AH11	51 J	332450	6648053
AH12	51 J	332222	6648619
AH13	51 J	332030	6649213
AH14	51 J	331390	6651930
AH15	51 J	331129	6653454
AH16	51 J	330742	6654321
AH17	51 J	330453	6655352
AH18	51 J	330022	6656472
AH19	51 J	329590	6657461
AH20	51 J	329561	6657861
AH21	51 J	329303	6658387
AH22	51 J	329151	6658769
KNGP1	51 J	334966	6643585
KNGP2	51 J	334875	6643856
KNGP3	51 J	334541	6644816
KNGP4	51 J	334280	6644833
KNGP5	51 J	334004	6644626
KNGP6	51 J	333670	6644575
KNGP7	51 J	333375	6644502
KNGP8	51 J	333566	6644379
KNGP9	51 J	333833	6644228
KNGP10	51 J	334364	6644577
KNGP11	51 J	334659	6644420
KNGP12	51 J	334881	6644243
KNGP13	51 J	333900	6643442
KNGP14	51 J	333714	6643389
KNGP15	51 J	334045	6642194
KNGP16	51 J	334510	6641482
KNGP17	51 J	335379	6643613
KNGP18	51 J	335071	6643985
KNGP19	51 J	335005	6643750
B1	51 J	333766	6634394
B2	51 J	333940	6634238
B3	51 J	334159	6634329
B4	51 J	334665	6634617
B5	51 J	334914	6634223

Quadrat ID	Zone	Easting	Northing
B6	51 J	334331	6635108
B7	51 J	333511	6634797
B8	51 J	333587	6634847
B9	51 J	333739	6634784
B10	51 J	334232	6635319
GHR1	51 J	336695	6642080
GHR2	51 J	336791	6641986
GHR3	51 J	336773	6641911
GHR4	51 J	336527	6642666
GHR5	51 J	336548	6642854
SB1	51 J	336218	6643156
SB2	51 J	336323	6643215
SB3	51 J	336752	6643363
SB4	51 J	336612	6643618
SB5	51 J	336261	6643613
SB6	51 J	336229	6644189
SB7	51 J	330877	6650008
SB8	51 J	330431	6650747
SB9	51 J	329744	6651818
SB10	51 J	328624	6653189
SB11	51 J	328474	6653317
SB12	51 J	326560	6655444
SB13	51 J	324147	6662474
SB14	51 J	324458	6661886
SB15	51 J	324721	6661434
SB16	51 J	325642	6659668
SB17	51 J	326093	6657582
SB18	51 J	326137	6656970
SB19	51 J	328331	6657479
SB20	51 J	323752	6656467
SB21	51 J	324398	6654641
SB22	51 J	322260	6654499
SB23	51 J	323185	6652689
SB24	51 J	321987	6651943
SB25	51 J	322426	6650769
SB26	51 J	321865	6650113
SB27	51 J	321970	6649250
SB28	51 J	322931	6665776
SB29	51 J	323528	6666609
SB30	51 J	322854	6667366
SB31	51 J	324778	6668595
KNGP20	51 J	335222	6641497
KNGP21	51 J	334503	6641208
KNGP22	51 J	334608	6640648
KNGP23	51 J	334478	6639855

Appendix 5: 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 6: Quadrat Datasheets

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Appendix 7: Quadrat Photographs

SB1			
Direction	East	South-East	South
SB2			
Direction	East	South-East	South
SB3			
Direction	East	South-East	South

SB4			
Direction	East	South-East	South
SB5			
Direction	East	South-East	South
SB6			
Direction	East	South-East	South

SB7			
Direction	East	South-East	South
SB8			
Direction	East	South-East	South
SB9			
Direction	East	South-East	South

SB10			
Direction	East	South-East	South
SB11			
Direction	East	South-East	South
SB12			
Direction	East	South-East	South

SB13			
Direction	East	South-East	South
SB14			
Direction	East	South-East	South
SB15			
Direction	East	South-East	South

SB16			
Direction	East	South-East	South
SB17			
Direction	East	South-East	South
SB18			
Direction	East	South-East	South

SB19			
Direction	East	South-East	South
SB20			
Direction	East	South-East	South
SB21			
Direction	East	South-East	South

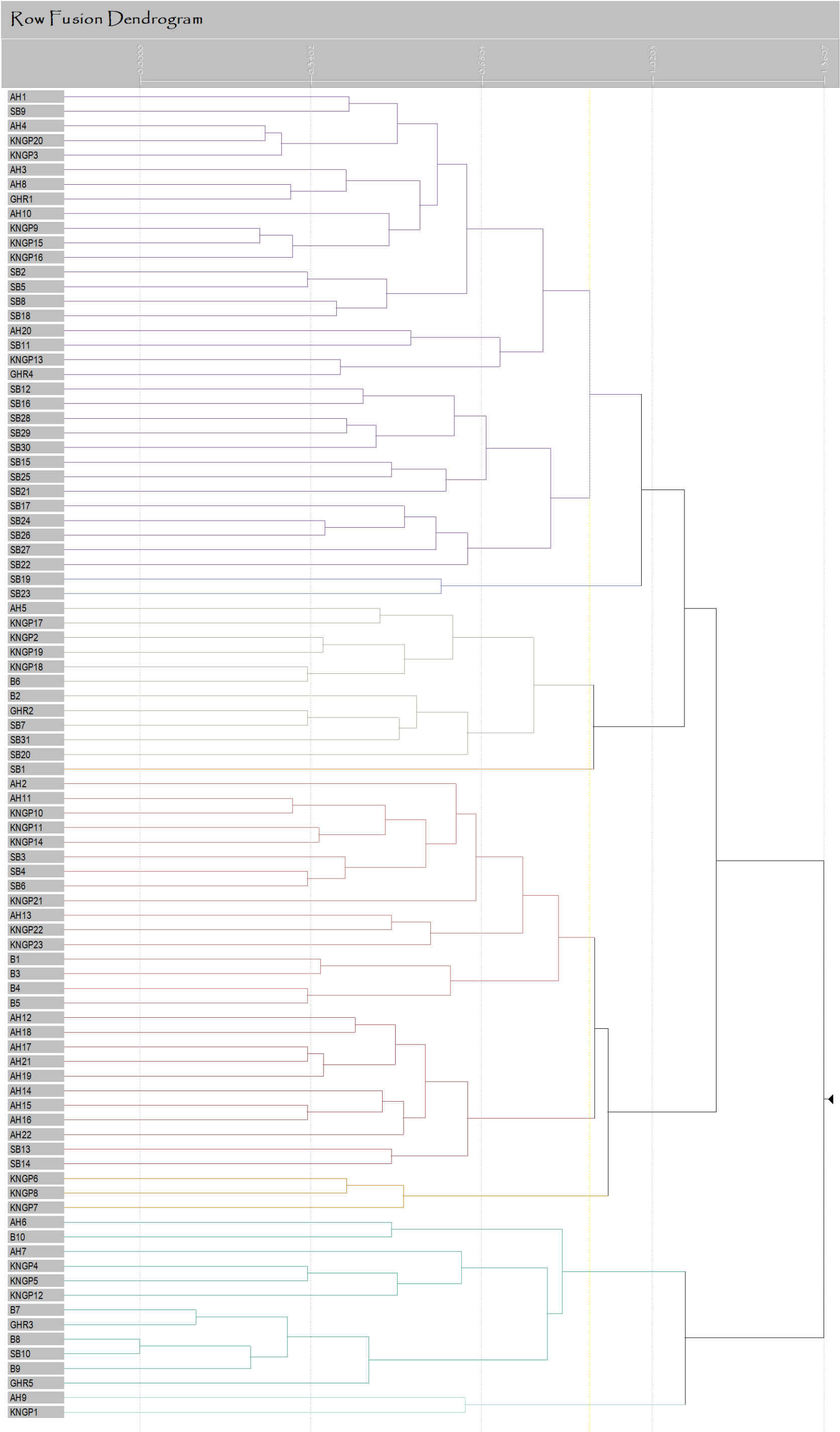
SB22			
Direction	East	South-East	South
SB23			
Direction	East	South-East	South
SB24			
Direction	East	South-East	South

SB25			
Direction	East	South-East	South
SB26			
Direction	East	South-East	South
SB27			
Direction	East	South-East	South

SB28			
Direction	East	South-East	South
SB29			
Direction	East	South-East	South
SB30			
Direction	East	South-East	South

SB31			
Direction	East	South-East	South

Appendix 8: PATN Analysis



PATN groups

Stress: 0.2458

LEGEND

Group 1

Group 2

Group 3

Group 4

Group 5

Group 6

Group 7

Group 8

Group 9

9

3

8

4

7

5

2

6

1

Appendix 9: Potential Fauna List

Potential Vertebrate Fauna List

Bardoc Project, W.A.

Compiled by Greg Harewood - Oct 2020

Recorded (Captured/Sighted/Heard/Signs) = X

Bamford Consulting Ecologists (2012). Fauna Assessment of the Excelsior Gold Bardoc Project. Unpublished report for Excelsior Gold Limited. May 2012.

Harewood, G. (2015). Fauna Survey (Level 2 - Phase 1 and 2) Proposed Tails Storage Facility Expansion. Unpublished report for KCGM Pty Ltd. June 2015.

Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) Proposed Powerline and Infrastructure Areas KCGM - Gidji Operations. Unpublished report for KCGM. January 2012.

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

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

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

KLA (2009a). Barrick (Kanowna) Shamrock Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.

KLA (2009b). Barrick (Kanowna) Crossroads Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. January 2009.

KLA (2009c). Barrick (Kanowna) Moonlight Project Level 1 Fauna Survey. Unpublished report for Barrick (Kanowna) Ltd. March 2009.

WAM (1992). The Biological Survey of the Eastern Goldfields of Western Australia. Part 8. The Kurnalpi - Kalgoorlie Study Area. Rec. West. Aust. Mus. Supplement No. 41. (Black Flag Records).

DBCA (2020). NatureMap Database Search – “By Circle” Centre 121° 13' 19" E, 30° 14' 29" S (plus 40km buffer). Accessed 27/09/2020.

Class Family Species	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Amphibia									
Myobatrachidae									
Ground or Burrowing Frogs									
<i>Neobatrachus kunapalari</i>	Kunapalari Frog	LC	X	X					X
<i>Neobatrachus pelobatoides</i>	Humming Frog	LC						X	
<i>Neobatrachus sutor</i>	Shoemaker Frog	LC		X				X	X
<i>Neobatrachus wilsmorei</i>	Plonking Frog	LC						X	X
<i>Pseudophryne occidentalis</i>	Western Toadlet	LC	X	X					X

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

Class Family Species	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Reptilia									
Carphodactylidae Knob-tailed Geckos									
<i>Nephrurus laevis</i>	Smooth Knob-tail	LC							X
<i>Nephrurus vertebralis</i>	Midline Knob-tailed Gecko	LC						X	X
<i>Underwoodisaurus milii</i>	Barking Gecko	LC	X	X				X	X
Diplodactylidae Geckoes									
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko	LC							X
<i>Diplodactylus granariensis</i>	Western Stone Gecko	LC		X				X	X
<i>Diplodactylus pulcher</i>	Pretty Gecko	LC		X				X	X
<i>Lucasium damaeum</i>	Beaded Gecko	LC							
<i>Lucasium maini</i>	Main's Ground Gecko	LC		X				X	X
<i>Oedura reticulata</i>	Reticulated Velvet Gecko	LC		X				X	
<i>Rhynchoedura ornata</i>	Western Beaked Gecko	LC		X				X	X
<i>Strophurus assimilis</i>	Thorn-tailed Gecko	LC		X					X
<i>Strophurus elderi</i>	Jewelled Gecko	LC						X	X

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

Class Family Species	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Gekkonidae									
Geckoes									
<i>Gehyra purpurascens</i>	Purple Arid Dtella	LC		X					X
<i>Gehyra variegata</i>	Variegated Dtella	LC		X				X	X
<i>Heteronotia binoei</i>	Bynoe's Gecko	LC	X	X				X	X
Pygopodidae									
Legless Lizards									
<i>Delma australis</i>	Marble-faced Delma	LC		X				X	X
<i>Delma butleri</i>	Unbanded Delma	LC						X	X
<i>Lialis burtonis</i>	Burton's Legless Lizard	LC						X	X
<i>Pygopus lepidopodus</i>	Common Scaly Foot	LC							
<i>Pygopus nigriceps</i>	Hooded Scaly Foot	LC							X

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

Class Family Species	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Agamidae									
Dragon Lizards									
<i>Caimanops amphiboluioides</i>	Mulga Dragon	LC							
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	LC		X					
<i>Ctenophorus cristatus</i>	Bicycle Dragon	LC		X	X	X	X	X	X
<i>Ctenophorus fordi</i>	Mallee Sand Dragon	LC						X	X
<i>Ctenophorus nuchalis</i>	Central Netted Dragon	LC							
<i>Ctenophorus reticulatus</i>	Western Netted Dragon	LC						X	X
<i>Ctenophorus salinarum</i>	Salt Pan Dragon	LC						X	X
<i>Ctenophorus scutulatus</i>	Lozenge-marked Bicycle Dragon	LC	X		X			X	X
<i>Moloch horridus</i>	Thorny Devil	LC						X	X
<i>Pogona minor</i>	Western Bearded Dragon	LC							X
<i>Tympanocryptis cephalus</i>	Pebble Dragon	LC							
Varanidae									
Monitor's or Goanna's									
<i>Varanus caudolineatus</i>	Stripe-tailed Pygmy Monitor	LC		X				X	X
<i>Varanus gouldii</i>	Sand Monitor	LC	X	X			X	X	X
<i>Varanus tristis</i>	Racehorse Monitor	LC							X

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

Class Family Species	Common Name	Conservation Status	BCE 2012	Harewood 2015	Harewood 2011	Harewood 2010a/b/c	KLA 2009a/b/c	WAM 1992	DBCA 2020
Scincidae									
Skinks									
<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink	LC						X	X
<i>Cryptoblepharus plagiocephalus</i>	Peron's Snake-eyed Skink	LC		X					X
<i>Ctenotus atlas</i>	Southern Mallee Ctenotus	LC						X	X
<i>Ctenotus leonhardii</i>	Leonhardi's Skink	LC						X	X
<i>Ctenotus pantherinus</i>	Leopard Ctenotus	LC							X
<i>Ctenotus schomburgkii</i>	Barred Wedge-snout Ctenotus	LC						X	X
<i>Ctenotus uber</i>	Western Spotted Ctenotus	LC		X				X	X
<i>Cyclodomorphus melanops elongatus</i>	Eastern Slender Blue-tongue	LC						X	
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink	LC	X						X
<i>Egernia formosa</i>	Goldfields Crevice Skink	LC	X					X	X
<i>Egernia inornata</i>	Desert Skink	LC						X	
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer	LC							X
<i>Hemiergis initialis initialis</i>	Sth Five-toed Mulch Skink	LC		X					
<i>Hemiergis peronii peronii</i>	Four-toed Earless Skink	LC							
<i>Lerista kingi</i>	King's Three-toed Slider	LC						X	X
<i>Lerista picturata</i>	Goldfields Robust Lerista	LC		X				X	X
<i>Lerista timida</i>	Dwarf Three-toed Slider	LC		X					X
<i>Menetia greyii</i>	Common Dwarf Skink	LC		X				X	X

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<i>Morethia adelaidensis</i>	Saltbush Flecked Morethia	LC						X	X
<i>Morethia butleri</i>	Woodland Dark-flecked Morethia	LC							X
<i>Morethia obscura</i>	Shrubland Pale-flecked Morethia	LC							
<i>Tiliqua occipitalis</i>	Western Bluetongue	LC		X				X	X
<i>Tiliqua rugosa</i>	Bobtail	LC		X		X	X	X	X
Typhlopidae Blind Snakes									
<i>Ramphotyphlops australis</i>	Southern Blind Snake	LC							
<i>Ramphotyphlops bicolor</i>	Dark-spined Blind Snake	LC							
<i>Ramphotyphlops bituberculatus</i>	Prong-snouted Blind Snake	LC							
<i>Ramphotyphlops hamatus</i>	Northern Hook-snouted Blind Snake	LC							
<i>Ramphotyphlops waitii</i>	Common Beaked Blind Snake	LC							
Boidae Pythons, Boas									
<i>Morelia spilota</i>	Carpet Python	LC							

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Elapidae									
Elapid Snakes									
<i>Acanthophis pyrrhus</i>	Desert Death Adder	LC							
<i>Brachyuropsis fasciolata</i>	Southern Shovel-nosed Snake	LC		X					
<i>Demansia psammophis</i>	Yellow-faced Whipsnake	LC		X					X
<i>Furina ornata</i>	Moon Snake	LC							
<i>Neelaps bimaculatus</i>	Black-naped Snake	LC							
<i>Parasuta gouldii</i>	Gould's Hooded Snake	LC							X
<i>Parasuta monachus</i>	Monk Snake	LC						X	X
<i>Pseudechis australis</i>	Mulga Snake	LC		X					X
<i>Pseudonaja modesta</i>	Ringed Brown Snake	LC						X	X
<i>Pseudonaja nuchalis</i>	Gwardar	LC		X				X	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake	LC		X					X
<i>Suta fasciata</i>	Rosen's Snake	LC							X

Aves

Casuariidae

Emus, Cassowaries

<i>Dromaius novaehollandiae</i>	Emu	LC	X	X		X	X	X	X
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Megapodiidae

Moundbuilders

<i>Leipoa ocellata</i>	Malleefowl	S3 VU VU							X
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Accipitridae Kites, Goshawks, Eagles, Harriers									
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	LC							X
<i>Accipiter fasciatus</i>	Brown Goshawk	LC	X		X				X
<i>Aquila audax</i>	Wedge-tailed Eagle	LC	X	X					X
<i>Aquila morphnoides</i>	Little Eagle	LC							
<i>Circus assimilis</i>	Spotted Harrier	LC							X
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC		X					
<i>Haliastur sphenurus</i>	Whistling Kite	LC							X
<i>Hamirostra isura</i>	Square-tailed Kite	LC							
Falconidae Falcons									
<i>Falco berigora</i>	Brown Falcon	LC	X	X				X	X
<i>Falco cenchroides</i>	Australian Kestrel	LC	X	X					X
<i>Falco longipennis</i>	Australian Hobby	LC		X					X
<i>Falco peregrinus</i>	Peregrine Falcon	S7 LC							
Otididae Bustards									
<i>Ardeotis australis</i>	Australian Bustard	LC							X
Turnicidae Button-quails									
<i>Turnix velox</i>	Little Button-quail	LC				X			

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Charadriidae Lapwings, Plovers, Dotterels									
<i>Vanellus tricolor</i>	Banded Lapwing	LC							
Columbidae Pigeons, Doves									
<i>Geopelia cuneata</i>	Diamond Dove	LC							X
<i>Ocyphaps lophotes</i>	Crested Pigeon	LC	X	X	X		X	X	X
<i>Phaps chalcoptera</i>	Common Bronzewing	LC	X	X	X	X			X
Psittacidae Parrots									
<i>Cacatua roseicapilla</i>	Galah	LC		X	X			X	
<i>Cacatua sanguinea</i>	Little Corella	LC							
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	LC	X	X				X	
<i>Melopsittacus undulatus</i>	Budgerigar	LC			X				X
<i>Nymphicus hollandicus</i>	Cockatiel	LC						X	X
<i>Platycercus varius</i>	Mulga Parrot	LC	X	X				X	
<i>Platycercus zonarius</i>	Australian Ringneck Parrot	LC	X	X	X	X	X	X	X

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Cuculidae Parasitic Cuckoos									
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	LC							X
<i>Chrysococcyx basal</i>	Horsfield's Bronze Cuckoo	LC		X	X			X	
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo	LC							X
<i>Cuculus pallidus</i>	Pallid Cuckoo	LC						X	
Strigidae Hawk Owls									
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC							
Tytonidae Barn Owls									
<i>Tyto alba</i>	Barn Owl	LC							
Podargidae Frogmouths									
<i>Podargus strigoides</i>	Tawny Frogmouth	LC	X	X					X
Caprimulgidae Nightjars									
<i>Eurostopodus argus</i>	Spotted Nightjar	LC							X
Aegotheidae Owlet-nightjars									
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	LC							X

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Halcyonidae Tree Kingfishers									
<i>Todiramphus pyrrhopygia</i>	Red-backed Kingfisher	LC		X		X			
<i>Todiramphus sanctus</i>	Sacred Kingfisher	LC							X
Meropidae Bee-eaters									
<i>Merops ornatus</i>	Rainbow Bee-eater	JA LC		X	X	X	X	X	X
Climacteridae Treecreepers									
<i>Climacteris affinis</i>	White-browed Treecreeper	LC							X
<i>Climacteris rufa</i>	Rufous Treecreeper	LC						X	
Maluridae Fairy Wrens, GrassWrens									
<i>Malurus lamberti</i>	Variegated Fairy-wren	LC				X			
<i>Malurus leucopterus</i>	White-winged Fairy-wren	LC	X	X	X			X	X
<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren	LC				X			X
<i>Malurus splendens</i>	Splendid Fairy-wren	LC	X	X	X	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
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	LC	X	X	X	X		X	X
<i>Aphelocephala leucopsis</i>	Southern Whiteface	LC		X					X
<i>Calamanthus campestris</i>	Rufous Fieldwren	LC							
<i>Gerygone fusca</i>	Western Gerygone	LC			X				X
<i>Pyrholaemus brunneus</i>	Redthroat	LC	X	X	X				X
<i>Smicrornis brevirostris</i>	Weebill	LC	X	X	X	X	X	X	X
Pardalotidae									
Pardalotes									
<i>Pardalotus punctatus</i>	Spotted Pardalote	LC							
<i>Pardalotus striatus</i>	Striated Pardalote	LC	X	X	X	X	X	X	X

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Meliphagidae Honeyeaters, Chats									
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	LC	X	X	X			X	X
<i>Anthochaera carunculata</i>	Red Wattlebird	LC	X	X	X	X	X	X	X
<i>Certhionyx variegatus</i>	Pied Honeyeater	LC							X
<i>Epthianura albifrons</i>	White-fronted Chat	LC							X
<i>Epthianura tricolor</i>	Crimson Chat	LC							X
<i>Lichenostomus leucotis</i>	White-eared Honeyeater	LC	X	X	X			X	X
<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater	LC	X	X	X	X			
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater	LC	X	X					
<i>Lichenostomus virescens</i>	Singing Honeyeater	LC	X	X	X			X	
<i>Lichmera indistincta</i>	Brown Honeyeater	LC	X	X	X	X		X	X
<i>Manorina flavigula</i>	Yellow-throated Miner	LC	X	X	X	X	X	X	X
<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	LC	X	X					X
<i>Phylidonyris albifrons</i>	White-fronted Honeyeater	LC	X	X	X	X		X	
Petroicidae Australian Robins									
<i>Eopsaltria australis griseogularis</i>	Western Yellow Robin	LC							
<i>Microeca fascians</i>	Jacky Winter	LC	X	X	X	X		X	X
<i>Petroica cucullata</i>	Hooded Robin	LC						X	
<i>Petroica goodenovii</i>	Red-capped Robin	LC	X	X		X	X	X	X

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Pomatostomidae Babblers									
<i>Pomatostomus superciliosus</i>	White-browed Babbler	LC	X	X				X	X
Cinclosomatidae Whipbirds, Wedgebills, Quail Thrushes									
<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush	LC		X	X				
Neosittidae Sitellas									
<i>Daphoenositta chrysoptera</i>	Varied Sittella	LC		X				X	X
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers									
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	LC	X	X	X		X	X	X
<i>Oreoica gutturalis</i>	Crested Bellbird	LC	X	X	X	X	X	X	X
<i>Pachycephala inornata</i>	Gilbert's Whistler	LC	X	X					X
<i>Pachycephala rufiventris</i>	Rufous Whistler	LC	X	X					X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo									
<i>Grallina cyanoleuca</i>	Magpie-lark	LC		X	X				X
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC							
<i>Rhipidura leucophrys</i>	Willie Wagtail	LC		X		X	X		X

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Campephagidae Cuckoo-shrikes, Trillers									
<i>Coracina maxima</i>	Ground Cuckoo-shrike	LC							X
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC	X	X	X	X		X	X
<i>Lalage tricolor</i>	White-winged Triller	LC		X				X	
Artamidae Woodswallows, Butcherbirds, Currawongs									
<i>Artamus cinereus</i>	Black-faced Woodswallow	LC	X					X	X
<i>Artamus cyanopterus</i>	Dusky Woodswallow	LC		X	X	X			X
<i>Artamus minor</i>	Little Woodswallow	LC							X
<i>Artamus personatus</i>	Masked Woodswallow	LC							X
<i>Artamus superciliosus</i>	White-browed Woodswallow	LC							
Cracticidae Currawongs, Magpies & Butcherbirds									
<i>Cracticus nigrogularis</i>	Pied Butcherbird	LC		X	X	X	X	X	X
<i>Cracticus tibicen</i>	Australian Magpie	LC	X	X		X	X	X	X
<i>Cracticus torquatus</i>	Grey Butcherbird	LC	X	X	X	X		X	X
<i>Strepera versicolor</i>	Grey Currawong	LC	X	X	X		X	X	X

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Corvidae Ravens, Crows									
<i>Corvus bennetti</i>	Little Crow	LC							X
<i>Corvus coronoides</i>	Australian Raven	LC	X	X	X		X		X
<i>Corvus orru</i>	Torresian Crow	LC							X
<i>Corvus sp</i>	Corvid	LC						X	
Motacillidae Old World Pipits, Wagtails									
<i>Anthus australis</i>	Australian Pipit	LC		X				X	
Estrilidae Grass Finches & Mannikins									
<i>Taeniopygia guttata</i>	Zebra Finch	LC							X
Dicaeidae Flowerpeckers									
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC	X	X					X
Hirundinidae Swallows, Martins									
<i>Cheramoeca leucosternus</i>	White-backed Swallow	LC		X					
<i>Hirundo ariel</i>	Fairy Martin	LC							
<i>Hirundo neoxena</i>	Welcome Swallow	LC		X		X		X	X
<i>Hirundo nigricans</i>	Tree Martin	LC		X				X	

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Sylviidae Old World Warblers									
<i>Cincloramphus cruralis</i>	Brown Songlark	LC						X	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC							
Zosteropidae White-eyes									
<i>Zosterops lateralis</i>	Silvereye	LC							
Mammalia									
Tachyglossidae Echidnas									
<i>Tachyglossus aculeatus</i>	Echidna	LC	X	X		X	X		
Dasyuridae Carnivorous Marsupials									
<i>Antechinomys laniger</i>	Kultarr	DD							X
<i>Ningau i yvonneae</i>	Southern Ningau i	LC							X
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	LC						X	X
<i>Sminthopsis dolichura</i>	Little long-tailed Dunnart	LC		X				X	X
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart	LC							X
<i>Sminthopsis ooldea</i>	Ooldea Dunnart	LC		X					X
Burramyidae Pygmy Possums									
<i>Cercartetus concinnus</i>	Western Pygmy-possum	LC		X				X	X

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Macropodidae Kangaroos, Wallabies									
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC	X	X	X		X	X	
<i>Macropus robustus</i>	Euro	LC				X			X
<i>Macropus rufus</i>	Red Kangaroo	LC		X		X		X	
Emballonuridae Sheath-tailed Bats									
<i>Taphozous hilli</i>	Hill's Sheath-tail-bat	LC		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	
Vespertilionidae Ordinary Bats									
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	LC	X	X				X	X
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	LC		X				X	
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	LC		X				X	X
<i>Nyctophilus major tor</i>	Central Long-eared Bat	P3							
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	LC		X				X	X
<i>Vespadelus baverstocki</i>	Inland Forest Bat	LC		X					X
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat	LC		X					
<i>Vespadelus regulus</i>	Southern Forest Bat	LC		X				X	X

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Muridae Rats, Mice									
<i>Mus musculus</i>	House Mouse	Introduced	X	X				X	X
<i>Pseudomys bolami</i>	Bolam's Mouse	LC		X					X
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	LC							X
Canidae Dogs, Foxes									
<i>Canis lupus</i>	Dingo/Dog	Introduced		X					
<i>Vulpes vulpes</i>	Red Fox	Introduced	X						X
Felidae Cats									
<i>Felis catus</i>	Cat	Introduced	X	X					
Bovidae Horned Ruminants									
<i>Bos taurus</i>	European Cattle	Introduced		X					
<i>Capra hircus</i>	Goat	Introduced	X	X		X	X		X
<i>Ovis aries</i>	Sheep	Introduced		X			X		
Leporidae Rabbits, Hares									
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	X	X	X	X	X		X

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