



Native Vegetation Clearing Permit (Purpose): Supporting Documentation

Tower Hill Project



Prepared for Genesis Minerals Ltd

23 August 2024

Project Number: TE24020

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Approval for Release

Name	Position	File Reference
Alayna Martin	Senior Environmental Consultant	TE24020 NVCP_Supporting Documentation_Rev 2.0

Signature

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Table of Contents

1	Introduction	5
1.1	Background	5
1.2	Purpose of Clearing Permit Application	6
1.3	Proposed Timeframe	6
1.4	Responsible Applicant.....	6
2	Site Overview	9
2.1	Climate	9
2.2	Topography	10
2.3	Interim Biogeographic Regionalisation of Australia (IBRA)	10
2.5	Hydrology	11
2.5.1	Surface Water	11
2.5.2	Groundwater.....	11
2.6	Conservation Features	12
3	Flora and Vegetation Assessment	13
3.1	Flora Assessment	13
3.1.1	Broad Vegetation Types	13
3.1.2	Vegetation Communities	16
3.1.3	Conservation Significant Flora	16
3.1.4	Threatened and Priority Ecological Communities.....	17
3.1.5	Introduced Species.....	17
4	Fauna Assessment	20
4.1	Fauna Habitat.....	20
4.2	Conservation Significant Species	20
4.3	Subterranean Fauna.....	22
4.4	Short Range Endemic Species	22
5	Assessment Against the Ten Clearing Principles	23
6	Summary of Assessment	28
7	References	29
8	Appendices	30

Tables

Table 1-1: Project Tenements held by St Barbara	5
Table 2-1: Soil Landscapes identified within the Project DE.....	11
Table 3-1: Extents of vegetation associations mapped within the survey area	14
Table 3-2: Ecological Communities Recorded at Tower Hill.	16
Table 3-3: Conservation significant flora in proximity to survey areas.	16
Table 4-1: Assessment of the potential presence of a Conservation Significant Fauna species	20
Table 5-1: Assessment Against the Ten Clearing Principles.....	23

Figures

Figure 1-1: Project Locality	7
Figure 1-2: Proposed Development Envelope	8
Figure 2-1: Mean Maximum/Minimum Temperature for Leonora	9
Figure 2-2: Mean rainfall (mm) for Leonora	10
Figure 3-1: Beard’s Pre-European Vegetation Associations	15
Figure 3-2: Melita Calcrete Vicinity to Project Area	18
Figure 3-3: Sturts Meadows Vicinity to Project Area.....	19

Appendices

APPENDIX A Leonora Operations Flora and Vegetation Site Visit and Basic Terrestrial Fauna Assessment
APPENDIX B Detailed Flora and Vegetation Survey of the Leonara Project
APPENDIX C Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment
APPENDIX D Genesis Minerals - Tower Hill expansion SRE Fauna Survey Report

1 Introduction

1.1 Background

Talis Consultants Pty Ltd (Talis) have been commissioned by Genesis Minerals Limited (Genesis) to prepare a Native Vegetation Clearing Permit (NVCP) application for clearing associated with the Tower Hill Project (the Project).

The Project is located approximately 1 kilometre (km) southwest of Leonora, in the Goldfields region of Western Australia (WA) (Figure 1-1). It forms part of the Genesis Leonora Operations Project which includes the Gwalia, Admiral, Harbour Lights and Ulysses operations. Tower Hill is an existing open cut pit, that is currently filled with a pit lake. The site has existing disturbance including a tailings dam, waste rock landform and access roads (Figure 1-2).

Genesis Minerals (Leonora) Pty Ltd (Genesis) acquired the Tower Hill tenements from St Barbara Limited (St Barbara) on 30 June 2023 (GMD ASX Release 3 July 2023). Genesis has a registered Power of Attorney with the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) to manage the tenements on behalf of St Barbara whilst Stamp Duty Assessment is underway. The tenements are expected to be transferred to Genesis within the next 6–12-month period. Details of relevant tenements for this NVCP application are included in Table 1-1.

Table 1-1: Project Tenements held by St Barbara

Tenement	Tenement Area (ha)	Date Granted	Expiry Date	Status
G 37/21	2.02	6 th February 1989	28 th February 2031	LIVE
L 37/220	34.82	11 th July 2017	10 th July 2038	LIVE
L 37/263	244.36	28 th July 2023	27 th July 2044	LIVE
L 37/28	0.34	28 th November 1985	22 nd September 2027	LIVE
L 37/29	0.48	28 th November 1985	22 nd September 2027	LIVE
L 37/30	0.02	28 th November 1985	22 nd September 2027	LIVE
L 37/70	1.28	24 th April 1991	23 rd April 2026	LIVE
L 37/80	6.00	14 th October 1992	13 th October 2027	LIVE
M 37/17	254.75	13 th December 1983	3 rd January 2026	LIVE
M 37/247	47.76	25 th October 1989	5 th November 2031	LIVE
M 37/25	823.50	26 th April 1995	29 th April 2027	LIVE
M 37/251	745.70	12 th November 1990	15 th November 2032	LIVE
M 37/55	362.20	3 rd September 1985	22 nd September 2027	LIVE
M 37/622	37.51	7 th January 2008	9 th January 2029	LIVE
M 37/689	513.40	7 th January 2008	9 th January 2029	LIVE
M 37/903	16.20	18 th November 2007	22 nd November 2028	LIVE

Under Section 51C of the *Environmental Protection Act 1986* (EP Act), the clearing of any native vegetation requires an approved clearing permit, unless an exemption applies. Exemptions for mining generally apply to areas of low impact mining and exploration or for proposals that have already been assessed by the Environmental Protection Authority (EPA), Department of Water, Environment and Regulation (DWER) or DEMIRS through a separate process. Tenement L37/246 is owned by Southern Cross Pipelines Australia Pty Ltd (Southern Cross Pipelines). Any clearing required on this tenement will be based on an agreement with Southern Cross Pipelines and Genesis. The area of tenement within the project boundary has been previously disturbed.

This NVCP application is to clear up to an additional 399.13 hectares (ha) of native vegetation within the Disturbance Envelope (DE) of approximately 618.79 ha. Approximately 219.66 ha has previously been disturbed (Figure 1-2).

1.2 Purpose of Clearing Permit Application

The purpose of this NVCP supporting document is to present the results of an assessment of the clearing required for this Project against the ten clearing principles as outlined in the clearing permit guidelines - *A guide to the assessment of applications to clear native vegetation (2014)* under Part V Division 2 of the EP Act. This report identifies the potential environmental impacts associated with the proposal based on the best available data. This report and accompanying NVCP Purpose Permit application form will be submitted to DEMIRS for assessment.

1.3 Proposed Timeframe

Clearing is proposed to commence in Q3 2025 with mining likely to be completed by 2033.

1.4 Responsible Applicant

Genesis Minerals Limited are responsible for the implementation of the clearing described within this report. Correspondence relating to this NVCP application should be addressed to:

Tim Pavlos

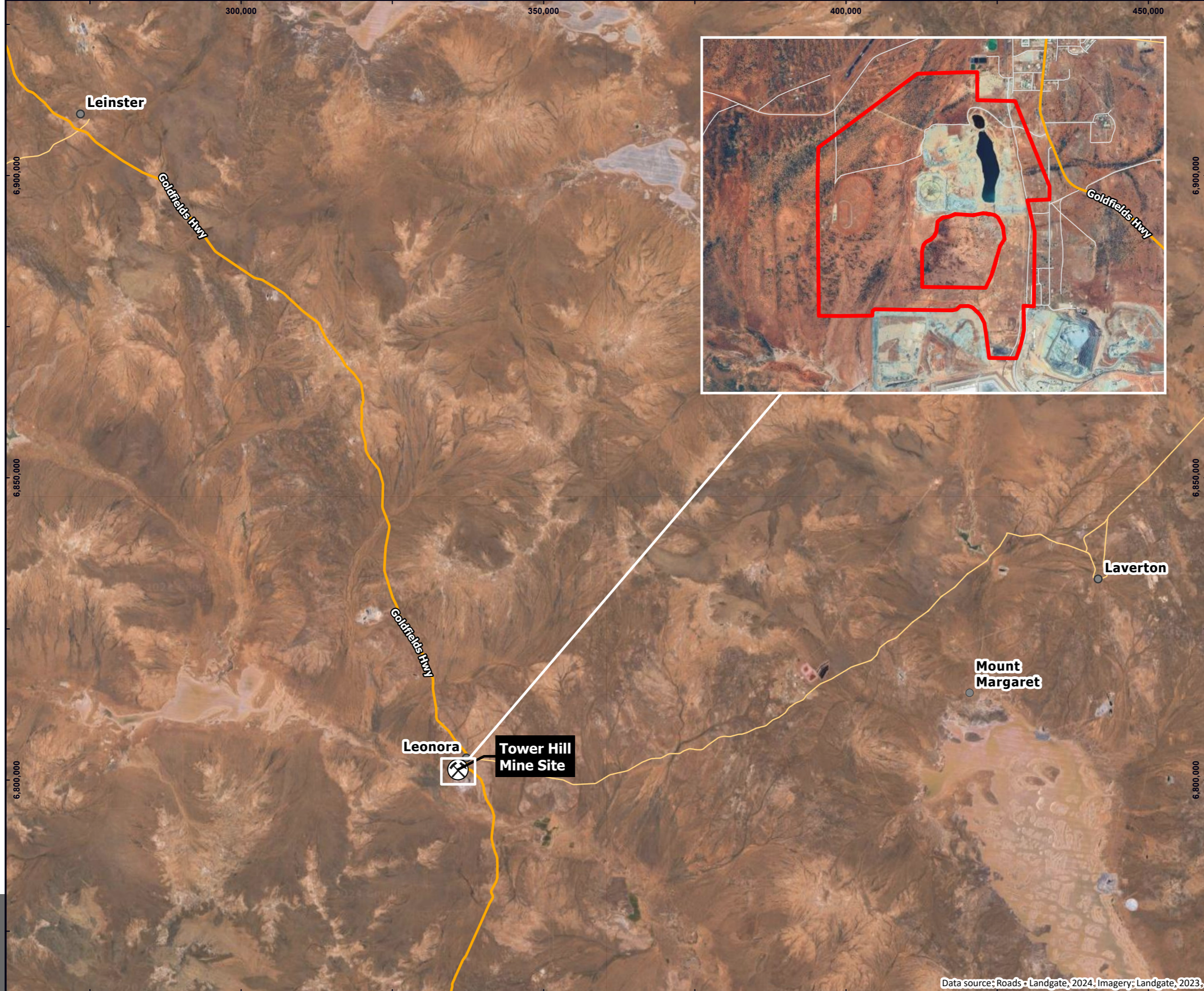
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Phone: (08) 6323 9094

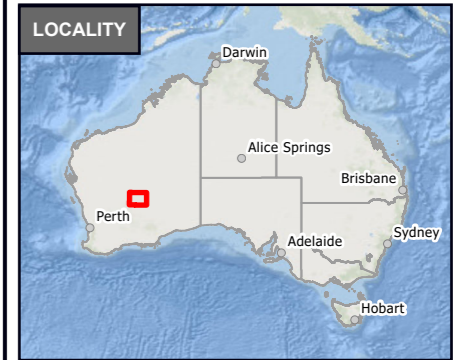
Email: tim.pavlos@genesisminerals.com.au



LEGEND

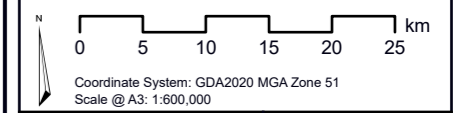
-  Tower Hill Mine Site
-  Native Vegetation Clearing Permit Boundary
- Western Australian Roads**
-  Freeway / Highway
-  Main Road
-  Minor Road

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PROJECT LOCALITY

Tower Hill
Native Vegetation Clearing Permit
Genesis Minerals Limited

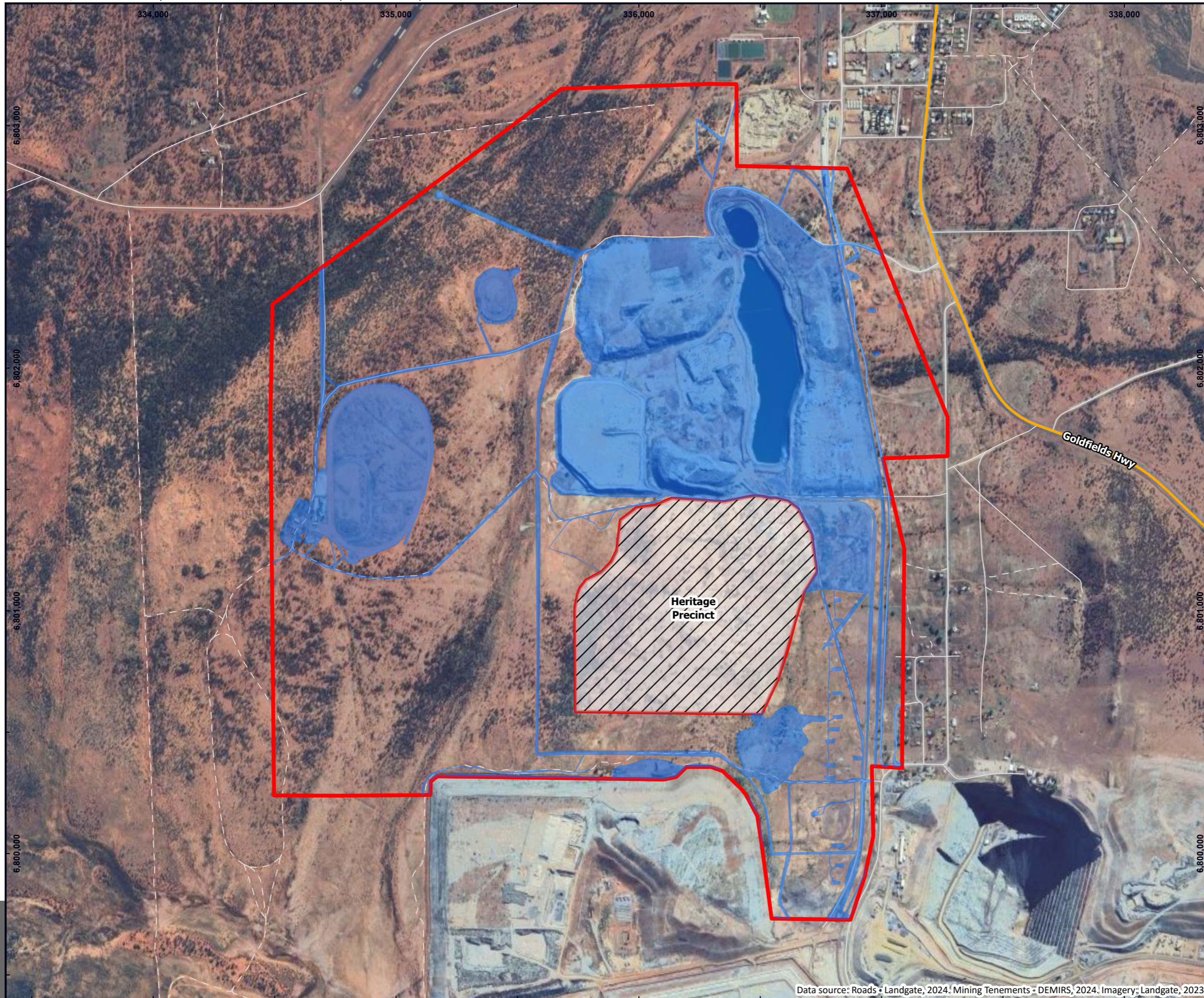


Prepared: E Jackson	Date: 12/07/2024
Reviewed: D Tills	Revision: A
Project: TE24020	



Figure 1-1

Data source: Roads - Landgate, 2024. Imagery: Landgate, 2023.



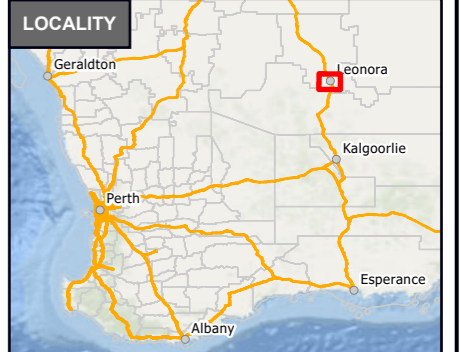
LEGEND

- Native Vegetation Clearing Permit Boundary
- Pre-Disturbed Areas
- Heritage Precinct (Exclusion Zone)
- Freeway / Highway
- Minor Road
- Other

Western Australian Roads

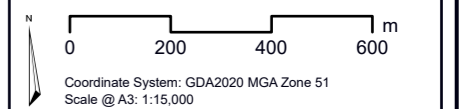
- Freeway / Highway
- Minor Road
- Other

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PROPOSED DEVELOPMENT ENVELOPE (UPDATED PRE-DISTURBED AREAS)

Tower Hill
Native Vegetation Clearing Permit
Genesis Minerals Limited



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Project: TE24020	



Figure 1-2

2 Site Overview

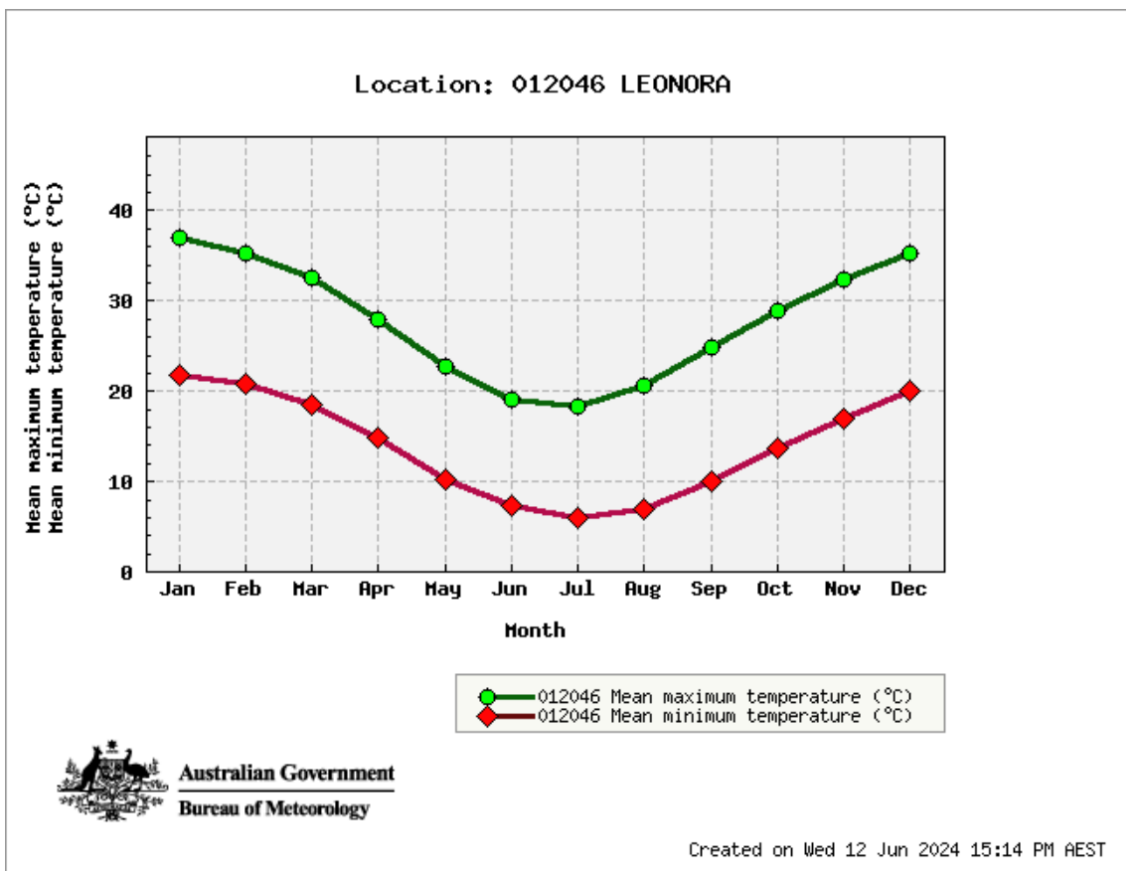
2.1 Climate

The Project is located in the Goldfields-Esperance region of WA, approximately 1 km Southwest of the town of Leonora. The local climate is classified as semi-arid, and is characterised by hot, dry summers and mild to warm winters with low and irregular rainfall. The region experiences significant temperature variations between day and night, and rainfall is usually sparse and unpredictable, often concentrated in short periods.

The monthly mean maximum temperatures range from 18.4 degrees Celsius (°C) in July to 37.0°C in January, while the mean minimum temperatures range from 6.1°C in July to 21.8°C in January. The annual mean minimum temperature is 14°C and the annual mean maximum temperature 27.9°C (Figure 2-1).

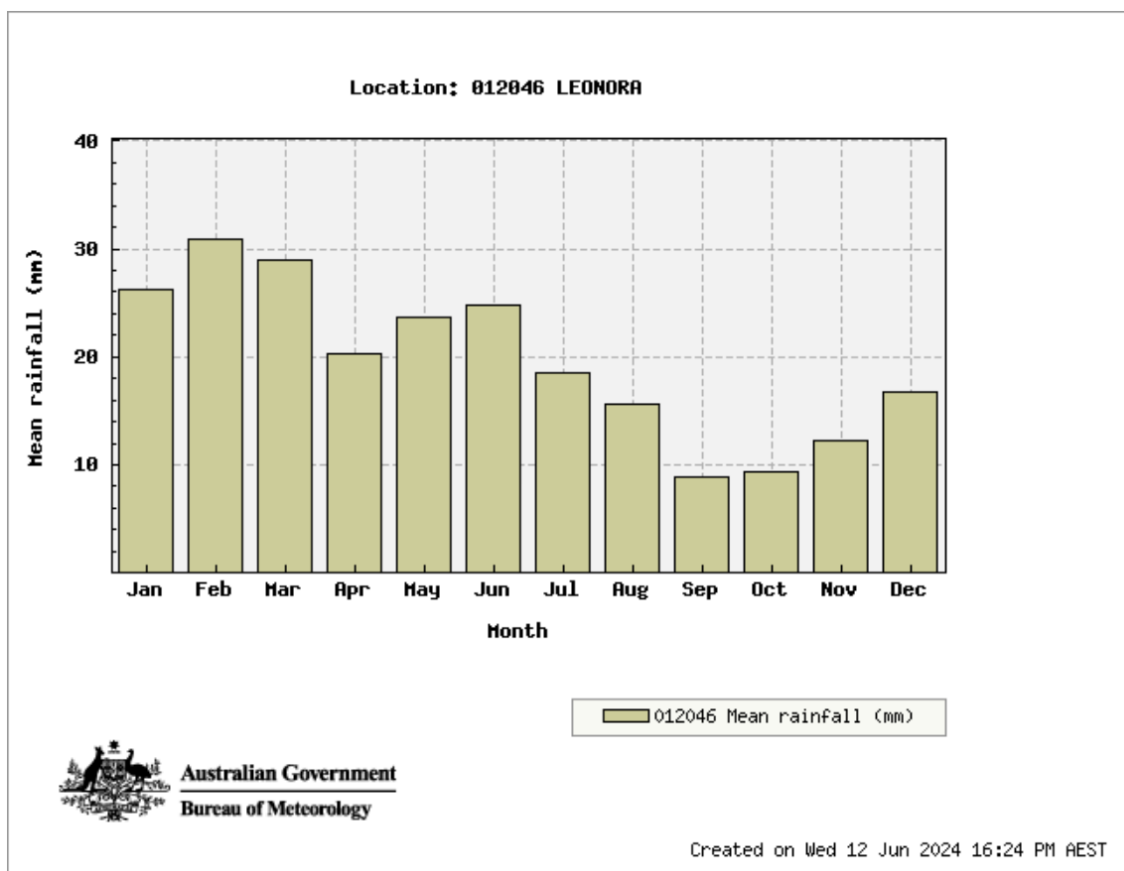
The mean rainfall at Leonora is lowest during September at 8.9 millimetres (mm) and at highest during February at 30.9 mm (Figure 2-2). Prevailing winds are easterly in the mornings (0900hrs) with an average speed of 9.8 kilometres per hour (km/h) (BoM, 2024). In the afternoons, direction varies by season between easterly and westerly.

Figure 2-1: Mean Maximum/Minimum Temperature for Leonora



Source: Bureau of Meteorology, 2024

Figure 2-2: Mean rainfall (mm) for Leonora



Source: Bureau of Meteorology, 2024

2.2 Topography

The area immediately surrounding Leonora has elevations ranging from approximately 370 metres Relative Level (mRL). A prominent range of hills extends north-northwest from south of Leonora, rising approximately 60 metres (m) above the surrounding plain, including Mt Leonora, which is one of the most prominent topographic features visible from the township of Leonora (MBS, 2023).

The Tower Hill Pit trends north to south and is located approximately 1.5 km south-west of Leonora. The Tower Hill cuts an old drainage line that trends east-west, which prior to pit development, carried water through to Lake Raeside. When mine was operational drainage was diverted around the northern end of the pit. During care and maintenance drainage ran into the pit void. Until a temporary diversion was installed in 2023 that diverted water to the north of the Tower Hill Pit. installation of diversion infrastructure, proposed as part of the Tower Hill Project will allow drainage from the Wilson Creek tributaries to connect with the Lake Raeside catchment for the first time since mining commenced.

2.3 Interim Biogeographic Regionalisation of Australia (IBRA)

The Interim Biogeographic Regionalisation of Australia (IBRA) divides Australia into 89 bioregions based on major biological, geographical, and geological attributes. These bioregions are subdivided into 419 subregions as part of a refinement of the IBRA framework (Department of Climate Change, Energy, the Environment and Water, 2023).

The Project is located within IBRA Bioregion of Murchison (sub-region of Eastern Murchison) which is generally characterised by arid climate, with mainly winter rainfall. Landscapes comprise of low hills and mesas separated by flat colluvium and alluvial plains. Salt Lake systems are associated with the occluded paleodrainage system. Broad plains of red-brown soils and breakaway complexes as well as red sandplains are widespread. Vegetation is dominated by mulga woodlands and is often rich in ephemerals, hummock grasslands, saltbush shrublands (on calcareous soils) and Halosarcia shrublands. The Murchison region is one of the main pastoral areas in WA (ACRIS, 2008).

2.4 Soil Landscape Systems

Soil landscapes and land system mapping of WA describes broad soil and landscape characteristics from regional to local scales, and has been captured at scales ranging from 1:20,000 to 1:250,000. The Project was mapped across several Soil Landscape Systems by Spectrum (2022). The systems present within the DE at Tower Hill are summarised in Table 2-1 below:

Table 2-1: Soil Landscapes identified within the Project DE

Land System ID	Description
Carnegie Land System	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.
Gundockerta Land System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.
Leonora Land System	Low greenstone hills and stony plains supporting mixed chenopod shrublands.
Rainbow Land System	Hardpan plains supporting mulga tall shrublands.

2.5 Hydrology

2.5.1 Surface Water

There are no permanent surface water resources within the immediate vicinity of the Gwalia operation. Lake Raeside, an ephemeral salt lake, is located approximately 800 m to the south of the Project area.

In 2024, Genesis commissioned AQ2 Consultants to undertake a Surface Water Hydrological Assessment and conceptual diversion designs. This work is ongoing and will determine future projects related to surface water. It is evident that several ephemeral creeks will have to be diverted around the project, and preliminary solutions have been identified with design works to be completed prior to the commencement of mining (Genesis, 2024).

2.5.2 Groundwater

Groundwater in the Tower Hill Pit area predominantly occurs within the weathered regolith profile and within joints, faults and shear zones in the underlying bedrock aquifer. The thickness of the weathered profiles within the area varies from a few metres near fresh bedrock outcrops and sub-crops, to more than 100 m within the nearby Raeside Palaeochannel.

Groundwater is typically saline, with salinity of the bores around the pit ranging from 12,000 to 81,000 mg/L TDS. Regional groundwater flow is typically south towards Lake Raeside. Groundwater levels in

the with the Project area have a high level of variability with depths ranging from 4 to 17mbgl. The 1 m drawdown contours from GHD (2022) show that the PEC including it's buffer area will not be impacted from the dewatering activities of the pit.

2.6 Conservation Features

There are no conservation reserves or estates located within or immediately adjacent to the proposed DE. No conservation reserve was located within 100 km of the survey area. Bulga Downs & Cashmere Downs Pastoral leases portions, is a Nature Reserve in progress, is located just outside of the 100 km buffer (Spectrum, 2022).

Desktop studies from both NVS (2023) and Spectrum (2022) found that no Environmental Sensitive Area (ESA) is located within the proposed disturbance footprint. There are two ESA's within a 100 km buffer zone being Lake Ballard (67.2 kms south) and Lake Marmion (81.1 km South).

There were no Threatened Ecological Communities (TEC) identified within the proposed DE during the studies by Spectrum (2022). Two Priority Ecological Communities (PEC) were found within proximity to the Project. One of the PECs; Melita Calcrete was identified in the survey overlapping the Tower Hill proposed disturbance footprint, and the other PEC, Sturt Meadows calcrete which is found roughly 37.58 kms northwest from the Project. Further details are provided below in Section 4.3.

3 Flora and Vegetation Assessment

A number of Flora and Vegetation surveys have been undertaken for the Project since 2006. For the purpose of this assessment, surveys that are dated more than three years have been excluded to describe the baseline biodiversity of the Project. This is to ensure survey relevancy and describe the environment in its current form.

In 2021, Spectrum Spatial and Ecology (Spectrum) undertook a comprehensive Flora and Vegetation Desktop Assessment which included a site visit. As a result from the findings of the Spectrum assessment, a further detailed Flora and Vegetation Survey was undertaken by Native Vegetation Solutions (NVS) in September 2022. The findings of these assessments are detailed below in Section 3.1, including the assessment against the Clearing Principles (Section 5).

3.1 Flora Assessment

Spectrum conducted a basic fauna survey and a flora site visit in November 2021 (Appendix A). The areas surveyed included four distinct mining areas; Gwalia, Tower Hill, Harbour Lights, Jaspers and two proposed railway corridors. Spectrum identified a total of 86 significant flora taxa during the flora desktop search. Of these, five were assigned a High Likelihood of occurrence, while ten were assigned a Medium Likelihood of occurrence. No TEC were recorded within 50 km of the survey area. However, the desktop assessment recorded two PEC within 50 km of the survey area which are both listed as Priority 1. One PEC intersects the survey area at both Gwalia and Tower Hill (Spectrum, 2022) whilst it was noted that the other PEC was located approximately 37 kms northwest of the Project area.

In 2022, NVS conducted a Detailed Flora and Vegetation Survey (Appendix B) with a survey area encompassing three distinct areas; Gwalia (2,015 ha), Tower Hill (1,143 ha) and Harbour Lights (400 ha). During the initial desktop study, NVS identified the 'potential' occurrence of Conservation Significant flora and confirmed two PECs within close proximity to the Project area. The detailed field survey later confirmed no Threatened or Priority flora or ESAs in the survey area (NVS, 2023).

The detailed field survey across the three areas found two-hundred and one species with 176 species recorded within quadrats. 42 families and 95 genera were recorded overall (NVS, 2023). The vegetation condition in the survey area was classified by good to very good condition using Keighery's, (1994) vegetation conditions definitions. The disturbance present within the Tower Hill survey area mostly attributed to, existing roads, historical open pits, waste landforms and exploration related activities. The vegetation more than 0.5 m from existing tracks was assessed as mostly in good condition (NVS, 2023). NVS concluded that results from the survey indicated the majority of the flora within the survey area is not unique and is common throughout the Eastern Murchison Subregion and adjoining regions and that the vegetation condition of the areas had been impacted by historical exploration and mining activities as well as grazing. (NVS, 2023).

3.1.1 Broad Vegetation Types

Mapping of pre-European broad vegetation within Western Australia was completed on a broad scale (1:1,000,000) by Beard (1976). Three of Beard's pre-European vegetation associations are mapped within the survey area (Figure 3-1):

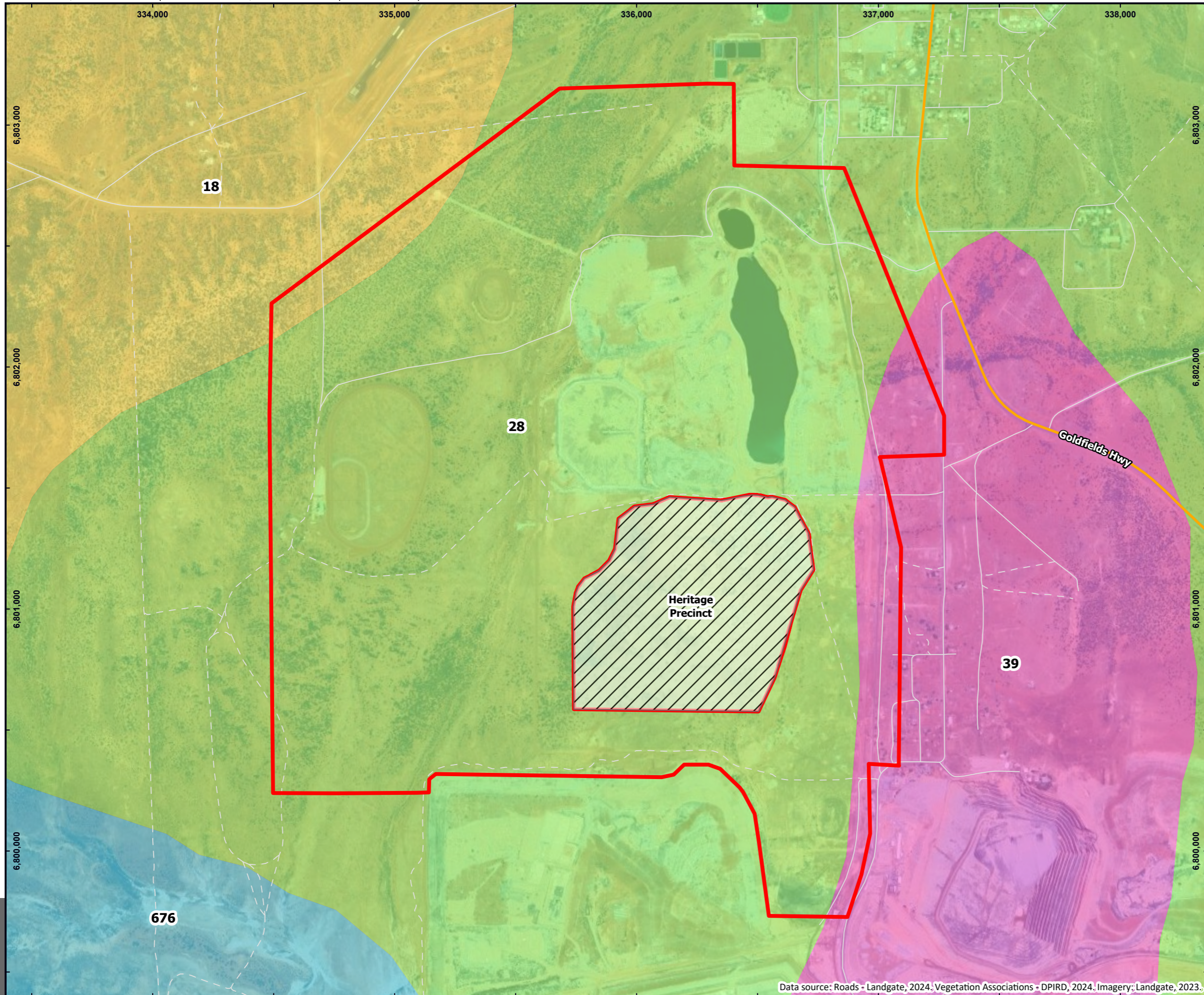
- Association 18: Low woodland; mulga (*Acacia aneura*);
- Association 28: Open low woodland; mulga; and
- Association 39: Shrublands; mulga scrub.

The extent of Beard vegetation units within the survey area is less than 1.5 percent (%) for all Vegetation types, and each are well above the 30 % threshold at a State, bioregional and subregional level (NVS, 2023).

Table 3-1 details the remaining proportion of the vegetation units that lie within the proposed clearing footprint.

Table 3-1: Extents of vegetation associations mapped within the survey area

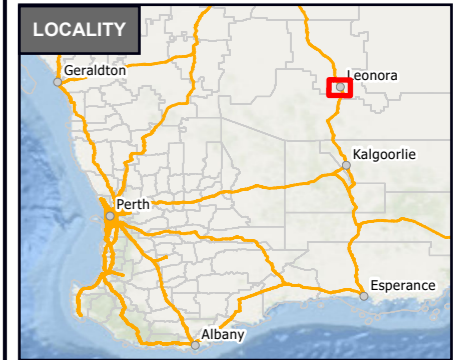
Vegetation Association	Scale	Pre-European extent (ha)	Current extent (ha)	Remaining (%)	Hectares (ha) within DE	% of current extent within DE
18	State: WA	19,892,306	19,843,148	99.75	13.27	<0.1
	IBRA Sub-region: Murchison (MUR01)	12,403,172	12,363,252	99.68		<0.1
	LGA: Shire of Leonora	2,010,057	2,002,508	99.62		<0.1
28	State: WA	395,895	392,171	99.06	567.88	0.1
	IBRA Sub-region: Murchison (MUR01)	224,291	220,583	98.35		0.3
	LGA: Shire of Leonora	126,344	124,136	98.25		0.5
39	State: WA	6,613,567	6,602,578	99.83	37.64	<0.1
	IBRA Sub-region: Murchison (MUR01)	1,148,400	1,138,064	99.10		<0.1
	LGA: Shire of Leonora	252,141	245,994	97.56		<0.1



LEGEND

- Native Vegetation Clearing Permit Boundary
- Heritage Precinct (Exclusion Zone)
- Pre-European Vegetation Associations**
- 18: Low woodland, open low woodland or sparse woodland (Mulga *Acacia aneura* and associated species.)
- 28: Low woodland, open low woodland or sparse woodland (Mulga *Acacia aneura* and associated species.)
- 39: Scrub, open scrub or sparse scrub (Wattle, teatree & other species *Acacia* spp. *Melaleuca* spp.)
- 676: Samphire (*Tecticornia* spp. communities in saline areas)
- Western Australian Roads**
- Freeway / Highway
- Minor Road
- Other

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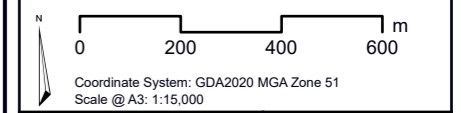


VEGETATION ASSOCIATIONS

Tower Hill

Native Vegetation Clearing Permit

Genesis Minerals Limited



Prepared: E Jackson	Date: 15/07/2024
Reviewed: D Tills	Revision: A
Project: TE24020	



Figure 3-1

3.1.2 Vegetation Communities

The Spectrum (2022) survey and site visit identified 6 ecological communities within the Tower Hill survey area, inclusive of the Heritage Precinct (Table 3-2).

Table 3-2: Ecological Communities Recorded at Tower Hill.

Ecological Community	Area (ha)
<i>Acacia</i> (Mulga) spp. over mixed shrubs on quartz outcrop	1.9
<i>Eremophila</i> over <i>Tecticornia</i> open plain on fine gravel	6.5
Low open shrubland of <i>Acacia</i> spp. over mixed chenopods and grasses on pebbles and quartz on lower slopes	61.8
Cleared/Disturbed	279.1
Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	153.0
Open woodland of <i>Acacia</i> spp. (Mulga) over sparse shrubs on sandy-loam on flats and lower slopes	240.0
Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	35.5

The ecological communities within the survey area that contain rocky ridges, rocky outcropping, and chenopods such as *Tecticornia* spp. were noted as potentially significant due to the possibility for rare or threatened species to be present (Spectrum, 2022). These communities will not be disturbed as part of the Tower Hill Project.

3.1.3 Conservation Significant Flora

Eighty-six (86) significant flora taxa were identified during the flora desktop searches by (Spectrum, 2022). Of these, five were assigned a 'High Likelihood' of occurrence, while ten were assigned a 'Medium Likelihood' of occurrence (Spectrum, 2022).

No conservation significant flora species were recorded during the field survey (NVS,2023). However, two conservation significant flora species records, located within close proximity to the survey area, were investigated. The findings are in Table 3-3 below.

Table 3-3: Conservation significant flora in proximity to survey areas.

Taxon	Conservation Status	Findings
<i>Acacia</i> sp. Marshall Pool (G. Cockerton 3024)	P3	The precision rating for the coordinates is three, which indicates the individual is located within 10 km of the record location. Record was located in the middle of Leonora indicating that the locality of Leonora may have been used instead of an GPS location (Spectrum, 2022).
<i>Frankenia glomerata</i>	P4	Record was located just west of the Tower Hill boundary and the species could not be located. The accuracy of the location is questionable as the record was located in <i>Acacia</i> shrubland on red loam soils; however, the species preferred habitat is white sand with Samphire and pigface (around salt lakes etc.). This species is expected to occur around the Lake Raeside drainage where suitable habitat exists (Spectrum, 2022).

3.1.4 Threatened and Priority Ecological Communities

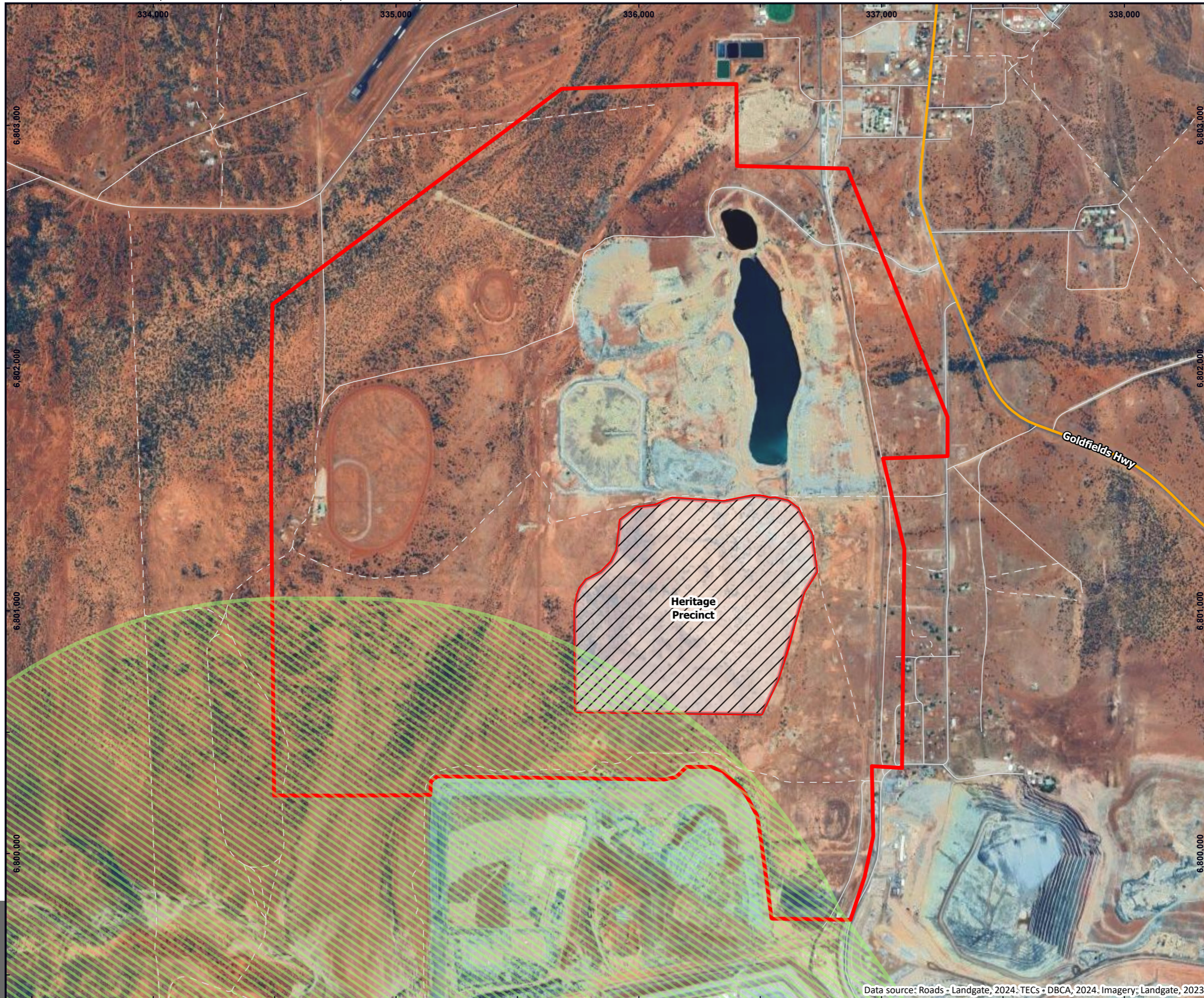
No TECs were recorded within 50 km of the survey area (NVS, 2023). Two PECs were found within 50 km of the survey area, both of which are listed as Priority 1:

- Melita Calcrete Groundwater Assemblage Type on Raeside Paleodrainage on Melita (Sons of Gwalia); and
- Sturt Meadows Calcrete Groundwater Assemblage Type on Raeside Paleodrainage on Sturt Meadows Station.

Melita Calcrete Groundwater Assemblage Type on Raeside Paleodrainage on Melita (Sons of Gwalia) Station intersects the survey area at both Gwalia and Tower Hill (NVS, 2023). Figure 3-2 shows the Melita Calcrete community in comparison to the proposed DE and further detail of the community is detailed in Section 4.3. Sturt Meadows Calcrete Groundwater Assemblage Type on Raeside Paleodrainage on Sturt Meadows Station lies roughly 37.58 kms northwest from the DE (Figure 3-3). It was assigned a 'Low likelihood' to occur within the survey area based on the restriction to a paleodrainage system on Sturt Meadows Station (NVS, 2023).

3.1.5 Introduced Species

Eighteen introduced weed species were detected within the survey area. Three of these are considered Declared Pests (DPIRD, 2023), *Cylindropuntia imbricata*- s22(2) C3 Restricted, *Opuntia stricta*- s22(2) C3 Restricted and *Rumex vesicarius*- Prohibited s12 C1 Prohibited (NVS, 2023).



LEGEND

- Native Vegetation Clearing Permit Boundary
 - Heritage Precinct (Exclusion Zone)
 - PEC: Melita Calcrete
 - Groundwater Assemblage Type on Raeside Palaeodrainage on Melita (Sons of Gwalia) Station
- Western Australian Roads**
- Freeway / Highway
 - Minor Road
 - Other

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PRIORITY ECOLOGICAL COMMUNITIES (MELITA CALCRETE)

Tower Hill
Native Vegetation Clearing Permit
Genesis Minerals Limited



Prepared: E Jackson	Date: 15/07/2024
Reviewed: D Tills	Revision: A
Project: TE24020	



Figure 3-2

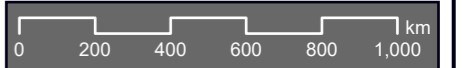
Data source: Roads - Landgate, 2024. TECs - DBCA, 2024. Imagery: Landgate, 2023.



LEGEND

- Native Vegetation Clearing Permit Boundary
- Heritage Precinct (Exclusion Zone)
- Threatened Ecological Communities**
- PEC: Sturt Meadows calcrete groundwater assemblage type on Raeside palaeodrainage on Sturt Meadows Station
- PEC: Melita Calcrete Groundwater Assemblage Type on Raeside Palaeodrainage on Melita (Sons of Gwalia) Station
- Separation Distance
- Western Australian Roads**
- Freeway / Highway
- Main Road

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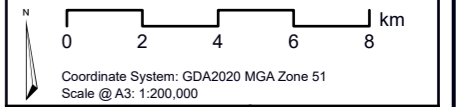


PRIORITY ECOLOGICAL COMMUNITIES (STURTS MEADOWS)

Tower Hill

Native Vegetation Clearing Permit

Genesis Minerals Limited



Prepared: E Jackson	Date: 25/07/2024
Reviewed: D Tills	Revision: A
Project: TE24020	

Figure 3-3

4 Fauna Assessment

Four fauna assessments have been completed for the Project since 2022. The following assessments form the basis of this assessment.

- 2022 Basic Terrestrial Fauna Assessment by Spectrum (2022);
- 2023 Vertebrate Survey completed by Terrestrial Ecosystems (2023);
- 2023 Subterranean Assessment conducted by Bennelongia (2023); and
- 2023 Short Range Endemic (SRE) Fauna Survey completed by Bennelongia (2024).

4.1 Fauna Habitat

Terrestrial Ecosystem (2023) recorded five broad fauna habitats within the Project area:

- Bare salt lakes;
- Ephemeral creek lines;
- Tall shrublands;
- Low shrublands; and
- Open mulga woodlands.

In addition, there are disturbed areas that are largely devoid of vegetation, including large and deep mining pits, some of which contain water, waste dumps, tailings storage facilities, mining infrastructure, parts of the Leonora airstrip, the Leonora racecourse and some residential housing (Terrestrial Ecosystems, 2023).

The density of trees and shrubs in the relatively undisturbed areas varied across the Project area but was mostly sparse. The fauna habitat varied from highly degraded to good; the highly degraded areas are due to historical and recent mining activity and grazing. There are numerous access tracks in the Project area, but these are narrow and mostly only wheel tracks on a sand-clay substrate (Terrestrial Ecosystems, 2023).

4.2 Conservation Significant Species

Terrestrial Ecosystems assessed the potential presence of a conservation significant fauna species within the Project area. The likelihood of occurrence of conservation significant species were mostly found to be unlikely in the Project area. Table 4-1 below summarises these findings.

Table 4-1: Assessment of the potential presence of a Conservation Significant Fauna species

Species	DBCAs Schedule/ Priority	EPBC Act Status	Likelihood of occurrence
Night Parrot (<i>Pezoporus occidentalis</i>)	Critically Endangered	Endangered	Highly unlikely to be in the Project area, due to a lack of suitable habitat.

Sandhill Dunnart (<i>Sminthopsis psammophilia</i>)	Endangered	Endangered	Highly unlikely to be in the Project area due to a lack of suitable habitat.
Western Spiny-tailed Skink (<i>Egernia stokesii badia</i>)	Endangered	Endangered	Highly unlikely to be in the Project area, as the Project area is well outside its geographic range.
Malleefowl (<i>Leipoa ocellata</i>)	Vulnerable	Vulnerable	No active or recently active mounds were recorded. It is likely that there are a few isolated Malleefowl in the Project or adjacent areas.
Giant Desert Skink (<i>Liopholis kintorei</i>)	Vulnerable	Vulnerable	Highly unlikely to be in the Project area due to a lack of suitable habitat.
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Vulnerable	Highly unlikely to occur in the Project area, as it has not been recorded in the region for many decades.
Princess Parrot <i>Polytelis alexandrae</i>	Priority 4	Vulnerable	May infrequently be seen in the region, however, unlikely to be a resident species.
Mulgara <i>Dasycercus blythi</i>	Priority 4		Highly unlikely to be in the Project area, due to a lack of suitable habitat.
Oriental Plover <i>Charadrius veredus</i>	IA	Migratory	Unlikely to be in the Project area due to a lack of suitable habitat.
Fork-tailed Swift <i>Apus pacificus</i>	IA	Migratory	May very infrequently be seen in the region, however, clearing vegetation is unlikely to impact on this aerial species. Rarely seen in the Goldfields.
Grey Wagtail <i>Motacilla cinerea</i>	IA	Migratory	Highly unlikely to be present in the Project area.
Yellow Wagtail <i>Motacilla flava</i>	IA	Migratory	Highly unlikely to be present in the Project area.
Peregrine Falcon <i>Falco peregrinus</i>	OS		May infrequently be seen in the region, however, unlikely to be a resident species.
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	Priority 4		Unlikely to be in the Project area due to a lack of its typical breakaway habitat requirements and a high density of feral fauna.

Source: *Terrestrial Ecosystems (2023)*

Terrestrial Ecosystems (2023) confirmed that the proposed Project is unlikely to significantly impact a conservation significant vertebrate fauna species, so a referral under the *Environmental Protection Conservation Act 1999* (EPBC Act) would not be required. Further details of the survey completed by Terrestrial Ecosystems can be found in Appendix C.

4.3 Subterranean Fauna

Bennelongia (2023) conducted a field survey in March 2023 within the Project area from ten boreholes. In total, 364 specimens attributable to at least 21 species were collected; 13 of the species are new, including two potentially new genera. Other species included, copepods, oligochaete annelids, beetles, and miscellaneous roundworms Bennelongia (2023).

The survey indicated a rich assemblage of stygofauna occurs at least in the Melita Calcrete, which partially overlaps the Project area, and possibly beyond it, despite relatively high salinity levels in and around the Project area. The community has evidently acclimated to any changes in groundwater regimen as a result of mining at Gwalia, which has been ongoing for over a century (Bennelongia, 2023).

Despite Bennelongia (2023) finding a high diversity of stygofauna in their surveys; they expect the conservation values of stygofauna are unlikely to be impacted by the Project.

4.4 Short Range Endemic Species

Bennelongia (2024) conducted a field survey for SRE groups in the vicinity of the Project area (Appendix D). Numerous habitats potentially prospective for species from SRE groups were identified in the Project area. Two habitats stand out as the most likely to host SRE species: stony plains with bluebush shrubland, and hardpan plains with mulga shrubland, both of which are abundant inside and outside the Project area. The field survey recovered just 18 species from SRE groups, all but 3 species are also found outside of the Project area. All three of those species were collected from widespread habitats and are expected to occur in other habitats which extend beyond the Project area. Based on the current known distributions of these species, the size of the proposed impact area, and the limited impact on the identified habitats, it is not expected that there will be any significant impacts on the populations of the Potential SRE species due to the development of the Project (Bennelongia, 2024).

5 Assessment Against the Ten Clearing Principles

Table 5-1 below provides an assessment against the ten clearing principles.

Table 5-1: Assessment Against the Ten Clearing Principles

Principle	Assessment	Outcome
<p>Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.</p>	<p>The remnant vegetation of the Project area is not comprised of a high level of biological diversity according to field work conducted by Bennelongia (2023 & 2024), NVS (2023), Spectrum (2022) and Terrestrial Ecosystems (2023). Targeted surveys for Threatened flora indicated there are no Threatened flora species within the proposed clearing area (NVS, 2022). Terrestrial Ecosystems concluded that the Project is unlikely to significantly impact conservation significant vertebrate fauna species and Bennelongia also confirmed SRE species will not be impacted by the clearing of native vegetation for the Project.</p> <p>There are no TECs located within or adjacent to the survey area. Two PECs were found within 50 km of the Project area, one being the Melita calccrete groundwater assemblage type on Raeside Paleodrainage which intersects the Project area in the southwestern corner of the Project (Bennelongia 2023). The other PEC, Sturt Meadows Calccrete Groundwater Assemblage Type on Raeside Paleodrainage is not within or adjacent to the DE and is not considered to be impacted by the Project.</p> <p>Due to the habitat distribution within the Project boundary, it is unlikely that the clearing will be a variance to this Principle.</p>	<p>Not likely to be a variance to this Principal</p>
<p>Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a</p>	<p>The vegetation present within the Project area is unlikely to provide significant habitat values or support indigenous Fauna. No potentially present species identified during the surveys within the proposed clearing area are considered solely dependent on any of the terrestrial habitat types identified. Disturbance within the proposed clearing area is unlikely to significantly impact any of the potentially present species listed due to the presence of similar habitat within the vicinity of the area. The extensive</p>	<p>Not likely to be a variance to this Principal</p>

<p>significant habitat for fauna indigenous to Western Australia.</p>	<p>distribution of the SRE habitats in the area means no significant impacts are expected on SRE species as a result of the Project. Subterranean fauna is also unlikely to be impacted by the clearing of vegetation.</p> <p>The DE is not considered necessary for the maintenance of significant habitat for fauna indigenous to WA and therefore the proposed clearing of 399.13 ha is unlikely to be at variance with this Principle.</p>	
<p>Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.</p>	<p>No declared or priority flora species occur or are likely to occur within the Project boundary. No Threatened or Priority Flora were identified by NVS (2022) or Spectrum (2022) during the two flora and vegetation surveys. A detailed flora survey was conducted in 2022 to identify any individuals potentially within the DE and survey area. No representatives of the Threatened flora species were identified during the survey completed by NVS. Given the results of NVS’s (2022) flora survey the DE is not necessary for the continued existence of any Threatened species. The closest Threatened flora P3 species, identified during the desktop survey, just outside of the Tower Hill DE, <i>Frankenia glomerata</i> is highly unlikely to be present due to the unsuitability of the habitat for the previous record, NVS additionally checked the area for the species and were unable to locate the threatened flora species. It is therefore unlikely that the native vegetation cleared will discontinue the existence of the species.</p>	<p>Not likely to be a variance to this Principal</p>
<p>Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a Threatened Ecological Community (TEC).</p>	<p>No TECs were identified by Spectrum (2022) during the commissioned studies. The PEC of Melita calcrete groundwater assemblage type on Raeside Paleodrainage is near the DE and the buffer area overlaps part of the DE at Tower Hill. The buffer area within the Tower Hill boundary contained one new species of harpacticoid amphipod <i>Nitocrella</i> `BHA368` but was expected to not be negatively affected by Project development due to the colluvium habitat type and distribution of the particular habitat type (Bennelongia, 2023).</p> <p>The other PEC identified during the studies, Sturt Meadows Calcrete Groundwater Assemblage Type on Raeside Paleodrainage is too far from the project to be impacted by the project. The two PEC found are underground habitat types, so no TEC or PEC is likely to be effected by the clearing of vegetation.</p> <p>The 1 m drawdown contours from GHD (2022) show that the PEC nor it’s buffer area will not be impacted from the dewatering activities of the pit.</p>	<p>Not likely to be a variance to this Principal</p>

<p>Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.</p>	<p>The vegetation proposed to be cleared consists of commonly occurring vegetation communities and is unlikely to have significance. The DE falls within the vegetation associations 18, 28 and 39 as mapped by Beard and Burns (1976). Information from both desktop and site assessments concluded that the extent of Beard vegetation units within the survey area is less than 1.5 % for all vegetation types, and each are well above the 30% threshold at a State, bioregional and subregional level (NVS, 2022). The closest nature reserves are Lake Ballard (67.2 kms south) and Lake Marmion (81.1 kms South), given their distance from the proposed clearing footprint, no harm is likely to occur to the ESA’s. The extent of the vegetation communities in the Project area is unlikely to be impacted by the proposed clearing.</p>	<p>Not likely to be a variance to this Principal</p>
<p>Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.</p>	<p>The Project is not located within any proclaimed Surface Water Areas and has no major fresh waterways or tributaries within its tenements. Surface water channels are ephemeral and do not feature year-round baseflow. A proposed creek diversion will allow the Wilsons Creek tributaries to be diverted to the south of the mining area ultimately towards Lake Raeside.</p>	<p>Not likely to be a variance to this Principal</p>
<p>Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.</p>	<p>The Department of Environmental Regulation, 2014 (now DWER) has defined land degradation as:</p> <ul style="list-style-type: none"> • The clearing of vegetation; • Decline in vegetation condition; • Soil erosion and soil acidity (caused by wind and water erosion due to vegetation clearing); • Salinity; or • Waterlogging/flooding. <p>The surrounding land use is heavily disturbed, as the DE of the Project is an existing mine footprint, clearing vegetation within the survey area is unlikely to cause appreciable land degradation to the areas adjacent to the proposed disturbance envelope. Based on arial images of the vicinity the previously disturbed areas within the Project area have not had significant erosion or further degradation of land.</p>	<p>Not likely to be a variance to this Principal</p>

	<p>NVS (2023) confirmed that vegetation 0.5 m from existing tracks were mostly considered to have good vegetation condition.</p> <p>The works associated with the clearing are unlikely to cause appreciable land degradation that is different or more significant than what has already occurred within the Project tenements and the surrounding area to date.</p>	
<p>Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.</p>	<p>The Project is not located within or within close proximity to any ESAs. Clearing of vegetation is unlikely to impact on the environmental values of the bioregion as the proposed disturbance envelope would account to less than 1.5 % reduction of Beards vegetation associations. Given the Project area overlaps an existing mine footprint the expansion of its operations is not likely to create any impact to any conservation areas. The Project is not adjacent to any site that contains significant conservation values.</p>	<p>Not likely to be a variance to this Principal</p>
<p>Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.</p>	<p>The DE has no major fresh waterways or tributaries within its boundary. Surface water channels are ephemeral and do not feature year-round baseflow.</p> <p>The Project will have a positive impact on the quality of surface water within the local environment as the installation of diversion channels will connect Wilsons Creek tributaries east of the Tower Hill pit to the lake Raeside system for the first time since mining commenced.</p>	<p>Not likely to be a variance to this Principal</p>
<p>Principle (j) – Native vegetation should not be cleared if</p>	<p>Installation of diversion channels will connect Wilsons Creek tributaries east of the Tower Hill pit to the lake Raeside system for the first time since mining commenced, therefore reducing the incidence of flooding in the area.</p>	<p>Not likely to be a variance to this Principal</p>

clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	Preliminary surface water modelling of a pre- and post – development environment indicates the western waste rock landform will not cause or exacerbate the likelihood of flooding.	
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6 Summary of Assessment

The assessment concludes that the clearing of up to 399.13 ha of native vegetation for the further development of the Project is not at variance with the Ten Clearing Principles. Field assessments of vegetation types found that <1.5 % of each vegetation association will be impacted by the disturbance footprint. The PEC found within the boundary of the proposed DE is an underground habitat type, so no PEC is likely to be effected by the clearing of vegetation. There were no TECs recorded in the Project area. The Project will have a positive impact on the quality of surface water within the local environment as the installation of diversion channels will connect Wilsons Creek tributaries east of the Tower Hill pit to the lake Raeside system for the first time since mining commenced.

7 References

ACRIS Management Committee and Bastin, G. (2008). *Rangelands 2008 – Taking the Pulse*. Published on behalf of the ACRIS Management Committee by the National Land & Water Resources Audit, Canberra.

Beard, J. S. (1976). *Vegetation Survey of Western Australia. Western Australia 1: 1 000 000 Vegetation Series. Sheet 6, Murchison*. Vegmap Publications, Perth, Western Australia

Bennelongia. (2023). *Leonora Operations Subterranean Fauna Desktop Assessment Prepared for St Barbara Limited by Bennelongia Environmental Consultants*.

Bennelongia. (2024). *Genesis Minerals - Tower Hill expansion SRE Fauna Survey Report. Prepared for Genesis Minerals Limited by Bennelongia Environmental Consultants*.

Bureau of Meteorology. (2024), Climate Data Online, Bureau of Meteorology <http://www.bom.gov.au/climate/data/>

DCCEEW. (2023). *Australia's bioregions*
<https://www.dcceew.gov.au/environment/land/nrs/science/ibra>

DPIRD. (2023), Declared Plants Database, Department of Primary Industries and Regional Development, Western Australia <https://www.agric.wa.gov.au/pests-weeds-diseases/weeds/declared-plants>

Genesis, (2024). Genesis comms, *Surface Water Studies Advice*.

GHD (2022), *Groundwater investigations and groundwater modelling at Tower Hill pit-updated results Hydrology and Hydrogeology Services for St Barbara, Technical Memorandum*.

Keighery, B.J., (1994), *Bushland Plant Survey; A guide to plant community survey for the Community, Wildflower Society of Western Australia (Inc.) Nedlands*

MBS. (2023). *St Barbara Limited Tower Hill Waste Rock Characterisation; Prepared for St Barbara Limited*.

Native Vegetation Solutions. (2023). Detailed Flora and Vegetation Survey of the Leonara Project; Prepared for St Barbara Limited

Spectrum. (2022). *Leonora Operations Flora and Vegetation Site Visit and Basic Terrestrial Fauna Assessment. Prepared for Talis Consultants/St Barbara Ltd by Spectrum Ecology & Spatial*.

Terrestrial Ecosystems. (2023). *Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment for St Barbara Leonora Province Expansion, Unpublished report for Native Vegetation Solutions, Perth*.

8 Appendices

APPENDIX A

Leonora Operations Flora and Vegetation Site Visit and Basic Terrestrial Fauna Assessment

LEONORA OPERATIONS FLORA & VEGETATION SITE VISIT & BASIC TERRESTRIAL FAUNA ASSESSMENT

PREPARED FOR: TALIS CONSULTANTS | ST BARBARA
LIMITED



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ECOLOGY & SPATIAL



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TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	1
1. INTRODUCTION.....	3
1.1. PROJECT BACKGROUND.....	3
1.2. SCOPE OF WORKS.....	3
1.3. LEGISLATION & GUIDELINES	3
1.4. BIOREGION.....	6
1.5. CLIMATE	6
1.6. DISTURBANCE HISTORY.....	7
1.7. GEOLOGY.....	7
1.8. LAND SYSTEMS.....	9
1.9. BEARD VEGETATION.....	11
1.10. SIGNIFICANT LANDS	13
1.10.1. Conservation Estate	13
1.10.2. Environmentally Sensitive Areas.....	13
1.10.3. Australian Wetlands Database.....	14
2. METHODS.....	16
2.1. DESKTOP ASSESSMENT	16
2.1.1. Previously Conducted Flora and Fauna Assessments.....	16
2.1.2. Likelihood of Occurrence.....	20
2.1.3. Data for the Index of Biodiversity Surveys for Assessment (IBSA).....	20
2.2. FIELD SURVEY TIMING	21
2.3. FIELD METHODS & SAMPLING EFFORT.....	22
2.3.1. Site Visit.....	22
2.3.2. Fauna Sampling Effort	22
2.4. ECOLOGICAL COMMUNITY MAPPING.....	22
2.5. SIGNIFICANT SPECIES & VEGETATION DEFINITIONS	24
2.6. INTRODUCED FLORA, FAUNA & DECLARED PLANTS	24
2.7. SHORT-RANGE ENDEMIC TARGET GROUPS.....	25
2.7.1. SRE Habitat	25
2.7.2. Determination of SRE Status	26
2.8. NOMENCLATURE	26
2.8.1. Flora.....	26
2.8.2. Fauna.....	27
2.9. PROJECT TEAM AND LICENCES.....	27
2.10. LIMITATIONS & CONSTRAINTS.....	27
3. RESULTS & DISCUSSION – DESKTOP ASSESSMENT.....	29
3.1. CONSERVATION SIGNIFICANT FLORA - DESKTOP.....	29
3.2. TEC & PEC – DESKTOP.....	32
3.3. TERRESTRIAL FAUNA – DESKTOP	34
3.3.1. Conservation Significant Fauna.....	35
3.3.2. Short Range Endemic Invertebrates Desktop Assessment	38
4. RESULTS & DISCUSSION – SITE VISIT	40

4.1.	ECOLOGICAL COMMUNITIES RECORDED	40
4.2.	TERRESTRIAL FAUNA.....	44
4.3.	SIGNIFICANT FINDINGS.....	44
4.3.1.	Conservation Significant Fauna.....	46
5.	CONCLUSION.....	56
5.1.	ADDITIONAL SURVEY RECOMMENDATIONS.....	57
5.1.1.	Flora & Vegetation.....	57
5.1.2.	Vertebrate Fauna.....	57
5.1.3.	SRE Invertebrate Fauna	57
6.	REFERENCES.....	58

TABLES

Table 1.1:	Geological Units of the Survey Area.....	7
Table 1.2:	Land Systems.....	9
Table 1.3:	Beard Vegetation Associations	11
Table 1.4:	Environmentally Significant Areas within the Survey Area	13
Table 2.1:	Summary of Database Searches	16
Table 2.2:	Summary of Previous Surveys Undertaken in the Vicinity of the Survey Area	16
Table 2.3:	Likelihood of Occurrence Assessment Criteria.....	20
Table 2.4:	Vertebrate Fauna Survey Techniques.....	22
Table 2.5:	SRE Target Groups.....	25
Table 2.6:	SRE Categories.....	26
Table 2.7:	References Used for Identification of Fauna Species.....	27
Table 2.8:	Project Team & Licences.....	27
Table 2.9:	Limitations & Constraints.....	27
Table 3.1:	Significant Flora Results of the Desktop Assessment	29
Table 3.2:	TEC & PEC Results of the Desktop Assessment.....	32
Table 3.3:	Summary of Terrestrial Fauna Species Previously Recorded in the Region.....	34
Table 3.4:	Significant Fauna Recorded during Databases Searches.....	35
Table 3.5:	Western Australian Museum (WAM) Invertebrate Database Results.....	38
Table 4.1:	Ecological Communities Recorded.....	40
Table 4.2:	Ecological Communities Recorded at each Operational Area.....	41
Table 4.3:	Significant Findings	44
Table 4.4:	Summary of Conservation Significant Fauna Species Identified Post Survey.....	47
Table 4.5:	EPBC Act Listed Migratory Bird Species.....	54

FIGURES

Figure 1.1:	IBRA Region.....	6
Figure 1.2:	Leonora Climate Data (Leonora Station #012046) (BOM 2022).....	7
Figure 2.1:	Monthly Rainfall and Temperature Data from Leonora (#12046) and Leonora Aero (#12241).....	21
Figure 4.1:	Potential <i>Idiosoma</i> spp. Burrow.....	44

MAPS

Map 1.1:	Location of the Survey Area.....	5
----------	----------------------------------	---

Map 1.2: Geology of the Survey Area (1:250,000)	8
Map 1.3: Land Systems.....	10
Map 1.4: Beard Vegetation Associations	12
Map 1.5: Significant Lands in the Region	15
Map 2.1: Location of Previous Surveys	19
Map 2.2: Survey Effort	23
Map 3.1: Desktop Significant Flora – Threatened, P1 & P2	30
Map 3.2: Desktop Significant Flora – P3 & P4.....	31
Map 3.3: Priority Ecological Communities Recorded	33
Map 3.4: Desktop Assessment Significant Vertebrate Fauna (DBCA)	37
Map 3.5: SRE Database Search Results (WAM)	39
Map 4.1: Ecological Communities	43
Map 4.2: Location of Potential <i>Idiosoma</i> sp. Burrows	45

APPENDICES

Appendix A: Site Visit – Assessment Sites	62
Appendix B: Conservation Codes	75
Appendix C: Significant Flora Desktop Assessment.....	79
Appendix D: Fauna Regional Appendix.....	87
Appendix E: Potential <i>Idiosoma</i> sp. Burrow Locations	110

EXECUTIVE SUMMARY

St Barbara Limited (SBL), an Australian based company, has three gold mining operations, including their Leonora Operations. The Leonora Operations consists of Gwalia mine, located just south of Leonora, approximately 235 kilometres (km) north of Kalgoorlie in the Goldfields-Esperance region of Western Australia (WA). St Barbara have proposed recommissioning of mine sites around their Leonora Operations.

Spectrum Ecology & Spatial (Spectrum) undertook a comprehensive desktop assessment of the flora & vegetation, and terrestrial fauna (vertebrate and SRE invertebrate fauna) values of the Survey Area; a basic fauna survey; and a flora site visit. The areas surveyed include for distinct mining areas Gwalia, Tower Hill, Harbour Lights, Jaspers and two proposed railway corridors.

The current assessment was undertaken by Spectrum and completed by one ecologist and one zoologist over a four day period from 16 to 19 November 2021. A variety of survey techniques were employed during the survey period.

A total of 86 significant flora taxa were identified during the flora desktop searches. Of these, five were assigned a High Likelihood of occurrence, while ten were assigned a Medium Likelihood of occurrence.

No Threatened Ecological Communities (TEC) were recorded within 50 km of the Survey Area. However, the desktop assessment recorded two Priority Ecological Communities (PEC) within 50 km of the Survey Area which are both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station.

The desktop assessment identified 23 species of conservation significant fauna (four mammals, 17 birds, one reptile and one invertebrate) as potentially occurring at the Survey Area based on the database search results and literature review.

The West Australian Museum database search identified four Arachnid (one spider and three pseudoscorpions), one Crustacean (fairy shrimp; aquatic species, excluded from the assessment), and one Mollusc (snail) species of potential short range endemic invertebrates within 40 km of the Survey Area.

The survey and site visit identified 13 ecological communities within the Survey Area:

- Woodland of *Acacia* (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines;
- Open woodland of *Acacia* (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes;
- Open shrubland of *Acacia* (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes;
- Low open shrubland of *Acacia* spp. over mixed chenopods and grasses on pebbles and quartz on lower slopes;
- *Acacia* (Mulga) spp. over mixed shrubs on quartz outcrop;
- Low chenopod shrubland on gravelly loam on flats and flowlines;
- Lake Raeside drainage with *Tecticornia* low open shrubland;
- Open woodland of *Acacia* and *Eremophila* over diverse chenopod shrubs on sand dunes fringing salt lake;
- Low chenopod shrubland on loam on flats;
- Open shrubland of *Acacia* spp. on ironstone gravel on flats;
- *Eremophila* over *Tecticornia* open plain on fine gravel;
- *Acacia* spp. over mixed shrubs on rocky ridges and outcrops; and

- Cleared/Disturbed areas.

The ecological communities within the Survey Area that contain rocky ridges, rocky outcropping, and chenopods such as *Tecticornia* spp. were noted as potentially significant due to the possibility for rare or threatened species to be present.

No conservation significant vertebrate fauna were recorded during the survey. However, seven species have a Medium to High likelihood of occurrence in the Survey Area:

- Malleefowl (*Leipoa ocellata*);
- Common Greenshank (*Tringa nebularia*);
- Common Sandpiper (*Tringa hypoleucos*);
- Sharp-tailed Sandpiper (*Calidris acuminata*);
- Wood Sandpiper (*Tringa glareola*);
- Long-tailed Dunnart (*Sminthopsis longicaudata*); and
- Peregrine Falcon (*Falco peregrinus*).

Approximately 25 trapdoor spider burrows were located at seven site assessment locations at Gwalia, Tower Hill, Harbour Lights and Railway Corridors. The trapdoor spider burrows recorded appeared to have the distinctive 'moustache-like' arrangement of twigs that the genus *Idiosoma* have. Further targeted surveys that include the collection of specimens are required to determine their identification to species level.

1. INTRODUCTION

1.1. Project Background

St Barbara Limited (SBL), an Australian based company, has three gold mining operations, including their Leonora Operations. The Leonora Operations consists of Gwalia mine, located just south of Leonora, approximately 235 kilometres (km) north of Kalgoorlie in the Goldfields-Esperance region of Western Australia (WA) (Map 1.1).

Talis Consultants (Talis) have recently completed an approvals strategy for St Barbara of the proposed recommissioning of mine sites around their Leonora Operations. It was identified that environmental approvals are required. Historical surveys were completed pre-2011, and it was recommended that updated surveys and studies be completed to reflect current guidelines and requirements.

The Leonora Operations expansion consists of four distinct mining areas: Gwalia, Tower Hill, Harbour Lights and Jaspers (Map 1.1). In addition, two areas are required for rail loading facilities (temporary and permanent) near the existing rail corridor, east of Gwalia mine. The Leonora Operations expansion area (Survey Area) covers approximately 3,628 hectares (ha).

1.2. Scope of Works

Talis commissioned Spectrum Ecology & Spatial (Spectrum) on behalf of SBL to undertake the following :

- A comprehensive desktop assessment of the flora, vegetation and terrestrial fauna (vertebrate and SRE invertebrate fauna) values of the Survey Area;
- A basic fauna survey; and
- A flora site visit.

The information collected during this assessment will inform the requirements and level of future surveys to be conducted in Autumn 2022.

1.3. Legislation & Guidelines

Flora and fauna in Western Australia are protected by various legislation, including:

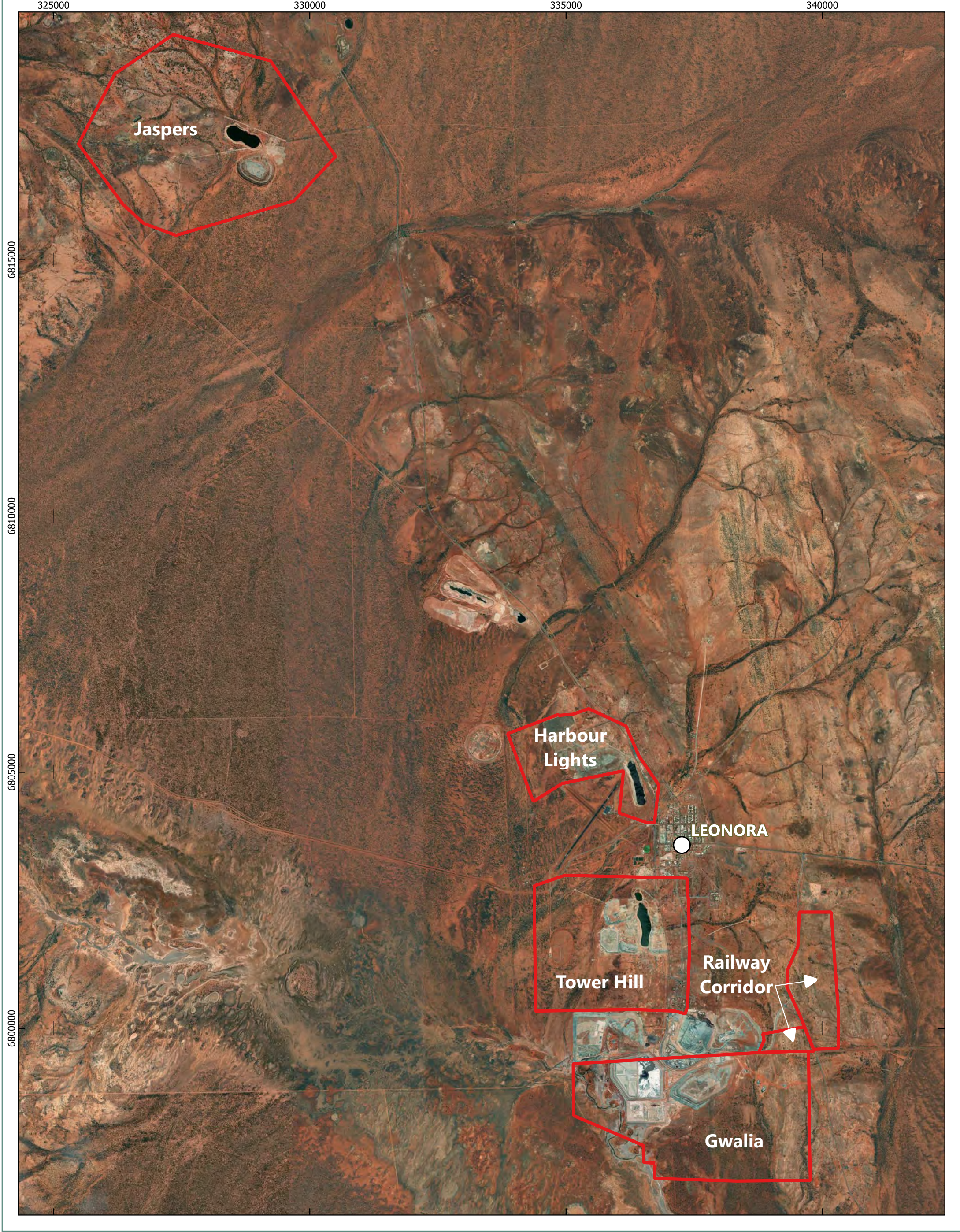
- *Biodiversity Conservation Act 2016* (BC Act);
- *Environmental Protection Act 1986* (EP Act); and
- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).





The assessments completed within this report are compliant with a flora site visit and a basic fauna survey, as outlined in:

- Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020);
- Environmental Protection Authority (EPA) Statement of Environmental Principles, Factors, and Objectives (EPA 2018);
- EPA Environmental Factor Guideline: Fauna (EPA, 2016a);
- EPA Environmental Factor Guideline: Flora and Vegetation (EPA 2016b);
- EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016c);
- Technical Guidance: Sampling of Short Range Endemic Invertebrate Fauna (EPA, 2016d);

Other survey and assessment guidelines that will be referred to include:

- DBCA Threatened and Priority Flora Report Form – Field Manual (DBCA 2017b);
- Survey Guidelines for Australia’s Threatened Birds (DEWHA 2010);
- Survey Guidelines for Australia’s Threatened Mammals (DSEWPC 2011a);
- Survey Guidelines for Australia’s Threatened Reptiles (DSEWPC 2011b);
- Interim Guideline for Preliminary Surveys of Night Parrot (*Pezoporus occidentalis*) in Western Australia (DPaW 2017); and
- Guideline for the Survey of Arid Bronze Azure Butterfly (ABAB) in Western Australia (DBCA 2020).
- DBCA Threatened and Priority Flora Report Form – Field Manual (DBCA 2017b); and
- National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual (ESCAVI, 2003).



<p>Legend</p> <p> Survey Area</p>	 <p>Survey Area</p> <p>KALGOORLIE</p> <p>PERTH</p>	<p></p> <p>0 1 2 km</p> <p>Scale 1:65,000 @ A3</p> <p>Coordinate System: GDA 1994 MGA Zone 51 Projection: Transverse Mercator Units: Meter</p> <p></p> <p>Author: EM Approved: AH Date: 09-12-2021</p>	<p>Location Map</p> <p>Leonora Operations</p> <p>Talis Consultants St Barbara</p>	<p>MAP</p> <p>1.1</p>
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1.4. Bioregion

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies Australia into bioregions based on dominant landscape, climate, lithology, geology, landform, and vegetation (Thackway and Cresswell, 1995).

The Survey Area is situated in the Murchison IBRA region, which is characterised by low hills and mesas with vegetation consisting mainly of low Mulga woodlands. The Murchison is divided into the Eastern and Western Murchison subregions, and the Survey Area is located in the Eastern Murchison (Figure 1.1).

The Eastern Murchison subregion features internal drainage, and extensive areas of elevated red desert sandplains with minimal dune development. Vegetation is dominated by Mulga Woodlands often rich in ephemeral species; hummock grasslands, saltbush shrublands and *Tecticornia* shrublands. The subregion contains calcrete aquifers in the northern part of the subregion which are known to support a wide range of subterranean aquatic fauna that are short range endemics (McKenzie, May and McKenna, 2003).



Figure 1.1: IBRA Region

1.5. Climate

The Murchison region has an arid climate with bimodal rainfall that usually falls in winter. Spatially averaged median rainfall is 201 mm per year (McKenzie, May and McKenna, 2003).

Leonora experiences hot summers due to the arid climate, with mean maximum temperature peaking in January at 37°C and a mean minimum temperature of 22°C. July is the coolest month, with mean maximum temperature of 18°C and an average minimum temperature of 6°C. Leonora's mean annual rainfall recorded from 1898 to 2020 is 236.4 mm, with most rainfall occurring from January to June (BOM 2022).

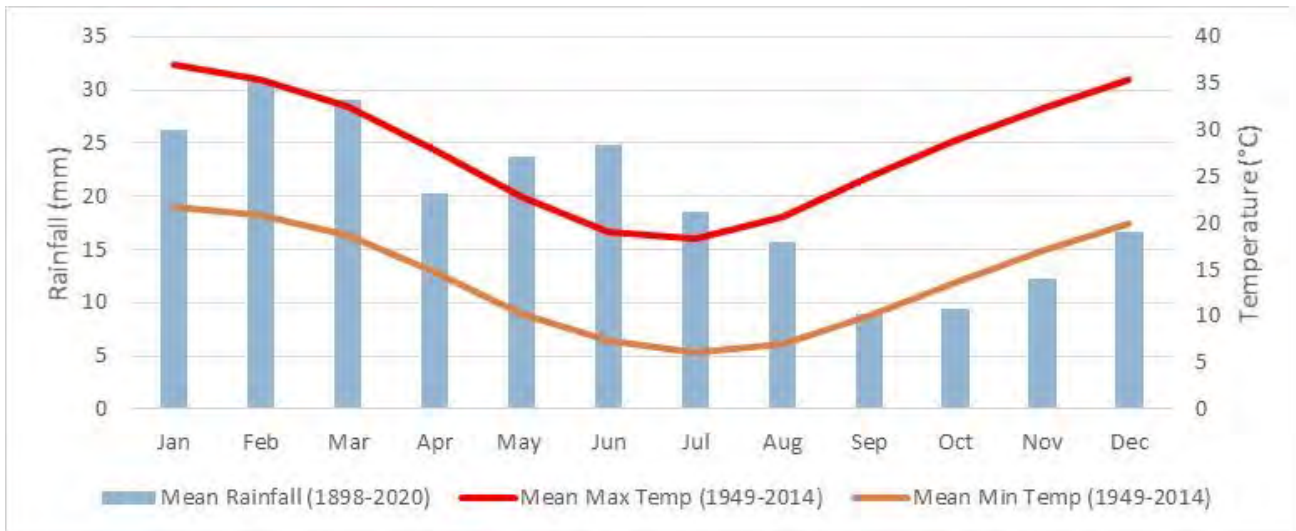


Figure 1.2: Leonora Climate Data (Leonora Station #012046) (BOM 2022)

1.6. Disturbance History

The Eastern Murchison subregion is mainly used for grazing native pastures (85.5%), with lesser areas of Unallocated Crown Land (UCL), and Crown Reserves (11.3%). Conservation lands constitute only 1.4% of the subregion. Mining interest in nickel and gold mining in particular are considerable; however, most mining leases still come under the Pastoral lands act and as such, are still required to be stocked (McKenzie, May and McKenna, 2003).

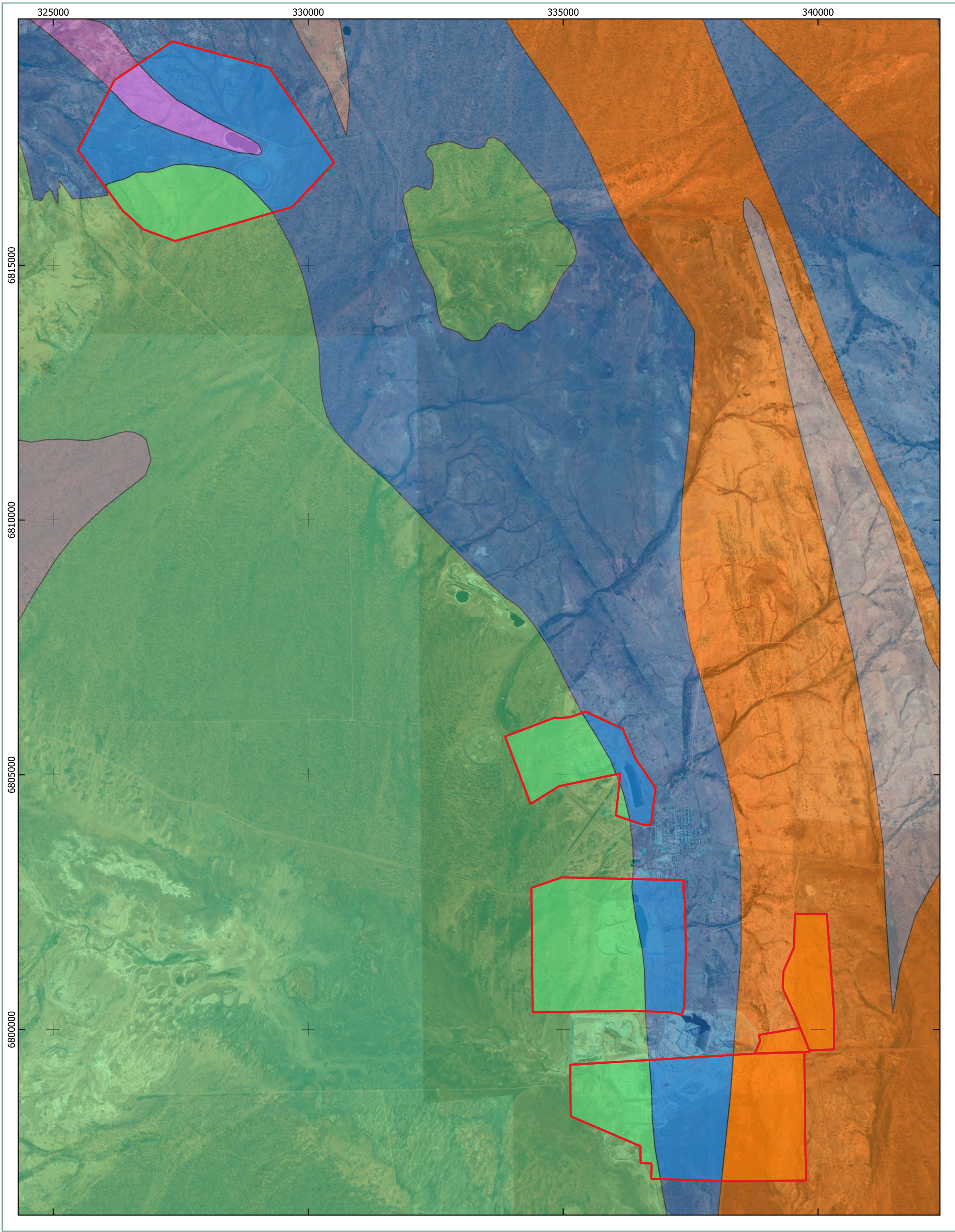
1.7. Geology

The surface geology of Western Australia has been mapped at a scale of 1:250,000 (DMIRS 2020), which is the finest-scale mapping available for the area. Four geological units (A-u-YEG, A-f-YEG, A-g-Y, A-b-YEG) have been mapped within the Survey Area and are listed in Table 1.1 and displayed in Map 1.2.

Unit A-b-YEG has the largest occurrence within the Survey Area, covering a total of 41.4%, which comprises 0.1% of the Eastern Murchison bioregion. The remaining three geological units have less than 0.1% of their total extents within the Survey Area (Table 1.1 and Map 1.2). None of the geological units are restricted to the Eastern Murchison IBRA region.

Table 1.1: Geological Units of the Survey Area

Unit	Description	Area in Survey Area (ha)	% of Survey Area	Total WA Extent (ha)	Total Eastern Murchison Extent (ha)	% of Eastern Murchison Extent Within Survey Area
A-u-YEG	Ultramafic volcanic rock dominant; metamorphosed.	169.7	4.7	279,290.7	120,603.4	0.1
A-f-YEG	Volcanic and volcanoclastic felsic rocks, undivided; andesite to rhyolite, minor basaltic andesite; local fragmental textures; metamorphosed.	620.7	17.1	1,275,988.2	968,910.2	0.1
A-g-Y	Granitic rock, undivided; metamorphosed.	1337.8	36.9	25,963,557.3	6,547,217.4	<0.1
A-b-YEG	Fine to very fine grained mafic rock with minor ultramafic rock, undivided; metamorphosed.	1500.9	41.4	2,288,281.1	1,706,323.5	0.1

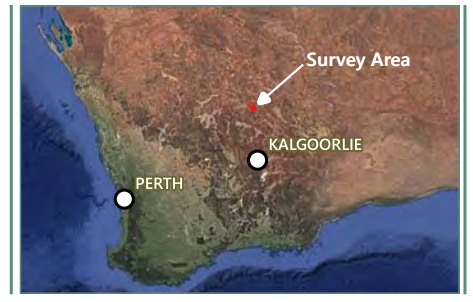


Legend

Survey Area

Geological Units

- A-b-YEG
- A-F-YEG
- A-g-Y
- A-u-YEG
- Not in Survey Area



N

0 1 2 km

Scale 1:65,000 @ A3

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum

Author: EM Approved: AH Date: 08-02-2022

Geology of the Survey Area
(1:250,000)

Leonora Operations

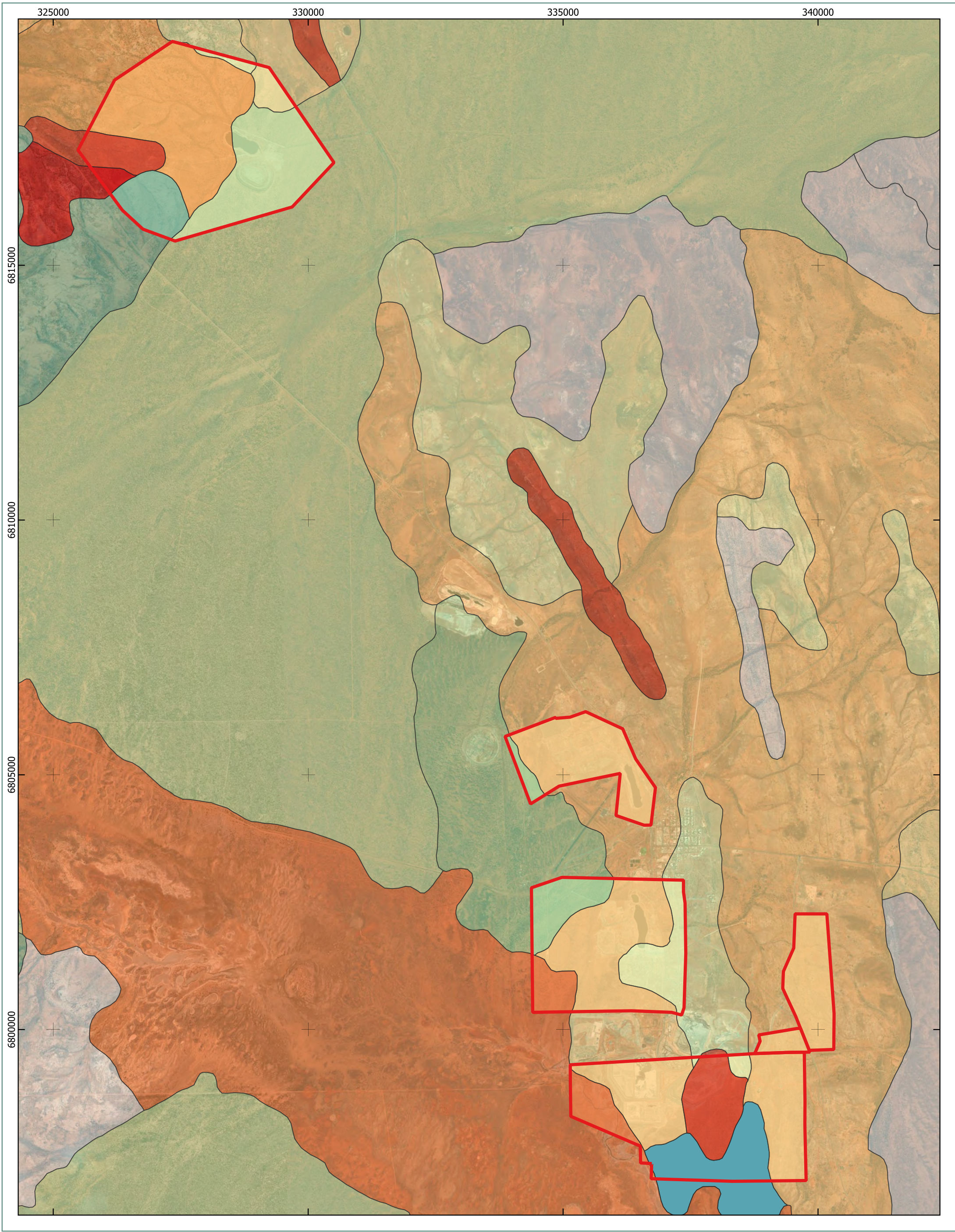
Talis Consultants | St Barbara

1.8. Land Systems

The land systems of Western Australia have been mapped at a scale of 1:250,000 (DAFWA 2016). Eleven land systems occur across the Survey Area. All land systems are well represented in the wider region, occur across multiple bioregions, and have less than 2% of their Eastern Murchison extent occurring within the Survey Area (Table 1.2 and Map 1.3). The most commonly occurring land system is the Gundockerta Land System, followed by the Felix Land System, covering 39.6% and 16.1% of the Survey Area, respectively. Although the Felix Land System covers only 16.1% within the Survey Area, it comprises 1.7% of the Eastern Murchison extent.

Table 1.2: Land Systems

Description	Area in Survey Area (ha)	% of Survey Area	Total WA Extent (ha)	Total Eastern Murchison Extent (ha)	% of Eastern Murchison Extent Within Survey Area
Bevon Land System Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.	23.6	0.7	239,287.9	223,993.6	<0.1
Brooking Land System Prominent ridges of banded iron formation supporting mulga shrublands and occasional minor halophytic communities.	283.3	7.8	96,668.2	95,991.2	0.3
Carnegie Land System Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.	172.1	4.7	1,747,656.2	1,104,320.9	<0.1
Felix Land System Gently undulating plains with quartz mantles, supporting acacia-eremophila shrublands locally with wanderrrie grasses.	583.9	16.1	35,408.1	34,104.4	1.7
Gundockerta Land System Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.	1438.7	39.6	340,744.8	329,681.6	0.4
Jundee Land System Hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly groved mulga shrublands.	48.4	1.3	665,060.0	508,923.4	<0.1
Leonora Land System Low greenstone hills and stony plains supporting mixed chenopod shrublands.	196.9	5.4	126,896.5	125,924.3	0.2
Monk Land System Hardpan plains with occasional sandy banks supporting mulga tall shrublands and wanderrrie grasses.	387.7	10.7	997,994.6	994,080.9	<0.1
Rainbow Land System Hardpan plains supporting mulga tall shrublands.	160.4	4.4	258,701.6	235,036.2	0.1
Violet Land System: Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and occasionally chenopod shrublands.	202.1	5.6	548,629.9	418,040.7	<0.1
Windarra Land System Gently undulating stony plains and low rises with quartz mantles on granite, supporting acacia-eremophila shrublands.	132.1	3.6	229,967.9	227,243.4	<0.1



Legend

Survey Area	Felix	Rainbow
Land Systems	Gundockerta	Windarra
Bevon	Jundee	Violet
Brooking	Leonora	Not in Survey Area
Carnegie	Monk	



N

0 1 2 km

Scale 1:65,000 @ A3

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum

Author: NP Approved: AH Date: 17-02-2022

Land Systems

Leonora Operations

Talis Consultants | St Barbara

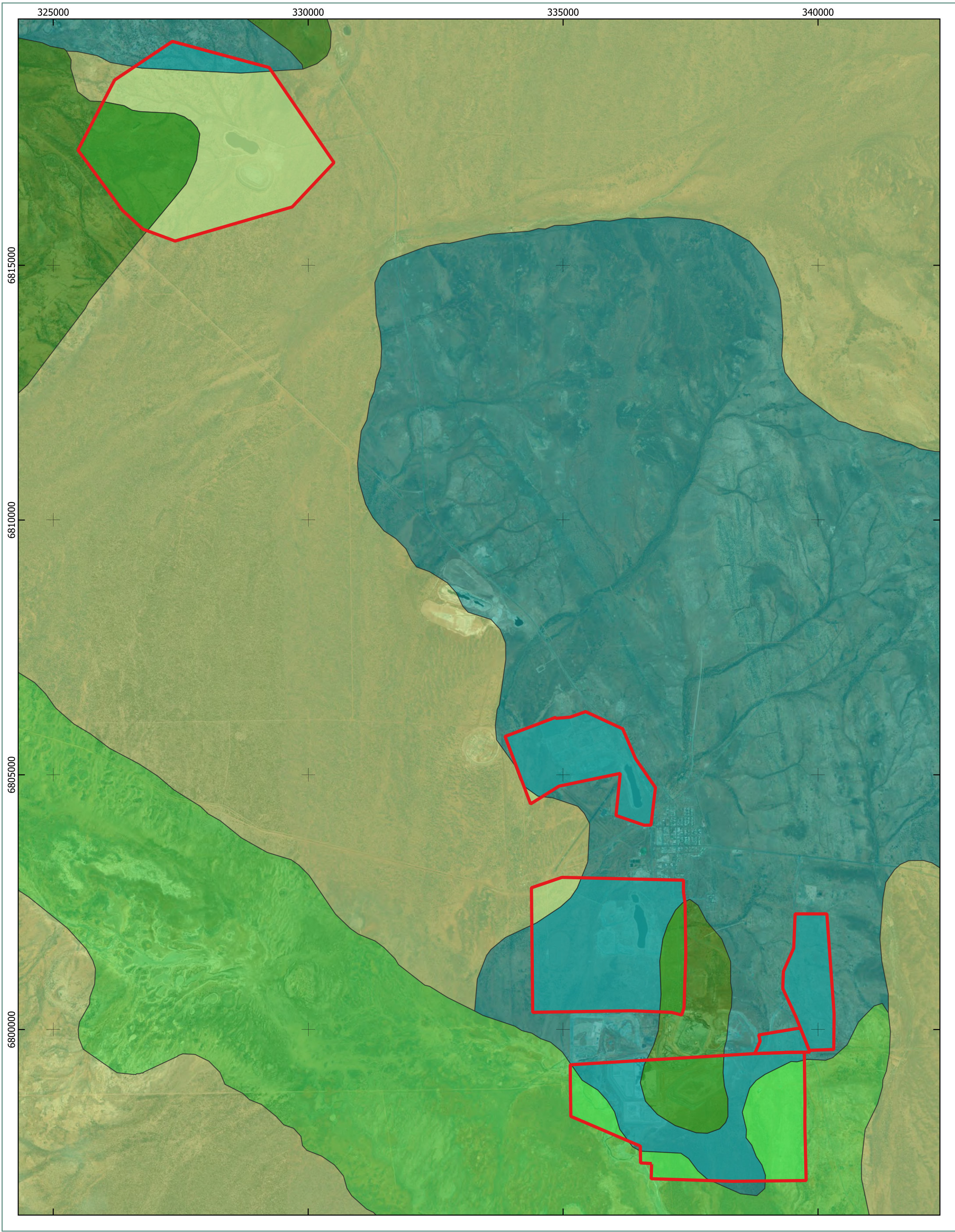
1.9. Beard Vegetation

Pre-European vegetation mapping was originally undertaken by Beard at various scales across the state and has since been updated to be consistent with NVIS descriptions a scale of 1:500,000 (DPIRD 2019). State-wide vegetation statistics are available from 2018, which lists pre-European extent, current extent, and area in DBCA managed lands, and is a useful tool to determine if a vegetation community is rare or otherwise significant (Government of Western Australia, 2019).

Four vegetation associations have been mapped within the Survey Area and are listed in Table 1.3 and displayed on Map 1.4. All four units have more than 97% of their pre-European extent remaining, with less than 0.5% of their extent occurring within the Survey Area (Table 1.3).

Table 1.3: Beard Vegetation Associations

Sub- Assoc.	Description	Area in Survey Area (ha)	% of Survey Area	Pre-European Extent	Current Extent	% Remaining	% of WA Current Extent in Survey Area
18.16	<i>Acacia aneura</i> , <i>Brachychiton gregorii</i> , <i>Alectryon oleifolius</i> , <i>Eucalyptus oleosa</i> open low woodland over <i>Eremophila margarethae</i> , <i>Eremophila granitica</i> , <i>Eremophila dielsiana</i> , <i>Eremophila fraseri</i> , <i>Eremophila abietina</i> tall sparse shrubland over <i>Eragrostis eriopoda</i> , <i>Danthonia bipartita</i> , <i>Aristida contorta</i> , <i>Enneapogon nigricans</i> , <i>Cephalipterum drummondii</i> low sparse tussock grassland.	884.5	24.4	WA: 2,539,657.3	WA: 2,524,495.7	WA: 99.4	<0.1
				Eastern Murchison: 2,536,021.0	Eastern Murchison: 2,520,869.5	Eastern Murchison: 99.4	
28	<i>Acacia aneura</i> open low woodland.	1,715.4	47.3	WA: 377,608.4	WA: 373,885.1	WA: 99	0.5
				Eastern Murchison: 141,411.3	Eastern Murchison: 137,703.1	Eastern Murchison: 97.3	
39.3	<i>Acacia aneura</i> , <i>Acacia quadrimarginea</i> , <i>Eremophila forresti</i> tall sparse shrubland over <i>Ptilotus obovatus</i> mid sparse forbland.	677.6	18.7	WA: 155,416.6	WA: 151,580.2	WA: 97.5	0.4
				Eastern Murchison: 155,416.6	Eastern Murchison: 151,580.2	Eastern Murchison: 97.5	
676.23	<i>Halosarcia</i> sp., <i>Rhagodia spinescens</i> , <i>Atriplex hymenotheca</i> , <i>Atriplex lindleyi</i> , <i>Aizoon quadrifidum</i> mid open samphire and chenopod shrubland.	350.8	9.7	WA: 221,870.3	WA: 221,809.0	WA: 99.9	0.2
				Eastern Murchison: 221,870.3	Eastern Murchison: 221,809.0	Eastern Murchison: 99.9	

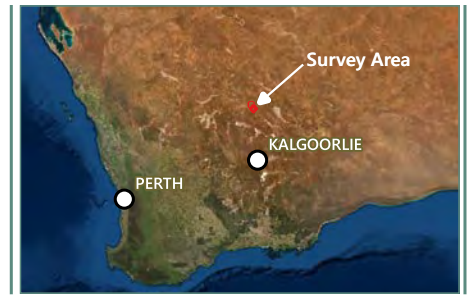


Legend

Survey Area

Beard Vegetation Associations

- 18.000000000000
- 28.000000000000
- 39.000000000000
- 676.000000000000



N

0 1 2 km

Scale 1:65,000 @ A3

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum

Author: EM Approved: AH Date: 09-12-2021

Beard Vegetation Associations

Leonora Operations

Talis Consultants | St Barbara

1.10. Significant Lands

Five significant lands are located within 100 km of the Survey Area. These are listed in Table 1.4, displayed on Map 1.5 and are described in the following sections.

Table 1.4: Environmentally Significant Areas within the Survey Area

Reserve Name (Protected Area ID)	Distance from Survey Area (km)
Conservation Estate	
Bulga Downs & Cashmere Downs Pastoral leases portions	100.2 km WNW
TECs/PECs	
Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station	Overlaps the Survey Area
Sturt Meadows calcrete groundwater assemblage type on Raeside palaeodrainage on Sturt Meadows Station	25 km WNW
Environmentally Sensitive Areas	
Lake Ballard	67.2 km S
Lake Marmion	81.1 km S
Wetlands	
Lake Ballard	67.2 km S
Lake Marmion	81.1 km S

1.10.1. Conservation Estate

The Western Australian conservation estate includes land and waters vested in the Conservation and Parks Commission under the *Conservation and Land Management Act 1984*. (DBCA 1984). The conservation estate is generally managed by the Parks and Wildlife Service of DBCA to protect Western Australia's biodiversity and includes National Parks, Nature Reserves, Conservation Reserves and other areas managed primarily for biodiversity conservation (DoEE 2016).

No conservation estates were identified from the Collaborative Australian Protected Area Database (CAPAD) within 100 km of the Survey Area. However, Bulga Downs & Cashmere Downs Pastoral leases portions, a Nature Reserve in progress, is located just outside of the 100 km buffer (Table 1.4 and Map 1.5).

1.10.2. Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESA) that are associated with flora and vegetation are areas that are defined by the Department of Water and Environmental Regulation (DWER 2019) as:

- A defined wetland and the area within 50 m of a wetland;
- The area covered by vegetation within 50 m of Threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the Threatened flora is located;
- The area covered by a Threatened Ecological Community (TEC);
- A Bush Forever site;
- Areas covered by the Gngangara Mound Crown Land Policy and Western Swamp Tortoise Policy; and
- Areas covered by lakes, wetlands, and fringing vegetation of the Swan Coastal Plain Lakes Policy, including South West Agricultural Zone Wetlands Policy and Swan and Canning Rivers Policy.

Two ESAs were found within 100 km of the Survey Area, Lake Ballard and Lake Marmion (Table 1.4 and Map 1.5). In addition, two TECs were recorded from within 50 km of the Survey Area and both are listed as

Priority 1 systems (Table 1.4 and Map 1.5). One of these TECs, Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station, overlaps the Survey Area.

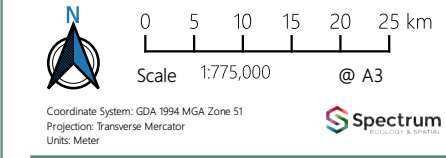
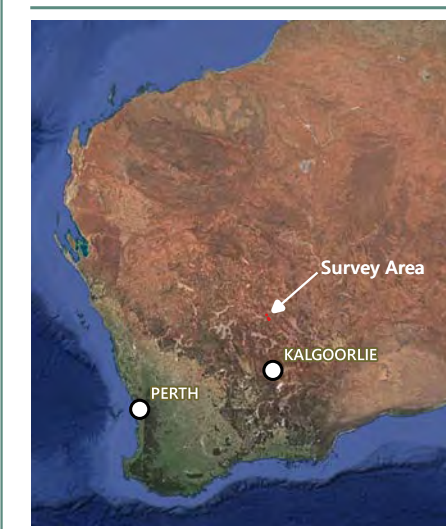
1.10.3. Australian Wetlands Database

The Australian Wetlands Database includes nationally significant wetlands (as listed in the directory of important wetlands), wetlands listed under the Ramsar convention, wetlands that are representative, rare or unique, or wetlands that are considered of international importance (DoEE 2019).

Two nationally significant wetlands were found within 100 km of the Survey Area, Lake Ballard and Lake Marmion, located 67.2 km and 81.1 km south, respectively (Table 1.4 and Map 1.5).



- Legend**
- Survey Area
 - Important Wetlands
 - Conservation Estates
 - Environmentally Sensitive Areas
 - TECs/PECs - (Priority 1)
 - 100 km buffer



Author: EM Approved: AH Date: 09-02-2022

Significant Lands in the Region

Leonora Operations

2. METHODS

2.1. Desktop Assessment

A desktop review of all relevant and available biological data sources was undertaken prior to the field survey to assess the flora, vegetation, and fauna and SRE likely to occur in the Survey Area. A summary of the database searches completed is outlined in Table 2.1.

Table 2.1: Summary of Database Searches

Source	Custodian	Details
Threatened and Priority Flora (TPFL)	Department of Biodiversity Conservation and Attraction (DBCA)	Central point with 80 km buffer Date: 5/11/21
Western Australian Herbarium (WAHerb)	DBCA	Central point with 80 km buffer
Threatened and Priority Ecological Communities (TEC/PEC)	DBCA	Central point with 50 km buffer
Threatened Fauna Database	DBCA	Central point with 100 km Date: 3/11/21
Invertebrate Fauna Databases - Arachnida & Myriapoda/ Mollusca/ Crustacea	Western Australian Museum (WAM)	Polygon plus 40 km buffer Date: 21/10/21
NatureMap	Department of Parks and Wildlife (DPAW), WAM	Central point with 40 km buffer Date: 22/10/21
Protected Matters	EPBC	Central point with 40 km buffer
Index of Biodiversity Surveys and Assessments (IBSA)	DBCA	Central point with 100 km buffer

The DBCA database searches were requested with a 40 km buffer. However, due to the low records returned, DBCA adjusted each database search as needed to include records of additional potentially occurring species.

2.1.1. Previously Conducted Flora and Fauna Assessments

Surveys previously conducted in the vicinity of the Survey Area were reviewed for significant flora, vegetation, and fauna. This included surveys up to 125 km away due to the lack of records. Reports were incorporated if they were provided by the client or publicly available. The reports included in the desktop assessment are listed in Table 2.2, and the approximate location of the survey, where available, is displayed on Map 2.1.

Table 2.2: Summary of Previous Surveys Undertaken in the Vicinity of the Survey Area

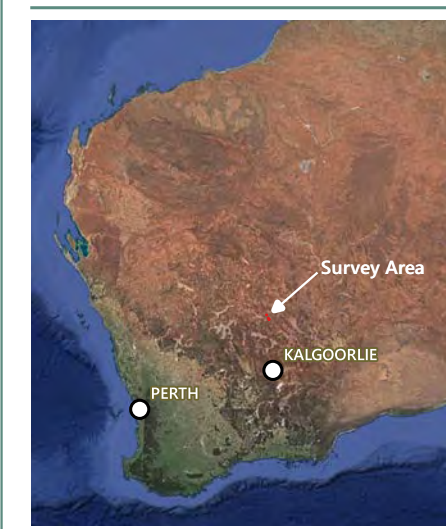
Report	Reference	Location from Current Project	Survey Summary
Flora reports			
Assessment of Flora and Vegetation Values – King of the Hills Mine Expansion	(Mattiske Consulting Pty Ltd, 2020)	5 km north	One Priority 1 species, <i>Frankenia georgei</i> , was recorded. No other threatened species were recorded. Five vegetation communities were recorded, with no TECs or PECs identified.
Flora and Vegetation Survey of the Kallis – Trump and Poker – Forrest Lease Areas	Mattiske Consulting Pty Ltd, 2008	Overlaps a small portion of the current Survey Area	No species of conservation significance were recorded. Six vegetation communities were defined and affected by grazing and previous mining activities.

Report	Reference	Location from Current Project	Survey Summary
Flora and Vegetation Survey and Establishment of Baseline Transects for a Creek Diversion at Tower Hill	Mattiske Consulting Pty Ltd, 2007	Overlaps current Survey Area	Three vegetation communities were recorded; none are considered regionally or locally significant. Two 50 m monitoring transects were established.
Flora and Vegetation Survey of St Barbara, Leonora Pipeline Site	Mattiske Consulting Pty Ltd, 2006	Overlaps current Survey Area	No Declared Rare Flora or Priority species were recorded during the survey. Four plant communities were defined, no TECs were located.
Declared Rare and Priority Flora Search of Proposed Mining Areas at Ulysses and Gwalia Deeps	Mattiske Consulting Pty Ltd, 2000	Overlaps current Survey Area	Fifty-nine rare and endangered taxa identified as potentially occurring. No Declared Rare Flora or Priority species were recorded during the survey.
Fauna reports			
Level 2 Fauna Assessment: King of the Hills Project	Terrestrial Ecosystems, 2020a	4 km north	A Level 2/detailed vertebrate fauna assessment was completed for Red 5's King of the Hills mine expansion. No conservation significant fauna were recorded.
Vertebrate Fauna Risk Assessment: Granny Smith Tailing Storage Facility Expansion	Terrestrial Ecosystems, 2020b	102 km east	Terrestrial Ecosystems completed a basic vertebrate fauna assessment at the Granny Smith Mine. No conservation significant fauna species were recorded. However, three have the potential to occur.
Level 2 Fauna Risk Assessment for Granny Deeps Project Area	Terrestrial Ecosystems, 2011	102 km east	Terrestrial Ecosystems completed a level 2/ detailed vertebrate fauna assessment at the Granny Deeps Project Area. Long-tailed Dunnart were recorded.
Fauna Survey of the Leonora Area	Bamford Consulting Ecologists, 2010	Overlaps current Survey Area	A detailed fauna assessment was conducted based on an initial desktop review and detailed field surveys. Five conservation significant fauna species were recorded during the field surveys (Malleefowl, Rainbow Bee-eater, Bush Stone-curlew, Wood Sandpiper, Inland Greater Long-eared Bat).
Fauna Assessment of the Kailis Project	Bamford Consulting Ecologists, 2008	Overlaps part of the Survey Area	A level 1/ basic survey was completed, with 43 species recorded. No species of conservation significance were recorded. However, nine species of conservation significance are considered likely to occur in or utilise habitats present.
Fauna Assessment of the Tower Hill Project	Bamford Consulting Ecologists, 2007	Overlaps current Survey Area	A level 1/ basic survey was conducted. Forty-one fauna species recorded in the study area. No conservation significant fauna species were recorded.
A Vertebrate Fauna Survey of the North Lake Carey Region	Dunlop and Payne, 1999	100 km east	A detailed fauna assessment was conducted. No conservation significant fauna species were recorded.
Vertebrate Fauna Survey of the Murrin Murrin Expansion Project	Ninox Wildlife Consulting, 1998	42 km east	Ninox Wildlife Consulting completed a Level 2 fauna survey at Murrin Murrin in 1998. Both Malleefowl and Peregrine Falcon were recorded during this survey. No site locations were available.

Report	Reference	Location from Current Project	Survey Summary
Mt Weld Rare Earths Project	Kinhill Engineers, 1992	Approximately 105 km east	Public Environmental Review outlining results of a detailed fauna survey. No conservation significant fauna species were recorded.
Flora and Fauna reports			
Basic Flora and Fauna Survey (Internal database)	Spectrum Ecology, 2021	Over 100 km east	Spectrum Ecology undertook a Basic Flora and Fauna Survey. Two significant vegetation types identified; RD1 supports two P3 species: <i>Phyllanthus baeckeoides</i> and <i>Calytrix praecipua</i> . <i>Phyllanthus baeckeoides</i> , has a restricted distribution. No TECs or PECs identified. No fauna species of conservation significance were recorded.. However there are five species which were assigned a Medium to High likelihood of occurrence.
Targeted Threatened Flora and Malleefowl Mound Search – Leonora Exploration Targets of POW Application	Native Vegetation Solutions, 2019	Overlaps current Survey Area	No Threatened Flora or evidence of Malleefowl were recorded.
The Terrestrial Flora and Fauna of Lake Carey	Brearley, Dunlop and Osborne, 1997	115 km east	Curtin University completed a terrestrial flora and fauna survey at Lake Carey. No species of conservation significance were detected during this survey. Site locations were not provided.



- Legend**
- Survey Area
 - Previous Flora and Fauna Surveys**
 - Bamford Consulting Ecologist (2010)
 - Bamford Consulting Ecologists (2008)
 - Bamford Consulting Ecologists (2007)
 - ◆ Brearley, Dunlop & Osborne (1997)
 - ◆ Dunlop and Payne (1999)
 - ◆ Kinhill Engineers (1992)
 - Native Vegetation Solutions (2019)
 - ◆ Ninnox Wildlife Consulting (1998)
 - Terrestrial Ecosystems (2020a)
 - Terrestrial Ecosystems (2020b)
 - Terrestrial Ecosystems (2011)
 - ▲ Spectrum Ecology (2021)
 - Mattiske Consulting Pty Ltd (2020)
 - Mattiske Consulting Pty Ltd (2008)
 - Mattiske Consulting Pty Ltd (2007, 2006)
 - ★ Mattiske Consulting Pty Ltd (2000)



0 5 10 15 20 25 km
 Scale 1:750,000 @ A3
 Coordinate System: GDA 1994 MGA Zone 51
 Projection: Transverse Mercator
 Units: Meter

Author: EM Approved: AH Date: 23-02-2022

Location of Previous Surveys
Leonora Operations

2.1.2. Likelihood of Occurrence

An assessment of each significant species or community identified in the above desktop assessment was completed with the following information provided:

- Conservation status (EPBC Act, BC Act, DBCA listing);
- Description of species habitat requirements;
- Description of flowering period (flora only);
- Distance of record to the Survey Area;
- Summary of relevant records including source of record (DBCA, previous report etc.); and
- Likelihood of occurrence criteria assigned and justification of likelihood of occurrence that considers known habitats, survey effort etc.

A likelihood of occurrence assessment was conducted using the criteria listed in Table 2.3, which included:

- assessing the distance of the record from the Survey Area (historical database records considered not accurate were excluded if required);
- presence of appropriate habitats within the Survey Area (using land systems, geology, vegetation mapping, and/or aerial imagery); and
- the age of the record (fauna only).

Table 2.3: Likelihood of Occurrence Assessment Criteria

Likelihood	Flora & Vegetation Criteria	Fauna Criteria
Recorded	Species or community recorded within the Survey Area.	Species recorded within the Survey Area within the previous ten years.
High	Species or community recorded in 20 km of the Survey Area and suitable habitat occurs in the Survey Area.	Species recorded within or in proximity to the Survey Area within the previous 20 years. Suitable habitat occurs in the Survey Area.
Medium	Species or community recorded outside the Survey Area, within 40 km and suitable habitat occurs within.	Species recorded within or in proximity to the Survey Area more than 20 years ago. Species recorded outside the Survey Area but within 50 km. Suitable habitat occurs in the Survey Area.
Low	Suitable habitat does not occur within or in proximity to the Survey Area.	Species rarely or not recorded within 50 km of the Survey Area. Suitable habitat does not occur within or in proximity to the Survey Area.
Very Low	N/A	Species not recorded within 50 km despite multiple recent surveys. Suitable habitat does not occur within the Survey Area. Species considered locally extinct.

2.1.3. Data for the Index of Biodiversity Surveys for Assessment (IBSA)

The Environmental Protection Authority (EPA) has given instruction that all biological surveys collecting data on biodiversity submit the report and associated raw data to IBSA as an IBSA data package. All survey data collected for this project will be provided electronically to comply with IBSA data standards.

2.2. Field Survey Timing

The basic fauna and flora site visit was undertaken from 16 to 19 November 2021. Rainfall preceding a field survey typically influences the number and type of flora and fauna species recorded. Monthly rainfall was sourced from the nearest Bureau of Meteorology (BOM) station with complete data, Leonora (#012046) for long-term data and Leonora Aero (#12241) for recent observations, with both stations occurring within or near the Survey Area (BOM 2022). Rainfall recorded 12 months prior to the survey, median monthly rainfall, and mean maximum temperatures are presented in Figure 2.1.

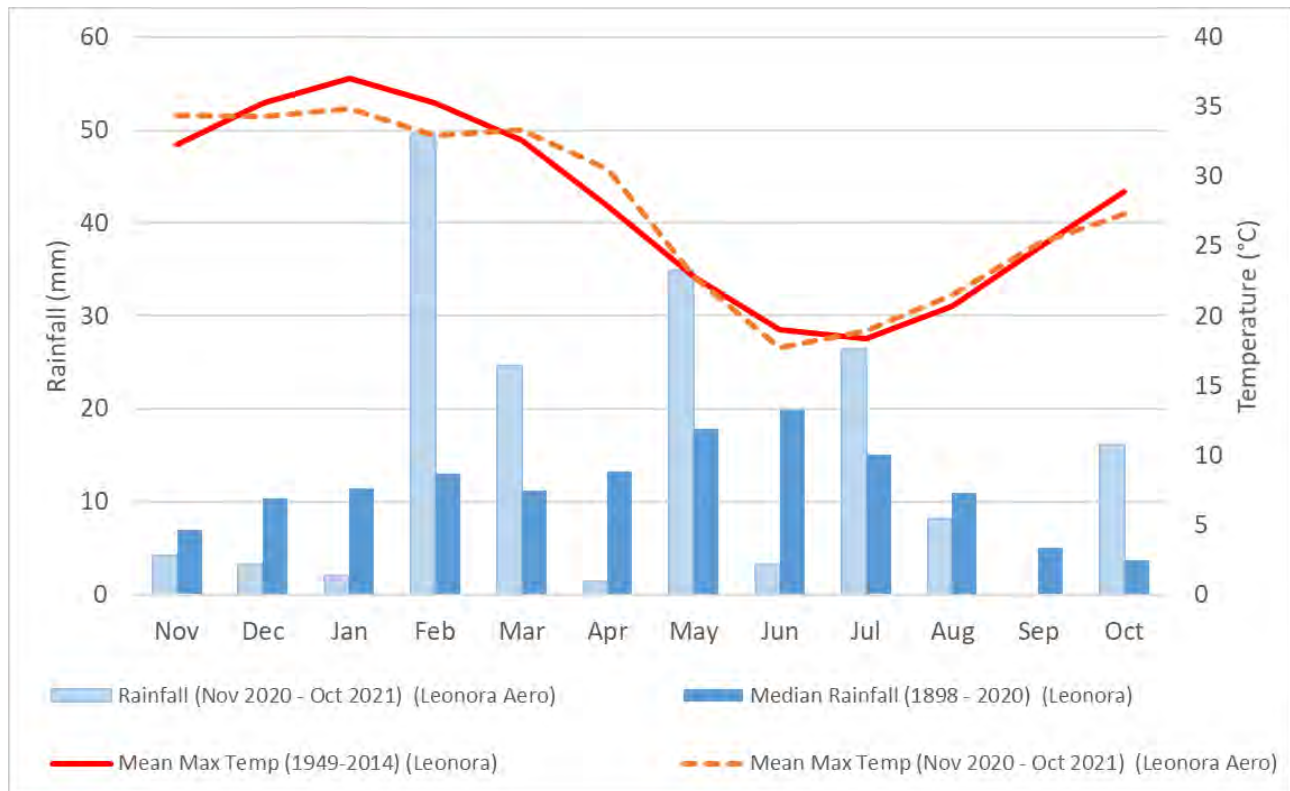


Figure 2.1: Monthly Rainfall and Temperature Data from Leonora (#12046) and Leonora Aero (#12241)

The following rainfall was recorded at Leonora prior to the survey:

- The 12 months preceding the survey (November 2020 to October 2021) recorded 173.8 mm, 35.2 mm above the long-term median of 138.6 mm; and
- The three months preceding the survey (August – October 2021) recorded 24.4 mm, 4.7 mm higher than the long-term median of 19.7 mm.

The Survey Area is located within the Eremaean Botanical Province, as described by Beard (1980). From a faunal perspective, surveys are best conducted during peak fauna activity. The survey was undertaken at the recommended time for surveying reptiles: September to April, with the majority of the remaining faunal groups best surveyed following significant rainfall events, as outlined in the Technical Guidance (EPA, 2020).

2.3. Field Methods & Sampling Effort

2.3.1. Site Visit

Spectrum conducted a site visit of the Survey Area from the 16 to 19 November 2021. The survey was completed by one ecologist and one zoologist over four days. The site visit focused on ground truthing the desktop results and to highlight any areas of significance within the Survey Area.

A total of 46 site assessments were completed, and information was collected to inform future surveys within the Survey Area (Map 2.2). The information (such as vegetation type, substrate and significance) collected at each site is detailed in Appendix A.

2.3.2. Fauna Sampling Effort

The basic terrestrial fauna survey was carried out in accordance with the Technical Guidance: Terrestrial Fauna Surveys (EPA 2020). The guidance suggests selective low-intensity sampling of fauna and identification of fauna habitats (ecological communities) to verify the accuracy of the desktop assessment. The approach of the basic fauna survey was to describe and map the fauna habitats/ecological communities across the Survey Area and complete active searches to describe the vertebrate fauna assemblages, particularly any significant fauna identified as likely to be present.

Various survey techniques were used for vertebrate fauna, as outlined in Table 2.4. All survey data has been provided electronically with this report as an IBSA data package.

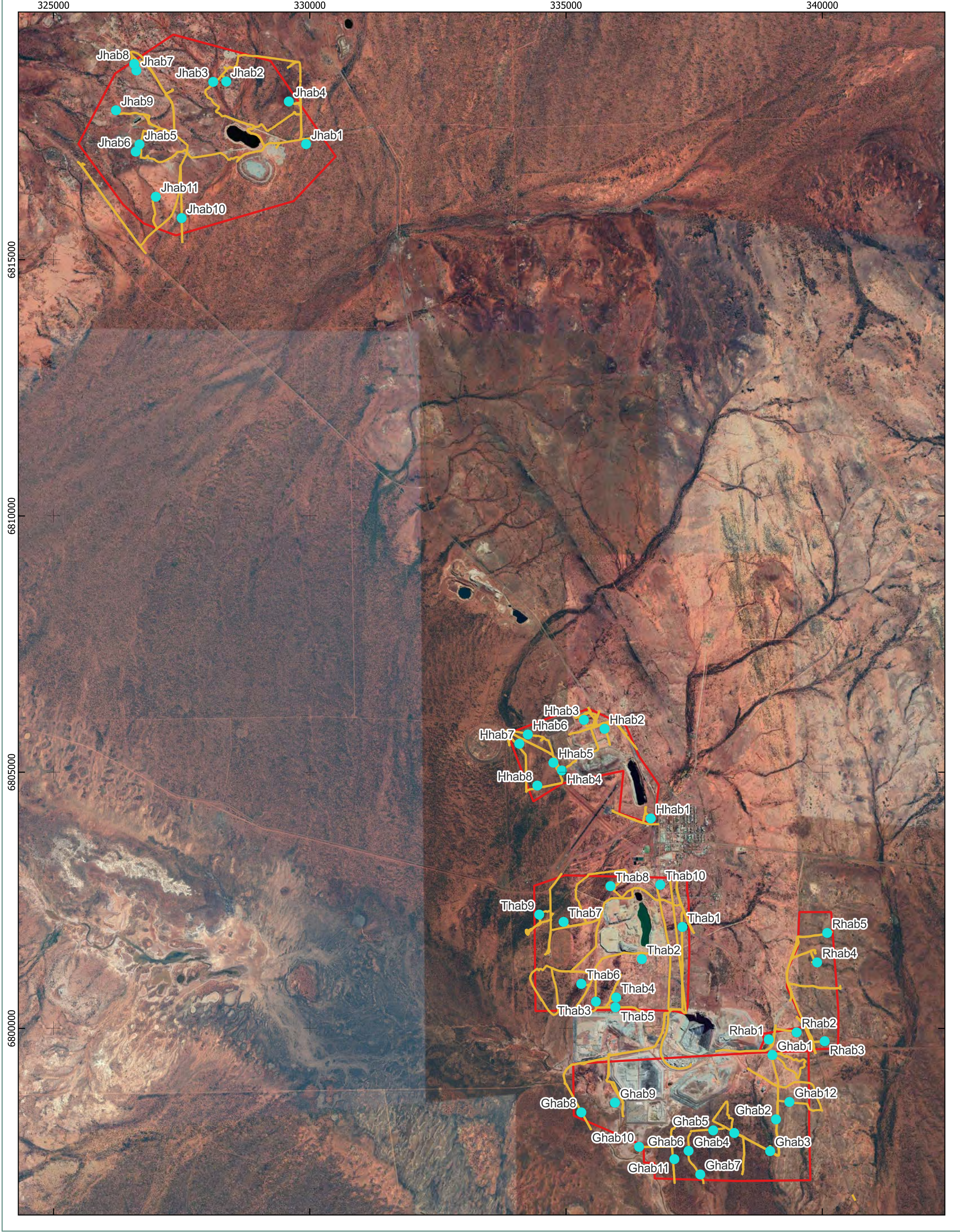
Table 2.4: Vertebrate Fauna Survey Techniques

Fauna	Survey Technique
Mammals	Direct sightings and indirect evidence such as tracks, scats and diggings were recorded across the Survey Area.
Birds	Direct sightings and calls, as well as indirect evidence such as feathers, pellets, and nests were recorded across the Survey Area. Search effort was focused on Malleefowl in areas of potential habitat.
Reptiles & Amphibians	Direct sightings and indirect evidence such as calls, tracks, diggings, skins, and latrines were recorded, and targeted searches were undertaken in areas with suitable habitat. Raking of leaf litter, if present, in an effort to detect leaf litter dwelling reptiles.
SRE Invertebrate Fauna	Litter beds and areas between litter beds were surveyed for the leaf arrangement burrow lids characteristic of trapdoor spiders (<i>Idiosoma</i> spp.) in the region.

2.4. Ecological Community Mapping

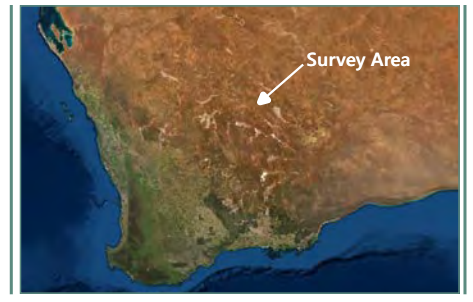
Ecological community mapping identifies areas of vegetation and land features that are distinguishable from other areas. Ecological communities were identified and mapped based on the following information:



- General vegetation type (Shepherd, Beeston and Hopkins, 2001);
- Vegetation types mapped within Survey Area (Mattiske 2006, 2007, 2008);
- Vegetation structure;
- Landforms;
- Geological units;
- Contours;
- Soil substrate;
- Aerial imagery;
- Fauna assemblage; and
- Field observations.



Legend

- ▭ Survey Area
- Ecological Community Assessment Sites
- Survey Effort - Tracks




0 1 2 km
 Scale: 1:65,000 @ A3
Coordinate System: GDA 1994 MGA Zone 51
 Projection: Transverse Mercator
 Units: Meter


Author: EM Approved: AH Date: 09-02-2022

Survey Effort

Leonora Operations

Talis Consultants | St Barbara

2.5. Significant Species & Vegetation Definitions

Significant flora can include (EPA 2016b):

- Being identified as Threatened: Critically Endangered, Endangered or Vulnerable (state listed BC Act and/or nationally listed EPBC Act);
- Being identified as Priority Flora species: Priority 1 to Priority 4 (DBCA 2019);
- Locally endemic or association with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or anomalous features that indicate a potential new species;
- 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; or
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant vegetation can include (EPA 2016b):

- Threatened Ecological Community (TEC): Critically Endangered, Endangered or Vulnerable (state listed BC Act and/or nationally listed EPBC Act);
- Priority Ecological Community (PEC): Priority 1 to Priority 5 (DBCA 2017a);
- Restricted distribution;
- Degree of historical impact from threatening processes;
- A role as a refuge; or
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

Significant fauna can include (EPA 2016a):

- Being identified as a Threatened or Priority species;
- Species with restricted distribution;
- Degree of historical impact from threatening processes; or
- Providing an important function required to maintain the ecological integrity of a significant ecosystem.

Refer to Appendix B for further information on Conservation Codes.

2.6. Introduced Flora, Fauna & Declared Plants

Introduced flora, fauna or weeds can pose a threat to native vegetation and biodiversity. The Department of Primary Industries and Regional Development (DPIRD) keeps a database of Declared Plants in Western Australia which are considered environmentally significant weeds. This database is regulated under the Biosecurity and Agricultural Management Act (Government of Western Australia, 2007). Legal status and control requirements for these Declared Plants are defined in Appendix A.

2.7. Short-Range Endemic Target Groups

Short-range endemic invertebrate species are defined as species with naturally small distributions (<10,000 km²) that possess ecological, morphological and life history characteristics that affect their range. Poor powers of dispersal, confinement to discontinuous habitats, slow growth rates and low levels of fecundity often result in fragmented or severely restricted distributions. Many species appear to be Gondwanan relicts now isolated in pockets of mesic habitat that was once more widespread and contiguous prior to the aridification of the Australian landscape. A low level of taxonomic resolution, lack of detailed ecological information and difficulties identifying many taxa via morphological means further complicates the assessment of potential SRE species. In many taxa, such as *Antichiropus* sp. millipedes, male only characters (e.g. gonopod morphology) are the primary diagnostic features used when identifying species (Wojcieszek, Harvey and Rix, 2010). If female or juvenile specimens are collected, identification to species level or alignment with known undescribed morphospecies using morphological characters is not possible. The use of DNA barcoding is gradually addressing this issue though the database of known sequences is still limited for many taxa (Western Australian Museum, 2014).

The combination of these factors make SRE species particularly vulnerable to threatening processes such as habitat loss, degradation and climate change (Harvey *et al.*, 2011). The taxa detailed in Table 2.5 have been identified as displaying one or more of the characteristics known to cause short-range endemism (Harvey, 2002) and as such are targeted during field assessment.

Table 2.5: SRE Target Groups

Phylum or Subphylum	Class	Order	Details
Annelida	Oligochaeta	Haplotaxida	Earthworms.
Chelicerata	Arachnida	Araneae	Spiders, particularly those belonging to the infraorder Mygalomorphae (trapdoor spider).
		Opiliones	Harvestmen.
		Pseudoscorpiones	False scorpion or book scorpion.
		Schizomida	Micro whip scorpions, mostly known from troglobitic species.
		Scorpiones	Scorpions.
Crustacea	Malacostraca	Isopoda	Terrestrial Isopods, also known as slaters or woodlice.
Mollusca	Gastropoda	Stylommatophora	Land snails.
Myriapoda	Chilopoda	Geophilomorpha	Elongate soil centipedes.
		Scolopendromorpha	Centipedes from the family Cryptopidae.
	Diplopoda	Not specified	Millipedes
Onychophora	Udeonychophora	Euonychophora	Velvet worms, family Peripatopsidae.

2.7.1. SRE Habitat

Sheltered, isolated, and often relictual mesic habitats have an increased likelihood of hosting SRE taxa. The gradual aridification of the Australian continent that began in the early Miocene has resulted in the contraction and isolation of mesic habitats and by association those relictual faunal groups that utilise them (Harvey, 2002). The following are examples of habitat types that have been recognised as potentially harbouring SRE species (Harvey, 2002; Durrant, 2011; EPA 2016d):

- Deep gorges;
- Isolated ranges, mesas, and rock outcrops;
- Rainforest patches;
- Islands;
- Drainage systems;
- Vine thickets;
- Hillslopes with south-west facing aspects; and
- Fire refuge areas such as cliffs and rock piles.

Many SRE species are associated with permanently moist, shaded, and sheltered microhabitats. In arid landscapes such as the ranges of the Pilbara region, these habitat types are typically limited and isolated by barriers of exposed, dry habitat not conducive to the dispersal SRE species. This isolation restricts or eliminates gene flow between populations and may result in speciation via selective pressures, genetic drift, and mutation. Even where speciation has not yet occurred, the geographical distribution of these species has severely contracted and fragmented. Isolated gorges and gullies that host complex microhabitats (heavy vegetation, deep leaf litter beds and varied rock cover) and protect relictual mesic habitat characteristics are more likely to host SRE taxa than simple widespread habitats exposed to climatic extremes. Isolated freshwater habitats associated with springs are also likely to provide conditions suitable for SRE taxa. Regionally extensive and exposed habitat types with high connectivity such as spinifex grassland are unlikely to host SRE taxa (Durrant, 2011).

2.7.2. Determination of SRE Status

The SRE status of invertebrates is based on categories which were developed by the Western Australian Museum (WAM). The classifications listed in Table 2.6 are based on known information of the species group such as distribution, representation of records in collections, and distinct morphological features. Information gaps lead to classifying taxa as potential SRE, which is a requirement under the precautionary principle.

Table 2.6: SRE Categories

Categories	Defining Characteristics
Confirmed SRE	<ul style="list-style-type: none"> • Known distribution of <10,000 km². • Taxonomy is well understood. • Species is well represented in collections. • Region of occurrence has been comprehensively sampled.
Potential SRE	<ul style="list-style-type: none"> • Limited sampling has resulted in incomplete knowledge of the species distribution. • Poor or limited taxonomic resolution. • Species not well represented in collections.
Not SRE	<ul style="list-style-type: none"> • Known distribution of >10,000 km². • Taxonomy is well understood. • Species is well represented in collections. • Region of occurrence has been comprehensively sampled.

2.8. Nomenclature

2.8.1. Flora

Flora nomenclature used in this report is consistent with the DBCA Census of Western Australian Plants database, provided through FloraBase (Western Australian Herbarium, 2020). All species are current at the time of report preparation. Species from previous reports have been checked for currency and updated.

2.8.2. Fauna

Nomenclature for mammals, birds, reptiles, and amphibians followed the Western Australian Museum Checklist of the Vertebrates of Western Australia (June 2021) (see Table 2.7). Nomenclature for SRE invertebrates is based on data provided by WAM and relevant experts.

Table 2.7: References Used for Identification of Fauna Species

Fauna	Survey Technique
Mammals	Menkhorst (2001) and Van Dyck (2008)
Birds	Menkhorst <i>et al.</i> (2019)
Reptiles & Amphibians	Wilson and Swan (2021), Cogger (2018), and Tyler and Doughty (2009)

2.9. Project Team and Licences

Spectrum staff involved with this assessment are listed in Table 2.8, along with their role, years of experience, and relevant licences.

Table 2.8: Project Team & Licences

Staff	Role	Project Tasks	Years of Experience	Fauna Licence
Astrid Heidrich	Principal Zoologist	Report review	14	BA27000561
Melissa Hay	Principal Botanist	Report review	15	-
Erica MacIntyre	Senior Zoologist	Field work, reporting	8	BA27000561
Nicola Palmer	Senior Zoologist / ecologist	Field work, report review	6	BA27000561
Gabrielle Beca	Zoologist	Reporting	1	BA27000561
Emily Crowther	Botanist	Reporting	2	-

2.10. Limitations & Constraints

Survey specific limitations and constraints are discussed in Table 2.9.

Table 2.9: Limitations & Constraints

Limitation	Constraint	Comment
Availability of the contextual information at a regional and local scale.	No	Beard vegetation, geology and land system mapping were used to determine regional significance of vegetation types. Database searches provided detailed information, adequate to guide field survey design and effort for the flora and fauna survey. Previous surveys in the vicinity and Survey Area were available.
Competency/ experience of the consultant carrying out the survey including experience in bioregion surveyed.	No	The ecologist, Nicola Palmer and zoologist, Erica MacIntyre involved in the field survey have extensive experience completing ecological surveys throughout Western Australia and are familiar with Murchison flora and fauna assemblages.
Timing/weather/ season/cycle.	No	The field survey was conducted during the optimal season for flora and fauna surveys conducted in the Murchison region and Eremaean Botanical Province. Seasonal conditions were around the mean, and rainfall was above the long-term median rainfall. The flora site visit was conducted at the optimal time for this region. Basic level fauna surveys are not dependent on seasonal timing.

Limitation	Constraint	Comment
Disturbances (e.g., fire, flood, accidental human intervention) which affected results of survey.	No	No disturbances were recorded at the Survey Area that have affected the results of the flora site visit and fauna assessment.
Remoteness and/or access problems.	No	There were no access restrictions at the Survey Area
Flora Specific		
Survey effort and extent.	No	The Survey Area was covered as completely as possible within four day period.
Proportion of flora recorded and/or collected, any identification issues.	Parital	The flora site visit did not include collection of flora records.
Fauna Specific		
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	Sampling techniques were adequate for a basic terrestrial fauna survey. All fauna groups were sampled, and no survey constraints were experienced. A total of 46 site assessments were completed within the Survey Area.
Proportion of fauna identified, recorded, and/or collected.	Partial	All vertebrate fauna species encountered were identified in the field. Basic survey methods do not require the identification of all fauna species present within the project level. Trapdoor spiders specimens were not collected due to the low likelihood of male spiders being excavated, time constraints and no licence to extract.
The proportion of the task achieved and further work which might be needed.	No	All components of a basic fauna assessment were completed.
Resources (degree of expertise available in animal identification to taxon level).	No	Fauna resources available were adequate and did not compromise the outcome of the survey.
Intensity (in retrospect, was the intensity adequate).	No	A basic fauna assessment was considered adequate to identify faunal assemblages and fauna habitat present within the Survey Area.
Completeness (was the relevant area fully surveyed).	No	A total of 46 site assessments were completed across the the five areas that make up the Survey Area. The coverage was good for a four day period.

3. RESULTS & DISCUSSION – DESKTOP ASSESSMENT

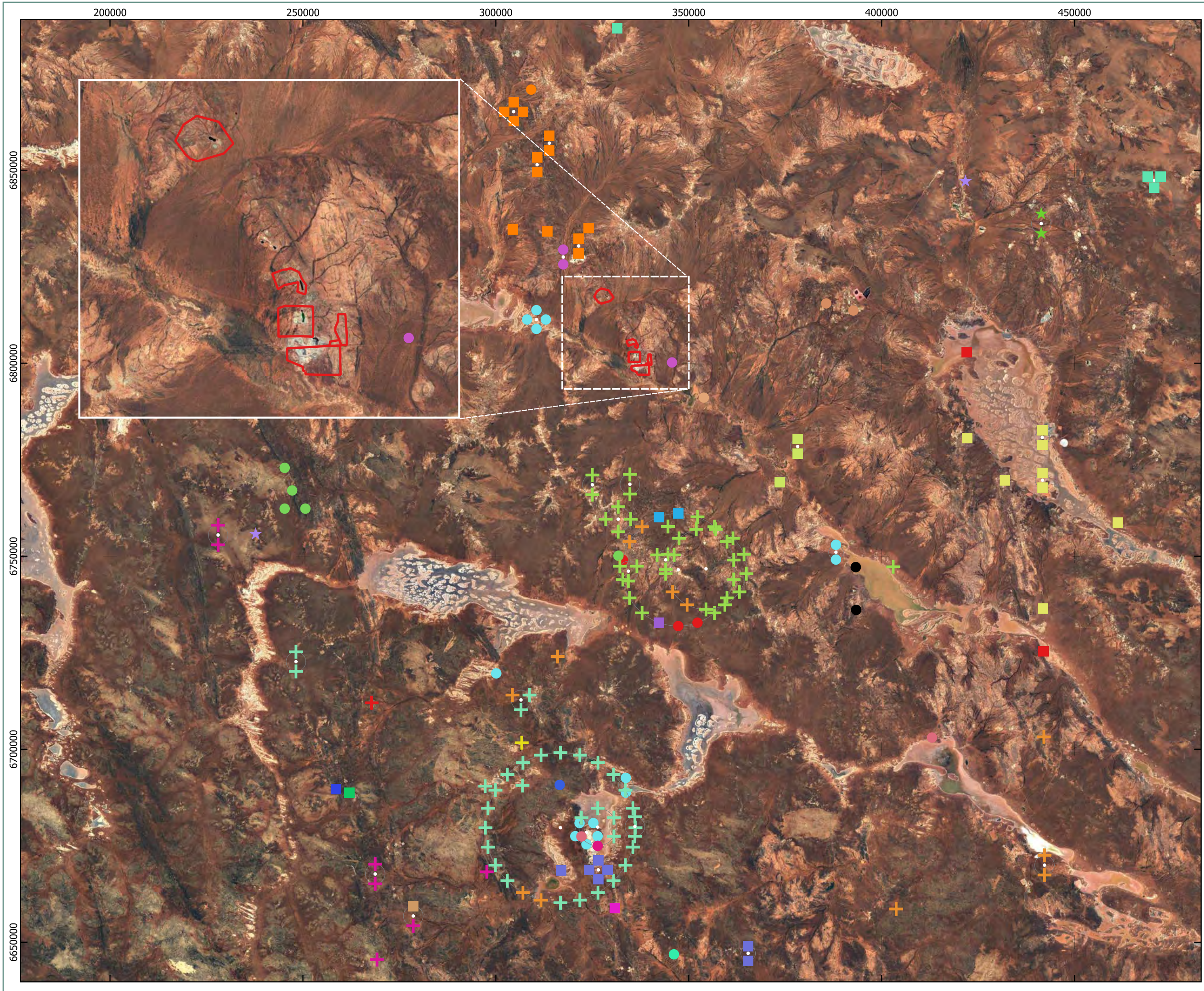
3.1. Conservation Significant Flora - Desktop

A total of eighty-six significant flora taxa were identified during the flora desktop searches. Of these, five were assigned a 'High Likelihood' of occurrence, while ten were assigned a 'Medium Likelihood' of occurrence.

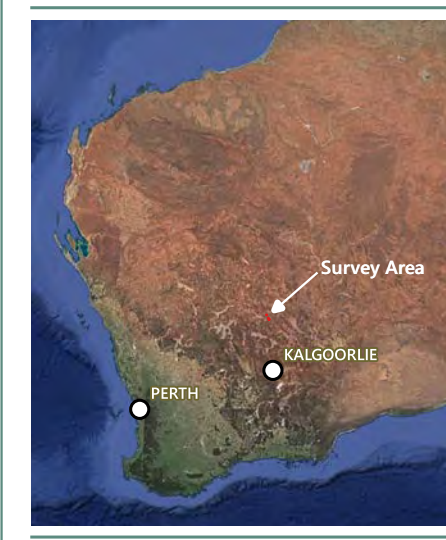
The likelihood of each significant species is listed in Table 3.1. Significant flora locations are presented on Map 3.1 and Map 3.2. More details of each taxa, including distance to the Survey Area, and taxa with low likelihood to occur are listed in Appendix C.

Table 3.1: Significant Flora Results of the Desktop Assessment

Pre-survey Likelihood	Status	Taxon
Recorded	Threatened	N/A
	Priority 1	N/A
	Priority 2	N/A
	Priority 3	N/A
High	Threatened	N/A
	Priority 1	<i>Frankenia georgei</i> , <i>Stenanthemum patens</i>
	Priority 2	N/A
	Priority 3	<i>Angianthus prostratus</i> , <i>Acacia</i> sp. Marshall Pool (G. Cockerton 3024)
	Priority 4	<i>Frankenia glomerata</i>
Medium	Threatened	N/A
	Priority 1	<i>Calandrinia quartzitica</i> , <i>Lepidium xylodes</i>
	Priority 2	<i>Eremophila mirabilis</i>
	Priority 3	<i>Triglochin protuberans</i> , <i>Eremophila simulans</i> subsp. <i>megacalyx</i> , <i>Eremophila veronica</i> , <i>Phyllanthus baeckeoides</i> , <i>Hybanthus floribundus</i> subsp. <i>chloroxanthus</i>
	Priority 4	<i>Grevillea inconspicua</i> , <i>Hemigenia exilis</i>



- Legend**
- Survey Area
 - Sig. Flora Locations**
 - ★ T *Eremophila viscida*
 - ★ T *Seringia exastia*
 - P1 *Acacia epedunculata*
 - P1 *Acacia websteri*
 - P1 *Anacamperos sp. Eremaean*
 - P1 *Calandrinia quartzitica*
 - P1 *Drosera eremaea*
 - P1 *Eremophila eversa*
 - P1 *Frankenia georgei*
 - P1 *Hemigenia obovata*
 - P1 *Korthalsella leucothrix*
 - P1 *Lepidium xyloides*
 - P1 *Persoonia leucopogon*
 - P1 *Philoteca linearis*
 - P1 *Philoteca tubiflora*
 - P1 *Pterostylis elegantissima*
 - P1 *Pterostylis xerampelina*
 - P1 *Ptilotus chortophytus*
 - P1 *Ptilotus procumbens*
 - P1 *Ptilotus rigidus*
 - P1 *Ptilotus sp. Kookynie*
 - P1 *Ptilotus tetrandrus*
 - P1 *Rhodanthe uniflora*
 - P1 *Stenanthemum patens*
 - P1 *Tecticornia mellarium*
 - P1 *Tecticornia sp. Lake Way (P. Armstrong 05/961)*
 - + P2 *Eremophila mirabilis*
 - + P2 *Eucalyptus educta*
 - + P2 *Malleostemon sp. Adelong*
 - + P2 *Newcastelia insignis*
 - + P2 *Thryptomene eremaea*
 - + P2 *Thysanotus brachyantherus*

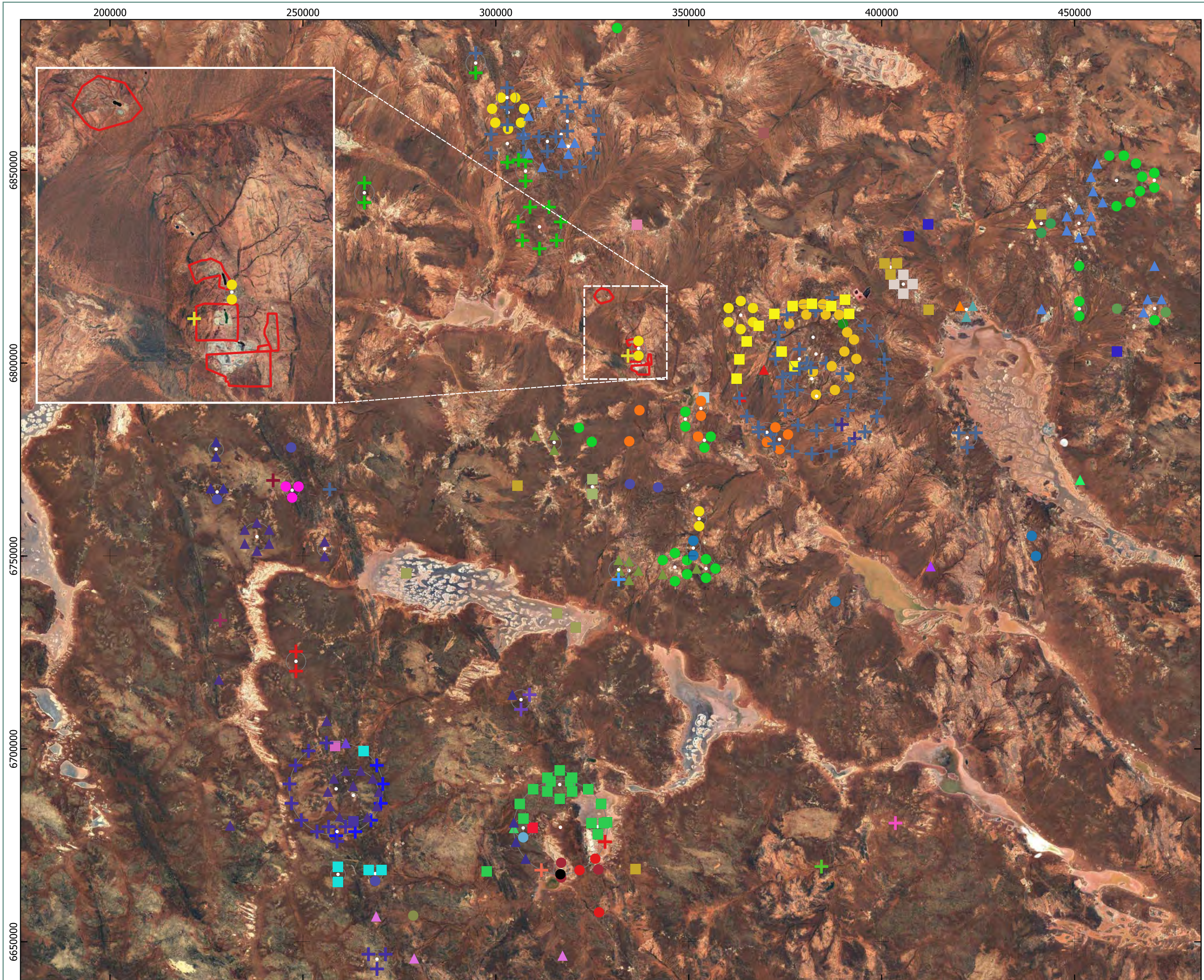


0 5 10 15 20 25 km
 Scale 1:900,000 @ A3
Coordinate System: GDA 1994 MGA Zone 51
 Projection: Transverse Mercator
 Units: Meter

Author: EM Approved: AH Date: 10-02-2022

Desktop Significant Flora - Threatened, P1 & P2

Leonora Operations



- Legend**
- Survey Area
- Significant Flora
- P3 Acacia sp. Marshall Pool
 - P3 Alyxia tetanifolia
 - P3 Angianthus prostratus
 - P3 Atriplex flabelliformis
 - P3 Austroparmelia macrospora
 - P3 Austrostipa blackii
 - P3 Bossiæa eremæa
 - P3 Calandrinia sp. Menzies
 - P3 Calotis latiuscula
 - P3 Calotis sp. Perrinvale Station
 - P3 Calytrix hislopii
 - P3 Calytrix præcipua
 - P3 Cratystylis centralis
 - P3 Elatine macrocalyx
 - P3 Eleocharis papillosa
 - P3 Eremophila annosicaulis
 - P3 Eremophila shonae subsp. diffusa
 - P3 Eremophila simulans subsp. megacalyx
 - P3 Eremophila veronica
 - P3 Eutaxia nanophylla
 - P3 Eutaxia rubricarina
 - P3 Goodenia lyrata
 - P3 Grevillea georgeana
 - P3 Grevillea subterlineata
 - P3 Gunniopsis propinqua
 - P3 Homalocalyx grandiflorus
 - P3 Hybanthus floribundus subsp. chloroxanthus
 - P3 Leptospermum macgillivrayi
 - P3 Meionectes tenuifolia
 - P3 Melaleuca apostiba
 - P3 Menkea draboides
 - P3 Micromyrtus serrulata
 - P3 Notisia intonsa
 - P3 Olearia mucronata
 - P3 Philotheca coateana
 - P3 Phyllanthus bæckeoides
 - P3 Placynthium nigrum
 - P3 Pterostylis virens
 - P3 Tecticornia cymbiformis
 - P3 Triglochin protuberans
 - P3 Vittadinia pustulata
 - P3 Xanthoparmelia dayiana
 - + P4 Banksia arborea
 - + P4 Comesperma viscidulum
 - + P4 Conospermum toddii
 - + P4 Eucalyptus jutsonii subsp. jutsonii
 - + P4 Eucalyptus kruseana
 - + P4 Frankenia glomerata
 - + P4 Goodenia berringbinensis
 - + P4 Grevillea erectiloba
 - + P4 Grevillea inconspicua
 - + P4 Grevillea secunda
 - + P4 Hemigenia exilis
 - + P4 Lepidosperma lyonsii
 - + P4 Sowerbaea multicaulis
 - + P4 Wurmbea murchisoniana

N

0 5 10 15 20 25 km

Scale 1:900,000 @ A3

Coordinate System: GDA 1994 MGA Zone 51
 Projection: Transverse Mercator
 Units: Meter

Spectrum

Author: EM Approved: AH Date: 10-02-2022

Desktop Significant Flora - P3 & P4

Leonora Operations

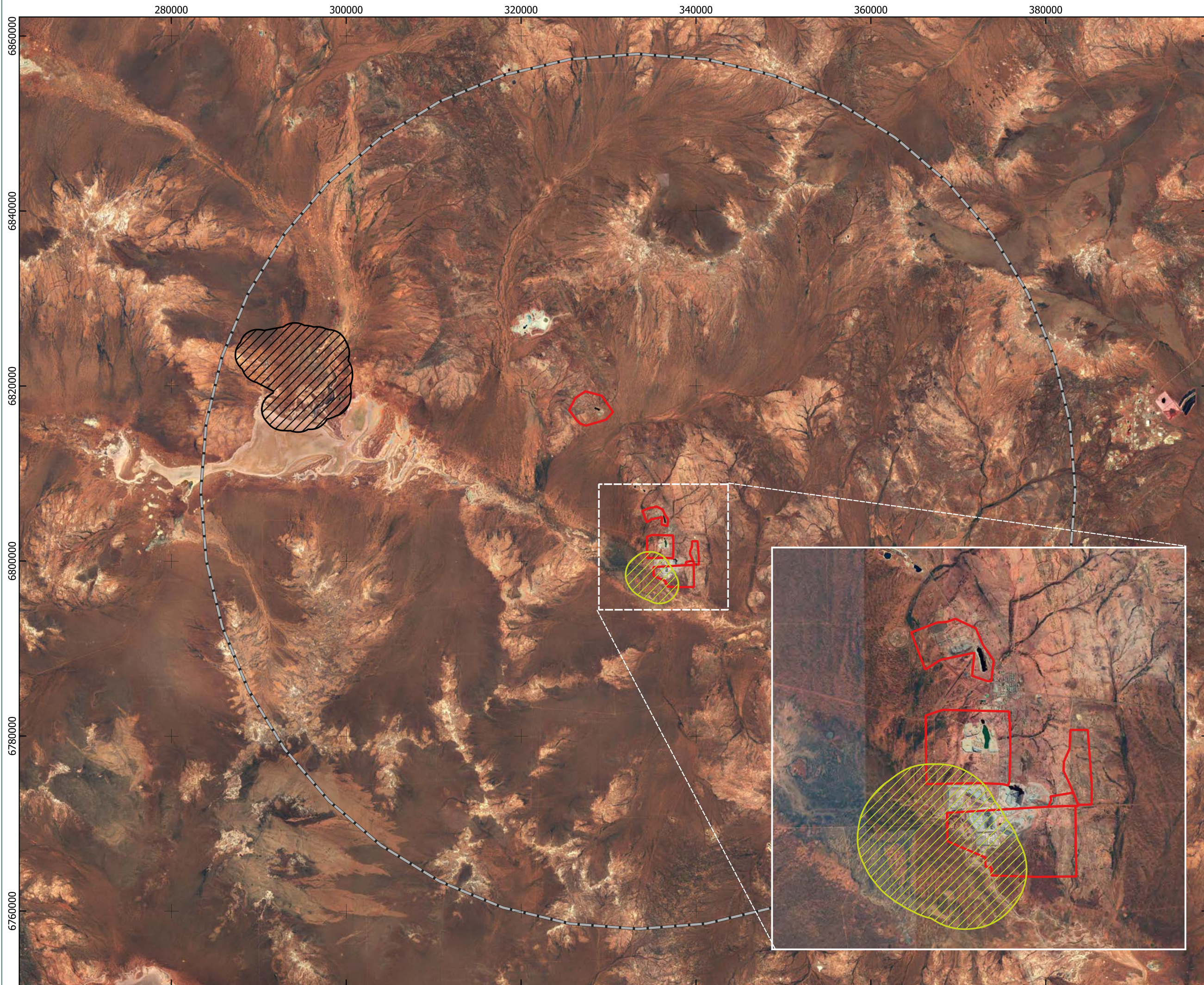
3.2. TEC & PEC – Desktop

The desktop assessment identified two Priority Ecological Communities (PEC) within 50 km of the Survey Area; both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station (Table 3.2). It is known for its unique assemblages of invertebrates in the groundwater calcretes, and is threatened by hydrological changes associated with mining. The remaining PEC is located 25 km to the west of the Survey Area (Map 3.3). It was assigned a 'Low likelihood' to occur based on the restriction to a paleodrainage system on Sturt Meadows Station.

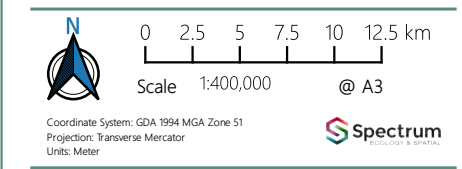
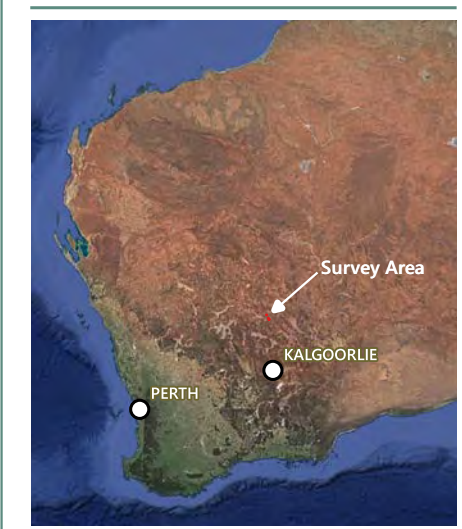
No Threatened Ecological Communities (TEC) were recorded within 50 km of the Survey Area.

Table 3.2: TEC & PEC Results of the Desktop Assessment

Likelihood	Status	Name	Description	Proximity to the Survey Area
Recorded	Priority 1	Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station.	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	PEC is within the Survey Area
Low	Priority 1	Sturt Meadows calcrete groundwater assemblage type on Raeside palaeodrainage on Sturt Meadows Station.	Unique assemblages of invertebrates have been identified in the groundwater calcretes.	25 km WNW



- Legend**
- Survey Area
 - PECs**
 - Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station
 - Sturt Meadows calcrete groundwater assemblage type on Raeside palaeodrainage on Sturt Meadows Station
 - 50 km Buffer



Author: EM Approved: AH Date: 10-02-2022

Priority Ecological Communities Recorded

Leonora Operations

3.3. Terrestrial Fauna – Desktop

To provide information to support the current assessment, 11 fauna surveys and three public databases were accessed as part of the desktop assessment. Details of the completed database searches are listed in Table 2.1, and details of the previous assessments are listed in Table 2.2.

The literature review and database searches identified 16 non-volant native mammals, 13 introduced mammals, ten bats, 147 birds, 58 reptiles, and seven amphibians recorded in the region surrounding the Survey Area. A summary of the total number of species identified during the desktop assessment is presented in Table 3.3 with a detailed list of species recorded during relevant surveys (11 vertebrate fauna surveys) listed in Appendix D. Obligate marine species, seabirds, and aquatic species have been excluded from the assessment due to the absence of coastal or marine habitat within the Survey Area. It should be noted that a Streaked Shearwater was vouchered from approximately 90 km west of the Survey Area. This specimen corresponds with a group of Streaked Shearwaters recorded in Perth waters in early 2012 and were likely a vagrant group that were blown inland and further south from their usual distribution along the northern and eastern coast of Australia (non breeding) and up north into northwest pacific region (breeding).

Table 3.3: Summary of Terrestrial Fauna Species Previously Recorded in the Region

Data Source	Level of Survey	Included in	Mammals (Native/ Introduced)	Bats	Birds	Reptiles	Amphibians	Total
Spectrum Ecology, 2021a	Fauna – basic	✓	0/3	0	23	2	0	25
Terrestrial Ecosystems, 2020a	Fauna – detailed	✓	7/5	5	43	33	3	84
Terrestrial Ecosystems, 2020b	Fauna – basic	✓	5/0	0	23	11	1	35
Terrestrial Ecosystems, 2011	Fauna - detailed	✓	4/1	1	47	15	3	66
Bamford Consulting Ecologists, 2010	Fauna – detailed	✓	8/8	6	77	37	1	121
Bamford Consulting Ecologists, 2008	Fauna – basic	✓	4/6	1	30	7	1	39
Bamford Consulting Ecologists, 2007	Fauna – basic	✓	4/3	0	42	5	0	47
Dunlop and Payne, 1999	Fauna – detailed (single phase)	✓	1/0	0	36	13	0	49
Ninox Wildlife Consulting, 1998	Fauna – detailed	✓	3/7	0	60	16	3	79
Brearley, Dunlop and Osbourne, 1997	Fauna - detailed	✓	3/7	3	33	13	0	49
Kinhill Engineers, 1992	Fauna - basic	✓	2/5	1	2	8	0	11
DBCAs Threatened Fauna Database	Database	✓	3/0	0	10	1	0	11
NatureMap	Database	✓	8/3	6	120	36	5	167
PMST	Database	✓	1/8	0	19	0	0	19
Total			16/13	10	147	58	7	251

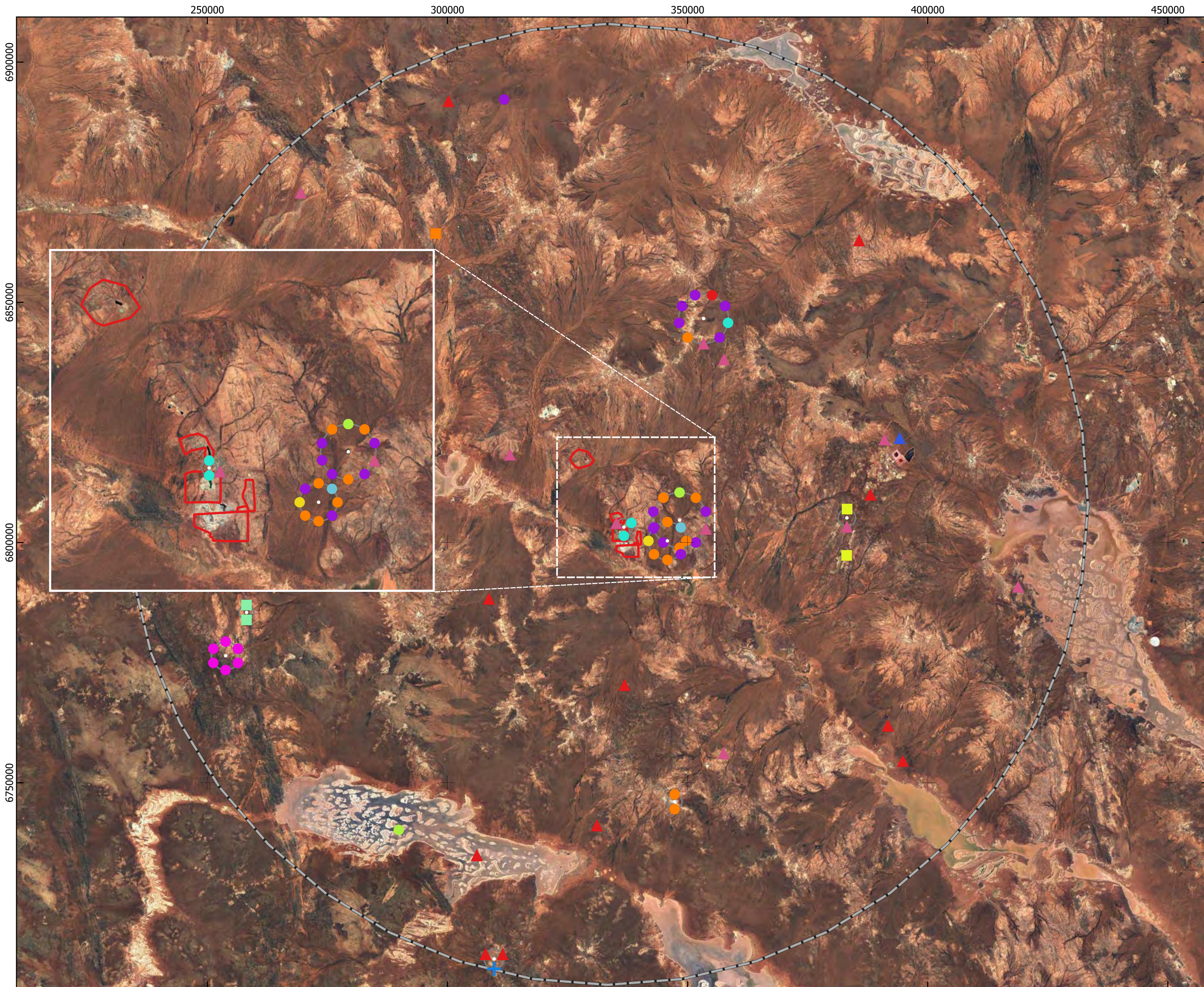
3.3.1. Conservation Significant Fauna

The desktop assessment identified 22 species of conservation significant fauna (four mammals, 17 birds, one reptile and one invertebrate) as potentially occurring at the Survey Area based on the database search results and literature review (DBCAs Threatened Fauna, Naturemap and PMST). Ten of the 22 species have a Medium to High likelihood to occur at the Survey Area. The details and likelihood of occurrence are listed in Table 3.4 and DBCA records (DBCAs database search) are shown on Map 3.4.

Table 3.4: Significant Fauna Recorded during Databases Searches

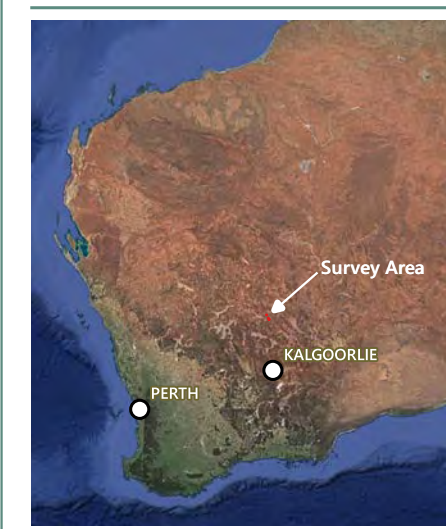
Species	Conservation Status			Database Record			No. Surveys Recorded	Likelihood of Occurrence
	EPBC Act	BC Act	DBCAs	PMST	DBCAs	NatureMap		
Mammals								
Western Quoll <i>Dasyurus geoffroii</i>	VU	VU	-	✓	-	-	0	Low
Greater Bilby <i>Macrotis lagotis</i>	VU	VU	-	-	✓	-	0	Low
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	-	-	P4	-	✓	-	5	High
Brush-tailed Mulgara <i>Dasyercus blythi</i>	-	-	P4	-	-	✓	0	Low
Birds								
Night Parrot <i>Pezoporus occidentalis</i>	EN	CR	-	✓	-	-	0	Low
Red Knot <i>Calidris canutus</i>	EN/MI	EN	-	-	✓	-	0	Very Low
Malleefowl <i>Leipoa ocellata</i>	VU	VU	-	✓	✓	✓	3	High
Princess Parrot <i>Polytelis alexandrae</i>	VU	-	P4	✓	-	-	0	Low
Grey Falcon <i>Falco hypoleucos</i>	-	VU	-	✓	✓	-	0	Medium
Fork-tailed Swift <i>Apus pacificus</i>	MI	MI	-	✓	-	-	1	Low
Oriental Plover <i>Charadrius veredus</i>	MI	MI	-	✓	-	-	1	Medium
Pacific Golden Plover <i>Pluvialis fulva</i>	MI	MI	-	-	✓	-	0	Low
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	MI	MI	-	✓	✓	-	0	Medium
Pectoral Sandpiper <i>Calidris melanotos</i>	MI	MI	-	✓	-	-	0	Very Low

Species	Conservation Status			Database Record			No. Surveys Recorded	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA	PMST	DBCA	NatureMap		
Common Sandpiper <i>Actitis hypoleucos</i>	MI	MI	-	✓	✓	✓	0	Medium
Wood Sandpiper <i>Tringa glareola</i>	MI	MI	-	-	-	✓	1	Medium
Common Greenshank <i>Tringa nebularia</i>	MI	MI	-	✓	✓	✓	0	Medium
Grey Wagtail <i>Motacilla cinerea</i>	MI	MI	-	✓	-	-	0	Very Low
Yellow Wagtail <i>Motacilla flava</i>	MI	MI	-	✓	-	-	0	Very Low
Hooded Plover (Hooded Dotterel) <i>Thinornis cucullatus</i>	-	-	P4	-	✓	-	1	Medium
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	-	-	✓	✓	2	High
Reptiles								
Woma <i>Aspidites ramsayi</i>	-	-	P1	✓	-	-	0	Low
Invertebrates								
Arid Bronze Azure Butterfly <i>Ogyris subterrestris</i> subsp. <i>petrina</i>	CR	CR	-	-	✓	-	0	Very Low



Legend

- Survey Area
- Threatened Fauna**
- Bilby
- Brush-tailed Mulgara
- Long-tailed Dunnart
- Red Knot
- Malleefowl
- Grey Falcon
- Common Greenshank
- Common Sandpiper
- Pacific Golden Plover
- Sharp-tailed Sandpiper
- Streaked Shearwater
- Wood Sandpiper
- Hooded Plover
- Peregrine Falcon
- Woma (southwest subpop.)
- 100 km Buffer



0 5 10 15 20 25 km
 Scale: 1:730,000 @ A3
Coordinate System: GDA 1994 MGA Zone 51
 Projection: Transverse Mercator
 Units: Meter

Author: EM Approved: AH Date: 10-02-2022

**Desktop Significant
Vertebrate Fauna (DBCAs)**
Leonora Operations

3.3.2. Short Range Endemic Invertebrates Desktop Assessment

The literature review did not identify any reports with an SRE component (Table 2.2). However, four databases were consulted (details provided in Table 2.1).

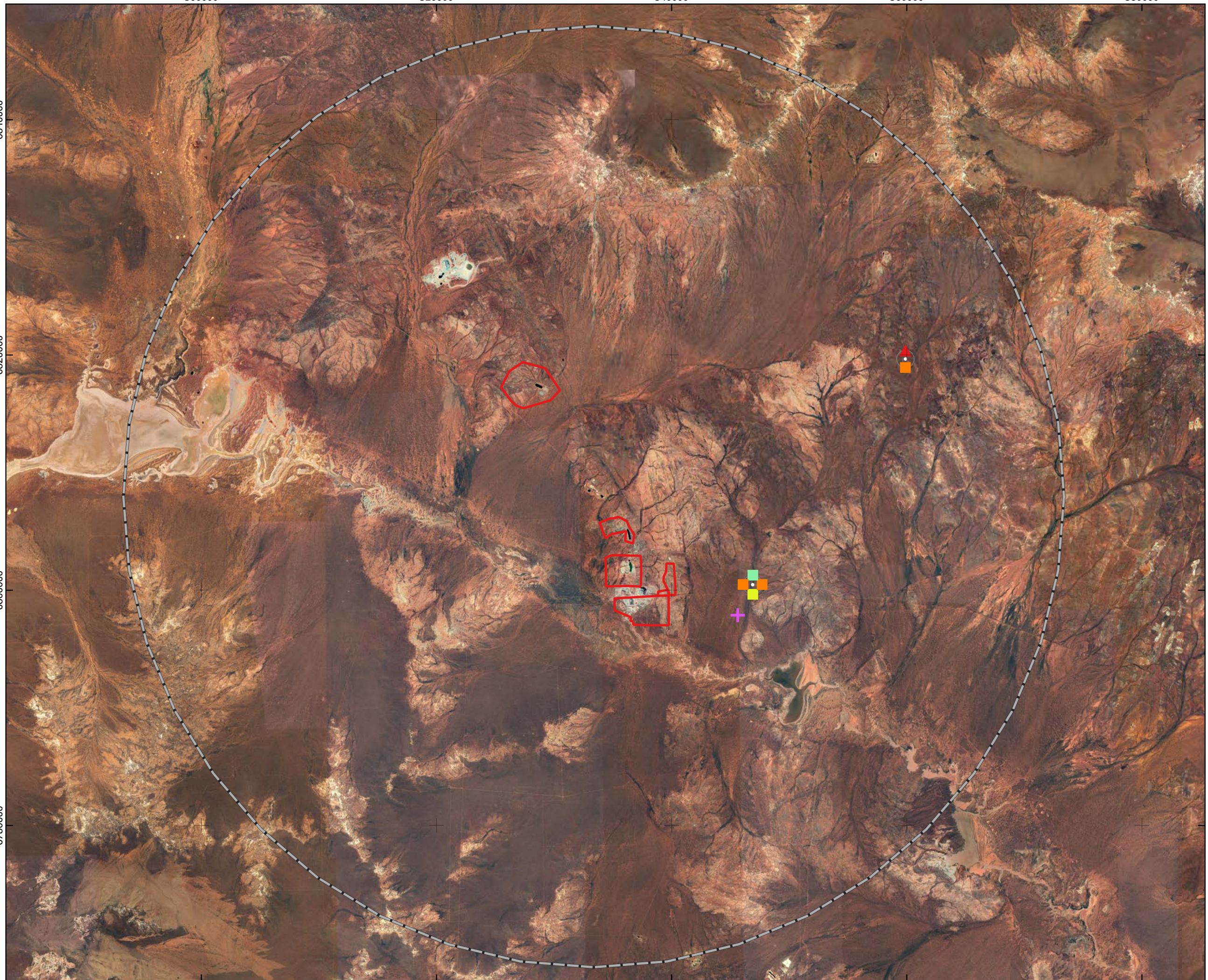
The West Australian Museum database search identified four Arachnid (one spider and three pseudoscorpions), one Crustacean (fairy shrimp; aquatic species, excluded from the assessment), and one Mollusc (snail) species of potential short range endemic invertebrates within 40 km of the Survey Area (Table 3.5, and Map 3.5).

Table 3.5: Western Australian Museum (WAM) Invertebrate Database Results

Class/ Order/ Family	Species	Record made Distance & Direction of Nearest Record from Survey Area - WAM Database
ARACHNIDS		
Mygalomorphae		
Barychelidae	<i>Idiommata</i> `sp. indet. (juvenile)`	27 km ENE
Pseudoscorpiones		
Olpiidae	`Genus indet.` `sp. indet. (juvenile)`	7 km E & 27 km ENE
	<i>Austrohorus</i>	7 km E
	<i>Beierolpium</i> `sp. 8/3`	7 km E
MOLLUSC (Snails)		
Gastropoda		
Succineidae	<i>Succinea</i> sp.	250 m – at Gwalia, outside of Survey Area

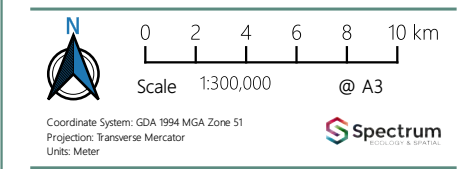
300000 320000 340000 360000 380000

6840000
6820000
6800000
6780000



Legend

- Survey Area
- 40 km Buffer
- WAM Potential SRE Species**
- 'Genus indet.' 'sp. indet. (juvenile)'
- Austrohorus sp.
- Beierolpium 'sp. 8/3'
- ▲ Idiommata 'sp. indet. (juvenile)'
- + Succinea sp.



Author: EM Approved: AH Date: 10-02-2022

SRE Database Search Results (WAM)
Leonora Operations

4. RESULTS & DISCUSSION – SITE VISIT

4.1. Ecological Communities Recorded

A total of 13 ecological communities were recorded during the site visit to the Survey Area. The ecological communities were based on vegetation communities outlined from previous flora and vegetation surveys undertaken by Mattiske Consulting Pty Ltd (2006, 2008). The ecological communities recorded are outlined in Table 4.1 and shown on Map 4.1.

Table 4.1: Ecological Communities Recorded

EC No*:	Ecological Community	Mattiske Veg Comm Code	Disturbance Areas	Total Area (ha)
EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	A1	All areas	261.5
EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	A2	Gwalia, Harbour Lights, Jaspers and Tower Hill	723.0
EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	A3	All areas	1,287.7
EC04	Low open shrubland of <i>Acacia</i> spp. over mixed chenopods and grasses on pebbles and quartz on lower slopes	A4	Tower Hill	61.8
EC05	<i>Acacia</i> spp. over mixed shrubs on rocky ridges and outcrops	A11	Gwalia and Jaspers	34.0
EC06	Low chenopod shrubland on gravelly loam on flats and flowlines	NA	Gwalia	52.0
EC07	Lake Raeside drainage with <i>Tecticornia</i> low open shrubland	NA	Gwalia	50.0
EC08	Open woodland of <i>Acacia</i> and <i>Eremophila</i> over diverse chenopod shrubs on sand dunes fringing salt lake	NA	Gwalia	48.8
EC09	Low chenopod shrubland on loam on flats	NA	Gwalia	44.8
EC10	Open shrubland of <i>Acacia</i> spp. on ironstone gravel on flats	NA	Jaspers	15.1
EC11	<i>Eremophila</i> over <i>Tecticornia</i> open plain on fine gravel	NA	Tower Hill	6.5
EC12	<i>Acacia</i> (Mulga) spp. over mixed shrubs on quartz outcrop	NA	Tower Hill	1.9
EC13	Cleared/Disturbed	CL/D	All areas	1,041.2
Total Area				3,628.2

* EC = Ecological Community

The most common ecological community was open shrubland of *Acacia* (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes, covering 1,287.7 ha in the Survey Area. This ecological community was recorded in all proposed disturbance areas except the railway corridors. The second most common community was cleared or disturbed areas, accounting for 1,041.2 ha. The least common ecological community recorded was *Acacia* (Mulga) spp. over mixed shrubs on quartz outcrop (1.9 ha), which was only recorded at Tower Hill.

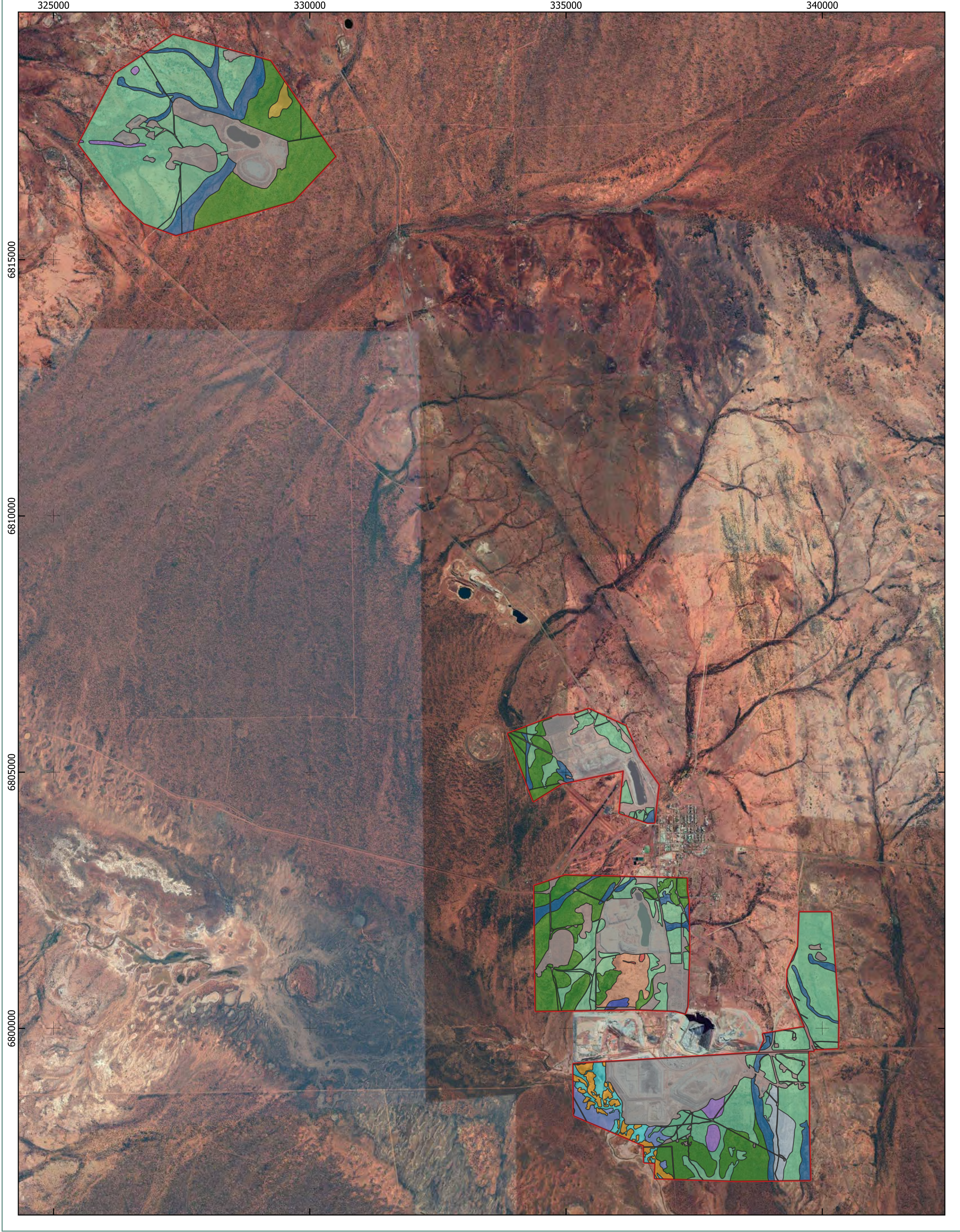
The ecological communities within the Survey Area were assessed and mapped based on the four distinct mining operational areas and the proposed railway corridors. The ecological communities present in each area are outlined in Table 4.2.

Table 4.2: Ecological Communities Recorded at each Operational Area

Operational Area/Railway Corridors	EC No.	Ecological Community	Mattiske Veg Comm Code	Total Area (ha)
Gwalia	EC05	<i>Acacia</i> spp. over mixed shrubs on rocky ridges and outcrops	A11?	24.5
	EC13	Cleared/Disturbed	CL/D	313.3
	EC07	Lake Raeside drainage with <i>Tecticornia</i> low open shrubland	NA	50.0
	EC06	Low chenopod shrubland on gravelly loam on flats and flowlines	CL/D	52.0
	EC09	Low chenopod shrubland on loam on flats	NA	44.8
	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	A3	249.1
	EC08	Open woodland of <i>Acacia</i> and <i>Eremophila</i> over diverse chenopod shrubs on sand dunes fringing salt lake	NA	48.8
	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	A2	132.8
	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	A1	52.3
Harbour Lights	EC13	Cleared/Disturbed	CL/D	201.6
	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	A3	70.3
	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	A2	61.8
	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	A1	16.1
Jaspers	EC05	<i>Acacia</i> spp. over mixed shrubs on rocky ridges and outcrops	A11	9.6
	EC13	Cleared/Disturbed	CL/D	227.4
	EC10	Open shrubland of <i>Acacia</i> spp. on ironstone gravel on flats	NA	15.1
	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	A3	613.2
	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	A2	288.4
	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	A1	138.7
Railway Corridor	EC13	Cleared/Disturbed	CL/D	19.8
	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	A3	202.1
	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	A1	18.8
Tower Hill	EC12	<i>Acacia</i> (Mulga) spp. over mixed shrubs on quartz outcrop	NA	1.9
	EC13	Cleared/Disturbed	CL/D	279.1
	EC11	<i>Eremophila</i> over <i>Tecticornia</i> open plain on fine gravel	NA	6.5
	EC04	Low open shrubland of <i>Acacia</i> spp. over mixed chenopods and grasses on pebbles and quartz on lower slopes	A4	61.8

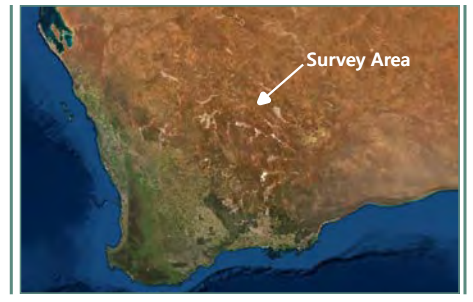
Operational Area/Railway Corridors	EC No.	Ecological Community	Mattiske Veg Comm Code	Total Area (ha)
	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	A3	153.0
	EC02	Open woodland of <i>Acacia</i> spp. (Mulga) over sparse shrubs on sandy-loam on flats and lower slopes	A2	240.0
	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	A1	35.5

Further details on the site assessments can be found in Appendix A.



Legend

Survey Area	EC05	EC13
Ecological Communities	EC06	EC11
EC01	EC07	EC04
EC02	EC08	EC12
EC03	EC09	EC10



N

0 1 2 km

Scale 1:65,000 @ A3

Coordinate System: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Units: Meter

Spectrum

Author: EM Approved: AH Date: 10-02-2022

Ecological Communities

Leonora Operations

Talis Consultants | St Barbara

4.2. Terrestrial Fauna

A total of 38 vertebrate fauna species were recorded during the survey, this included 31 birds, one native mammal, four introduced mammals and two reptiles. The species recorded are detailed in Appendix D.

4.3. Significant Findings

No conservation significant flora species were recorded during the survey. However, two conservation significant flora species records, located within close proximity to the Survey Area, were investigated (Map 3.2). The findings are outlined in Table 4.3.

Table 4.3: Significant Findings

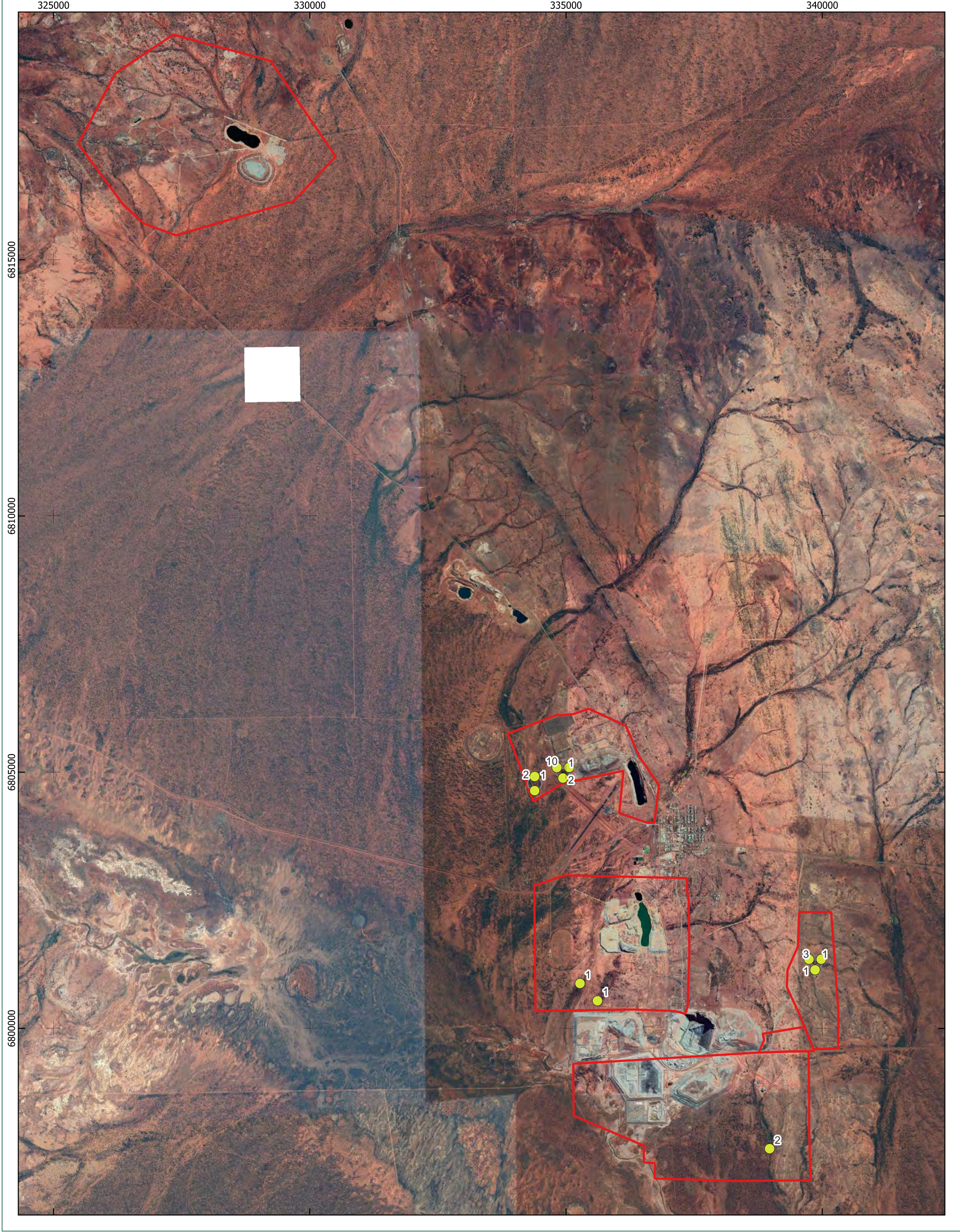
Taxon	Consevation Status	Findings
<i>Acacia</i> sp. Marshall Pool (G. Cockerton 3024)	P3	The precision rating for the coordinates is three, which indicates the individual is located within 10 km of the record location. Record was located in the middle of Leonora indicating that the locality of Leonora may have been used instead of an GPS location.
<i>Frankenia glomerata</i>	P3	Record was located just west of the Tower Hill boundary and the species could not be located. The accuracy of the location is questionable as the record was located in <i>Acacia</i> shrubland on red loam soils; however, the species preferred habitat is white sand with Samphire and pigface (around salt lakes etc.). This species is expected to occur around the Lake Raeside drainage where suitable habitat exists.

The ecological communities within the Survey Area that contain rocky ridges, rocky outcropping, and chenopods such as *Tecticornia* spp. were noted as potentially significant due to the possibility for rare or threatened species to be present.

Approximately 25 trapdoor spider burrows were located at seven site assessment locations at Gwalia, Tower Hill, Harbour Lights and Railway Corridors (Map 4.2, Appendix E). The trapdoor spider burrows recorded, appeared to have the distinctive 'moustache-like' arrangement of twigs that the genus *Idiosoma* typically displays, see Figure 4.1 (Rix *et al.*, 2018). Further targeted surveys will be required to accurately identify these trapdoor spiders.



Figure 4.1: Potential *Idiosoma* spp. Burrow



- Legend**
- Survey Area
 - Potential Idiosoma Locations & Number of Burrows



0 1 2 km
 Scale: 1:65,000 @ A3
Coordinate System: GDA 1994 MGA Zone 51
 Projection: Transverse Mercator
 Units: Meter

Author: EM Approved: AH Date: 17-02-2022

Location of Potential Idiosoma sp. Burrows

Leonora Operations

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4.3.1. Conservation Significant Fauna

The conservation significant fauna species identified in the desktop assessment were given a likelihood of occurrence scoring following the field survey. The preliminary desktop assessment was reviewed and amended based on the following:

- Suitable fauna habitats recorded from the Survey Area;
- Distribution of previously recorded conservation significant species;
- Frequency of occurrence of conservation significant species in the region;
- Temporal distribution of conservation significant species; and
- Accuracy of record locations, date, and source of record (level of reliability).

The desktop assessment identified 22 conservation significant fauna species, including four mammals, 17 birds, one reptile and one invertebrate. Following the field survey, seven conservation significant fauna species are considered to have a Medium to High likelihood of occurrence based on the relevant species distributions and habitats occurring within the Survey Areas (Table 4.4). Fifteen species identified in the desktop assessment are considered to have a Low to Very Low likelihood of occurring in the Survey Area. Species descriptions for those assigned a High or Medium likelihood of occurrence are provided in Section 4.3.1.1 to Section 4.3.1.4. Definitions of the relevant conservation status codes are provided in Appendix B.

The likelihood of occurrence of each conservation significant species listed by the database searches was determined based on the criteria outlined in Table 2.3.

Table 4.4: Summary of Conservation Significant Fauna Species Identified Post Survey

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Mammals						
Western Quoll <i>Dasyurus geoffroii</i>	VU	VU	-	Sclerophyll forest, riparian forest, dry woodland, heath and mallee shrubland (Van Dyck and Strahan, 2008).	No records from the surrounding region. Potential habitat is identified by PMST.	Low No suitable habitat exists in the Survey Area.
Greater Bilby <i>(Macrotis lagotis)</i>	VU	VU	-	In WA, the preferred habitat is Mulga scrub and hummock grasslands or sandplains or along drainage or salt lakes systems. Require sandy or loamy soil in which to burrow. Only found in areas where foxes are rare or absent.	One DBCA record exists from 1981, 53 km NW of the Survey Area.	Low Survey Area contains marginal habitat within the Lake Raeside drainage, however, no recent records, last record was over 50 km north-east the Survey Area over 90 years ago.
Long-tailed Dunnart <i>(Sminthopsis longicaudata)</i>	-	-	p4	Primarily rocky hills, breakaways, and plateaus with open mulga, but may also occur in open plains with a stony substrate.	DBCA has two records from 2011 and 2018 located 42 km E of the Survey Area.	Medium Some small areas of marginally suitable rocky habitat occurs within the Survey Area, with recent records less than 50 km away.
Brush-tailed Mulgara <i>(Dasycercus blythi)</i>	-	-	P4	Mature hummock grasslands of spinifex, especially <i>Triodia basedowii</i> and <i>T. pungens</i> . Colonies are thought to be influenced by the presence of well-watered areas such as drainage channels (Masters, Dickman and Crowther, 2003).	Two DBCA records from 2012 are located approximately 78 km SW of the Survey Area.	Low No suitable habitat exists within the Survey Area and records are over 50 km away.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Birds						
Night Parrot <i>Pezoporus occidentalis</i>	EN	CR	-	Recorded from long unburnt, ring forming <i>Triodia</i> grasslands in association with low lying saline lakes and drainages hosting chenopods/ samphire (Jackett <i>et al.</i> , 2017).	PMST lists habitat potentially present within the Survey Area. As outlined in DPaW (2017), the Survey Area is located within the High priority survey area (Eastern Murchison IBRA region), nearing the Medium priority survey area.	Low Suitable foraging habitat may have been present in the Survey Area historically, however livestock grazing has removed all areas of dense grass tussocks and hummocks (breeding habitat) in the region.
Red Knot <i>Calidris canutus</i>	EN/MI	EN	-	Migratory shorebird, usually restricted to coastal areas with large tidal flats, uncommon inland (Menkhorst <i>et al.</i> , 2019; Birdlife Australia, 2022)	Historic record (1978) from DBCA 37 km NE. No recent records.	Very Low Migratory shorebird that is usually restricted to coastal areas. No recent records or suitable habitat.
Malleefowl <i>Leipoa ocellata</i>	VU	VU	-	Semi-arid and arid mallee, mulga and other habitats with dense litter forming vegetation. Variety of dry forest, woodlands and shrublands dominated by eucalypts and acacias (Benshemesh, 2007).	Several historic and recent records in the region surrounding the Survey Area were returned from the DBCA search. The closest recent record is from 2011, located approximately 27 km S of the Survey Area.	Medium Some suitable habitat recorded from the Survey Area, however the vegetation density is low, minimizing the favourable habitat for this species. In addition, the Survey Area is disturbed from historic and current mining activities.
Princess Parrot <i>(Polytelis alexandrae)</i>	VU	-	P4	Western and central deserts. Typically, in sand dune country with scattered trees and good cover of shrubs and <i>Triodia</i> or stands of Mulga and Casuarina (Menkhorst <i>et al.</i> , 2019).	No previous records from within the vicinity of the Survey Area. PMST listed as species or species habitat known to occur within the area.	Low No recent records and only marginally suitable habitat is present inside the Survey Area.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Grey Falcon <i>Falco hypoleucos</i>	-	VU	-	Likely a nomadic species in the arid and semi-arid zones. Does not appear to be associated with any particular vegetation types (Schoenjahn, Pavey and Walter, 2020).	No confirmed records within 50 km. One historical record from over 25 years ago, located 58 km W (DBCA). PMST lists species or species habitat may occur within the Survey Areas.	Low No recent records in the vicinity. Suitable habitat could occur in the region and the Survey Area. Habitat preferences are not well known and the Survey Area occurs at the southern extent of the species known range.
Fork-tailed Swift <i>Apus pacificus</i>	MI	MI	-	Nomadic, almost entirely aerial lifestyle over a variety of habitats; associated with storm fronts (Australian Government & DAWE 2020).	No confirmed records within 50 km. PMST lists species or species habitat likely to occur within the Survey Area.	Low The Fork-tailed Swift is highly nomadic and can occur across Australia. Records are typically associated with suitable climatic conditions instead of habitat types.
Oriental Plover <i>Charadrius veredus</i>	MI	MI	-	Migrant to plains and grasslands of northern Australia. Prefers thinly vegetated plains such as recently burnt or heavily grazed areas (Menkhorst <i>et al.</i> , 2019).	No previous records from within the vicinity of the Survey Area from DBCA. PMST listed as a species or species habitat may occur within the area. ALA lists one record of this species from 2018 approximately 12 km to east (with a 10 km generalised locality).	Low Migratory shorebird rarely recorded in the region and limited suitable habitat with the Survey Area and surrounds.
Pacific Golden Plover <i>Pluvialis fulva</i>	MI	MI	-	Migratory shorebird, mainly occurs in coastal areas with tidal flats or beaches and reefs, usually with seaweed. Also less commonly found inland at wetlands or sparse grasslands (Menkhorst <i>et al.</i> , 2019).	One historic record from DBCA.	Very Low No recent records and limited suitable habitat occurs within the Survey Area and surrounding region.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	MI	MI	-	Common migratory shorebird in Australia, regularly seen around fresh and saline inland wetlands. Also found around sewage farms, lagoons and temporary floodwaters (Morcombe, 2003).	Historic DBCA record from 1979, 5 km W of Survey Area. ALA has more recent records (2018, 2019) both less than 20 km W (with a 10 km generalised locality). PMST lists habitat to potentially be present within the Survey Area.	Medium Migratory shorebird. May occasionally visit the wetland areas associated with Lake Raeside drainage when inundated and the limited artificial waterbodies associated with mining and sewage located within or near the Survey Area.
Pectoral Sandpiper <i>Calidris melanotos</i>	MI	MI	-	Uncommon migrant. Grassy edges of freshwater wetlands or brackish wetlands with short saltmarsh fringes when no freshwater is available (Menkhorst <i>et al.</i> , 2019).	No confirmed records within 50 km. PMST lists habitat as potentially present within the Survey Area.	Very Low Uncommon migratory shorebird, with limited records inland within the vicinity of the Survey Area. No preferred habitat is present in the Survey Area.
Common Sandpiper <i>Tringa hypoleucos</i>	MI	MI	-	Migratory/waterbird species typically associated with narrow steep shorelines and mangrove lined creeks. This species also inhabits inland ephemeral wetland habitat types when present and sewage ponds and dams (Birdlife Australia, 2012; Menkhorst <i>et al.</i> , 2019).	Seven DBCA records within 8 km W of the Survey Area, with two recent records (2013 & 2016). PMST lists species or species habitat likely to occur within the Survey Area. ALA also has recent records from 2019 and 2020 at the Leonora Wastewater Treatment Plant.	Medium Migratory shorebird with some local records using nearby wetlands and sewage ponds. May occasionally visit the visit the wetland areas associated with Lake Raeside drainage when inundated and the limited artificial waterbodies associated with mining and sewage located within or near the Survey Area.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Wood Sandpiper <i>Tringa glareola</i>	MI	MI	-	Migratory shorebird. Freshwater wetlands, especially with emergent sedges or other small plants and taller fringe vegetation. Usually near shorelines on mudflats or in shallow water (Menkhorst <i>et al.</i> , 2019).	DBCA has two recent records (2015), <1 km from the Survey Area at the Leonora Waste Water Treatment Plant. ALA also has a records for this species from 2019 approximately 4.5 km E of the Survey Area (with a 10 km generalised locality).	Medium Migratory shorebird with some local records using nearby wetlands and sewage ponds. May occasionally visit the limited freshwater artificial waterbodies associated with mining and sewage located within or near the Survey Area.
Common Greenshank <i>Tringa nebularia</i>	MI	MI	-	Migratory shorebird. Shallow, coastal, and freshwater wetlands with open mudflats or still shallow water (Menkhorst <i>et al.</i> , 2019).	DBCA has a number of recent and historic records with five within the last 20 years, 8.5 km E of the Survey Area. Listed as a potential species for the area from PMST and Nature Map.	Medium Migratory shorebird with some local records using nearby wetlands. May occasionally visit the limited freshwater artificial waterbodies associated with mining and sewage located within or near the Survey Area.
Grey Wagtail <i>Motacilla cinerea</i>	MI	MI	-	Migratory species rarely reaching Australian fresh streams, mowed grass, ploughed land or sewage ponds (Morcombe, 2003).	No previous records from the vicinity of the Survey Area. PMST list the habitat as potentially occurring at the Survey Area.	Very Low The species has not been recorded in the wider region, and only marginal habitat exists within or near the Survey Area.
Yellow Wagtail <i>Motacilla flava</i>	MI	MI	-	Occurs across Europe, Western Asia, and Africa. Utilises a variety of damp or wet habitats with low vegetation, such as meadows, marshes, waterside pastures and sewage treatment plants (Menkhorst <i>et al.</i> , 2019).	No previous records from within the vicinity of the Survey Area. PMST listed them as a potential species for the area.	Very Low Rare visitor to Australia. No previous records and limited suitable habitat within the Survey Area and surrounds.

Species	Conservation Status			Preferred Habitats	Previous Records	Likelihood of Occurrence
	EPBC Act	BC Act	DBCA			
Hooded Plover <i>Thinornis rubricollis</i>	-	-	P4	Inland margins and shallows of salt lakes, estuaries, coastal lakes and ocean beaches (Morcombe, 2003; Menkhorst <i>et al.</i> , 2019).	One record from 2001 (DBCA) exists, approximately 8 km E of the Survey Area.	Low The species is rarely recorded in the region as it is at the north-eastern extent of it's range. Limited suitable habitat within the Survey Area.
Peregrine Falcon <i>Falco peregrinus</i>	-	OS	-	Occur across much of Australia inhabiting cliffs, coastal habitats, rivers, wooded water courses and lakes (Birdlife Australia, 2012).	Several historical and recent records from the surrounding region. One record from DBCA (2014) is 9 km E of Survey Area.	Medium Recently recorded from the region. The species may use foraging habitat within the Survey Area sporadically.
Reptiles						
Woma <i>Aspidites ramsayi</i>	-	-	P1	Generally restricted to arid and dry inland areas, preferably with sandy soils. A nocturnal species which shelters in dense vegetation such as spinifex, hollow logs and animal burrows during the day (Cogger, 2018).	Historic record from a roadkill specimen at Menzies, south of the Survey Area.	Low No recent records of this species and limited habitat present within the Survey Area.
Invertebrates						
Arid Bronze Azure Butterfly <i>Ogyris subterrestris</i> subsp. <i>petrina</i>	CR	CR	-	Associated with the sugar ant (<i>Camponotus</i> sp. nr. <i>terebrans</i>). Habitat present at known sites include mature mixed Salmon Gum (<i>Eucalyptus salmonophloia</i>) with Gimet (<i>E. salubris</i>) with an open understorey over red-brown soils (DBCA, 2020).	No records in the vicinity of the Survey Area. The Survey Area is located in the presumed range of the host ant (DBCA, 2020).	Low No preferred habitat recorded from the Survey Area. Any woodland habitat will be required to be surveyed

4.3.1.1. Malleefowl (*Leipoa ocellata*)

Conservation Status

- EPBC Act: Vulnerable.
- BC Act: Vulnerable.

Distribution, Habitat and Ecology: The Malleefowl is a large ground-dwelling bird species. It is restricted to the mainland of Australia where it inhabits semi-arid and arid habitats. In its range, the density of the Malleefowl is generally greater in areas of higher rainfall and where shrub diversity is greatest (Benshemesh, 2007; Malleefowl Recovery Team, 2018). In Western Australia, Malleefowl occur in *Acacia* shrublands as well as areas that are dominated by mallee, Wandoo (*Eucalyptus accedens*), Marri (*Corymbia calophylla*), Mallet (*Eucalyptus astringens*) or Broombush (*Melaleuca uncinata*). The species is most abundant in undegraded areas with dense shrubs and trees that have a sandy substrate and plenty of leaf litter (Benshemesh, 2007).

The Malleefowl is a generalist feeder, consisting of seeds, fruits, flowers, fungi, invertebrates, herbs, legumes depending on location and season (Australian Government, 2018). The species mates for life and each pair builds large mounds (3-5 m in diameter) which are used as nests for the incubation of eggs. Egg laying typically begins in September when one egg is laid every 5-7 days (total of about 15-25 eggs) until the end of summer. The incubation period is approximately 60 days which depends on the temperature of the nest. The eggs are incubated by decomposition of leaf litter and plant material, as well as the heat from the sunlight later in the season (summer). Whilst the male predominantly attends the eggs and maintains the temperature for incubation, the females spends most of her time feeding for egg production and only rarely visits the nest (Benshemesh, 2007).

Occurrence in the Survey Area: The DBCA database search returned 11 historic and recent records, with the closest located 27 km south of the Survey Area in 2011. A survey conducted within the Survey Area and surrounds by Bamford Consulting Ecologists in (2010), recorded five Malleefowl mounds, with only one recently excavated with tracks. All five mounds were recorded within approximately 600 m of each other, located approximately 28 km south-west of the Survey Area. Additional Malleefowl tracks were also located around 22 km north-east of the Survey Area. All of the records appear to have been located in dense *Acacia* (Mulga) woodlands. The species was not recorded during the survey and suitable habitat present within the Survey Area is only marginal for the species due to the low density of vegetation and disturbance from historic and current mining activities. In addition, as much of the Survey Area is in close vicinity to Leonora, this may increase the predation pressure on this species.

It has a Medium likelihood to occur based on the records in the region and that the species may use some of the marginal habitat present in the Survey Area for foraging.

4.3.1.2. EPBC Act/BC Act Migratory Shorebirds

Database searches returned eight shorebirds listed as Migratory under the EPBC Act that could potentially occur in the Study Area. The Red Knot is also listed as Endangered by both the EPBC and BC Acts. Four of these were scored a Medium likelihood of occurrence (Table 4.4) all of which are primarily associated with coastal or inland water bodies. The four shorebirds species names and their EPBC Act status are summarised in Table 4.5 below.

Table 4.5: EPBC Act Listed Migratory Bird Species

Common name	Species name	EPBC Act/ BC Act Listing
Common Greenshank	<i>Tringa nebularia</i>	Migratory
Common Sandpiper	<i>Actitis hypoleucos</i>	Migratory
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Migratory
Wood Sandpiper	<i>Tringa glareola</i>	Migratory

Distribution, Ecology and Habitat

There are 37 species of migratory shorebirds in Australia that utilise the East-Asian-Australasian Flyway (EAAF); four of which have been given a Medium likelihood of occurring in the Survey Area. This flyway describes the migratory pattern whereby birds breed in the Northern hemisphere and migrate through Eastern Asia to spend a non-breeding period in the southern hemisphere (Hansen *et al.*, 2016). While movements vary between species, the non-breeding period spent in Australia is typically from spring to autumn (CoA, 2015). Feeding and roosting habitats used by migratory shorebirds in Australia include coastal and inland wetlands, estuaries, mudflats, tidal flats, rocky inlets, sandy beaches, floodplains, artificial wetlands as well as farm and grassland areas. The non-breeding diet of most species consists of invertebrates, including crustaceans, gastropods and bivalves (CoA, 2015).

Occurrence in the Study Area

All four shorebird species have been recorded outside but within close vicinity to the Survey Area from 1978 to 2020 (see Map 3.4 for DBCA records). The ephemeral salt-lake habitat associated with Lake Raeside drainage in the south of the Study Area is likely to provide foraging habitat for shorebirds that feed on aquatic invertebrates. In addition, a limited number of artificial freshwater waterbodies associated with mining and sewage occur within or in close proximity to the Survey Area. However, as these species are non-breeding migrants to Australia, their presence in the Survey Area is expected to be sporadic and temporary, depending on the availability of water.

4.3.1.3. Long-tailed Dunnart (*Sminthopsis longicaudata*)

Conservation Status

- DBCA: Priority 4.

Distribution, Habitat and Ecology: The Long-tailed Dunnart is a small, nocturnal, white-grey marsupial. It is the only Dunnart species with a tail more than twice the length of its body including a small terminal tuft of long hairs at the end. It occurs in the Pilbara, Murchison, north-eastern Goldfields, Ashburton and Gibson Desert region. In Western Australia, populations have been found to be relatively isolated indicating a very poor dispersal capability. The Long-tailed Dunnart is often found in rocky landscapes, such as lateritic plateaux, flat-topped hills and mesas as well as breakaways. The vegetation is often dominated by low open woodland or mixed shrubland of *Acacia* spp. over *Triodia* grassland (Government of Western Australia, 2018). It is a specialist rock dwelling species that has great agility climbing between rocks, using its striated foot pads and long tail for balance. The Long-tailed Dunnart feeds on a range of invertebrates including grasshoppers, beetles, ants, cockroaches and spiders (Burbidge, McKenzie and Fuller, 2008)

Occurrence in the Survey Area: The Long-tailed Dunnart was given a Medium likelihood of occurrence due to recent records from within 50 km of the Survey Area and the marginal rocky habitat that was recorded in the Survey Area.

4.3.1.4. Peregrine Falcon (*Falco peregrinus*)

Conservation Status

- BC Act: Other Specially Protected Fauna (OS)

Distribution, Habitat and Ecology: The Peregrine Falcon is one of the most widespread birds in the world, breeding on all continents except Antarctica (Olsen *et al.*, 2006). It occurs throughout most of Australia though it is an uncommon species and rare across all states and territories (Birdlife Australia, 2012). The Peregrine Falcon is known to be both a nomadic and sedentary species and is uncommon in the Kimberley, Hamersley and Darling Ranges. They inhabit cliffs, coastal habitats, rivers, wooded water courses and lakes as well as urban environments. Peregrine Falcons usually nest by making a scrape on a high cliff edge but will also use stick nests of other large birds and tree hollows in some areas (Olsen *et al.*, 2006). Hunting is mainly done during the day and feeding is primarily on small to medium sized birds caught in flight, often above drainage lines and rivers. Favoured prey species include the Galah (*Eolophus roseicapilla*) and Sulphur-crested Cockatoo (*Cacatua galerita*) (Birdlife Australia, 2012).

Occurrence in the Survey Area: The DBCA database search identified ten records from the surrounding region. The closest, and most recent record is from 2014, located 9 km east of the Survey Area. The Peregrine Falcon may use the Survey Area occasionally for foraging. This species is also known to nest in sheer cliffs of open pits, and may potentially use one of the numerous open pits in the Survey Area.

5. CONCLUSION

A total of 13 ecological communities were recorded from the Survey Area, these were:

- Woodland of *Acacia* (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines;
- Open woodland of *Acacia* (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes;
- Open shrubland of *Acacia* (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes;
- Low open shrubland of *Acacia* spp. over mixed chenopods and grasses on pebbles and quartz on lower slopes;
- *Acacia* (Mulga) spp. over mixed shrubs on quartz outcrop;
- Low chenopod shrubland on gravelly loam on flats and flowlines;
- Lake Raeside drainage with *Tecticornia* low open shrubland;
- Open woodland of *Acacia* and *Eremophila* over diverse chenopod shrubs on sand dunes fringing salt lake;
- Low chenopod shrubland on loam on flats;
- Open shrubland of *Acacia* spp. on ironstone gravel on flats;
- *Eremophila* over *Tecticornia* open plain on fine gravel;
- *Acacia* spp. over mixed shrubs on rocky ridges and outcrops; and
- Cleared/Disturbed areas.

The most common ecological community in the Survey Area was open shrubland of *Acacia* (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes, covering 1,287.7 ha.

The ecological communities within the Survey Area that contain rocky ridges, rocky outcropping, and chenopods such as *Tecticornia* spp. were noted as potentially significant due to the possibility for rare or threatened species to be present.

Five significant flora species were assigned a High likelihood of occurrence:

- *Frankenia georgei*;
- *Stenanthemum patens*;
- *Angianthus prostrates*;
- *Acacia* sp. Marshall Pool (G. Cockerton 3024); and
- *Frankenia glomerata*.

No conservation significant vertebrate fauna were recorded during the survey. However, seven species have a Medium to High likelihood of occurrence in the Survey Area:

- Malleefowl (*Leipoa ocellata*);
- EPBC Act/BC Act Listed Shorebirds:
 - Common Greenshank (*Tringa nebularia*);
 - Common Sandpiper (*Tringa hypoleucos*);
 - Sharp-tailed Sandpiper (*Calidris acuminata*);
 - Wood Sandpiper (*Tringa glareola*);
- Long-tailed Dunnart (*Sminthopsis longicaudata*); and
- Peregrine Falcon (*Falco peregrinus*).

Approximately 25 trapdoor spider burrows were located at seven site assessment locations at Gwalia, Tower Hill, Harbour Lights and Railway Corridors. The trapdoor spider burrows recorded, appeared to have the distinctive 'moustache-like' arrangement of twigs that are typical of the genus *Idiosoma*. Further targeted surveys will be required to determine their identity.

5.1. Additional Survey Recommendations

Additional biological surveys are recommended for the Survey Area and these are discussed below. All recommendations should be discussed with relevant staff from the EPA/DBCA to confirm current expectations from these organisations.

It should also be noted that subterranean fauna have not been considered in this report (although the presence of the *Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station* PEC is a strong indication that a detailed subterranean fauna assessment may be required)

5.1.1. Flora & Vegetation

Due to the limited number of recent flora and vegetation surveys in the local region, it would be expected that a single season detailed flora and vegetation assessment (completed after significant rainfall) and targeted flora survey (completed in the correct season(s)) would be required. Additional assessments may be required if rainfall in 2022 is not sufficient to allow the assessment of annual species.

5.1.2. Vertebrate Fauna

Due to the size of the Survey Area and availability of recent regional vertebrate fauna assessments, a targeted vertebrate fauna survey is expected to be sufficient. The main species of concern will be Malleefowl, with any impact to the surrounding salt lakes and claypans potentially requiring an assessment of the migratory bird usage during periods of inundation.

5.1.3. SRE Invertebrate Fauna

No available SRE invertebrate fauna assessments have been identified from the surrounding region, therefore it is recommended that a detailed SRE invertebrate fauna assessment be completed. Survey timing is post significant rainfall, which can be either associated summer cyclones coming down from the north or winter rainfall that has pushed up from the south. The SRE survey can be completed at the same time as the vertebrate fauna assessment, which will potentially allow the detection of additional vertebrate fauna species.

6. REFERENCES

- Australian Government (2018) *Malleefowl *Leipoa ocellata*. Australian Threatened Species*. Available at: <https://www.environment.gov.au/system/files/resources/eed39fb9-0a63-4aac-bc84-785330d8b9fb/files/tsd06malleefowl.pdf>.
- Australian Government & Department of Agriculture Water and the Environment (2020) *Species Profile and Threats Database. *Apus pacificus* - Fork-tailed Swift*. Available at: http://secure.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678.
- Bamford Consulting Ecologists (2007) *Fauna Assessment of the Tower Hill Project, Unpublished report prepared for St Barbara Limited*.
- Bamford Consulting Ecologists (2008) *Fauna Assessment of the Kailis Project, Unpublished report prepared for St Barbara Limited*.
- Bamford Consulting Ecologists (2010) *Fauna Survey of the Leonora Area, Unpublished report prepared for St Barbara Limited*.
- Beard, J. S. (1980) 'A new phytogeographic map of Western Australia'.
- Benshemesh, J. (2007) *National Recovery Plan for Malleefowl *Leipoa ocellata**.
- Birdlife Australia (2012) 'Peregrine Falcon'.
- Birdlife Australia (2022) *Red Knot *Calidris canutus**. Available at: <https://www.birdlife.org.au/bird-profile/red-knot> (Accessed: 25 January 2022).
- Brearely, D., Dunlop, J. and Osbourne, J. (1997) *The Terrestrial Flora and Fauna of Lake Carey*.
- Brearely, D. R., Dunlop, J. N. and Osborne, J. M. (1997) *The Terrestrial Flora and Fauna of Lake Carey*.
- Burbidge, A. A., McKenzie, N. L. and Fuller, P. J. (2008) 'Long-tailed Dunnart', in Van Dyck, S. and Strahan, R. (eds) *The Mammals of Australia*. 2nd edn. Reed New Holland, pp. 148–150.
- Bureau of Meteorology (2022) 'Climate Data Online'. Available at: <http://www.bom.gov.au/climate/data/>.
- Cogger, H. G. (2018) *Reptiles and Amphibians of Australia*. 7th Editio. Collingwood, Victoria: CSIRO Publishing.
- Commonwealth of Australia (2015) *Wildlife Conservation Plan for Migratory Shorebirds*.
- Department of Agriculture and Food Western Australia (2016) *Rangeland land system mapping Western Australia*.
- Department of Biodiversity Conservation and Attractions (1984) *Conservation and Land Management Act*.
- Department of Biodiversity Conservation and Attractions (2017a) 'Priority Ecological Communities for Western Australia Version 27'. Species and Communities Branch, Department of Biodiversity, Conservation and Attractions.
- Department of Biodiversity Conservation and Attractions (2017b) 'Threatened and Priority Flora Report Form - Field Manual'. Department of Biodiversity, Conservation and Attractions.
- Department of Biodiversity Conservation and Attractions (2019) 'Conservation Codes for Western Australian Flora and Fauna'. Department of Parks and Wildlife.
- Department of Biodiversity Conservation and Attractions (2020) *Guideline for the Survey of Arid Bronze Azure Butterfly (ABAB) in Western Australia*. Perth, WA.

Department of Mines Industry Regulation and Safety (2020) *1:500 000 State interpreted bedrock geology of Western Australia, 2020*.

Department of Parks and Wildlife (2017) *Interim guideline for preliminary surveys of night parrot (*Pezoporus occidentalis*) in Western Australia*.

Department of Primary Industry and Regional Development (2019) 'Pre-European Vegetation - Western Australia (NVIS Compliant Version 20110715)'.

Department of Sustainability Environment Water Population and Communities (2011a) 'Survey guidelines for Australia's threatened mammals. Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999'.

Department of Sustainability Environment Water Population and Communities (2011b) 'Survey guidelines for Australia's threatened reptiles. Guidelines for detecting reptiles listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999'.

Department of the Environment and Energy (2016) 'Collaborative Australian Protected Areas Database - Terrestrial CAPAD2016'. Australian Government.

Department of the Environment and Energy (2019) 'Australian Wetlands Database'. Australian Government. Available at: <https://www.environment.gov.au/water/wetlands/australian-wetlands-database>.

Department of the Environment Water Heritage and the Arts (2010) 'Survey guidelines for Australia's threatened birds. Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999'.

Department of Water and Environmental Regulation (2019) 'Clearing Regulations - Environmentally Sensitive Areas'. Government of Western Australia.

Dunlop, J. and Payne, W. (1999) *A Vertebrate Fauna Survey of the North Lake Carey Region including the Hillside Prospect, Wallaby Prospect, Just in Time/ Just in Case Prospect*. Unpublished Report for Granny Smith and Homestake.

Durrant, B. J. (2011) *Short-range endemism in the Central Pilbara*. Wildlife Research Centre, Science Division. Woodvale, WA.

Van Dyck, S. and Strahan, R. (2008) *The Mammals of Australia (Third Edition)*. Sydney: Reed New Holland.

Environmental Protection Authority (2016a) 'Environmental Factor Guideline: Terrestrial Fauna'. Western Australia: EPA.

Environmental Protection Authority (2016b) 'EPA Environmental Factor Guideline: Flora and Vegetation'. Western Australia: EPA.

Environmental Protection Authority (2016c) 'EPA Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment'. Western Australia: EPA.

Environmental Protection Authority (2016d) 'Technical Guidance: Sampling of short range endemic invertebrate fauna'. Western Australia: EPA.

Environmental Protection Authority (2018) 'Statement of Environmental Principles, Factors and Objectives'. Western Australia: EPA.

Environmental Protection Authority (2020) 'Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment'. Western Australia: EPA.





- ESCAVI (2003) 'Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0'. Canberra: Executive Steering Committee for Australian Vegetation information. Department of Environment and Heritage.
- Government of Western Australia (2007) 'Biosecurity and Agriculture Management Act (BAM Act) 2007'. Available at: https://www.legislation.wa.gov.au/legislation/statutes.nsf/main_mrtitle_2736_homepage.html.
- Government of Western Australia (2018) *Long-tailed Dunnart Sminthopsis longicaudata*. WA Museum Collections & Research.
- Government of Western Australia (2019) '2018 Statewide Vegetation Statistics Incorporating the CAR Reserve Analysis (Full Report). Current as of December 2018'. Perth: WA Department of Biodiversity, Conservation and Attractions. Available at: <https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>.
- Hansen, B. D. *et al.* (2016) *Revision of the East Asian-Australasian Flyway population estimates for 37 listed migratory shorebird species*. Unpublished report for the Department of Environment, Birdlife Australia, Melbourne.
- Harvey, M. S. (2002) 'Short-range endemism among the Australian fauna: some examples from non-marine environments', *Invertebrate Systematics*, 16, pp. 555–570.
- Harvey, M. S. *et al.* (2011) 'Protecting the innocent: studying short-range endemic taxa enhances conservation outcomes', *Invertebrate Systematics*, 25(1), pp. 1–10. Available at: <https://doi.org/10.1071/IS11011>.
- Jackett, N. A. *et al.* (2017) 'A nesting record and vocalisations of the Night Parrot *Pezoporus occidentalis* from the East Murchison, Western Australia', *Australian Field Ornithology*, 34, pp. 144–150.
- Kinhill Engineers (1992) *Mt Weld Rare Earths Project*. Public Environmental Review.
- Malleefowl Recovery Team (2018) *Malleefowl Facts*. Available at: <http://www.nationalmalleefowl.com.au/malleefowl-facts.html>.
- Masters, P., Dickman, C. R. and Crowther, M. (2003) 'Effects of cover reduction on mulgara *Dasyercus cristicauda* (Marsupialia: Dasyuridae), rodent and invertebrate populations in central Australia: implications for land management', *Austral Ecology*, 28(6), pp. 658–665.
- Mattiske Consulting Pty Ltd (2000) *Declared Rare and Priority Flora Search of Proposed Mining Areas at Ulysses and Gwalia Deeps*, Unpublished report prepared for St Barbara Limited.
- Mattiske Consulting Pty Ltd (2006) *Flora and Vegetation Survey of St Barbara, Leonora Pipeline Site*, Unpublished report prepared for St Barbara Limited.
- Mattiske Consulting Pty Ltd (2007) *Flora and Vegetation Survey and Establishment of Baseline Transects for a Creek Diversion at near St Barbara's Gwalia Operations (Tower Hill)*, Unpublished report prepared for St Barbara Limited.
- Mattiske Consulting Pty Ltd (2008) *Flora and Vegetation Survey of the Kailis – Trump and Poker – Forrest Lease Areas*, Unpublished report prepared for St Barbara Limited.
- Mattiske Consulting Pty Ltd (2020) *Assessment of Flora and Vegetation Values: King of the Hills Mine Expansion, Leonora, WA*. Unpublished report prepared for Red 5 Limited.
- McKenzie, N. L., May, J. E. and McKenna, S. (2003) 'Bioregional Summary of the 2002 Biodiversity Audit for Western Australia'.
- Menkhorst, P. *et al.* (2019) *The Australian Bird Guide*. Revised. Csiro Publishing.




- Menkhorst, P. W. and Knight, F. (2001) *A Field Guide to the Mammals of Australia*.
- Morcombe, M. K. (2003) *Field guide to Australian birds*. Steve Parish Publishing.
- Native Vegetation Solutions (2019) *Targeted Threatened Flora and Malleefowl Mound Search – Leonora Exploration Targets of POW Application, Unpublished letter prepared for St Barbara Limited*.
- Ninox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Murrin Murrin Expansion Project. Unpublished Report for Barrick Gold Corporation*. Perth, WA.
- Olsen, J. *et al.* (2006) 'Male Peregrine Falcon *Falco peregrinus* fledged from a cliff-nest found breeding in a stick-nest', *Australian Field Ornithology*, 23(1), pp. 8–14.
- Rix, M. G. *et al.* (2018) 'Conservation systematics of the shield-backed trapdoor spiders of the nigrum-group (Mygalomorphae, Idiopidae, Idiosoma): integrative taxonomy reveals a diverse and threatened fauna from south-western Australia', *ZooKeys*, (756), p. 1.
- Schoenjahn, J., Pavey, C. R. and Walter, G. H. (2020) 'Ecology of the Grey Falcon *Falco hypoleucos*—current and required knowledge', *Emu-Austral Ornithology*, 120(1), pp. 74–82.
- Shepherd, D. P., Beeston, G. R. and Hopkins, A. J. M. (2001) *Native vegetation in Western Australia: Extent, type and status. Technical Report 249*.
- Spectrum Ecology (2021) *Mon Ami Project Reconnaissance Flora & Basic Fauna Assessment. Unpublished report for Great Southern Mining*.
- Terrestrial Ecosystems (2011) *Level 2 Fauna Risk Assessment for Granny Deeps Project Area. Unpublished report for Barrick Gold Corporation*. Perth, WA.
- Terrestrial Ecosystems (2020a) *Level 2 Vertebrate Fauna Assessment: King of the Hills Project, Unpublished report prepared for Red 5*.
- Terrestrial Ecosystems (2020b) *Vertebrate Fauna Risk Assessment, Granny Smith Tailing Storage Facility Expansion*. Unpublished Report for Granny Smith Mining Company.
- Thackway, R. and Cresswell, I. D. (1995) 'An Interim Biogeographic Regionalisation for Australia (IBRA)'.
- Tyler, M. J. and Doughty, P. (2009) *Field Guide to Frogs of Western Australia*. Western Australian Museum, Perth.
- Western Australian Herbarium (2020) 'FloraBase—the Western Australian Flora. Department of Biodiversity, Conservation and Attractions'. Available at: <https://florabase.dpaw.wa.gov.au/>.
- Western Australian Museum (2014) 'DNA Barcoding'.
- Wilson, S. . and Swan, G. . (2021) *A Complete Guide to Reptiles of Australia*. Sixth. New Holland Publishers.
- Wojcieszek, J., Harvey, M. and Rix, M. (2010) 'Optimised captive husbandry conditions for the Western Australian "Marri Millipede" *Antichiropus variabilis* (Diplopoda: Polydesmida: Paradoxosomatidae), with notes on natural history and tissue preservation techniques', *Records of the Western Australian Museum*, 26, p. 87. doi: 10.18195/issn.0312-3162.26(1).2010.087-093.




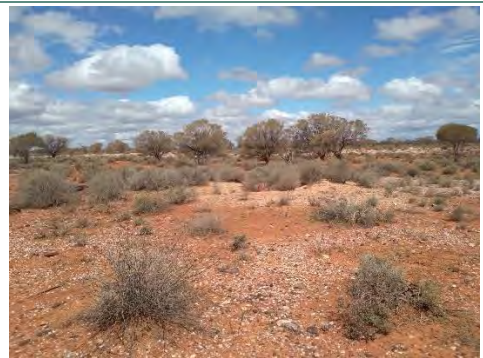
Appendix A: Site Visit – Assessment Sites











Site Visit - Assessment Notes





Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Ghab1	339026	6799482	EC03	Open shrubland of <i>Acacia</i> spp (Mulga). over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat plain, red-orange sandy loam, quartz/granite/ Ironstone	
Ghab2	339096	6798226	EC09	Low chenopod shrubland on gravelly loam on flats and flowlines	Flat plain, red-orange sandy loam, quartz/granite/ ironstone	
Ghab3	338982	6797606	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange, sandy-clay-loam, quartz/granite	
Ghab4	338282	6797960	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat plain, red-orange sandy-loam	





Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Ghab5	337871	6798011	EC05	<i>Acacia spp. over mixed shrubs on rocky ridges and outcrops</i>	Hill/Crest red-orange, ironstone, granite, quartz	
Ghab6	337390	6797612	EC02	Open woodland of <i>Acacia (Mulga) spp.</i> over sparse shrubs on sandy-loam on flats and lower slopes	Flat plain, red-orange sandy-loam	
Ghab7	337619	6797151	EC03	Open shrubland of <i>Acacia (Mulga) spp.</i> over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat plain, red-orange sandy loam, quartz/granite/ironstone	
Ghab8	335298	6798362	EC09	Low chenopod shrubland on loam on flats	Flat plain, red-orange sandy-clay-loam	





Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Ghab9	335953	6798551	EC08	Open woodland of <i>Acacia</i> and <i>Eremophila</i> over diverse chenopod shrubs on sand dunes fringing salt lake	Sand dunes at edge of salt lake, red-orange sand	
Ghab10	336425	6797690	EC08	Open woodland of <i>Acacia</i> and <i>Eremophila</i> over diverse chenopod shrubs on sand dunes fringing salt lake	Sand dunes at edge of salt lake, red-orange sand	
Ghab11	337113	6797450	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat plain, red-orange sandy-loam	
Ghab12	339358	6798566	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat to lower slopes, red-orange sandy loam, quartz/granite/Ironstone	





Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Rhab1	338955	6799785	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange, sandy-clay-loam, quartz/granite	
Rhab2	339499	6799924	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat to lower slopes, red-orange sandy loam, quartz/granite	
Rhab3	340046	6799751	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat to lower slopes, red-orange sandy loam, quartz/granite/ Ironstone	
Rhab4	339899	6801289	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange, sandy-clay-loam, quartz/granite	





Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Rhab5	340095	6801864	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat to lower slopes, red-orange sandy loam, quartz/granite	
Thab1	337270	6801981	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange sandy-clay-loam	
Thab2	336479	6801353	EC12	<i>Acacia</i> (Mulga) spp. over mixed shrubs on quartz outcrop	Hill, crest, red-orange loam, quartz outcropping	
Thab3	335582	6800524	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	





Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Thab4	335979	6800605	EC04	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flats and lower slopes, red-orange sandy-loam, quartz	
Thab5	335963	6800413	EC11	<i>Eremophila</i> over <i>Tecticornia</i> open plain on fine gravel	Flat, plain, red-orange sandy-clay-loam, quartz	
Thab6	335297	6800870	E02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	
Thab7	334952	6802080	E02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	



Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Thab8	335866	6802777	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Flat, plain, red-orange sandy-loam	
Thab9	334476	6802222	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Flat, plain, red-orange sandy-loam	
Thab10	336838	6802803	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	
Hhab1	336654	6804098	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange sandy-loam	

Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Hhab2	335751	6805848	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz, granite, ironstone	
Hhab3	335349	6806021	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz, granite, ironstone	
Hhab4	334918	6805034	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange sandy-loam	
Hhab5	334752	6805187	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz, granite, ironstone	

Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Hhab6	334254	6805736	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz, granite, ironstone	
Hhab7	334088	6805555	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam	
Hhab8	334440	6804739	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam	
Jhab1	329927	6817257	EC02	Open woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs on sandy-loam on flats and lower slopes	Flat, plain, red-orange sandy-loam	

Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Jhab2	328371	6818478	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	
Jhab3	328115	6818472	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Minor drainage line, red-orange sandy-clay-loam	
Jhab4	329590	6818089	EC10	Open shrubland of <i>Acacia</i> spp. on ironstone gravel on flats	Flat, plain, red-orange sandy-loam, ironstone gravel	
Jhab5	326677	6817251	EC05	<i>Acacia</i> spp. over mixed shrubs on rocky ridges and outcrops	Hill, crest, red-brown sandy-loam, granitic rocky outcropping	

Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Jhab6	326603	6817110	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Hill, Mid slope, red-brown, granite, ironstone, quartz	
Jhab7	326616	6818694	EC05	<i>Acacia</i> spp. over mixed shrubs on rocky ridges and outcrops	Hill, crest, red-orange sandy-loam, granitic rocky outcropping	
Jhab8	326574	6818820	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	
Jhab9	326218	6817917	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	

Site ID	Easting	Northing	EC No.	Ecological Community	Landform, Soil & Geology	Photograph
Jhab10	327500	6815814	EC01	Woodland of <i>Acacia</i> (Mulga) spp. over sparse shrubs and grasses on sandy-loams on flats and flowlines	Flat, plain, red-orange sandy-loam	
Jhab11	326996	6816230	EC03	Open shrubland of <i>Acacia</i> (Mulga) spp. over mixed chenopods with pebbles and quartz on flats and lower slopes	Flat, plain, red-orange sandy-loam, quartz	

Appendix B: Conservation Codes



Appendix B1: Definitions of Conservation Categories under the EPBC Act

Category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is 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 management 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.

Appendix B2: Definitions of Conservation Categories Under the BC Act

Code	Definition (BC Act)
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). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
Critically Endangered (CR)	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.
Endangered (EN)	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.

Code	Definition (BC Act)
Vulnerable (VU)	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.	
Extinct species (EX)	Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for extinct fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for extinct flora.
Extinct in the wild species (EW)	Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	
Migratory species (MI)	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Conservation Dependent (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018
Priority species (P) Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. 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.	

Code	Definition (BC Act)
Priority 1: Poorly-known species (P1)	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.
Priority 2: Poorly-known species (P2)	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.
Priority 3: Poorly-known species (P3)	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.
Priority 4: Rare, Near Threatened and other species in need of monitoring (P4)	<p>(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Appendix B3: Legal Status Definition of Listed Plants in Western Australia

Legal Status	Definition
Declared Pest, Prohibited – s12	Prohibited organisms are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits.
Declared Pest – s22(2)	Declared pests must satisfy any applicable import requirements when imported and may be subject to control keeping requirements.
Permitted – s11	Permitted organisms must satisfy applicable import requirements and import permits (where required).
Permitted, Requires Permit – r73	Regulation 73 permitted organisms may be subject to restriction under legislation other than the BAM Act (2007).
Unlisted	Unlisted organisms are prohibited in WA.
Control Categories	Definition
C1 Exclusion	Organisms should be excluded from parts or all of WA.
C2 Eradication	Organisms should be eradicated from all or parts of WA.
C3 Management	Organisms should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism.
Unassigned	Declared pest that are recognised as having a harmful impact under certain circumstances where their subsequent control requirements are determined by a plan or other legislative arrangements under the Act.
Keeping Categories	Definition
Prohibited keeping	Can only be kept under a permit for public display, education or scientific purposes.
Restricted keeping	Kept under a permit by private individuals due to a low risk of becoming a problem for the environment.
Exempt keeping	No permit or conditions are required for keeping. Organism may be subject to restrictions under the Wildlife Conservation Act (WCA, 1950).

Appendix C: Significant Flora Desktop Assessment



Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
Threatened	Scrophulariaceae	<i>Eremophila viscida</i>	Shrub, 1.2-4 m high. Fl. green-white-yellow	Shrub	Sep to Oct.	Granitic soils, sandy loam. Stony gullies, sandplains.	105.989	Low
Threatened	Malvaceae	<i>Seringia exastia</i>	Low shrub to 1 m. Pink flowers. All flora flowering well. Seringia 90% flowering, 0% in fruit.	-	Aug.	Pindan plain. Pink - orange pindan sand. Gently undulating pindan sandplain with deep red sands. 2-3 years post-burn.	92.8235	Low
Presumed extinct	Amaranthaceae	<i>Ptilotus caespitosus</i>	Prostrate perennial, herb, presumed extinct. Fl. pink/white & other,	Herb	Nov.	Sandy clay. Around salt lakes.	105.989	Low
Priority 1	Fabaceae	<i>Acacia epedunculata</i>	Low spreading, becoming rounded, multi-stemmed shrub, 0.5-0.65 m high. Fl. yellow	Shrub	Aug.	Yellow sand. Sandplains.	150.294	Low
Priority 1	Fabaceae	<i>Acacia websteri</i>	Shrub, 1.2-5 m high, bark fibrous. Fl. yellow.	Shrub	May to June.	Red sand, clay or loam. Low-lying areas, flats.	46.5337	Low
Priority 1	Portulacaceae	<i>Anacampseros sp. Eremaean (F. Hort, J. Hort & J. Shanks 3248)</i>	Erect, single-stemmed tuberous, perennial, herb (with succulent green leaves), to 0.1 m high. Fl. white,	Herb	Sep.	Sand patches inside rocks, brown sandy clay, granite. Depressions in rock outcrops, breakaways, flats.	51.2936	Low
Priority 1	Montiaceae	<i>Calandrinia quartzitica</i>	Scrambling erect perennial herb, height 12-25 cm, width 7-14 cm, very succulent basal leaves, petals 5, creamy white blushed with pink, stigmas 3 and numerous stamens.	herb	Oct.	Flats adjacent to lake edge, soil red-brown silty loam with occasional quartz stones. Floodplain of nearby lake. Red brown clayey sand.	16.0931	Medium
Priority 1	Droseraceae	<i>Drosera ermaea</i>	Pink flowers, sweet vanilla fragrance. Aborted flowers and one young plant with basal rosette	Herb	Jul to Oct.	Low banded ironstone ridge, W facing slope, growing in soil pockets on BIF outcrop. Exfoliating granite outcrop.	47.1914	Low
Priority 1	Scrophulariaceae	<i>Eremophila eversa</i>	Shrub. Fl.	Shrub	Sep.	-	73.1342	Low
Priority 1	Frankeniaceae	<i>Frankenia georgei</i>	Small shrub. Fl. pink,	Shrub	Dec.	Rocky slopes.	3.96054	High
Priority 1	Lamiaceae	<i>Hemigenia obovata</i>	Erect compact shrub to 40 cm. Mauve flowers.	Shrub	Nov.	Flat plain. At roadside in wet sand. Black sand below white. Wetland; bare to littered moist sedgy black clay soil.	117.679	Low
Priority 1	Santalaceae	<i>Korthalsella leucothrix</i>	Host Acacia various sp. Including ramulosa & aneura var. microcarpa. Unusual bright green cladodes, in bud or fruit. Tufted, erect, dark green hemi-parasite on the smaller twigs of the host. Ripe fruits green.	Herb	-	Coarse reddish sandy loam, lateritic.	54.6177	Low

Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
Priority 1	Brassicaceae	<i>Lepidium xylodes</i>	Erect shrub, 0.4-1.5 m high, stems becoming spinescent. Fl. white/cream,	Shrub	Aug or Nov.	Gravelly loam, clayey sand.	14.9518	Medium
Priority 1	Proteaceae	<i>Persoonia leucopogon</i>	Erect or decumbent shrub, 0.3-0.6 m high. Fl. yellow/green-yellow,	Shrub	Oct to Dec.	Yellow sand or sandy clay.	117.679	Low
Priority 1	Rutaceae	<i>Philotheca linearis</i>	Shrub, to 2 m high. Fl. white,	Shrub	Jul.	Yellow sand. Base of granite outcrop.	108.191	Low
Priority 1	Rutaceae	<i>Philotheca tubiflora</i>	Compact, much-branched shrub, 0.2-0.6 m high. Fl. pink-white,	Shrub	Jun to Oct.	Rocky rises & hills, outcrops.	67.5677	Low
Priority 1	Orchidaceae	<i>Pterostylis elegantissima</i>	Deciduous terrestrial orchid, plants tall and slender; lateral sepals brown; galea green; flowers semi-erect.	Herb	Sep.	Gentle to steep slopes, S aspect. Granitic sand over granite.	132.794	Low
Priority 1	Orchidaceae	<i>Pterostylis xerampelina</i>	Tuberous perennial herb to 150 mm with several hooded brown flowers.	Herb	Sep to Nov.	Huge granite dome to 100 m high overlooking salt lake. Small pockets and soil in rock crevices otherwise mostly bare granite.	131.592	Low
Priority 1	Amaranthaceae	<i>Ptilotus chortophytus</i>	Erect herb, 10 cm high x 15 cm wide. Flowers cream / yellow.	Herb	Nov.	Breakaway. Rocky brown loam with shale.	52.1072	Low
Priority 1	Amaranthaceae	<i>Ptilotus procumbens</i>	Spreading procumbent annual, herb, ca 0.1 m high. Fl. pink-white.	Herb	Nov.	Red clay.	151.816	Low
Priority 1	Amaranthaceae	<i>Ptilotus rigidus</i>	Shrubs, stems several, more or less prostrate	Shrub	Oct.	Ironstone outcrop on the edge of a salt lake. Red soil. Gentle E facing hillslope with abundant quartzite stones on the edge of a saline flat, orange sand.	128.71	Low
Priority 1	Amaranthaceae	<i>Ptilotus sp. Kookynie (I. Jackson & B. Moyle 261)</i>	Small perennial herb to 12 cm high, 12 cm wide, green flowers, small succulent basal leaves. This is the population Weber collected from in 1975. Growing on and around an old area of mining/prospecting.	Herb	Sep.	On rock on rocky hill. Area of dense quartz.	51.028	Low
Priority 1	Amaranthaceae	<i>Ptilotus tetrandrus</i>	Annual, herb, 0.15-0.3 m high. Fl.	Herb	Oct.	Loamy sand.	42.1309	Low
Priority 1	Asteraceae	<i>Rhodanthe uniflora</i>	Erect, woolly annual, herb, 0.02-0.1(-0.3) m high. Fl. Yellow.	Herb	Aug to Oct.	Brown earth. Open eucalyptus woodland.	138.346	Low
Priority 1	Rhamnaceae	<i>Stenanthemum patens</i>	Shrub, ca 0.5 m high.	Shrub	Aug.	Rocky hillside.	12.4645	High
Priority 1	Chenopodiaceae	<i>Tecticornia mellarium</i>	Shrub, 0.5 m high.	Shrub	-	Sand dune by salt lake. Brown, red-orange sand, sandy clay.	82.7613	Low

Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
Priority 1	Chenopodiaceae	<i>Tecticornia sp. Lake Way (P. Armstrong 05/961)</i>	Small upright shrub 30 to 40 cm tall with a spread to 10 cm.	Shrub	-	Lake bed. Level that would occasionally be inundated. Grey loamy clay sand.	80.3735	Low
Priority 2	Scrophulariaceae	<i>Eremophila mirabilis</i>	Shrub, 0.3-2 m high. Fl. yellow,	Shrub	Jul to Sep.	Clay sand, stony clayey loam. Granite country.	28.4806	Medium
Priority 2	Myrtaceae	<i>Eucalyptus educta</i>	Mallee to 3 m tall. Bark minni-ritchi, red - brown. Leaves consistently small, dull, greyish, +/- pruinose. Branchlets, buds and new fruits pruinose. Opercula conical (longer than wide), to long - beaked.	Tree	April.	On low stony rise of red loam. Greenstone hills, basalt. On ironstone hill.	115.335	Low
Priority 2	Myrtaceae	<i>Malleostemon sp. Adelong (G.J. Keighery 11825)</i>	Spreading shrub, 0.1-0.3 m high. Fl. white	Shrub	Oct.	Red sand.	99.9854	Low
Priority 2	Lamiaceae	<i>Newcastelia insignis</i>	Much-branched shrub, 0.3-0.9(-1.5) m high. Fl. yellow-white,	Shrub	Sep to Nov.	Red or yellow sandy soils.	89.5397	Low
Priority 2	Myrtaceae	<i>Thryptomene eremaea</i>	Erect open shrub, 0.5-1.5 m high. Fl. pink/white,	Shrub	Jul to Sep.	Red or yellow sand. Sandplains.	49.9448	Low
Priority 2	Asparagaceae	<i>Thysanotus brachyantherus</i>	Caespitose perennial, herb (with roots becoming tuberous), 0.1-0.4 m high. Fl. purple,	Herb	Oct to Dec.	Clay over limestone, loam.	109.42	Low
Priority 3	Fabaceae	<i>Acacia sp. Marshall Pool (G. Cockerton 3024)</i>	Shrub. Foliage dull green. Flowers golden spikes, 30 mm long.	Shrub	April to May.	Low basalt hill. Dry brown clayey sand.	0.30322	High
Priority 3	Apocynaceae	<i>Alyxia tetanifolia</i>	Erect, rigid, pungent shrub, 1-2 m high, to 2.5 m wide. Fl. white-cream	Shrub	May to June, Nov.	Sandy clay, loam, concretionary gravel. Drainage lines, near lakes.	128.71	Low
Priority 3	Asteraceae	<i>Angianthus prostratus</i>	Prostrate annual, herb. Fl. white-yellow,	Herb	Jul to Sep.	Red clay or loamy soils. Saline depressions.	9.28433	High
Priority 3	Chenopodiaceae	<i>Atriplex flabelliformis</i>	Monoecious, erect, rounded perennial, herb, to 0.35 m high.	Herb	May to June.	Clay loam, loam. Saline flats or marshes.	105.989	Low
Priority 3	Poaceae	<i>Austrostipa blackii</i>	Tufted perennial, grass-like or herb, 1 m high.	Herb	Fl. Sep to Nov.	West north-west facing gently inclined lower slope of basalt with red-brown deep sandy clay loam soils.	151.816	Low
Priority 3	Fabaceae	<i>Bossiaea eremaea</i>	Divaricately-branched, spreading shrub, to 1.2 m high. Fl. red-yellow-purple-brown,	Shrub	Jul to Sep.	Deep red sand.	120.119	Low

Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
Priority 3	Portulacaceae	<i>Calandrinia sp. Menzies (F. Hort et al. FH 4100)</i>	Semi erect to erect annual herb, height 3-6.5 cm,	herb	August.	Flat. Few quartz and ironstone pebbles. Orange sand/loam/gravel. No sign of fire. Stony hardpan plain with saline inclusions.	46.3924	Low
Priority 3	Asteraceae	<i>Calotis latiuscula</i>	Erect herb, to 0.5 m high. Fl. yellow,	Herb	Jun to Oct.	Sand, loam. Rocky hillsides, floodplains, rocky creeks or river beds.	41.3845	Low
Priority 3	Asteraceae	<i>Calotis sp. Perrinvale Station (R.J. Cranfield 7096)</i>	Annual to 5 cm high, green leaves, red spikey heads.	Herb	-	Flat. Red-orange sandy clay-loam over Banded Ironstone Formation. Plain. Red clay loam over laterite.	92.9814	Low
Priority 3	Myrtaceae	<i>Calytrix hislopii</i>	Ridge. Red/brown loam/clay over laterite ridge.	Shrub	Sep.	Top of lateritic breakaway. Soil lateritic rubble and cap rock. Aspect E. Ridge. Red/brown loam/clay over laterite ridge.	28.4806	Low
Priority 3	Myrtaceae	<i>Calytrix praecipua</i>	Shrub, 0.3-0.7 m high. Fl. pink-white,	Shrub	Jun to Nov.	Skeletal sandy soils over granite or laterite. Breakaways, outcrops.	14.846	Low
Priority 3	Asteraceae	<i>Cratystylis centralis</i>	Much-branched, brittle, greyish shrub, to 1 m high.	Shrub	Aug to Nov.	Red sandy loam with ironstone gravel. Flat plains, breakaway country.	40.959	Low
Priority 3	Elatinaceae	<i>Elatine macrocalyx</i>	Prostrate, glabrous, mat-forming annual, herb, sepals 2-3mm long, fruit indehiscent. Fl. white,	Herb	May to Oct.	Shallow sands over clay. Margins of playa lakes and clay pans.	119.067	Low
Priority 3	Cyperaceae	<i>Eleocharis papillosa</i>	Annual, herb. Fl. Brown.	Sedge	Nov.	Red clay over granite, open clay flats. Claypans.	119.067	Low
Priority 3	Scrophulariaceae	<i>Eremophila annosicaulis</i>	Small, upright and spreading shrub up to 0.5 m high x 0.5 m wide. Very dry. Flowers purple / violet.	Shrub	June.	Stony, flat, sandy plain. Red sand. Rocky sloping plain in rangeland with brown loam / rocky soil. Frequency: over 50 plants.	66.8542	Low
Priority 3	Scrophulariaceae	<i>Eremophila shonae subsp. diffusa</i>	Perennial erect open shrub 75 cm high x 75 cm wide. Purple flowers.	Shrub	Aug.	Footslope below breakaway, soil deep red-brown loamy sand with quartzite strew on surface.	57.2052	Low
Priority 3	Scrophulariaceae	<i>Eremophila simulans subsp. megacalyx</i>	Shrub, 0.9-2 m high. Fl. violet,	Shrub	Aug to Sep.	East facing gently inclined mid slope of laterite banded ironstone with yellow brown shallow sandy loam soils. Rangeland plain. Road	18.4764	Medium

Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
						verge with red, sandy gravel laterite.		
Priority 3	Scrophulariaceae	<i>Eremophila veronica</i>	Spreading, erect shrub, 0.5-1 m high. Fl. Purple.	Shrub	Apr to May.	Stony clay, clay loam. Lateritic breakaways.	30.868	Medium
Priority 3	Fabaceae	<i>Eutaxia nanophylla</i>	Straggly, rounded shrub, to 0.35 m high. Fl. yellow&orange&red,	Shrub	Oct to Nov.	Clayey sand, red clay, stoney clayey loam. Low-lying areas, damp flats, slopes, undulating plains, low stony ridges.	124.124	Low
Priority 3	Fabaceae	<i>Eutaxia rubricarina</i>	Shrub to 0.5 m tall.	Shrub	Jul to Oct.	Midslope, gentle slope. Red sandy loam, cracking clay, with calcrete and quartz.	121.218	Low
Priority 3	Goodeniaceae	<i>Goodenia lyrata</i>	Prostrate herb, with lyrate leaves. Fl. yellow, Aug.	Herb	Aug.	Red sandy loam. Near claypan. Clay soiled broad drainage tract in hardpan plain.	73.023	Low
Priority 3	Proteaceae	<i>Grevillea georgeana</i>	Erect to widely spreading shrub, 1-3 m high, up to 4 m wide. Fl. red/red & pink & cream.	Shrub	Jan, Mar, Sept to Nov.	Stony loam/clay. Ironstone hilltops & slopes.	132.794	Low
Priority 3	Proteaceae	<i>Grevillea subterlineata</i>	Shrub, to 2.5 m high. Fl. white,	Shrub	Aug.	Landform: flat. Soil type: sand. Soil colour: red. Above creek bed. Brown, gravelly clayey - sand. Low rises of siltstone. Red powdery loam over sandy siltstone.	65.3896	Low
Priority 3	Aizoaceae	<i>Gunnopsis propinqua</i>	Prostrate annual or perennial, herb, 0.03-0.1 m high. Fl. white/pink,	Herb	Aug to Sep.	Stony sandy loam. Lateritic outcrops, winter-wet sites.	42.2074	Low
Priority 3	Myrtaceae	<i>Homalocalyx grandiflorus</i>	Spreading shrub, 0.2-0.5(-2) m high. Fl. purple-red-pink,	Shrub	Oct to Dec.	Yellow sand. Sandplains.	108.191	Low
Priority 3	Violaceae	<i>Hybanthus floribundus subsp. chloroxanthus</i>	Shrub 0.8 m high. Flowers white.	Shrub	Mar.	Drainage line. Well drained dry red clay loam over. Rock type meta-gabbro, basalt. Red-brown silty sand. Slope 5 degrees. Aspect westerly.	39.5372	Medium
Priority 3	Myrtaceae	<i>Leptospermum macgillivrayi</i>	Divaricate shrub, to 1 m high. Fl. probably	Shrub	Aug to Sep.	Loam. Decaying granite outcrops.	131.716	Low
Priority 3	Haloragaceae	<i>Meionectes tenuifolia</i>	Erect herb, 20-25 cm high x ca. 5 cm wide. Prostrate aquatic herb, red/green, in bud.	Herb	Nov to Dec.	Seasonally wet poorly drained flat. Grey sand. Granite flats, shallow soil at margins, inundated.	14.9518	Low

Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
Priority 3	Myrtaceae	<i>Melaleuca apostiba</i>	Spreading shrub, to 2 m high, with grey fissured bark and dull green leaves. Fl. red,	Shrub	Jun.	Low lying salt flats, at edge of salt lake in dry red loam sands, seasonally inundated. Red clayey sand. Sandy dune / flat, growing around a smaller wetland. Red / brown sand.	113.803	Low
Priority 3	Brassicaceae	<i>Menkea draboides</i>	Prostrate, spreading annual, herb, to 0.6 m wide. Fl. white/cream,	Herb	Aug to Sep.	Red sand or clay, granite.	132.794	Low
Priority 3	Myrtaceae	<i>Micromyrtus serrulata</i>	Erect or somewhat spreading shrub, 0.4-1.5 m high. Fl. white,	Shrub	Jun to Nov.	Brownish sandy and clayey soils over granite.	27.5194	Low
Priority 3	Asteraceae	<i>Notisia intonsa</i>	Annual herb.	Herb	Sep.	Moist red sand. Lake bank.	151.879	Low
Priority 3	Asteraceae	<i>Olearia mucronata</i>	Densely branched, unpleasantly aromatic shrub, 0.6-1 m high. Fl. white & yellow, Aug to Dec or Jan.	Shrub	Jul to Aug.	Schistose hills. Drainage channels.	81.4279	Low
Priority 3	Rutaceae	<i>Philotheca coateana</i>	Shrub, 0.3-0.5 m high, branchlets glabrous; leaf blades 3-4 mm long; flowers terminal, solitary; petals 7-9 mm long. Fl. white & pink,	Shrub	Aug to Sep.	Red sand.	89.5397	Low
Priority 3	Phyllanthaceae	<i>Phyllanthus baeckeoides</i>	Shrub, 0.5-1.5 m high. Fl. white-yellow/green-yellow,	Shrub	Jul to Sep.	Red lateritic & sandy clay soils. Granite outcrops.	37.0891	Medium
Priority 3	Orchidaceae	<i>Pterostylis virens</i>	Deciduous terrestrial orchid, plants dwarf; flowers green, nodding.	Herb	Sep to Oct.	Granite dome with low open granite surround.	92.0809	Low
Priority 3	Chenopodiaceae	<i>Tecticornia cymbiformis</i>	Erect, perennial shrub, 0.3-0.5 m high.	Shrub	Aug.	Saline soils. Along the edge of creeklines.	81.4279	Low
Priority 3	Juncaginaceae	<i>Triglochin protuberans</i>	Annual, herb, 0.03-0.13 m high.	Herb	Aug to Oct.	Red loam, grey mud over clay. Winter-wet sites, claypans, near salt lakes, margins of pools.	23.5768	Medium
Priority 3	Asteraceae	<i>Vittadinia pustulata</i>	Low annual, herb (sometimes persisting as an under-shrub), 0.1-0.3 m high. Fl.	Herb / Shrub	Sep.	-	105.989	Low
Priority 4	Proteaceae	<i>Banksia arborea</i>	Tree or shrub (large), 2-8 m high. Fl. yellow,	Shrub	Mar to May, Sept to Oct.	Stony loam. Ironstone hills.	124.803	Low
Priority 4	Polygalaceae	<i>Comesperma viscidulum</i>	Shrub, to ca 0.7 m high.	Shrub	Sep.	On sandplain with gravel at depth. Red sandplain.	132.614	Low
Priority 4	Proteaceae	<i>Conospermum toddii</i>	Spreading shrub, 1.2-2 m high. Fl. white/white-yellow,	Shrub	Jul to Oct.	Yellow sand. Sand dunes.	50.5223	Low
Priority 4	Myrtaceae	<i>Eucalyptus jutsonii</i> subsp. <i>jutsonii</i>	Mallee to 7 m, sprawling, foliage lush green and linear leaves semi glossy, flowers creamy,	Tree	Nov.	Flat, red sand, sandplain.	50.8613	Low

Status	Family	Taxon	Description	Lifeform	Flowering Time	Habitat	Closest Record (km)	Likelihood
			smooth above and stocking base, rough. Ornamental for form.					
Priority 4	Myrtaceae	<i>Eucalyptus kruseana</i>	(Straggly mallee), 2-3.5 m high, bark smooth. Fl. yellow,	Tree	Jun to Sep.	Sandy loam. Granite outcrops & hills.	135.106	Low
Priority 4	Frankeniaceae	<i>Frankenia glomerata</i>	Prostrate shrub. Fl. pink-white.	Shrub	Nov.	White sand.	0.88866	High
Priority 4	Goodeniaceae	<i>Goodenia berringbinensis</i>	Ascending annual, herb, 0.1-0.3 m high. Fl. yellow,	Herb	Oct.	Red sandy loam. Along watercourses.	132.794	Low
Priority 4	Proteaceae	<i>Grevillea erectiloba</i>	Shrub, 1-3 m high. Fl. red,	Shrub	Sep to Oct.	Gravelly loam. Lateritic ridges.	89.5397	Low
Priority 4	Proteaceae	<i>Grevillea inconspicua</i>	Intricately branched, spreading shrub, 0.6-2 m high. Fl. white/pink-white,	Shrub	Jun to Aug.	Loam, gravel. Along drainage lines on rocky outcrops, creeklines.	21.0121	Medium
Priority 4	Proteaceae	<i>Grevillea secunda</i>	Low spreading shrub, 0.3-0.8 m high. Fl. red,	Shrub	Sep to Oct.	Yellow or red sand. Sand dunes, sandplains.	115.197	Low
Priority 4	Lamiaceae	<i>Hemigenia exilis</i>	Erect, multi-stemmed shrub, 0.5-2 m high. Fl. blue-purple/white,	Shrub	Apr or Sep to Nov.	Laterite. Breakaways, slopes.	31.6451	Medium
Priority 4	Cyperaceae	<i>Lepidosperma lyonsii</i>	Tufted rhizomatous, perennial, herb (sedge), leaves 0.31-0.53 m high, culms and leaves distichous.	Sedge	Jun.	Pale orange skeletal sandy loam with banded ironstone gravel & rock, well-drained shallow stony loamy with quartz. Gentle hill slopes, upper slopes of large hill.	95.8768	Low
Priority 4	Asparagaceae	<i>Sowerbaea multicaulis</i>	Tufted perennial, herb, 0.075-0.25 m high. Fl. purple-violet,	Herb	Oct to Dec or Jan.	Yellow-brown sand.	119.067	Low
Priority 4	Colchicaceae	<i>Wurmbea murchisoniana</i>	Cormous, perennial, herb, 0.1-0.26 m high, hermaphrodite. Fl. white,	Herb	Jul to Sep.	Clay, sandy clay, loam. Seasonally inundated clay hollows, rock pools.	132.794	Low

Appendix D: Fauna Regional Appendix



Family & Scientific Name	Common Name	Conservation Status			Database Searches			Literature Review										This Survey
		EPBC Act	BC Act	DBC Act	Naturemap	DBC Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino • Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)	
MAMMALS																		
TACHYGLOSSIDAE																		
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna								•	•		•	•	•			•	
DASYUIRIDAE																		
<i>Antechinomys laniger</i>	Kultarr											•			•	•		
<i>Dasyercus blythi</i>	Brush-tailed Mulgara			P4	•	•												
<i>Dasyurus geoffroii</i>	Western Quoll	VU	VU				•											
<i>Ningauai ridei</i>	Wongai Ningauai				•					•			•				•	
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus				•						•		•					
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart							•	•				•					
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart				•			•					•	•	•	•		
<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart			P4		•								•	•			
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart				•									•	•	•		
THYLACOMYIDAE																		
<i>Macrotis lagotis</i>	Greater Bilby	VU	VU			•												

Family & Scientific Name	Common Name	Conservation Status			Database Searches			Literature Review										This Survey		
		EPBC Act	BC Act	DBCA	Naturemap	DBCA Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino • Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)		Spectrum (2021)	
MACROPODIDAE																				
<i>Osphranter robustus</i>	Euro, Biggada				•								•	•				•		•
<i>Osphranter rufus</i>	Red Kangaroo				•							•	•	•				•		
MURIDAE																				
<i>Notomys alexis</i>	Spinifex Hopping-mouse												•							
<i>Pseudomys desertor</i>	Desert Mouse													•						
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				•					•							•	•		
MOLOSSIDAE																				
<i>Austronomus australis</i>	White-striped Free-tail Bat								•						•					
<i>Ozimops kitcheneri</i>	Western Free-tailed Bat																	•		
VESPERTILIONIDAE																				
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat				•				•						•				•	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat													•	•					
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat				•			•	•											
<i>Nyctophilus major tor</i>	Central Long-eared Bat													•						
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat				•									•				•		

Family & Scientific Name	Common Name	Conservation Status			Database Searches				Literature Review										This Survey	
		EPBC Act	BC Act	DBCA	Naturemap	DBCA Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino• Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)	Spectrum (2021)		
<i>Taphozous hilli</i>	Hill's Sheathtail-bat				•															
<i>Vespadelus baverstocki</i>	Inland Forest Bat				•														•	
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat				•								•	•					•	
INTRODUCED MAMMALS																				
* <i>Mus musculus</i>	House Mouse				•		•		•	•				•	•	•				
* <i>Oryctolagus cuniculus</i>	Rabbit				•		•	•	•	•		•	•	•				•	•	•
* <i>Sus scrofa</i>	Pig				•															
* <i>Canis familiaris dingo</i>	Dingo									•			•	•						
* <i>Canis lupus familiaris</i>	Domestic Dog						•											•		
* <i>Vulpes vulpes</i>	Red Fox						•	•	•	•			•	•						
* <i>Felis catus</i>	Cat						•		•				•	•					•	•
* <i>Ovis aries</i>	Sheep											•								
* <i>Equus asinus</i>	Donkey						•			•				•						•
* <i>Equus caballus</i>	Horse																		•	
* <i>Camelus dromedarius</i>	Dromedary, Camel						•		•											•
* <i>Bos taurus</i>	European Cattle									•			•	•					•	•

Family & Scientific Name	Common Name	Conservation Status			Database Searches			Literature Review											This Survey
		EPBC Act	BC Act	DBCA	Naturemap	DBCA Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino• Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)	Spectrum (2021)	
* <i>Capra hircus</i>	Goat						•			•		•	•	•			•		
BIRDS																			
CASUARIIDAE																			
<i>Dromaius novaehollandiae</i>	Emu				•			•	•	•	•	•	•	•	•	•	•		
ANATIDAE																			
<i>Anas gracilis</i>	Grey Teal				•					•	•						•		
<i>Anas superciliosa</i>	Pacific Black Duck				•					•							•	•	
<i>Aythya australis</i>	Hardhead				•												•		
<i>Biziura lobata</i>	Musk Duck				•												•		
<i>Chenonetta jubata</i>	Australian Wood Duck				•												•	•	
<i>Cygnus atratus</i>	Black Swan				•														•
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck				•														•
<i>Tadorna tadornoides</i>	Australian Shelduck				•														•
MEGAPODIIDAE																			
<i>Leipoa ocellata</i>	Malleefowl	VU	VU		•	•	•			•		•		•					

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PHASIANIDAE																				
<i>Coturnix pectoralis</i>	Stubble Quail				•									•						
PODARGIDAE																				
<i>Podargus strigoides</i>	Tawny Frogmouth				•					•				•						
CAPRIMULGIDAE																				
<i>Eurostopodus argus</i>	Spotted Nightjar				•									•						
AEGOTHELIDAE																				
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				•					•										
APODIDAE																				
<i>Apus pacificus</i>	Fork-tailed Swift	MI	MI				•						•							
OTIDIDAE																				
<i>Ardeotis australis</i>	Australian Bustard				•					•			•							
CUCULIDAE																				
<i>Chalcites basalis</i>	Horsfield's Bronze-cuckoo				•						•			•						•
<i>Chalcites osculans</i>	Black-eared Cuckoo										•			•						
<i>Cacomantis pallidus</i>	Pallid Cuckoo				•					•						•				

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COLUMBIDAE																			
<i>*Columba livia</i>	Rock Dove				•		•												
<i>Geopelia cuneata</i>	Diamond Dove				•														
<i>Ocyphaps lophotes</i>	Crested Pigeon				•					•	•	•	•	•		•	•	•	•
<i>Phaps chalcoptera</i>	Common Bronzewing				•				•	•	•		•	•		•	•	•	•
<i>*Streptopelia senegalensis</i>	Laughing Dove				•		•												
RALLIDAE																			
<i>Fulica atra</i>	Eurasian Coot				•														
<i>Tribonyx ventralis</i>	Black-tailed Nativehen				•			•		•	•								•
PODICIPEDIDAE																			
<i>Podiceps cristatus</i>	Great crested Grebe				•														
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe				•														
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe				•														
BURHINIDAE																			
<i>Burhinus grallarius</i>	Bush Stone-curlew				•							•		•					

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RECURVIROSTRIDAE																				
<i>Cladorhynchus leucocephalus</i>	Banded Stilt									•			•		•					
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet				•					•										
CHARADRIIDAE																				
<i>Vanellus tricolor</i>	Banded Lapwing				•					•			•							
<i>Erythrogonys cinctus</i>	Red-kneed Dotterel				•															
<i>Pluvialis fulva</i>	Pacific Golden Plover	MI	MI			•														
<i>Charadrius ruficapillus</i>	Red-capped Plover				•					•		•		•						
<i>Charadrius veredus</i>	Oriental Plover	MI	MI				•					•								
<i>Thinornis cucullatus</i>	Hooded Plover (Hooded Dotterel)			P4		•						•								
<i>Euseyonis melanops</i>	Black-fronted Dotterel				•					•					•					
SCOLOPACIDAE																				
<i>Calidris canutus</i>	Red Knot	EN	EN			•														
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI			•	•													
<i>Calidris melanotos</i>	Pectoral Sandpiper	MI	MI				•													
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI		•	•	•													

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<i>Tringa glareola</i>	Wood Sandpiper	MI	MI		•	•									•						
<i>Tringa nebularia</i>	Common Greenshank	MI	MI		•	•	•														
LARIDAE																					
<i>Chlidonias hybrida</i>	Whiskered Tern				•																
<i>Larus novaehollandiae</i>	Silver Gull				•																
THRESKIORNITHIDAE																					
<i>Platalea flavipes</i>	Yellow-billed Spoonbill				•																
<i>Threskiornis spinicollis</i>	Straw-necked Ibis				•																
ANHINGIDAE																					
<i>Anhinga novaehollandiae</i>	Australasian Darter				•																
PHALACROCORACIDAE																					
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant				•																
<i>Phalacrocorax carbo</i>	Great Cormorant				•																
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant				•																
PELECANIDAE																					
<i>Pelecanus conspicillatus</i>	Australian Pelican				•																

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ARDEIDAE																				
<i>Ardea alba</i>	Great White Egret																			
<i>Ardea modesta</i>	Eastern Great Egret																			
<i>Ardea pacifica</i>	White-necked Heron																			
<i>Egretta novaehollandiae</i>	White-faced Heron																			
ACCIPITRIDAE																				
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard																			
<i>Hieraaetus morphnoides</i>	Little Eagle																			
<i>Aquila audax</i>	Wedge-tailed Eagle																			
<i>Accipiter fasciatus</i>	Brown Goshawk																			
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk																			
<i>Circus approximans</i>	Swamp Harrier																			
<i>Milvus migrans</i>	Black Kite																			
<i>Haliastur sphenurus</i>	Whistling Kite																			
TYTONIDAE																				
<i>Tyto alba subsp. delicatula</i>	Barn Owl																			

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ALCEDINIDAE																				
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher				•									•				•		
<i>Todiramphus sanctus</i>	Sacred Kingfisher				•				•											
MEROPIDAE																				
<i>Merops ornatus</i>	Rainbow Bee-eater				•		•			•		•		•				•	•	•
FALCONIDAE																				
<i>Falco cenchroides</i>	Australian (Nankeen) Kestrel				•					•	•	•			•	•	•	•		•
<i>Falco longipennis</i>	Australian Hobby				•					•	•		•		•		•			
<i>Falco berigora</i>	Brown Falcon				•					•	•				•	•	•			
<i>Falco hypoleucos</i>	Grey Falcon	VU	VU			•	•													
<i>Falco peregrinus</i>	Peregrine Falcon		OS		•	•				•		•								
CACATUIDAE																				
<i>Nymphicus hollandicus</i>	Cockatiel				•					•		•								
<i>Cacatua roseicapilla</i>	Galah				•					•	•	•			•				•	•
<i>Cacatua sanguinea</i>	Little Corella													•						

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PSITTACIDAE																		
<i>Polytelis alexandrae</i>	Princess Parrot	VU		P4			•											
<i>Platycercus varius</i>	Mulga Parrot				•				•	•			•	•				
<i>Barnardius zonarius</i>	Australian Ringneck				•				•	•		•	•	•			•	
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR				•											
<i>Neophema bourkii</i>	Bourke's Parrot				•					•							•	
<i>Neophema splendida</i>	Scarlet-chested Parrot										•		•					
<i>Melopsittacus undulatus</i>	Budgerigar				•												•	
PTILONORHYNCHIDAE																		
<i>Ptilonorhynchus maculatus</i> subsp. <i>guttatus</i>	Western Bowerbird				•						•	•	•	•	•	•	•	
CLIMACTERIDAE																		
<i>Climacteris affinis</i>	White-browed Treecreeper																•	
MALURIDAE																		
<i>Malurus lamberti</i>	Variiegated Fairywren											•	•					
<i>Malurus leucopterus</i>	White-winged Fairywren				•					•	•	•		•	•	•	•	
<i>Malurus pulcherrimus</i>	Blue-breasted Fairywren				•													

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<i>Malurus splendens</i>	Splendid Fairywren				•					•		•	•	•	•		•	•	•
MELIPHAGIDAE																			
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater				•				•	•	•	•		•	•	•	•		•
<i>Anthochaera carunculata</i>	Red Wattlebird				•					•				•					
<i>Certhionyx variegatus</i>	Pied Honeyeater				•					•					•				
<i>Epthianura albifrons</i>	White-fronted Chat				•														
<i>Epthianura aurifrons</i>	Orange Chat				•														
<i>Epthianura tricolor</i>	Crimson Chat				•						•				•	•	•		•
<i>Gavicalis virescens</i>	Singing Honeyeater								•	•	•	•	•	•	•	•	•	•	•
<i>Lacustroica whitei</i>	Grey Honeyeater											•							
<i>Purnella albifrons</i>	White-fronted Honeyeater				•					•									
<i>Lichmera indistincta</i>	Brown Honeyeater				•									•					
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater													•					
<i>Manorina flavigula</i>	Yellow-throated Miner				•				•	•	•	•	•	•	•	•	•	•	•
PARDALOTIDAE																			
<i>Pardalotus striatus</i>	Striated Pardalote				•					•					•		•	•	

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ACANTHIZIDAE																				
<i>Smicromis brevirostris</i>	Weebill				•									•				•		
<i>Pyrrholaemus brunneus</i>	Redthroat									•	•	•	•	•				•	•	
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill (Inland)				•				•		•		•	•				•	•	•
<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill				•					•		•		•		•		•	•	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill				•				•	•	•		•	•				•		
<i>Acanthiza iredalei iredalei</i>	Western Slender-billed Thornbill											•								
<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill				•					•			•	•	•			•		
<i>Aphelocephala leucopsis</i>	Southern Whiteface				•					•		•	•	•	•	•		•		
<i>Aphelocephala nigricincta</i>	Banded Whiteface											•								
POMATOSTOMIDAE																				
<i>Pomatostomus superciliosus</i>	White-browed Babbler				•					•		•		•	•			•	•	•
PSOPHODIDAE																				
<i>Psophodes occidentalis</i>	Chiming Wedgebill				•															
CINCLOSOMATIDAE																				

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<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush				•							•		•						
ARTAMIDAE																				
<i>Artamus cinereus</i>	Black-faced Woodswallow				•				•		•	•	•	•	•	•	•	•		•
<i>Artamus personatus</i>	Masked Woodswallow				•				•		•			•	•					
<i>Cracticus nigrogularis</i>	Pied Butcherbird				•				•	•	•	•	•	•	•	•	•	•		
<i>Cracticus torquatus</i>	Grey Butcherbird				•				•	•	•	•	•	•	•	•			•	
<i>Gymnorhina tibicen</i>	Australian Magpie				•				•	•	•		•	•	•			•		
<i>Strepera versicolor</i>	Grey Currawong									•	•			•						
CAMPEPHAGIDAE																				
<i>Coracina maxima</i>	Ground Cuckoo-shrike				•				•		•			•	•	•				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				•				•	•	•			•	•	•			•	•
<i>Lalage tricolor</i>	White-winged Triller				•						•			•	•					
NEOSITTIDAE																				
<i>Daphoenositta chrysoptera</i>	Varied Sittella																		•	
OREOICIDAE																				
<i>Oreoica gutturalis subsp. gutturalis</i>	Crested Bellbird (southern)				•								•	•	•				•	•

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PACHYCEPHALIDAE																			
<i>Pachycephala rufiventris</i>	Rufous Whistler				•					•		•	•	•	•		•	•	•
<i>Colluricincla harmonica</i>	Grey Shrikethrush				•					•	•	•	•	•			•	•	•
RHIPIDURIDAE																			
<i>Rhipidura albiscapa</i>	Grey Fantail				•					•			•				•		
<i>Rhipidura leucophrys</i>	Willie Wagtail				•					•	•		•	•	•	•	•	•	•
MONARCHIDAE																			
<i>Grallina cyanoleuca</i>	Magpie-lark				•					•	•	•	•	•	•	•			•
CORVIDAE																			
<i>Corvus bennetti</i>	Little Crow				•					•	•	•	•	•	•		•		
<i>Corvus coronoides</i>	Australian Raven				•								•				•		
<i>Corvus orru</i>	Torresian Crow				•					•	•	•		•	•		•	•	•
PETROICIDAE																			
<i>Melanodryas cucullata</i>	Hooded Robin				•					•			•	•	•	•	•	•	•
<i>Microeca fascinans</i>	Jacky Winter				•					•									
<i>Petroica goodenovii</i>	Red-capped Robin				•					•	•		•	•	•	•	•	•	•

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HIRUNDINIDAE																				
<i>Cheramoeca leucosterna</i>	White-backed Swallow				•					•				•	•					•
<i>Hirundo neoxena</i>	Welcome Swallow				•				•		•			•	•			•		
<i>Petrochelidon ariel</i>	Fairy Martin				•									•						
<i>Petrochelidon nigricans</i>	Tree Martin				•						•			•	•					
DICAEIDAE																				
<i>Dicaeum hirundinaceum</i>	Mistletoebird				•								•	•	•					
ESTRILDIDAE																				
<i>Taeniopygia guttata</i>	Zebra Finch				•					•		•		•	•					•
MOTACILLIDAE																				
<i>Motacilla flava (tschutschensis)</i>	Yellow Wagtail	MI	MI				•													
<i>Motacilla cinerea</i>	Grey Wagtail	MI	MI				•													
<i>Anthus novaeseelandiae</i>	Australasian Pipit				•					•	•	•		•	•	•	•			•
REPTILES																				
CARPHODACTYLIDAE																				
<i>Nephurus vertebralis</i>	Midline Knob-tail				•						•							•	•	

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<i>Nephurus wheeleri subsp. wheeleri</i>	Banded knob-tailed gecko				•															
<i>Underwoodisaurus milii</i>	Barking Gecko				•				•	•								•	•	
DIPLODACTYLIDAE																				
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko				•															
<i>Diplodactylus granariensis subsp. rex</i>	Giant Stone Gecko				•								•					•		
<i>Diplodactylus pulcher</i>	Fine-faced Gecko				•			•		•			•	•	•			•		
<i>Lucasium squarrosus</i>	Mottled Ground Gecko										•		•							
<i>Rhynchoedura ornata</i>	Western Beaked Gecko				•			•	•				•	•				•		
<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko				•															
<i>Strophurus strophurus</i>	Western Spiny-Tailed Gecko				•								•							
<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko				•					•			•	•				•		
GEKKONIDAE																				
<i>Heteronotia binoei</i>	Bynoe's Gecko				•				•	•	•		•	•	•			•		
<i>Gehyra variegata</i>	Variegated Gehyra				•			•	•	•	•	•	•	•	•			•		
PYGOPODIDAE																				
<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot				•								•					•		

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AGAMIDAE																				
<i>Ctenophorus caudicinctus</i> subsp. <i>infans</i>	Ring-tailed Dragon				•															
<i>Ctenophorus fordi</i>	Mallee Dragon				•					•		•		•						
<i>Ctenophorus nuchalis</i>	Central Netted Dragon				•					•	•			•						
<i>Ctenophorus reticulatus</i>	Western Netted Dragon				•			•	•		•					•	•			
<i>Ctenophorus salinarum</i>	Salt Pan Dragon								•		•			•		•				
<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon							•				•	•	•				•		•
<i>Diporiphora amphiboluroides</i>	Mulga Snake																	•		
<i>Pogona minor</i> subsp. <i>minor</i>	Western Bearded Dragon				•				•	•			•	•				•		
SCINCIDAE																				
<i>Cryptoblepharus australis</i>	Inland Snake-Eyed Skink				•															
<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink				•					•								•		
<i>Ctenotus leonhardii</i>	Leonhard's Ctenotus								•	•	•			•	•	•				
<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus																	•		
<i>Ctenotus severus</i>	Stern Ctenotus				•									•				•		
<i>Ctenotus uber</i>	Spotted Ctenotus				•									•				•		

Family & Scientific Name	Common Name	Conservation Status			Database Searches				Literature Review										This Survey
		EPBC Act	BC Act	DBCA	Naturemap	DBCA Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino• Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)	Spectrum (2021)	
<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink				•			•		•		•		•	•	•	•		
<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer				•									•	•	•			
<i>Lerista desertorum</i>	Central Desert Robust Slider				•					•				•	•	•	•		
<i>Lerista kingi</i>	King's Tree-Toed Slider													•					
<i>Lerista muelleri</i>	Wood Mulch Slider																•		
<i>Lerista timida</i>	Timid Slider				•														
<i>Liopholis inornata</i>	Desert Skink				•														
<i>Liopholis striata</i>	Night Skink													•					
<i>Morethia adelaidensis</i>	Saltbush Morethia Skink													•					
<i>Morethia butleri</i>	Woodland morethia skink									•				•	•	•	•		
<i>Menetia greyii</i>	Common Dwarf Skink				•				•	•	•			•	•	•	•		
<i>Tiliqua occipitalis</i>	Western Bluetongue											•	•						
VARANIDAE																			
<i>Varanus caudolineatus</i>	Stripe-tailed Pygmy Monitor				•				•	•	•			•	•	•	•		
<i>Varanus gouldii</i>	Bungarra or Sand Monitor				•			•	•		•			•					•

Family & Scientific Name	Common Name	Conservation Status			Database Searches			Literature Review										This Survey	
		EPBC Act	BC Act	DBCA	Naturemap	DBCA Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino• Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)		Spectrum (2021)
<i>Varanus panoptes</i>	Yellow-spotted Monitor				•					•		•	•	•	•	•	•		
TYPHLOPIDAE																			
<i>Anilius bicolor</i>	Dark-spined Blind Snake												•	•	•				
<i>Anilius waitii</i>	Beaked Blind Snake												•						
PYTHONIDAE																			
<i>Antaresia childreni</i>	Children's Python													•				•	
<i>Aspidites ramsayi</i>	Woma (south-west population)			P1		•								•					
ELAPIDAE																			
<i>Brachyuropis semifasciatus</i>	Southern Shovel-Nosed Snake													•				•	
<i>Parasuta monachus</i>	Monk Snake													•				•	
<i>Pseudechis australis</i>	Mulga Snake				•				•										
<i>Pseudechis butleri</i>	Spotted Mulga Snake																	•	
<i>Pseudonaja mengdeni</i>	Western Brown Snake				•														
<i>Pseudonaja modesta</i>	Ringed Brown Snake				•									•				•	
<i>Pseudonaja nuchalis</i>	Gwardar													•					

Family & Scientific Name	Common Name	Conservation Status			Database Searches					Literature Review									This Survey
		EPBC Act	BC Act	DBCA	Naturemap	DBCA Threatened Fauna	PMST	Kinhill Engineers (1992)	Brearley, Dunlop, and Osborne 1997	Nino• Wildlife Consulting (1998)	Dunlop and Payne (1999)	Bamford Ecological Consulting (2007)	Bamford Consulting Ecologists (2008)	Bamford Ecological Consulting (2010)	Terrestrial Ecosystems (2011)	Terrestrial Ecosystems (2020b)	Terrestrial Ecosystems (2020a)	Spectrum (2021)	
<i>Simoselaps bertholdi</i>	Jan's Banded Snake									•				•			•		
<i>Suta fasciata</i>	Rosen's Snake				•									•					
<i>Suta monachus</i>	Monk Snake				•			•	•	•					•			•	
<i>Suta punctata</i>	Spotted Snake																	•	
AMPHIBIANS																			
PELODRYADIDAE																			
<i>Cyclorana maini</i>	Sheep Frog				•					•					•	•			
<i>Cyclorana occidentalis</i>	Western Water-holding Frog				•										•				
<i>Litoria rubella</i>	Little Red Tree Frog				•								•	•				•	
MYOBATRACHIDAE																			
<i>Pseudophryne occidentalis</i>	Western Toadlet																	•	
LIMNODYNASTIDAE																			
<i>Neobatrachus kunapalari</i>	Kunapalari Frog				•					•									
<i>Neobatrachus sutor</i>	Shoemaker Frog				•					•								•	
<i>Notaden nichollsi</i>	Desert Spadefoot				•					•					•				

Appendix E: Potential *Idiosoma* sp. Burrow Locations



Potential *Idiosoma* sp. Burrow Locations

GPS Waypoint	Survey Area	Site Assessment Location	Taxon Name	No. of Burrows
SPI02	Railway Corridor Area (new)	Rhab4	<i>Idiosoma</i> sp.	1
SPI05	Railway Corridor Area (new)	Rhab4	<i>Idiosoma</i> sp.	1
SPI07	Tower Hill	Thab6	<i>Idiosoma</i> sp.	1
SPI08	Harbour Lights	Hhab4	<i>Idiosoma</i> sp.	1
SPI09	Harbour Lights	Hhab4	<i>Idiosoma</i> sp.	2
SPI10	Harbour Lights	Hhab4	<i>Idiosoma</i> sp.	10
SPI11	Harbour Lights	Hhab8	<i>Idiosoma</i> sp.	2
SPI13	Harbour Lights	Hhab8	<i>Idiosoma</i> sp.	1
SPI01	Gwalia	Ghab3	<i>Idiosoma</i> sp.	2
SPI06	Tower Hill	Thab3	<i>Idiosoma</i> sp.	1
TRAP3	Railway Corridor Area (new)	Rhab4	<i>Idiosoma</i> sp.	3

APPENDIX B

Detailed Flora and Vegetation Survey of the Leonara Project



DETAILED FLORA AND
VEGETATION SURVEY OF THE
LEONORA PROJECT-
September 2022

Prepared for:  **St Barbara**

St Barbara Limited

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FINAL
V2.0
March 2023

EXECUTIVE SUMMARY

St Barbara Limited (ASX: SBM), an Australian based company, has three gold mining operations, including their Leonora Operation/Project. The Leonora Project consists of the Gwalia mine, located just south of Leonora, approximately 235 kilometres (km) north of Kalgoorlie, Western Australia (WA).

SBM plan to expand their existing Leonora Project to include additional railway facilities, solar and wind farms, as well as open pit and waste landform expansions.

Talis Consultants (Talis) provided Native Vegetation Solutions (NVS) with a survey area encompassing the proposed disturbances. The Leonora Project expansion consists of three distinct areas: Gwalia (2,015 ha), Tower Hill (1,143 ha) and Harbour Lights (400 ha). The location of these survey areas is within the Murchison Bioregion of Western Australia (Figure 1), totalling approximately 3,558 hectares. At this stage, the final footprint of proposed disturbances is yet to be finalised, however, these disturbances are anticipated to be wholly contained within the survey area.

A previous comprehensive desktop assessment of the flora and vegetation within the same survey area was completed by Spectrum Ecology in November 2021 (Spectrum, 2022). The findings of the desktop assessment identified the potential occurrence of conservation significant flora, and hence a detailed flora and vegetation survey was recommended.

The survey area is located within the Eastern Murchison Interim Biogeographic Regionalisation for Australia (IBRA) subregion. The vegetation of the Eastern Murchison botanical subregion consists of Mulga woodlands often rich in ephemerals. Vegetation is dominated by hummock grasslands, saltbush and *Tecticornia* shrublands (CALM, 2002).

The Protected Matters Search Tool (PMST) provided information under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 and indicated no Threatened Ecological Communities (TECs) or Commonwealth Reserves occur within the requested search area.

The Western Australian Department of Biodiversity Conservation and Attractions (DBCA) database searches revealed a potential for no Threatened and 3 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2023a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Priority Flora located approximately 8.6 km south of the survey area.

The Threatened Ecological Communities (TEC) search revealed no TECs within the survey area (DBCA, 2023).

The search identified two Priority Ecological Communities (PEC) within 50 km of the Survey Area; both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station (Appendix A). It is known for its unique assemblages of invertebrates in the groundwater calcretes and is threatened by hydrological changes associated with mining. The remaining PEC is located 25 km to the west of the Survey Area. It was assigned a 'Low likelihood' to occur within the survey area based on the restriction to a palaeodrainage system on Sturt Meadows Station.

No Environmentally Sensitive Areas (ESAs) are located within the survey area.

No water bodies were identified within the survey area via the Clearing Permit System (CPS) Map Viewer (DWER, 2023).

The survey area lies south of the 26th parallel, however receives average annual rainfall of approximately 236.4 mm (BOM, 2023). There is no record of *Phytophthora cinnamomi* (Dieback) establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). However, as indicated within the new Dieback guidelines (DBCA, 2020), other species of *Phytophthora* may persist east of the 400mm isohyet in unusually wet conditions. It is therefore recommended to conduct a risk assessment as per these guidelines.

Additionally if clearing is to occur within the survey area, all measures should be taken to prevent any possible soil contamination (seeds of non-native species etc.) which poses a risk in the survey area during seasonally favourable conditions.

Sixteen vegetation groups were identified during this survey, largely following topographical features and dominant species. Mapping of the 16 vegetation groups, as well as the quadrat locations can be seen in Appendix C. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F.

Two-hundred and one species were recorded within the survey area with 176 species recorded within quadrats. Forty-two families and 95 genera were recorded overall. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Asteraceae had the highest representation, with 31 species from 21 genera. The next best represented families were Chenopodiaceae and Fabaceae with 30 and 25 species respectively.

The most common and widespread species was *Ptilotus obovatus* which was recorded in 41 quadrats. The next most common were *Erodium cygnorum* and *Maireana pyramidata*, both occurring in 35 quadrats.

Quadrats Q53 and Q59 had the richest species list with 34 taxa recorded in both.

There were no Threatened or Priority Flora recorded during the survey.

Eighteen introduced weed species were detected within the survey area. Three of these are considered Declared Pests (DPIRD, 2023), *Cylindropuntia imbricata*- s22(2) C3 Restricted, *Opuntia stricta*- s22(2) C3 Restricted and *Rumex vesicarius*- Prohibited s12 C1 Prohibited.

Vegetation condition was generally 'Good' to 'Very Good' (Keighery 1994). Disturbance was present within the survey area mostly attributed to, access tracks and exploration related activities, as well as open pit mines and waste landforms.

The Environmental Protection Authority's (EPA) objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora, consistent with the provisions of the *Biodiversity Conservation Act 2016*.

Most of the species and communities recorded during this survey are widespread throughout the Eastern Murchison subregion and adjoining regions. At this stage, the final footprint of mining related disturbances is yet to be finalised, however, these disturbances are not anticipated to occur within the survey area.

This report summarises the results of a detailed flora and vegetation survey. This detailed flora and vegetation report will support numerous applications including mining proposals and clearing permits submitted to relevant Government Departments.

TABLE OF CONTENTS

Page No.

EXECUTIVE SUMMARY.....	i
1 INTRODUCTION.....	1
1.1 BACKGROUND.....	1
1.2 PURPOSE AND SCOPE.....	4
1.3 STATUTORY FRAMEWORK AND GUIDANCE.....	4
1.3.1 <i>Western Australian Biodiversity Conservation Act 2016</i>	5
1.3.2 <i>Environmental Protection Act 1986</i>	5
1.3.3 <i>Environment Protection and Biodiversity Conservation Act 1999</i>	5
1.3.4 <i>Flora</i>	5
1.3.5 <i>Ecological Communities and Vegetation</i>	6
2 EXISTING ENVIRONMENT.....	8
2.1 CLIMATE.....	8
2.1.1 <i>Temperature</i>	8
2.1.2 <i>Rainfall</i>	8
2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION.....	10
2.3 LANDFORMS AND SOILS.....	10
2.4 BOTANICAL SUBREGION AND EXISTING VEGETATION.....	10
3 METHODS.....	10
3.1 PERSONNEL AND REPORTING.....	10
3.2 PRELIMINARY DESKTOP STUDY.....	10
3.2.1 <i>Previous Flora Surveys</i>	10
3.2.2 <i>Environment Protection and Biodiversity Conservation Act Protected Matters</i>	11
3.2.3 <i>Threatened Flora and Communities</i>	11
3.2.4 <i>Environmentally Sensitive Areas (ESAs) and Conservation Reserves</i>	11
3.2.5 <i>Land Systems</i>	11
3.2.6 <i>Vegetation Type, Extent and Status</i>	12
3.2.7 <i>Wetlands</i>	12
3.2.8 <i>Dieback</i>	12
3.3 SITE INVESTIGATION.....	12
3.3.1 <i>Licenses</i>	12
3.3.2 <i>Field Methods</i>	13
3.3.3 <i>Post-Field Methods</i>	13
3.3.4 <i>Mapping</i>	14
3.3.5 <i>IBSA Data Package</i>	14
3.4 NOMENCLATURE AND TAXONOMY.....	15
3.5 LIMITATIONS.....	16
4 RESULTS.....	17
4.1 PRELIMINARY DESKTOP ASSESSMENT.....	17
4.1.1 <i>EPBC Protected Matters Search Tool</i>	17
4.1.2 <i>Threatened Flora and Communities</i>	17
4.1.3 <i>Environmentally Sensitive Areas and Conservation Reserves</i>	17
4.1.4 <i>Land Systems</i>	17
4.1.5 <i>Vegetation Type, Extent and Status</i>	18
4.1.6 <i>Wetlands</i>	20
4.1.7 <i>Dieback</i>	20
4.2 FIELD ASSESSMENT.....	22
4.2.1 <i>Vegetation of the Survey Area</i>	22
4.2.2 <i>Flora of the Survey Area</i>	27
5 DISCUSSION.....	30
IMPACT ASSESSMENT.....	31
5.1 THREATENING PROCESSES.....	31

6	CONCLUSIONS	32
7	REFERENCES	33
8	GLOSSARY.....	35

FIGURES

Figure 1: Regional Location of the Leonora Project.....	2
Figure 2: Survey Areas	3
Figure 3: Mean temperature ranges for Leonora Meteorological Station (BOM, 2023).....	8
Figure 4: Average rainfall data for the Leonora Meteorological Station (BOM, 2023)	9
Figure 5: Leonora rainfall in 2022 (BOM, 2023)	9
Figure 6: PATN Analysis of Dominant Species into 16 groups	24
Figure 7: PATN Analysis of All Species into 16 groups	26
Figure 8: Species Accumulation Curve for the 59 sampled quadrats.....	28

TABLES

Table 1: Previous Flora and Vegetation Surveys.....	11
Table 2: List of potential survey limitations	16
Table 3: Threatened flora database search results	17
Table 4: Land Systems occurring within the survey area (DPIRD, 2017)	18
Table 5: Extent of Beard Association within the survey area	18
Table 6: Summary of information regarding Pre-European and current vegetation extent of vegetation association 18 within the survey area	19
Table 7: Summary of information regarding Pre-European and current vegetation extent of vegetation association 28 within the survey area	19
Table 8: Summary of information regarding Pre-European and current vegetation extent of vegetation association 39 within the survey area	20
Table 9: Summary of information regarding Pre-European and current vegetation extent of vegetation association 676 within the survey area	20
Table 10: Vegetation Group Extent within Survey Area.....	22

APPENDICES

Appendix A - EPBC and Other Government Database Search Results.....	38
Appendix B - Vegetation Definitions	50
Appendix C - Mapping	53
Appendix D – Priority Flora Recorded During the Survey.....	62
Appendix E - Species Recorded During the September 2022 Survey	64
Appendix F - Site Descriptions	75

1 INTRODUCTION

1.1 BACKGROUND

St Barbara Limited (ASX: SBM), an Australian based company, has three gold mining operations, including their Leonora Operation/Project. The Leonora Project consists of the Gwalia mine, located just south of Leonora, approximately 235 kilometres (km) north of Kalgoorlie, Western Australia (WA).

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This detailed flora and vegetation report will support numerous applications including mining proposals and clearing permits submitted to relevant Government Departments.

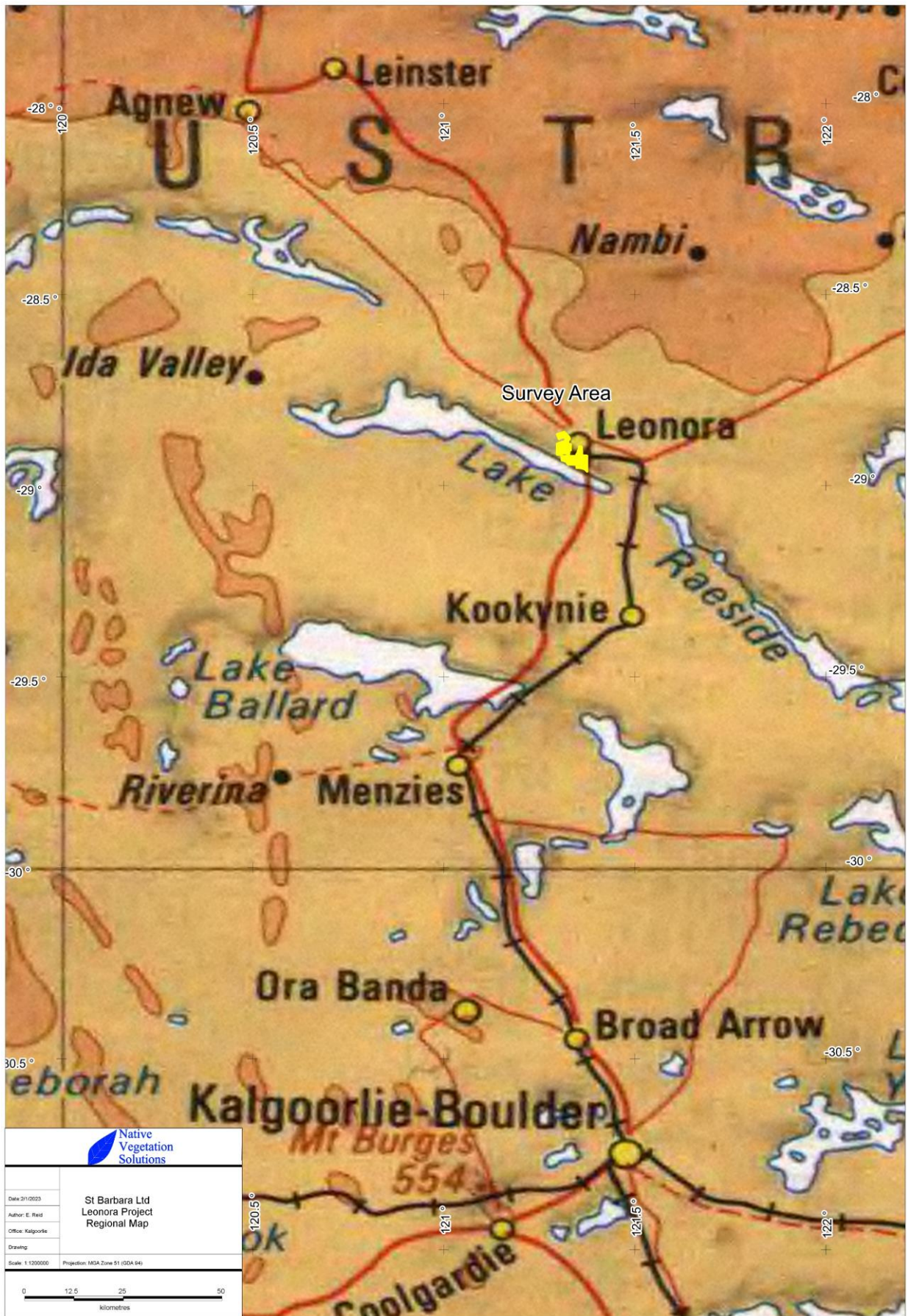


Figure 1: Regional Location of the Leonora Project

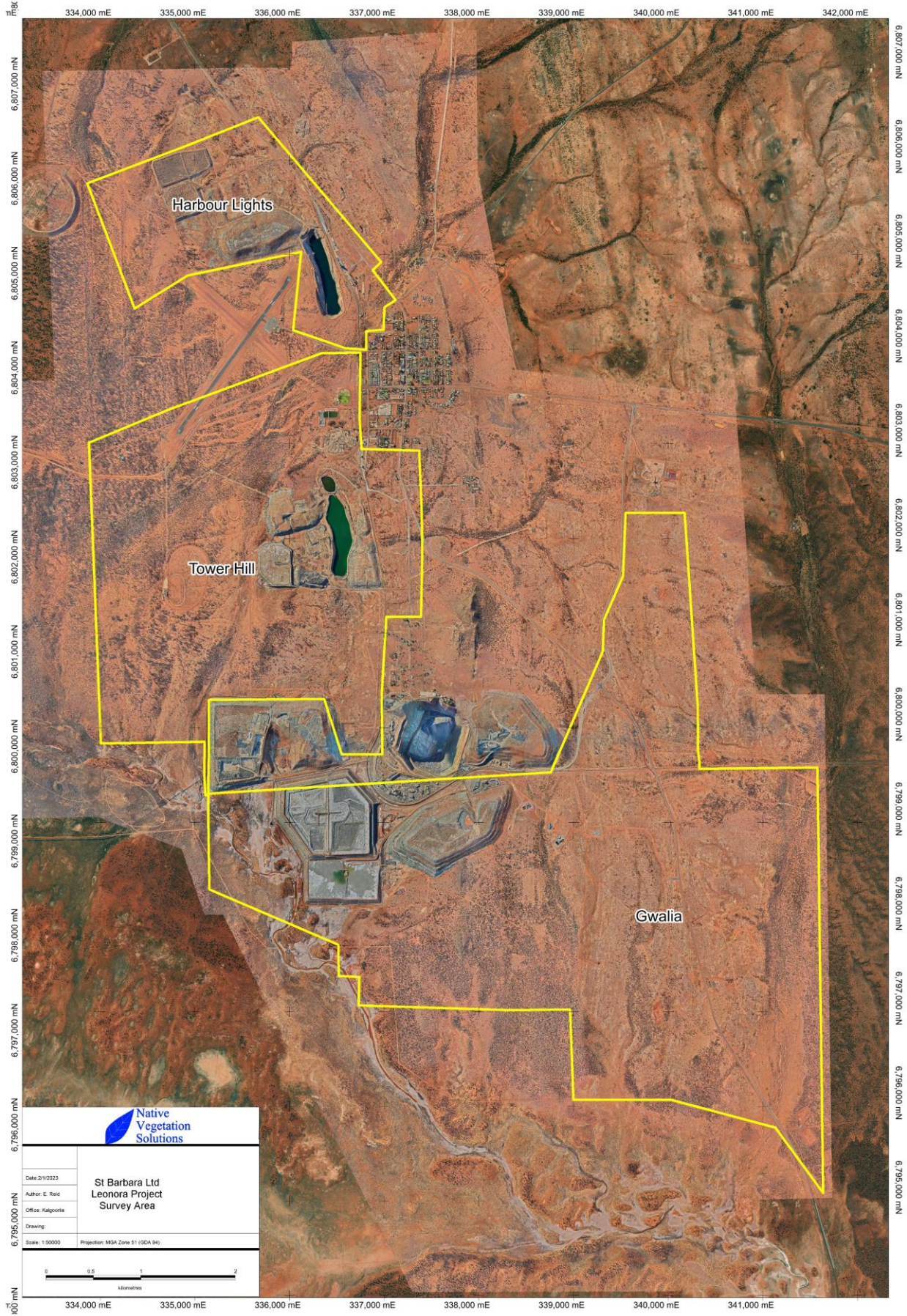


Figure 2: Survey Areas

1.2 PURPOSE AND SCOPE

The objective of this report is to record and analyse the results of the flora and vegetation component of a Detailed assessment conducted in accordance with the following documents:

- *Environmental Factor Guideline- Flora and Vegetation* (EPA, 2016); and
- *Technical Guidance- Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016a).

A Detailed Flora and Vegetation Survey has two components:

- 1) Reconnaissance Survey
 - a) Desktop study which includes a literature review and a search of the relevant databases; and
 - b) Reconnaissance survey of the subject area to verify the desktop survey, undertake low impact sampling, define vegetation groups present in the area, search for species of conservation significance and to determine potential sensitivity to impact.
- 2) Detailed Plot Based Survey
 - a) Detailed survey, comprising multiple visits in main flowering seasons or other seasons and replication of plots in vegetation units incorporating greater coverage than a reconnaissance survey; and
 - b) Comprehensive survey when necessary to: enhance the level of knowledge at the locality or sub-regional scale, in order to provide wider context for the local scale.

Therefore, the scope of work for the Detailed flora and vegetation survey was to:

- Conduct a desktop study that included a literature review and search of relevant databases
- Conduct a plot-based survey within the survey area (incorporating 20m x 20m quadrats)
- Prepare an inventory of species occurring in the study area
- Conduct PATN[®] analysis of quadrat-based presence/absence data
- Quantify survey intensity via a Species Accumulation Curve
- Describe the vegetation associations in the survey area
- Identify any vegetation communities or flora species of particular conservation significance
- Map broad-scale vegetation groups found within the survey area, including vegetation condition; and
- Provide recommendations, including the management of perceived impacts to flora and vegetation, particularly flora of conservation significance, within the study area.

1.3 STATUTORY FRAMEWORK AND GUIDANCE

This assessment took into account relevant sections of Commonwealth and State legislation and guidelines:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Environmental Protection Act 1986* (EP Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Biosecurity and Agriculture Management Act 2007* (BAM Act)

The Minister for the Environment publishes lists of flora species in need of special protection because they are considered rare, likely to become extinct, or are presumed extinct. The current listings were published in the Government Gazette on 5 December 2018 (Smith and Jones, 2018) and were taken into account.

As well as those listed above, the assessment took into account relevant sections of:

- EPA (2016) *Statement of Environmental Principles, Factors and Objectives*; and
- EPA (2016a) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*, known as *Flora and Vegetation Technical Guidance*

1.3.1 Western Australian Biodiversity Conservation Act 2016

The Western Australian *Biodiversity Conservation Act 2016* (BC Act, the Act) provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia. The BC Act replaced the *Wildlife Conservation Act 1950*.

Threatened species (both flora and fauna) that meet the categories listed within the Act are highly protected and require authorisation by the Ministerial to take or disturb. These are known as Threatened Flora and Threatened Fauna. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act, as below.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as specially protected species in the Act.

Threatened Ecological Communities (TECs) are also protected under the Act and are categorised using the same criteria as threatened species.

1.3.2 Environmental Protection Act 1986

The *EP Act 1986* was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information included in environmental assessments and provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

1.3.3 Environment Protection and Biodiversity Conservation Act 1999

At a Commonwealth level, Threatened taxa are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Extinct, or Extinct in the Wild (Section 6 below).

1.3.4 Flora

1.3.4.1 Threatened and Priority Flora

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as threatened by the

Western Australian Department of Biodiversity Conservation and Attractions (DBCA) and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act.

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and these may require a greater level of protection than unlisted species. Generally though, PF have no statutory protection. They are generally considered in environmental impact assessments under the state approval processes by Department of Mines, Industry Regulation and Safety (DMIRS) under the Mining Act and DBCA under the EP Act. Under this approval process measures are usually taken to protect and avoid PF.

There are seven categories covering State-listed TF and PF species (DBCA, 2019) which are defined in Section 8 below. PF for Western Australia are regularly reviewed by DBCA whenever new information becomes available, with species status altered or removed from the list (Smith and Jones, 2018) when data indicates that they no longer meet the requirements outlined in Section 8 below.

1.3.4.2 Other Significant Flora

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g., surface water or groundwater dependent ecosystems)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids and
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

1.3.5 Ecological Communities and Vegetation

1.3.5.1 Threatened and Priority Ecological Communities

Nationally Listed Threatened Ecological Communities

An ecological community is a naturally occurring group of plants, animals and other organisms interacting in a unique habitat. The complex range of interactions between the component species provides an important level of biological diversity in addition to genetics and species. At Commonwealth level, Threatened Flora and Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. An ecological community may be categorised into one of the three subcategories:

- Critically Endangered, if it is facing an extremely high risk of extinction in the wild in the immediate future
- Endangered, if it is not critically endangered and is facing a very high risk of extinction in the wild in the near future and
- Vulnerable, if it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

State Listed Threatened Ecological Communities

The Western Australian DBCA also maintains a list of TECs, protected under the BC Act, which are further categorised into three subcategories much like those of the EPBC Act.

State Listed Priority Ecological Communities

DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined.

1.3.5.2 Other Significant Vegetation

According to the Flora and Vegetation Technical Guidance (EPA 2016a), other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge; and/or
- provides an important function required to maintain ecological integrity of a significant ecosystem.

1.3.5.3 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage; or
- Exempt (no category).

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The subregion climate is Arid with an annual average of 200 mm of rainfall, sometimes in summer but usually in winter (CALM, 2002). The nearest official meteorological weather station with the most complete and up to date information is Leonora weather station, which is located less than 5 km of the survey area. Recordings of the local climatic conditions commenced at Leonora in 1994 (BOM, 2023) and data collected at stations 012046 and 012241 were used for this report.

2.1.1 Temperature

Mean annual minimum temperature at Leonora is 14.0°C and mean annual maximum temperature is 27.9°C. The coldest temperatures occur in July (mean minimum temperature 6.1°C), the hottest is January (mean maximum temperature 37.0°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

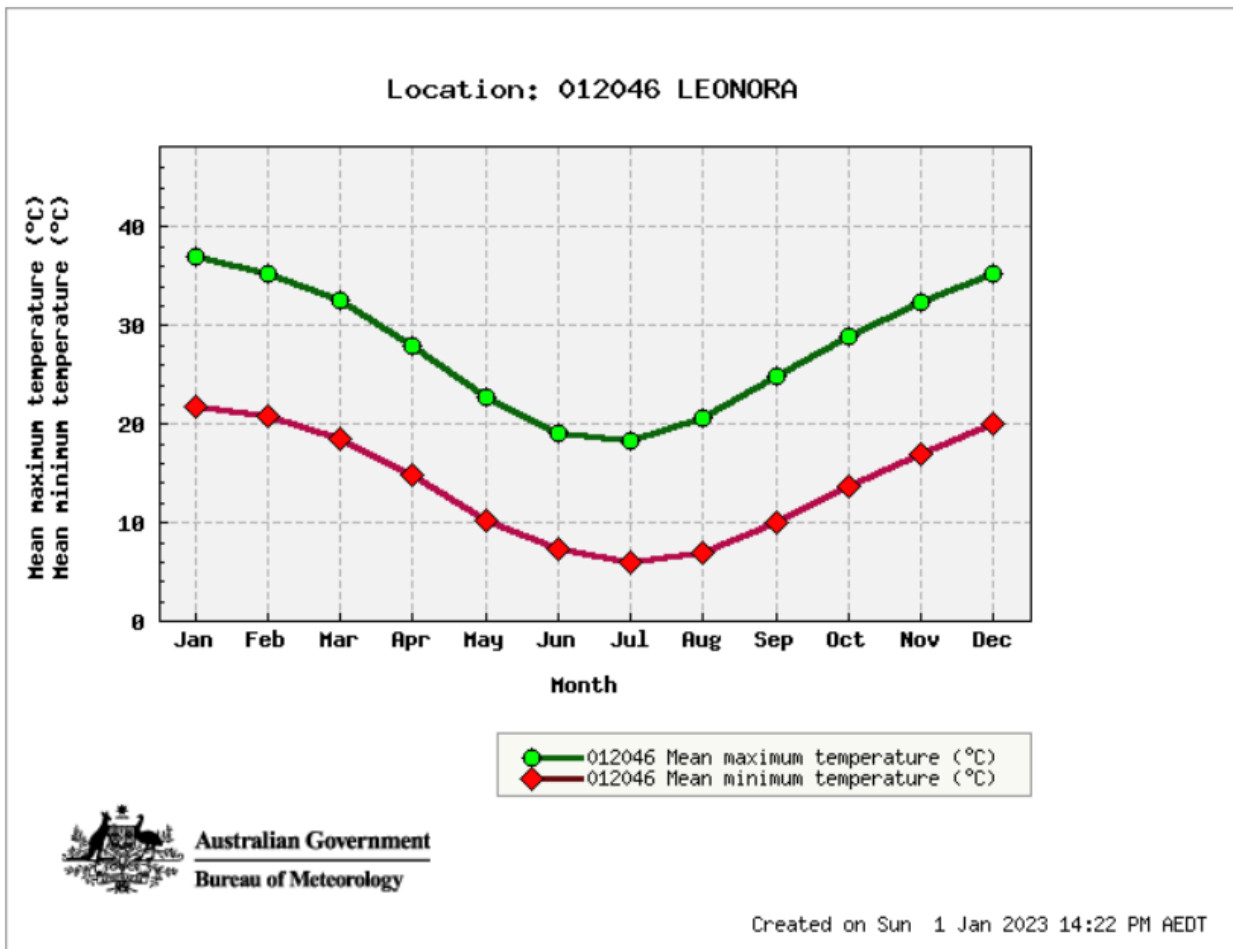


Figure 3: Mean temperature ranges for Leonora Meteorological Station (BOM, 2023)

2.1.2 Rainfall

The annual average rainfall at Leonora is 236.4 mm over an average of 28.9 days above 1mm of rain (BOM, 2023). Average rainfall varies across the months, with larger rainfall events falling between December to June (Figure 4). Rainfall for 2022 was above average for the months of April, July and September and below average for all other months prior to the survey (Figure 5). September 2022 rainfall was more than 5 times higher than the average monthly rainfall amount (Figure 5), invigorating and extending the flowering season beyond normal circumstances.

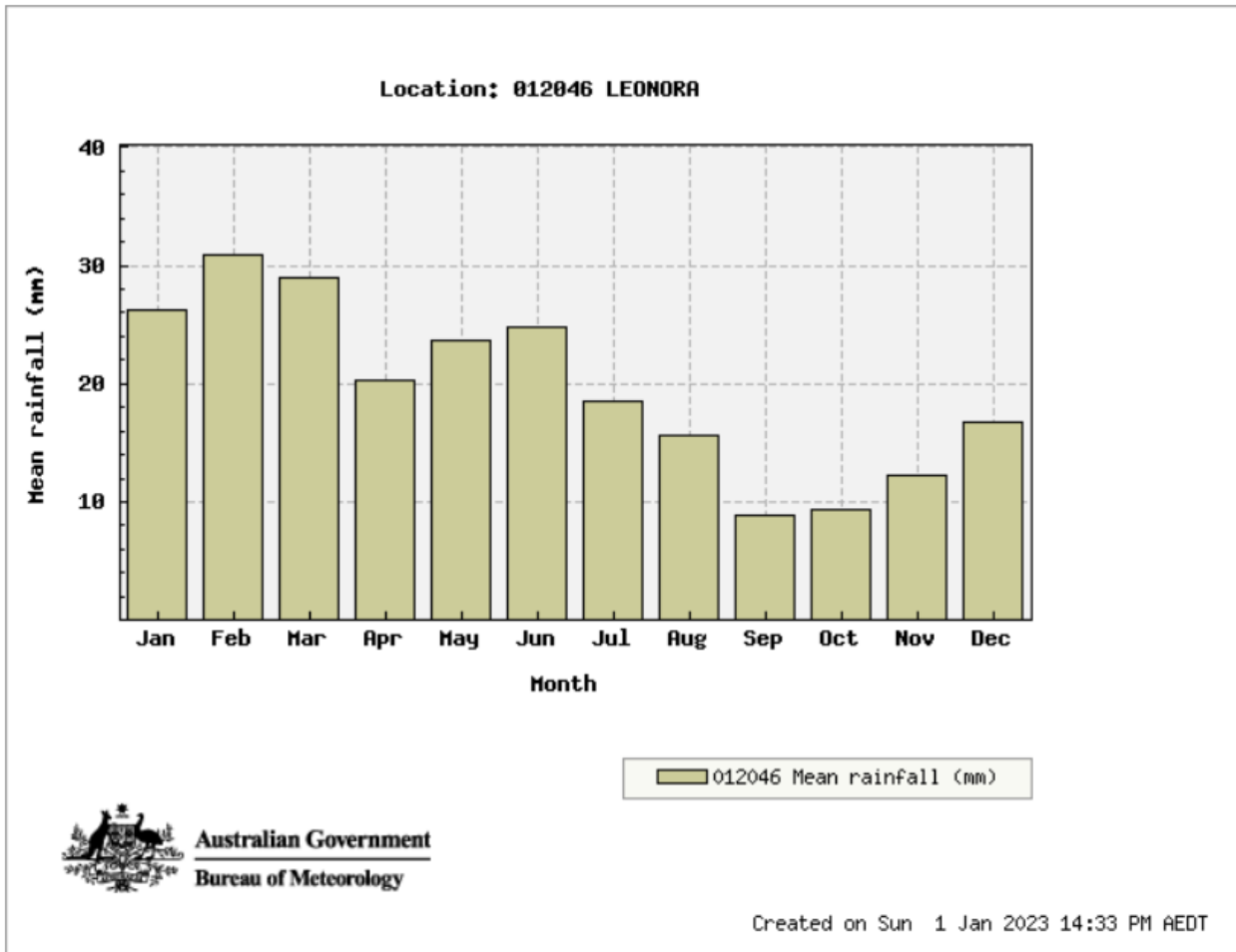


Figure 4: Average rainfall data for the Leonora Meteorological Station (BOM, 2023)

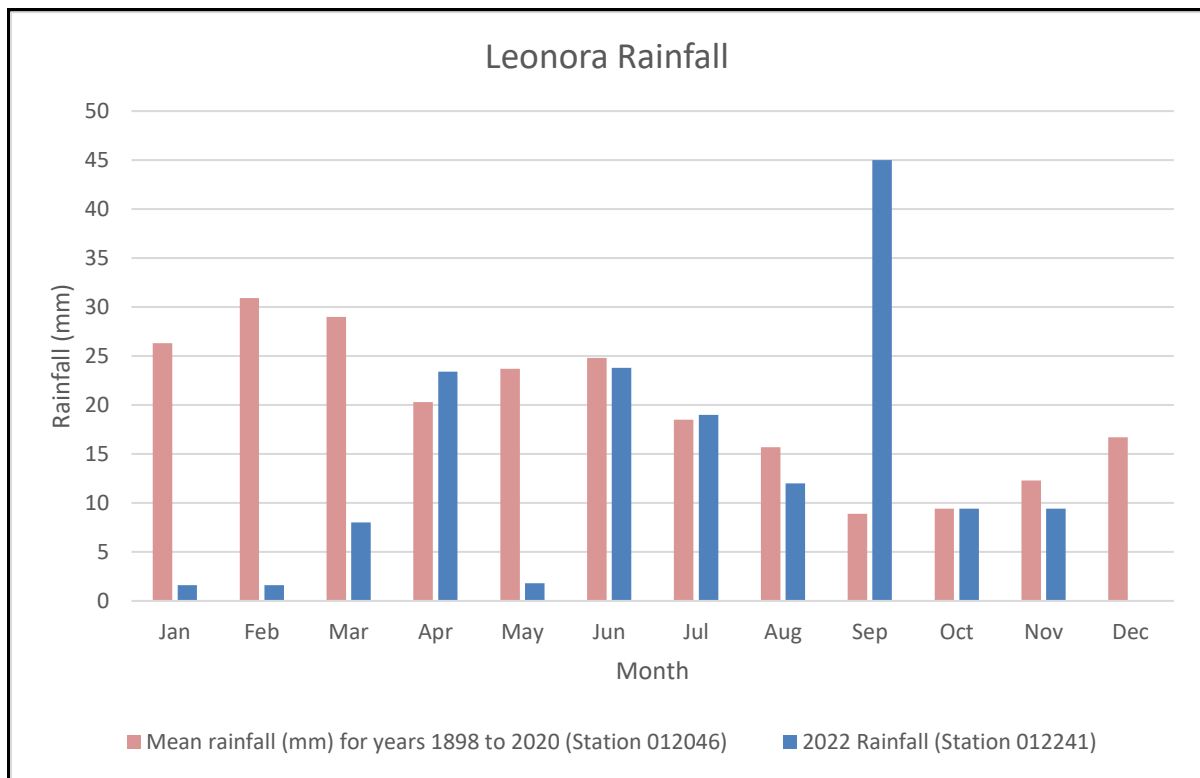


Figure 5: Leonora rainfall in 2022 (BOM, 2023)

2.2 INTERIM BIOGEOGRAPHIC REGIONALISATION OF AUSTRALIA (IBRA) REGION

The IBRA recognises 89 bioregions within Australia and 419 subregions (DCCEEW, 2023). The project is located within the Eastern Murchison IBRA subregion (MUR01) which totals over 7 million hectares (CALM, 2002). The Eastern Murchison subregion is characterised by extensive areas of elevated red desert sandplains with minimal dune development and internal drainage. (CALM 2002).

2.3 LANDFORMS AND SOILS

The Eastern Murchison comprises the northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton. The occluded Paleodrainage system generates Salt Lake systems. Other features include broad plains of red-brown soils, breakaway complexes, and red sandplains (CALM 2002).

2.4 BOTANICAL SUBREGION AND EXISTING VEGETATION

The vegetation of the Eastern Murchison botanical subregion consists of Mulga woodlands often rich in ephemerals. Vegetation is dominated by hummock grasslands, saltbush and *Tecticornia* shrublands (CALM, 2002).

3 METHODS

3.1 PERSONNEL AND REPORTING

The following personnel were involved in the single season detailed flora and vegetation survey (September 2022):

- Mr Eren Reid (*BSc*- Biological Science), Principal Botanist, Native Vegetation Solutions (NVS), undertook field work of the detailed survey in September 2022, vegetation mapping, data collation, identification of flora during field work and preparation and review of the report; and
- Mr Frank Obbens (*BSc*) Consultant Botanist, Bushtech Consultancy, undertook the identification of unknown flora samples collected by NVS in the field, made recommendations regarding Threatened flora, range extensions and new locations requiring submission to the WAHERB as per the EPA Technical Guidelines (EPA 2016a).

3.2 PRELIMINARY DESKTOP STUDY

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 3.2.2 to 3.2.8, and Appendices A & D) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

3.2.1 Previous Flora Surveys

Multiple surveys have been conducted in the general vicinity of the current survey area, however, most of these surveys occurred prior to 2011. One previous desktop assessment of flora vegetation was completed in the current survey area in November 2021 (Spectrum, 2022).

All surveys previously conducted in the vicinity of the survey area were reviewed for significant flora and vegetation. Reports were incorporated if they were provided by the client or publicly available. The reports included in the desktop assessment are listed in Table 1.

Table 1: Previous Flora and Vegetation Surveys

Report	Reference	Location from current survey area	Survey Summary
Comprehensive desktop assessment of flora and vegetation, with site visit in November 2021	Spectrum, 2022	Overlaps current Survey Area	A total of 86 significant flora taxa were identified during the flora desktop searches. Of these, five were assigned a High Likelihood of occurrence, while ten were assigned a Medium Likelihood of occurrence. No Threatened Ecological Communities (TEC) were recorded within 50 km of the Survey Area. However, the desktop assessment recorded two Priority Ecological Communities (PEC) within 50 km of the Survey Area which are both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station
Assessment of Flora and Vegetation Values- King of the Hills Mine	Mattiske Consulting Pty Ltd, 2020	5km North	One Priority 1 species, <i>Frankenia georgei</i> , was recorded. No other threatened species were recorded. Five vegetation communities were recorded, with no TECs or PECs identified.
Flora and Vegetation Survey of the Kallis – Trump and Poker – Forrest Lease Areas	Mattiske Consulting Pty Ltd, 2008	Overlaps a small portion of the current Survey Area	No species of conservation significance were recorded. Six vegetation communities were defined and affected by grazing and previous mining activities.
Flora and Vegetation Survey and Establishment of Baseline Transects for a Creek Diversion at Tower Hill	Mattiske Consulting Pty Ltd, 2007	Overlaps current Survey Area	Three vegetation communities were recorded; none are considered regionally or locally significant. Two 50 m monitoring transects were established.
Flora and Vegetation Survey of St Barbara, Leonora Pipeline Site	Mattiske Consulting Pty Ltd, 2006	Overlaps current Survey Area	No Declared Rare Flora or Priority species were recorded during the survey. Four plant communities were defined, no TECs were located.
Declared Rare and Priority Flora Search of Proposed Mining Areas at Ulysses and Gwalia Deeps	Mattiske Consulting Pty Ltd, 2000	Overlaps current Survey Area	Fifty-nine rare and endangered taxa identified as potentially occurring. No Declared Rare Flora or Priority species were recorded during the survey.

3.2.2 Environment Protection and Biodiversity Conservation Act Protected Matters

The *EPBC Act* Protected Matters Search tool was utilised to provide results for matters of National Environmental Significance within the survey area using the shapefiles of the survey area (Appendix A) with a 10 km buffer (DCCEE, 2023a).

3.2.3 Threatened Flora and Communities

The Threatened and Priority Flora Database managed by the Department of Biodiversity, Conservation and Attractions (DBCA) was searched for threatened and priority flora within a 20 km radial area of the survey area shapefile (DBCA, 2023a).

The presence of Threatened and Priority Ecological Communities (TECs & PECs) was determined by examining Geographic Information System (GIS) data supplied by the DBCA upon request within a 20 km buffer of the survey area shapefile (DBCA, 2023).

3.2.4 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER) Clearing Permit System (CPS) Map Viewer was used to determine the location of any ESAs and Conservation Reserves (DWER, 2023).

3.2.5 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture mapped the Land Systems of Western Australia (DPIRD, 2017). The purpose of the survey was to provide comprehensive description and mapping of the biophysical resources of the region, together with an evaluation of the condition of the soils and vegetation throughout. The report and the accompanying series of maps at 1:250,000 scale, are primarily intended as a reference for land managers, land management advisers and land administrators, that is, the people most involved in planning and implementing land management practices. The report and complementary maps

also provide researchers and the public with a basic reference on the landscape resources in Western Australia.

3.2.6 Vegetation Type, Extent and Status

Vegetation extent and status data was sourced from the Department of Agriculture and Food (DAFWA) report and its associated GIS file (Shepherd *et al*, 2002). This data comprises Beard's Pre-European vegetation groups.

DBCA's Statewide Vegetation Statistics (DBCA, 2019) was also referenced for the current extent of Beard's Vegetation Groups. The purpose of examining this information is to determine if the survey area lies within any vegetation groups defined by Beard that may have been subjected to widescale clearing for European settlement. The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of a Beard vegetation association is necessary if Australia's biological diversity is to be protected.

3.2.7 Wetlands

The potential of wetlands within the project area was determined by examining DWER's Clearing Permit System Map Viewer (DWER, 2023).

3.2.8 Dieback

Under normal circumstances Dieback is only considered a potential issue for any project if the project area lies within the Southwest Land Division and the mean annual rainfall of the area is greater than 400 mm. There is no record of *Phytophthora cinnamomi* (Dieback) establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). However, as indicated within the more recent Dieback guidelines (DBCA, 2020), other species of *Phytophthora* may persist east of the 400mm isohyet in unusually wet conditions. It is therefore recommended to conduct a risk assessment as per these guidelines.

3.3 SITE INVESTIGATION

The field survey was conducted by Mr. Eren Reid, Botanist of Native Vegetation Solutions (NVS), from the 12th to 16th of September 2022. NVS established 59 quadrats within the survey area, recording 176 vascular plant species within 16 vegetation groups. A further 440 Relevé sample sites were also recorded within and around the survey area, determining vegetation units for mapping and species present.

A total of 60 hours was spent on site traversing the survey area in September 2022.

While a vehicle was used to reach the site, all traverses were made on foot or via a Yamaha Viking (All Terrain Vehicle).

The survey was conducted in accordance with relevant EPA's Statements and Guidelines (Section 1.2).

The EPA uses the Interim Biogeographic Regionalisation of Australia (IBRA) as the largest unit for Environmental Impact Assessment decision making in relation to the conservation of biodiversity. Given the scale and nature of the proposed disturbance as well as the existing disturbance, and that the survey area is located within the Murchison IBRA region, a detailed flora and vegetation survey was deemed appropriate.

3.3.1 Licenses

Flora was collected for identification under the Scientific Collection License FB62000171, held by Mr Eren Reid with expiry 08/10/2023.

3.3.2 Field Methods

Prior to the field work, the aerial photography was examined and representative sample sites for quadrat locations were chosen to provide coverage over all viable vegetation types.

20 x 20m quadrats were established at these sites in appropriate locations, taking into account representation of surrounding vegetation and vegetation boundaries.

Each quadrat site was marked in all corners with a 97cm galvanized fence dropper and was defined by tape measures. The location of the North-East (NE) corner was captured on a TwoNav Aventura GPS at ± 4 m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each quadrat site from the NE corner.

Data collected at each of the six quadrats included, but not limited to:

- Site Code
- Location (via GPS)
- Size of Quadrat
- Quadrat marking method
- Photograph/s from north-west corner
- Landform and soil description
- Comprehensive Species List (including dominant growth form, height, cover and species present for the upper, mid and lower strata)
- % Bare Ground and Litter
- Description of disturbances (including fire history)
- Vegetation Condition

A complete list of all species encountered was also recorded, detailing the average height and estimated coverage of the dominant species from the three stratum levels (Upper, Mid and Lower).

Specimens of taxa not recognised by the Botanist were collected and pressed along with specimens of taxa recognised as, or thought to be, conservation-significant species.

The vegetation structure was assessed using the method developed by Muir (1977). Definitions of the vegetation structure are presented in Appendix B.

The condition of each quadrat was assessed using the method developed by Keighery (1994). Definitions of the condition scale are presented in Appendix B.

Vegetation groups were mapped (section 3.3.4 below).

Relevé sites were used between quadrat sampling points, and outside of the survey area via wandering traverses for opportunistic sampling of plant taxa, to collect flora specimens and to aid vegetation group mapping in the survey area. Opportunistic sampled plant taxa are listed in the table "Species List per Vegetation Group" in Appendix E.

Maps of all sample sites are included in Appendix C, Map 2, with detailed quadrat information listed in Appendix F.

3.3.3 Post-Field Methods

Unknown specimens collected in the field were identified post field work by Eren Reid and Frank Obbens with reference to published keys and samples held in the Reference Section of the Western Australian Herbarium (WAHERB, 2023).

Species information was transferred into Microsoft Excel® worksheets in preparation for PATN analysis (Belbin, 1994), via Bray and Curtis Flexible unweighted pair group method with arithmetic mean (UPGMA).

PATN Analysis was completed on both the dominant species and all species recorded within each quadrat. PATN is a software package that aims to try and display patterns in complex data. Complex in PATN's terms, requires a minimum of 6 objects (i.e., different species) and a suite of more than 4 variables (i.e., different quadrats) that describe the objects. The vegetation groups listed in Section 4.2.1.2 show the grouping of quadrats based on similarities in the flora species that are present or absent in each quadrat. This data is entered into the PATN Analysis software which produces a quantitative estimate of the relationship between species composition of each quadrat.

A Species Accumulation Curve was also generated via input into the computer program “Species Diversity and Richness IV” (Seaby & Henderson, 2006).

3.3.4 Mapping

Vegetation mapping was produced via GPS recorded information in the field, cross-referenced with vegetation descriptions made in the field, overlaid on aerial imagery of the survey area. The GPS utilized (TwoNav Aventura GPS) displayed aerial imagery, hence real-time mapping of vegetation groups was available during field work.

GPS tracks and waypoints recorded during field work are presented in Appendix C. Vegetation Health Condition was assessed in the field with reference to Keighery (1994).

3.3.5 IBSA Data Package

The Environmental Protection Authority (EPA), Department of Water and Environmental Regulation (DWER) and DMIRS require Index of Biodiversity Surveys for Assessments (IBSA) Data Packages to be submitted to support assessment and compliance under the *Environmental Protection Act 1986*.

An IBSA data package is a single file in .zip format, containing:

- one **Metadata and Licensing Statement** in .pdf format
- one **survey report** in .pdf format
- one **plain-text survey report** in .txt format; and
- a set of electronic data files, comprising:
 - one **survey details** spatial dataset in shapefile (.shp, etc.) or Mapinfo (.tab, etc.) format; and
 - one or more **survey data** spatial datasets, as required, in shapefile (.shp, etc.) or Mapinfo (.tab, etc.) format.

The IBSA Data package for this survey has been submitted via the DWER IBSA Submission Portal.

3.4 NOMENCLATURE AND TAXONOMY

Nomenclature follows that used by the WAHERB.

The WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey. Definitions of Threatened Flora are also included in Section 8 below.

3.5 LIMITATIONS

Table 1 lists potential limitations that may have affected the survey.

Table 2: List of potential survey limitations

Possible Limitation	Constraint	Comment
Competency/experience of the consultant carrying out the survey	No	Experienced and competent personnel conducted the survey. Eren Reid has over 18 years' experience in botanical surveys throughout the Goldfields and over a variety of environments across Western Australia.
Scope	No	The Scope of work was adequately defined. Vascular flora species were the focus of the survey and were thoroughly sampled.
Proportion of flora identified, recorded and/or collected	No	All taxa not identified in the field were collected and pressed, and later identified by Eren Reid or Frank Obbens. See also Species Accumulation Curve in section 4.2.2.2.
Sources of information	No	Information on flora and vegetation of the region and local area was available from publicly available databases, books and reports.
Proportion of the tasks achieved	No	All tasks completed.
Timing/season	No	This survey was undertaken in September 2022. Local rainfall in 2022 was below average for most months prior to the survey excluding April, July and September. Rainfall received in September was more than 5 times the monthly average in 2022. The survey coincided with flowering of many flora species that were invigorated by the September rainfall.
Disturbance in survey area	Yes	Disturbances within the survey area included the Goldfields Highway, existing open pits and waste landforms, as well as exploration areas. The disturbances did not significantly compromise the results of the survey as these areas were avoided whilst collecting data.
Intensity of survey effort	No	The survey intensity is considered to have been sufficient for a detailed survey according to EPA (2016) guidelines. Areas most likely to contain threatened and priority species were targeted. Vegetation mapping sites were selected to provide adequate coverage of the survey area. The Species accumulation curve suggests sampling efficacy was sufficient.
Resources	No	Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the detailed survey.
Remoteness and/or access problems	No	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information for the region	No	Contextual information regarding vegetation and flora around the Eastern Murchison subregion is readily available. Adequate information was able to be accessed from available databases.

4 RESULTS

4.1 PRELIMINARY DESKTOP ASSESSMENT

4.1.1 EPBC Protected Matters Search Tool

The EPBC Protected Matters report indicated no TECs or Commonwealth Reserves within the requested search area.

The results of the EPBC Protected Matters search are included in Appendix A.

4.1.2 Threatened Flora and Communities

The DBCA database searches revealed a potential for no Threatened and 3 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2023a). No known locations of Threatened or Priority Flora occur within the survey area.

Results of the threatened flora database search are included in Table 2 below.

Table 3: Threatened flora database search results

TAXON	CONS_CODE	Likelihood of occurring in survey area- Comment post field work
<i>Angianthus prostratus</i>	P3	Unlikely- possible suitable habitat , extensively searched
<i>Calytrix praecipua</i>	P3	Unlikely- possible suitable habitat , extensively searched
<i>Nicotiana salina</i>	P1	Unlikely- possible suitable habitat , extensively searched

The PEC/TEC search revealed no TECs within 50km of the survey area (DBCA, 2023).

The search identified two Priority Ecological Communities (PEC) within 50 km of the Survey Area; both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station (Appendix A). It is known for its unique assemblages of invertebrates in the groundwater calcretes and is threatened by hydrological changes associated with mining. The remaining PEC is located 25 km to the west of the Survey Area. It was assigned a 'Low likelihood' to occur within the survey area based on the restriction to a palaeodrainage system on Sturt Meadows Station.

4.1.3 Environmentally Sensitive Areas and Conservation Reserves

No ESAs are located within the survey area (DWER, 2023).

4.1.4 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture mapped the Land Systems of Western Australia (DPIRD, 2017). The Land Systems occurring within the survey area are listed in Table 4 below, and displayed in Appendix C.

Table 4: Land Systems occurring within the survey area (DPIRD, 2017)

Land System	Description	Extent of Survey Area (ha)	% Of Survey Area (%)	Total Eastern Murchison Extent (ha)	% of Eastern Murchison extent within survey area
Rainbow System	Hardpan plains supporting mulga tall shrublands.	320.13	9.00	235,345.67	0.14
Violet System	Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains; supporting groved mulga and bowgada shrublands and occasionally chenopod shrublands.	221.49	6.23	418,724.97	0.05
Leonora System	Low greenstone hills and stony plains supporting mixed chenopod shrublands.	152.74	4.29	125,955.45	0.12
Tiger System	Gravelly hardpan plains and sandy banks with mulga shrublands and wanderrie grasses.	102.70	2.89	110,095.64	0.09
Gundockerta System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.	2,241.51	63.00	330,076.45	0.68
Brooking System	Prominent ridges of banded iron formation supporting mulga shrublands and occasional minor halophytic communities.	182.69	5.13	96,123.30	0.19
Carnegie System	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and <i>Acacia</i> tall shrublands.	336.75	9.46	1,664,130.07	0.02

4.1.5 Vegetation Type, Extent and Status

One vegetation unit defined by Beard (1990) was identified as part of the desktop assessment. Vegetation units identify the Pre-European extent of vegetation, as mapped by Beard (1990). The national objectives and targets for biodiversity conservation recognise that the retention of 30% or more of the pre-clearing extent of Beard’s vegetation associations is necessary if Australia’s biological diversity is to be protected.

Information relating to the known Beard (1990) vegetation units within the survey area has been summarised in Tables 5, 6, 7, 8 and 9 below. This information has been compiled through both desktop assessments and the site visit. The extent of Beard vegetation units within the survey area is less than 1.5% of the total area at each scale (Table 5), and each are above the 30% threshold at a State, bioregional and subregional level (Tables 6, 7, 8 & 9).

Table 5: Extent of Beard Association within the survey area

Beard Vegetation Association	Extent within survey area (ha)	% of survey area (%)	% of extent at each scale^
18	382.74	10.76	<1%
28	1,994.72	56.06	0<1.5%
39	272.98	7.67	<1%
676	907.61	25.51	<1%

^ **By Association (WA)** (Shepherd et al., 2002), **By Association (WA)**, **By IBRA Region** (Murchison), **By IBRA Sub-region** (Eastern Murchison) and **By LGA** (Shire of Leonora) (DBCA, 2019).

Table 6: Summary of information regarding Pre-European and current vegetation extent of vegetation association 18 within the survey area

Factor	Value				
Beard Vegetation Association*	18				
Vegetation Association Description*	Low woodland; mulga (<i>Acacia aneura</i>)				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (Murchison)	By IBRA Sub-region (Eastern Murchison)	By LGA (Shire of Leonora)
	22,029,557*	19,892,306**	12,363,252**	10,269,896**	2,010,057**
% Pre-European Extent Remaining	100.00%*	99.75%**	99.68%**	99.66%**	99.62%**
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2

**Source: DBCA, (2019)

*** Source: Field Assessment

Table 7: Summary of information regarding Pre-European and current vegetation extent of vegetation association 28 within the survey area

Factor	Value				
Beard Vegetation Association*	28				
Vegetation Association Description*	Open low woodland; mulga				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (Murchison)	By IBRA Sub-region (Eastern Murchison)	By LGA (Shire of Leonora)
	317,397*	395,895**	220,583**	141,411**	126,344**
% Pre-European Extent Remaining	100.00%*	99.06%**	98.35%**	97.38%**	98.25%**
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2

**Source: DBCA, (2019)

*** Source: Field Assessment

Table 8: Summary of information regarding Pre-European and current vegetation extent of vegetation association 39 within the survey area

Factor	Value				
Beard Vegetation Association*	39				
Vegetation Association Description*	Shrublands; mulga scrub				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (Murchison)	By IBRA Sub-region (Eastern Murchison)	By LGA (Shire of Leonora)
	4,856,768*	6,613,567**	1,138,064**	711,328.84**	252,141**
% Pre-European Extent Remaining	100.00%*	99.83%**	99.10%**	98.68%**	97.56%**
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2

**Source: DBCA, (2019)

*** Source: Field Assessment

Table 9: Summary of information regarding Pre-European and current vegetation extent of vegetation association 676 within the survey area

Factor	Value				
Beard Vegetation Association*	676				
Vegetation Association Description*	Succulent steppe; samphire				
Pre-European Extent (ha)	Scale				
	By Association (WA)	By Association (WA)	By IBRA Region (Murchison)	By IBRA Sub-region (Eastern Murchison)	By LGA (Shire of Leonora)
	1,907,938*	2,063,413**	382,704**	369,324**	207,892**
% Pre-European Extent Remaining	99.01%*	95.18%**	99.97%**	99.97%**	99.95%**
Surrounding Land Use***	Mining, Exploration, Prospecting, Pastoral Lease				
Weed prevalence***	Low				

* Source: Shepherd *et al.* (2002) Appendix 2

**Source: DBCA, (2019)

*** Source: Field Assessment

4.1.6 Wetlands

No water bodies were identified within the survey area via the CPS Map Viewer. The closest waterbody lies 400 m south of the survey area (DWER, 2023).

4.1.7 Dieback

The survey area receives average annual rainfall of approximately 236.4 mm (BOM, 2023). Under normal circumstances Dieback is only considered a potential issue for any project if the project

area lies within the Southwest Land Division and the mean annual rainfall of the area is greater than 400 mm. There is no record of *Phytophthora cinnamomi* (Dieback) establishing in natural ecosystems in regions receiving <400mm rainfall per annum (CALM, 2003). However, as indicated within the more recent Dieback guidelines (DBCA, 2020), other species of *Phytophthora* may persist east of the 400mm isohyet in unusually wet conditions. Therefore, if any clearing is to be completed within the survey area, it is recommended to conduct a risk assessment as per these guidelines.

Additionally, if clearing is proposed within the survey area, all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc.*) which poses a risk in the survey area during seasonally favourable conditions.

4.2 FIELD ASSESSMENT

4.2.1 Vegetation of the Survey Area

Beard's vegetation associations are very broad and are used over large areas in which there is also a large amount of variation at a more local level. The vegetation groups described below for the survey area fit into the broader Beard description above in section 4.1.5.

The vegetation groups described below were determined visually based on dominant species and topographical features, to form the descriptions taken at the time of the field survey.

Descriptions of all 59 sites/quadrats are presented in Appendix F. For each of these sites, the physical features, vegetation description and unit, along with the species lists for the 20 x 20m plots with typical canopy cover and height, are provided.

4.2.1.1 Vegetation Groups

Sixteen vegetation groups were identified during this survey, largely following topographical features and dominant species. Table 10 summarises the vegetation group extent and relative Quadrat and flora information. Mapping of the 16 vegetation groups, as well as the quadrat locations can be seen in Appendix C. Photographs of each quadrat and the relevant vegetation group can be seen in Appendix F.

Table 10: Vegetation Group Extent within Survey Area

Vegetation Group	Vegetation Group Code	Quadrats	Family	Genera	Species	Area (ha)	Percentage of Survey Area (%)
Open Mulga Woodland over Chenopod Shrubland	A	Q1, Q4, Q7, Q15, Q25 and Q59	26	44	80	261.07	7.34
Creekline Vegetation	B	Q2, Q5, Q6, Q45, Q48 and Q50	25	48	70	170.32	4.79
Mulga Woodland	C	Q3, Q11, Q12, Q13, Q16, Q20 and Q46	20	32	55	890.80	25.03
Mulga over <i>Senna</i> shrubland	D	Q8, Q28 and Q57	11	17	25	115.33	3.24
Mulga over Chenopod Shrubland	E	Q9, Q23, Q24 and Q49	21	32	56	411.62	11.57
Mulga over Ironstone and Quartz outcrops	F	Q10, Q56 and Q58	14	20	28	2.96	0.08
Open Low Chenopod Shrubland	G	Q14, Q18 and Q19	13	22	32	393.74	11.06
<i>Eremophila youngii</i> subsp. <i>youngii</i> over Chenopod and <i>Tecticornia</i> shrubland	H	Q17, Q26, Q54 and Q55	11	19	25	35.88	1.01
<i>Acacia quadrimarginea</i> shrubland over rocky plain	I	Q21	13	16	21	17.67	0.50
Mulga over <i>Eremophila forrestii</i> and <i>Eremophila compacta</i>	J	Q22, Q27, Q29 and Q31	17	22	31	121.57	3.42
Mulga over Banded Ironstone Formation (BIF)	K	Q30, Q32 and Q33	18	26	49	60.43	1.70
<i>Acacia duriuscula</i> over <i>Maireana sedifolia</i> and <i>Scaevola spinescens</i>	L	Q34, Q35 and Q36	12	17	29	9.05	0.25
<i>Tecticornia</i> shrubland	M	Q37, Q39, Q40 and Q44	6	10	15	85.43	2.40
Mulga over <i>Melaleuca interioris</i> and <i>Eremophila miniata</i> sand dune	N	Q38, Q41 and Q47	15	24	32	38.43	1.08
<i>Melaleuca sheathiana</i> over <i>Cratystylis subspinescens</i> and <i>Tecticornia</i> shrubland	O	Q42 and Q43	13	20	23	9.54	0.27
<i>Acacia burkittii</i> creekline vegetation	P	Q51, Q52 and Q53	18	28	39	6.62	0.19
Bare Salt Lake	Q	None	N/A	N/A	N/A	15.93	0.45
Existing Disturbance	R	None	N/A	N/A	N/A	912.23	25.63
		Total	42*	95*	201*	3558.62#	100%#

*Denotes total recorded in the survey area (not sum of column)

Denotes sum of column

4.2.1.2 PATN Analysis of Quadrat Data

PATN analysis was used to determine the similarities or differences between and within the delineated vegetation groups. The results are supplied below in Figure 6 and Figure 7 as dendrograms. Dendrograms demonstrate the hierarchical relationship between objects.

Quadrats representing similar vegetation groups (as depicted in field work by NVS) are based on species composition, density, topographical features and/or lithology. The PATN analysis does not take these factors into account, and only demonstrates similarities based on presence/absence data within each quadrat. Therefore, PATN analysis groupings are not necessarily distinct, when defining vegetation groups. Hence quadrats depicted as outliers are expected when variations in species composition occurs between quadrats of the same predetermined vegetation grouping.

The PATN analysis dendrogram of the dominant species in Figure 6, displays each quadrat with like symbols representing the NVS mapped vegetation groups, and coloured lines depicting PATN defined vegetation groups. The dendrogram shows a good association between vegetation groups described in section 4.2.1.1, as there were 13 outliers. Outliers are quadrats that do not show a good association with other quadrats in the same NVS mapped vegetation group.

Outliers are expected to occur for most vegetation groups. In most cases one or two dominant species will be present within a 20x20 quadrat, but it will not contain all the varieties of dominant species that will occur across that vegetation type, and as such some quadrats of the same vegetation group will be separated when assessed by the PATN Analysis.

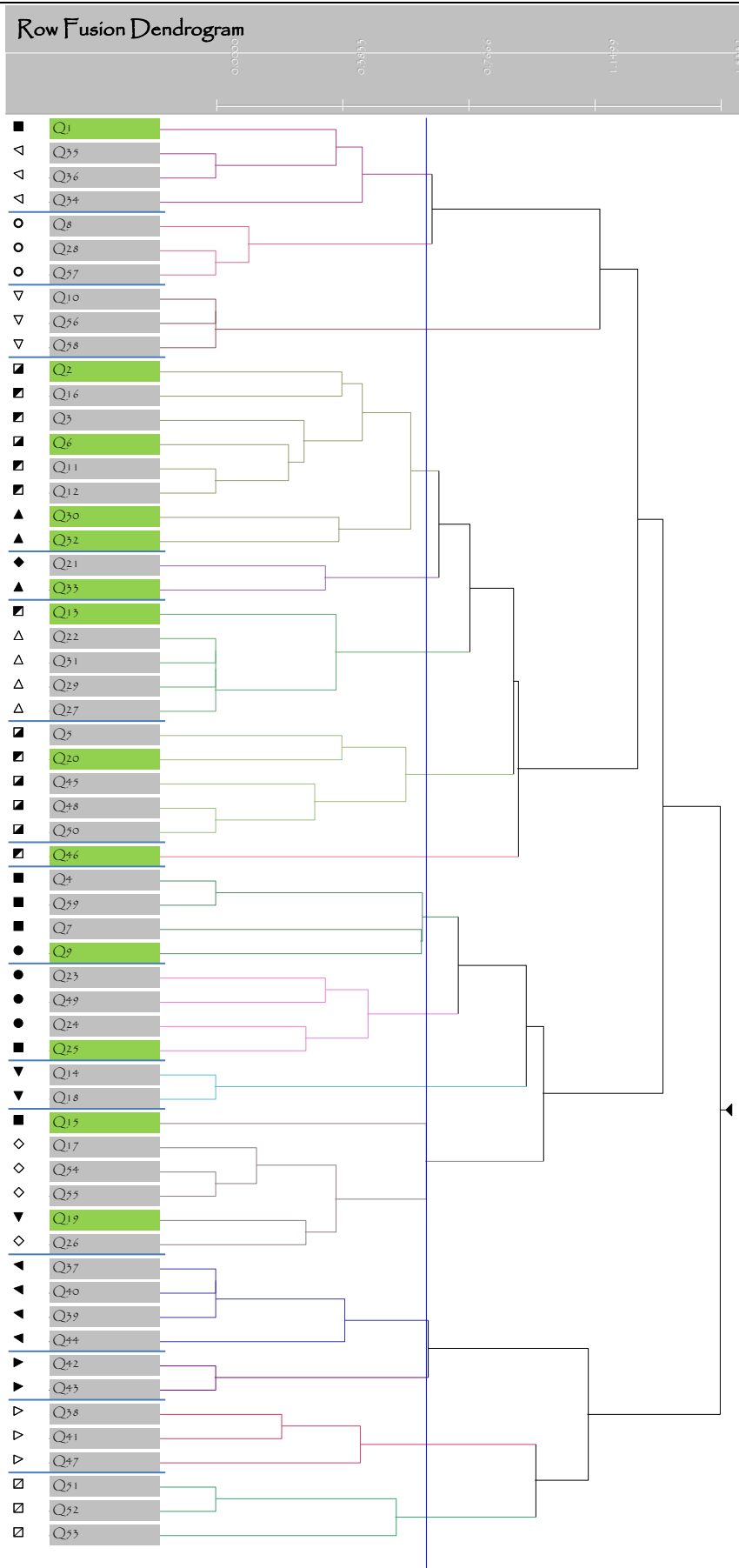


Figure 6: PATN Analysis of Dominant Species into 16 groups

The dendrogram below (Figure 7) of the analysis of all species shows a correlation to pre-grouped quadrats described in section 4.2.1.1. The dendrogram displays each quadrat with like symbols representing NVS mapped vegetation groups, and coloured lines depicting PATN defined vegetation groups. The All species PATN analysis shows a good association between vegetation groups as there were only eight outliers (Figure 7). Outliers are quadrats in the PATN Analysis that do not show a good association with other quadrats in the same vegetation group mapped by NVS. This is expected due to the unweighted nature of PATN analysis, which does not take into account topographical/lithological features or the density of key species defining the vegetation group.

All 16 vegetation groups were well represented via all species PATN Analysis, with all NVS grouped quadrats forming in the analysis. Of the 176 species detected within Quadrats, only eight were shared across 10 or more different vegetation groups.

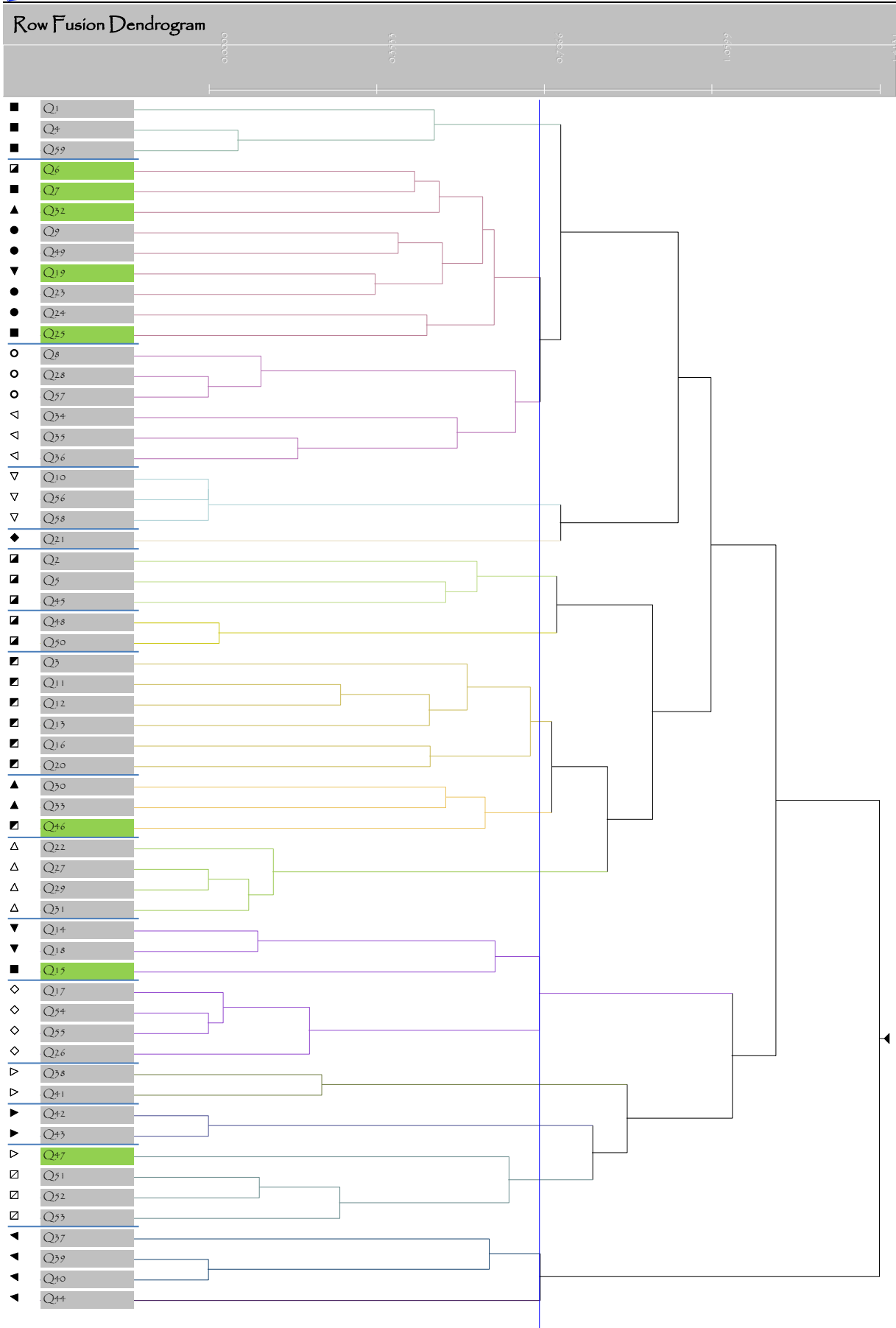


Figure 7: PATN Analysis of All Species into 16 groups

4.2.1.3 Vegetation Condition

Vegetation in the survey area has been subjected to historical exploration and mining activities and grazing.

In accordance with the Keighery (1994) scale, most of the sites/quadrats inspected were in Good to Very Good condition (Appendix F). Disturbed areas were present within the survey area, mostly attributed existing roads, historical open pits and historical waste land forms. The vegetation more than 0.5m off these tracks was mostly in Good to condition (Keighery 1994).

As discussed below in Section 4.2.2.4 below, there were eighteen non-native species recorded in the survey area.

4.2.2 Flora of the Survey Area

4.2.2.1 General

Two-hundred and one species were recorded within the survey area with 176 species recorded within quadrats. Forty-two families and 95 genera were recorded overall. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Asteraceae had the highest representation, with 31 species from 21 genera. The next best represented families were Chenopodiaceae and Fabaceae with 30 and 25 species respectively.

The most common and widespread species was *Ptilotus obovatus* which was recorded in 41 quadrats. The next most common were *Erodium cymorum* and *Maireana pyramidata*, both occurring in 35 quadrats.

Quadrats Q53 and Q59 had the richest species list with 34 taxa recorded in both.

Eighteen introduced weed species were detected within the survey area. Three of these are considered Declared Pests (DPIRD, 2023), *Cylindropuntia imbricata*- s22(2) C3 Restricted, *Opuntia stricta*- s22(2) C3 Restricted and *Rumex vesicarius*- Prohibited s12 C1 Prohibited.

4.2.2.2 Species Accumulation Curve

A Species Accumulation Curve was generated using the computer programme Species Diversity and Richness- Version 4.1.2 (Seaby & Henderson, 2006). The model assumed 59 random selections of sample order. This curve was then fitted to a logarithmic curve in Excel® (Figure 8). The logarithmic trend line and R² values were generated in Excel®. According to the Species Accumulation Curve below, the R² value (0.993) shows an acceptable fit for a logarithmic curve of the total accumulated species per number of quadrats established (Figure 8).

Sufficient sampling was inferred via the effort of intensity (number of quadrats established) versus the return of species collected (total accumulated species). From this fitted logarithmic curve formula, sufficient sampling was determined where the gain of new species was less than 1% for every new quadrat established. Based on this reasoning, sufficient sampling would be reached at 30 quadrats, at which the extrapolated total accumulated number of species would be 147. Therefore the 176 species collected within the 59 quadrats represents 119% of the predicted total abundance.

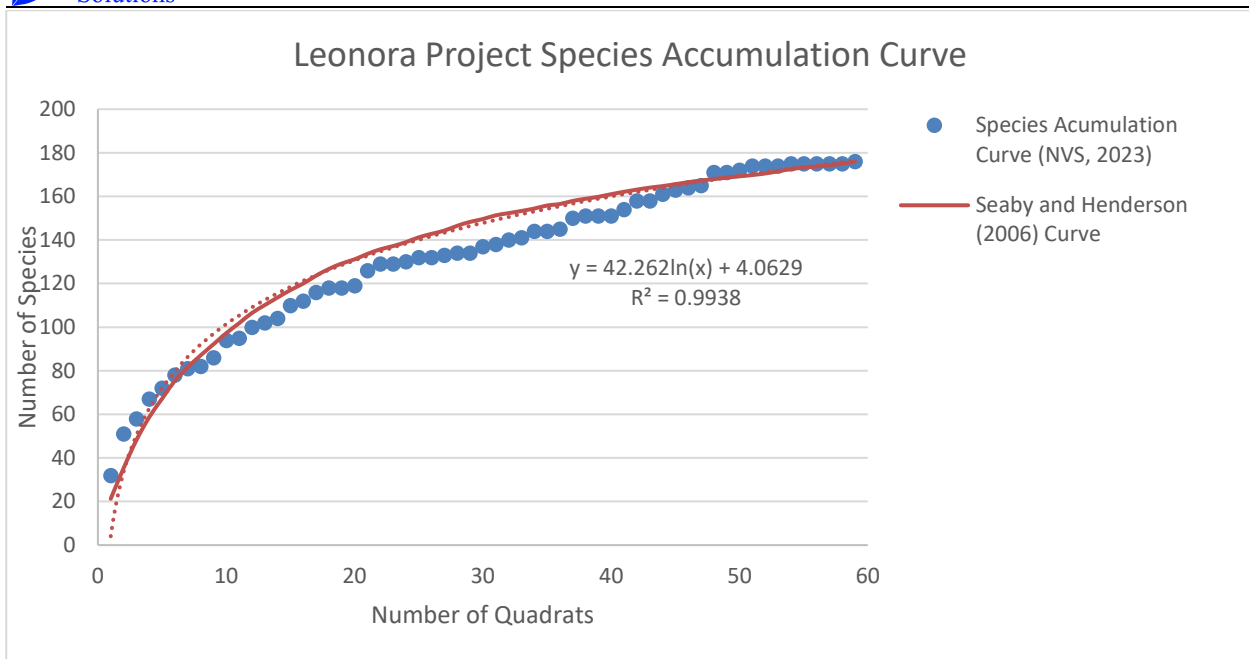


Figure 8: Species Accumulation Curve for the 59 sampled quadrats

4.2.2.3 Conservation significant species

No Threatened flora were recorded in the survey area.

No Priority flora were recorded in the survey area.

One species recorded in the survey area, *Sondottia connata* is considered a significant range extension to already known population locations. The Leonora location is more than 200km east of known locations west of Lake Barlee and Mount Magnet.

4.2.2.4 Introduced species

Eighteen introduced weed species were detected within the survey area. Three of these are considered Declared Pests (DPIRD, 2023), *Cylindropuntia imbricata*- s22(2) C3 Restricted, *Opuntia stricta*- s22(2) C3 Restricted and *Rumex vesicarius*- Prohibited s12 C1 Prohibited.

The other 15 introduced species recorded were:

- Aloe vera*
- Asphodelus fistulosus*
- Carrichtera annua*
- Cenchrus ciliaris*
- Citrullus amarus*
- Cuscuta planiflora*
- Lysimachia arvensis*
- Medicago laciniata*
- Medicago minima*
- Salvia verbenaca*

- *Schinus molle* var. *areira**
- *Sisymbrium erysimoides**
- *Sisymbrium irio**
- *Solanum nigrum**
- *Sonchus oleraceus**

5 DISCUSSION

The survey area is located within the Eastern Murchison subregion (CALM, 2002). Results of this survey indicate that the majority of the flora within the survey area is not unique and is in fact common throughout the Eastern Murchison subregion and adjoining regions.

Two-hundred and one species were recorded within the survey area with 176 of those species recorded within quadrats. Forty-two families and 95 genera were recorded overall. These are listed in Appendix E, per Quadrat as well as per vegetation group. Of the native species, Asteraceae had the highest representation, with 31 species from 21 genera. The next best represented families were Chenopodiaceae and Fabaceae with 30 and 25 species respectively.

The most common and widespread species was *Ptilotus obovatus* which was recorded in 41 quadrats. The next most common were *Erodium cymorum* and *Maireana pyramidata*, both occurring in 35 quadrats.

Quadrats Q53 and Q59 had the richest species list with 34 taxa recorded in both.

The database searches revealed a potential for no Threatened and 3 Priority Flora species to occur within a 20 km radius of the survey area (DBCA, 2023a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Priority Flora located approximately 8.6 km south of the survey area.

No Threatened Flora were recorded in the survey area.

No Priority Flora were recorded in the survey area.

One species recorded in the survey area, *Sondottia connata* is considered a significant range extension to already known population locations. The Leonora location is more than 200km east of known locations west of Lake Barlee and Mount Magnet.

The PEC/TEC search revealed no TECs occur within 50km of the survey area (DBCA, 2023).

The search did identify two PECs within 50 km of the Survey Area; both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station. It is known for its unique assemblages of invertebrates in the groundwater calcretes and is threatened by hydrological changes associated with mining. The remaining PEC is located 25 km to the west of the Survey Area. It was assigned a 'Low likelihood' to occur within the survey area based on the restriction to a palaeodrainage system on Sturt Meadows Station.

Vegetation condition was generally 'Good' to 'Very Good' (Keighery 1994). Disturbance was present within the survey area and mostly attributed to access tracks and exploration related activities, as well as waste landforms and open pits.

Eighteen introduced weed species were detected within the survey area. Three of these are considered Declared Pests (DPIRD, 2023), *Cylindropuntia imbricata*- s22(2) C3 Restricted, *Opuntia stricta*- s22(2) C3 Restricted and *Rumex vesicarius*- Prohibited s12 C1 Prohibited.

Given the above, any potential future clearing within the survey will not result in significant impacts such as vegetation fragmentation or the loss of vegetation associations or species that may be unique. This is partially due to the relevant size of the survey area in comparison to similar abundant vegetation and habitat represented and retained outside of the survey area.

IMPACT ASSESSMENT

5.1 THREATENING PROCESSES

Proposed clearing may affect the Flora within the survey area via the following ways:

- Vehicle use damaging vegetation if existing tracks are not adhered to;
- The introduction and increased abundance of non-native species;
- Dust generated during clearing of native vegetation and associated activities may settle on adjacent native vegetation, causing possible stress and perhaps death, especially during drier months; and
- Accidental fire, arising from clearing and associated activities, may affect vegetation in surrounding areas.

6 CONCLUSIONS

This report summarises the results of a detailed flora and vegetation survey.

The survey established that the condition of most of the vegetation in the survey area is overall 'Good' to 'Very Good' condition. No Threatened or Priority Flora were recorded in the area. No TECs were recorded in the survey area.

The search did identify two PECs within 50 km of the Survey Area; both listed as Priority 1. One of PECs intersects the Survey Area at both Gwalia and Tower Hill: The Melita calcrete groundwater assemblage type on Raeside palaeodrainage on Melita (Sons of Gwalia) Station. It is known for its unique assemblages of invertebrates in the groundwater calcretes and is threatened by hydrological changes associated with mining. The remaining PEC is located 25 km to the west of the Survey Area. It was assigned a 'Low likelihood' to occur within the survey area based on the restriction to a palaeodrainage system on Sturt Meadows Station.

The EPA objective for flora and vegetation is to maintain the abundance, species diversity and geographical distribution of flora and vegetation as well as protect Threatened flora consistent with the provisions of the *Biodiversity Conservation Act 2016*. Most of the species and communities recorded during this survey are widespread throughout the Eastern Murchison subregion and adjoining regions.

7 REFERENCES

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

Belbin, L. (1994). *PATN: pattern analysis package: Technical reference*, Division of Wildlife and Ecology, CSIRO

BOM, (2023), *Climate Data Online*, Bureau of Meteorology
<http://www.bom.gov.au/climate/data/>
Accessed: 01/01/2023

CALM, (2002), *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002 (MUR01 – Eastern Murchison Subregion)*, Department of Conservation and Land Management

CALM, (2003), *Phytophthora cinnamomi and Diseases Caused by It, Volume 1-Management Guidelines*, Department of Conservation and Land Management
<https://library.dbca.wa.gov.au/FullTextFiles/021873.pdf>
Accessed: 01/01/2023

DBCA, (2019), *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report)- Current as of March 2019*, WA Department of Biodiversity, Conservation and Attractions, Perth,
<https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>
Accessed: 01/01/2023

DBCA, (2019a) Conservation Codes for Western Australian Flora and Fauna. Department of Biodiversity, Conservation and Attractions, Western Australia, January 2019

DBCA, (2020), *Phytophthora Dieback Management Manual, October 2020*, Department of Biodiversity, Conservation and Attractions, Perth
<https://www.dpaw.wa.gov.au/images/documents/conservation-management/pests-diseases/disease-risk-areas/DBCA%20PDMM%20v1.2%20October%202020.pdf>
Accessed: 01/01/2023

DBCA, (2023), *TEC/PEC Database Results Ref: 01-0123EC*, Department of Biodiversity, Conservation and Attractions

DBCA, (2023a), *Threatened Flora Database Results Ref: 13-0123FL*, Department of Biodiversity, Conservation and Attractions

DCCEEW, (2023), *Interim Biogeographic Regionalisation for Australia (IBRA)*, Department of Climate Change, Energy, the Environment and Water, Australian Government
<https://www.environment.gov.au/land/nrs/science/ibra>
Accessed: 01/01/2023

DCCEEW, (2023a), *Protected Matters Search Tool*, Department of Climate Change, Energy, the Environment and Water
<http://www.environment.gov.au/webgis-framework/apps/pmst/pmst-coordinate.jsf>
Accessed: 01/01/2023

DPIRD, (2017), *NRInfo Digital Mapping*, Department of Primary Industries and Regional Development
<https://maps.agric.wa.gov.au/nrm-info/>
Accessed: 01/01/2023

DPIRD, (2023), *Declared Plants Database*, Department of Primary Industries and Regional Development, Western Australia

<https://www.agric.wa.gov.au/pests-weeds-diseases/weeds/declared-plants>

Accessed: 01/01/2023

DWER, (2023), *Clearing Permit System Map Viewer*, Department of Water and Environmental Regulation

<https://cps.der.wa.gov.au/main.html>

Accessed: 01/01/2023

EPA, (2016), *Environmental Factor Guideline: Flora and Vegetation*, Environmental Protection Authority, Western Australia

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

Keighery, B.J., (1994), *Bushland Plant Survey; A guide to plant community survey for the Community*, Wildflower Society of Western Australia (Inc.) Nedlands

Muir, B.G. (1977), *Biological Survey of the Western Australian Wheatbelt. Pt. 2. Vegetation and habitat of the Bendering Reserve*. Records of the Western Australian Museum Supplement 3

Seaby R. M. & Henderson, P. A., (2006), *Species Diversity and Richness Version 4.1.2*, Pisces Conservation Ltd., Lymington, England.

Shepherd, D.P., Beeston, G.R., and A.J.M. Hopkins, (2002), *Land-Use and Vegetation in Western Australia- National Land and Water Resources Audit Report*, Technical Report 250, Department of Agriculture Western Australia

Smith, M.G., Jones, A., (2018) *Threatened and priority flora list for Western Australia*, Department of Biodiversity, Conservation and Attractions

WAHERB, (2023), *FloraBase- the Western Australian Flora*, Department of Parks and Wildlife

<http://florabase.dpaw.wa.gov.au/>

Accessed: 01/01/2023

8 GLOSSARY

Acronyms:

BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i> , Western Australia
BC Act	<i>Biodiversity Conservation Act 2016</i> (partly enacted), Western Australia
BOM	Bureau of Meteorology, Australian Government
BSc	Bachelor of Science
CALM	Department of Conservation and Land Management (now DBCA)
CPS	Clearing Permit System (DWER)
DBCA	Department of Biodiversity, Conservation and Attractions, Western Australia
DCCEEW	Department of Climate Change, Energy, the Environment and Water, Australian Government
DMIRS	Department of Mines, Industry Regulation and Safety, Western Australia
DPAW	Department of Parks and Wildlife, Western Australia (now DBCA)
DPIRD	Department of Primary Industries and Regional Development, Western Australia
DRF	Declared Rare Flora
DWER	Department of Water and Environmental Regulation, Western Australia
EPA	Environmental Protection Authority, Western Australia
EP Act	<i>Environmental Protection Act 1986</i> , Western Australia
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth Act)
ESA	Environmentally Sensitive Area
GIS	Geographical Information System
ha	Hectare (10,000 square metres)
IBRA	Interim Biogeographic Regionalisation for Australia, DCCEEW
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
km	Kilometres
m	Metres
MUR	Murchison Bioregion, IBRA
MUR01	Eastern Murchison Subregion, IBRA
NVS	Native Vegetation Solutions
PEC	Priority Ecological Community, Western Australia
Ramsar	A wetland site designated of international importance under the Ramsar Convention (UNESCO)
TEC	Threatened Ecological Community
UNESCO	United Nations Educational, Scientific and Cultural Organization
WA	Western Australia
WAHERB	Western Australian Herbarium, DBCA
WAOL	Western Australian Organism List
WC Act	<i>Wildlife Conservation Act 1950</i> , Western Australia

Definitions:

{DBCA (2019a) Conservation Codes for Western Australian Flora and Fauna. Department of Biodiversity, Conservation and Attractions, Western Australia, January 2019}: -

T Threatened species:

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

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

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

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

CR Critically endangered species

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

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

EN Endangered species

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

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

VU Vulnerable species

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

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

Extinct species:

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

EX Extinct species

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

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

EW Extinct in the wild species

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

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

Specially protected species

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

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

MI Migratory species

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

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

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

CD Species of special conservation interest (conservation dependent fauna)

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

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

OS Other specially protected species

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

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

P Priority Species

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

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

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

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.

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.

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.

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

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

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

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

Appendix A - EPBC and Other Government Database Search Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 02-Jan-2023

[Summary](#)

[Details](#)

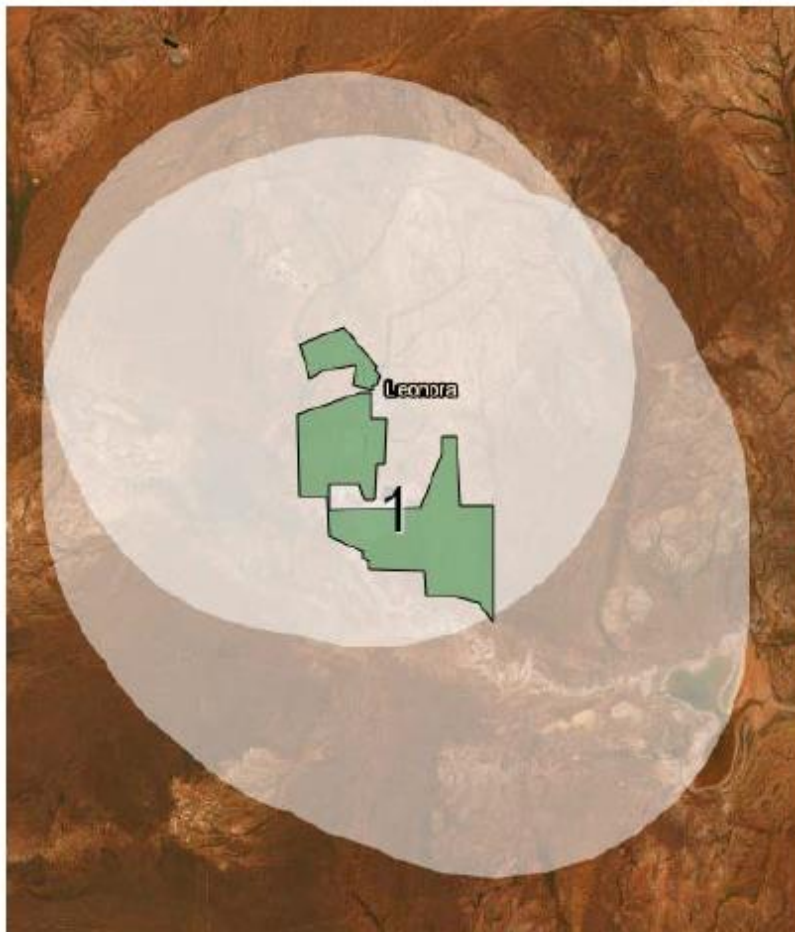
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	4
Listed Migratory Species:	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	10
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In feature area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area

Migratory Wetlands Species

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [51752]	WA	In feature area
Commonwealth Land - [51754]	WA	In feature area
Commonwealth Land - [51755]	WA	In feature area
Commonwealth Land - [52213]	WA	In feature area
Commonwealth Land - [51756]	WA	In feature area
Commonwealth Land - [52232]	WA	In feature area
Commonwealth Land - [51753]	WA	In feature area
Commonwealth Land - [51751]	WA	In feature area
Commonwealth Land - [51058]	WA	In feature area
Commonwealth Land - [52197]	WA	In feature area

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
-----------------	---------------------	---------------	---------------

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthm two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

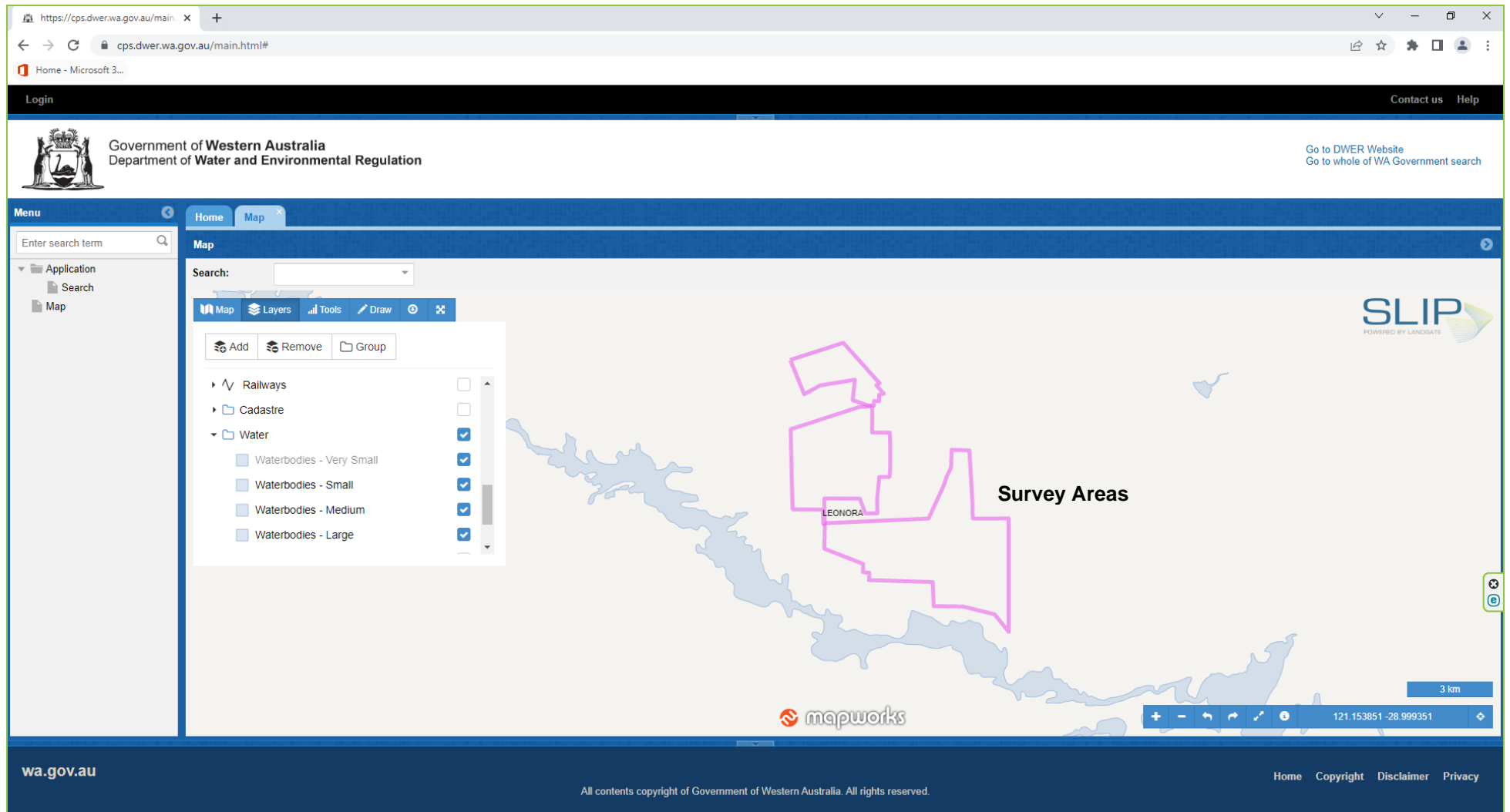
- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- [Natural history museums of Australia](#)
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

The screenshot displays the DWER CPS Map Viewer interface. At the top, the browser address bar shows the URL <https://cps.dwer.wa.gov.au/main.html#>. The page header includes the Government of Western Australia logo and the Department of Water and Environmental Regulation. A navigation menu on the left contains 'Application', 'Search', and 'Map'. The main map area is titled 'Map' and features a search bar, a toolbar with 'Map', 'Layers', 'Tools', 'Draw', and 'Print' icons, and a layer list. The layer list includes 'Clearing Regulations - Instruments', 'Clearing Referrals', 'Clearing Regulations - Environmentally S...' (checked), 'Local Government Authority', 'Overview Towns', 'Transport/Railway Stations', and 'Roads'. The map shows several pink polygons representing 'Survey Areas' and a label for 'LEONORA'. A scale bar indicates 3 km. The footer contains the 'wa.gov.au' logo, copyright information, and links for 'Home', 'Copyright', 'Disclaimer', and 'Privacy'.

DWER CPS Map Viewer - showing no ESA's (dark green shaded areas) within the survey areas (pink polygons) (DWER, 2023)



DWER CPS Map Viewer - showing no water bodies within the survey areas (pink polygons) (DWER, 2023)

The screenshot displays the DWER CPS Map Viewer interface. At the top, the browser address bar shows the URL <https://cps.dwer.wa.gov.au/main.html#>. The page header includes the Government of Western Australia logo and the Department of Water and Environmental Regulation. A search bar is located in the top right corner. The main content area features a map of the Leonora region with pink polygons representing Survey Areas and green shaded areas representing Schedule One areas. A legend on the left side of the map lists various layers, including Markup layer, Additional Layers, DER Regions, Australia, Interim Marine and Coastal R..., IBRA Australia, Mining Tenements, Clearing Regulations - Schedule One A..., and Locations. The map is powered by SLIP (powered by LANGRANGE) and Mapworks. The bottom of the page contains the website URL wa.gov.au, copyright information, and links to Home, Copyright, Disclaimer, and Privacy.

DWER CPS Map Viewer - showing Schedule One areas (green shaded area) within the survey areas (pink polygons) (DWER, 2023)

Appendix B - Vegetation Definitions

Vegetation Condition Definitions (Keighery, 1994)

Pristine (1). Pristine or nearly so, no obvious signs of disturbance.

Excellent (2). Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.

Very Good (3). Vegetation structure altered, obvious signs of disturbance.
For example, disturbance to vegetation structure caused by repeating fires, the presence of some more aggressive weeds, dieback, logging and grazing.

Good (4). Vegetation structure significantly altered by very obvious signs of multiple disturbance.

Retains basic vegetation structure or ability to regenerate it.

For example, disturbance to vegetation structure caused by frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.

Degraded (5). Basic vegetation structure severely impacted by disturbance.

Scope for regeneration but not to a state approaching good condition without intensive management.

For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

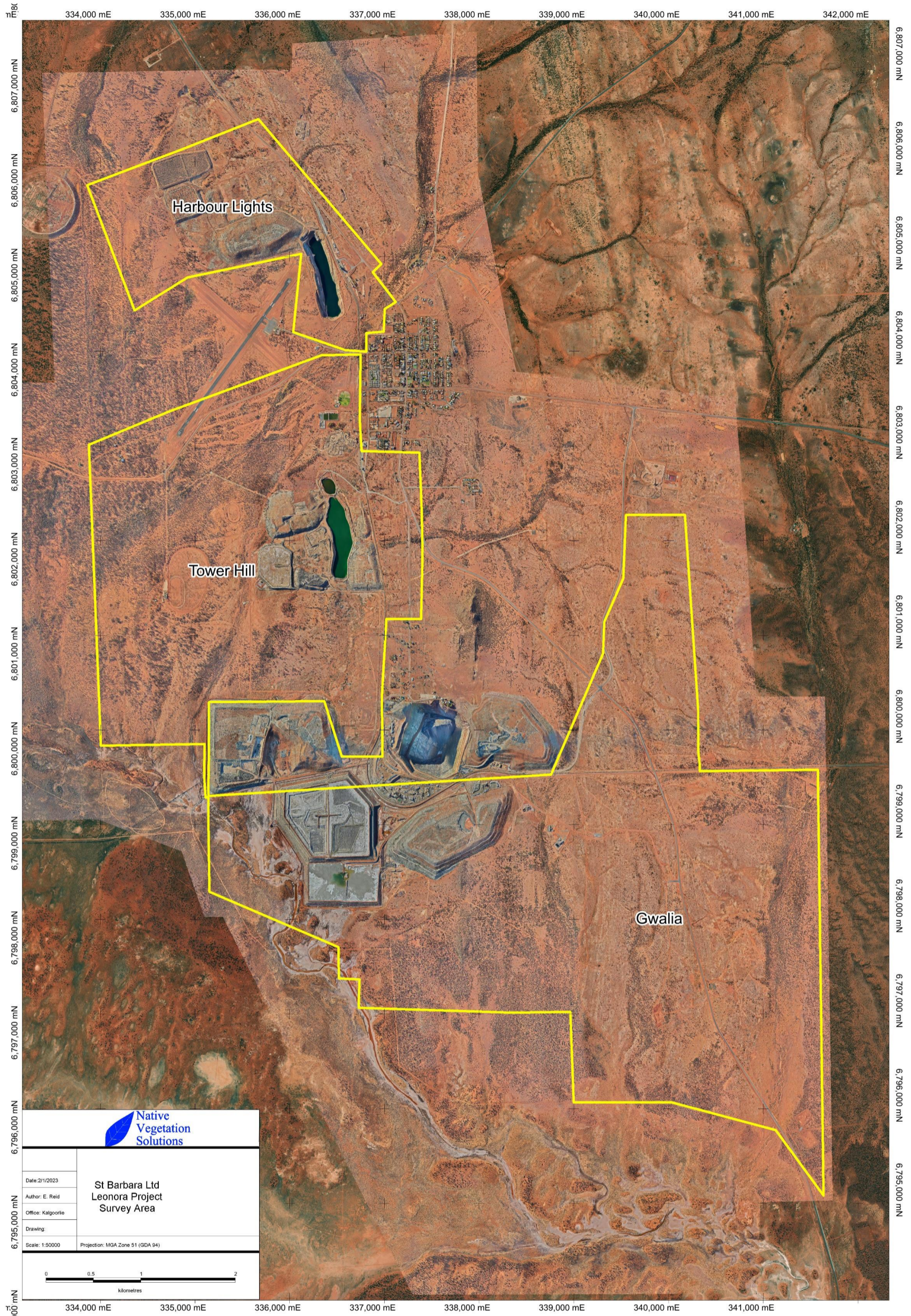
Completely Degraded (6). The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

These areas are often described as 'parkland cleared' with the flora compromising weed or crop species with isolated trees or shrubs.

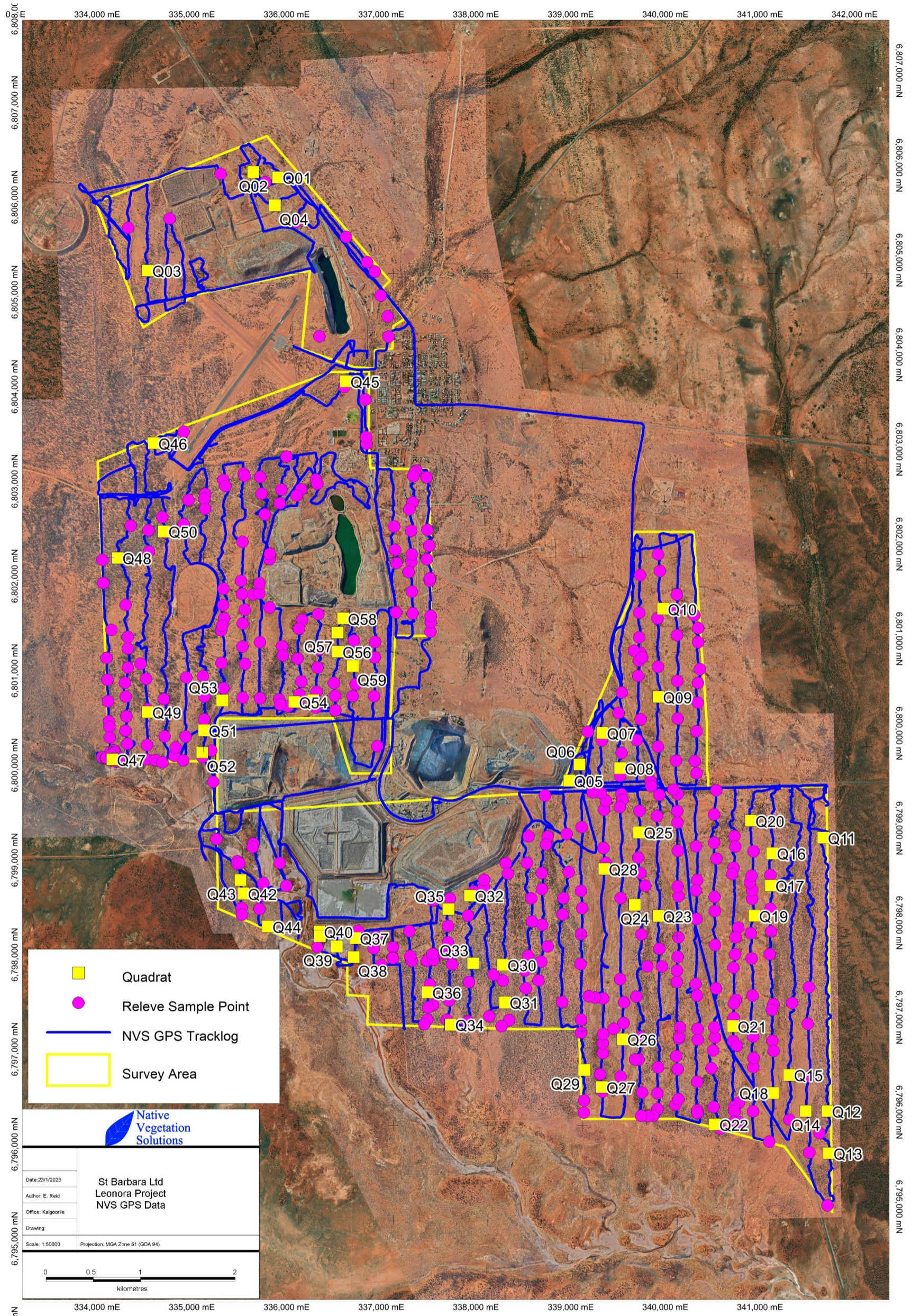
Vegetation Structure Definitions (Muir, 1977)

Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% i	Very Sparse 2-10% r
T Trees>30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB Trees<5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S Shrubs>2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H Hummock Grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

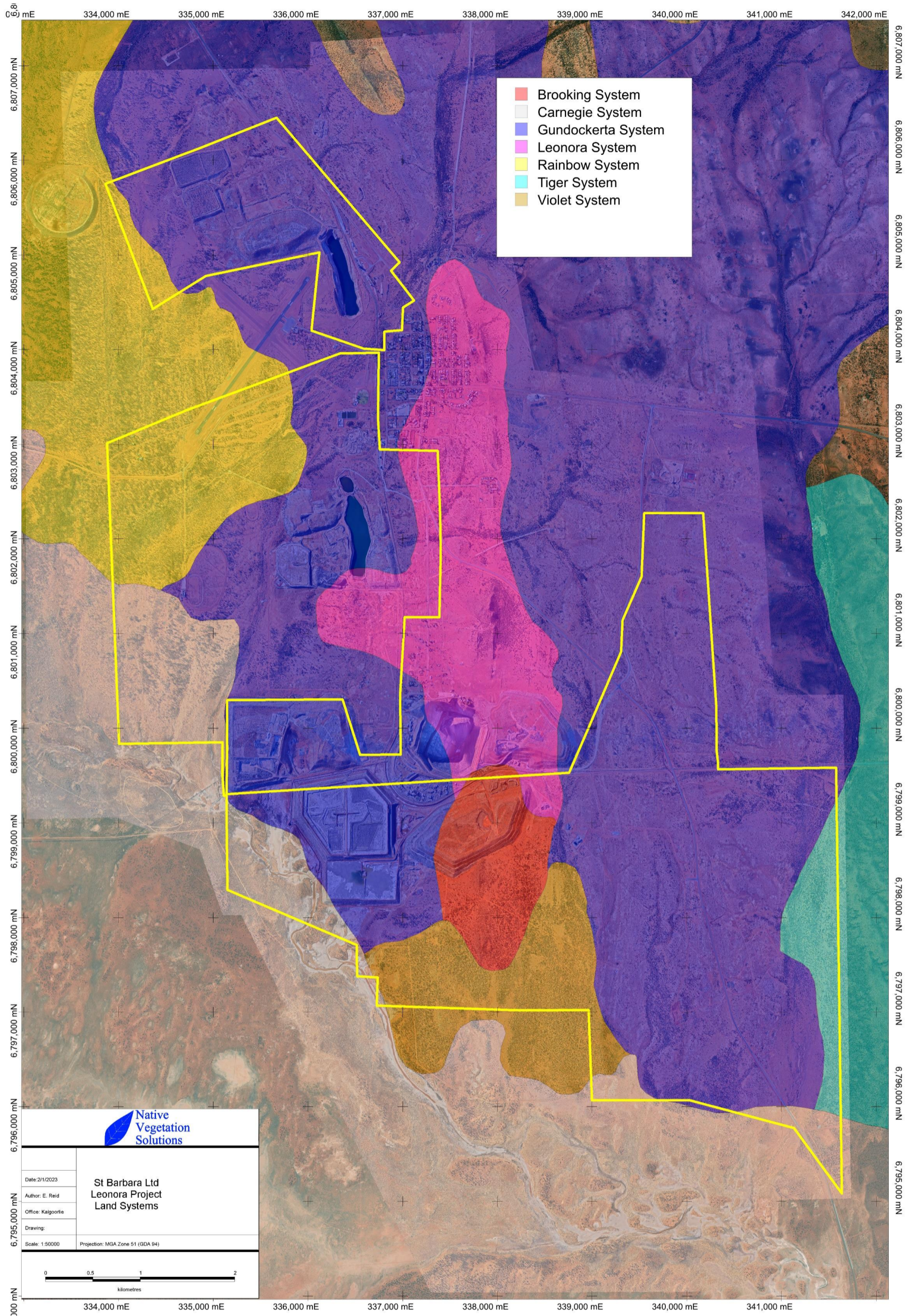
Appendix C - Mapping



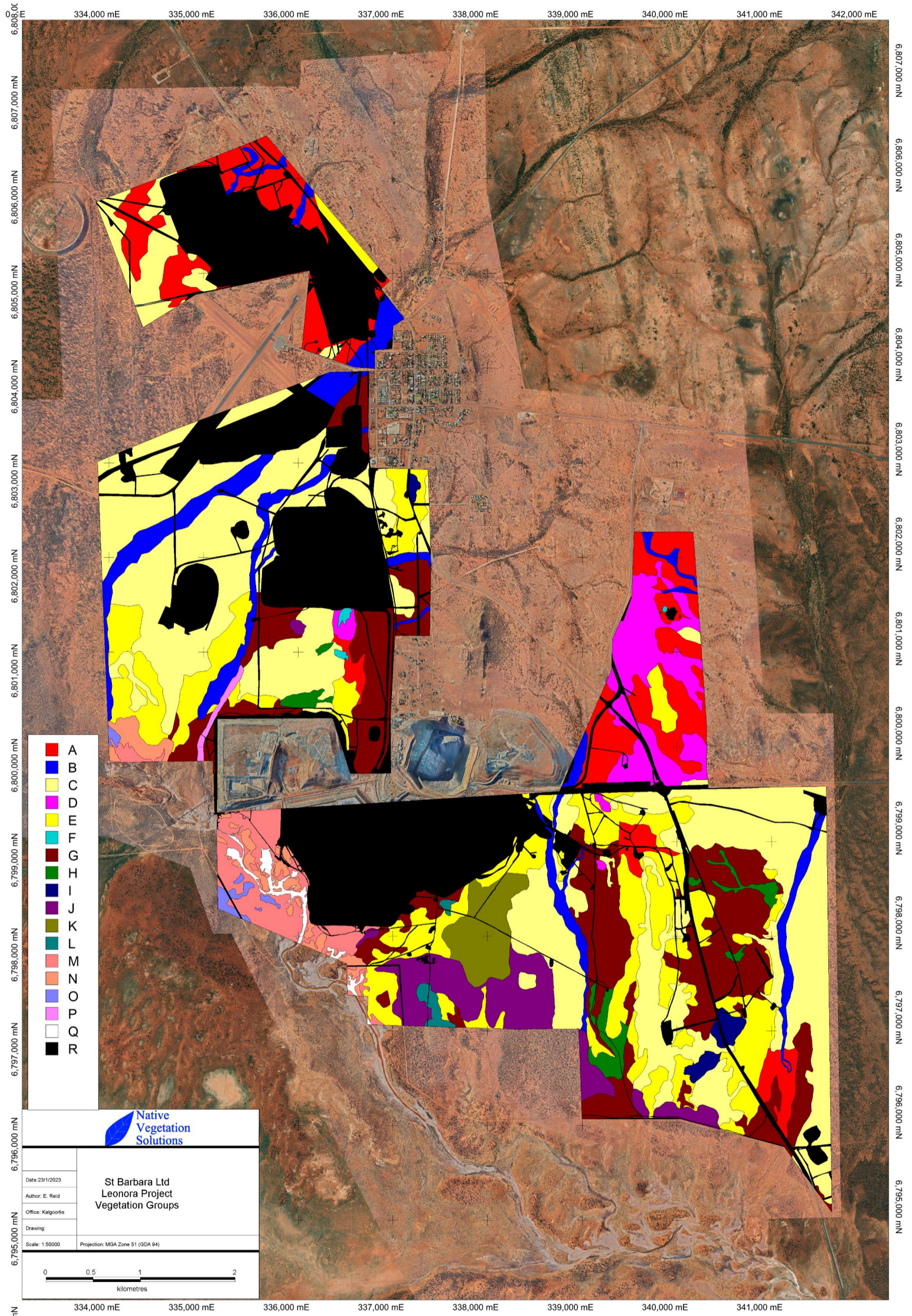
Map 1: Leonora Project Survey Area



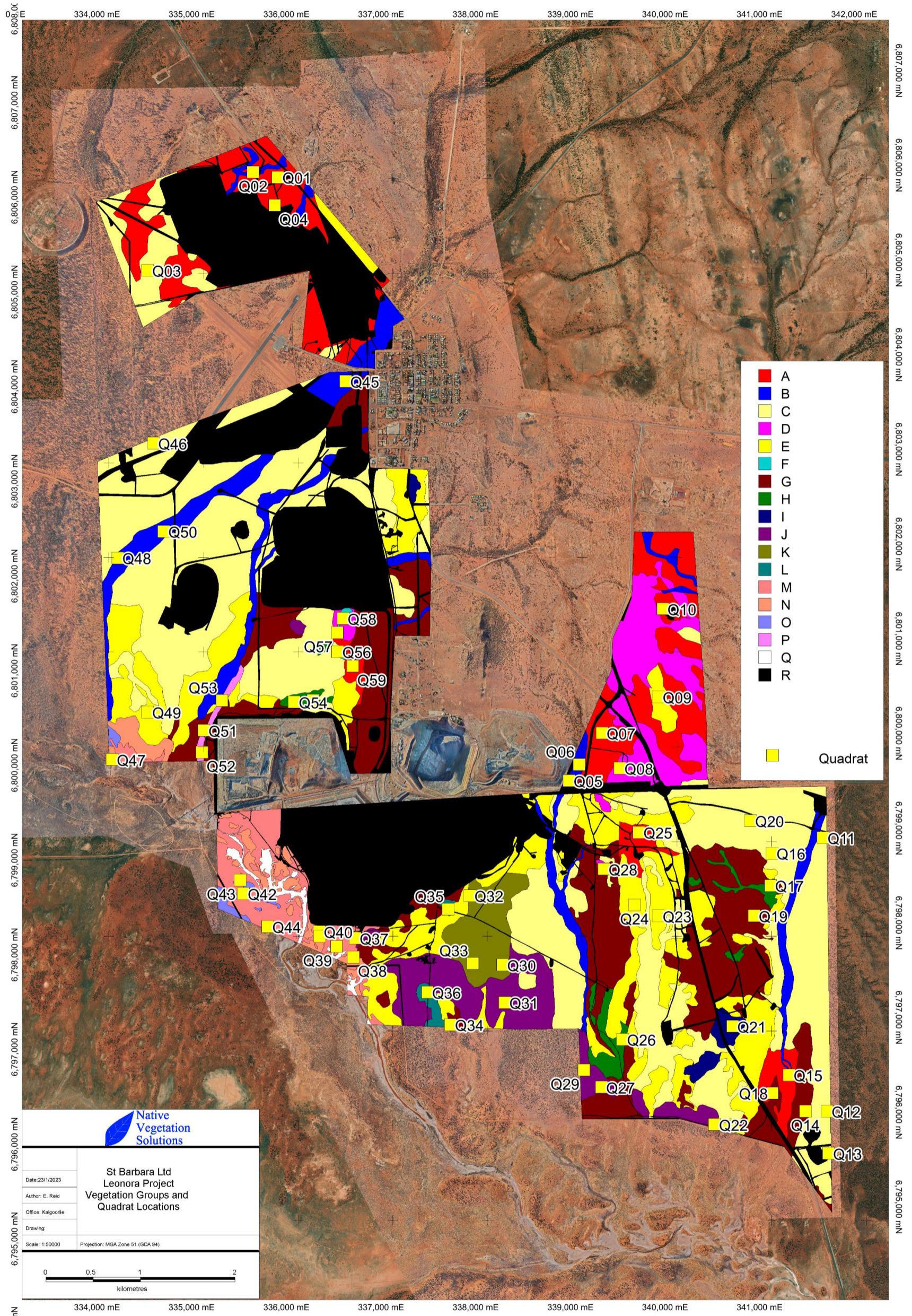
Map 2: NVS GPS Data for the Leonora Project



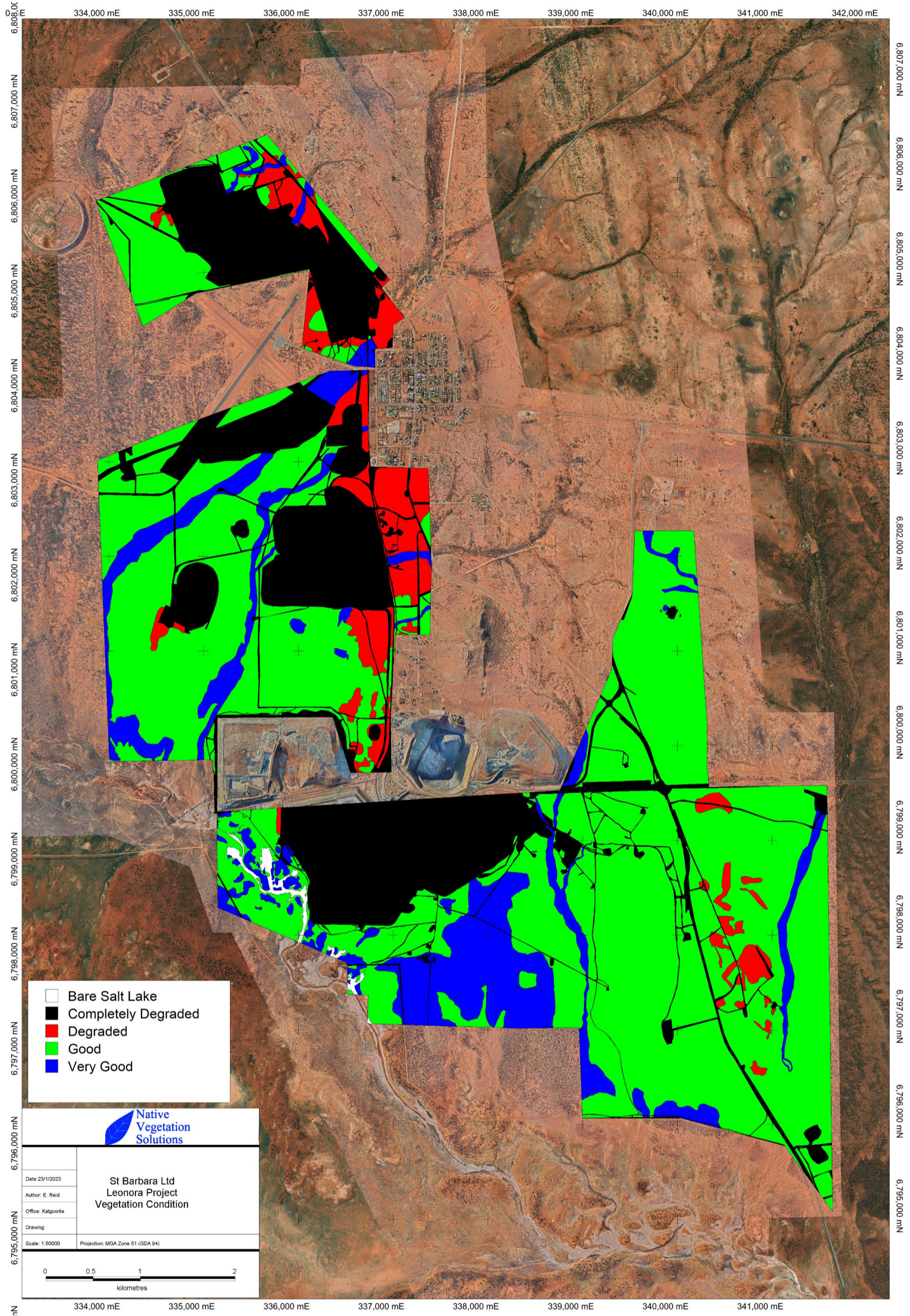
Map 3: Land Systems for the Leonora Project



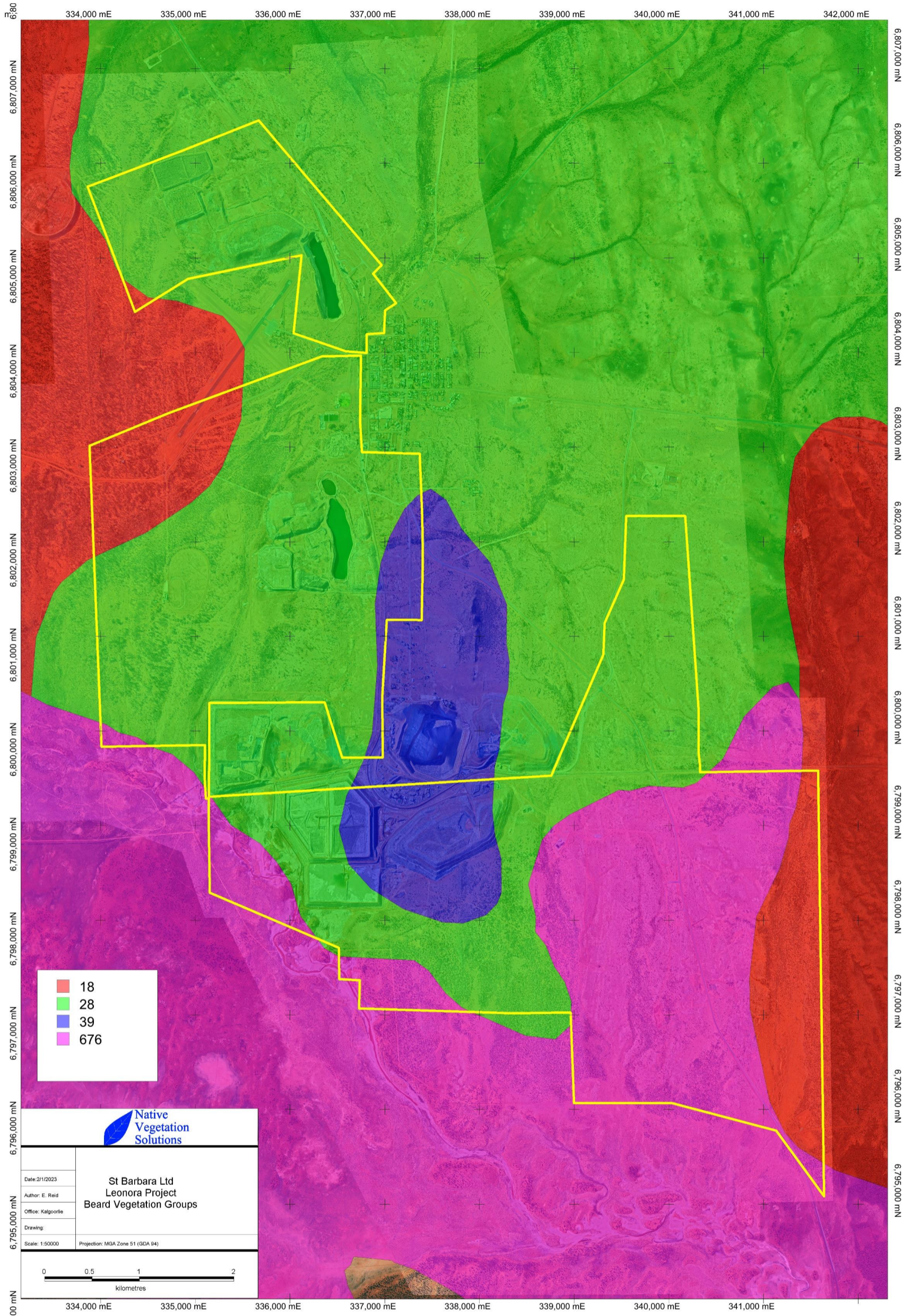
Map 4: Vegetation Groups for the Leonora Project



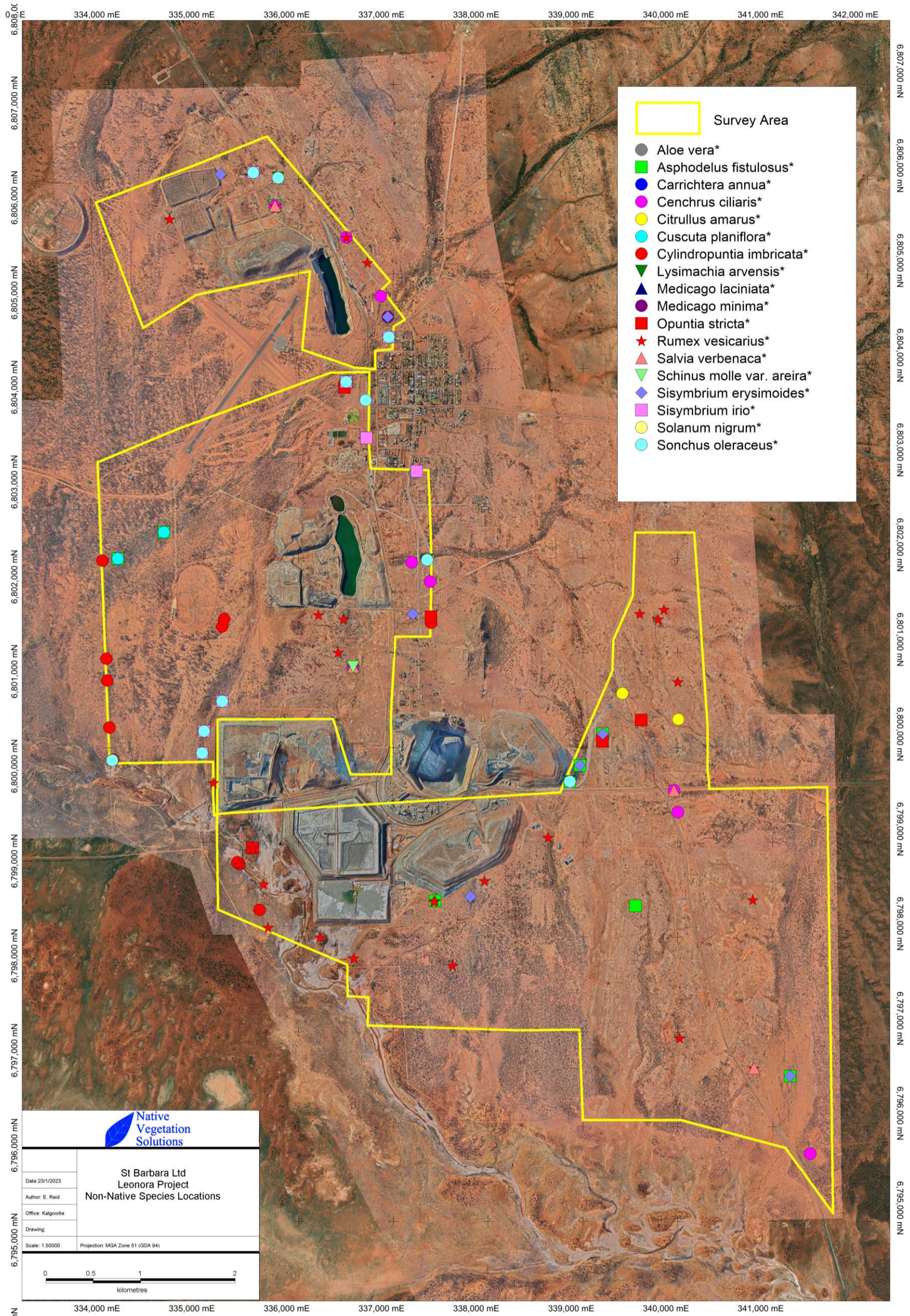
Map 5: Vegetation Groups and Quadrat Locations for the Leonora Project



Map 6: Vegetation Condition for the Leonora Project



Map 7: Beard Vegetation mapping for the Leonora Project



Map 8: Non-Native Species recorded in the Leonora Project

Appendix D – Priority Flora Recorded During the Survey

No Threatened or Priority Flora were recorded in the Survey Area.

Appendix E - Species Recorded During the September 2022 Survey

Family	Genus	Taxon	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59
Poaceae	<i>Austrostipa</i>	<i>Austrostipa elegantissima</i>																													
Poaceae	<i>Austrostipa</i>	<i>Austrostipa nitida</i>												*	*											*	*				
Poaceae	<i>Cenchrus</i>	<i>Cenchrus ciliaris</i> *															*		*												
Poaceae	<i>Enneapogon</i>	<i>Enneapogon caeruleus</i>		*				*																							
Poaceae	<i>Eragrostis</i>	<i>Eragrostis eriopoda</i>	*											*	*																
Poaceae	<i>Eriachne</i>	<i>Eriachne flaccida</i>																													
Poaceae	<i>Eriachne</i>	<i>Eriachne mucronata</i>																													
Poaceae	<i>Eriachne</i>	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>												*	*																
Poaceae	<i>Monachather</i>	<i>Monachather paradoxus</i>																								*	*				
Polygonaceae	<i>Rumex</i>	<i>Rumex vesicarius</i> *		*						*			*																		*
Primulaceae	<i>Lysimachia</i>	<i>Lysimachia arvensis</i> *															*						*	*	*		*				*
Proteaceae	<i>Grevillea</i>	<i>Grevillea berryana</i>																*													
Proteaceae	<i>Hakea</i>	<i>Hakea preissii</i>		*						*			*																	*	*
Proteaceae	<i>Hakea</i>	<i>Hakea recurva</i> subsp. <i>recurva</i>				*										*															*
Pteridaceae	<i>Cheilanthes</i>	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>		*	*													*		*		*						*			*
Rubiaceae	<i>Psychax</i>	<i>Psychax rigidula</i>			*																										
Rubiaceae	<i>Psychax</i>	<i>Psychax suaveolens</i>	*																												
Rutaceae	<i>Phebalium</i>	<i>Phebalium lepidotum</i>																													
Santalaceae	<i>Exocarpos</i>	<i>Exocarpos aphyllus</i>												*	*																
Santalaceae	<i>Santalum</i>	<i>Santalum lanceolatum</i>																		*		*		*	*	*					
Santalaceae	<i>Santalum</i>	<i>Santalum spicatum</i>																					*	*	*	*					
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea rigida</i>				*																									
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila clarkei</i>				*												*		*		*									
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila compacta</i>	*														*					*									*
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	*																			*						*			*
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila glandulifera</i>																													
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>		*	*		*	*																							
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila maculata</i> subsp. <i>brevifolia</i>																													
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila metallicorum</i>	*							*																				*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila miniata</i>									*		*	*	*				*												
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>		*		*	*	*																						*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>				*	*	*																						*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila pantanii</i>				*																									
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila platycalyx</i> subsp. <i>Leonora</i>					*	*																						*	*
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila scoparia</i>																								*	*			*	*
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila youngii</i> subsp. <i>youngii</i>																					*	*		*	*				
Scrophulariaceae	<i>Myoporum</i>	<i>Myoporum montanum</i>																					*	*		*	*				
Solanaceae	<i>Lycium</i>	<i>Lycium australe</i>												*	*								*	*	*						
Solanaceae	<i>Nicotiana</i>	<i>Nicotiana rosulata</i>																													
Solanaceae	<i>Solanum</i>	<i>Solanum lasiophyllum</i>																					*	*	*						
Solanaceae	<i>Solanum</i>	<i>Solanum nigrum</i> *																													
Solanaceae	<i>Solanum</i>	<i>Solanum nummularium</i>				*		*																							
Stylidiaceae	<i>Stylidium</i>	<i>Stylidium ?sp 111-5</i>																													
Zygophyllaceae	<i>Roepera</i>	<i>Roepera eremaea</i>												*	*													*		*	

Species List per Vegetation Group (Opportunistically sampled species not captured in quadrats identified in Bold type)

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Aizoaceae	<i>Disphyma</i>	<i>Disphyma crassifolium</i>	*						*	*					*		*	
Aizoaceae	<i>Gunnioopsis</i>	<i>Gunnioopsis quadrifida</i>														*	*	*
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus divaricatus</i>	*															
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus exaltatus</i>		*									*					
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus gaudichaudii</i>									*							
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus helipteroides</i>	*	*				*					*					
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus obovatus</i>	*	*	*	*	*		*	*	*	*	*	*				*
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus roei</i>						*			*							
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus schwartzii</i>			*			*			*		*					
Anacardiaceae	<i>Schinus</i>	<i>Schinus molle</i> var. <i>areira</i>	*															
Apiaceae	Daucus	Daucus glochidiatius		*														
Apocynaceae	<i>Leichhardtia</i>	<i>Leichhardtia australis</i>	*		*		*	*			*	*		*		*		*
Asparagaceae	<i>Thysanotus</i>	<i>Thysanotus manglesianus</i>										*						
Asphodelaceae	Aloe	Aloe vera*					*											
Asphodelaceae	<i>Asphodelus</i>	<i>Asphodelus fistulosus*</i>	*	*			*											
Asteraceae	<i>Brachyscome</i>	<i>Brachyscome ciliaris</i>	*	*			*		*									
Asteraceae	<i>Brachyscome</i>	<i>Brachyscome iberidifolia</i>			*													
Asteraceae	<i>Calocephalus</i>	<i>Calocephalus knappii</i>		*														
Asteraceae	<i>Calotis</i>	<i>Calotis hispidula</i>							*	*								
Asteraceae	<i>Calotis</i>	<i>Calotis multicaulis</i>		*			*											
Asteraceae	<i>Cephalipterum</i>	<i>Cephalipterum drummondii</i>	*	*	*	*	*		*									
Asteraceae	<i>Chrysocephalum</i>	<i>Chrysocephalum puteale</i>									*							
Asteraceae	<i>Cratystylis</i>	<i>Cratystylis subspinescens</i>	*				*		*	*				*	*		*	
Asteraceae	<i>Erymophyllum</i>	<i>Erymophyllum ramosum</i> subsp. <i>ramosum</i>							*									
Asteraceae	Gnephosis	Gnephosis angianthoides														*		
Asteraceae	<i>Gnephosis</i>	<i>Gnephosis brevifolia</i>	*													*		
Asteraceae	<i>Helipterum</i>	<i>Helipterum craspedioides</i>									*							
Asteraceae	<i>Isoetopsis</i>	<i>Isoetopsis graminifolia</i>											*					
Asteraceae	Myriocephalus	Myriocephalus oldfieldii		*														
Asteraceae	Panaetia	Panaetia lessonii				*												
Asteraceae	<i>Podolepis</i>	<i>Podolepis canescens</i>		*														
Asteraceae	<i>Podolepis</i>	<i>Podolepis capillaris</i>	*							*								
Asteraceae	<i>Podolepis</i>	<i>Podolepis lessonii</i>			*													
Asteraceae	Rhodanthe	Rhodanthe chlorocephala subsp. <i>splendida</i>					*											
Asteraceae	<i>Rhodanthe</i>	<i>Rhodanthe floribunda</i>	*		*													
Asteraceae	<i>Rhodanthe</i>	<i>Rhodanthe maryonii</i>		*				*			*							
Asteraceae	Rhodanthe	Rhodanthe oppositifolia subsp. <i>oppositifolia</i>		*														
Asteraceae	<i>Rhodanthe</i>	<i>Rhodanthe propinqua</i>		*	*		*	*										
Asteraceae	<i>Rhodanthe</i>	<i>Rhodanthe charsleyae</i>	*	*	*		*											*
Asteraceae	<i>Schoenia</i>	<i>Schoenia cassiniana</i>		*														
Asteraceae	<i>Senecio</i>	<i>Senecio glossanthus</i>		*						*						*	*	
Asteraceae	Senecio	Senecio magnificus	*															
Asteraceae	<i>Sonchus</i>	<i>Sonchus oleraceus*</i>	*	*												*		*
Asteraceae	<i>Sondottia</i>	<i>Sondottia cannata</i>													*			
Asteraceae	<i>Vittadinia</i>	<i>Vittadinia sulcata</i>		*														
Asteraceae	<i>Walshia</i>	<i>Walshia kendallii</i>		*														
Brassicaceae	<i>Carrichtera</i>	<i>Carrichtera annua*</i>	*	*														
Brassicaceae	<i>Lepidium</i>	<i>Lepidium oxytrichum</i>	*	*			*	*		*			*					
Brassicaceae	<i>Lepidium</i>	<i>Lepidium platypetalum</i>				*												
Brassicaceae	<i>Sisymbrium</i>	<i>Sisymbrium erysimoides*</i>	*	*									*					
Brassicaceae	<i>Sisymbrium</i>	<i>Sisymbrium irio*</i>		*														*
Brassicaceae	<i>Stenopetalum</i>	<i>Stenopetalum salicola</i>													*			
Cactaceae	Cylindropuntia	Cylindropuntia imbricata*	*	*	*		*		*							*	*	
Cactaceae	Opuntia	Opuntia stricta*	*	*					*							*		
Campanulaceae	<i>Wahlenbergia</i>	<i>Wahlenbergia gracilenta</i>		*														
Campanulaceae	<i>Wahlenbergia</i>	<i>Wahlenbergia tumidiflucta</i>		*														*

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Casuarinaceae	Casuarina	Casuarina pauper										*						
Chenopodiaceae	Atriplex	Atriplex bunburyana	*				*	*	*	*			*	*				*
Chenopodiaceae	Atriplex	Atriplex codonocarpa	*	*					*	*								
Chenopodiaceae	Atriplex	Atriplex vesicaria	*							*			*				*	*
Chenopodiaceae	Didymanthus	Didymanthus roei													*			
Chenopodiaceae	Dysphania	Dysphania kalpari		*														
Chenopodiaceae	Enchylaena	Enchylaena tomentosa var. tomentosa	*	*		*	*		*	*		*	*	*		*		*
Chenopodiaceae	Maireana	Maireana amoena															*	
Chenopodiaceae	Maireana	Maireana carnosa													*			
Chenopodiaceae	Maireana	Maireana georgei	*		*								*	*		*		*
Chenopodiaceae	Maireana	Maireana glomerifolia					*											
Chenopodiaceae	Maireana	Maireana pyramidata	*	*	*	*	*		*	*		*	*	*		*		*
Chenopodiaceae	Maireana	Maireana sedifolia	*			*		*				*	*	*				
Chenopodiaceae	Maireana	Maireana thesioides			*							*	*	*				
Chenopodiaceae	Maireana	Maireana tomentosa	*			*	*		*	*		*	*	*				*
Chenopodiaceae	Maireana	Maireana trichoptera	*			*	*		*			*	*	*				
Chenopodiaceae	Maireana	Maireana triptera	*		*	*	*	*	*	*		*	*	*	*			
Chenopodiaceae	Rhagodia	Rhagodia drummondii		*	*	*	*		*	*		*	*	*				
Chenopodiaceae	Rhagodia	Rhagodia eremaea	*	*								*	*			*		
Chenopodiaceae	Salsola	Salsola australis														*		
Chenopodiaceae	Sclerolaena	Sclerolaena cuneata					*	*		*				*				*
Chenopodiaceae	Sclerolaena	Sclerolaena densiflora	*						*									
Chenopodiaceae	Sclerolaena	Sclerolaena diacantha	*	*	*	*	*	*	*		*		*	*	*	*	*	*
Chenopodiaceae	Sclerolaena	Sclerolaena drummondii													*		*	
Chenopodiaceae	Sclerolaena	Sclerolaena erioantha	*				*											
Chenopodiaceae	Sclerolaena	Sclerolaena eurotioides							*									
Chenopodiaceae	Sclerolaena	Sclerolaena patenticuspis	*		*				*	*					*		*	*
Chenopodiaceae	Tecticornia	Tecticornia disarticulata	*							*								
Chenopodiaceae	Tecticornia	Tecticornia indica subsp. bidens													*	*	*	
Chenopodiaceae	Tecticornia	Tecticornia pruinosa													*	*	*	*
Chenopodiaceae	Tecticornia	Tecticornia undulata													*	*	*	*
Convolvulaceae	Cuscuta	Cuscuta planiflora*		*														
Crassulaceae	Crassula	Crassula colorata var. acuminata		*									*					
Cucurbitaceae	Citrullus	Citrullus amarus*	*			*												
Cucurbitaceae	Cucumis	Cucumis myriocarpus*					*											
Fabaceae	Acacia	Acacia aneura	*	*	*	*	*	*			*	*	*			*		
Fabaceae	Acacia	Acacia burkittii		*	*		*					*	*			*		*
Fabaceae	Acacia	Acacia caesaneura		*	*		*					*	*			*		
Fabaceae	Acacia	Acacia craspedocarpa	*	*	*	*	*					*	*	*				*
Fabaceae	Acacia	Acacia duriuscula												*				
Fabaceae	Acacia	Acacia incurvaneura	*	*	*													
Fabaceae	Acacia	Acacia kempeana	*															
Fabaceae	Acacia	Acacia masliniana					*											
Fabaceae	Acacia	Acacia mulganeura	*	*	*		*						*			*		
Fabaceae	Acacia	Acacia oswaldii					*											
Fabaceae	Acacia	Acacia pteraneura	*	*		*												
Fabaceae	Acacia	Acacia quadrimarginea					*				*		*					
Fabaceae	Acacia	Acacia ramulosa var. ramulosa			*			*				*						
Fabaceae	Acacia	Acacia sibirica					*											
Fabaceae	Acacia	Acacia tetragonophylla	*	*	*		*	*			*	*	*					*
Fabaceae	Acacia	Acacia victoriae							*									
Fabaceae	Medicago	Medicago laciniata*		*														
Fabaceae	Medicago	Medicago minima*		*														
Fabaceae	Senna	Senna artemisioides subsp. xsturtii	*			*	*	*										
Fabaceae	Senna	Senna artemisioides subsp. artemisioides	*				*	*	*				*					
Fabaceae	Senna	Senna artemisioides subsp. filifolia	*		*	*	*					*	*	*				
Fabaceae	Senna	Senna cardiosperma	*															*

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Fabaceae	Senna	Senna charlesiana			*		*						*	*				
Fabaceae	Senna	Senna glutinosa subsp. chatelainiana	*			*												
Fabaceae	Senna	Senna sp. Meekatharra	*										*					
Frankeniaceae	Frankenia	Frankenia cinerea	*			*	*		*	*								
Frankeniaceae	Frankenia	Frankenia interioris	*															
Frankeniaceae	Frankenia	Frankenia laxiflora														*		
Frankeniaceae	Frankenia	Frankenia pauciflora var. pauciflora													*		*	
Geraniaceae	Erodium	Erodium crinitum										*						
Geraniaceae	Erodium	Erodium cygnorum	*	*	*		*	*	*		*	*	*	*		*		*
Goodeniaceae	Goodenia	Goodenia havilandii		*									*					
Goodeniaceae	Goodenia	Goodenia rosea			*						*	*						
Goodeniaceae	Goodenia	Goodenia sp. Midwest	*	*		*	*	*	*	*								*
Goodeniaceae	Scaevola	Scaevola spinescens	*	*	*	*	*	*				*	*	*		*	*	*
Haloragaceae	Haloragis	Haloragis gossei										*						
Haloragaceae	Haloragis	Haloragis trigonocarpa												*				
Hemerocallidaceae	Dianella	Dianella revoluta var. divaricata				*						*	*					
Lamiaceae	Salvia	Salvia verbenaca*	*															
Lamiaceae	Teucrium	Teucrium teucriiflorum		*	*		*						*					
Loranthaceae	Amyema	Amyema fitzgeraldii			*													
Loranthaceae	Amyema	Amyema fitzgeraldii			*													
Malvaceae	Abutilon	Abutilon cryptopetalum			*													
Malvaceae	Abutilon	Abutilon otocarpum		*														
Malvaceae	Abutilon	Abutilon oxycarpum		*														
Malvaceae	Brachychiton	Brachychiton gregorii									*							
Malvaceae	Sida	Sida calyxymenia	*		*		*				*		*					
Malvaceae	Sida	Sida ectogama	*	*	*		*					*	*					
Malvaceae	Sida	Sida intricata	*															
Malvaceae	Sida	Sida sp. Excedentifolia	*															
Malvaceae	Sida	Sida sp. Golden calyces glabrous	*	*	*			*					*					
Montiaceae	Calandrinia	Calandrinia creethae		*														*
Montiaceae	Calandrinia	Calandrinia eremaea	*	*			*					*		*		*	*	*
Montiaceae	Calandrinia	Calandrinia eremaea sans lat						*										
Montiaceae	Calandrinia	Calandrinia polyandra	*				*		*	*								*
Myrtaceae	Eucalyptus	Eucalyptus camaldulensis subsp. obtusa		*														*
Myrtaceae	Eucalyptus	Eucalyptus lesouefii		*														
Myrtaceae	Eucalyptus	Eucalyptus oleosa subsp. oleosa										*						
Myrtaceae	Eucalyptus	Eucalyptus torquata	*															
Myrtaceae	Melaleuca	Melaleuca interioris														*		*
Myrtaceae	Melaleuca	Melaleuca sheathiana														*	*	*
Pittosporaceae	Pittosporum	Pittosporum angustifolium			*		*											
Plantaginaceae	Plantago	Plantago turrifera		*														
Poaceae	Aristida	Aristida contorta					*					*				*		
Poaceae	Austrostipa	Austrostipa elegantissima								*								
Poaceae	Austrostipa	Austrostipa nitida	*		*	*	*	*									*	
Poaceae	Cenchrus	Cenchrus ciliaris*	*	*												*		*
Poaceae	Enneapogon	Enneapogon caerulescens						*					*	*				
Poaceae	Eragrostis	Eragrostis eriopoda	*		*			*				*						*
Poaceae	Eriachne	Eriachne flaccida						*										
Poaceae	Eriachne	Eriachne mucronata									*							
Poaceae	Eriachne	Eriachne pulchella subsp. pulchella						*										*
Poaceae	Monachather	Monachather paradoxus								*								
Polygonaceae	Rumex	Rumex vesicarius*	*	*				*					*		*	*		*
Primulaceae	Lysimachia	Lysimachia arvensis*	*	*														*
Proteaceae	Grevillea	Grevillea berryana			*								*					
Proteaceae	Hakea	Hakea preissii	*			*	*		*	*			*			*		
Proteaceae	Hakea	Hakea recurva subsp. recurva			*								*					
Pteridaceae	Cheilanthes	Cheilanthes sieberi subsp. sieberi		*	*			*			*		*					

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Rubiaceae	<i>Psyrax</i>	<i>Psyrax rigidula</i>			*								*					
Rubiaceae	<i>Psyrax</i>	<i>Psyrax suaveolens</i>										*						
Rutaceae	<i>Phebalium</i>	<i>Phebalium lepidotum</i>	*															
Santalaceae	<i>Exocarpos</i>	<i>Exocarpos aphyllus</i>			*												*	*
Santalaceae	<i>Santalum</i>	<i>Santalum lanceolatum</i>		*	*													
Santalaceae	<i>Santalum</i>	<i>Santalum spicatum</i>			*													
Sapindaceae	<i>Alectryon</i>	<i>Alectryon oleifolius</i> subsp. <i>canescens</i>										*						
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea rigida</i>											*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila clarkei</i>		*	*								*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila compacta</i>	*	*	*		*	*	*			*						
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>			*		*	*				*						
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila glandulifera</i>			*		*	*				*						
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>											*	*				
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila longifolia</i>							*									
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila maculata</i> subsp. <i>brevifolia</i>							*									
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila metallicorum</i>	*	*	*	*	*					*						
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila miniata</i>										*				*	*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila olafieldii</i> subsp. <i>angustifolia</i>	*			*						*	*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>	*															
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila pantonii</i>												*				
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila platycalyx</i> subsp. <i>Leonora</i>	*	*	*		*	*						*				
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila scoparia</i>								*								
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila youngii</i> subsp. <i>youngii</i>	*			*			*	*								*
Scrophulariaceae	<i>Myoporum</i>	<i>Myoporum montanum</i>																*
Solanaceae	<i>Lycium</i>	<i>Lycium australe</i>															*	*
Solanaceae	<i>Nicotiana</i>	<i>Nicotiana rosulata</i>		*	*													
Solanaceae	<i>Solanum</i>	<i>Solanum lasiophyllum</i>	*		*		*	*	*		*		*					*
Solanaceae	<i>Solanum</i>	<i>Solanum nigrum</i> *		*														
Solanaceae	<i>Solanum</i>	<i>Solanum nummularium</i>												*				
Stylidiaceae	<i>Stylidium</i>	<i>Stylidium</i> ?sp 111-5									*							
Zygophyllaceae	<i>Roepera</i>	<i>Roepera eremaea</i>	*				*	*									*	

Appendix F - Site Descriptions

Project Name: St Barbara Ltd Leonora Project					
Date:	12/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.316362 -28.863108	Quadrat:	Q1		
Quadrat size:	20x20				
Vegetation group:	Open mulga over Chenopod shrubland				
WP:	wpt001				
Photo number:			1 and 2		
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Medium gravelly; medium pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Eremophila oldfieldii subsp. angustifolia		Senna artemisioides subsp. filifolia		Ptilotus obovatus	
		Eremophila platycalyx subsp. Leonora		Maireana sedifolia	
		Eremophila oppositifolia subsp. angustifolia		Scaevola spinescens	
ALL SPECIES					
Eremophila oldfieldii subsp. angustifolia					
Senna artemisioides subsp. filifolia					
Eremophila platycalyx subsp. Leonora					
Eremophila oppositifolia subsp. angustifolia					
Ptilotus obovatus					
Maireana sedifolia					
Scaevola spinescens					
Solanum lasiophyllum					
Sida calyxhymenia					
Maireana tomentosa					
Sclerolaena densiflora					
Sclerolaena diacantha					
Carrichtera annua*					
Sonchus oleraceus*					
Lysimachia arvensis*					
Cenchrus ciliaris*					
Acacia aneura					
Roepera eremaea					
Sida sp. Excedentifolia					
Atriplex bunburyana					
Maireana georgei					
Maireana trichoptera					
Hakea preissii					
Erodium cygnorum					
Rumex vesicarius*					
Senna sp. Meekatharra					
Leichhardtia australis					
Maireana triptera					
Acacia tetragonophylla					
Acacia incurvaneura					
Salvia verbenaca*					
Rhodanthe charsleyae					
Outside					
Eucalyptus torquata					
Acacia kempeana					
Eremophila compacta					
Rhodanthe floribunda					



Project Name: St Barbara Ltd Leonora Project					
Date:	12/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.313678 -28.862588	Quadrat:	Q2		
Quadrat size:	20x20				
Vegetation group:	Creekline Vegetation				
WP:	wpt002				
Photo number:			3		
Landform:			Closed		
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals		
Fire History:			Greater than 10 years ago		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			60		
% Cover bare ground:			45		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia incurvaneura		Eremophila platycalyx subsp. Leonora		Maireana pyramidata	
Acacia aneura		Acacia tetragonophylla		Rhagodia eremaea	
ALL SPECIES					
Acacia incurvaneura					
Acacia aneura					
Eremophila platycalyx subsp. Leonora					
Acacia tetragonophylla					
Maireana pyramidata					
Rhagodia eremaea					
Ptilotus obovatus					
Asphodelus fistulosus*					
Lysimachia arvensis*					
Sonchus oleraceus*					
Sisymbrium irio*					
Calandrinia eremaea					
Cuscuta planiflora*					
Erodium cygnorum					
Rhodanthe charsleyae					
Nicotiana rosulata					
Abutilon otocarpum					
Abutilon oxycarpum					
Rumex vesicarius*					
Calocephalus knappii					
Cheilanthes sieberi subsp. sieberi					
Lepidium oxytrichum					
Solanum nigrum*					
Teucrium teucriiflorum					
Scaevola spinescens					
Goodenia havilandii					
Crassula colorata var. acuminata					
Ptilotus helipteroides					
Dysphania kalpari					
Goodenia sp. Midwest					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	12/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.302107 -28.871817	Quadrat:	Q3		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland				
WP:	wpt005				
Photo number:	4				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Eremophila platycalyx subsp. Leonora		Teucrium teucriiflorum		
Acacia aneura	Acacia tetragonophylla		Ptilotus obovatus		
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Eremophila platycalyx subsp. Leonora					
Acacia tetragonophylla					
Teucrium teucriiflorum					
Ptilotus obovatus					
Erodium cygnorum					
Sclerolaena diacantha					
Rhodanthe charsleyae					
Eremophila metallicorum					
Eremophila glandulifera					
Leichhardtia australis					
Rhodanthe floribunda					
Abutilon cryptopetalum					
Pittosporum angustifolium					
Sclerolaena patentiscuspis					
Outside					
Acacia craspedocarpa					
Nicotiana rosulata					
Santalum spicatum					
Sida sp. Golden calyces glabrous					



Project Name: St Barbara Ltd Leonora Project					
Date:	12/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.315957 -28.865763	Quadrat:	Q4		
Quadrat size:	20x20				
Vegetation group:	Open mulga over chenopod shrubland				
WP:	wpt008				
Photo number:	7				
Landform:	Flat/Plain				
Land surface/disturbance:	Limited clearing				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	75				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia pteraneura		Hakea preissii		Maireana pyramidata	
Acacia aneura				Atriplex bunburyana	
				Ptilotus obovatus	
ALL SPECIES					
Acacia pteraneura					
Acacia aneura					
Hakea preissii					
Maireana pyramidata					
Atriplex bunburyana					
Ptilotus obovatus					
Maireana triptera					
Cenchrus ciliaris*					
Sclerolaena diacantha					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Atriplex vesicaria					
Eremophila compacta					
Austrostipa nitida					
Sclerolaena densiflora					
Maireana georgei					
Brachyscome ciliaris					
Erodium cygnorum					
Sida intricata					
Sida sp. Excedentifolia					
Eremophila platycalyx subsp. Leonora					
Rumex vesicarius*					
Solanum lasiophyllum					
Calandrinia eremaea					
Calandrinia polyandra					
Asphodelus fistulosus*					
Sclerolaena eriacantha					
Lepidium oxytrichum					
Salvia verbenaca*					
Acacia tetragonophylla					
Outside					
Senecio magnificus					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.346965 -28.920992	Quadrat:	Q5		
Quadrat size:	20x20				
Vegetation group:	Creekline vegetation				
WP:	wpt017				
Photo number:	10				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	40				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	F Forb
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	M 30-70
Dominant taxa:	Acacia incurvaneura		Acacia tetragonophylla		Lysimachia arvensis*
Acacia incurvaneura					Sisymbrium erysimoides*
Acacia aneura					Erodium cygnorum
Acacia caesaneura					
ALL SPECIES					
Acacia incurvaneura					
Acacia aneura					
Acacia caesaneura					
Acacia tetragonophylla					
Lysimachia arvensis*					
Erodium cygnorum					
Asphodelus fistulosus*					
Atriplex codonocarpa					
Carrichtera annua*					
Rhagodia eremaea					
Cenchrus ciliaris*					
Sonchus oleraceus*					
Nicotiana rosulata					
Wahlenbergia gracilentia					
Brachyscome ciliaris					
Ptilotus obovatus					
Sclerolaena diacantha					
Acacia craspedocarpa					
Teucrium teucriiflorum					
Sida sp. Golden calyces glabrous					
Outside					
Rhagodia drummondii					
Eremophila metallicorum					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.348083 -28.919477	Quadrat:	Q6		
Quadrat size:	20x20				
Vegetation group:	Mulga creekline				
WP:	wpt018				
Photo number:			11		
Landform:			Open depression (vale)/Drainage depression		
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals		
Fire History:			Greater than 10 years ago		
Coarse fragments on the surface (abundance/size/shape):			Very; abundant/Coarse gravelly; large pebbles/Subrounded		
Rock outcrop (abundance/runoff):			No bedrock exposed/Rapid		
Soil (profile/field texture/soil surface):			Uniform/Sandy clay loam/Firm		
% Cover leaf litter:			5		
% Cover bare ground:			45		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia tetragonophylla		Maireana pyramidata	
Acacia mulganeura		Eremophila platycalyx subsp. Leonora		Eremophila metallicorum	
Acacia caesaneura				Ptilotus obovatus	
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Acacia caesaneura					
Acacia tetragonophylla					
Eremophila platycalyx subsp. Leonora					
Maireana pyramidata					
Eremophila metallicorum					
Ptilotus obovatus					
Acacia craspedocarpa					
Enchylaena tomentosa var. tomentosa					
Goodenia sp. Midwest					
Calotis multicaulis					
Sclerolaena diacantha					
Erodium cygnum					
Sida sp. Golden calyces glabrous					
Asphodelus fistulosus*					
Sisymbrium erysimoides*					
Rhagodia drummondii					
Sida ectogama					
Cephalipterum drummondii					
Rhodanthe maryonii					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.350612 -28.916497	Quadrat:	Q7		
Quadrat size:	20x20				
Vegetation group:	Open mulga over chenopod shrubland				
WP:	wpt020				
Photo number:			12-13		
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	65				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia craspedocarpa		Scaevola spinescens		Maireana pyramidata	
Hakea preissii		Senna glutinosa subsp. chatelainiana		Ptilotus obovatus	
		Acacia tetragonophylla		Eremophila metallicorum	
ALL SPECIES					
Acacia craspedocarpa					
Hakea preissii					
Scaevola spinescens					
Senna glutinosa subsp. chatelainiana					
Acacia tetragonophylla					
Maireana pyramidata					
Ptilotus obovatus					
Eremophila metallicorum					
Maireana tomentosa					
Sida ectogama					
Sida sp. Golden calyces glabrous					
Maireana triptera					
Maireana georgei					
Goodenia sp. Midwest					
Sclerolaena diacantha					
Enchylaena tomentosa var. tomentosa					
Leichhardtia australis					
Atriplex bunburyana					
Rhagodia drummondii					
Senna artemisioides subsp. artemisioides					
Asphodelus fistulosus*					
Rhagodia eremaea					
Calandrinia polyandra					
Sisymbrium erysimoides*					
Senna artemisioides subsp. xsturtii					
Outside					
Cephalopterum drummondii					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.352503 -28.91987	Quadrat:	Q8		
Quadrat size:	20x20				
Vegetation group:	Mulga over Senna shrubland				
WP:	wpt023				
Photo number:	17				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Senna artemisioides subsp. xsturtii		Maireana sedifolia		
Acacia aneura	Eremophila oldfieldii subsp. angustifolia		Maireana triptera		
ALL SPECIES					
Acacia aneura					
Senna artemisioides subsp. xsturtii					
Eremophila oldfieldii subsp. angustifolia					
Maireana sedifolia					
Maireana triptera					
Ptilotus obovatus					
Maireana pyramidata					
Rhagodia drummondii					
Enchylaena tomentosa var. tomentosa					
Scaevola spinescens					
Sclerolaena diacantha					
Frankenia cinerea					
Eremophila metallicorum					
Goodenia sp. Midwest					
Acacia pteraneura					
Senna artemisioides subsp. filifolia					
Senna glutinosa subsp. chatelainiana					
Hakea preissii					
Outside					
Eremophila youngii subsp. youngii					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.356747 -28.913132	Quadrat:	Q9		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod				
WP:	wpt040				
Photo number:	18-19				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	80				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:	Acacia tetragonophylla		Frankenia cinerea		
Acacia aneura	Scaevola spinescens		Maireana pyramidata		
Acacia caesaneura	Senna artemisioides subsp. filifolia		Atriplex bunburyana		
ALL SPECIES					
Acacia aneura					
Acacia caesaneura					
Acacia tetragonophylla					
Scaevola spinescens					
Senna artemisioides subsp. filifolia					
Frankenia cinerea					
Maireana pyramidata					
Atriplex bunburyana					
Ptilotus obovatus					
Maireana triptera					
Maireana trichoptera					
Rhodanthe propinqua					
Cephalopterum drummondii					
Erodium cygnotum					
Solanum lasiophyllum					
Goodenia sp. Midwest					
Maireana glomerifolia					
Sclerolaena diacantha					
Eremophila metallicorum					
Eriachne pulchella subsp. pulchella					
Senna artemisioides subsp. xsturtii					
Maireana tomentosa					
Eremophila forrestii subsp. forrestii					
Enchylaena tomentosa var. tomentosa					
Leichhardtia australis					
Outside					
Pittosporum angustifolium					
Hakea preissii					
Acacia oswaldii					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.357402 -28.904742	Quadrat:	Q10		
Quadrat size:	20x20				
Vegetation group:	Mulga over ironstone quartz outcrop				
WP:	wpt043				
Photo number:	20				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	20-30cm				
Rock outcrop (abundance/runoff):	50%				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Acacia ramulosa var. ramulosa		Senna artemisioides subsp. xsturtii		Eremophila forrestii subsp. forrestii
Acacia aneura			Eremophila platycalyx subsp. Leonora		Eremophila platycalyx subsp. Leonora
ALL SPECIES					
Acacia aneura					
Acacia ramulosa var. ramulosa					
Senna artemisioides subsp. xsturtii					
Eremophila forrestii subsp. forrestii					
Eremophila platycalyx subsp. Leonora					
Erodium cygnorum					
Goodenia sp. Midwest					
Sclerolaena cuneata					
Sclerolaena diacantha					
Rhodanthe propinqua					
Leichhardtia australis					
Atriplex bunburyana					
Ptilotus helipteroides					
Rumex vesicarius*					
Cheilanthes sieberi subsp. sieberi					
Roepera eremaea					
Austrostipa nitida					
Enneapogon caeruleus					
Rhodanthe maryonii					
Sida sp. Golden calyces glabrous					
Acacia tetragonophylla					
Ptilotus schwartzii					
Ptilotus roei					
Eragrostis eriopoda					
Eriachne flaccida					
Maireana sedifolia					
Maireana triptera					
Calandrinia eremaea sans lat					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.374397 -28.926763	Quadrat:	Q11		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland				
WP:	wpt061				
Photo number:	22				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very slightly; very few/Medium gravelly; medium pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	65				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:		Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia tetragonophylla		Eremophila metallicorum	
Acacia mulganeura		Eremophila platycalyx subsp. Leonora		Ptilotus obovatus	
Acacia craspedocarpa					
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila platycalyx subsp. Leonora					
Eremophila metallicorum					
Ptilotus obovatus					
Teucrium teucriiflorum					
Brachyscome iberidifolia					
Rhodanthe charsleyae					
Erodium cygnorum					
Rhodanthe propinqua					
Nicotiana rosulata					
Outside					
Acacia ramulosa var. ramulosa					
Dianella revoluta var. divaricata					
Eremophila compacta					
Hakea recurva subsp. recurva					
Ptilotus schwartzii					
Santalum spicatum					
Psydrax rigidula					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.37444 -28.952827	Quadrat:	Q12		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland				
WP:	wpt062				
Photo number:	23				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Rounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	15				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:		Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia tetragonophylla		Eremophila metallicorum	
Acacia mulganeura		Eremophila platycalyx subsp. Leonora		Ptilotus obovatus	
Acacia craspedocarpa					
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila platycalyx subsp. Leonora					
Eremophila metallicorum					
Ptilotus obovatus					
Teucrium teucriiflorum					
Brachyscome iberidifolia					
Rhodanthe charsleyae					
Erodium cygnorum					
Rhodanthe propinqua					
Nicotiana rosulata					
Hakea recurva subsp. recurva					
Dianella revoluta var. divaricata					
Acacia caesaneura					
Solanum lasiophyllum					
Maireana georgei					
Eremophila compacta					
Santalum spicatum					
Rhagodia drummondii					
Maireana thesioides					
Psychrax rigidula					
Outside					
Maireana pyramidata					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.374525 -28.956852	Quadrat:	Q13		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland				
WP:	wpt064				
Photo number:	no pic				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Rounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia caesaneura		Scaevola spinescens		Eremophila compacta	
Acacia mulganeura		Exocarpos aphyllus		Eragrostis eriopoda	
Acacia craspedocarpa		Acacia tetragonophylla		Ptilotus obovatus	
ALL SPECIES					
Acacia caesaneura					
Acacia mulganeura					
Acacia craspedocarpa					
Scaevola spinescens					
Exocarpos aphyllus					
Acacia tetragonophylla					
Eremophila compacta					
Eragrostis eriopoda					
Ptilotus obovatus					
Goodenia rosea					
Rhodanthe charsleyae					
Maireana thesioides					
Maireana georgei					
Senna artemisioides subsp. filifolia					
Erodium cygnum					
Dianella revoluta var. divaricata					
Santalum spicatum					
Rhagodia drummondii					
Teucrium teucriiflorum					
Outside					

Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.372083 -28.952807	Quadrat:	Q14		
Quadrat size:	20x20				
Vegetation group:	Open low chenopod shrubland				
WP:	wpt067				
Photo number:	25				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Medium gravelly; medium pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	<5				
% Cover bare ground:	90				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:		Growth form:	S Shrub	Growth form:	S Shrub
Height:		Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:		Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:	Maireana pyramidata	Dominant taxa:	Frankenia cinerea
				Dominant taxa:	Maireana tomentosa
ALL SPECIES					
Maireana pyramidata					
Frankenia cinerea					
Maireana tomentosa					
Goodenia sp. Midwest					
Sclerolaena diacantha					
Atriplex codonocarpa					
Sclerolaena densiflora					
Calandrinia polyandra					
Enchylaena tomentosa var. tomentosa					
Eremophila compacta					
Sclerolaena patentiscus					
Erymophyllum ramosum subsp. ramosum					
Calotis hispidula					
Outside					
Hakea preissii					



Project Name: St Barbara Ltd Leonora Project					
Date:	13/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.370353 -28.949332	Quadrat:	Q15		
Quadrat size:	20x20				
Vegetation group:	Open mulga Creepline over chenopod				
WP:	wpt072				
Photo number:	26				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Rounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Eremophila youngii subsp. youngii		Cratystylis subspinescens	
				Frankenia cinerea	
ALL SPECIES					
Acacia mulganeura					
Eremophila youngii subsp. youngii					
Cratystylis subspinescens					
Frankenia cinerea					
Goodenia sp. Midwest					
Senna artemisioides subsp. filifolia					
Maireana triptera					
Podolepis capillaris					
Maireana tomentosa					
Sclerolaena diacantha					
Asphodelus fistulosus*					
Atriplex codonocarpa					
Acacia tetragonophylla					
Calandrinia eremaea					
Calandrinia polyandra					
Eragrostis eriopoda					
Maireana pyramidata					
Sclerolaena eriacantha					
Sisymbrium erysimoides*					
Sclerolaena patenticuspis					
Atriplex bunburyana					
Ptilotus divaricatus					
Frankenia interioris					
Gnephosis brevifolia					
Outside					
Disphyma crassifolium					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.368845 -28.928178	Quadrat:	Q16		
Quadrat size:	20x20				
Vegetation group:	mulga woodland				
WP:	wpt074				
Photo number:	28				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	75				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Dominant taxa:		Dominant taxa:		
Acacia aneura	Eremophila platycalyx subsp. Leonora		Eremophila compacta		
	Acacia tetragonophylla		Ptilotus obovatus		
			Sida sp. Golden calyces glabrous		
ALL SPECIES					
Acacia aneura					
Eremophila platycalyx subsp. Leonora					
Acacia tetragonophylla					
Eremophila compacta					
Ptilotus obovatus					
Sida sp. Golden calyces glabrous					
Podolepis lessonii					
Teucrium teucriiflorum					
Santalum lanceolatum					
Erodium cygnorum					
Solanum lasiophyllum					
Acacia craspedocarpa					
Sida ectogama					
Austrostipa nitida					
Maireana triptera					
Outside					
Cephalopterum drummondii					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.368625 -28.931255	Quadrat:	Q17		
Quadrat size:	20x20				
Vegetation group:	Eremophila youngii over chenopod and Tecticornia				
WP:	wpt076				
Photo number:	29				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Surface crust				
% Cover leaf litter:	15				
% Cover bare ground:	55				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	M 30-70
Dominant taxa:	Cratystylis subspinescens		Cratystylis subspinescens		Tecticornia disarticulata
Eremophila youngii subsp. youngii	Maireana pyramidata				
ALL SPECIES					
Eremophila youngii subsp. youngii					
Cratystylis subspinescens					
Maireana pyramidata					
Tecticornia disarticulata					
Ptilotus obovatus					
Goodenia sp. Midwest					
Austrostipa elegantissima					
Enchylaena tomentosa var. tomentosa					
Senecio glossanthus					
Maireana triptera					
Sclerolaena cuneata					
Sclerolaena patentiscuspis					
Monachather paradoxus					
Maireana tomentosa					
Lepidium oxytrichum					
Calotis hispidula					
Atriplex codonocarpa					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.368545 -28.951028	Quadrat:	Q18		
Quadrat size:	20x20				
Vegetation group:	Low open shrubland				
WP:	wpt084				
Photo number:	30				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	85				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:		Growth form:	S Shrub	Growth form:	S Shrub
Height:		Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:		Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
		Maireana pyramidata		Frankenia cinerea	
				Maireana tomentosa	
				Goodenia sp. Midwest	
				Sclerolaena diacantha	
				Atriplex codonocarpa	
				Sclerolaena densiflora	
				Calandrinia polyandra	
				Enchylaena tomentosa var. tomentosa	
				Eremophila compacta	
				Sclerolaena patentiscuspis	
				Erymophyllum ramosum subsp. ramosum	
				Calotis hispidula	
				Maireana triptera	
				Disphyma crassifolium	
				Eremophila maculata subsp. brevifolia	
ALL SPECIES					
Maireana pyramidata					
Frankenia cinerea					
Maireana tomentosa					
Goodenia sp. Midwest					
Sclerolaena diacantha					
Atriplex codonocarpa					
Sclerolaena densiflora					
Calandrinia polyandra					
Enchylaena tomentosa var. tomentosa					
Eremophila compacta					
Sclerolaena patentiscuspis					
Erymophyllum ramosum subsp. ramosum					
Calotis hispidula					
Maireana triptera					
Disphyma crassifolium					
Eremophila maculata subsp. brevifolia					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.366825 -28.934115	Quadrat:	Q19		
Quadrat size:	20x20				
Vegetation group:	open low chenopod shrubland				
WP:	wpt093				
Photo number:	31				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	l <1	Crown cover %:	l <1	Crown cover %:	S 10-30
Dominant taxa:	Eremophila youngii subsp. youngii		Maireana pyramidata		Cratystylis subspinescens
Hakea preissii			Maireana triptera		
ALL SPECIES					
Hakea preissii					
Eremophila youngii subsp. youngii					
Maireana pyramidata					
Cratystylis subspinescens					
Maireana triptera					
Sclerolaena diacantha					
Maireana tomentosa					
Ptilotus obovatus					
Goodenia sp. Midwest					
Atriplex bunburyana					
Senna artemisioides subsp. artemisioides					
Brachyscome ciliaris					
Calotis hispidula					
Solanum lasiophyllum					
Cephalopterum drummondii					
Maireana trichoptera					
Erodium cygnorum					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.366558 -28.925045	Quadrat:	Q20		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland				
WP:	wpt099				
Photo number:	32				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subangular				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	20				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	I <1	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia caesaneura		Grevillea berryana		Dianella revoluta var. divaricata	
Acacia aneura				Eremophila compacta	
Acacia incurvaneura				Acacia tetragonophylla	
ALL SPECIES					
Acacia caesaneura					
Acacia aneura					
Acacia incurvaneura					
Grevillea berryana					
Dianella revoluta var. divaricata					
Eremophila compacta					
Acacia tetragonophylla					
Eremophila forrestii subsp. forrestii					
Ptilotus obovatus					
Sida ectogama					
Sida sp. Golden calyces glabrous					
Sida calyxhymania					
Teucrium teucriiflorum					
Maireana triptera					
Eragrostis eriopoda					
Outside					
Eremophila platycalyx subsp. Leonora					
Acacia craspedocarpa					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.364332 -28.944615	Quadrat:	Q21		
Quadrat size:	20x20				
Vegetation group:	Acacia quadrimarginea over rocky plain				
WP:	wpt111				
Photo number:	35				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Cobbly; or cobbles/Subangular tabular				
Rock outcrop (abundance/runoff):	Very rocky/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia quadrimarginea		Eremophila glandulifera		Ptilotus obovatus	
Acacia aneura				Ptilotus schwartzii	
ALL SPECIES					
Acacia quadrimarginea					
Acacia aneura					
Eremophila glandulifera					
Ptilotus obovatus					
Ptilotus schwartzii					
Eriachne mucronata					
Brachychiton gregorii					
Ptilotus gaudichaudii					
Goodenia rosea					
Sclerolaena diacantha					
Cheilanthes sieberi subsp. sieberi					
Solanum lasiophyllum					
Erodium cygnorum					
Leichhardtia australis					
Rhodanthe marionii					
Sida calyxhymenia					
Acacia tetragonophylla					
Helipterum craspedioides					
Chrysocephalum puteale					
Stylidium ?sp 111-5					
Ptilotus roei					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.362205 -28.95395	Quadrat:	Q22		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila Forrestii and Eremophila compacta				
WP:	wpt120				
Photo number:	36				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose				
% Cover leaf litter:	35				
% Cover bare ground:	45				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:	Acacia tetragonophylla		Eremophila compacta		Eremophila compacta
Acacia caesaneura	Eremophila forrestii subsp. forrestii		Eragrostis eriopoda		
Acacia aneura			Ptilotus obovatus		
Acacia craspedocarpa					
ALL SPECIES					
Acacia caesaneura					
Acacia aneura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila forrestii subsp. forrestii					
Eremophila compacta					
Eragrostis eriopoda					
Ptilotus obovatus					
Dianella revoluta var. divaricata					
Maireana thesioides					
Leichhardtia australis					
Rhagodia drummondii					
Aristida contorta					
Maireana pyramidata					
Goodenia rosea					
Erodium crinitum					
Erodium cygnorum					
Thysanotus manglesianus					
Senna artemisioides subsp. filifolia					
Acacia ramulosa var. ramulosa					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:		Botanist:	Eren Reid		
Location:	GDA94 121.356405 -28.934007		Quadrat:	Q23	
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod and sclerophyll shrubland				
WP:	wpt165				
Photo number:	40				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:	Senna artemisioides subsp. artemisioides		Dominant taxa:		Maireana pyramidata
Acacia aneura					Cratystylis subspinescens
					Maireana triptera
ALL SPECIES					
Acacia aneura					
Senna artemisioides subsp. artemisioides					
Maireana pyramidata					
Cratystylis subspinescens					
Maireana triptera					
Ptilotus obovatus					
Erodium cygnorum					
Sclerolaena diacantha					
Eremophila platycalyx subsp. Leonora					
Eremophila metallicorum					
Solanum lasiophyllum					
Atriplex bunburyana					
Sida calyxhymenia					
Sclerolaena eriacantha					
Cephalopterum drummondii					
Goodenia sp. Midwest					
Sida ectogama					
Brachyscome ciliaris					
Acacia tetragonophylla					
Scaevola spinescens					
Outside					
Acacia caesaneura					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.353875 -28.932923	Quadrat:	Q24		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod				
WP:	wpt181				
Photo number:	41 & 42				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia sibirica		Maireana pyramidata	
Acacia mulganeura		Hakea preissii		Maireana triptera	
ALL SPECIES					
Acacia aneura					
Acacia mulganeura					
Acacia sibirica					
Hakea preissii					
Maireana pyramidata					
Maireana triptera					
Scaevola spinescens					
Cephalopterum drummondii					
Erodium cygnorum					
Enchylaena tomentosa var. tomentosa					
Roepera eremaea					
Brachyscome ciliaris					
Calotis multicaulis					
Rhodanthe charsleyae					
Calandrinia polyandra					
Ptilotus obovatus					
Aristida contorta					
Goodenia sp. Midwest					
Lepidium oxytrichum					
Asphodelus fistulosus*					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.354457 -28.926007	Quadrat:	Q25		
Quadrat size:	20x20				
Vegetation group:	Open mulga over chenopod				
WP:	wpt185				
Photo number:	43				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	1 <1	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Hakea preissii		Maireana pyramidata	
				Maireana triptera	
				Phebalium lepidotum	
ALL SPECIES					
Acacia aneura					
Hakea preissii					
Maireana pyramidata					
Maireana triptera					
Phebalium lepidotum					
Scaevola spinescens					
Maireana sedifolia					
Maireana georgei					
Sclerolaena diacantha					
Goodenia sp. Midwest					
Cephalopterum drummondii					
Ptilotus helipteroides					
Senna cardiosperma					
Ptilotus obovatus					
Calandrinia polyandra					
Maireana trichoptera					
Erodium cygnorum					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.352363 -28.945712	Quadrat:	Q26		
Quadrat size:	20x20				
Vegetation group:	Erem young over chenopod and Tecticornia				
WP:	wpt194				
Photo number:	44				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subangular				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	I <1	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:	Eremophila youngii subsp. youngii		Maireana pyramidata		Disphyma crassifolium
	Hakea preissii		Cratystylis subspinescens		Tecticornia disarticulata
ALL SPECIES					
Eremophila youngii subsp. youngii					
Hakea preissii					
Maireana pyramidata					
Cratystylis subspinescens					
Disphyma crassifolium					
Tecticornia disarticulata					
Atriplex vesicaria					
Ptilotus obovatus					
Goodenia sp. Midwest					
Austrostipa elegantissima					
Enchylaena tomentosa var. tomentosa					
Senecio glossanthus					
Maireana triptera					
Sclerolaena cuneata					
Sclerolaena patentiscuspis					
Monachather paradoxus					
Maireana tomentosa					
Lepidium oxytrichum					
Calotis hispidula					
Atriplex codonocarpa					
Atriplex bunburyana					
Podolepis capillaris					
Calandrinia polyandra					
Frankenia cinerea					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.350025 -28.950238	Quadrat:	Q27		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii and grassland				
WP:	wpt197				
Photo number:	45				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose				
% Cover leaf litter:	15				
% Cover bare ground:	45				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:	Acacia tetragonophylla		Eremophila compacta		Eragrostis eriopoda
Acacia caesaneura	Eremophila forrestii subsp. forrestii		Ptilotus obovatus		
Acacia aneura					
Acacia craspedocarpa					
ALL SPECIES					
Acacia caesaneura					
Acacia aneura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila forrestii subsp. forrestii					
Eremophila compacta					
Eragrostis eriopoda					
Ptilotus obovatus					
Dianella revoluta var. divaricata					
Maireana thesioides					
Leichhardtia australis					
Rhagodia drummondii					
Aristida contorta					
Maireana pyramidata					
Goodenia rosea					
Erodium crinitum					
Erodium cygnorum					
Thysanotus manglesianus					
Senna artemisioides subsp. filifolia					
Acacia ramulosa var. ramulosa					
Calandrinia eremaea					
Scaevola spinescens					
Eremophila miniata					
Enchylaena tomentosa var. tomentosa					
Haloragis gossei					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.350622 -28.929467	Quadrat:	Q28		
Quadrat size:	20x20				
Vegetation group:	Mulga over Senna shrubland				
WP:	wpt206				
Photo number:			46 & 47		
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subangular tabular				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	65				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Dominant taxa:		Dominant taxa:		
Acacia aneura	Senna artemisioides subsp. xsturtii		Maireana sedifolia		
	Eremophila oldfieldii subsp. angustifolia		Maireana triptera		
			Ptilotus obovatus		
ALL SPECIES					
Acacia aneura					
Senna artemisioides subsp. xsturtii					
Eremophila oldfieldii subsp. angustifolia					
Maireana sedifolia					
Maireana triptera					
Ptilotus obovatus					
Maireana pyramidata					
Rhagodia drummondii					
Enchylaena tomentosa var. tomentosa					
Scaevola spinescens					
Sclerolaena diacantha					
Frankenia cinerea					
Eremophila metallicorum					
Goodenia sp. Midwest					
Acacia pteraneura					
Senna artemisioides subsp. filifolia					
Senna glutinosa subsp. chatelainiana					
Hakea preissii					
Maireana tomentosa					
Lepidium platypetalum					
Austrostipa nitida					
Cephalopterum drummondii					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	14/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.348148 -28.948588	Quadrat:	Q29		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii				
WP:	wpt220				
Photo number:	48				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose				
% Cover leaf litter:	10				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	M 30-70	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:	Acacia tetragonophylla		Eremophila compacta		Eragrostis eriopoda
Acacia caesaneura	Eremophila forrestii subsp. forrestii		Ptilotus obovatus		
Acacia aneura					
Acacia craspedocarpa					
ALL SPECIES					
Acacia caesaneura					
Acacia aneura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila forrestii subsp. forrestii					
Eremophila compacta					
Eragrostis eriopoda					
Ptilotus obovatus					
Dianella revoluta var. divaricata					
Maireana thesioides					
Leichhardtia australis					
Rhagodia drummondii					
Aristida contorta					
Maireana pyramidata					
Goodenia rosea					
Erodium crinitum					
Erodium cygnorum					
Thysanotus manglesianus					
Senna artemisioides subsp. filifolia					
Acacia ramulosa var. ramulosa					
Eremophila miniata					
Enchylaena tomentosa var. tomentosa					
Haloragis gossei					
Scaevola spinescens					
Calandrinia eremaea					
Outside					
Eucalyptus oleosa subsp. oleosa					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.339487 -28.938457	Quadrat:	Q30		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland over ironstone hillslopes				
WP:	wpt246				
Photo number:	49				
Landform:	Simple slope/Hillslope				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Subangular tabular				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	30				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:	Acacia tetragonophylla		Dominant taxa:		Eremophila latrobei subsp. latrobei
Acacia caesaneura			Dominant taxa:		Sida ectogama
Acacia mulganeura			Dominant taxa:		Ptilotus obovatus
Acacia craspedocarpa			Dominant taxa:		
ALL SPECIES					
Acacia caesaneura					
Acacia mulganeura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila latrobei subsp. latrobei					
Sida ectogama					
Ptilotus obovatus					
Acacia aneura					
Eremophila clarkei					
Sida sp. Golden calyces glabrous					
Teucrium teucriiflorum					
Cheilanthes sieberi subsp. sieberi					
Maireana thesioides					
Senna artemisioides subsp. filifolia					
Sida calyxhymenia					
Rhagodia drummondii					
Dianella revoluta var. divaricata					
Goodenia havilandii					
Isoetopsis graminifolia					
Crassula colorata var. acuminata					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.339685 -28.942046	Quadrat:	Q31		
Quadrat size:	20x20				
Vegetation group:	Mulga over Eremophila forrestii				
WP:	wpt248				
Photo number:			50		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals		
Fire History:			Greater than 10 years ago		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/No runoff		
Soil (profile/field texture/soil surface):			Uniform/Sandy loam/Loose		
% Cover leaf litter:			20		
% Cover bare ground:			65		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	M Tree Mallee (> 8m)	Growth form:		Growth form:	
Height:	6-12m	Height:		Height:	
Crown cover %:	S 10-30	Crown cover %:		Crown cover %:	
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia caesaneura		Acacia tetragonophylla		Eremophila compacta	
Acacia aneura		Eremophila forrestii subsp. forrestii		Eragrostis eriopoda	
Acacia craspedocarpa				Ptilotus obovatus	
ALL SPECIES					
Acacia caesaneura					
Acacia aneura					
Acacia craspedocarpa					
Acacia tetragonophylla					
Eremophila forrestii subsp. forrestii					
Eremophila compacta					
Eragrostis eriopoda					
Ptilotus obovatus					
Dianella revoluta var. divaricata					
Maireana thesioides					
Leichhardtia australis					
Rhagodia drummondii					
Aristida contorta					
Maireana pyramidata					
Goodenia rosea					
Erodium crinitum					
Erodium cygnorum					
Thysanotus manglesianus					
Senna artemisioides subsp. filifolia					
Acacia ramulosa var. ramulosa					
Eremophila metallicorum					
Enchylaena tomentosa var. tomentosa					
Haloragis gossei					
Scaevola spinescens					
Sida ectogama					
Calandrinia eremaea					
Psydrax suaveolens					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.336042 -28.931813	Quadrat:	Q32		
Quadrat size:	20x20				
Vegetation group:	Mulga over bif				
WP:	wpt255				
Photo number:	55-57				
Landform:	Crest/Hill Crest				
Land surface/disturbance:	Limited clearing				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Stony; stones/Angular tabular				
Rock outcrop (abundance/runoff):	Very rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	25				
% Cover bare ground:	75				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Eremophila oldfieldii subsp. angustifolia		Eremophila latrobei subsp. latrobei	
Acacia caesaneura		Senna charlesiana		Ptilotus obovatus	
Acacia mulganeura		Acacia tetragonophylla		Maireana pyramidata	
ALL SPECIES					
Acacia aneura					
Acacia caesaneura					
Acacia mulganeura					
Eremophila oldfieldii subsp. angustifolia					
Senna charlesiana					
Acacia tetragonophylla					
Eremophila latrobei subsp. latrobei					
Ptilotus obovatus					
Maireana pyramidata					
Atriplex bunburyana					
Sisymbrium erisimoides*					
Maireana triptera					
Maireana georgei					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Scaevola spinescens					
Cheilanthes sieberi subsp. sieberi					
Erodium cygnorum					
Rhagodia drummondii					
Teucrium teucriiflorum					
Sclerolaena diacantha					
Ptilotus exaltatus					
Hakea preissii					
Atriplex vesicaria					
Enneapogon caerulescens					
Rhagodia eremaea					
Rumex vesicarius*					
Acacia quadrimarginea					
Sida ectogama					
Outside					
Senna artemisioides subsp. artemisioides					
Dodonaea rigida					
Grevillea berryana					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.336265 -28.938267	Quadrat:	Q33		
Quadrat size:	20x20				
Vegetation group:	Mulga on bif				
WP:	wpt258				
Photo number:	58				
Landform:	Crest/Hill Crest				
Land surface/disturbance:	Limited clearing				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Stony; stones/Angular tabular				
Rock outcrop (abundance/runoff):	Very rocky/Rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia tetragonophylla		Eremophila latrobei subsp. latrobei	
Acacia quadrimarginea				Ptilotus schwartzii	
Acacia mulganeura				Ptilotus obovatus	
ALL SPECIES					
Acacia aneura					
Acacia quadrimarginea					
Acacia mulganeura					
Acacia tetragonophylla					
Eremophila latrobei subsp. latrobei					
Ptilotus schwartzii					
Ptilotus obovatus					
Erodium cygnorum					
Cheilanthes sieberi subsp. sieberi					
Psychrax rigidula					
Dodonaea rigida					
Lepidium oxytrichum					
Eremophila clarkei					
Goodenia havilandii					
Ptilotus helipteroides					
Senna sp. Meekatharra					
Hakea recurva subsp. recurva					
Senna artemisioides subsp. artemisioides					
Rhagodia drummondii					
Sida ectogama					
Outside					
Scaevola spinescens					
Maireana sedifolia					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.333738 -28.944087	Quadrat:	Q34		
Quadrat size:	20x20				
Vegetation group:	Ac duriuscula on sand plain and chenopod shrubland.				
WP:	wpt262				
Photo number:			59		
Landform:			Flat/Plain		
Land surface/disturbance:			No effective disturbance except grazing by hoofed animals		
Fire History:			Greater than 10 years ago		
Coarse fragments on the surface (abundance/size/shape):			No coarse fragments		
Rock outcrop (abundance/runoff):			No bedrock exposed/No runoff		
Soil (profile/field texture/soil surface):			Uniform/Sandy loam/Loose		
% Cover leaf litter:			30		
% Cover bare ground:			65		
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia duriuscula		Eremophila pantonii		Maireana sedifolia	
Acacia craspedocarpa		Eremophila oldfieldii subsp. angustifolia		Ptilotus obovatus	
		Senna artemisioides subsp. filifolia		Maireana triptera	
ALL SPECIES					
Acacia duriuscula					
Acacia craspedocarpa					
Eremophila pantonii					
Eremophila oldfieldii subsp. angustifolia					
Senna artemisioides subsp. filifolia					
Maireana sedifolia					
Ptilotus obovatus					
Maireana triptera					
Solunum nummularium					
Calandrinia eremaea					
Atriplex bunburyana					
Scaevola spinescens					
Rhagodia drummondii					
Maireana pyramidata					
Enchylaena tomentosa var. tomentosa					
Cratystylis subspinescens					
Leichhardtia australis					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.33369 -28.93309	Quadrat:	Q35		
Quadrat size:	20x20				
Vegetation group:	Ac duriuscula over Maireana sedifolia and Scaevola spinescens on rocky substrate				
WP:	wpt270				
Photo number:	60				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Bouldery; or boulders/Subangular tabular				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:	Acacia duriuscula		Eremophila oldfieldii subsp. angustifolia		Maireana sedifolia
					Ptilotus obovatus
					Scaevola spinescens
					Sclerolaena diacantha
					Eremophila platycalyx subsp. Leonora
					Maireana pyramidata
					Maireana triptera
					Erodium cygnorum
					Eremophila latrobei subsp. latrobei
					Senna charlesiana
					Rhagodia drummondii
					Maireana tomentosa
					Solanum lasiophyllum
ALL SPECIES					
Acacia duriuscula					
Eremophila oldfieldii subsp. angustifolia					
Maireana sedifolia					
Ptilotus obovatus					
Scaevola spinescens					
Sclerolaena diacantha					
Eremophila platycalyx subsp. Leonora					
Maireana pyramidata					
Maireana triptera					
Erodium cygnorum					
Eremophila latrobei subsp. latrobei					
Senna charlesiana					
Rhagodia drummondii					
Maireana tomentosa					
Solanum lasiophyllum					
Outside					



Project Name: St Barbara Ltd Leonora Project						
Date:	15/09/2022	Botanist:	Eren Reid			
Location:	GDA94 121.331312 -28.940967	Quadrat:	Q36			
Quadrat size:	20x20					
Vegetation group:	Ac duriuscula over Maireana sedifolia and Scaevola spinescens					
WP:	wpt278					
Photo number:	61					
Landform:	Hillock/Mound					
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals					
Fire History:	Greater than 10 years ago					
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Cobbly; or cobbles/Subangular tabular					
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff					
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm					
% Cover leaf litter:	5					
% Cover bare ground:	75					
Tallest stratum		Mid-stratum		Lower stratum		
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub	
Height:	3-6m	Height:	1-3m	Height:	0.5-1m	
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30	
Dominant taxa:	Acacia duriuscula		Eremophila oldfieldii subsp. angustifolia		Maireana sedifolia	
					Ptilotus obovatus	
					Scaevola spinescens	
ALL SPECIES						
Acacia duriuscula						
Eremophila oldfieldii subsp. angustifolia						
Maireana sedifolia						
Ptilotus obovatus						
Scaevola spinescens						
Sclerolaena diacantha						
Eremophila platycalyx subsp. Leonora						
Maireana pyramidata						
Maireana triptera						
Erodium cygnorum						
Eremophila latrobei subsp. latrobei						
Senna charlesiana						
Rhagodia drummondii						
Maireana tomentosa						
Solanum lasiophyllum						
Senna artemisioides subsp. filifolia						
Enneapogon caeruleus						
Haloragis trigonocarpa						
Atriplex bunburyana						
Sclerolaena cuneata						
Maireana trichoptera						
Maireana georgei						
Outside						



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.323544 -28.935713	Quadrat:	Q37		
Quadrat size:	20x20				
Vegetation group:	Tecticornia shrubland				
WP:	wpt293				
Photo number:			72		
Landform:	Flat/Plain				
Land surface/disturbance:	Limited clearing				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Silty clay loam/Firm				
% Cover leaf litter:	<5				
% Cover bare ground:	90				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:		Growth form:		Growth form:	C Chenopod shrub
Height:		Height:		Height:	0.25-0.5m
Crown cover %:		Crown cover %:		Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	Tecticornia undulata
					Tecticornia indica subsp. bidens
					Tecticornia pruinosa
ALL SPECIES					
Tecticornia undulata					
Tecticornia indica subsp. bidens					
Tecticornia pruinosa					
Disphyma crassifolium					
Sclerolaena diacantha					
Frankenia pauciflora var. pauciflora					
Maireana triptera					
Sclerolaena patentiscuspis					
Sclerolaena drummondii					
Maireana carnososa					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.32335 -28.937525	Quadrat:	Q38		
Quadrat size:	20x20				
Vegetation group:	Mulga over Melaleuca interioris Eremophila miniata sand dune				
WP:	wpt294				
Photo number:	73-74-75				
Landform:	Dune rise				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose				
% Cover leaf litter:	5				
% Cover bare ground:	80				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:	Dominant taxa:		Dominant taxa:		
Acacia aneura	Melaleuca interioris		Scaevola spinescens		
	Hakea preissii				
	Eremophila miniata				
ALL SPECIES					
Acacia aneura					
Melaleuca interioris					
Hakea preissii					
Eremophila miniata					
Scaevola spinescens					
Rumex vesicarius*					
Maireana pyramidata					
Calandrinia eremaea					
Aristida contorta					
Outside					
Tecticornia pruinosa					
Tecticornia undulata					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.321543 -28.936477	Quadrat:	Q39		
Quadrat size:	20x20				
Vegetation group:	Tecticornia shrubland				
WP:	wpt295				
Photo number:			76		
Landform:	Closed depression/Playa				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Silty clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:		Growth form:		Growth form:	C Chenopod shrub
Height:		Height:		Height:	0.25-0.5m
Crown cover %:		Crown cover %:		Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	Tecticornia indica subsp. bidens
					Tecticornia undulata
					Tecticornia pruinosa
ALL SPECIES					
Tecticornia indica subsp. bidens					
Tecticornia undulata					
Tecticornia pruinosa					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	15/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.31971 -28.935485	Quadrat:	Q41		
Quadrat size:	20x20				
Vegetation group:	Mulga over Melaleuca interioris and Eremophila miniata				
WP:	wpt297				
Photo number:	78				
Landform:	Hillock/Dune*				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose				
% Cover leaf litter:	10				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:	Dominant taxa:		Dominant taxa:		
Acacia caesaneura	Melaleuca interioris		Scaevola spinescens		
	Hakea preissii				
	Eremophila miniata				
ALL SPECIES					
Acacia caesaneura					
Melaleuca interioris					
Hakea preissii					
Eremophila miniata					
Scaevola spinescens					
Rumex vesicarius*					
Maireana pyramidata					
Calandrinia eremaea					
Aristida contorta					
Salsola australis					
Melaleuca sheathiana					
Gunnipopsis quadrifida					
Outside					



Project Name: St Barbara Ltd Leonora Project						
Date:	15/09/2022	Botanist:	Eren Reid			
Location:	GDA94 121.311482 -28.931313	Quadrat:	Q42			
Quadrat size:	20x20					
Vegetation group:	Melaleuca sheathiana over Cratystylis subspinescens and Tecticornia					
WP:	wpt302					
Photo number:	79					
Landform:	Hillock/Dune*					
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals					
Fire History:	Greater than 10 years ago					
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments					
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff					
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose					
% Cover leaf litter:	5					
% Cover bare ground:	80					
Tallest stratum		Mid-stratum		Lower stratum		
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub	
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m	
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30	
Dominant taxa:	Melaleuca sheathiana		Cratystylis subspinescens		Tecticornia indica subsp. bidens	
				Tecticornia undulata		
				Atriplex vesicaria		
ALL SPECIES						
Melaleuca sheathiana						
Cratystylis subspinescens						
Tecticornia indica subsp. bidens						
Tecticornia undulata						
Atriplex vesicaria						
Sclerolaena diacantha						
Sclerolaena drummondii						
Eragrostis eriopoda						
Maireana amoena						
Scaevola spinescens						
Sclerolaena patenticuspis						
Disphyma crassifolium						
Frankenia pauciflora var. pauciflora						
Roepera eremaea						
Lycium australe						
Exocarpos aphyllus						
Eremophila miniata						
Austrostipa nitida						
Calandrinia eremaea						
Gunningsia quadrifida						
Eriachne pulchella subsp. pulchella						
Senecio glossanthus						
Outside						



Project Name: St Barbara Ltd Leonora Project						
Date:	15/09/2022	Botanist:	Eren Reid			
Location:	GDA94 121.311213 -28.930015	Quadrat:	Q43			
Quadrat size:	20x20					
Vegetation group:	Melaleuca sheathiana over Cratystylis subspinescens and Tecticornia					
WP:	wpt303					
Photo number:	80-81					
Landform:	Hillock/Dune*					
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals					
Fire History:	Greater than 10 years ago					
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments					
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff					
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose					
% Cover leaf litter:	5					
% Cover bare ground:	80					
Tallest stratum		Mid-stratum		Lower stratum		
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub	
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m	
Crown cover %:	V <10	Crown cover %:	S 10-30	Crown cover %:	S 10-30	
Dominant taxa:	Melaleuca sheathiana		Cratystylis subspinescens		Tecticornia indica subsp. bidens	
				Tecticornia undulata		
				Atriplex vesicaria		
ALL SPECIES						
Melaleuca sheathiana						
Cratystylis subspinescens						
Tecticornia indica subsp. bidens						
Tecticornia undulata						
Atriplex vesicaria						
Sclerolaena diacantha						
Sclerolaena drummondii						
Eragrostis eriopoda						
Maireana amoena						
Scaevola spinescens						
Sclerolaena patenticuspis						
Disphyma crassifolium						
Frankenia pauciflora var. pauciflora						
Roepera eremaea						
Lycium australe						
Exocarpos aphyllus						
Eremophila miniata						
Austrostipa nitida						
Calandrinia eremaea						
Gunnioopsis quadrifida						
Eriachne pulchella subsp. pulchella						
Senecio glossanthus						
Outside						



Project Name: St Barbara Ltd Leonora Project			
Date:	15/09/2022	Botanist:	Eren Reid
Location:	GDA94 121.314113 -28.934488	Quadrat:	Q44
Quadrat size:	20x20		
Vegetation group:	Tecticornia shrubland		
WP:	wpt309		
Photo number:	84		
Landform:	Closed depression/Playa		
Land surface/disturbance:	No effective disturbance		
Fire History:	Greater than 10 years ago		
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments		
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff		
Soil (profile/field texture/soil surface):	Uniform/Silty clay loam/Firm		
% Cover leaf litter:	5		
% Cover bare ground:	55		
Tallest stratum	Mid-stratum		Lower stratum
Growth form:	Growth form:	Growth form:	C Chenopod shrub
Height:	Height:	Height:	0.25-0.5m
Crown cover %:	Crown cover %:	Crown cover %:	M 30-70
Dominant taxa:	Dominant taxa:	Dominant taxa:	Tecticornia undulata
			Tecticornia indica subsp. bidens
			Frankenia pauciflora var. pauciflora
ALL SPECIES			
			Tecticornia undulata
			Tecticornia indica subsp. bidens
			Frankenia pauciflora var. pauciflora
			Stenopetalum salicola
			Cratystylis subspinescens
			Sondottia connata
			Didymanthus roei
			Rumex vesicarius*
Outside			



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.323392 -28.882643	Quadrat:	Q45		
Quadrat size:	20x20				
Vegetation group:	Creekline Vegetation				
WP:	wpt343				
Photo number:	89				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	75				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	T Tree	Growth form:	S Shrub	Growth form:	F Forb
Height:	6-12m	Height:	1-3m	Height:	0.25-0.5m
Crown cover %:	I <1	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Eucalyptus camaldulensis subsp. obtusa		Acacia tetragonophylla		Rhodanthe charleyae	
Acacia incurvaneura					
Acacia mulganeura					
ALL SPECIES					
Eucalyptus camaldulensis subsp. obtusa					
Acacia incurvaneura					
Acacia mulganeura					
Acacia tetragonophylla					
Rhodanthe charleyae					
Goodenia sp. Midwest					
Sisymbrium irio*					
Acacia pteraneura					
Sonchus oleraceus*					
Cenchrus ciliaris*					
Erodium cygnorum					
Acacia craspedocarpa					
Medicago minima*					
Lysimachia arvensis*					
Asphodelus fistulosus*					
Calandrinia eremaea					
Acacia aneura					
Senecio glossanthus					
Brachyscome ciliaris					
Ptilotus exaltatus					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.30249 -28.88828	Quadrat:	Q46		
Quadrat size:	20x20				
Vegetation group:	Mulga woodland				
WP:	wpt346				
Photo number:	91				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Slightly; few/Medium gravelly; medium pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	65				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Grevillea berryana		Eremophila compacta	
Acacia craspedocarpa					
ALL SPECIES					
Acacia mulganeura					
Acacia craspedocarpa					
Grevillea berryana					
Eremophila compacta					
Ptilotus obovatus					
Ptilotus schwartzii					
Amyema fitzgeraldii					
Erodium cygnorum					
Cheilanthes sieberi subsp. sieberi					
Dianella revoluta var. divaricata					
Eremophila clarkei					
Rhagodia drummondii					
Senna charlesiana					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.297512 -28.918365	Quadrat:	Q47		
Quadrat size:	20x20				
Vegetation group:	Mulga over Melaleuca interioris and Eremophila miniata				
WP:	wpt382				
Photo number:	96				
Landform:	Hillock/Dune*				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy loam/Loose				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia mulganeura		Eremophila miniata		Scaevola spinescens	
Acacia caesaneura		Melaleuca interioris		Tecticornia undulata	
				Tecticornia indica subsp. bidens	
ALL SPECIES					
Acacia mulganeura					
Acacia caesaneura					
Eremophila miniata					
Melaleuca interioris					
Scaevola spinescens					
Tecticornia undulata					
Tecticornia indica subsp. bidens					
Rhagodia eremaea					
Maireana pyramidata					
Gnephosis brevifolia					
Calandrinia eremaea					
Calandrinia polyandra					
Sclerolaena diacantha					
Maireana georgei					
Cenchrus ciliaris*					
Frankenia laxiflora					
Leichhardtia australis					
Enchylaena tomentosa var. tomentosa					
Melaleuca sheathiana					
Senecio glossanthus					
Sonchus oleraceus*					
Erodium cygnorum					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.29843 -28.899157	Quadrat:	Q48		
Quadrat size:	20x20				
Vegetation group:	Creekline Vegetation				
WP:	wpt393				
Photo number:	98				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Cracking				
% Cover leaf litter:	10				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	F Forb
Height:	6-12m	Height:	1-3m	Height:	<0.25m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	M 30-70
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia aneura		Acacia tetragonophylla		Rhodanthe charsleyae	
Acacia incurvaneura				Erodium cygnorum	
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia mulganeura					
Acacia tetragonophylla					
Rhodanthe charsleyae					
Erodium cygnorum					
Podolepis canescens					
Cuscuta planiflora*					
Wahlenbergia gracilentia					
Asphodelus fistulosus*					
Calandrinia eremaea					
Eremophila clarkei					
Cheilanthes sieberi subsp. sieberi					
Walshia kendallii					
Vittadinia sulcata					
Rhodanthe propinqua					
Goodenia havilandii					
Calandrinia creethae					
Wahlenbergia tumidiflora					
Plantago turrifera					
Crassula colorata var. acuminata					
Santalum lanceolatum					
Outside					
Schoenia cassiniana					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.301422 -28.913897	Quadrat:	Q49		
Quadrat size:	20x20				
Vegetation group:	Mulga over chenopod shrubland				
WP:	wpt400				
Photo number:	101				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Rounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	75				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	I <1	Crown cover %:	S 10-30
Dominant taxa:	Acacia tetragonophylla		Maireana pyramidata		Maireana triptera
Acacia aneura					Maireana triptera
Acacia craspedocarpa					Cratystylis subspinescens
Acacia mulganeura					
ALL SPECIES					
Acacia aneura					
Acacia craspedocarpa					
Acacia mulganeura					
Acacia tetragonophylla					
Maireana pyramidata					
Maireana triptera					
Cratystylis subspinescens					
Ptilotus obovatus					
Eremophila compacta					
Atriplex bunburyana					
Erodium cygnorum					
Rhodanthe propinqua					
Sclerolaena diacantha					
Sclerolaena cuneata					
Maireana tomentosa					
Eremophila forrestii subsp. forrestii					
Cephalopterum drummondii					
Goodenia sp. Midwest					
Calandrinia eremaea					
Calandrinia polyandra					
Enchylaena tomentosa var. tomentosa					
Senna charlesiana					
Sida ectogama					
Leichhardtia australis					
Teucrium teucriiflorum					
Outside					
Eremophila metallicorum					
Acacia quadrimarginea					
Acacia caesaneura					
Frankenia cinerea					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.303447 -28.896702	Quadrat:	Q50		
Quadrat size:	20x20				
Vegetation group:	Creekline vegetation				
WP:	wpt410				
Photo number:	102				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No coarse fragments				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Cracking				
% Cover leaf litter:	10				
% Cover bare ground:	60				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	Y Shrub Mallee (< 8m)	Growth form:	S Shrub	Growth form:	F Forb
Height:	6-12m	Height:	1-3m	Height:	<0.25m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	M 30-70
Dominant taxa:			Dominant taxa:		
Acacia aneura			Acacia tetragonophylla		
Acacia incurvaneura				Rhodanthe charsleyae	
Acacia mulganeura				Erodium cygnorum	
ALL SPECIES					
Acacia aneura					
Acacia incurvaneura					
Acacia mulganeura					
Acacia tetragonophylla					
Rhodanthe charsleyae					
Erodium cygnorum					
Podolepis canescens					
Cuscuta planiflora*					
Wahlenbergia gracilentia					
Asphodelus fistulosus*					
Calandrinia eremaea					
Eremophila clarkei					
Cheilanthes sieberi subsp. sieberi					
Walshia kendallii					
Vittadinia sulcata					
Rhodanthe propinqua					
Goodenia havilandii					
Calandrinia creethae					
Wahlenbergia tumidiflora					
Plantago turrifera					
Crassula colorata var. acuminata					
Santalum lanceolatum					
Schoenia cassiniana					
Outside					



Project Name: St Barbara Ltd Leonora Project						
Date:	16/09/2022	Botanist:	Eren Reid			
Location:	GDA94 121.307497 -28.915712	Quadrat:	Q51			
Quadrat size:	20x20					
Vegetation group:	Acacia burkittii creekline vegetation					
WP:	wpt424					
Photo number:	103					
Landform:	Open depression (vale)/Drainage depression					
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals					
Fire History:	Greater than 10 years ago					
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Coarse gravelly; large pebbles/Subrounded					
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff					
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm					
% Cover leaf litter:	10					
% Cover bare ground:	55					
Tallest stratum		Mid-stratum		Lower stratum		
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub	
Height:	3-6m	Height:	1-3m	Height:	0.5-1m	
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30	
Dominant taxa:	Acacia burkittii		Myoporum montanum		Atriplex bunburyana	
			Scaevola spinescens		Tecticornia pruinosa	
					Tecticornia undulata	
ALL SPECIES						
Acacia burkittii						
Myoporum montanum						
Scaevola spinescens						
Atriplex bunburyana						
Tecticornia pruinosa						
Tecticornia undulata						
Rumex vesicarius*						
Lysimachia arvensis*						
Cenchrus ciliaris*						
Sisymbrium irio*						
Enchylaena tomentosa var. tomentosa						
Eremophila youngii subsp. youngii						
Sonchus oleraceus*						
Maireana tomentosa						
Maireana pyramidata						
Atriplex vesicaria						
Eucalyptus camaldulensis subsp. obtusa						
Sclerolaena cuneata						
Sclerolaena diacantha						
Sclerolaena patentiuspis						
Gunnopsia quadrifida						
Leichhardtia australis						
Ptilotus obovatus						
Solanium lasiophyllum						
Exocarpos aphyllus						
Outside						



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.307248 -28.917792	Quadrat:	Q52		
Quadrat size:	20x20				
Vegetation group:	Acacia burkittii creekline vegetation				
WP:	wpt426				
Photo number:	104				
Landform:	Open depression (vale)/Drainage depression				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Bouldery; or boulders/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	10				
% Cover bare ground:	55				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30
Dominant taxa:		Dominant taxa:		Dominant taxa:	
Acacia burkittii		Myoporum montanum		Atriplex bunburyana	
		Scaevola spinescens		Tecticornia pruinosa	
				Tecticornia undulata	
ALL SPECIES					
Acacia burkittii					
Myoporum montanum					
Scaevola spinescens					
Atriplex bunburyana					
Tecticornia pruinosa					
Tecticornia undulata					
Rumex vesicarius*					
Lysimachia arvensis*					
Cenchrus ciliaris*					
Sisymbrium irio*					
Enchylaena tomentosa var. tomentosa					
Eremophila youngii subsp. youngii					
Sonchus oleraceus*					
Maireana tomentosa					
Maireana pyramidata					
Atriplex vesicaria					
Eucalyptus camaldulensis subsp. obtusa					
Sclerolaena cuneata					
Sclerolaena diacantha					
Sclerolaena patentiscuspis					
Gunnipopsis quadrifida					
Leichhardtia australis					
Ptilotus obovatus					
Solanum lasiophyllum					
Exocarpos aphyllus					
Maireana georgei					
Lycium australe					
Melaleuca interioris					
Melaleuca sheathiana					
Calandrinia eremaea					
Calandrinia polyandra					
Outside					



Project Name: St Barbara Ltd Leonora Project						
Date:	16/09/2022	Botanist:	Eren Reid			
Location:	GDA94 121.30949 -28.912877	Quadrat:	Q53			
Quadrat size:	20x20					
Vegetation group:	Acacia burkittii creekline vegetation					
WP:	wpt429					
Photo number:	105					
Landform:	Open depression (vale)/Drainage depression					
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals					
Fire History:	Greater than 10 years ago					
Coarse fragments on the surface (abundance/size/shape):	No qualifier; common/Bouldery; or boulders/Subrounded					
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff					
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm					
% Cover leaf litter:	10					
% Cover bare ground:	55					
Tallest stratum		Mid-stratum		Lower stratum		
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub	
Height:	3-6m	Height:	1-3m	Height:	0.5-1m	
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	S 10-30	
Dominant taxa:	Acacia burkittii		Acacia craspedocarpa		Atriplex bunburyana	
			Scaevola spinescens		Senna cardiosperma	
			Acacia tetragonophylla			
ALL SPECIES						
Acacia burkittii						
Acacia craspedocarpa						
Scaevola spinescens						
Acacia tetragonophylla						
Atriplex bunburyana						
Senna cardiosperma						
Rumex vesicarius*						
Lysimachia arvensis*						
Cenchrus ciliaris*						
Sisymbrium irio*						
Enchylaena tomentosa var. tomentosa						
Rhodanthe charsleyae						
Sonchus oleraceus*						
Maireana tomentosa						
Maireana pyramidata						
Atriplex vesicaria						
Goodenia sp. Midwest						
Sclerolaena cuneata						
Sclerolaena diacantha						
Sclerolaena patentiscuspis						
Gunnopsis quadrifida						
Leichhardtia australis						
Ptilotus obovatus						
Solanum lasiophyllum						
Exocarpos aphyllus						
Maireana georgei						
Lycium australe						
Melaleuca interioris						
Melaleuca sheathiana						
Calandrinia eremaea						
Calandrinia polyandra						
Calandrinia creethae						
Wahlenbergia tumidifruca						
Erodium cygnorum						
Outside						



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.317306 -28.913124	Quadrat:	Q54		
Quadrat size:	20x20				
Vegetation group:	Eremophila youngii over Eremophila scoparia over Tecticornia shrubland				
WP:	wpt470				
Photo number:	107				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Surface crust				
% Cover leaf litter:	15				
% Cover bare ground:	55				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	M 30-70
Dominant taxa:	Cratystylis subspinescens		Maireana pyramidata		Tecticornia disarticulata
Eremophila youngii subsp. youngii	Maireana pyramidata		Eremophila scoparia		
	Eremophila scoparia				
ALL SPECIES					
Eremophila youngii subsp. youngii					
Cratystylis subspinescens					
Maireana pyramidata					
Eremophila scoparia					
Tecticornia disarticulata					
Ptilotus obovatus					
Goodenia sp. Midwest					
Austrostipa elegantissima					
Enchylaena tomentosa var. tomentosa					
Senecio glossanthus					
Maireana triptera					
Sclerolaena cuneata					
Sclerolaena patentiuspis					
Monachather paradoxus					
Maireana tomentosa					
Lepidium oxytrichum					
Calotis hispidula					
Atriplex codonocarpa					
Outside					



Project Name: St Barbara Ltd Leonora Project						
Date:	16/09/2022	Botanist:	Eren Reid			
Location:	GDA94 121.319353 -28.912977	Quadrat:	Q55			
Quadrat size:	20x20					
Vegetation group:	Eremophila youngii over Eremophila scoparia over Tecticornia shrubland					
WP:	wpt484					
Photo number:	108					
Landform:	Flat/Plain					
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals					
Fire History:	Greater than 10 years ago					
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Medium gravelly; medium pebbles/Subrounded					
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff					
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Surface crust					
% Cover leaf litter:	15					
% Cover bare ground:	55					
Tallest stratum		Mid-stratum		Lower stratum		
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub	
Height:	1-3m	Height:	0.5-1m	Height:	0.25-0.5m	
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	M 30-70	
Dominant taxa:	Eremophila youngii subsp. youngii		Cratystylis subspinescens		Tecticornia disarticulata	
			Maireana pyramidata			
			Eremophila scoparia			
ALL SPECIES						
Eremophila youngii subsp. youngii						
Cratystylis subspinescens						
Maireana pyramidata						
Eremophila scoparia						
Tecticornia disarticulata						
Ptilotus obovatus						
Goodenia sp. Midwest						
Austrostipa elegantissima						
Enchylaena tomentosa var. tomentosa						
Senecio glossanthus						
Maireana triptera						
Sclerolaena cuneata						
Sclerolaena patentiuspis						
Monachather paradoxus						
Maireana tomentosa						
Lepidium oxytrichum						
Calotis hispidula						
Atriplex codonocarpa						
Outside						



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.322124 -28.908388	Quadrat:	Q56		
Quadrat size:	20x20				
Vegetation group:	Mulga over Quartz outcrop				
WP:	wpt489				
Photo number:	109				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Stony; stones/Subangular				
Rock outcrop (abundance/runoff):	No bedrock exposed/Very rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Acacia ramulosa var. ramulosa		Senna artemisioides subsp. xsturtii		Eremophila forrestii subsp. forrestii
Acacia aneura			Eremophila platycalyx subsp. Leonora		Eremophila platycalyx subsp. Leonora
ALL SPECIES					
Acacia aneura					
Acacia ramulosa var. ramulosa					
Senna artemisioides subsp. xsturtii					
Eremophila forrestii subsp. forrestii					
Eremophila platycalyx subsp. Leonora					
Erodium cygnorum					
Goodenia sp. Midwest					
Sclerolaena cuneata					
Sclerolaena diacantha					
Rhodanthe propinqua					
Leichhardtia australis					
Atriplex bunburyana					
Ptilotus helipteroides					
Rumex vesicarius*					
Cheilanthes sieberi subsp. sieberi					
Roepera eremaea					
Austrostipa nitida					
Enneapogon caeruleus					
Rhodanthe maryonii					
Sida sp. Golden calyces glabrous					
Acacia tetragonophylla					
Ptilotus schwartzii					
Ptilotus roei					
Eragrostis eriopoda					
Eriachne flaccida					
Maireana sedifolia					
Maireana triptera					
Calandrinia eremaea sans lat					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.32209 -28.906573	Quadrat:	Q57		
Quadrat size:	20x20				
Vegetation group:	Mulga over Senna Shrubland				
WP:	wpt490				
Photo number:			110		
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Cobbly; or cobbles/Subangular				
Rock outcrop (abundance/runoff):	No bedrock exposed/Slow				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	6-12m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Dominant taxa:		Dominant taxa:		
Acacia aneura	Senna artemisioides subsp. xsturtii		Maireana sedifolia		
	Eremophila oldfieldii subsp. angustifolia		Maireana triptera		
			Ptilotus obovatus		
ALL SPECIES					
Acacia aneura					
Senna artemisioides subsp. xsturtii					
Eremophila oldfieldii subsp. angustifolia					
Maireana sedifolia					
Maireana triptera					
Ptilotus obovatus					
Maireana pyramidata					
Rhagodia drummondii					
Enchylaena tomentosa var. tomentosa					
Scaevola spinescens					
Sclerolaena diacantha					
Frankenia cinerea					
Eremophila metallicorum					
Goodenia sp. Midwest					
Acacia pteraneura					
Senna artemisioides subsp. filifolia					
Senna glutinosa subsp. chatelainiana					
Hakea preissii					
Maireana tomentosa					
Lepidium platypetalum					
Austrostipa nitida					
Cephalopterum drummondii					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022	Botanist:	Eren Reid		
Location:	GDA94 121.32274 -28.905232	Quadrat:	Q58		
Quadrat size:	20x20				
Vegetation group:	Mulga over Quartz outcrop				
WP:	wpt491				
Photo number:	111				
Landform:	Hillock/Mound				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Moderately; many/Stony; stones/Subangular				
Rock outcrop (abundance/runoff):	Rockland/Very rapid				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Hard setting				
% Cover leaf litter:	5				
% Cover bare ground:	70				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	S 10-30	Crown cover %:	S 10-30	Crown cover %:	V <10
Dominant taxa:	Acacia ramulosa var. ramulosa		Senna artemisioides subsp. xsturtii		Eremophila forrestii subsp. forrestii
Acacia aneura			Eremophila platycalyx subsp. Leonora		Eremophila platycalyx subsp. Leonora
ALL SPECIES					
Acacia aneura					
Acacia ramulosa var. ramulosa					
Senna artemisioides subsp. xsturtii					
Eremophila forrestii subsp. forrestii					
Eremophila platycalyx subsp. Leonora					
Erodium cygnorum					
Goodenia sp. Midwest					
Sclerolaena cuneata					
Sclerolaena diacantha					
Rhodanthe propinqua					
Leichhardtia australis					
Atriplex bunburyana					
Ptilotus helipteroides					
Rumex vesicarius*					
Cheilanthes sieberi subsp. sieberi					
Roepera eremaea					
Austrostipa nitida					
Enneapogon caeruleus					
Rhodanthe maryonii					
Sida sp. Golden calyces glabrous					
Acacia tetragonophylla					
Ptilotus schwartzii					
Ptilotus roei					
Eragrostis eriopoda					
Eriachne flaccida					
Maireana sedifolia					
Maireana triptera					
Calandrinia eremaea sans lat					
Outside					



Project Name: St Barbara Ltd Leonora Project					
Date:	16/09/2022		Botanist:	Eren Reid	
Location:	GDA94 121.323712 -28.909788		Quadrat:	Q59	
Quadrat size:	20x20				
Vegetation group:	Open mulga over chenopod				
WP:	wpt493				
Photo number:	112				
Landform:	Flat/Plain				
Land surface/disturbance:	No effective disturbance except grazing by hoofed animals				
Fire History:	Greater than 10 years ago				
Coarse fragments on the surface (abundance/size/shape):	Very; abundant/Coarse gravelly; large pebbles/Subrounded				
Rock outcrop (abundance/runoff):	No bedrock exposed/No runoff				
Soil (profile/field texture/soil surface):	Uniform/Sandy clay loam/Firm				
% Cover leaf litter:	5				
% Cover bare ground:	80				
Tallest stratum		Mid-stratum		Lower stratum	
Growth form:	S Shrub	Growth form:	S Shrub	Growth form:	S Shrub
Height:	3-6m	Height:	1-3m	Height:	0.5-1m
Crown cover %:	V <10	Crown cover %:	V <10	Crown cover %:	S 10-30
Dominant taxa:	Acacia pteraneura		Dominant taxa:	Maireana pyramidata	
	Acacia aneura		Dominant taxa:	Atriplex bunburyana	
			Dominant taxa:	Ptilotus obovatus	
ALL SPECIES					
Acacia pteraneura					
Acacia aneura					
Hakea preissii					
Maireana pyramidata					
Atriplex bunburyana					
Ptilotus obovatus					
Maireana triptera					
Cenchrus ciliaris*					
Sclerolaena diacantha					
Maireana tomentosa					
Enchylaena tomentosa var. tomentosa					
Atriplex vesicaria					
Eremophila compacta					
Austrostipa nitida					
Sclerolaena densiflora					
Maireana georgei					
Brachyscome ciliaris					
Erodium cygnorum					
Sida intricata					
Sida sp. Excedentifolia					
Eremophila platycalyx subsp. Leonora					
Rumex vesicarius*					
Solanum lasiophyllum					
Calandrinia eremaea					
Calandrinia polyandra					
Asphodelus fistulosus*					
Sclerolaena eriacantha					
Lepidium oxytrichum					
Salvia verbenaca*					
Acacia tetragonophylla					
Senna artemisioides subsp. filifolia					
Schinus molle var. areira					
Rhodanthe charsleyae					
Tecticornia disarticulata					
Outside					



APPENDIX C

Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment

Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment

St Barbara Leonora Province Expansion

Prepared for: Native Vegetation Solutions

Version 1. February, 2023



RECORD OF DISTRIBUTION

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REPORT CONTENTS

EXECUTIVE SUMMARY

1.	INTRODUCTION	1
1.1	Background	1
1.2	Project objectives and scope of works	1
2.	EXISTING ENVIRONMENT	2
2.1	Location of project area	2
2.2	Land use history	2
2.3	Climate	2
2.4	Regional biological fauna context of project area	3
2.5	Fauna species at risk.....	5
3.	METHODOLOGY	6
3.1	Database searches.....	6
3.2	Site inspection and fauna habitat assessment.....	6
3.3	Survey and reporting staff	8
3.4	Taxonomy and nomenclature.....	8
3.5	Limitations.....	8
4.	RESULTS	10
4.1	Fauna habitat.....	10
4.2	Feral species.....	13
4.3	Bioregional vertebrate fauna assemblage	14
4.4	Conservation significant fauna	19
5.	DISCUSSION	28
5.1	Adequacy of the fauna survey data for fauna habitats represented in the project area	28
5.1.1	Amphibians	28
5.1.2	Reptiles	28
5.1.3	Birds	29
5.1.4	Mammals.....	29
5.2	Biodiversity value	29
5.2.1	Ecological functional value at the ecosystem level	29
5.2.2	Maintenance of threatened ecological communities.....	29
5.2.3	Condition of fauna habitat.....	30
5.2.4	Ecological linkages	30
5.2.5	Size and scale of the proposed disturbance	30
5.2.6	Abundance and distribution of similar habitat in the adjacent areas.....	30
6.	POTENTIAL ENVIRONMENTAL IMPACTS	31
6.1.1	Animal deaths during the clearing process and displacement of fauna	31
6.1.2	Impacts of the wind turbines on birds and bats	31
6.1.3	Reduction or loss of activity areas and closure of burrows	32
6.1.4	Habitat fragmentation	32

6.1.5	Introduced fauna and weeds	32
6.1.6	Road fauna deaths	33
6.1.7	Fire	33
6.1.8	Anthropogenic activity	33
6.1.9	Dust	33
6.1.10	Risk assessment	33
6.2	Native vegetation clearing principles as they pertain to vertebrate fauna	37
6.3	Referral under the EPBC Act	37
7.	SUMMARY	38
8.	MANAGEMENT STRATEGIES.....	39
8.1	Induction and awareness	39
8.2	Fauna management plan	39
8.3	Feral predators	39
9.	REFERENCES	40

LIST OF CHARTS

Chart 1. Climatic averages for Leonora	2
--	---

LIST OF PLATES

Plate 1. Salt lake.....	10
Plate 2. Ephemeral creek line.....	10
Plate 3. Ephemeral creek line.....	11
Plate 4. Tall shrubland.....	11
Plate 5. Tall shrubland.....	11
Plate 6. Tall shrubland.....	11
Plate 7. Low shrubland	11
Plate 8. Low shrubland	11
Plate 9. Open mulga woodland	12
Plate 10. Open mulga woodland.....	12
Plate 11. Disturbed area.....	12
Plate 12. Disturbed area.....	12
Plate 13. Evidence of earlier mining activity.....	12
Plate 14. Evidence of earlier mining activity.....	12
Plate 15. Malleefowl tracks	13
Plate 16. Malleefowl tracks	13
Plate 17. Rabbit scats	13
Plate 18. Cattle tracks.....	13
Plate 19. Horse scats.....	14
Plate 20. Dog tracks.....	14

LIST OF TABLES

Table 1. Variables assessed during the rapid habitat assessment	7
Table 2. Fauna survey limitations and constraints	9
Table 3. Location of Malleefowl tracks (GDA 94, UTM Zone 51)	13
Table 4. Birds potentially found near the project area.....	14
Table 5. Amphibians potentially found near the project area	16
Table 6. Mammals potentially found near the project area.....	17
Table 7. Reptiles potentially found near the project area	17
Table 8. Assessment of the potential presence of a conservation significant fauna species in the project area	20
Table 9. Bat species potentially in the Goldfields.....	31
Table 10. Fauna impact risk assessment descriptors	34
Table 11. Levels of acceptable risk	34
Table 12. A risk assessment of the impact of ground disturbance activity on fauna	35
Table 13. Assessment of impact using the native vegetation clearing principles.....	37



LIST OF FIGURES

Figure 1. Regional context	46
Figure 2. Fauna habitats and rapid habitat assessment locations	46

LIST OF APPENDICES

Appendix A. Results of the <i>EPBC Act</i> Protected Matters Search	
Appendix B. Vertebrate fauna recorded in biological surveys in the region	
Appendix C. Definitions of Significant Fauna under the <i>WA Biodiversity Conservation Act 2016</i> and Priority Species	
Appendix D. Rapid habitat assessments	

EXECUTIVE SUMMARY

Native Vegetation Solutions on behalf of St Barbara Ltd requested a vertebrate fauna risk assessment to support the preparation of environmental approval applications for the Leonora Province Expansion project area in Leonora (i.e. project area). The project is located north and south of Leonora and straddles the Goldfields Highway and the Leonora Mount Ida Road. The total assessed area was 3,581.2ha.

There are five broad fauna habitats in the project area:

- Bare salt lakes;
- Ephemeral creek lines;
- Tall shrublands;
- Low shrublands; and
- Open mulga woodlands.

In addition, there are disturbed areas that are largely devoid of vegetation, and if present are mostly weeds with few vertebrate fauna.

The density of trees and shrubs in the relatively undisturbed areas varied across the project area but was mostly sparse. The fauna habitat varied from highly degraded to good; the more degraded areas are due to historical and recent mining activity and grazing. There are numerous access tracks in the project area, but these are narrow and mostly only wheel tracks on a sand-clay substrate. There is extensive evidence of feral fauna in the area.

Tracks of Malleefowl were recorded at three locations in the project area, but there are no active or recently active Malleefowl mounds, so it is probable these are isolated birds that are moving around in the areas of slightly more-dense vegetation, but are not breeding. Clearing native vegetation in the project area is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the vegetation clearing process, however, this loss is not likely to be significant when viewed in a bioregional context. The few larger animals, such as kangaroos, large goannas and snakes, and most of the birds will move into adjacent areas once vegetation clearing commences, so potential impacts will be low. There may be an on-going loss of small native fauna to vehicle strikes on access tracks, but overall, this impact will be very low. Forced fauna migrants because of vegetation clearing increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

There was evidence of rabbits, cattle, horses and wild dogs in the project area, and probably feral cats. These feral and pest fauna are likely to be doing more environmental damage than the combined impacts of proposed development.

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

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

The proposed windfarm will potentially impact on birds and bats in the project area, so a management plan is required, that may include increasing the wind-turbines cut-in speed to minimise the impact on birds and bats.

It is recommended that:

- an induction program that includes a component on managing vertebrate fauna is mandatory for staff working in the project area;

- the vertebrate fauna management plan for the project should specifically address potential impacts on birds and bats, and include mitigation strategies to minimise this impact;
- the management of wild dogs and feral cats is specifically addressed in the vertebrate fauna management plan; and
- the impact of dust on adjacent vegetation and therefore fauna habitat is managed and monitored against appropriate KPIs.

1. INTRODUCTION

1.1 BACKGROUND

Native Vegetation Solutions on behalf of St Barbara Ltd requested a vertebrate fauna risk assessment to support the preparation of environmental approval applications for the Leonora Province Expansion project area in Leonora (i.e. project area; Figure 1). The project is located north and south of Leonora and straddles the Goldfields Highway and the Leonora Mount Ida Road. The total assessed area was 3,581.2ha. The project area includes large and deep mining pits, some of which contain water, waste dumps, tailings storage facilities, mining infrastructure, part of the Leonora airstrip, the Leonora racecourse and some residential housing.

1.2 PROJECT OBJECTIVES AND SCOPE OF WORKS

Terrestrial Ecosystems was commissioned to undertake a Basic vertebrate fauna risk assessment including a targeted survey for Malleefowl and their mounds for the Leonora Province Expansion project area. The purpose of this Basic vertebrate fauna risk assessment was to provide information to the proponent on the potential impacts on the vertebrate fauna assemblage in the project area to enable the proposed development to be adequately assessed. The methodology broadly follows that described in the Environmental Protection Authority (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*.

This Basic fauna risk assessment involved a desktop review and site visit. The assessment objectives were to:

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

To achieve these objectives, Terrestrial Ecosystems:

- reviewed Terrestrial Ecosystems' database [includes Atlas of Living Australia and Western Australian Museum records] to identify potential vertebrate fauna within the area;
- searched the Commonwealth Governments database of fauna of national environmental significance to identify species potentially occurring within the area that are protected under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* or international migratory bird agreements (JAMBA/CAMBA);
- undertook a site reconnaissance survey;
- reviewed previous fauna surveys conducted near the project area;
- undertook an assessment of the potential risks to the fauna associated with clearing additional areas of native vegetation and operation of wind turbines in the area;
- discussed the likelihood of *EPBC Act 1999* and *Biodiversity Conservation Act 2016 (BC Act)* listed species being present in the project area; and
- provided management recommendations to avoid, mitigate and minimise potential impacts on the fauna in the project area.

2. EXISTING ENVIRONMENT

2.1 LOCATION OF PROJECT AREA

The project area is in the Murchison 1 (MUR1 - East Murchison subregion) IBRA bioregion. Cowan (2001) described the subregion as mostly dominated by mulga woodlands that are often rich in ephemerals; hummock grasslands, salt bush shrub lands and halosarcia shrub lands. Cowan (2001) recorded no threatened ecological communities in the vicinity of the project areas. Threatening process for conservation significant fauna were listed by Cowan (2001) as foxes and cats.

2.2 LAND USE HISTORY

The dominant land uses for the bioregion are native pasture to support grazing and crown land reserves, and to a lesser extent mining and exploration. The region surrounding the project area has been disturbed for minerals exploration and there are many operational and non-operational mining projects in the region.

The project area includes large and deep mining pits, some of which contain water, waste dumps, tailings storage facilities, mining infrastructure, part of the Leonora airstrip, the Leonora racecourse and some residential housing.

2.3 CLIMATE

The project area is characterised as semi-arid. Leonora has an annual rainfall of approximately 235mm, although this varies considerably from year-to-year. The highest mean maximum and minimum temperatures in Leonora are in January with an average of 37°C and 21.8°C, respectively (Bureau of Meteorology, 2022). The lowest mean daily maximum and minimum temperatures occur in July (Chart 1). Average monthly rainfall is heaviest in January - March.

Summer rain is unpredictable and often results from thunderstorms coming from the north and the west or decaying cyclonic activity as low-pressure cells move from the Pilbara through the Goldfields.

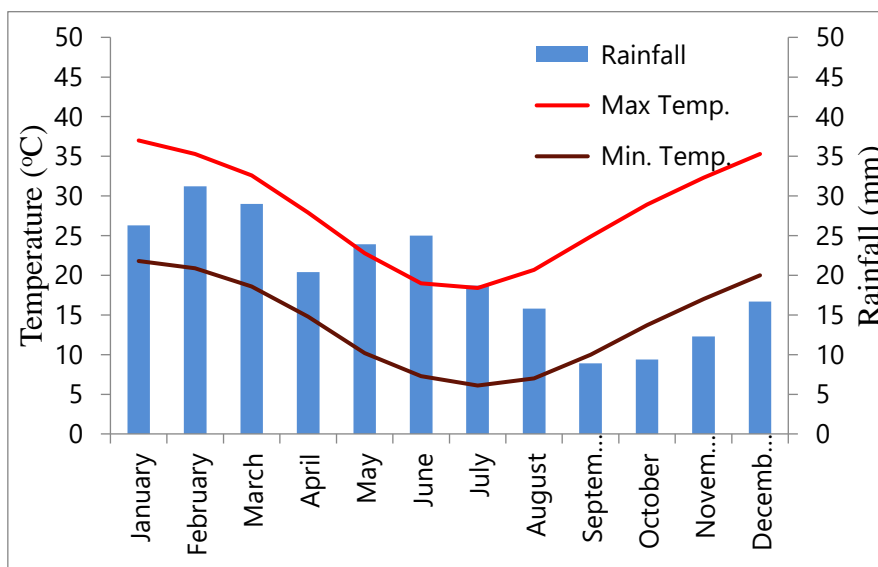


Chart 1. Climatic averages for Leonora

2.4 REGIONAL BIOLOGICAL FAUNA CONTEXT OF PROJECT AREA

The frogs, reptiles, mammals and birds in the vicinity of the project area have been surveyed for other environmental assessments and research purposes and are therefore known. Fauna surveys and assessments undertaken in the vicinity of the project area that have been reviewed for this assessment include:

- Bamford Consulting Ecologists (2007) *Fauna Assessment and Targeted Mulgara Search of the Fish Deposit, Laverton Gold Project*.
- Bell, D. T., Bell, R. C. and Loneragan, W. A. (2007) Winter bird assemblages across an arid gradient in south-west Western Australia. *Journal of the Royal Society of Western Australia* 90, 219-227.
- Biota Environmental Sciences (2004) *Cosmos Nickel Mine Extension Fauna Survey*. Unpublished report for Sir Samuel Mines NL and URS, Perth.
- Biota Environmental Sciences (2007) *Bannockburn Fauna Habitat and Assemblage Survey*. Unpublished report for Jubilee Mines NL, Perth.
- Coffey Environments (2007) *Level 1 Fauna Assessment, Leinster Nickel Operations*, Perth.
- Coffey Environments (2008) *Level 2 Fauna Assessment for the Duketon Gold Project*. Unpublished report for Regis Resources, Perth.
- Craig, M. D. and Chapman, A. (2003) Effects of short-term drought on the avifauna of Wanjarri Nature Reserve: What do they tell us about drought refugia. *Journal of the Royal Society of Western Australia* 86: 133-137.
- Dell, J. and How, R. A. (1988) Vertebrate fauna. In: The biological survey of the Eastern Goldfields of Western Australia, Part 5, Edjudina - Menzies Study Area. *Records of the Western Australian Museum*, Supplement No 31, 38-77.
- Dell, J., How, R. A. and Milewski, A. V. (1992) The biological survey of the Eastern Goldfields, Part 6, Youanmi-Leonora Study Area. *Records of the Western Australian Museum*, Supplement No 40, 131.
- Donarto Environmental Services (2005a) *Leinster Nickel Operations Tailing Storage Facility and Water Storage Areas: Wildlife Interactions and Assessment of Risks*, Perth.
- Dunlop, J. N. (1990) The small vertebrate ground fauna of Mulga habitats near Wiluna, Western Australia. *Mulga Research Centre Journal*, 10, 19-27.
- ENV Australia (2008) *Agnew Prospects Fauna Assessment*. Unpublished report for Agnew Gold Mining Company Pty Limited, Perth.
- Halpern Glick Maunsell, (1999) *Rosemont Gold Project Biological Assessment Survey - Phases 1 & 2*. Unpublished report for Johnson's Well Mining NL, Perth.
- Hall, N.J, McKenzie, N.L. and Keighery, B.J. (1994b) The Biological Survey of the Eastern Goldfields of Western Australia Part 10. Sandstone-Sir Samuel and Laverton-Leonora Study Areas. *Records of the Western Australian Museum*. Supplement No. 47.
- Harewood, G (2011) *Terrestrial Fauna Survey (Level 1) of the West Laverton Area (P38/3717, P38/3718, P38/3491, P38/3492, P38/3314, P38/3490, P38/3315, M38/0046, M38/0049, M38/0040, M38/0358, M38/0048, M38/0101, M38/0364, M38/0342, M38/0345, L38/0179, L38/0177, L38/0178, L38/0153, L38/0092, E38/1930, E38/2347, E38/2084 & E38/1966)*. Unpublished report for Crescent Gold Limited.
- Hart, Simpson and Associates (2000) Anaconda Nickel Ltd, *Cawse Expansion Project Fauna Survey*. Unpublished report for Anaconda Nickel Ltd, Perth.
- How, R. A. and Dell, J. (1992) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia Part 7. Duketon - Sir Samuel Study Area. *Records of the Western Australian Museum*; Supplement 40, 90-109.
- Kingfisher Environmental Consulting (2014) *Murrin Murrin – Sunrise Dam Infrastructure Corridor Level 1 Fauna Survey*. Unpublished report for Anglogold Ashanti Australia, Perth.
- Kingfisher Environmental Consulting (2020) *Northern Goldfields Interconnect Pipeline Fauna Assessment*. Unpublished report for APA Group, Perth.
- MBS Environmental (2004) *Vegetation and Habitat Assessment of the Euro, Sickle and Admiral Hill Project Areas, Laverton*. Unpublished report for Crescent Gold Limited.

- McKenzie, N. L., Rolfe, J. K. and Youngson, W. K. (1992) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia; Part 8; Kurnalpi - Kalgoorlie Study Area. *Records of the Western Australian Museum*, Supplement No 41, 37-65.
- McKenzie, N. L., Rolfe, J. K. and Youngson, W. K. (1994a) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia Part 10, Sandstone-Sir Samuel and Laverton-Leonora Study Areas. *Records of the Western Australian Museum*, Supplement No 47, pp. 51-85.
- Moriarty, T. K. (1972) Birds of Wanjarrri; WA (27°; 25'S; 120° 40'E) *The Emu*, 72, 1-7.
- Murphy, D. (1994) *Vertebrate fauna species of the North-eastern Goldfields*. Report to Western Mining's Leinster Nickel and Mount Keith Operations, Perth.
- Ninox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Murrin Expansion Project*. Unpublished report for Anaconda Nickel Ltd, Perth.
- Ninox Wildlife Consulting (2005) *Vertebrate Fauna Habitat Assessment of the Proposed Expansions to the Cosmos Nickel Mine, near Leinster, Western Australia*. Unpublished report for URS Australia Pty Ltd, Perth.
- Phoenix Environmental Sciences (2021) Fauna and habitat survey for the Redcliffe Gold Project. Unpublished report for Dacian Gold Limited, Perth.
- Spectrum Ecology and Spatial (2022) Leonora Operations Flora and Vegetation Site Visit and Basic Vertebrate Fauna Assessment. Unpublished report for Talis Consultants and St Barbara Limited, Perth.
- Terrestrial Ecosystems (2010) *Level 2 Fauna Risk Assessment for the Garden Well Project Area*. Unpublished report for Regis Resources Ltd, Perth.
- Terrestrial Ecosystems (2011a) *Level 2 Fauna Risk Assessment for Granny Deeps Project Area*. Unpublished report for Barrick Gold Corporation, Perth.
- Terrestrial Ecosystems (2011c) *Targeted Survey for Long-tailed Dunnarts for the Granny Deeps Project Area*. Perth.
- Terrestrial Ecosystems (2012a) *Level 1 Vertebrate Fauna Risk Assessment for the Proposed Exploration Areas around the Granny Open Pit Project Area*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2012b) *Level 1 Vertebrate Fauna Risk Assessment for the Proposed Mining Areas around the Granny Open Pit Project Area*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2014) *Level 1 Fauna Risk Assessment for a proposed power station site, Perth*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2015) *Fauna risk assessment of the proposed borrow pit expansion*. Unpublished report for Granny Smith Mining Pty Ltd, Perth.
- Terrestrial Ecosystems (2018) *Vertebrate Fauna Risk Assessment for the Granny Smith Solar Power Farm Project*, Unpublished report for Granny Smith Mining Company Pty Ltd, Perth.
- Terrestrial Ecosystems (2020) *Level 2 Vertebrate Fauna Assessment for the King of the Hills Project*, Unpublished report for Red 5, Perth.

In addition, there are individual records for fauna contained in the Atlas of Living Australia and the Western Australian Museum collection have also been accessed.

The most useful of these are the report by Terrestrial Ecosystems (2020) for the King of the Hills project area, which is approximately 25km to the north of the project area and includes very similar fauna habitats, the Western Australian Museum's (WAM) regional eastern goldfields biological surveys which were undertaken in the Duketon-Sir Samuel, Sandstone-Sir Samuel and Laverton areas (How and Dell 1992, McKenzie et al. 1994b) and the Murrin Murrin Expansion project fauna survey (Ninox Wildlife Consulting 1998) which is east of the project area and has similar fauna habitats and fauna assemblages.

These fauna surveys, when considered together, provide a near complete list of the vertebrate species likely to be found in the project area. The composition of vertebrate fauna assemblages varies from habitat-to-habitat and site-to-site within the bioregion, but the survey data contained in the attached appendices provide a good indication of the vertebrate fauna assemblage that is likely to be found in the project area. These data therefore provide a good regional context and indicate the extent of fauna assemblage variation that might be anticipated from site-to-site and temporally.

2.5 FAUNA SPECIES AT RISK

Cowan (2003), in a dated report, indicated fauna species at risk in the East Murchison subregion were the Bilby (*Macrotis lagotis*), Marsupial Mole (*Notoryctes typhlops*), Mulgara (*Dasyercus cristicauda / blythi*), Malleefowl (*Leipoa ocellata*), Princess Parrot (*Polytelis alexandrae*), Slender-billed Thornbill (*Acanthiza iredalei iredalei*), Giant Desert Skink (*Liopholis kintorei*) and Peregrine Falcon (*Falco peregrinus*). Since then, several additional species have been added to the list including Night Parrot (*Pezoporus occidentalis*), Sandhill Dunnart (*Sminthopsis psammophila*), Western Spiny-tailed Skink (*Egernia stokesii badia*), Grey Falcon (*Falco hypoleucos*), and Chuditch (*Dasyurus geoffroii*). This report assesses the potential for these species to be found in the project area and the potential impact that the proposed development might have on these species, and other conservation significant fauna.

3. METHODOLOGY

3.1 DATABASE SEARCHES

A review of the *EPBC Act 1999* Matters of National Environmental Significance (MNES) list of protected species was undertaken to identify species of conservation interest to the Commonwealth Government (Appendix A). In addition, a desktop search of Terrestrial Ecosystems' fauna survey database was used to develop an appreciation of the vertebrate fauna assemblages in relevant sections of the bioregion near the project area.

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

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

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

3.2 SITE INSPECTION AND FAUNA HABITAT ASSESSMENT

A site visit was undertaken on 12 and 17 September 2022 to assess fauna habitat types and condition in the project area and to search for evidence of Malleefowl.

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

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

The surveyor who undertook the site assessment, stopped at multiple locations within the project area and recorded a suite of data about the fauna habitat and its condition. This information included a description of the habitat structure, habitat condition, landform, soils and vegetation and time since last fire (Table 1).

Table 1. Variables assessed during the rapid habitat assessment

Observer's Name:	
Coordinates of the location as UTM (GDA94):	
Fire history – options	
<input type="checkbox"/> > 5 years	
<input type="checkbox"/> 1-5 years	
<input type="checkbox"/> < 1 year	
Landform – options	
<input type="checkbox"/> Beach	<input type="checkbox"/> Lower slope
<input type="checkbox"/> Clay plain	<input type="checkbox"/> Mid slope
<input type="checkbox"/> Cliff	<input type="checkbox"/> Ridge
<input type="checkbox"/> Creek line	<input type="checkbox"/> River
<input type="checkbox"/> Dam	<input type="checkbox"/> Rocky outcrop / breakaway
<input type="checkbox"/> Drainage line	<input type="checkbox"/> Salt lake
<input type="checkbox"/> Dune crest	<input type="checkbox"/> Sand dune
<input type="checkbox"/> Dune slope	<input type="checkbox"/> Sand plain
<input type="checkbox"/> Dune swale	<input type="checkbox"/> Stony plain
<input type="checkbox"/> Escarpment	<input type="checkbox"/> Swamp
<input type="checkbox"/> Flat	<input type="checkbox"/> Undulating
<input type="checkbox"/> Gorge	<input type="checkbox"/> Upper slope
<input type="checkbox"/> Gully	<input type="checkbox"/> Wetland
<input type="checkbox"/> Intertidal / mangrove	<input type="checkbox"/> Water hole
<input type="checkbox"/> Lake / lake edge	
Habitat quality – options	
<input type="checkbox"/> <i>High quality fauna habitat</i> – These areas closely approximate the vegetation mix and quality that would have been in the area prior to any disturbance. The habitat has connectivity with other habitats and is likely to contain the most natural vertebrate fauna assemblage.	
<input type="checkbox"/> <i>Very good fauna habitat</i> - These areas show minimal signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) and generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be minimally effected by disturbance.	
<input type="checkbox"/> <i>Good fauna habitat</i> – These areas showed signs of disturbance (e.g. grazing, clearing, fragmentation, weeds) but generally retain many of the characteristics of the habitat if it had not been disturbed. The habitat has connectivity with other habitats and fauna assemblages in these areas are likely to be affected by disturbance.	
<input type="checkbox"/> <i>Disturbed fauna habitat</i> – These areas showed signs of significant disturbance. Many of the trees, shrubs and undergrowth are cleared. These areas may be in the early succession and regeneration stages. Areas may show signs of significant grazing, containing weeds or have been damaged by vehicle or machinery. Habitats are fragmented or have limited connectivity with other fauna habitats. Fauna assemblages in these areas are likely to differ significantly from what might be expected in the area had the disturbance not occurred.	
<input type="checkbox"/> <i>Highly degraded fauna habitat</i> – These areas often have a significant loss of vegetation, an abundance of weeds, and a large number of vehicle tracks or are completely cleared. Limited or no fauna habitat connectivity. Fauna	

assemblages in these areas are likely to be significantly different to what might have been in the area pre-disturbance.	
Soil colour - options	
<input type="checkbox"/> Black	<input type="checkbox"/> Red
<input type="checkbox"/> Brown	<input type="checkbox"/> White
<input type="checkbox"/> Grey	<input type="checkbox"/> Yellow
<input type="checkbox"/> Orange	
Surface stones – options	
<input type="checkbox"/> None	<input type="checkbox"/> Boulders (>250mm)
<input type="checkbox"/> Pebbles (0-50mm)	<input type="checkbox"/> Rocks
<input type="checkbox"/> Cobbles (51-250)	

3.3 SURVEY AND REPORTING STAFF

Joel Wilson undertook the site investigation and fauna habitat assessment and searched the project area for Malleefowl and their mounds. Dr Graham Thompson prepared this report and Dr Scott Thompson reviewed the report before it was sent to the client. Both senior scientists have appropriate relevant post-graduate qualifications, extensive experience in conducting fauna assessments in the Goldfields, have published research articles on biodiversity, fauna assemblages, conservation significant species, trapping techniques and temporal variations in trapped fauna assemblages based on Goldfields surveys and are therefore appropriately trained and experienced for the task of preparing this assessment. Both Scott and Graham have undertaken multiple assessments near Leonora and are familiar with the habitat in the project area and surrounds.

3.4 TAXONOMY AND NOMENCLATURE

Taxonomy and nomenclature for fauna species used in this report are based on the WA Museum species list. Terrestrial Ecosystems has presumed that the identifications referred to in the appendices or in reports used to provide local and regional comparative data were correct and we have only corrected obvious records where the nomenclature was known to be incorrect.

3.5 LIMITATIONS

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

The EPA (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* suggested that fauna surveys may be limited by many variables. Limitations associated with each of these variables are assessed in Table 2.

Table 2. Fauna survey limitations and constraints

Possible limitations	Constraint (yes/no); significant, moderate or negligible	Comment
Availability of data and information	Yes, negligible	There are vertebrate fauna survey data available for similar habitats near the project area.
Competency/experience of the survey team, including experience in the bioregion surveyed	No	The field survey team and authors of this report have appropriate post-graduate qualifications, undertaken multiple surveys and assessments in the region, have published a book and multiple refereed journal articles based on fauna surveys in the goldfields and are familiar with the vertebrate fauna in this bioregion.
Scope of the survey, e.g. where faunal groups were excluded from the survey	N/A	
Timing, weather and season	No	Weather was suitable for a site and fauna habitat assessment.
Disturbance that may have affected results, e.g. fire, flood	No	Disturbances in the project area have been factored into this assessment.
The proportion of fauna identified, recorded or collected	N/A	
Adequacy of the survey intensity and proportion of survey achieved, e.g. the extent to which the area was surveyed	No	Discussed in the report.
Access problems	No	There were no access problems.
Problems with data and analysis, including sampling biases	N/A	
Timing, weather and season	No	Weather was suitable for a site survey and assessment.

N/A = not applicable, Significant = major impact on outcome of the assessment, Moderate = impacted parts of the assessment, Negligible = almost no impact on the assessment.

4. RESULTS

4.1 FAUNA HABITAT

There are five broad fauna habitats in the project area:

- Bare salt lakes;
- Ephemeral creek lines;
- Tall shrublands;
- Low shrublands; and
- Open mulga woodlands.

In addition, there are disturbed areas that are largely devoid of vegetation, including large and deep mining pits, some of which contain water, waste dumps, tailings storage facilities, mining infrastructure, part of the Leonora airstrip, the Leonora racecourse and some residential housing.

The density of trees and shrubs in the relatively undisturbed areas varied across the project area but was mostly sparse. Trees and shrubs are most dense in the ephemeral creek lines. Fauna habitat quality varied from highly degraded to good; the more degraded areas are due to historical and recent exploration and mining activity, grazing, and existing tracks. There are numerous access tracks in the project area, but these are narrow and mostly only wheel tracks on a sand-clay substrate. There is extensive evidence of feral fauna in the area.

Plates 1-14 show some of the fauna habitats present in the project area.



Plate 1. Salt lake



Plate 2. Ephemeral creek line



Plate 3. Ephemeral creek line



Plate 4. Tall shrubland



Plate 5. Tall shrubland



Plate 6. Tall shrubland



Plate 7. Low shrubland



Plate 8. Low shrubland



Plate 9. Open mulga woodland



Plate 10. Open mulga woodland



Plate 11. Disturbed area



Plate 12. Disturbed area



Plate 13. Evidence of earlier mining activity



Plate 14. Evidence of earlier mining activity

Some very old disused Malleefowl mounds were recorded in other regional surveys. Malleefowl tracks were recorded in three locations (Table 3), two in the southern section and one in the western section of the project area (Plates 15 and 16). No Malleefowl mounds were recorded.

Table 3. Location of Malleefowl tracks (GDA 94, UTM Zone 51)

Easting	Northing
338186	6797369
336582	6797779
334013	6799946



Plate 15. Malleefowl tracks



Plate 16. Malleefowl tracks

4.2 FERAL SPECIES

The project area supports rabbits (Plate 17), cattle (Plate 18), horses (Plate 19) and wild dogs (Plate 20) and probably feral cats.



Plate 17. Rabbit scats



Plate 18. Cattle tracks



Plate 19. Horse scats



Plate 20. Dog tracks

4.3 BIOREGIONAL VERTEBRATE FAUNA ASSEMBLAGE

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

Tables 3-6 provide a list of vertebrate species potentially found near the project area that have been compiled based on the fauna survey report results shown in Appendix B.

Table 4. Birds potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu	Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth
Anatidae	<i>Biziura lobata</i>	Musk Duck	Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar
	<i>Tadorna tadornoides</i>	Australian Shelduck	Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar
	<i>Chenonetta jubata</i>	Australian Wood Duck	Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	Otididae	<i>Ardeotis australis</i>	Australian Bustard
	<i>Anas gracilis</i>	Grey Teal	Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
	<i>Anas superciliosa</i>	Pacific Black Duck	Ardeidae	<i>Ardea pacifica</i>	White-necked Heron
	<i>Aythya australis</i>	Hardhead		<i>Egretta novaehollandiae</i>	White-faced Heron
Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	Accipitridae	<i>Haliastur sphenurus</i>	Whistling Kite
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing		<i>Accipiter fasciatus</i>	Brown Goshawk
	<i>Phaps histrionica</i>	Flock Bronzewing		<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk
	<i>Ocyphaps lophotes</i>	Crested Pigeon		<i>Circus assimilis</i>	Spotted Harrier
	<i>Geopelia placida</i>	Diamond Dove		<i>Aquila audax</i>	Wedge-tailed Eagle
				<i>Hieraaetus morphnoides</i>	Little Eagle

Family	Species	Common Name
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel
Falconidae	<i>Falco berigora</i>	Brown Falcon
	<i>Falco longipennis</i>	Australian Hobby
	<i>Falco peregrinus</i>	Peregrine Falcon
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Native-hen
	<i>Fulica atra</i>	Eurasian Coot
Recurvirostridae	<i>Himantopus leucocephalus</i>	Pied Stilt
Recurvirostridae	<i>Cladorhynchus leucocephalus</i>	Banded Stilt
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover
	<i>Elsyornis melanops</i>	Black-fronted Dotterel
	<i>Vanellus tricolor</i>	Banded Lapwing
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Turnicidae	<i>Turnix velox</i>	Little Button-quail
Cacatuidae	<i>Eolophus roseicapillus</i>	Galah
	<i>Nymphicus hollandicus</i>	Cockatiel
Psittacidae	<i>Barnardius zonarius</i>	Australian Ringneck
	<i>Psephotus varius</i>	Mulga Parrot
	<i>Melopsittacus undulatus</i>	Budgerigar
	<i>Neopsephotus bourkii</i>	Bourke's Parrot
	<i>Neophema splendida</i>	Scarlet-chested Parrot
Cuculidae	<i>Chalcites basalus</i>	Horsfield's Bronze-cuckoo
	<i>Chalcites osculans</i>	Black-eared Cuckoo
	<i>Heteroscenes pallidus</i>	Pallid Cuckoo
Halcyonidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper
	<i>Climacteris rufa</i>	Rufous Treecreeper
Ptilonorhynchidae	<i>Ptilonorhynchus maculatus</i>	Spotted Bowerbird
	<i>Ptilonorhynchus guttatus</i>	Western Bowerbird

Family	Species	Common Name
Maluridae	<i>Malurus splendens</i>	Splendid Fairy-wren
	<i>Malurus leucopterus</i>	White-winged Fairy-wren
	<i>Malurus lamberti</i>	Variegated Fairy-wren
Acanthizidae	<i>Calamanthus fuliginosus</i>	Striated Fieldwren
	<i>Pyrrholaemus brunneus</i>	Redthroat
	<i>Smicronis brevirostris</i>	Weebill
	<i>Gerygone fusca</i>	Western Gerygone
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill
	<i>Acanthiza apicalis</i>	Inland Thornbill
	<i>Aphelocephala leucopsis</i>	Southern Whiteface
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater
	<i>Gavicalis virescens</i>	Singing Honeyeater
	<i>Lichenostomus ornatus</i>	Yellow-plumed Honeyeater
	<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater
	<i>Purnella albifrons</i>	White-fronted Honeyeater
	<i>Manorina flavigula</i>	Yellow-throated Miner
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater
	<i>Epthianura tricolor</i>	Crimson Chat
	<i>Epthianura aurifrons</i>	Orange Chat
	<i>Sugomel niger</i>	Black Honeyeater
	<i>Lichmera indistincta</i>	Brown Honeyeater
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler
Psophodidae	<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush
Neositidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella
Campephagidae	<i>Coracina maxima</i>	Ground Cuckoo-shrike
	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike

Family	Species	Common Name	Family	Species	Common Name
	<i>Lalage tricolor</i>	White-winged Triller		<i>Corvus bennetti</i>	Little Crow
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous Whistler		<i>Corvus orru</i>	Torresian Crow
	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark
	<i>Oreoica gutturalis</i>	Crested Bellbird	Petroicidae	<i>Microeca fascinans</i>	Jacky Winter
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow		<i>Petroica goodenovii</i>	Red-capped Robin
	<i>Artamus cinereus</i>	Black-faced Woodswallow		<i>Melanodryas cucullata</i>	Hooded Robin
	<i>Artamus minor</i>	Little Woodswallow	Megaluridae	<i>Cincloramphus mathewsi</i>	Rufous Songlark
	<i>Cracticus torquatus</i>	Grey Butcherbird		<i>Cincloramphus cruralis</i>	Brown Songlark
	<i>Cracticus nigrogularis</i>	Pied Butcherbird	Hirundinidae	<i>Cheramoeca leucosterna</i>	White-backed Swallow
	<i>Gymnorhina tibicen</i>	Australian Magpie		<i>Hirundo neoxena</i>	Welcome Swallow
	<i>Strepera versicolor</i>	Grey Currawong		<i>Petrochelidon ariel</i>	Fairy Martin
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail		<i>Petrochelidon nigricans</i>	Tree Martin
	<i>Rhipidura leucophrys</i>	Willie Wagtail	Nectariniidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird
Corvidae	<i>Corvus coronoides</i>	Australian Raven	Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit

Table 5. Amphibians potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Hylidae	<i>Cyclorana maini</i>	Sheep Frog		<i>Neobatrachus sudelli</i>	Sudell's Frog
	<i>Cyclorana platycephala</i>	Water-holding Frog		<i>Neobatrachus sutor</i>	Shoemaker Frog
Limnodynastidae	<i>Neobatrachus aqilonius</i>	Northern Burrowing Frog		<i>Neobatrachus wilsmorei</i>	Goldfields Bullfrog
	<i>Neobatrachus kunapalari</i>	Kunapalari Frog		<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog

Table 6. Mammals potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Bovidae	<i>Bos taurus</i>	Cow		<i>Ningai ridei</i>	Wongai Ningai
	<i>Capra hircus</i>	Goat		<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart
	<i>Ovis aries</i>	Sheep		<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart
Camelidae	<i>Camelus dromedarius</i>	Dromedary		<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart
Canidae	<i>Canis lupus</i>	Dingo/dog		<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart
	<i>Vulpes vulpes</i>	Red Fox		<i>Sminthopsis macroura</i>	Stripe-faced Dunnart
Felidae	<i>Felis catus</i>	House Cat		<i>Sminthopsis ooldea</i>	Ooldea Dunnart
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail Bat	Macropodidae	<i>Osphranter robustus</i>	Euro
Molossidae	<i>Austronomus australis</i>	White-striped Free-tail Bat		<i>Osphranter rufus</i>	Red Kangaroo
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Leporidae	<i>Oryctolagus cuniculus</i>	European Rabbit
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		<i>Equus caballus</i>	Domestic Horse
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	Equidae	<i>Mus musculus</i>	House Mouse
	<i>Vespadelus regulus</i>	Southern Forest Bat	Muridae	<i>Notomys alexis</i>	Spinifex Hopping Mouse
Dasyuridae	<i>Antechinomys laniger</i>	Kultarr		<i>Pseudomys desertor</i>	Desert Mouse
	<i>Dasyercus cristicauda/blythi</i>	Mulgara		<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse

Table 7. Reptiles potentially found near the project area

Family	Species	Common Name	Family	Species	Common Name
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon		<i>Nephurus wheeleri</i>	Banded Knob-tail
	<i>Ctenophorus fordi</i>	Mallee Dragon		<i>Underwoodisaurus milii</i>	Barking Gecko
	<i>Ctenophorus inermis</i>	Military Dragon	Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Diplodactylus
	<i>Ctenophorus isolepis</i>	Crested Dragon		<i>Diplodactylus granariensis</i>	Wheat-belt Stone Gecko
	<i>Ctenophorus maculatus</i>	Spotted Dragon		<i>Diplodactylus pulcher</i>	Fine-faced Gecko
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon		<i>Lucasium damaeum</i>	Beaded Gecko
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon		<i>Lucasium squarrosus</i>	Mottled Ground Gecko
	<i>Ctenophorus salinarum</i>	Saltpan Dragon		<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon		<i>Strophurus elderi</i>	Jewelled Gecko
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon		<i>Strophurus strophurus</i>	Western Spiny-tailed Gecko
	<i>Moloch horridus</i>	Thorny Devil		<i>Strophurus wellingtonae</i>	Spiny-tailed Gecko
	<i>Pogona minor</i>	Western Bearded Dragon	Elapidae	<i>Brachyuropis fasciolata</i>	Narrow-banded Burrowing Snake
	<i>Tympanocryptis pseudopsephos</i>	Pebble Dragon		<i>Brachyuropis semifasciata</i>	Half-girdled Snake
Boidae	<i>Antaresia stimsoni</i>	Stimson's Python		<i>Furina ornata</i>	Orange-naped Snake
Carphodactylidae	<i>Nephurus levis</i>	Three-lined Knob-tail		<i>Parasuta monachus</i>	Monk Snake
	<i>Nephurus vertebralis</i>	Midline Knob-tail			

Family	Species	Common Name
	<i>Pseudechis australis</i>	Mulga Snake
	<i>Pseudechis butleri</i>	Spotted Mulga Snake
	<i>Pseudonaja mengdeni</i>	Gwardar
	<i>Pseudonaja modesta</i>	Ringed Brown Snake
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake
	<i>Suta fasciata</i>	Rosen's Snake
Gekkonidae	<i>Gehyra purpurascens</i>	Purplish Dtella
	<i>Gehyra variegata</i>	Tree Dtella
	<i>Gehyra xenopus</i>	Crocodile-faced Dtella
	<i>Heteronotia binoei</i>	Bynoe's Prickly Gecko
	<i>Rhynchoedura ornata</i>	Western Beaked Gecko
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard
	<i>Delma butleri</i>	Unbanded Delma
	<i>Delma nasuta</i>	Sharp-snouted Delma
	<i>Lialis burtonis</i>	Burton's Snake-lizard
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot
Scincidae	<i>Cryptoblepharus australis</i>	Inland Snake-eyed Skink
	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink
	<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus
	<i>Ctenotus dux</i>	Fine Side-lined Ctenotus
	<i>Ctenotus grandis</i>	Grand Ctenotus
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus
	<i>Ctenotus hanloni</i>	Nimbel Ctenotus
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus
	<i>Ctenotus pantherinus</i>	Leopard Skink
	<i>Ctenotus piankai</i>	Coarse Sands Ctenotus
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus
	<i>Ctenotus schomburgkii</i>	Schomburgk's Ctenotus

Family	Species	Common Name
	<i>Ctenotus severus</i>	Stern Ctenotus
	<i>Ctenotus uber</i>	Spotted Ctenotus
	<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink
	<i>Egernia formosa</i>	Goldfields Crevice-skink
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand Swimmer
	<i>Lerista bipes</i>	North-western Sandslider
	<i>Lerista desertorum</i>	Central Desert Robust Slider
	<i>Lerista distinguenda</i>	South-western Orange-tailed Slider
	<i>Lerista kingi</i>	King's Slider
	<i>Lerista timida</i>	Timid Slider
	<i>Liopholis inornata</i>	Desert Skink
	<i>Liopholis striata</i>	Nocturnal Desert Skink
	<i>Menetia greyii</i>	Common Dwarf Skink
	<i>Morethia butleri</i>	Woodland Morethia Skink
	<i>Tiliqua multifasciata</i>	Centralian Blue-tongued Lizard
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake
	<i>Anilius bicolor</i>	Dark-spined Blind Snake
	<i>Anilius endoterus</i>	Interior Blind Snake
	<i>Anilius hamatus</i>	Pale-headed Blind Snake
	<i>Anilius waitii</i>	Waite's Blind Snake
Varanidae	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor
	<i>Varanus eremius</i>	Pygmy Desert Monitor
	<i>Varanus giganteus</i>	Perentie
	<i>Varanus gouldii</i>	Gould's Goanna
	<i>Varanus panoptes</i>	Yellow-spotted Monitor
	<i>Varanus tristis</i>	Black-headed Monitor
Cheluidae	<i>Chelodina steindachneri</i>	Steindachner's Snake-necked Turtle

4.4 CONSERVATION SIGNIFICANT FAUNA

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

Wetland and wetland migratory bird species have been excluded from the following list and assessments as there is no suitable habitat for these species in the project area, other than the water in the mining pits. One threatened species of fauna, and one migratory/marine species of birds identified under the *EPBC Act 1999* potentially occur in the project area. There are additional species listed under the *BC Act 2016* that potentially occur in the project area. Following Table 8 is an assessment of the likelihood of each of the species listed in Table 8 being found in the project area.

Table 8. Assessment of the potential presence of a conservation significant fauna species in the project area

Species	DBCAs Schedule / Priority	Status under Commonwealth EPBC Act	Comment on the potential presence of the species
Night Parrot <i>Pezoporus occidentalis</i>	Critically Endangered	Endangered	Highly unlikely to be in the project area, due to a lack of suitable habitat.
Sandhill Dunnart <i>Sminthopsis psammophila</i>	Endangered	Endangered	Highly unlikely to be in the project area due to a lack of suitable habitat.
Western Spiny-tailed Skink <i>Egernia stokesii badia</i>	Endangered	Endangered	Highly unlikely to be in the project area, as the project area is well outside its geographic range.
Malleefowl <i>Leipoa ocellata</i>	Vulnerable	Vulnerable	Footprints were recorded in three areas during the field assessment, however, no active or recently active mounds were recorded. It is likely that there are a few isolated Malleefowl in the project or adjacent areas.
Giant Desert Skink <i>Liopholis kintorei</i>	Vulnerable	Vulnerable	Highly unlikely to be in the project area due to a lack of suitable habitat.
Chuditch <i>Dasyurus geoffroii</i>	Vulnerable	Vulnerable	Highly unlikely to occur in the project area, as it has not been recorded in the region for many decades.
Princess Parrot <i>Polytelis alexandrae</i>	Priority 4	Vulnerable	May infrequently be seen in the region, however, unlikely to be a resident species.
Mulgara <i>Dasyercus blythi</i>	Priority 4		Highly unlikely to be in the project area due to a lack of suitable habitat.
Oriental Plover <i>Charadrius veredus</i>	IA	Migratory	Unlikely to be in the project area due to a lack of suitable habitat.
Fork-tailed Swift <i>Apus pacificus</i>	IA	Migratory	May very infrequently be seen in the region, however, unlikely to be a resident species.
Grey Wagtail <i>Motacilla cinerea</i>	IA	Migratory	Highly unlikely to be present in the project area.
Yellow Wagtail <i>Motacilla flava</i>	IA	Migratory	Highly unlikely to be present in the project area.
Peregrine Falcon <i>Falco peregrinus</i>	OS		May infrequently be seen in the region, however, unlikely to be a resident species.
Long-tailed Dunnart <i>Sminthopsis longicaudata</i>	Priority 4		Unlikely to be in the project area due to a lack of its typical breakaway habitat requirements and a high density of feral fauna.

IA – Migratory birds protected under international agreements;

OS – Other Specially protected fauna

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

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

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

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

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

There are no mature spinifex hummocks and there are an abundance of feral predators in the project area. As the preferred roosting and nesting sites for Night Parrots are not present in the project area and there are significant threatening processes for the species in the area (i.e. wild dogs and feral cats), it is Terrestrial Ecosystems' assessment that Night Parrots are not present in the project area and will therefore not be impacted by any proposed development.

Sandhill Dunnart (*Sminthopsis psammophila*) –Endangered under the *BC Act 2016* and *EPBC Act 1999*

The Sandhill Dunnart is a small (30-45g) arid adapted dasyurid that is found in the eastern part of the Western Australian section of the Great Victoria Desert and the western and southern parts of South Australia. Recent surveys undertaken for the Great Victoria Desert Trust have increased their geographic range in the Great Victoria Desert.

The habitat in the project area is not suitable for this Dunnart and there are no records of the Sandhill Dunnart near the project area in the Atlas of Living Australia. As the preferred habitat for the Sandhill Dunnart is not present and there is a significant threatening process for the species in the area (i.e. feral cats), it is Terrestrial

Ecosystems' assessment that Sandhill Dunnarts are not present in the project area due to a lack of suitable habitat and will therefore not be impacted by any proposed development.

Western Spiny-tailed Skink (*Egernia stokesii badia*) - Endangered under the *BC Act 2016* and the *EPBC Act 1999*

The Western Spiny-tailed Skink is a large stout, live-bearing skink with short dorsal spines and longer tail spines. It has multiple geographically separate populations, and sister subspecies that are found on off-shore islands. It is typically found in York gum woodlands, living in logs with an obvious faecal pellet latrine site nearby (How et al. 2003). But they can also be found in Gimlet and Salmon Gum woodlands. Openings in fallen logs need to be a minimum of 25 cm in diameter, with a preference for overlapping log piles (How et al. 2003). However, they have also be found in abandoned old houses, under a stack of tiles and in rock crevices.

It is highly unlikely that the Western Spiny-tailed Skink is present in the project area, as they have not been recorded nearby.

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

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

Malleefowl have been found in mallee regions of southern Australia from approximately the 26th parallel of latitude southwards. Malleefowl are now only found throughout these regions in fragmented patches due to clearing of habitat for agriculture, increased fire frequency, competition with exotic herbivores (sheep, rabbits, cattle, goats) and kangaroos, predation by foxes and cats, inbreeding as a result of fragmentation and possibly hunting for food. DBCA records show the only recorded observation was near Leonora in 1998.

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

Malleefowl tracks were present in the project area and some very old mounds that will never be used again were also recorded. No active or recently active nest-mounds were recorded, so it is probable that Malleefowl in the project area are a few isolated birds moving in and through the project and adjacent areas. These birds are likely to move to adjacent areas if disturbed.

Giant Desert Skink (*Liopholis kintorei*) - Vulnerable under the *EPBC Act 1999* and *BC Act 2016*

Liopholis kintorei is a large skink found in the sandy desert regions of Western Australia, Northern Territory and South Australia. It is found on sandflats and clay-based or loamy soils vegetated with spinifex. It lives in a multi-entranced communal burrow system and uses shared defecation sites. Storr et al. (1999) recorded them as being in the Wanjarri area of the Great Victoria Desert, and the DBCA Threatened species database records them in Laverton in 1967.

The Giant Desert Skink prefers sandy soils vegetated with spinifex. This habitat is not present in the project area and there is a high density of feral fauna. Terrestrial Ecosystems' assessment is that *Liopholis kintorei* is very unlikely to be found in the project area due to a lack of suitable habitat and presence of a threatening process for this species.

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

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

How et al. (1988) reported Chuditch being found near the Norseman-Lake King Road and near Mount Holland. DBCA records show that one specimen was recorded in 1974 in Kambalda East. There are multiple records south of Southern Cross and Marvel Loch and there have been other reported sightings east of Kambalda and near Norseman, but Terrestrial Ecosystems can find none north of Kalgoorlie. It is therefore highly unlikely that the Chuditch will be found as far north at Leonora and in atypical habitat. As the project area is a significantly long way north of the species known geographic distribution it is unlikely that the Chuditch would be found in the project area, therefore the clearing of vegetation and mining operations are unlikely to have a significant impact on this species.

Princess Parrot (*Polytelis alexandrae*) - Vulnerable species under the *EPBC Act 1999* and a Priority 4 species with DBCA

The species is found mostly in the inland arid areas of Australia, and in Western Australia in the Gibson, Little Sandy and Great Victoria Deserts (Johnstone and Storr 1998, Pavey et al. 2014). However, they occasionally occurred in lightly wooded areas adjacent to the sandy deserts (Moriarty 1972). Dr S. Thompson sighted this parrot in a survey near the Wanjarri Nature Reserve in 2006 and Moriarty (1972) also reported it in the same area, so it may occasionally be seen in the region. If it was present any proposed development is unlikely to significantly impact on this species as it will move away to other areas if it is disturbed.

Very little is known about the Princess Parrot; even the exact extent of its geographical distribution. It is thought to be nomadic within the central desert regions of Australia, occupying arid shrub lands, particularly those dominated by Mulga, Desert Oak and spinifex. Due to the paucity of information on the species, accurate estimates of its conservation significance are difficult to make, however, this species is probably threatened by habitat loss to agricultural practices and changes in fire regimes.

The project area is a long way south and west of its known geographic distribution, so it is Terrestrial Ecosystems' assessment it is highly unlikely to be seen in the project area, unless it is an aviary escapee.

Brush-tailed Mulgara (*Dasyercus blythi*) - Priority 4 with the DBCA

Woolley (2005) recognises two species of 'Mulgara'; *Dasyercus blythi* and *D. cristicauda*. *Dasyercus blythi* has a non-crested tail, two upper premolars and six nipples; *D. cristicauda* has a crested tail, three upper premolars and eight nipples. Both species potentially have overlapping distributions in arid Australia, but it is thought that *D. cristicauda* does not currently exist in Western Australia, although there are old records indicating its presence. Woolley (2005) suggested the common names for these two species be Brush-tailed Mulgara for *D. blythi* and Crest-tailed Mulgara for *D. cristicauda*. These two species can be sympatric in places, but probably utilise different parts of the habitat on a local scale when they are recorded in the same area. Currently, there are insufficient data to separate the spatial ecology, burrows and reproductive biology of these two species. Information that follows is based on what is known for 'Mulgara' without distinguishing between the species.

The reported distribution of *Mulgara* includes much of the inland spinifex covered sandy desert and spinifex vegetated areas in the Pilbara and northern goldfields. Within these areas their distribution is patchy, and it is most frequently confined to mature spinifex dominated habitat (Gibson and Cole 1992, Masters 1998, Masters et al. 2003, Thompson and Thompson 2008). In some areas, their relative abundance is positively associated with rainfall in the previous 12 to 24 months (Gibson and Cole 1992, Masters 1998, Dickman et al. 2001, Letnic and Dickman 2005) and recent burning of the spinifex does not seem to be sufficient to shift *Mulgara* out of an area (Thompson and Thompson 2007). *Mulgara* is generally sedentary in contrast with some other small dasyurids and have high site fidelity and a low propensity for dispersal once a home range has been established (Masters 1998, Dickman et al. 2001).

Fauna habitat in the project area is not suitable for *Mulgara*. It is therefore Terrestrial Ecosystems' view that they are unlikely of be found in the project area.

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

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

Terrestrial Ecosystems' assessment is that the Oriental Plover is unlikely to be seen in the project area and therefore unlikely to be impacted.

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

This species breeds in the northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara in November and in the southwest land division in mid-December, and leaving by late April. The Fork-tailed swift is an almost exclusively an aerial species, foraging and sleeping on the wing. It rarely comes to earth, usually only for breeding. It is common in the Kimberley, uncommon to moderately common near northwest, west and southeast coasts and rare to scarce elsewhere. It is rarely seen in the Goldfields (Plate 21).

Terrestrial Ecosystems' assessment is that the Fork-tailed Swift may infrequently be seen in the region. However, any proposed vegetation clearing, or mining operations are unlikely to significantly impact on this species as it is an aerial species and will move away to other areas if it is disturbed.

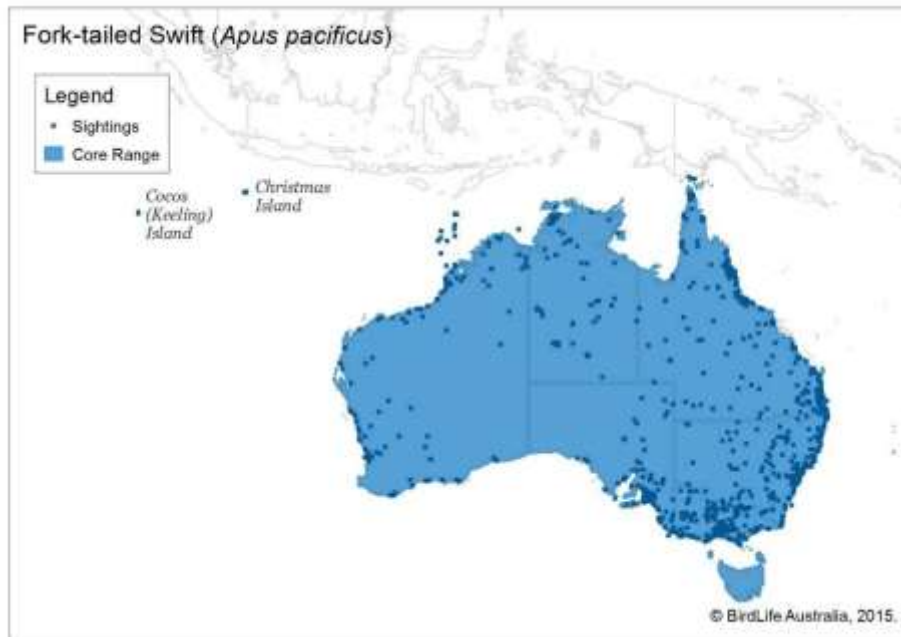


Plate 21. Range and actual reported sightings of the Fork-tailed Swift

(taken from <http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds>)

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

The Grey Wagtail is a small yellow breasted bird with a grey back and head. Johnstone and Storr (2004) reported this migratory species as breeding in Palearctic from western Europe and north-west Africa to eastern Asia and wintering in Africa, south-east Asia, Indonesia, the Philippines, New Guinea and Australia. Its preferred habitat in Australia is banks and rocks in fast-running fresh water including rivers, streams and creeks where it feeds on insects.

The Atlas of Living Australia records two sightings on the south-coast of Western Australia and none around the project area (Plate 22). It is highly unlikely to be seen in the project area due to a lack of records and suitable habitat.

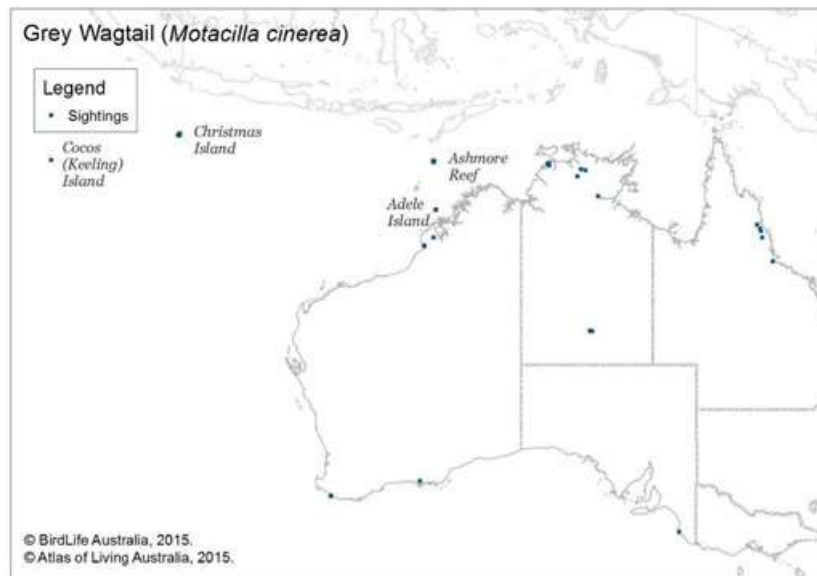


Plate 22. Reported sightings of the Grey Wagtail

(taken from <http://www.environment.gov.au/biodiversity/threatened/publications/epbc-act-referral-guidelines-migratory-birds>)

Yellow Wagtail (*Motacilla flava*) - Migratory under the *EPBC Act 1999* and *BC Act 2016*

The Yellow Wagtail is found in the millions in the northern hemisphere and the Atlas of Living Australia records multiple records of this bird in Australia in the coastal areas. There are no records for this species in inland Western Australia near the project area, therefore it is highly unlikely to be impacted by the proposed development.

Peregrine Falcon (*Falco peregrinus*) - Otherwise specially protected under the *BC Act 2016*

The Peregrine Falcon is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes. Nesting sites include ledges along cliffs, granite outcrops and quarries, hollow trees near wetlands and old nests of other large bird species. There is no evidence to suggest any change in status in the last 50 years. The Peregrine Falcon has been seen in the Wanjarri Nature Reserve (Moriarty 1972, Ninox Wildlife Consulting 1994), at Honeymoon Well (Ninox Wildlife Consulting 1994) and Mileura (Tingay and Tingay 1977), so they could infrequently be seen in the general area.

Terrestrial Ecosystems' assessment is that the Peregrine Falcon may infrequently be seen in the project area, however, development is unlikely to have a significant impact on this species as it will readily move away from disturbance and there are abundant areas of similar habitat in the region.

Long-tailed Dunnart (*Sminthopsis longicaudata*) - Priority 4 species with DBCA.

Burbidge et al. (2008) summarised the Long-tailed Dunnart distribution as widely scattered in arid zone where it inhabits rugged rocky areas. They went on to suggest that its striated foot-pads, long tail and behaviour in captivity indicated that it was an active and capable climber. Specimens have been recorded in several rocky ranges in the Gibson Desert, West MacDonnell National Park, Murchison, Carnarvon Basin and the Pilbara. All previous capture sites for Long-tailed Dunnarts are within rugged rocky landscapes that support a low open woodland or shrubland of Acacias (especially mulga) with an understorey of spinifex hummocks, and (occasionally) also perennial grasses and cassias.

Three adult Long-tailed Dunnarts were caught in the Granny Smith Level 2 fauna survey (Terrestrial Ecosystems 2011a) and a single individual was caught in the follow up targeted survey (Terrestrial Ecosystems 2011c). Subsequently, Long-tailed Dunnarts have been caught at Mt Ida and Bottle Creek, which area west of Leonora.

There are no suitable rocky outcrops in the project area, so, it is high improbability that they are present.

5. DISCUSSION

5.1 ADEQUACY OF THE FAUNA SURVEY DATA FOR FAUNA HABITATS REPRESENTED IN THE PROJECT AREA

The EPA's (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* indicated that the level of survey effort should be determined after consideration of the following:

- level of existing regional knowledge
- type and comprehensiveness of recent local surveys
- degree of existing disturbance or fragmentation at the regional scale
- extent, distribution and significance of habitats
- significance of species likely to be present
- sensitivity of the environment to the proposed activities
- scale and nature of impact.

Terrestrial Ecosystems' (2020) Detailed and comprehensive terrestrial fauna survey for the King of the Hills project area which is approximately 25km north of the project area and in similar habitat provides a comprehensive appreciation of the vertebrate fauna within the project area. In addition, there are other surveys (How and Dell 1992, McKenzie et al. 1994b, Ninox Wildlife Consulting 1998) for nearby areas that have been undertaken in similar fauna habitats. A Detailed or Targeted fauna survey in the project area is unlikely to yield fauna data that will alter the assessment of potential impacts of the proposed development on the vertebrate fauna and is therefore not recommended.

5.1.1 Amphibians

Frogs are normally only detected immediately after rainfall or around semi-permanent pools. There were pools of water in the drainage channels during the field assessment. *Cyclorana maini*, *C. occidentalis*, *Pseudophryne occidentalis* and *Litoria rubella* were all recorded. It is likely that *Neobatrachus kunapalari* and *Neobatrachus wilsmorei* could also be found in the general area. These species, other than *P. occidentalis* and *L. rubella*, burrow into the ground and aestivate between rainfall events. *Pseudophryne occidentalis* and *L. rubella* find shelter under rocks and in crevices during the dry periods and enter temporary ponds to breed after major rainfall events. All species have a wide-spread distribution and are abundant. Development of the project area is likely to result in a loss of individuals within the disturbed area, however, is unlikely to have a significant impact on these species when assessed in a regional context.

5.1.2 Reptiles

Typically, between 25 and 35 species of reptiles are caught in predominantly open mulga woodland (Coffey Environments 2008, Terrestrial Ecosystems 2010, 2011a, 2020). None of the species likely to be in the project area, are of conservation significance. There were no characteristics of the reptile assemblage surveyed in earlier Terrestrial Ecosystems' Level 2/Detailed surveys in adjacent areas that indicated the fauna habitat present in the project area was of conservation significance or different to that in the neighbouring areas, and given that there were large expanses of similar habitat in adjacent areas, development of the project area is unlikely to have significant impact on reptiles when assessed in a regional context.

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

5.1.3 Birds

The number of birds and bird species in the northern Goldfields fluctuates based on seasons and recent rainfall (Craig and Chapman 2003). Semi-arid and arid areas of inland Australia support a diverse range of transient and nomadic species that move through large areas in search of available resources. Heavy rain that is followed by flowering and seeding of many plant species is often sufficient to draw a large number of these nomadic species to the general area. These species move on to other areas once the resource is depleted or better resources are available in adjacent areas.

The project area is likely to support a similar assemblage to that present in the adjacent areas. Malleefowl tracks were recorded in three locations within the project area, but there are no active or recently active Malleefowl mounds, so it is likely that there are a few isolated birds moving in the project and adjacent areas. The Princess Parrot is nomadic and moves around the arid interior often in search of water and resources and may very infrequently be seen in the general area. The Peregrine Falcon will normally have a very large home range, and if it was present is unlikely to be significantly impact as it will readily move to other areas if disturbed. The majority of avifauna will readily shift to other areas when there is a disturbance.

5.1.4 Mammals

The diversity of small terrestrial mammals potentially caught in the project area would be low due the sparsely vegetated and degraded habitat and presence of feral and pest fauna.

Terrestrial Ecosystems' view is that the development of the project area is unlikely to significantly impact on the mammal fauna of the bioregion.

5.2 BIODIVERSITY VALUE

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

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

5.2.1 Ecological functional value at the ecosystem level

Large sections of the project area have been disturbed by previous mining activity, with the consequence that these area and surrounds will have a depleted vertebrate fauna assemblage. The most significant impact on vertebrate fauna in the project area and surrounds will have been feral cats and wild dogs. Historically, goats would have heavily grazed the region which impacted the vertebrate fauna assemblages, but the recent increase in the wild dog population has reduced the abundance of feral goats.

5.2.2 Maintenance of threatened ecological communities

No threatened ecological communities were identified in the project area.

5.2.3 Condition of fauna habitat

Some of the project area has been highly disturbed due to historical mining and anthropogenic activity. The uncleared fauna habitat present in the project area is similar to many square kilometres of adjacent habitat. The proposed vegetation clearing and wind-turbines are therefore unlikely to have a significant impact on the vertebrate fauna when considered in a bioregional context.

5.2.4 Ecological linkages

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

5.2.5 Size and scale of the proposed disturbance

The project area (3,581.2ha) is a small proportion of similar fauna habitat found in the adjacent area and region. Given the available fauna survey data for these habitat types, no additional surveys are warranted.

5.2.6 Abundance and distribution of similar habitat in the adjacent areas

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

6. POTENTIAL ENVIRONMENTAL IMPACTS

Clearing native vegetation are likely to result in the loss of small vertebrate fauna on site that are unable to move away during the clearing process and aerial species could be hit by the blades of wind-turbines.

6.1.1 Animal deaths during the clearing process and displacement of fauna

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

6.1.2 Impacts of the wind turbines on birds and bats

There are five species of bats potentially in this part of the Goldfields (Table 9), and all are nocturnal, insectivorous, use echolocation to find food and roost in tree hollows. Bats are killed by wind-turbines (Hull and Cawthen 2013, Thompson et al. 2017, Smallwood et al. 2020, Davy et al. 2021), so it can be expected that a number of bats foraging at night in the vicinity of wind-turbines will be killed, and over time many of the local bats would be lost (Bennett et al. 2022) .

Table 9. Bat species potentially in the Goldfields

Species	Common name
<i>Chalinolobus gouldii</i>	Gould’s Wattled Bat
<i>Chalinolobus morio</i>	Chocolate Wattled Bat
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat
<i>Vespadelus regulus</i>	Southern Forest Bat

Birds are also killed by wind-turbines (Drewitt and Langston 2006, Perold et al. 2020, Smallwood et al. 2020, Chambert and Besnard 2021), so it can be expected that a small number of birds foraging in the vicinity of wind-turbines will be killed, and overtime some of the local birds would be lost (Chambert and Besnard 2021). In a summary of South African data (Perold et al. 2020), diurnal raptors were killed most often (36% of carcasses, 23 species) followed by passerines (30%, 49 species), waterbirds (11%, 24 species), swifts (9%, six species), large terrestrial birds (5%, 10 species), pigeons (4%, six species) and other near passerines (1%, seven species). So a wide range of species will potentially be negatively impacted by wind-turbines.

Smallwood et al. (2020) indicated that bird and bat mortality increases with increasing wind energy capacity of wind-turbines. Arnett et al. (2010) reported that by increasing the wind-turbines cut-in speed (i.e. the lowest wind speed at which the turbine generates power) it reduced bat mortality 5.5 and 3.6 times compared with the normal operational cut-in speed; demonstrating that active management of wind-turbines could reduce bat, and probably bird mortality.

6.1.3 Reduction or loss of activity areas and closure of burrows

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

6.1.4 Habitat fragmentation

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

6.1.5 Introduced fauna and weeds

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

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

There are reliable reports that the population of wild dogs has significantly increased in response to the abundance of feral goats that were present in the region. The goat population has now been significantly reduced, so the wild dogs will turn their attention to preying on native animals. Given the proximity to Leonora it is likely that some of the dogs would also be coming from town.

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

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

6.1.6 Road fauna deaths

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

6.1.7 Fire

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

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

6.1.8 Anthropogenic activity

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

6.1.9 Dust

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

6.1.10 Risk assessment

Fauna surveys to support Environmental Impact Assessments (EIA) are part of the environmental risk assessment undertaken to consider what potential impacts a development might have on the biodiversity on a particular area and region. Potential impacts on fauna from the proposed development are identified and briefly described above. Tables 10, 11 and 12 provide a summary of the risk assessment associated with this project.

Any risk assessment is a product of the likelihood of an impact occurring and the consequences of that impact. Likelihood and consequences are categorised and described below. The assessed risk level (likelihood x consequences) is then calculated as the overall risk for the development. This is followed by an assessment of the acceptability of the risk associated with each of the impacts. Disturbances and vegetation clearing have an impact on the fauna at multiple scales – site, local, landscape and regional. Each of these is considered in the risk assessment. This assessment should be considered in the context of the summary in Table 12.

Table 10. Fauna impact risk assessment descriptors

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

Table 11. Levels of acceptable risk

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

Table 12. A risk assessment of the impact of ground disturbance activity on fauna

			Before management			With management			
Potential impacts			Inherent risk			Risk controls	Residual risk		
Factor			Likelihood	Consequence	Significance		Likelihood	Consequence	Significance
Fauna survey data	Inadequate survey data to adequately assess the risks	Unknown loss of fauna, fauna of conservation significance, and fauna assemblages, and an incomplete fauna assessment.	B	2	Low				
	Inadequacy of comparative data	Limits on the availability of comparative data reduced the capacity to assess the uniqueness of the fauna assemblages in the project area.	B	2	Low				
Clearing vegetation	Loss of fauna habitat – local scale	Loss of terrestrial fauna in the project area.	E	2	Mod.				
	Loss of fauna habitat – landscape scale	Loss of some fauna during vegetation clearing.	B	1	Low				
	Loss of fauna habitat – regional scale	Small loss of some fauna from the region.	B	1	Low				
	Loss of a threatened ecological fauna community	Loss of an undetected threatened ecological fauna community.	A	3	Low				
	Habitat fragmentation	Fauna movement restricted resulting in the death of fauna and a loss of biodiversity.	A	2	Low				
Death or loss of conservation significant fauna	Loss of a unique terrestrial fauna ecosystem	Loss of an ecosystem containing fauna with high species richness, high abundance and numerous top of the food chain predators.	A	2	Low				
	Night Parrot		A	2	Low				
	Sandhill Dunnart		A	2	Low				
	Malleefowl		C	3	Mod	Implementing speed controls around the project area will minimise	B	3	Mod

			Before management			With management			
						potential impacts on Malleefowl			
	Giant Desert Skink		A	2	Low				
	Chuditch		A	2	Low				
	Princess Parrot		A	2	Low				
	Mulgara		A	2	Low				
	Oriental Plover		A	2	Low				
	Fork-tailed Swift		A	2	Low				
	Grey Wagtail		A	2	Low				
	Yellow Wagtail		A	2	Low				
	Peregrine Falcon		A	2	Low				
	Branchinella anophysata		A	2	Low				
	Long-tailed Dunnart		A	2	Low				
Human impacts	Increase or spread of weeds	Changed vegetation and a resulting loss of fauna habitat.	E	2	Mod.	Implementation of a weed management plan.	D	2	Low
	Road kills	Animals being killed by vehicles as they cross roads	E	1	Low	Limiting speeds	E	1	Low
	Increase in feral mammals, specifically the dog and cat	Increased predation on the native fauna	C	2	Low				

6.2 NATIVE VEGETATION CLEARING PRINCIPLES AS THEY PERTAIN TO VERTEBRATE FAUNA

The *Environmental Protection Act* (1986) outlines 10 principles that are to be used in the assessment of native vegetation clearing permit applications which are also applicable for other assessments and approvals (Table 13). Where possible, native vegetation should not be cleared if any of the following principles are comprised.

Table 13. Assessment of impact using the native vegetation clearing principles

Principle	Response
It comprises a high level of biological diversity.	There are a small number of Malleefowl in the project and adjacent areas. These birds are not breeding in the project area and are likely to be moving into adjacent areas. Active management will reduce potential impacts on this species.
It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	Fauna habitat in the project area is like that in adjacent areas, so other than potential impacts on Malleefowl, clearing the vegetation will not result in the loss of significant habitat for indigenous fauna.
It includes, or is necessary for the continued existence or, rare flora.	N/A
It comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.	The area does not contain a threatened ecological fauna community.
It is significant as a remnant of native vegetation in an area that has been extensively cleared.	The area is not a remnant.
It is growing in, or in association with, an environment associated with a watercourses or wetland.	The area does not contain a natural wetland. Some of the mining pits have water in the bottom.
The clearing of the vegetation is likely to cause appreciable land degradation.	N/A
The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	Clearing of vegetation is unlikely to impact on the environmental values of the bioregion.
The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	N/A
The clearing of the vegetation is likely to cause, or exacerbate the incidence of flooding.	N/A

6.3 REFERRAL UNDER THE EPBC ACT

The proposed project is unlikely to significantly impact on a conservation significant vertebrate fauna species, so a referral under the *EPBC Act 1999* is not required.

7. SUMMARY

There are five broad fauna habitats in the project area:

- Bare salt lakes;
- Ephemeral creek lines;
- Tall shrublands;
- Low shrublands; and
- Open mulga woodlands.

In addition, there are disturbed areas that are largely devoid of vegetation, and if present are mostly weeds with few vertebrate fauna.

The density of trees and shrubs in the relatively undisturbed areas varied across the project area but was mostly sparse. The fauna habitat varied from highly degraded to good; the more degraded areas are due to historical and recent mining activity and grazing. There are numerous access tracks in the project area, but these are narrow and mostly only wheel tracks on a sand-clay substrate. There is extensive evidence of feral fauna in the area.

Tracks of Malleefowl were recorded at three locations in the project area, but there are no active or recently active Malleefowl mounds, so it is probable these are isolated birds that are moving around in the areas of slightly more-dense vegetation, but are not breeding. Clearing native vegetation in the project area is likely to result in the loss of small vertebrate fauna on-site that are unable to move away during the vegetation clearing process, however, this loss is not likely to be significant when viewed in a bioregional context. The few larger animals, such as kangaroos, large goannas and snakes, and most of the birds will move into adjacent areas once vegetation clearing commences, so potential impacts will be low. There may be an on-going loss of small native fauna to vehicle strikes on access tracks, but overall, this impact will be very low. Forced fauna migrants because of vegetation clearing increase competition for resources, which may result in the subsequent loss of migrants or local individuals. Individuals shifted out of their established activity areas are also vulnerable to predation until they have become established in their new areas.

There was evidence of rabbits, cattle, horses and wild dogs in the project area, and probably feral cats. These feral and pest fauna are likely to be doing more environmental damage than the combined impacts of proposed development.

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

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

The proposed windfarm will potentially impact on birds and bats in the project area, so a management plan is required, that may include increasing the wind-turbines cut-in speed to minimise the impact on birds and bats.

8. MANAGEMENT STRATEGIES

The purpose of this section is to identify generic management and mitigation strategies to address the potential impacts of development in the project area. Specific management and mitigation strategies to address potential impacts should be addressed in the recommended Vertebrate Fauna Management Plan and Construction Environmental Management Plan.

8.1 INDUCTION AND AWARENESS

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

Recommendation 1: An induction program that includes a component on managing fauna is mandatory for staff working in the project area.

8.2 FAUNA MANAGEMENT PLAN

The wind-turbines are likely to result in a loss of bats and birds in the project area. This loss can be partially mitigated by altering the cut-in speed for the turbine to operate. The potential impact on aerial fauna will need to be monitored. Details of the mitigation and monitoring should be contained in the fauna management plan for the project.

Recommendation 2: The fauna management plan for the project should specifically address potential impacts on birds and bats and include mitigation strategies to minimise this impact.

8.3 FERAL PREDATORS

The abundance of wild dogs and feral cats often increases around mining and other operations in the Goldfields, particularly due to poor waste management. These increased predator numbers can then impact on the native fauna. The potential impact of feral predators should be addressed in the fauna management plan and wild dog and feral cat management programs regularly implemented.

Recommendation 3: The management of wild dogs and feral cats is specifically addressed in the fauna management plan and management plans are regularly implemented.

9. REFERENCES

- AG staff. 2017. Night parrot feather discovered in South Australia gives hope to ecologists. Australian Geographic **September**.
- AG staff. 2018. Critically endangered night parrot fledging photographed on Queensland reserve. Australian Geographic **February**.
- Arnett, E. B., M. M. P. Huso, M. R. Schirmacher, and J. P. Hayes. 2010. Altering turbine speed reduces bat mortality at wind-energy facilities. *Frontiers in Ecology and the Environment* **9**:209-214.
- Bamford Consulting Ecologists. 2007. Fauna Assessment and Targeted Mulgara Search of the Fish Deposit, Laverton Gold Project. Perth.
- Bamford, M. J. 1995. Predation by feral cats upon lizards. *The Western Australian Naturalist* **20**:191-196.
- Bell, D. T., R. C. Bell, and W. A. Loneragan. 2007. Winter bird assemblages across an arid gradient in south-west Western Australia. *Winter bird assemblages across an arid gradient in south-west Western Australia* **90**:219-227.
- Bennett, E., L. T. Jamieson, S. N. Florent, N. Gill, C. Hauser, and R. H. Cristescu. 2022. Detection dogs provide a powerful method for conservation surveys. *Austral Ecology*.
- Benshemesh, J. 2007. National Recovery Plan for Malleefowl. South Australia.
- Benshemesh, J., and P. Burton. 1999. Fox predation on Malleefowl three years after the spread of RCD in Victoria. Unpublished report for Parks Victoria and Department of Natural Resources and Environment, Mildura.
- Biota Environmental Sciences. 2004. Cosmos Nickel Mine Extension Fauna Survey. Perth.
- Biota Environmental Sciences. 2007. Bannockburn Fauna Habitat and Assemblage Survey. Perth.
- Boles, W. E., N. W. Longmore, and M. C. Thompson. 2016. A Recent Specimen of the Night Parrot *Geopsittacus occidentalis*. *Emu* **94**:37-40.
- Burbidge, A. A., N. L. McKenzie, and P. J. Fuller. 2008. Long-tailed Dunnart *Sminthopsis longicaudata*. Pages 148-150 in S. van Dyck and R. Strahan, editors. *The Mammals of Australia*. Reed New Holland, Sydney.
- Chambert, T., and A. Besnard. 2021. Assessing the demographic impact of bird collisions with wind turbines. University of Montpellier, France.
- Charalambous, S. 2016. First night parrot fledgling spotted in 100 years spotted in western Queensland. Australian Geographic **November**.
- Coffey Environments. 2007. Level 1 Fauna Assessment, Leinster Nickel Operations. Perth.
- Coffey Environments. 2008. Level 2 Fauna Assessment for the Duketon Gold Project.
- Cowan, M. 2001. Murchison 1 (MUR1 - East Murchison subregion). Pages 466-479 in N. L. McKenzie, J. E. May, and S. McKenna, editors. *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Conservation and Land Management, Perth.
- Cowan, M. A., and R. A. How. 2004. Comparisons of ground vertebrate assemblages in arid Western Australia in different seasons and decades. *Records of the Western Australian Museum* **22**:91-100.
- Craig, M. D., and A. Chapman. 2003. Effects of short-term drought on the avifauna of Wanjarri Nature Reserve: What do they tell us about drought refugia? *Journal of the Royal Society of Western Australia* **86**:133-137.
- Cupitt, R., and S. Cupitt. 2008. Another recent specimen of the Night Parrot *Pezoporus occidentalis* from Western Queensland. *Australian Field Ornithology* **25**:69-75.
- Davis, R. A., and B. M. Metcalf. 2008. The Night Parrot (*Pezoporus occidentalis*) in northern Western Australia: a recent sighting from the Pilbara region. *Emu* **108**:233-236.
- Davy, C. M., K. Squires, and J. R. Zimmerling. 2021. Estimation of spatiotemporal trends in bat abundance from mortality data collected at wind turbines. *Conserv Biol* **35**:227-238.
- Dell, J., and R. A. How. 1988. Vertebrate Fauna. *Records of the Australian Museum* **Supplement No 31**:38-75.

- Dell, J., R. A. How, and A. V. Milewski. 1992. The biological Survey of the Eastern Goldfields, Part 6, Youanmi - Leonora Study Area. Records of the Western Australian Museum **Supplement 40**:20-32.
- Dickman, C. R., A. S. Haythornthwaite, G. H. McNaught, P. S. Mahon, B. Tamayo, and M. Letnic. 2001. Population dynamics of three species of dasyurid marsupials in arid central Australia: a 10 year study. *Wildlife Research* **28**:493-506.
- Donato Environmental Services. 2005a. Leinster Nickel Operations Tailing Storage Facility and Water Storage Areas: Wildlife Interactions and Assessment of Risks. Perth.
- Donato Environmental Services. 2005b. Ornithological Survey of the Leinster Nickel Operation Mining Lease: An assessment of Goat Grazing Impact. Perth.
- Drewitt, A. L., and R. H. W. Langston. 2006. Assessing the impacts of wind farms on birds. *Ibis* **148**:29-42.
- Dunlop, J. N. 1990. The small vertebrate ground fauna of mulga habitats near Wiluna, Western Australia. *Mulga Research Centre Journal* **10**:19-27.
- ecologia Environment. 2007. Jump Up Dam Fauna Assessment.
- ENV Australia. 2008. Agnew Prospects Fauna Assessment. Perth.
- Environmental Protection Authority. 2020. Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment. Western Australia.
- Garnett, S., G. Crowley, R. Duncan, N. Baker, and P. Doherty. 1993. Notes on live Night Parrot sightings in north-western Queensland. *Emu* **93**:292-296.
- Garnett, S. T., J. K. Szabo, and G. Dutson. 2011. The Action Plan for Australian Birds 2010. CSIRO, Collingwood, Melbourne.
- Gibson, D. F., and J. R. Cole. 1992. Aspects of the ecology of the Mulgara, *Dasyercus cristicauda*, (Marsupialia: Dasyuridae) in the Northern Territory. *Australian Mammalogy* **15**:105-112.
- Halpern Glick Maunsell. 1999. Rosemont Gold Project Biological Assessment Survey - Phases 1 & 2. Perth.
- Hamilton, N., A. Burbidge, T. Douglas, and L. Gilbert. 2017. Piecing the puzzle together: the fate of the Night Parrot nest found in Western Australia by Jackett et al. (2017). *Australian Field Ornithology* **34**:151-154.
- Harewood, G. 2011. Terrestrial Fauna Survey (Level 1) of the West Laverton Area (P38/3717, P38/3718, P38/3491, P38/3492, P38/3314, P38/3490, P38/3315, M38/0046, M38/0049, M38/0040, M38/0358, M38/0048, M38/0101, M38/0364, M38/0342, M38/0345, L38/0179, L38/0177, L38/0178, L38/0153, L38/0092, E38/1930, E38/2347, E38/2084 & E38/1966). Bunbury.
- Hart Simpson and Associates. 2000. Anaconda Nickel Ltd, Cawse Expansion Project, Fauna Survey. Perth.
- How, R. A., and J. Dell. 1992. Vertebrate Fauna. Records of the Australian Museum **Supplement No 40**:90-103.
- How, R. A., J. Dell, A. V. Milewski, and G. J. Keighery. 1992. The Biological Survey of the Eastern Goldfields of Western Australia: Part 7, Duketon-Sir Samuel Study Area. Records of the Western Australian Museum **Supplement 40**:69-131.
- How, R. A., J. Dell, and B. G. Muir. 1988. Vertebrate Fauna. Pages 44-94 in R. A. How, K. R. Newbey, J. Dell, B. G. Muir, and R. J. Hnatiuk, editors. The Biological Survey of the Eastern Goldfields of Western Australia; Part 4, Lake Johnston - Hyden Study Area. Records of the Western Australian Museum.
- How, R. A., J. Dell, and D. J. Robinson. 2003. The Western Spiny-Tailed Skink, *Egernia stokesii badia*: Declining distribution in a habitat specialist. *The Western Australian Naturalist* **24**:138-146.
- Hull, C. L., and L. Cawthen. 2013. Bat fatalities at two wind farms in Tasmania, Australia: bat characteristics, and spatial and temporal patterns. *New Zealand Journal of Zoology* **40**:5-15.
- Jackett, N., B. Greatwich, G. Swann, and A. Boyle. 2017. A nesting record and vocalisations of the Night Parrot *Pezoporus occidentalis* from the East Murchison, Western Australia. *Australian Field Ornithology* **34**:144-150.
- Johnstone, R. E., and G. M. Storr. 1998. Handbook of Western Australian Birds. Volume I - Non-Passerines (Emu to Dollarbird). Western Australian Museum, Perth.
- Johnstone, R. E., and G. M. Storr. 2004. Handbook of Western Australian Birds. Volume II - Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth.
- Jones, A. 2017. Night parrot sighting in Western Australia shocks birdwatching world. ABC News.

- Keith Lindbeck and Associates. 2011. Snark Project Fauna Assessment. Perth.
- Keith Lindbeck and Associates. 2012. Central Yilgarn Iron Project (CYIP) Fauna Assessment. Perth.
- Keith Lindbeck and Associates. 2013. Mt Mason Project and Proposed Haul Road Targeted EPBC Fauna Survey. Perth.
- Kingfisher Environmental Consulting. 2014. Murrin Murrin – Sunrise Dam Infrastructure Corridor Level 1 Fauna Survey.
- Kingfisher Environmental Consulting. 2020. Northern Goldfields Interconnect Pipeline Fauna Assessment. Perth.
- Kinnear, J. 1993. Masterly marauders: The cat and the fox. *Landscape* **8**:20-28.
- Letnic, M., and C. R. Dickman. 2005. The responses of small mammals to patches regenerating after fire and rainfall in the Simpson Desert, central Australia. *Austral Ecology* **30**:24-39.
- Lewis, M., and M. Hines. 2014. Malleefowl activity at nesting sites increase fox and other feral animal visitation rates. Pages 242-247 *Proceedings of the 5th National Malleefowl Forum 2014*.
- Macarthur Minerals Limited. 2012. Ularring Hematite Project Targeted Survey of Malleefowl. Perth.
- Masters, P. 1998. The Mulgara *Dasyercus cristicauda* (Marsupialia: Dasyuridae) at Uluru National Park, Northern Territory. *Australian Mammalogy* **20**:403-407.
- Masters, P., C. R. Dickman, and M. Crowther. 2003. Effects of cover reduction on Mulgara *Dasyercus cristicauda* (Marsupialia: Dasyuridae), rodent and invertebrate populations in central Australia: Implications for land management. *Austral Ecology* **28**:658-665.
- MBS Environmental. 2004. Vegetation and Habitat Assessment of the Euro, Sickle and Admiral Hill Project Areas, Laverton. Perth.
- McCarthy, M. 2017. Night parrot feather discovery proves Australia's most elusive bird is alive in South Australia. ABC News.
- McKenzie, N. L., J. K. Rolfe, and K. Youngson. 1994a. Vertebrate Fauna: In The Biological Survey of the Eastern Goldfields of Western Australia Part 10. Sandstone-Sir Samuel and Laverton-Leonora Study Areas. *Records of the Western Australian Museum Supplement No. 47*:166.
- McKenzie, N. L., J. K. Rolfe, and W. K. Youngson. 1992. IV Vertebrate fauna. *Records of the Western Australian Museum, Supplement, No 41*:37-64.
- McKenzie, N. L., J. K. Rolfe, and W. K. Youngson. 1994b. Vertebrate Fauna In: The Biological Survey of the Eastern Goldfields of Western Australia Part 10. Sandstone-Sir Samuel and Laverton-Leonora Study Areas. *Records of the Western Australian Museum Supplement No. 47*:51-85.
- Moriarty, T. K. 1972. Birds of Wanjarri, W.A. (27°25'S, 120°40'E). *Emu* **72**:1-7.
- Murphy, B. P., L.-A. Woolley, H. M. Geyle, S. M. Legge, R. Palmer, C. R. Dickman, J. Augusteyn, S. C. Brown, S. Comer, T. S. Doherty, C. Eager, G. Edwards, D. A. Fordham, D. Harley, P. J. McDonald, H. McGregor, K. E. Moseby, C. Myers, J. Read, J. Riley, D. Stokeld, G. J. Trewella, J. M. Turpin, and J. C. Z. Woinarski. 2019. Introduced cats (*Felis catus*) eating a continental fauna: The number of mammals killed in Australia. *Biological Conservation* **237**:28-40.
- Murphy, D. 1994. Vertebrate fauna species of the North-Eastern Goldfields: Report to Western Mining's Leinster Nickel and Mount Keith Operations. High Wycombe, Western Australia.
- Murphy, S. 2015. Shining a light: The research unlocking the secrets of the mysterious Night Parrot. *Australian Birdlife* **4**:30-35.
- Murphy, S. A., J. J. Austin, R. K. Murphy, J. Silcock, L. Joseph, S. T. Garnett, N. P. Leseberg, J. E. M. Watson, and A. H. Burbidge. 2017a. Observations on breeding Night Parrots (*Pezoporus occidentalis*) in western Queensland. *Emu* **117**:107-113.
- Murphy, S. A., J. Silcock, R. Murphy, J. Reid, and J. J. Austin. 2017b. Movements and habitat use of the night parrot *Pezoporus occidentalis* in south-western Queensland. *Austral Ecology*.
- Ninox Wildlife Consulting. 1994. A Fauna Assessment of the Honeymoon Well Project Area. April and September 1993. Perth.
- Ninox Wildlife Consulting. 1998. A Vertebrate Fauna Survey of the Murrin Murrin Expansion Project. Perth.
- Ninox Wildlife Consulting. 2005. Vertebrate Fauna Habitat Assessment of the Proposed Expansions to the Cosmos Nickel Mine, near Leinster, Western Australia. Perth.

- Ninox Wildlife Consulting. 2006. A Vertebrate Fauna Assessment of the Tarmoola Area. Perth.
- Ninox Wildlife Consulting. 2012. A Spring Vertebrate Fauna Survey, Ularring Hematite Project, Snark Area, Western Australia. Perth.
- Palaszczuk, A., and S. Miles. 2017. New night parrot community discovered in central west Queensland.
- Pavey, C. R., C. E. M. Nano, J. R. Cole, P. J. McDonald, P. Nunn, A. Silcocks, and R. H. Clarke. 2014. The breeding and foraging ecology and abundance of the Princess Parrot (*Polytelis alexandrae*) during a population irruption. *Emu*:NULL.
- Perold, V., S. Ralston-Paton, and P. Ryan. 2020. On a collision course? The large diversity of birds killed by wind turbines in South Africa. *Ostrich* **91**:228-239.
- Phoenix Environmental Sciences. 2021. Fauna and habitat survey for the Redcliffe Gold Project. Perth.
- Pickrell, J. 2016. The night parrot's secret sanctuary. *Australian Geographic* **August**.
- Priddel, D., and R. Wheeler. 1990. Survival of Malleefowl *Leipoa ocellata* chicks in the absence of ground-dwelling predators. *Emu* **90**:81-87.
- Rykers, E. 2017. Night parrot call recordings released online for first time. *Australian Geographic* **February**.
- Smallwood, K. S., D. A. Bell, and S. Standish. 2020. Dogs Detect Larger Wind Energy Effects on Bats and Birds. *The Journal of Wildlife Management* **84**:852-864.
- Spectrum Ecology and Spatial. 2022. Leonora Operations Flora and Vegetation Site Visit and Basic Terrestrial Fauna Assessments. Perth.
- Storr, G. M., and R. E. Johnstone. 1983. Part VI Amphibians and Reptiles. Pages 70-74 in N. L. McKenzie, editor. *Wildlife of the Dampier Peninsula, south-west Kimberley, Western Australia*. Western Australian Wildlife Research Centre, Department of Fisheries and Wildlife, Perth.
- Storr, G. M., L. A. Smith, and R. E. Johnstone. 1990. *Lizards of Western Australia. III: Geckos and Pygopods*. Western Australian Museum, Perth.
- Storr, G. M., L. A. Smith, and R. E. Johnstone. 1999. *Lizards of Western Australia. I: Skinks*. Western Australian Museum, Perth.
- Storr, G. M., L. A. Smith, and R. E. Johnstone. 2002. *Snakes of Western Australia*. Western Australian Museum, Perth.
- Terrestrial Ecosystems. 2010. Level 2 Fauna Risk Assessment for the Garden Well Project Area. Perth.
- Terrestrial Ecosystems. 2011a. Level 2 Fauna Risk Assessment for the Granny Deeps Project Area. Perth.
- Terrestrial Ecosystems. 2011b. Malleefowl (*Leipoa ocellata*) survey for the Snark Project. Perth.
- Terrestrial Ecosystems. 2011c. Targeted Survey for Long-tailed Dunnarts for the Granny Deeps Project Area. Perth.
- Terrestrial Ecosystems. 2012a. Level 1 Vertebrate Fauna Risk Assessment for the Proposed Exploration Areas around the Granny Open Pit Project Area. Perth.
- Terrestrial Ecosystems. 2012b. Level 1 Vertebrate Fauna Risk Assessment for the Proposed Mining Areas around the Granny Open Pit Project Area. Perth.
- Terrestrial Ecosystems. 2014. Fauna risk assessment of the proposed power station site. Perth.
- Terrestrial Ecosystems. 2015. Fauna risk assessment of the proposed borrow pit expansion. Perth.
- Terrestrial Ecosystems. 2018. Vertebrate Fauna Risk Assessment for the Granny Smith Solar Power Farm Project. Perth.
- Terrestrial Ecosystems. 2020. Level 2 Vertebrate Fauna Assessment for the King of the Hills Project. Perth.
- Thompson, G. G., and S. A. Thompson. 2007. Shape and spatial distribution of Mulgara (*Dasyercus cristicauda*) burrows, with comments on their presence in a burnt habitat and a translocation protocol. *Journal of the Royal Society of Western Australia* **90**:195-202.
- Thompson, G. G., and S. A. Thompson. 2008. Abundance and spatial distribution of five small mammals at a local scale. *Australian Mammalogy* **30**:65-70.
- Thompson, M., J. A. Beston, M. Etterson, J. E. Diffendorfer, and S. R. Loss. 2017. Factors associated with bat mortality at wind energy facilities in the United States. *Biol Conserv* **215**:241-245.

- Thompson, S. A., and G. G. Thompson. 2006. Reptiles of the Western Australian Goldfields. Goldfields Environmental Management Group, Kalgoorlie, WA.
- Threatened Species Scientific Committee. 2016. Conservation Advice *Pezoporus occidentalis* Night Parrot. Canberra.
- Tingay, A., and S. R. Tingay. 1977. A Vertebrate Fauna Survey of Yeelirrie Station, Western Australia. Perth.
- Tyler, M. J., L. A. Smith, and R. E. Johnstone. 2000. Frogs of Western Australia. Western Australian Museum, Perth.
- Van Dyck, S., and R. Strahan. 2008. The Mammals of Australia. Reed New Holland, Sydney.
- Wilson, H. 1937. Notes on the Night Parrot, with references to recent occurrences. *Emu* **37**:79-87.
- Woinarski, J. C. Z., B. P. Murphy, S. M. Legge, S. T. Garnett, M. J. Lawes, S. Comer, C. R. Dickman, T. S. Doherty, G. Edwards, A. Nankivell, D. Paton, R. Palmer, and L. A. Woolley. 2017. How many birds are killed by cats in Australia? *Biological Conservation* **214**:76-87.
- Woinarski, J. C. Z., B. P. Murphy, R. Palmer, S. M. Legge, C. R. Dickman, T. S. Doherty, G. Edwards, A. Nankivell, J. L. Read, and D. Stokeld. 2018. How many reptiles are killed by cats in Australia? *Wildlife Research* **45**:247-266.
- Woolley, P. A. 2005. The species of *Dasyercus* Peters, 1875 (Marsupialia: Dasyuridae). *Memoirs of Museum Victoria* **62**:213-221.

Figures

**Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment
St Barbara Leonora Province Expansion**



Appendix A.

Results of the *EPBC Act* Protected Matters Search

**Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment
St Barbara Leonora Province Expansion**





EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 20-Sep-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar)	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	18
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	14
Regional Forest Agreements:	None
Nationally Important Wetlands:	4
EPBC Act Referrals:	20
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species

[\[Resource Information \]](#)

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name

Threatened Category

Presence Text

BIRD

[Calidris ferruginea](#)

Curlew Sandpiper [856]

Critically Endangered

Species or species habitat likely to occur within area

[Falco hypoleucos](#)

Grey Falcon [929]

Vulnerable

Species or species habitat likely to occur within area

[Leipoa ocellata](#)

Malleefowl [934]

Vulnerable

Species or species habitat known to occur within area

[Pezoporus occidentalis](#)

Night Parrot [59350]

Endangered

Species or species habitat likely to occur within area

[Polytelis alexandrae](#)

Princess Parrot, Alexandra's Parrot [758]

Vulnerable

Species or species habitat known to occur within area

MAMMAL

[Dasyurus geoffroii](#)

Chuditch, Western Quoll [330]

Vulnerable

Species or species habitat known to occur within area

[Sminthopsis psammophila](#)

Sandhill Dunnart [291]

Endangered

Species or species habitat known to occur within area

PLANT

Scientific Name	Threatened Category	Presence Text
Atriplex yeelirrie [88538]	Endangered	Species or species habitat known to occur within area
Eleocharis papillosa Dwarf Desert Spike-rush [2519]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus articulata Ponton Creek Mallee [56772]	Vulnerable	Species or species habitat likely to occur within area
Gastrolobium graniticum Granite Poison [14872]	Endangered	Species or species habitat may occur within area
Hibbertia crispula Ooldea Guinea-flower [15222]	Vulnerable	Species or species habitat may occur within area
Leucopogon spectabilis Ironstone Beard-heath [83012]	Critically Endangered	Species or species habitat known to occur within area
Myriophyllum lapidicola Chiddarcooping Myriophyllum [55940]	Endangered	Species or species habitat known to occur within area
Ricinocarpos brevis [82879]	Endangered	Species or species habitat known to occur within area
Tecticornia flabelliformis Bead Glasswort [82664]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca aphylla Bungalbin Tetratheca [2915]	Vulnerable	Species or species habitat known to occur within area
Tetratheca paynterae Paynter's Tetratheca [66451]	Endangered	Species or species habitat may occur within area

REPTILE

Scientific Name	Threatened Category	Presence Text
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area

Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [[Resource Information](#)]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State
Defence	
Defence - JINDALEE STATION [50257]	WA
Defence - JINDALEE STATION [50256]	WA
Unknown	
Commonwealth Land - [51752]	WA
Commonwealth Land - [51753]	WA
Commonwealth Land - [51754]	WA
Commonwealth Land - [51755]	WA
Commonwealth Land - [51058]	WA
Commonwealth Land - [51750]	WA
Commonwealth Land - [51751]	WA
Commonwealth Land - [51829]	WA
Commonwealth Land - [51828]	WA
Commonwealth Land - [51827]	WA
Commonwealth Land - [52232]	WA
Commonwealth Land - [51756]	WA
Commonwealth Land - [51796]	WA
Commonwealth Land - [52213]	WA

Commonwealth Land Name	State
Commonwealth Land - [51984]	WA
Commonwealth Land - [52197]	WA

Listed Marine Species [[Resource Information](#)]

Scientific Name	Threatened Category	Presence Text
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Bird

[Actitis hypoleucos](#)

Common Sandpiper [59309]		Species or species habitat known to occur within area
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[Apus pacificus](#)

Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
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[Bubulcus ibis as Ardea ibis](#)

Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
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[Calidris acuminata](#)

Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
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[Calidris ferruginea](#)

Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
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[Calidris melanotos](#)

Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
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[Chalcites osculans as Chrysococcyx osculans](#)

Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
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[Charadrius veredus](#)

Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
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Scientific Name	Threatened Category	Presence Text
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Bulga Downs & Cashmere Downs Pastoral leases portions	NRS Addition - Gazettal in Progress	WA
Bullock Holes Timber Reserve	5(1)(g) Reserve	WA
Clear And Muddy Lakes	Nature Reserve	WA
Credo	NRS Addition - Gazettal in Progress	WA
De La Poer Range	Nature Reserve	WA
Goongarrie	National Park	WA
Kaluwiri	NRS Addition - Gazettal in Progress	WA
Lake Mason	NRS Addition - Gazettal in Progress	WA

Protected Area Name	Reserve Type	State
Mount Manning - Helena And Aurora Ranges	Conservation Park	WA
Mount Manning Range	Nature Reserve	WA
Queen Victoria Spring	Nature Reserve	WA
Rowles Lagoon	Conservation Park	WA
Unnamed WA46847	Nature Reserve	WA
Wanjarri	Nature Reserve	WA

Nationally Important Wetlands [\[Resource Information \]](#)

Wetland Name	State
Lake Ballard	WA
Lake Barlee	WA
Lake Marmion	WA
Rowles Lagoon System	WA

EPBC Act Referrals [\[Resource Information \]](#)

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Extension to Wiluna Uranium Mine (Millipede & Lake Maitland), Wiluna, WA	2014/7138	Controlled Action	Post-Approval
J5 and Bungalbin East Iron Ore Project, Shire of Yilgarn, WA	2015/7494	Controlled Action	Proposed Decision Comment
Lake Maitland Uranium Project	2009/5220	Controlled Action	Completed
Mt Jackson, Windarling & Bungalbin deposits	2001/174	Controlled Action	Post-Approval
Northern Star Resources - Carosue Dam TSF Cell 4	2021/9026	Controlled Action	Assessment Approach
Sandy Ridge Project (kaolin clay mine & complementary waste storage and isolation business) Koolyano	2015/7478	Controlled Action	Post-Approval
Tropicana Gold Project-Develop open cut gold mine, and associated infrastructure	2008/4270	Controlled Action	Post-Approval
Yeelirrie Uranium Mine	2009/4906	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Clearing for Mt Keith Satellite Project, WA	2017/8001	Not Controlled Action	Completed
Construction of a bypass road, haulage contractor workshop & laydown yard	2012/6639	Not Controlled Action	Completed
Develop Carina Iron Ore Project, including open cut mine and associated infrastructure, exploration	2008/4501	Not Controlled Action	Completed
Eastern Goldfields Gas Pipeline Construction, WA	2014/7284	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Murrin Murrin East Nickel and Cobalt Mine Expansion	2008/4140	Not Controlled Action	Completed
Re-establish and Recommencement of Mount Windarra Nickel Mine	2008/4016	Not Controlled Action	Completed
Saracen Gold-Carusue Dam Aerodrome, WA	2017/7925	Not Controlled Action	Completed
Ularring Hematite Project, WA	2012/6426	Not Controlled Action	Completed
Not controlled action (particular manner)			
Mt Mason Hematite DSO Project, 110kms northwest of Menzies, WA	2013/6870	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Mt Richardson Iron Ore Project and Northern Yilgarn Haul Road	2022/9152	Referral Decision	Referral Publication
Northern Goldfields Interconnect Pipeline	2021/8900	Referral Decision	Referral Publication

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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Appendix B.

Vertebrate fauna recorded in biological surveys in the region

Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment
St Barbara Leonora Province Expansion



Family	Species	Common Name	Surveys A			B							C							D						E						F				
			Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30	Weebo		
Amphibians																																				
Limnodynastidae	<i>Neobatrachus kunapalari</i>	Wheatbelt Frog	X	6	1	2																														
	<i>Neobatrachus sudelli</i>	Sudell's Frog	X																																	
	<i>Neobatrachus sutor</i>	Shoemaker Frog	X							3	5	10						1	1																	
	<i>Neobatrachus wilmorei</i>	Plonking Frog	X						1	11		2	2												3	2										
	<i>Platyplectrum spenceri</i>	Spencer's Burrowing Frog	X																																	
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet	X																																	
Pelodyadidae	<i>Cyclorana maini</i>	Main's Frog	X	4																	1															
	<i>Cyclorana occidentalis</i>	Western Water-holding Frog	X	2																																
	<i>Litoria cyclorhyncha</i>	Spotted-thighed Frog	X																																	
	<i>Litoria moorei</i>	Motorbike Frog	X																																	
Reptiles																																				
Agamidae	<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon	X																																	
	<i>Ctenophorus cristatus</i>	Crested Dragon	X																																	
	<i>Ctenophorus fordi</i>	Mallee Dragon	X	5						43			2												42	2	15	2	2	9						
	<i>Ctenophorus graafi</i>	Ring-tailed Dragon	X																																	
	<i>Ctenophorus inermis</i>	Military Dragon		2			1																													1
	<i>Ctenophorus infans</i>	Ring-tailed Dragon	X																																	
	<i>Ctenophorus isolepis</i>	Central Military Dragon	X	7	4													1																		
	<i>Ctenophorus nuchalis</i>	Central Netted Dragon	X																																	
	<i>Ctenophorus ornatus</i>	Ornate Crevice Dragon	X																																	
	<i>Ctenophorus pictus</i>	Painted Dragon	X																																	
	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	X	2							2	1		2	4						1	1	1	3									1	2		
	<i>Ctenophorus salinarum</i>	Saltpan Dragon	X	3				1	5																											
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon	X	1			1																	3	7	3		8		3	1					
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon	X																																	
	<i>Moloch horridus</i>	Thorny Devil	X	3						1		1	2											1				1	2		1					
	<i>Pogona minor</i>	Western Bearded Dragon	X	2	2	1	1			1	2	4	2	1	1	2								1	1	1		3	1				3			
	<i>Tympanocryptis cephalus</i>	Pebble Dragon	X																																	
Carphodactylidae	<i>Nephrurus laevisimus</i>	Smooth Knob-tail	X							18			1											18		2	1	1	9							
	<i>Nephrurus vertebralis</i>	Midline Knob-tail	X																																	
	<i>Nephrurus wheeleri</i>	Banded Knob-tail	X																																	
	<i>Underwoodisaurus milii</i>	Barking Gecko	X	1																													9			
Diplodactylidae	<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko	X																																	

Family	Species	Common Name	Surveys A			B					C						D					E					F												
			Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30	Weebo					
Elapidae	<i>Brachyuropsis fasciolatus</i>	Narrow-banded Burrowing Snake																																1					
	<i>Brachyuropsis semifasciata</i>	Half-girdled Snake	X																																		1		
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake	X																							2													
	<i>Furina ornata</i>	Orange-naped Snake	X	2																																			
	<i>Neelaps bimaculatus</i>	Black-naped Burrowing Snake	X																																				
	<i>Suta monachus</i>	Hooded Snake	X																	1						1													
	<i>Pseudechis australis</i>	Mulga Snake	X	1																																			
	<i>Pseudechis butleri</i>	Spotted Mulga Snake	X																	1																			
	<i>Pseudonaja mengdeni</i>	Western Brown Snake	X									1																											
	<i>Pseudonaja modesta</i>	Ringed Brown Snake	X							1														1		3													
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	X	1												1												1											
	<i>Suta fasciata</i>	Rosen's Snake	X																																				
Gekkonidae	<i>Christinus marmoratus</i>	Marbled Gecko	X																																				
	<i>Gehyra punctata</i>	Spotted Dtella	X																																				
	<i>Gehyra purpurascens</i>	Purplish Dtella	X	1		1																					2												
	<i>Gehyra variegata</i>	Variiegated Gehyra	X	25		1	1	1			1				2			2	1		3	9	1	3	2	9	1		3	4	6	2	3	1					
	<i>Heteronotia binoei</i>	Bynoe's Gecko	X	5																																		2	
Pygopodidae	<i>Aprasia picturata</i>	Black-headed Worm-lizard	X																																				
	<i>Delma butleri</i>	Unbanded Delma	X		1																					1													
	<i>Delma nasuta</i>	Sharp-snouted Delma	X		1		1																																
	<i>Lialis burtonis</i>	Burton's Legless Lizard	X	1										1																									
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot	X												1	1										1													
Pythonidae	<i>Antaresia stimsoni</i>	Stimson's Python	X																																				
Scincidae	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink	X	3				1						1	1					2	1					1	3					1			3				
	<i>Ctenotus ariadnae</i>	Ariadna's Ctenotus	X																																				
	<i>Ctenotus atlas</i>	Southern Mallee Ctenotus	X								3														3	1	4	3	2	3									
	<i>Ctenotus brooksi</i>	Wedgsnout Ctenotus	X																																				
	<i>Ctenotus calurus</i>	Blue-tailed Finesnout Ctenotus														1																							
	<i>Ctenotus grandis</i>	Grand Ctenotus	X																																				
	<i>Ctenotus greeri</i>	Spotted-necked Ctenotus	X			2										12																							
	<i>Ctenotus helenae</i>	Clay-soil Ctenotus	X	3	3											1																							

Family	Species	Common Name	Surveys A			B						C						D						E						F						
			Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30	Weebo		
	<i>Ctenotus leae</i>	Orange-tailed Finesnout Ctenotus	X																																	
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus	X									5	9								1															
	<i>Ctenotus mimetes</i>	Checker-sided Ctenotus																																		
	<i>Ctenotus pantherinus</i>	Leopard Ctenotus	X	6		1										4																				
	<i>Ctenotus quattuordecimlineatus</i>	Fourteen-lined Ctenotus														11																				
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus	X	3						9	1			3		11		1		1				9	3	5	5	1	1							
	<i>Ctenotus severus</i>	Stern Ctenotus	X																																	
	<i>Ctenotus uber</i>	Spotted Ctenotus	X											1	1										1						1	6				
	<i>Ctenotus xenopleura</i>	Wide-striped Ctenotus	X																																	
	<i>Cyclodomorphus branchialis</i>	Common Slender Bluetongue												1																						
	<i>Cyclodomorphus melanops</i>	Spinifex Slender Blue-tongue	X																						10	2		2		2						
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink	X	3										2								1														
	<i>Egernia formosa</i>	Goldfields Crevice Skink	X																												5	2				
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer	X																																	
	<i>Lerista desertorum</i>	Central Desert Robust Slider	X	1		1	1	1								6				1			1													
	<i>Lerista kingi</i>	King's Slider	X																																	
	<i>Lerista lineopunctulata</i>	Dotted-line Robust Slider																																		
	<i>Lerista macropisthopus</i>	Unpatterned Robust Slider	X																							1										
	<i>Lerista muelleri</i>	Wood Mulch-slider	X																																	
	<i>Lerista picturata</i>	Southern Robust Slider	X																																	
	<i>Lerista timida</i>	Timid Slider	X																																	
	<i>Liopholis inornata</i>	Desert Skink	X							1				1	1	1								2	1		2		4							
	<i>Menetia greyii</i>	Common Dwarf Skink	X	2		1	1			2	1			1				4		1				2	1	1	1	1	1	1		1				
	<i>Morethia butleri</i>	Woodland Morethia Skink	X	2											2	2			2	1		1	3									2	1			
	<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard	X	2						1			1											1								1				
	<i>Tiliqua rugosa</i>	Bobtail	X																																	
Typhlopidae	<i>Anilius australis</i>	Austral Blind Snake																														2				
	<i>Anilius bituberculatus</i>	Prong-snouted Blind Snake	X																								1									

Family	Species	Common Name	Surveys A			B					C						D				E					F									
			Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30	Weebo	
Varanidae	<i>Anillos hamatus</i>	Pale-headed Blind Snake			1																							1							
	<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor	X	1			1																												
	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor	X	1	1					1									1				1												
	<i>Varanus eremius</i>	Pygmy Desert Monitor	X																																
	<i>Varanus giganteus</i>	Perentie	X																																
	<i>Varanus gouldii</i>	Gould's Goanna	X	1							1	1	2	2												2	1								
	<i>Varanus panoptes</i>	Yellow-spotted Monitor	X																		1		1												
	<i>Varanus tristis</i>	Black-headed Monitor	X												3																1				
Birds																																			
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu			2	1			8	1			1	2		1	1	1			1														
Anatidae	<i>Cygnus atratus</i>	Black Swan																		1															
	<i>Tadorna tadornoides</i>	Australian Shelduck	1																	1															
	<i>Chenonetta jubata</i>	Australian Wood Duck	1																																
	<i>Anas superciliosa</i>	Pacific Black Duck	1																		1														
	<i>Anas gracilis</i>	Grey Teal	1																		1														
	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck	1																		1														
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl																			1														
Podicipedidae	<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	1																																
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing		4										1		1					1														
	<i>Ocyphaps lophotes</i>	Crested Pigeon		5	4	2				6			1				2				1		2												
	<i>Geopelia cuneata</i>	Diamond Dove			8					1																									
Cuculidae	<i>Chrysococcyx basalus</i>	Horsfield's Bronze-Cuckoo		1					6	1				2	3																				
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo							3							1																			
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	1											3																					
Podargidae	<i>Podargus strigoides</i>	Tawny Frogmouth	1																																
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen	1																		1														
	<i>Fulica atra</i>	Eurasian Coot	1																																
Recurvirostridae	<i>Himantopus leucocephalus</i>	Pied Stilt	1																			1													
	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet																				1													
Charadriidae	<i>Vanellus tricolor</i>	Banded Lapwing	1																																
	<i>Charadrius ruficapillus</i>	Red-capped Plover	1																																

Family	Species	Common Name	Surveys A			B			C							D				E					F								
			Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30
	<i>Eseyornis melanops</i>	Black-fronted Dotterel	1																		1												
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	1																														
Turnicidae	<i>Turnix velox</i>	Little Buttonquail								13																							
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron	1																		1												
	<i>Egretta novaehollandiae</i>	White-faced Heron	1																		1												
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	1																														
Accipitridae	<i>Hieraetus morphnoides</i>	Little Eagle	1													3				1													
	<i>Aquila audax</i>	Wedge-tailed Eagle				4	8	3						6																			
	<i>Circus assimilis</i>	Spotted Harrier	1										1																				
	<i>Accipiter fasciatus</i>	Brown Goshawk														3																	
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo	1											4	2	1				1													
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher	1																														
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater								3						3																	
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel			1		1	2																									
	<i>Falco longipennis</i>	Australian Hobby	1																		1												
	<i>Falco berigora</i>	Brown Falcon				1										5																	
	<i>Falco peregrinus</i>	Peregrine Falcon																		1													
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah		26	4		10							44	62	5					1												
	<i>Nymphicus hollandicus</i>	Cockatiel		15	12		20								4	3																	
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot			6																1												
	<i>Barnardius zonarius</i>	Australian Ringneck		3	4	3	2				10		3	25	16					1	1		2	3									
	<i>Psephotus varius</i>	Mulga Parrot			9					4	3		2		2					1	1	5	5										
	<i>Melopsittacus undulatus</i>	Budgerigar		6	9	6	5	8		1			38	11	29																		
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird	X																														
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper	X	1									1		1						1		2										
	<i>Climacteris rufus</i>	Rufous Treecreeper	X																														
Maluridae	<i>Malurus pulcherrimus</i>	Blue-breasted Fairywren									15																						
	<i>Malurus lamberti</i>	Variagated Fairywren			2																												
	<i>Malurus splendens</i>	Splendid Fairywren	X								24										1		9										
	<i>Malurus leucopterus</i>	White-winged Fairywren	X				69	57				17																					
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater	X	2	4						2			2																			
	<i>Purnella albifrons</i>	White-fronted Honeyeater	X	33	17	40	81	99		69	16		7	3	6	4	4	80	100	1	12	10	1										
	<i>Manorina flavigula</i>	Yellow-throated Miner									109		3	10		13		10	5	1	7		10										
	<i>Manorina flavigula</i>	Yellow-throated Miner	X																														

Family	Species	Common Name	Surveys A			B							C							D						E						F	
			Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater	X	5	32	12				18	7		6	11	4	8		25	20	1		1	2										
	<i>Anthochaera carunculata</i>	Red Wattlebird	X													2																	
	<i>Gavicalis virescens</i>	Singing Honeyeater	X		20	1				2	4			11		2		4	1	2	1	1											
	<i>Ptilotula ornata</i>	Yellow-plumed Honeyeater	X																														
	<i>Ptilotula plumula</i>	Grey-fronted Honeyeater												56		3																	
	<i>Conopophila whitei</i>	Grey Honeyeater								2	1					17																	
	<i>Epthianura tricolor</i>	Crimson Chat	X		11	43	20							154																			
	<i>Epthianura aurifrons</i>	Orange Chat	X																														
	<i>Epthianura albifrons</i>	White-fronted Chat	X																														
	<i>Sugomel nigrum</i>	Black Honeyeater	X	1						7																							
	<i>Lichmera indistincta</i>	Brown Honeyeater	X		1																												
	<i>Nesoptilotis leucotis</i>	White-eared Honeyeater	X							4																							
	<i>Melithreptus brevirostris</i>	Brown-headed Honeyeater	X																														
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	X				2									2					1												
Acanthizidae	<i>Pyrrholaemus brunneus</i>	Redthroat	X							16			2		1						1												
	<i>Acanthiza apicalis</i>	Inland Thornbill	X		8					32			1	2	3	2	2			1		6	2										
	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	X		3					2	4				4		5	6	1		4	2											
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill	X	3	20	3				23	27				10	88	2	8	30	1	2	50	15										
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill	X												3					1		2											
	<i>Smicrornis brevirostris</i>	Weebill	X	8	6					50			2	2	98					1													
	<i>Gerygone fusca</i>	Western Gerygone	X																														
	<i>Aphelocephala leucopsis</i>	Southern Whiteface	X		9										12	5				1		20	6										
	<i>Pomatostomus superciliosus</i>	White-browed Babbler	X		22					1					3					1													
Cinclosomatidae	<i>Cinclosoma castaneothorax</i>	Chestnut-breasted Quail-thrush	X																														
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike	X					3																									
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike	X				1	2	2					4		9			2	1													
	<i>Lalage tricolor</i>	White-winged Triller	X	1	11					2	2				6																		
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella								2						6																	
Psophodidae	<i>Psophodes occidentalis</i>	Chiming Wedgebill	X																														
Oreocidae	<i>Oreocia gutturalis</i>	Crested Bellbird	X	2	18	17				11	2				14	2	15	1	1	3	1	1	2	1									
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrike Thrush	X		1					6						1	5				1	2	1										
	<i>Pachycephala inornata</i>	Gilbert's Whistler	X																														

Family	Species	Common Name	Surveys A			B					C								D				E						F							
			X	Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30	Weebo	
	<i>Pachycephala rufiventris</i>	Rufous Whistler	X	1	18										1	8					1		1	1												
Artamidae	<i>Artamus personatus</i>	Masked Woodswallow	X		1					1					2	2																				
	<i>Artamus superciliosus</i>	White-browed Woodswallow																			1	4		1												
	<i>Artamus cinereus</i>	Black-faced Woodswallow	X	1	1	23	43	1							55	1																				
	<i>Cracticus torquatus</i>	Grey Butcherbird	X	1						2	1				2	8		1	1	1	1	1	1	1												
	<i>Cracticus nigrogularis</i>	Pied Butcherbird	X	1	3	15	5	2		3	14				6	2	4		2	1	1	1														
	<i>Gymnorhina tibicen</i>	Australian Magpie	X	1							5								3		1															
	<i>Strepera versicolor</i>	Grey Currawong	X	1							4					1	2					1														
Rhipiduridae	<i>Rhipidura leucophrys</i>	Willie Wagtail	X	1	7	3	2				1							1		1																
	<i>Rhipidura albiscapa</i>	Grey Fantail	X																				1													
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark	X	1															1	1	2		2													
Corvidae	<i>Corvus orru</i>	Torresian Crow	X																1	1	2		1													
	<i>Corvus bennetti</i>	Little Crow	X					10			149				29	24			2	1		1														
	<i>Corvus coronoides</i>	Australian Raven	X																																	
Petroicidae	<i>Microeca fascians</i>	Jacky Winter	X		3	1										22																				
	<i>Petroica goodenovii</i>	Red-capped Robin	X		33	12			8	4				1	4	29		1	2	1		6	2													
	<i>Melanodryas cucullata</i>	Hooded Robin	X		5	3								2	1					1	3															
	<i>Eopsaltria griseogularis</i>	Western Yellow Robin	X																																	
Locustellidae	<i>Cincloramphus cruralis</i>	Brown Songlark	X	1											3																					
	<i>Cincloramphus mathewsi</i>	Rufous Songlark	X	1												2																				
Hirundinidae	<i>Hirundo rustica</i>	Barn Swallow																																		
	<i>Hirundo neoxena</i>	Welcome Swallow	X							2																										
	<i>Petrochelidon ariel</i>	Fairy Martin	X																																	
	<i>Petrochelidon nigricans</i>	Tree Martin	X	1																																
	<i>Cheramoeca leucosterna</i>	White-backed Swallow	X	1																	1	2														
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird	X	4	7				3	4			1																							
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch	X			22									12	5					1															
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit	X		2	5	4				2										1	4														
Mammals																																				
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna	X	1																1	1															
Bovidae	<i>Capra hircus</i>	Goat													1	1					1															
	<i>Ovis aries</i>	Sheep									1	1	1			1																				
Camelidae	<i>Camelus dromedarius</i>	Dromedary		1			1																													
Suidae	<i>Sus scrofa</i>	Pig	X																																	
Canidae	<i>Canis lupus</i>	Dingo	X							1												1														
	<i>Vulpes vulpes</i>	Red Fox		1						1						1	1				1															
Felidae	<i>Felis catus</i>	Cat		2																																

Family	Species	Common Name	Surveys		A					B					C					D				E				F									
			X		Site 1E	Site LL4	Site LL5	Site LL3	Site LL1	Site LL2	Site 7	Site 8	Site 13	Site 9	Site 9a	Site 12	Site 21	Site 14	Site 21a	Site 19	Site 12a	MME1	MME2	Opportunis	MME3	MME7	MME6	GG27	GG29	GG28	GS28	GS29	GS27	GS30	GG30	Weebo	
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat	X						1	1																											
	<i>Mormopterus planiceps</i>	Southern Free-tail Bat	X	2					1																												
Pteropodidae	<i>Syconycteris australis</i>	Common Blossom-bat		2																																	
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X	5						1																											1
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	X	5		4				1																											
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	X	6						1																											
	<i>Vespadelus baverstocki</i>	Inland Forest Bat	X																																		
Dasyuridae	<i>Antechinomys laniger</i>	Kultarr	X																																		1
	<i>Ningau ridei</i>	Wongai Ningau	X		5						1						5											4	3								
	<i>Ningau yvonneae</i>	Mallee Ningau	X																																		
	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus	X																																		
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart	X				1	4	7				1						1		1																1
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart	X								3				1			1								1	1	1		1	2	12					
	<i>Sminthopsis hirtipes</i>	Hairy-footed Dunnart	X																																		
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart	X			3	2		1																												
	<i>Sminthopsis ooldea</i>	Ooldea Dunnart	X		2		1	1																													
Macropodidae	<i>Osphranter robustus</i>	Euro	X	3											1			1				1															
	<i>Osphranter rufus</i>	Red Kangaroo	X	38		1	2	4								1						1	5														1
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit		3				1														1															
Equidae	<i>Equus asinus</i>	Donkey																					1														
Muridae	<i>Mus musculus</i>	House Mouse	X		2	3	3	3	8		4						3			1	2		2													4	
	<i>Notomys alexis</i>	Spinifex Hopping Mouse	X								2								7				2			3	1	1		2							
	<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse	X												1																						
	<i>Pseudomys albocinereus</i>	Ash-grey Mouse	X																																		
	<i>Pseudomys bolami</i>	Bolam's Mouse	X														3																				
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse	X	1	8	1	6	1			2							7																			4

A Atlas of Living Australia

B McKenzie N.L., Rolfe, J.K. and Youngson, W.K. (1994b) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia Part 10, Sandstone-Sir Samuel and Laverton-Leonora Study Areas. *Records of the Western Australian Museum*, Supplement No 47, PP. 51-85.

C Dell, J and How, R.A. (1988) Vertebrate fauna. In: The biological Survey of the Eastern Goldfields of Western Australia, Part 5, Edjudina - Menzies Study Area. *Records of the Western Australian Museum*, Supplement No 31., pp. 38-77.

D Ninnox Wildlife Consulting (1998) *A Vertebrate Fauna Survey of the Murrin Murrin Expansion Project*. Unpublished report for Anaconda Nickel Ltd, Perth.

E Cowan, M.A. and How, R.A. (2004) Comparisons of ground vertebrate assemblages in arid Western Australia in different seasons and decades. *Records of the Western Australian Museum*, 22, 91-100.

F How R.A. and Dell J. (1992) Vertebrate fauna. In: The Biological Survey of the Eastern Goldfields of Western Australia Part 7. Duketon - Sir Samuel Study Area. *Records of the Western Australian Museum*; Supplement 40, 90-109.

Family	Species	Common Name	Surveys												E Mine (Tarmoola Operations) Pipeline (proposed)	F Site 1 Site 2 Site 3 Site 4 Site 5 Site 6 Site 9 Site 8	G Allan's Pool and Mid Gum TSF3 Leinster Nickel Operations Gum Pool	H Unknown	I Unknown	J Unknown	K Goongarrie																		
			A Site 6 Site 5 Site 7 Oppportunistic Site 7 Site 6 Jump Up Dam MC06 MC05 MC07	B Site 7 Site 6	C Jump Up Dam MC06 MC05 MC07	D BIF 15 7 18																																	
Reptiles																																							
Agamidae	<i>Ctenophorus reticulatus</i>	Western Netted Dragon	1	3		1		1	1	1					X																								
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon		1	2	15			1	16	3						1	3	5	3	1																		
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon		1					1										2																				
	<i>Pogona minor</i>	Western Bearded Dragon		1			6		2	1	1							1		1																			
Carphodactylidae	<i>Underwoodisaurus milii</i>	Barking Gecko						1																															
Diplodactylidae	<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko				1				1																													
	<i>Diplodactylus pulcher</i>	Beautiful Gecko		1		1	4		4	9							1			1																			
	<i>Lucasium maini</i>	Main's Ground Gecko				1																																	
	<i>Rhynchoedura ornata</i>	Beaked Gecko						1																															
	<i>Strophurus assimilis</i>	Goldfields Spiny-tailed Gecko														1																							
Elapidae	<i>Brachyuropsis semifasciata</i>	Half-girdled Snake						1	1		2																												
	<i>Demansia psammophis</i>	Yellow-faced Whipsnake					1																																
	<i>Suta monachus</i>	Hooded Snake								1																													
Gekkonidae	<i>Gehyra variegata</i>	Variiegated Gehyra						1		3				X						1																			
	<i>Heteronotia binoei</i>	Bynoe's Gecko						1		1											1																		
Scincidae	<i>Ctenotus grandis</i>	Grand Ctenotus			1																																		
	<i>Ctenotus leonhardii</i>	Leonhardi's Ctenotus				1											1	8	2	1																			
	<i>Ctenotus mimetes</i>	Checker-sided Ctenotus		1																																			
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus			2						2							1	1																				
	<i>Ctenotus uber</i>	Spotted Ctenotus					2			13	4																												
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink						1													3																		
	<i>Egernia formosa</i>	Goldfields Crevice Skink						1	1																														
	<i>Lerista kingi</i>	King's Slider									1																												
	<i>Lerista lineopunctulata</i>	Dotted-line Robust Slider					4																																
<i>Lerista timida</i>	Timid Slider							3	3	3																													
<i>Liopholis inornata</i>	Desert Skink				2					2																													
<i>Menetia greyii</i>	Common Dwarf Skink																1			3																			

Family	Species	Common Name	Surveys													G	H	I	J	K																
			A	B	C	D	E	F	G	H	I	J	K																							
			Site 6	Site 5	Site 7	Opportunistic	Site 7	Site 6	Jump Up Dam	MC06	MC05	MC07	BIF	15	7	18	Mine (Tarmoola Operations)	Pipeline (proposed)	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 9	Site 8	Allan's Pool and Mid Gum	TSF3	Leinster Nickel Operations	Gum Pool	Unknown	Unknown	Unknown	Goongarrie		
	<i>Morethia butleri</i>	Woodland Morethia Skink								1																										
Typhlopidae	<i>Anilius bituberculatus</i>	Prong-snouted Blind Snake									3																									
	<i>Anilius hamatus</i>	Pale-headed Blind Snake				1				2																										
Varanidae	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor							1	1								3	2																	
	<i>Varanus giganteus</i>	Perentie											2																							
	<i>Varanus gouldii</i>	Gould's Goanna				2			1							X																				
	<i>Varanus panoptes</i>	Yellow-spotted Monitor							1									1	2	1	2															
Birds																																				
Casuariidae	<i>Dromaius novaehollandiae</i>	Emu						1								X																				
Anatidae	<i>Tadorna tadornoides</i>	Australian Shelduck																									1									
	<i>Chenonetta jubata</i>	Australian Wood Duck															X									1										
	<i>Anas superciliosa</i>	Pacific Black Duck																								1										
	<i>Anas gracilis</i>	Grey Teal																							1											
Megapodiidae	<i>Leipoa ocellata</i>	Malleefowl				X		1						X	X	X															X	X	2			
Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing						1					1													1										
	<i>Ocyphaps lophotes</i>	Crested Pigeon						1									X	X								1										
	<i>Geopelia cuneata</i>	Diamond Dove							2																	1										
Cuculidae	<i>Chrysococcyx basalus</i>	Horsfield's Bronze-Cuckoo						1											1	2	2	1														
	<i>Chrysococcyx osculans</i>	Black-eared Cuckoo						1										X	1				1													
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owllet-nightjar						1													1															
Caprimulgidae	<i>Eurostopodus argus</i>	Spotted Nightjar						1																												
Apodidae	<i>Apus pacificus</i>	Pacific Swift						1																												
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Nativehen																									1									
Charadriidae	<i>Charadrius ruficapillus</i>	Red-capped Plover																									1									
	<i>Erythrogonys cinctus</i>	Red-kneed Dotterel																									1									
	<i>Elsayornis melanops</i>	Black-fronted Dotterel																									1									
Scolopacidae	<i>Calidris ruficollis</i>	Red-necked Stint																									1									
	<i>Tringa nebularia</i>	Common Greenshank																									1									
	<i>Tringa glareola</i>	Wood Sandpiper																									1									
Turnicidae	<i>Turnix velox</i>	Little Buttonquail							1																											
Otididae	<i>Ardeotis australis</i>	Australian Bustard							1																											

Family	Species	Common Name	Surveys															G	H	I	J	K																
			A	B	C	D	E	F	G	H	I	J	K																									
			Site 6	Site 5	Site 7	Opportunistic	Site 7	Site 6	Jump Up Dam	MC06	MC05	MC07	BIF	15	7	18	Mine (Tarmoola Operations)	Pipeline (proposed)	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 9	Site 8	Allan's Pool and Mid Gum	TSF3	Leinster Nickel Operations	Gum Pool	Unknown	Unknown	Unknown	Goongarrie				
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron															X										1											
Accipitridae	<i>Hieraetus morphnoides</i>	Little Eagle																										1										
	<i>Aquila audax</i>	Wedge-tailed Eagle															X											1										
	<i>Accipiter fasciatus</i>	Brown Goshawk											1																									
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk						1																														
	<i>Haliastur sphenurus</i>	Whistling Kite															X											1										
Cuculidae	<i>Heteroscenes pallidus</i>	Pallid Cuckoo							1	1							X		1	2	2	1																
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra																																			1	
	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher											1																									
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater						1		2																											7	
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel															X											1										
	<i>Falco longipennis</i>	Australian Hobby						1									X																					
	<i>Falco berigora</i>	Brown Falcon						1									X	X																				
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah						1									X	X		2			2				1											
	<i>Nymphicus hollandicus</i>	Cockatiel						1	1	5							X		13	3		21	3															
Psittaculidae	<i>Neopsephotus bourkii</i>	Bourke's Parrot						1															5															
	<i>Neophema elegans</i>	Elegant Parrot			2																																	
	<i>Barnardius zonarius</i>	Australian Ringneck	4	8	2			1									X	X	8	5	8	5	5														1	
	<i>Psephotus varius</i>	Mulga Parrot			2			1									X																					
	<i>Melopsittacus undulatus</i>	Budgerigar						1	10	10	20								10		20	15																
Ptilonorhynchidae	<i>Chlamydera guttata</i>	Western Bowerbird						1												1							1											
	<i>Ptilonorhynchus maculata</i>	Spotted Bowerbird															X																					
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper			1			1										X																				
Maluridae	<i>Malurus assimilis</i>	Purple-backed Fairywren	6	3																																		
	<i>Malurus splendens</i>	Splendid Fairywren	17	15	7			1	8	4	3						X	X	15	10	20	14	21														1	
	<i>Malurus leucopterus</i>	White-winged Fairywren						1									X																					
Meliphagidae	<i>Certhionyx variegatus</i>	Pied Honeyeater								1																												
	<i>Purnella albifrons</i>	White-fronted Honeyeater						1	2	2	10																											
	<i>Manorina flavigula</i>	Yellow-throated Miner						1									X	X			1	7					1										1	
	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater						1	2	4	10						X	X	1	1	5	5	6															1
	<i>Anthochaera carunculata</i>	Red Wattlebird						1															2	5														1

Family	Species	Common Name	Surveys													G	H	I	J	K																
			A	B	C	D	E	F	F		G		G		H						I		J		K											
			Site 6	Site 5	Site 7	Opportunistic	Site 7	Site 6	Jump Up Dam	MC06	MC05	MC07	BIF	15	7	18	Mine (Tarmoola Operations)	Pipeline (proposed)	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 9	Site 8	Allan's Pool and Mid Gum	TSF3	Leinster Nickel Operations	Gum Pool	Unknown	Unknown	Unknown	Goongarrie		
	<i>Rhipidura albiscapa</i>	Grey Fantail	1	1						1								1																	1	
Monarchidae	<i>Gallina cyanoleuca</i>	Maggie-lark															X									1										
Corvidae	<i>Corvus orru</i>	Torresian Crow															X	X	3	2	4															
	<i>Corvus bennetti</i>	Little Crow						1											1		1	1													1	
Petroicidae	<i>Petroica goodenovii</i>	Red-capped Robin	1		2			1	2	3	2						X	X		4	4	5	3												1	
	<i>Melanodryas cucullata</i>	Hooded Robin	2																																1	
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow															X									1										
	<i>Petrochelidon nigricans</i>	Tree Martin															X									1										
	<i>Cheramoeca leucosterna</i>	White-backed Swallow															X									1										
Dicaeidae	<i>Dicaeum hirundinaceum</i>	Mistletoebird						1		2																									1	
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch						1		6	2						X	X																		
Motacillidae	<i>Motacilla alba</i>	White Wagtail																								1										
	<i>Anthus novaeseelandiae</i>	Australasian Pipit						1									X									1										
Mammal																																				
Tachyglossidae	<i>Tachyglossus aculeatus</i>	Short-beaked Echidna					1	1									X																			
Bovidae	<i>Bos taurus</i>	Cow						1									X																			
	<i>Capra hircus</i>	Goat						1									X																			
	<i>Ovis aries</i>	Sheep															X																			
Camelidae	<i>Camelus dromedarius</i>	Dromedary										X																								
Canidae	<i>Canis lupus</i>	Dingo															X																			
	<i>Vulpes vulpes</i>	Red Fox						1																												
Felidae	<i>Felis catus</i>	Cat						1																												
Molossidae	<i>Austronomus australis</i>	White-striped Freetail Bat	X	X	X				X				X					1	1	1	1	1														
	<i>Mormopterus sp. 4</i>	South-western Free-tail Bat						1																												
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	X	X				1	X				X					1	1	1	1	1				1	1	1								
	<i>Chalinolobus morio</i>	Chocolate Wattled Bat	X	X	X			1					X																							
	<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat						1										1	1	1	1						1	1								
	<i>Vespadelus baverstocki</i>	Inland Forest Bat		X	X				X																		1	1	1							
	<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat							X				X					1	1	1	1	1														
Dasyuridae	<i>Pseudantechinus woolleyae</i>	Woolley's False Antechinus												9					1	1	1	1	1			1										
	<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart					1																													

Family	Species	Common Name	Surveys													E		F					G			H	I	J	K								
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z									
			Site 6	Site 5	Site 7	Opportunistic	Site 7	Site 6	Jump Up Dam	MC06	MC05	MC07	BIF	15	7	18	Mine (Tarmoola Operations)	Pipeline (proposed)	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 9	Site 8	Allan's Pool and Mid Gum	TSF3	Leinster Nickel Operations	Gum Pool	Unknown	Unknown	Unknown	Goongarrie			
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart																1	2	3	4	3															
	<i>Sminthopsis longicaudata</i>	Long-tailed Dunnart																			2																
Macropodidae	<i>Osphranter robustus</i>	Euro						1									X																				
	<i>Osphranter rufus</i>	Red Kangaroo						1									X																				
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit						1									X																				
Muridae	<i>Leporillus apicalis</i>	Lesser Stick-nest Rat											X																								
	<i>Mus musculus</i>	House Mouse							10	4	5							4	2	2	23	10		1	2												
	<i>Notomys alexis</i>	Spinifex Hopping Mouse								1								5																			
	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse								1								3		1	2	1															

- A Keith Lindbeck and Associates (2011) *Snark Project Fauna Assessment*, Unpublished report for Macarthur Minerals Ltd, Perth.
- B Hart, Simpson and Associates (2000) *Anaconda Nickel Ltd, Cawse Expansion Project, Fauna Survey*. Unpublished report for Anaconda Nickel Ltd, Perth.
- C Ecologia Environment (2007) *Jump Up Dam Fauna Assessment*. Unpublished report for Heron Resources, Perth.
- D Ninox Wildlife Consulting (2012) *A Spring Vertebrate Fauna Survey, Ularring Hematite Project, Snark Area, WA*, Unpublished report for Macarthur Minerals, Perth.
- E Ninox Wildlife Consulting (2006) *A vertebrate fauna assessment of the Tarmoola area*. Unpublished report for St Barbara Limited, Lower King WA.
- F Keith Lindbeck and Associates (2012) *Central Yilgarn Iron Project (CYIP) Fauna Assessment Mt Mason*, Unpublished report for Jupiter Mines Ltd, Perth.
- G Donato Environmental Services (2005b) *Ornithological Survey of the Leinster Nickel Operation Mining Lease: An assessment of Goat Grazing Impact*, Unpublished report for Leinster Nickel Operations, Perth.
- H Macarthur Minerals Ltd (2012) *Ularring Hematite Project Targeted Survey of Malleefowl*, Unpublished report for Macarthur Minerals, Perth.
- I Terrestrial Ecosystems (2011b) *Malleefowl (Leipoa ocellata) survey for the Snark Project*, Unpublished report for Macarthur Minerals, Perth.
- J Keith Lindbeck and Associates (2013) *Mt Mason Project and Proposed Haul Rd Targeted EPBC Fauna Survey*, unpublished report for Jupiter Mines Ltd, Perth.
- K Bell, D.T., Bell, R.C. and Loneragan, W.A. (2007) Winter bird assemblages across an arid gradient in south-west Western Australia. *Journal of the Royal Society of Western Australia* 90, 219-227.

Family	Species	Common name	Survey													Opportunistic	
			9	8	15	7	10	4	2	1	12	11	14	3	13		5
Amphibians																	
Limnodynastidae	<i>Neobatrachus sutor</i>	Shoemaker Frog	16	11	5	1	14	6									1
Myobatrachidae	<i>Pseudophryne occidentalis</i>	Western Toadlet	4														1
Pelodyadidae	<i>Cyclorana occidentalis</i>	Western Water-holding Frog															1
	<i>Litoria rubella</i>	Desert Tree Frog	1				1										1
Birds																	
Aegothelidae	<i>Aegotheles cristatus</i>	Australian Owlet-nightjar															1
	<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk															1
	<i>Accipiter fasciatus</i>	Brown Goshawk															1
Accipitridae	<i>Aquila audax</i>	Wedge-tailed Eagle															1
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon															1
	<i>Phaps chalcoptera</i>	Common Bronzewing															1
Alcedinidae	<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher															1
Meropidae	<i>Merops ornatus</i>	Rainbow Bee-eater															1
Cuculidae	<i>Chrysococcyx basalis</i>	Horsfield's Bronze-Cuckoo															1
Falconidae	<i>Falco berigora</i>	Brown Falcon															1
	<i>Falco cenchroides</i>	Nankeen Kestrel															1
Acanthizidae	<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill															1
	<i>Acanthiza robustirostris</i>	Slaty-backed Thornbill															1
	<i>Acanthiza uropygialis</i>	Chestnut-rumped Thornbill															1
	<i>Aphelocephala leucopsis</i>	Southern Whiteface															1
	<i>Gerygone fusca</i>	Western Gerygone															1
	<i>Pyrrholaemus brunneus</i>	Redthroat															1
	<i>Smicrornis brevirostris</i>	Weebill															1
	Artamidae	<i>Artamus cinereus</i>	Black-faced Woodswallow														
<i>Cracticus nigrogularis</i>		Pied Butcherbird															1
<i>Gymnorhina tibicen</i>		Australian Magpie															1
<i>Strepera versicolor</i>		Grey Currawong															1
Campephagidae	<i>Coracina maxima</i>	Ground Cuckooshrike															1
	<i>Coracina novaehollandiae</i>	Black-faced Cuckooshrike															1
Climacteridae	<i>Climacteris affinis</i>	White-browed Treecreeper															1

Family	Species	Common name	Survey													Opportunistic	
			9	8	15	7	10	4	2	1	12	11	14	3	13		5
Corvidae	<i>Corvus bennetti</i>	Little Crow															1
	<i>Corvus orru</i>	Torresian Crow															1
Estrildidae	<i>Taeniopygia guttata</i>	Zebra Finch															1
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow															1
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairywren															1
	<i>Malurus splendens</i>	Splendid Fairywren															1
Meliphagidae	<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater															1
	<i>Epthianura tricolor</i>	Crimson Chat															1
	<i>Lichenostomus virescens</i>	Singing Honeyeater															1
	<i>Manorina flavigula</i>	Yellow-throated Miner															1
	<i>Purnella albifrons</i>	White-fronted Honeyeater															1
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark															1
Motacillidae	<i>Anthus novaeseelandiae</i>	Australasian Pipit															1
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella															1
Oreoicidae	<i>Oreoica gutturalis</i>	Crested Bellbird															1
Pachycephalidae	<i>Colluricincla harmonica</i>	Grey Shrikethrush															1
	<i>Pachycephala rufiventris</i>	Rufous Whistler															1
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote															1
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin															1
	<i>Petroica goodenovii</i>	Red-capped Robin															1
Pomatostomidae	<i>Pomatostomus superciliosus</i>	White-browed Babbler															1
Ptilinorhynchidae	<i>Ptilinorhynchus guttatus</i>	Western Bowerbird															1
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail															1
	<i>Rhipidura leucophrys</i>	Willie Wagtail															1
Cacatuidae	<i>Eolophus roseicapilla</i>	Galah															1
Psittaculidae	<i>Barnardius zonarius</i>	Australian Ringneck															1
	<i>Neopsephotus bourkii</i>	Bourke's Parrot															1
Mammals																	
Canidae	<i>Canis lupus</i>	Dingo			1												1
Dasyuridae	<i>Ningau ridei</i>	Wongai Ningai													1		1
	<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart			1				1	2		3	2	1	2	2	1
	<i>Sminthopsis macroura</i>	Stripe-faced Dunnart			3				1								1
Macropodidae	<i>Osphranter robustus</i>	Euro															1

Family	Species	Common name	Survey													Opportunistic			
			9	8	15	7	10	4	2	1	12	11	14	3	13		5	6	
	<i>Osphranter rufus</i>	Red Kangaroo																1	
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit																1	
Muridae	<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse															1	9	1
Reptiles																			
Agamidae	<i>Ctenophorus reticulatus</i>	Western Netted Dragon			1					6	1	1	2	1	1			1	
	<i>Ctenophorus scutulatus</i>	Lozenge-marked Dragon											3				1	1	
	<i>Diporiphora amphiboluroides</i>	Mulga Dragon								2		1						1	
	<i>Pogona minor</i>	Western Bearded Dragon	1					1	1									1	
Carphodactylidae	<i>Nephrurus vertebralis</i>	Midline Knob-tail											5					1	
	<i>Underwoodisaurus milii</i>	Barking Gecko	11	9		7	20	5										1	
Diplodactylidae	<i>Diplodactylus granariensis</i>	Wheatbelt Stone Gecko	2	2	6	4	9	10	14	18	7	5	2	12	10	12	12	1	
	<i>Diplodactylus pulcher</i>	Beautiful Gecko			33				8	17	10	11	4	3	16	11	12	1	
	<i>Rhynchoedura ornata</i>	Beaked Gecko			1				2		1		7				8	1	1
	<i>Strophurus wellingtonae</i>	Western Shield Spiny-tailed Gecko							3	2	2	1	4	2		3	1	1	
Elapidae	<i>Brachyuropsis semifasciata</i>	Half-girdled Snake	1			1	4			1								1	
	<i>Pseudechis butleri</i>	Spotted Mulga Snake								1				1				1	
	<i>Pseudonaja modesta</i>	Ringed Brown Snake							1									1	
	<i>Simoselaps bertholdi</i>	Jan's Banded Snake	1	1		2		1						1				1	
	<i>Suta fasciata</i>	Rosen's Snake																1	
	<i>Suta monachus</i>	Hooded Snake	1									2		1		1		1	
	<i>Suta punctata</i>	Spotted-headed Snake	1															1	
Gekkonidae	<i>Gehyra variegata</i>	Variiegated Gehyra	10	5	5	4	9	16	5	5	3	6	3	1	15	11	5	1	
	<i>Heteronotia binoei</i>	Bynoe's Gecko	20	31		27	26	32			4	8	4	3	12	2	1	1	
Pygopodidae	<i>Lialis burtonis</i>	Burton's Legless Lizard					1	1										1	
	<i>Pygopus nigriceps</i>	Western Hooded Scaly-foot											1		1		2	1	
Pythonidae	<i>Antaresia stimsoni</i>	Stimson's Python				1												1	
Scincidae	<i>Cryptoblepharus buchananii</i>	Buchanan's Snake-eyed Skink	5	2		3	5											1	
	<i>Ctenotus schomburgkii</i>	Barred Wedgesnout Ctenotus							11	1		6	9					1	
	<i>Ctenotus severus</i>	Stern Ctenotus	4	16		16	11	11										1	
	<i>Ctenotus uber</i>	Spotted Ctenotus	2	13	9	5	1	9	35	14	1	12	19	13	9	4	2	1	
	<i>Egernia depressa</i>	Southern Pygmy Spiny-tailed Skink							5	6	6	3		1	4	2	5	1	

Family	Species	Common name	Survey														Opportunistic		
			9	8	15	7	10	4	2	1	12	11	14	3	13	5		6	
	<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer	2		1	2	13	2				3			1	2	1		
	<i>Lerista desertorum</i>	Central Desert Robust Slider	20	23	1	15	40	24	1	4				3			5	1	
	<i>Lerista muelleri</i>	Wood Mulch-slider	3	1		5	4	2	2	3	1	1	3			1		1	
	<i>Menetia greyii</i>	Common Dwarf Skink			2		4				2	3	3		1	2		1	
	<i>Morethia butleri</i>	Woodland Morethia Skink	20	12		14	15	20	5	3	3	1	2	3	2	1	3	1	
Typhlopidae	<i>Anilius hamatus</i>	Pale-headed Blind Snake										1						1	
Varanidae	<i>Varanus caudolineatus</i>	Stripe-tailed Monitor			3		2		3	2	2		1				5	1	
	<i>Varanus panotes</i>	Yellow-spotted Monitor					1					1	1	1		1	2	1	1

A Terrestrial Ecosystems (2020) Level 2 Vertebrate Fauna Assessment for the King of the Hills Project, Unpublished report for Red 5, Perth.

Appendix C.

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

**Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment
St Barbara Leonora Province Expansion**



ATTACHMENT C

DEFINITIONS OF SIGNIFICANT FAUNA UNDER THE WA BIODIVERSITY CONSERVATION ACT 2016

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

T Threatened Species

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

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

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

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

CR Critically endangered species

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

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

¹ The definition of flora includes algae, fungi and lichens

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

EN Endangered species

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

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

VU Vulnerable species

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

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

Extinct Species

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

EX Extinct species

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

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

EW Extinct in the wild species

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

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

Specially Protected Species

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

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

MI Migratory birds protected under an international agreement

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

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

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

CD Species of special conservation interest (conservation dependant fauna)

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

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

OS Other specially protected species

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

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

P Priority species

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

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

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

P1 Priority 1: Poorly-known species

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

P2 Priority 2: Poorly-known species

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

P3 Priority 3: Poorly-known species

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

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

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

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

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

Appendix D.

Rapid habitat assessments

Basic Vertebrate Fauna Reconnaissance Survey and Risk Assessment
St Barbara Leonora Province Expansion



Date: 12-Sep-22

Habitat Assessment #: 0

Observer: Joel Wilson

Zone: 51

Easting: 335551 mE

Northing: 6805836 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 1

Observer: Joel Wilson

Zone: 51

Easting: 335783 mE

Northing: 6806018 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 12-Sep-22

Habitat Assessment #: 2

Observer: Joel Wilson

Zone: 51

Easting: 335536 mE

Northing: 6806084 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 3

Observer: Joel Wilson

Zone: 51

Easting: 335428 mE

Northing: 6806349 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 4

Observer: Joel Wilson

Zone: 51

Easting: 335393 mE

Northing: 6806007 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 12-Sep-22

Habitat Assessment #: 5

Observer: Joel Wilson

Zone: 51

Easting: 335187 mE

Northing: 6806054 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Few stones



Date: 12-Sep-22

Habitat Assessment #: 6

Observer: Joel Wilson

Zone: 51

Easting: 333987 mE

Northing: 6805603 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 12-Sep-22

Habitat Assessment #: 7

Observer: Joel Wilson

Zone: 51

Easting: 334087 mE

Northing: 6805211 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 8

Observer: Joel Wilson

Zone: 51

Easting: 334200 mE

Northing: 6805482 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 9

Observer: Joel Wilson

Zone: 51

Easting: 334254 mE

Northing: 6805874 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 10

Observer: Joel Wilson

Zone: 51

Easting: 334407 mE

Northing: 6805669 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 11

Observer: Joel Wilson

Zone: 51

Easting: 334382 mE

Northing: 6805179 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 12

Observer: Joel Wilson

Zone: 51

Easting: 334390 mE

Northing: 6804834 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 12-Sep-22

Habitat Assessment #: 13

Observer: Joel Wilson

Zone: 51

Easting: 334610 mE

Northing: 6805084 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 14

Observer: Joel Wilson

Zone: 51

Easting: 334613 mE

Northing: 6805471 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 15

Observer: Joel Wilson

Zone: 51

Easting: 334796 mE

Northing: 6804960 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 16

Observer: Joel Wilson

Zone: 51

Easting: 334594 mE

Northing: 6804663 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 12-Sep-22

Habitat Assessment #: 17

Observer: Joel Wilson

Zone: 51

Easting: 334356 mE

Northing: 6804494 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 18

Observer: Joel Wilson

Zone: 51

Easting: 334983 mE

Northing: 6805142 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 12-Sep-22

Habitat Assessment #: 19

Observer: Joel Wilson

Zone: 51

Easting: 335720 mE

Northing: 6805720 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 20

Observer: Joel Wilson

Zone: 51

Easting: 335975 mE

Northing: 6805545 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 21

Observer: Joel Wilson

Zone: 51

Easting: 336298 mE

Northing: 6805644 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 22

Observer: Joel Wilson

Zone: 51

Easting: 336502 mE

Northing: 6805388 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 23

Observer: Joel Wilson

Zone: 51

Easting: 336664 mE

Northing: 6805191 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 24

Observer: Joel Wilson

Zone: 51

Easting: 336869 mE

Northing: 6804765 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 25

Observer: Joel Wilson

Zone: 51

Easting: 336944 mE

Northing: 6804548 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 26

Observer: Joel Wilson

Zone: 51

Easting: 336950 mE

Northing: 6804333 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 27

Observer: Joel Wilson

Zone: 51

Easting: 336586 mE

Northing: 6804126 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 28

Observer: Joel Wilson

Zone: 51

Easting: 338859 mE

Northing: 6799644 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 29

Observer: Joel Wilson

Zone: 51

Easting: 338965 mE

Northing: 6799811 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 30

Observer: Joel Wilson

Zone: 51

Easting: 339054 mE

Northing: 6800158 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 31

Observer: Joel Wilson

Zone: 51

Easting: 339209 mE

Northing: 6800147 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 32

Observer: Joel Wilson

Zone: 51

Easting: 339200 mE

Northing: 6799862 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 33

Observer: Joel Wilson

Zone: 51

Easting: 339178 mE

Northing: 6799588 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 34

Observer: Joel Wilson

Zone: 51

Easting: 339394 mE

Northing: 6799693 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 35

Observer: Joel Wilson

Zone: 51

Easting: 339403 mE

Northing: 6799964 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 36

Observer: Joel Wilson

Zone: 51

Easting: 339412 mE

Northing: 6800413 mN

Fire History: > 5 years

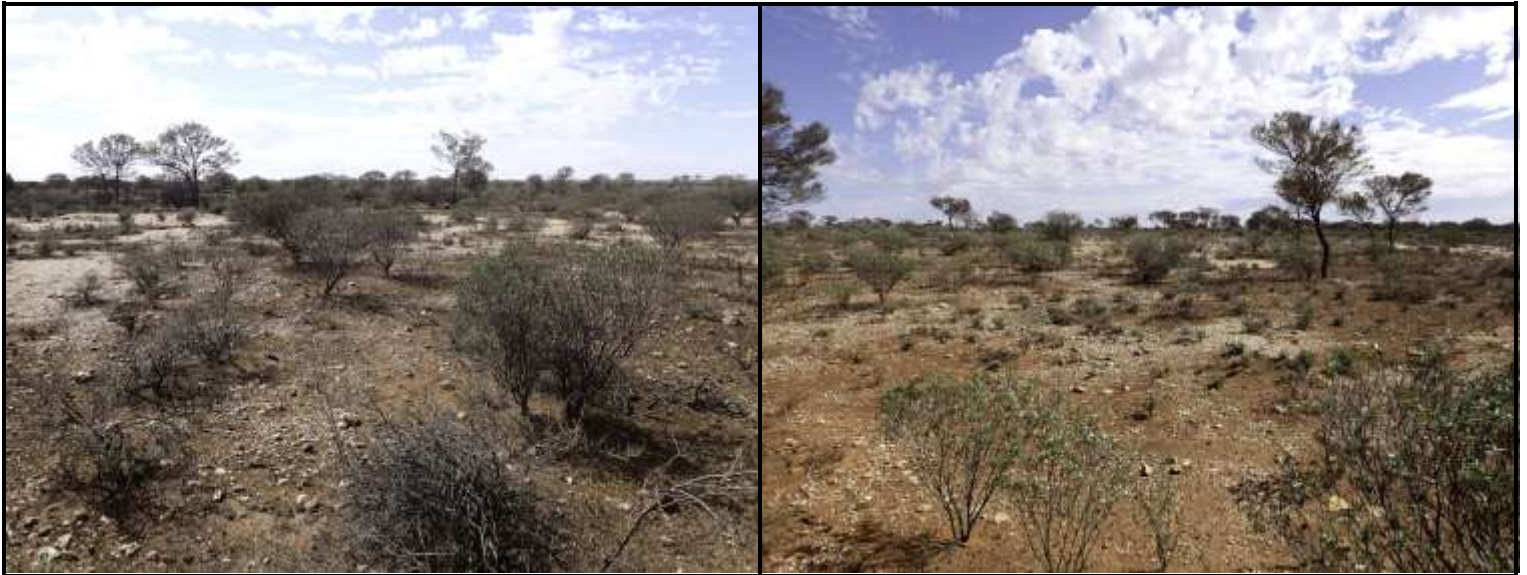
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 37

Observer: Joel Wilson

Zone: 51

Easting: 339400 mE

Northing: 6800808 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 38

Observer: Joel Wilson

Zone: 51

Easting: 339423 mE

Northing: 6801202 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 39

Observer: Joel Wilson

Zone: 51

Easting: 339540 mE

Northing: 6801818 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 40

Observer: Joel Wilson

Zone: 51

Easting: 339597 mE

Northing: 6801418 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 41

Observer: Joel Wilson

Zone: 51

Easting: 339593 mE

Northing: 6800989 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 42

Observer: Joel Wilson

Zone: 51

Easting: 339589 mE

Northing: 6800635 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stony



Date: 13-Sep-22

Habitat Assessment #: 43

Observer: Joel Wilson

Zone: 51

Easting: 339592 mE

Northing: 6800275 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 44

Observer: Joel Wilson

Zone: 51

Easting: 339584 mE

Northing: 6799952 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 45

Observer: Joel Wilson

Zone: 51

Easting: 339574 mE

Northing: 6799691 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 46

Observer: Joel Wilson

Zone: 51

Easting: 339800 mE

Northing: 6799886 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 47

Observer: Joel Wilson

Zone: 51

Easting: 339797 mE

Northing: 6800144 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 48

Observer: Joel Wilson

Zone: 51

Easting: 339800 mE

Northing: 6800527 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 49

Observer: Joel Wilson

Zone: 51

Easting: 339796 mE

Northing: 6800845 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 50

Observer: Joel Wilson

Zone: 51

Easting: 339789 mE

Northing: 6801320 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 51

Observer: Joel Wilson

Zone: 51

Easting: 339815 mE

Northing: 6801855 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 52

Observer: Joel Wilson

Zone: 51

Easting: 340010 mE

Northing: 6802167 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 53

Observer: Joel Wilson

Zone: 51

Easting: 339999 mE

Northing: 6801672 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 54

Observer: Joel Wilson

Zone: 51

Easting: 339995 mE

Northing: 6801180 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 55

Observer: Joel Wilson

Zone: 51

Easting: 340001 mE

Northing: 6800646 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 56

Observer: Joel Wilson

Zone: 51

Easting: 340004 mE

Northing: 6800297 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 57

Observer: Joel Wilson

Zone: 51

Easting: 339986 mE

Northing: 6799783 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 58

Observer: Joel Wilson

Zone: 51

Easting: 340202 mE

Northing: 6799720 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 59

Observer: Joel Wilson

Zone: 51

Easting: 340217 mE

Northing: 6800226 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 60

Observer: Joel Wilson

Zone: 51

Easting: 340212 mE

Northing: 6800667 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 61

Observer: Joel Wilson

Zone: 51

Easting: 340226 mE

Northing: 6801168 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 62

Observer: Joel Wilson

Zone: 51

Easting: 340178 mE

Northing: 6801972 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 63

Observer: Joel Wilson

Zone: 51

Easting: 341543 mE

Northing: 6799042 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 64

Observer: Joel Wilson

Zone: 51

Easting: 341570 mE

Northing: 6798823 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 65

Observer: Joel Wilson

Zone: 51

Easting: 341576 mE

Northing: 6798548 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 66

Observer: Joel Wilson

Zone: 51

Easting: 341580 mE

Northing: 6798147 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 67

Observer: Joel Wilson

Zone: 51

Easting: 341578 mE

Northing: 6797616 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 68

Observer: Joel Wilson

Zone: 51

Easting: 341588 mE

Northing: 6797120 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 69

Observer: Joel Wilson

Zone: 51

Easting: 341590 mE

Northing: 6796658 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 70

Observer: Joel Wilson

Zone: 51

Easting: 341588 mE

Northing: 6796164 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 71

Observer: Joel Wilson

Zone: 51

Easting: 341599 mE

Northing: 6795707 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 72

Observer: Joel Wilson

Zone: 51

Easting: 341604 mE

Northing: 6795306 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 73

Observer: Joel Wilson

Zone: 51

Easting: 341407 mE

Northing: 6795616 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 74

Observer: Joel Wilson

Zone: 51

Easting: 341357 mE

Northing: 6796149 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 75

Observer: Joel Wilson

Zone: 51

Easting: 341386 mE

Northing: 6796515 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 76

Observer: Joel Wilson

Zone: 51

Easting: 341377 mE

Northing: 6797074 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 77

Observer: Joel Wilson

Zone: 51

Easting: 341390 mE

Northing: 6797459 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 78

Observer: Joel Wilson

Zone: 51

Easting: 341416 mE

Northing: 6798204 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 79

Observer: Joel Wilson

Zone: 51

Easting: 341389 mE

Northing: 6798730 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 80

Observer: Joel Wilson

Zone: 51

Easting: 341387 mE

Northing: 6799162 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 81

Observer: Joel Wilson

Zone: 51

Easting: 341205 mE

Northing: 6799357 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 82

Observer: Joel Wilson

Zone: 51

Easting: 341196 mE

Northing: 6798742 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 83

Observer: Joel Wilson

Zone: 51

Easting: 341210 mE

Northing: 6798185 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 84

Observer: Joel Wilson

Zone: 51

Easting: 341234 mE

Northing: 6797437 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 85

Observer: Joel Wilson

Zone: 51

Easting: 341204 mE

Northing: 6796956 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 13-Sep-22

Habitat Assessment #: 86

Observer: Joel Wilson

Zone: 51

Easting: 341184 mE

Northing: 6796536 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 13-Sep-22

Habitat Assessment #: 87

Observer: Joel Wilson

Zone: 51

Easting: 341166 mE

Northing: 6796208 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 88

Observer: Joel Wilson

Zone: 51

Easting: 340998 mE

Northing: 6799177 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 89

Observer: Joel Wilson

Zone: 51

Easting: 341009 mE

Northing: 6798845 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 90

Observer: Joel Wilson

Zone: 51

Easting: 340987 mE

Northing: 6798536 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 91

Observer: Joel Wilson

Zone: 51

Easting: 340992 mE

Northing: 6798049 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 92

Observer: Joel Wilson

Zone: 51

Easting: 340995 mE

Northing: 6797408 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 93

Observer: Joel Wilson

Zone: 51

Easting: 340998 mE

Northing: 6796951 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 94

Observer: Joel Wilson

Zone: 51

Easting: 341005 mE

Northing: 6796527 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 95

Observer: Joel Wilson

Zone: 51

Easting: 341011 mE

Northing: 6796292 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 96

Observer: Joel Wilson

Zone: 51

Easting: 340803 mE

Northing: 6795985 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 97

Observer: Joel Wilson

Zone: 51

Easting: 340816 mE

Northing: 6796626 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 98

Observer: Joel Wilson

Zone: 51

Easting: 340778 mE

Northing: 6797153 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 99

Observer: Joel Wilson

Zone: 51

Easting: 340779 mE

Northing: 6798028 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 100

Observer: Joel Wilson

Zone: 51

Easting: 340788 mE

Northing: 6798483 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 101

Observer: Joel Wilson

Zone: 51

Easting: 340805 mE

Northing: 6798894 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 102

Observer: Joel Wilson

Zone: 51

Easting: 340776 mE

Northing: 6799219 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 103

Observer: Joel Wilson

Zone: 51

Easting: 340592 mE

Northing: 6799105 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 104

Observer: Joel Wilson

Zone: 51

Easting: 340583 mE

Northing: 6798888 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 105

Observer: Joel Wilson

Zone: 51

Easting: 340604 mE

Northing: 6798499 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 106

Observer: Joel Wilson

Zone: 51

Easting: 340590 mE

Northing: 6798066 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 107

Observer: Joel Wilson

Zone: 51

Easting: 340593 mE

Northing: 6797658 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 108

Observer: Joel Wilson

Zone: 51

Easting: 340599 mE

Northing: 6797325 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 109

Observer: Joel Wilson

Zone: 51

Easting: 340588 mE

Northing: 6796978 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 110

Observer: Joel Wilson

Zone: 51

Easting: 340585 mE

Northing: 6796537 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 111

Observer: Joel Wilson

Zone: 51

Easting: 340597 mE

Northing: 6796200 mN

Fire History: > 5 years

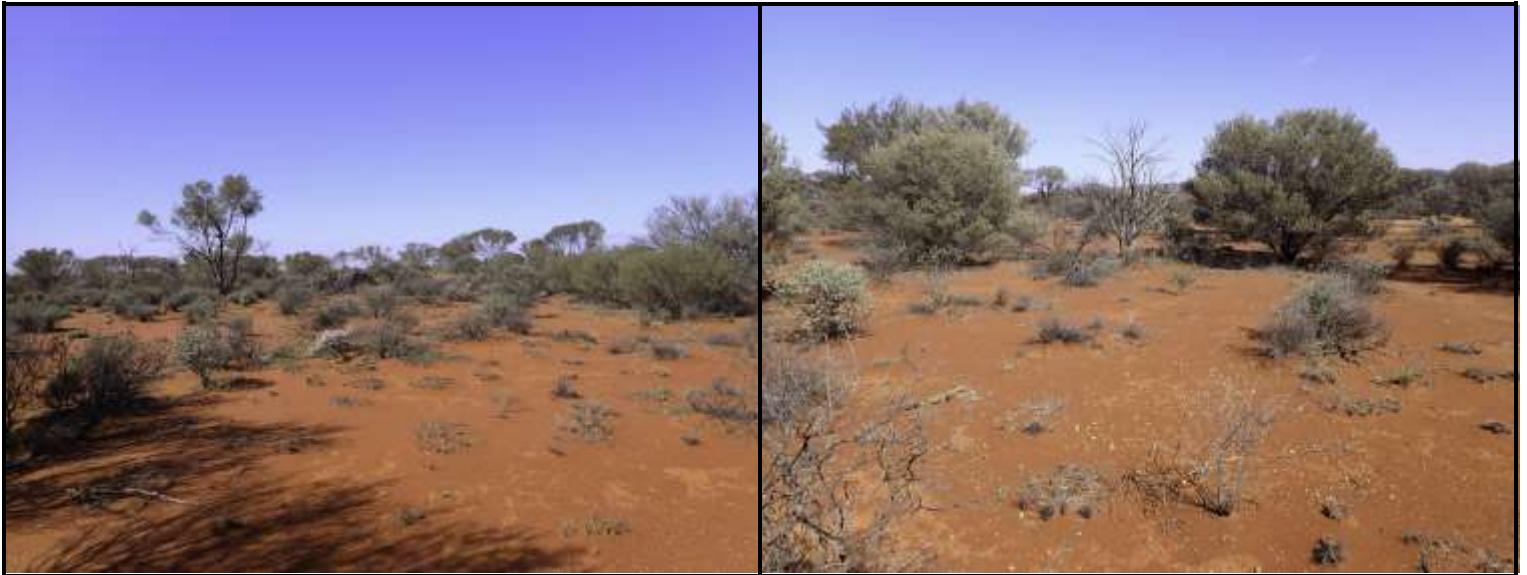
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 112

Observer: Joel Wilson

Zone: 51

Easting: 340572 mE

Northing: 6795994 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 113

Observer: Joel Wilson

Zone: 51

Easting: 340396 mE

Northing: 6796010 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 114

Observer: Joel Wilson

Zone: 51

Easting: 340400 mE

Northing: 6796298 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 115

Observer: Joel Wilson

Zone: 51

Easting: 340359 mE

Northing: 6796636 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 116

Observer: Joel Wilson

Zone: 51

Easting: 340407 mE

Northing: 6797446 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 117

Observer: Joel Wilson

Zone: 51

Easting: 340400 mE

Northing: 6797904 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 118

Observer: Joel Wilson

Zone: 51

Easting: 340395 mE

Northing: 6798416 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 119

Observer: Joel Wilson

Zone: 51

Easting: 340375 mE

Northing: 6799089 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 120

Observer: Joel Wilson

Zone: 51

Easting: 340388 mE

Northing: 6799288 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 121

Observer: Joel Wilson

Zone: 51

Easting: 340207 mE

Northing: 6799405 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 122

Observer: Joel Wilson

Zone: 51

Easting: 340197 mE

Northing: 6798946 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 123

Observer: Joel Wilson

Zone: 51

Easting: 340208 mE

Northing: 6798594 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 124

Observer: Joel Wilson

Zone: 51

Easting: 340206 mE

Northing: 6797793 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 125

Observer: Joel Wilson

Zone: 51

Easting: 340191 mE

Northing: 6797497 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 126

Observer: Joel Wilson

Zone: 51

Easting: 340213 mE

Northing: 6797207 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 127

Observer: Joel Wilson

Zone: 51

Easting: 340195 mE

Northing: 6796735 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 128

Observer: Joel Wilson

Zone: 51

Easting: 340208 mE

Northing: 6796462 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 129

Observer: Joel Wilson

Zone: 51

Easting: 340208 mE

Northing: 6796161 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 130

Observer: Joel Wilson

Zone: 51

Easting: 339979 mE

Northing: 6796217 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 131

Observer: Joel Wilson

Zone: 51

Easting: 340006 mE

Northing: 6796566 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 132

Observer: Joel Wilson

Zone: 51

Easting: 340016 mE

Northing: 6796916 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 133

Observer: Joel Wilson

Zone: 51

Easting: 339986 mE

Northing: 6797525 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 134

Observer: Joel Wilson

Zone: 51

Easting: 340009 mE

Northing: 6797844 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 135

Observer: Joel Wilson

Zone: 51

Easting: 340013 mE

Northing: 6798423 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 136

Observer: Joel Wilson

Zone: 51

Easting: 340009 mE

Northing: 6798908 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 137

Observer: Joel Wilson

Zone: 51

Easting: 339787 mE

Northing: 6799272 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 138

Observer: Joel Wilson

Zone: 51

Easting: 339786 mE

Northing: 6798822 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 139

Observer: Joel Wilson

Zone: 51

Easting: 339808 mE

Northing: 6798284 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 140

Observer: Joel Wilson

Zone: 51

Easting: 339812 mE

Northing: 6797856 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 141

Observer: Joel Wilson

Zone: 51

Easting: 339820 mE

Northing: 6797294 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 142

Observer: Joel Wilson

Zone: 51

Easting: 339814 mE

Northing: 6796790 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 143

Observer: Joel Wilson

Zone: 51

Easting: 339795 mE

Northing: 6796392 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 144

Observer: Joel Wilson

Zone: 51

Easting: 339793 mE

Northing: 6796177 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 145

Observer: Joel Wilson

Zone: 51

Easting: 339630 mE

Northing: 6796349 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 146

Observer: Joel Wilson

Zone: 51

Easting: 339593 mE

Northing: 6796697 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 147

Observer: Joel Wilson

Zone: 51

Easting: 339629 mE

Northing: 6797093 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 148

Observer: Joel Wilson

Zone: 51

Easting: 339609 mE

Northing: 6797702 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 149

Observer: Joel Wilson

Zone: 51

Easting: 339621 mE

Northing: 6798039 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 150

Observer: Joel Wilson

Zone: 51

Easting: 339610 mE

Northing: 6798546 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 151

Observer: Joel Wilson

Zone: 51

Easting: 339597 mE

Northing: 6799093 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 152

Observer: Joel Wilson

Zone: 51

Easting: 339418 mE

Northing: 6799434 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 153

Observer: Joel Wilson

Zone: 51

Easting: 339408 mE

Northing: 6798831 mN

Fire History: > 5 years

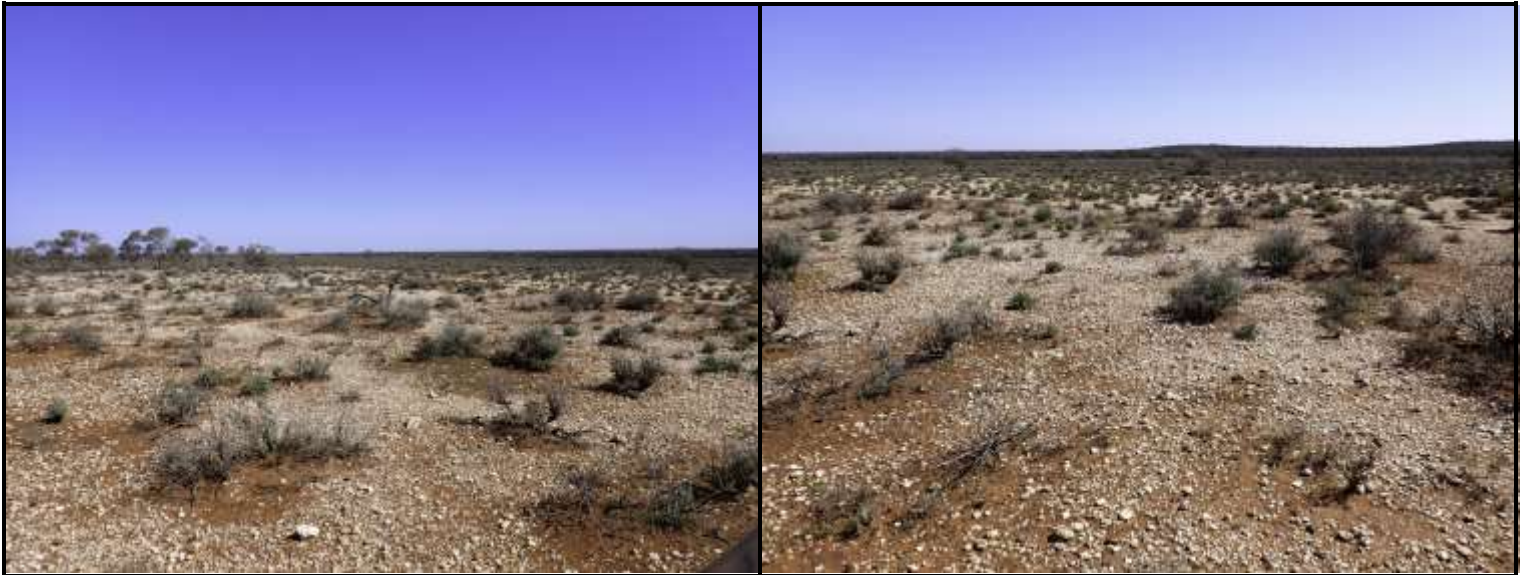
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 154

Observer: Joel Wilson

Zone: 51

Easting: 339401 mE

Northing: 6798405 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 155

Observer: Joel Wilson

Zone: 51

Easting: 339399 mE

Northing: 6797575 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 156

Observer: Joel Wilson

Zone: 51

Easting: 339431 mE

Northing: 6797087 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 157

Observer: Joel Wilson

Zone: 51

Easting: 339423 mE

Northing: 6796442 mN

Fire History: > 5 years

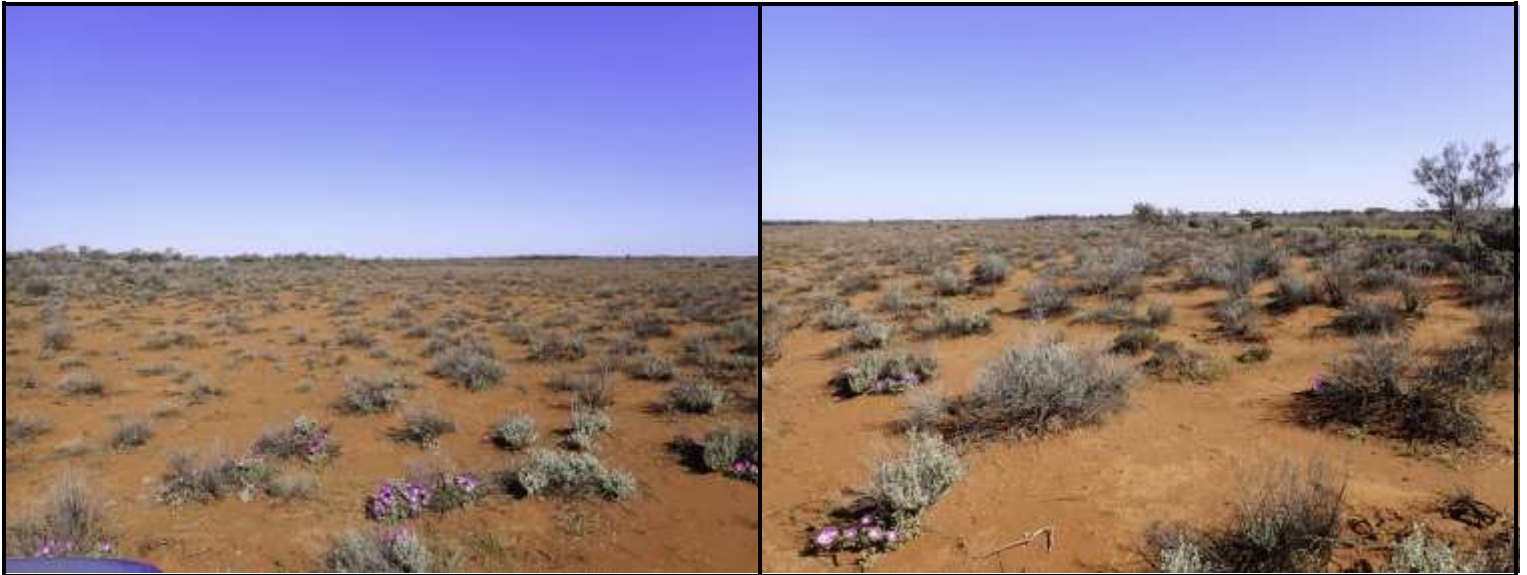
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 158

Observer: Joel Wilson

Zone: 51

Easting: 339448 mE

Northing: 6796220 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 159

Observer: Joel Wilson

Zone: 51

Easting: 339212 mE

Northing: 6796228 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 160

Observer: Joel Wilson

Zone: 51

Easting: 339209 mE

Northing: 6796358 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 161

Observer: Joel Wilson

Zone: 51

Easting: 339216 mE

Northing: 6796777 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 162

Observer: Joel Wilson

Zone: 51

Easting: 339228 mE

Northing: 6797258 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 163

Observer: Joel Wilson

Zone: 51

Easting: 339207 mE

Northing: 6797805 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 164

Observer: Joel Wilson

Zone: 51

Easting: 339210 mE

Northing: 6798232 mN

Fire History: > 5 years

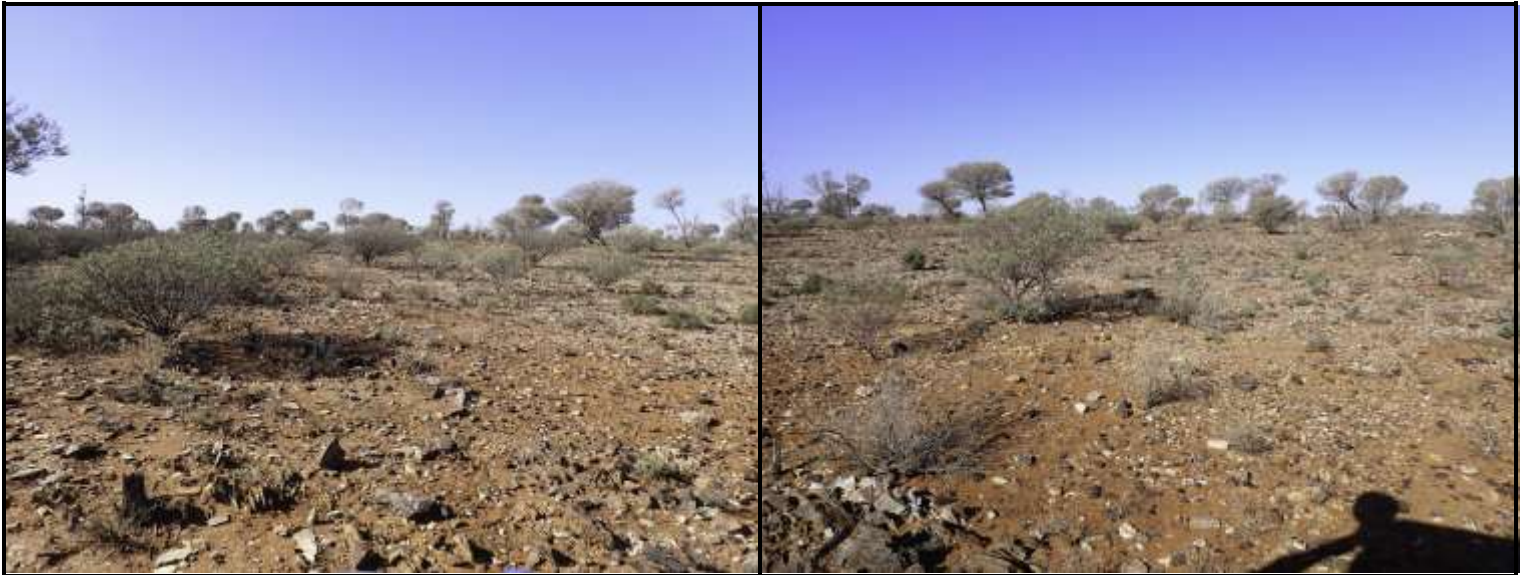
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 165

Observer: Joel Wilson

Zone: 51

Easting: 339230 mE

Northing: 6798707 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 166

Observer: Joel Wilson

Zone: 51

Easting: 339230 mE

Northing: 6799227 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 167

Observer: Joel Wilson

Zone: 51

Easting: 338997 mE

Northing: 6799046 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 168

Observer: Joel Wilson

Zone: 51

Easting: 338979 mE

Northing: 6798467 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 169

Observer: Joel Wilson

Zone: 51

Easting: 338985 mE

Northing: 6797960 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 170

Observer: Joel Wilson

Zone: 51

Easting: 338953 mE

Northing: 6797444 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 171

Observer: Joel Wilson

Zone: 51

Easting: 338986 mE

Northing: 6797041 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 172

Observer: Joel Wilson

Zone: 51

Easting: 339017 mE

Northing: 6796586 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 173

Observer: Joel Wilson

Zone: 51

Easting: 339014 mE

Northing: 6796265 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 174

Observer: Joel Wilson

Zone: 51

Easting: 338779 mE

Northing: 6797369 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 175

Observer: Joel Wilson

Zone: 51

Easting: 338793 mE

Northing: 6797872 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 176

Observer: Joel Wilson

Zone: 51

Easting: 338796 mE

Northing: 6798401 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 177

Observer: Joel Wilson

Zone: 51

Easting: 338802 mE

Northing: 6799368 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 178

Observer: Joel Wilson

Zone: 51

Easting: 338600 mE

Northing: 6799430 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 179

Observer: Joel Wilson

Zone: 51

Easting: 338611 mE

Northing: 6798969 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 180

Observer: Joel Wilson

Zone: 51

Easting: 338572 mE

Northing: 6798495 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 181

Observer: Joel Wilson

Zone: 51

Easting: 338571 mE

Northing: 6798102 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 182

Observer: Joel Wilson

Zone: 51

Easting: 338535 mE

Northing: 6797534 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 183

Observer: Joel Wilson

Zone: 51

Easting: 338403 mE

Northing: 6797151 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 14-Sep-22

Habitat Assessment #: 184

Observer: Joel Wilson

Zone: 51

Easting: 338398 mE

Northing: 6797450 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 185

Observer: Joel Wilson

Zone: 51

Easting: 338429 mE

Northing: 6798064 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 14-Sep-22

Habitat Assessment #: 186

Observer: Joel Wilson

Zone: 51

Easting: 338398 mE

Northing: 6798531 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 187

Observer: Joel Wilson

Zone: 51

Easting: 338189 mE

Northing: 6798549 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 188

Observer: Joel Wilson

Zone: 51

Easting: 338183 mE

Northing: 6798117 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 189

Observer: Joel Wilson

Zone: 51

Easting: 338160 mE

Northing: 6797698 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 190

Observer: Joel Wilson

Zone: 51

Easting: 338186 mE

Northing: 6797369 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 191

Observer: Joel Wilson

Zone: 51

Easting: 338216 mE

Northing: 6797122 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 192

Observer: Joel Wilson

Zone: 51

Easting: 338015 mE

Northing: 6797152 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 193

Observer: Joel Wilson

Zone: 51

Easting: 338057 mE

Northing: 6797515 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 194

Observer: Joel Wilson

Zone: 51

Easting: 337974 mE

Northing: 6797955 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 195

Observer: Joel Wilson

Zone: 51

Easting: 337958 mE

Northing: 6798520 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 196

Observer: Joel Wilson

Zone: 51

Easting: 337790 mE

Northing: 6798204 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 197

Observer: Joel Wilson

Zone: 51

Easting: 337822 mE

Northing: 6797803 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 198

Observer: Joel Wilson

Zone: 51

Easting: 337800 mE

Northing: 6797515 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 199

Observer: Joel Wilson

Zone: 51

Easting: 337812 mE

Northing: 6797144 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 200

Observer: Joel Wilson

Zone: 51

Easting: 337604 mE

Northing: 6797065 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 201

Observer: Joel Wilson

Zone: 51

Easting: 337597 mE

Northing: 6797533 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 202

Observer: Joel Wilson

Zone: 51

Easting: 337614 mE

Northing: 6797785 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 203

Observer: Joel Wilson

Zone: 51

Easting: 337578 mE

Northing: 6798108 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Sandy clay



Date: 15-Sep-22

Habitat Assessment #: 204

Observer: Joel Wilson

Zone: 51

Easting: 337398 mE

Northing: 6798301 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Sandy clay



Date: 15-Sep-22

Habitat Assessment #: 205

Observer: Joel Wilson

Zone: 51

Easting: 337425 mE

Northing: 6797864 mN

Fire History: > 5 years

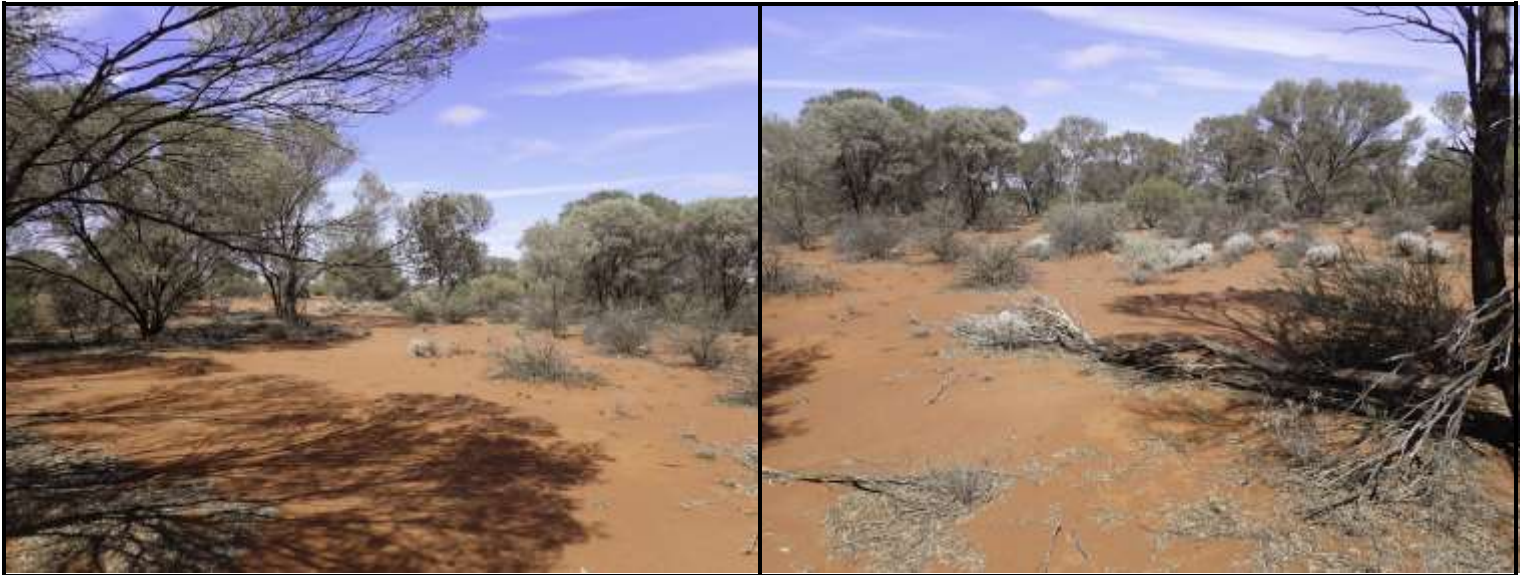
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 206

Observer: Joel Wilson

Zone: 51

Easting: 337380 mE

Northing: 6797569 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 207

Observer: Joel Wilson

Zone: 51

Easting: 337366 mE

Northing: 6797249 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 208

Observer: Joel Wilson

Zone: 51

Easting: 337207 mE

Northing: 6797317 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 209

Observer: Joel Wilson

Zone: 51

Easting: 337195 mE

Northing: 6797734 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 210

Observer: Joel Wilson

Zone: 51

Easting: 337168 mE

Northing: 6798012 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 211

Observer: Joel Wilson

Zone: 51

Easting: 336997 mE

Northing: 6797880 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Sandy clay



Date: 15-Sep-22

Habitat Assessment #: 212

Observer: Joel Wilson

Zone: 51

Easting: 337095 mE

Northing: 6797382 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 213

Observer: Joel Wilson

Zone: 51

Easting: 336798 mE

Northing: 6797869 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 214

Observer: Joel Wilson

Zone: 51

Easting: 336629 mE

Northing: 6798053 mN

Fire History: > 5 years

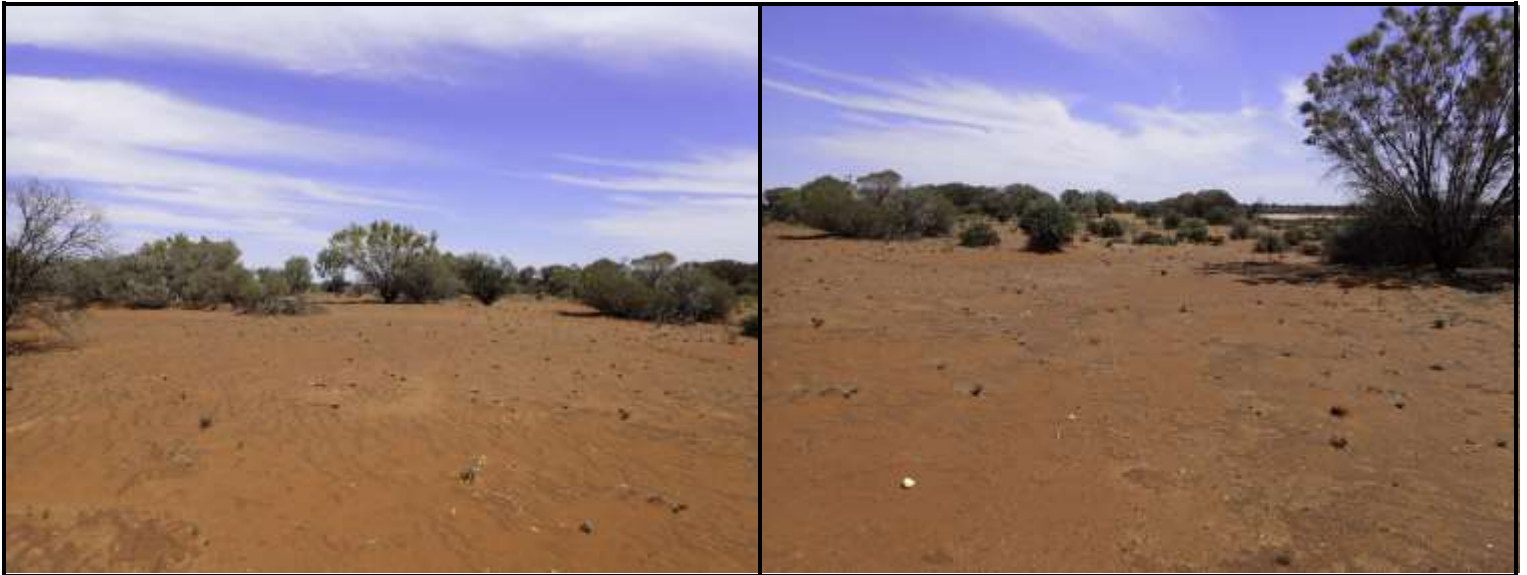
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 215

Observer: Joel Wilson

Zone: 51

Easting: 336582 mE

Northing: 6797779 mN

Fire History: > 5 years

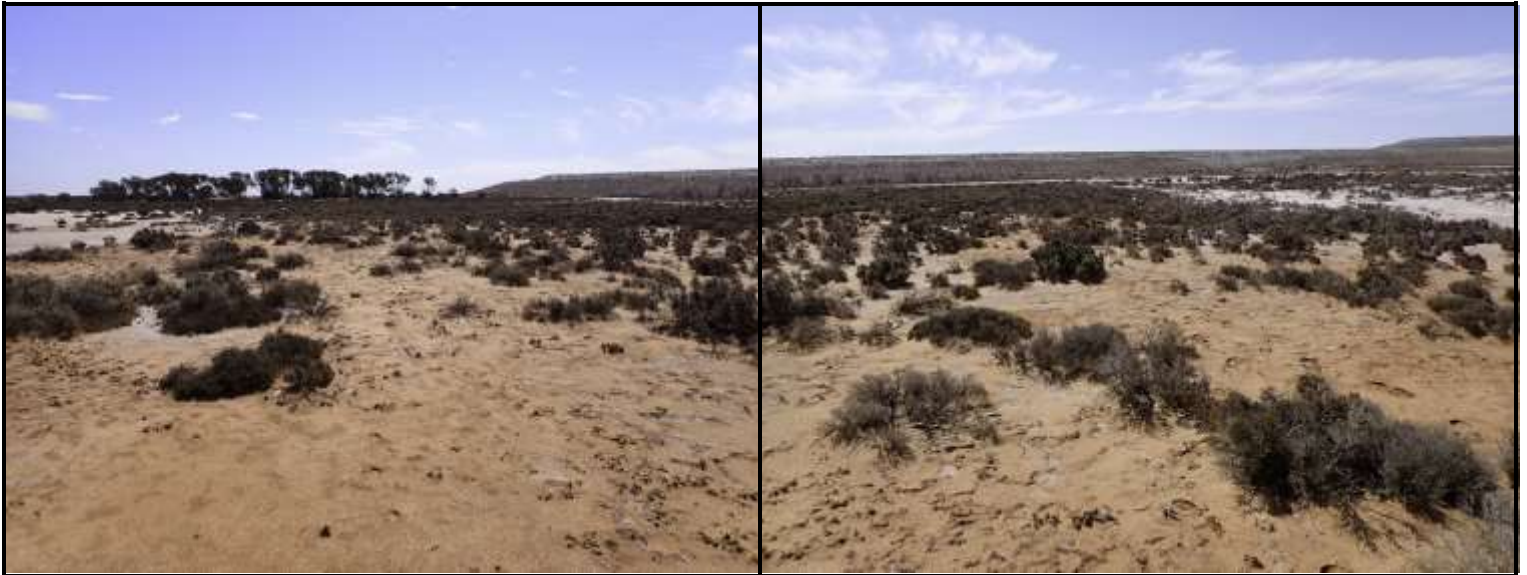
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 15-Sep-22

Habitat Assessment #: 216

Observer: Joel Wilson

Zone: 51

Easting: 336406 mE

Northing: 6797865 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 217

Observer: Joel Wilson

Zone: 51

Easting: 336219 mE

Northing: 6798051 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 218

Observer: Joel Wilson

Zone: 51

Easting: 336190 mE

Northing: 6797913 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 219

Observer: Joel Wilson

Zone: 51

Easting: 335191 mE

Northing: 6798717 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 220

Observer: Joel Wilson

Zone: 51

Easting: 335402 mE

Northing: 6798226 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 221

Observer: Joel Wilson

Zone: 51

Easting: 335397 mE

Northing: 6798440 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 222

Observer: Joel Wilson

Zone: 51

Easting: 335389 mE

Northing: 6798593 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 223

Observer: Joel Wilson

Zone: 51

Easting: 335550 mE

Northing: 6798496 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 224

Observer: Joel Wilson

Zone: 51

Easting: 335635 mE

Northing: 6798113 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 225

Observer: Joel Wilson

Zone: 51

Easting: 335824 mE

Northing: 6798210 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 226

Observer: Joel Wilson

Zone: 51

Easting: 336023 mE

Northing: 6798308 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 227

Observer: Joel Wilson

Zone: 51

Easting: 335133 mE

Northing: 6799023 mN

Fire History: > 5 years

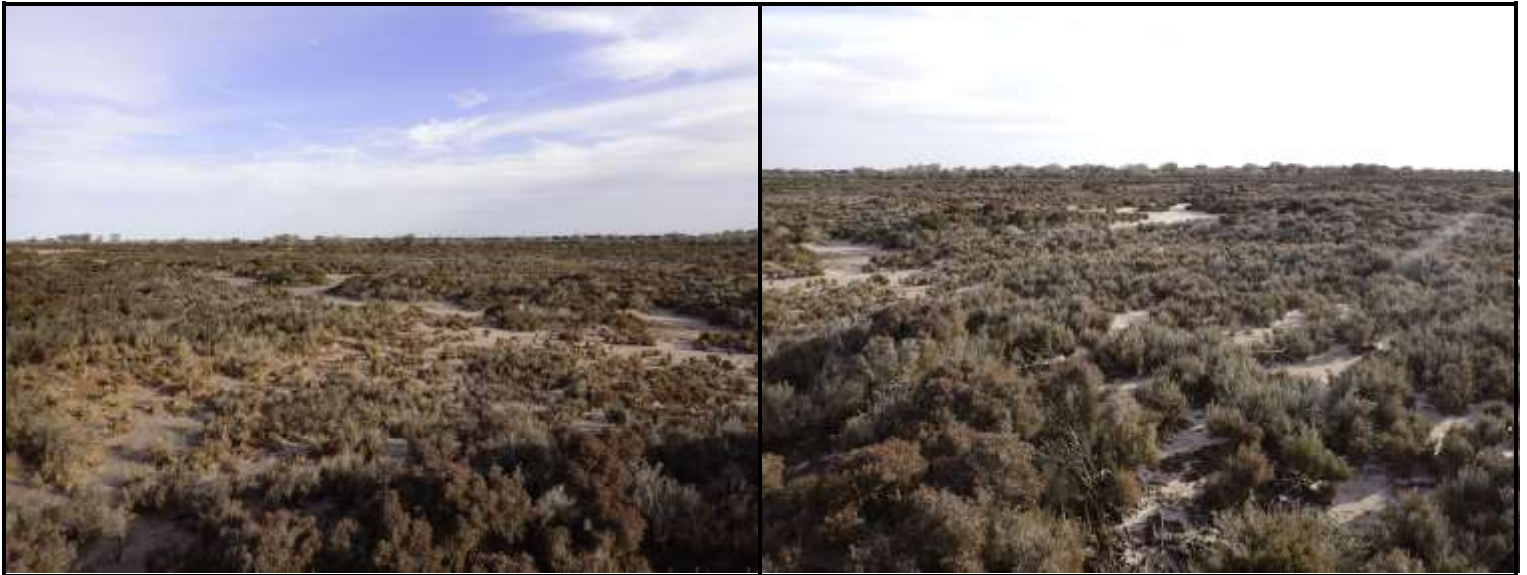
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 228

Observer: Joel Wilson

Zone: 51

Easting: 335226 mE

Northing: 6799144 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: d

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 229

Observer: Joel Wilson

Zone: 51

Easting: 335595 mE

Northing: 6799292 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 230

Observer: Joel Wilson

Zone: 51

Easting: 335582 mE

Northing: 6799068 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 231

Observer: Joel Wilson

Zone: 51

Easting: 335514 mE

Northing: 6798978 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 15-Sep-22

Habitat Assessment #: 232

Observer: Joel Wilson

Zone: 51

Easting: 335587 mE

Northing: 6798714 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 233

Observer: Joel Wilson

Zone: 51

Easting: 335869 mE

Northing: 6798533 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 15-Sep-22

Habitat Assessment #: 234

Observer: Joel Wilson

Zone: 51

Easting: 335797 mE

Northing: 6798732 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 235

Observer: Joel Wilson

Zone: 51

Easting: 337395 mE

Northing: 6801214 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 236

Observer: Joel Wilson

Zone: 51

Easting: 337392 mE

Northing: 6801658 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 237

Observer: Joel Wilson

Zone: 51

Easting: 337358 mE

Northing: 6801981 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 238

Observer: Joel Wilson

Zone: 51

Easting: 337367 mE

Northing: 6802408 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 239

Observer: Joel Wilson

Zone: 51

Easting: 337374 mE

Northing: 6802805 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 240

Observer: Joel Wilson

Zone: 51

Easting: 337214 mE

Northing: 6802855 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 241

Observer: Joel Wilson

Zone: 51

Easting: 337170 mE

Northing: 6802507 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 242

Observer: Joel Wilson

Zone: 51

Easting: 337199 mE

Northing: 6802034 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 243

Observer: Joel Wilson

Zone: 51

Easting: 337199 mE

Northing: 6801732 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 244

Observer: Joel Wilson

Zone: 51

Easting: 337208 mE

Northing: 6801411 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 245

Observer: Joel Wilson

Zone: 51

Easting: 337033 mE

Northing: 6801202 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: d

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 246

Observer: Joel Wilson

Zone: 51

Easting: 337013 mE

Northing: 6801600 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: d

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 247

Observer: Joel Wilson

Zone: 51

Easting: 337037 mE

Northing: 6801944 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 248

Observer: Joel Wilson

Zone: 51

Easting: 337009 mE

Northing: 6802329 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 249

Observer: Joel Wilson

Zone: 51

Easting: 337002 mE

Northing: 6802703 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 250

Observer: Joel Wilson

Zone: 51

Easting: 336705 mE

Northing: 6803666 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 251

Observer: Joel Wilson

Zone: 51

Easting: 336686 mE

Northing: 6803899 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 252

Observer: Joel Wilson

Zone: 51

Easting: 336484 mE

Northing: 6803801 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 253

Observer: Joel Wilson

Zone: 51

Easting: 334788 mE

Northing: 6803329 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 254

Observer: Joel Wilson

Zone: 51

Easting: 334472 mE

Northing: 6803207 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 255

Observer: Joel Wilson

Zone: 51

Easting: 333914 mE

Northing: 6802370 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 256

Observer: Joel Wilson

Zone: 51

Easting: 333929 mE

Northing: 6802011 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 257

Observer: Joel Wilson

Zone: 51

Easting: 333942 mE

Northing: 6801638 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 258

Observer: Joel Wilson

Zone: 51

Easting: 333979 mE

Northing: 6801283 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 259

Observer: Joel Wilson

Zone: 51

Easting: 333973 mE

Northing: 6800931 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 260

Observer: Joel Wilson

Zone: 51

Easting: 333988 mE

Northing: 6800573 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 261

Observer: Joel Wilson

Zone: 51

Easting: 333997 mE

Northing: 6800271 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 262

Observer: Joel Wilson

Zone: 51

Easting: 334013 mE

Northing: 6799946 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 263

Observer: Joel Wilson

Zone: 51

Easting: 334180 mE

Northing: 6799857 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 264

Observer: Joel Wilson

Zone: 51

Easting: 334172 mE

Northing: 6800169 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 265

Observer: Joel Wilson

Zone: 51

Easting: 334176 mE

Northing: 6800525 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 266

Observer: Joel Wilson

Zone: 51

Easting: 334216 mE

Northing: 6800910 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 267

Observer: Joel Wilson

Zone: 51

Easting: 334194 mE

Northing: 6801202 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 268

Observer: Joel Wilson

Zone: 51

Easting: 334194 mE

Northing: 6801644 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 269

Observer: Joel Wilson

Zone: 51

Easting: 334091 mE

Northing: 6801997 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 270

Observer: Joel Wilson

Zone: 51

Easting: 334230 mE

Northing: 6802339 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 271

Observer: Joel Wilson

Zone: 51

Easting: 334417 mE

Northing: 6802321 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 272

Observer: Joel Wilson

Zone: 51

Easting: 334415 mE

Northing: 6802036 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 273

Observer: Joel Wilson

Zone: 51

Easting: 334412 mE

Northing: 6801644 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 274

Observer: Joel Wilson

Zone: 51

Easting: 334364 mE

Northing: 6801173 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 275

Observer: Joel Wilson

Zone: 51

Easting: 334386 mE

Northing: 6800880 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 276

Observer: Joel Wilson

Zone: 51

Easting: 334399 mE

Northing: 6800506 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 277

Observer: Joel Wilson

Zone: 51

Easting: 334393 mE

Northing: 6800241 mN

Fire History: > 5 years

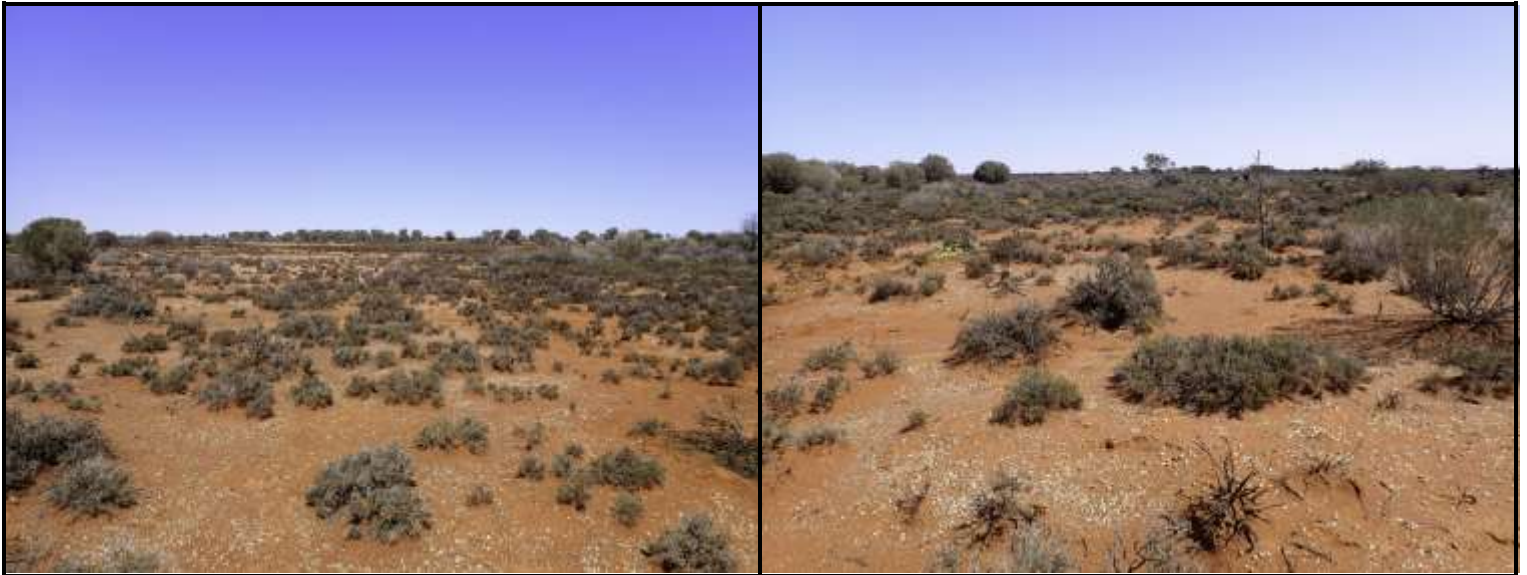
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 278

Observer: Joel Wilson

Zone: 51

Easting: 334392 mE

Northing: 6799849 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 279

Observer: Joel Wilson

Zone: 51

Easting: 334581 mE

Northing: 6799842 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 280

Observer: Joel Wilson

Zone: 51

Easting: 334596 mE

Northing: 6800178 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 281

Observer: Joel Wilson

Zone: 51

Easting: 334579 mE

Northing: 6800507 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 282

Observer: Joel Wilson

Zone: 51

Easting: 334594 mE

Northing: 6800906 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 283

Observer: Joel Wilson

Zone: 51

Easting: 334586 mE

Northing: 6801204 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 284

Observer: Joel Wilson

Zone: 51

Easting: 334595 mE

Northing: 6802006 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 285

Observer: Joel Wilson

Zone: 51

Easting: 334595 mE

Northing: 6802259 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 286

Observer: Joel Wilson

Zone: 51

Easting: 334392 mE

Northing: 6802738 mN

Fire History: > 5 years

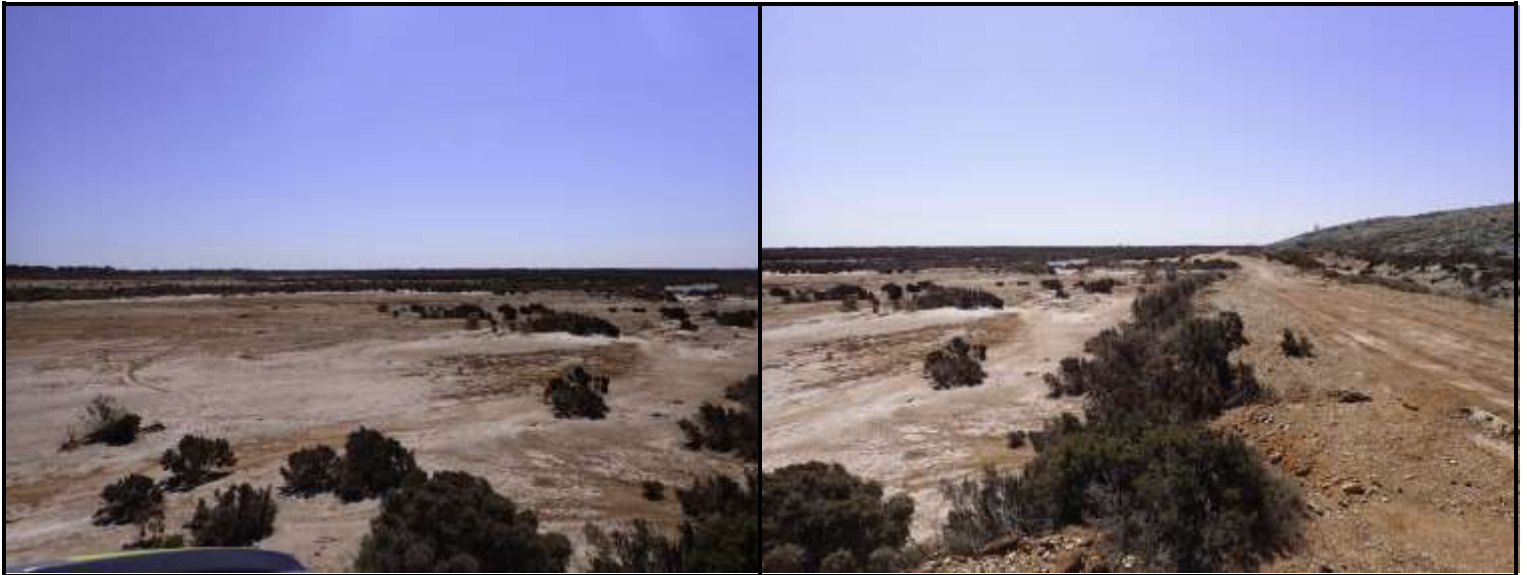
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 287

Observer: Joel Wilson

Zone: 51

Easting: 335122 mE

Northing: 6799315 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: d

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 288

Observer: Joel Wilson

Zone: 51

Easting: 335100 mE

Northing: 6799629 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: d

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 289

Observer: Joel Wilson

Zone: 51

Easting: 334951 mE

Northing: 6800151 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 290

Observer: Joel Wilson

Zone: 51

Easting: 334789 mE

Northing: 6799869 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 291

Observer: Joel Wilson

Zone: 51

Easting: 334811 mE

Northing: 6800174 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 292

Observer: Joel Wilson

Zone: 51

Easting: 334815 mE

Northing: 6800521 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 293

Observer: Joel Wilson

Zone: 51

Easting: 334819 mE

Northing: 6800912 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 294

Observer: Joel Wilson

Zone: 51

Easting: 334785 mE

Northing: 6801189 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 295

Observer: Joel Wilson

Zone: 51

Easting: 334794 mE

Northing: 6802061 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 296

Observer: Joel Wilson

Zone: 51

Easting: 334787 mE

Northing: 6802356 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 297

Observer: Joel Wilson

Zone: 51

Easting: 334837 mE

Northing: 6802605 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 298

Observer: Joel Wilson

Zone: 51

Easting: 335025 mE

Northing: 6802871 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 299

Observer: Joel Wilson

Zone: 51

Easting: 335014 mE

Northing: 6802513 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 300

Observer: Joel Wilson

Zone: 51

Easting: 334967 mE

Northing: 6802263 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 301

Observer: Joel Wilson

Zone: 51

Easting: 334986 mE

Northing: 6801165 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 302

Observer: Joel Wilson

Zone: 51

Easting: 334960 mE

Northing: 6800878 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 303

Observer: Joel Wilson

Zone: 51

Easting: 335007 mE

Northing: 6800533 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 304

Observer: Joel Wilson

Zone: 51

Easting: 334982 mE

Northing: 6799942 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 305

Observer: Joel Wilson

Zone: 51

Easting: 335194 mE

Northing: 6800489 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Tall shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 306

Observer: Joel Wilson

Zone: 51

Easting: 335188 mE

Northing: 6800891 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 307

Observer: Joel Wilson

Zone: 51

Easting: 335186 mE

Northing: 6801229 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 308

Observer: Joel Wilson

Zone: 51

Easting: 335206 mE

Northing: 6801665 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 309

Observer: Joel Wilson

Zone: 51

Easting: 335196 mE

Northing: 6802116 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 310

Observer: Joel Wilson

Zone: 51

Easting: 335226 mE

Northing: 6802448 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 311

Observer: Joel Wilson

Zone: 51

Easting: 335206 mE

Northing: 6802819 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 312

Observer: Joel Wilson

Zone: 51

Easting: 335427 mE

Northing: 6802861 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 313

Observer: Joel Wilson

Zone: 51

Easting: 335406 mE

Northing: 6802165 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 314

Observer: Joel Wilson

Zone: 51

Easting: 335390 mE

Northing: 6801750 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 315

Observer: Joel Wilson

Zone: 51

Easting: 335408 mE

Northing: 6801304 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 316

Observer: Joel Wilson

Zone: 51

Easting: 335384 mE

Northing: 6800986 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 317

Observer: Joel Wilson

Zone: 51

Easting: 335409 mE

Northing: 6800519 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 318

Observer: Joel Wilson

Zone: 51

Easting: 335591 mE

Northing: 6800509 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 319

Observer: Joel Wilson

Zone: 51

Easting: 335596 mE

Northing: 6800922 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 320

Observer: Joel Wilson

Zone: 51

Easting: 335595 mE

Northing: 6801248 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 321

Observer: Joel Wilson

Zone: 51

Easting: 335585 mE

Northing: 6801621 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 322

Observer: Joel Wilson

Zone: 51

Easting: 335695 mE

Northing: 6801981 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 323

Observer: Joel Wilson

Zone: 51

Easting: 335649 mE

Northing: 6802352 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 324

Observer: Joel Wilson

Zone: 51

Easting: 335596 mE

Northing: 6802850 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 325

Observer: Joel Wilson

Zone: 51

Easting: 335982 mE

Northing: 6803000 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 326

Observer: Joel Wilson

Zone: 51

Easting: 335968 mE

Northing: 6802685 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 327

Observer: Joel Wilson

Zone: 51

Easting: 335803 mE

Northing: 6802644 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Ephemeral creekline

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 328

Observer: Joel Wilson

Zone: 51

Easting: 335819 mE

Northing: 6803028 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 329

Observer: Joel Wilson

Zone: 51

Easting: 336186 mE

Northing: 6803055 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 330

Observer: Joel Wilson

Zone: 51

Easting: 336208 mE

Northing: 6802761 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 331

Observer: Joel Wilson

Zone: 51

Easting: 336584 mE

Northing: 6802786 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 332

Observer: Joel Wilson

Zone: 51

Easting: 335805 mE

Northing: 6801283 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 333

Observer: Joel Wilson

Zone: 51

Easting: 335836 mE

Northing: 6800956 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 334

Observer: Joel Wilson

Zone: 51

Easting: 335793 mE

Northing: 6800501 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 335

Observer: Joel Wilson

Zone: 51

Easting: 335999 mE

Northing: 6800447 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 336

Observer: Joel Wilson

Zone: 51

Easting: 335990 mE

Northing: 6800927 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 337

Observer: Joel Wilson

Zone: 51

Easting: 336005 mE

Northing: 6801245 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 338

Observer: Joel Wilson

Zone: 51

Easting: 336228 mE

Northing: 6801273 mN

Fire History: > 5 years

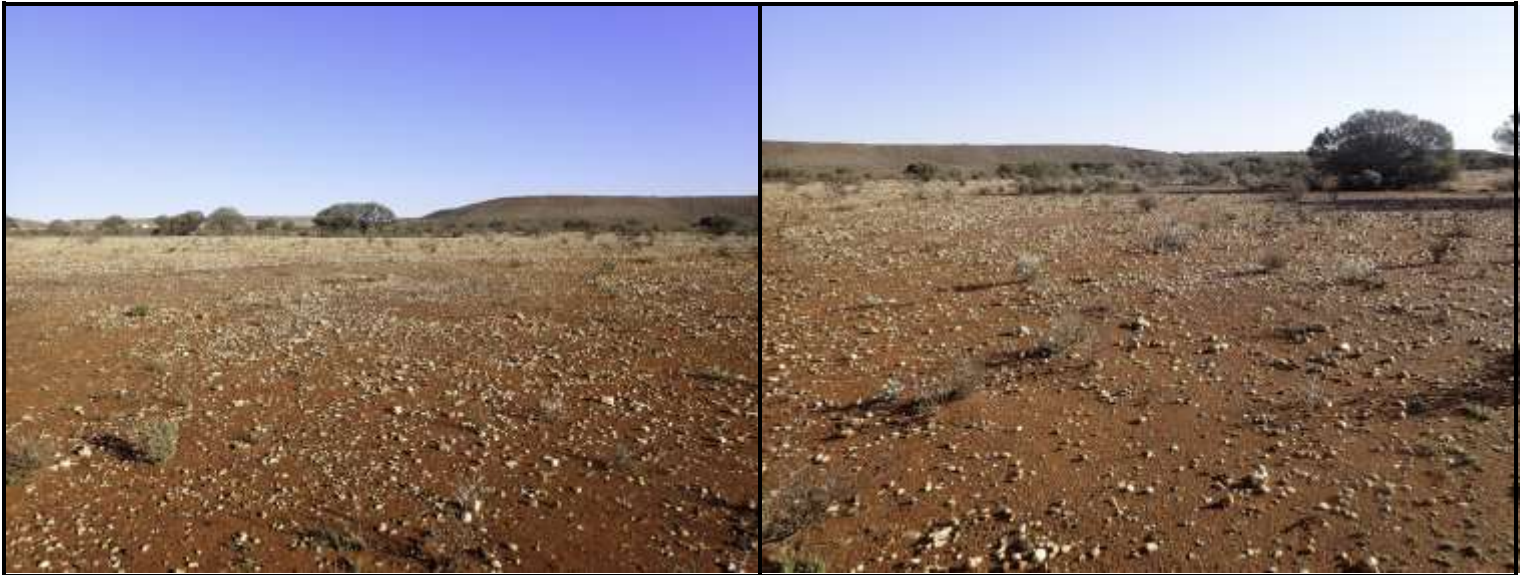
Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 339

Observer: Joel Wilson

Zone: 51

Easting: 336201 mE

Northing: 6800838 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 340

Observer: Joel Wilson

Zone: 51

Easting: 336155 mE

Northing: 6800494 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 341

Observer: Joel Wilson

Zone: 51

Easting: 336389 mE

Northing: 6800385 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: No stones



Date: 16-Sep-22

Habitat Assessment #: 342

Observer: Joel Wilson

Zone: 51

Easting: 336435 mE

Northing: 6800937 mN

Fire History: > 5 years

Landform: Stoney rise

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 343

Observer: Joel Wilson

Zone: 51

Easting: 336427 mE

Northing: 6801256 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 344

Observer: Joel Wilson

Zone: 51

Easting: 336590 mE

Northing: 6801144 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 345

Observer: Joel Wilson

Zone: 51

Easting: 336573 mE

Northing: 6800852 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Open mulga woodland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 346

Observer: Joel Wilson

Zone: 51

Easting: 336580 mE

Northing: 6800251 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 347

Observer: Joel Wilson

Zone: 51

Easting: 336548 mE

Northing: 6799995 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Disturbed

Habitat Quality: Disturbed

Surface: Few stones



Date: 16-Sep-22

Habitat Assessment #: 348

Observer: Joel Wilson

Zone: 51

Easting: 336830 mE

Northing: 6800003 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 349

Observer: Joel Wilson

Zone: 51

Easting: 336793 mE

Northing: 6800322 mN

Fire History: > 5 years

Landform: Plain

Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney



Date: 16-Sep-22

Habitat Assessment #: 350

Observer: Joel Wilson

Zone: 51

Easting: 336806 mE

Northing: 6800943 mN

Fire History: > 5 years

Landform: Plain

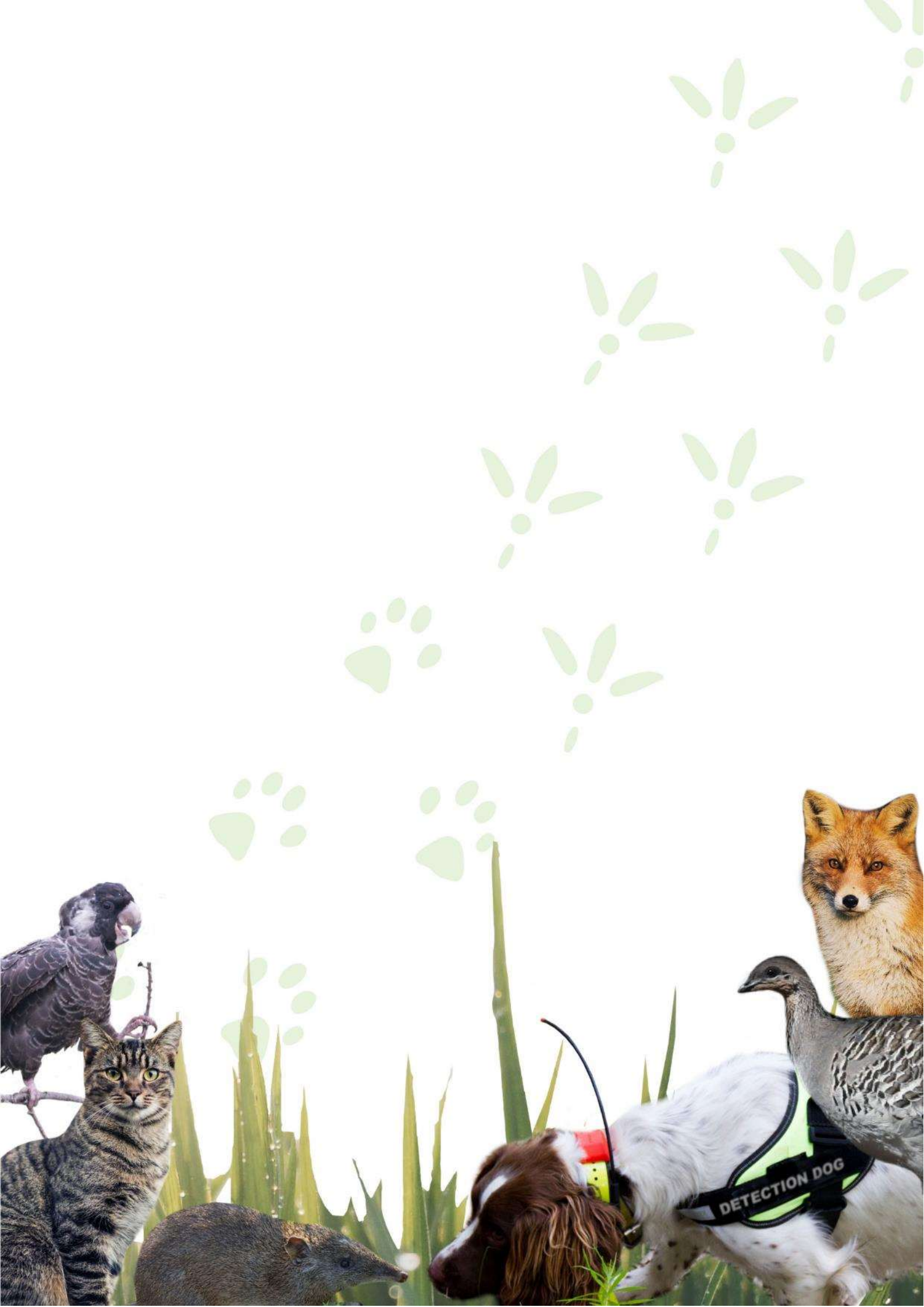
Soil Type: Sandy clay

Habitat Structure: Low shrubland

Habitat Quality: Very good

Surface: Stoney





APPENDIX D

Genesis Minerals - Tower Hill expansion SRE Fauna Survey Report



Genesis Minerals - Tower Hill
expansion SRE Fauna Survey Report

Prepared for:

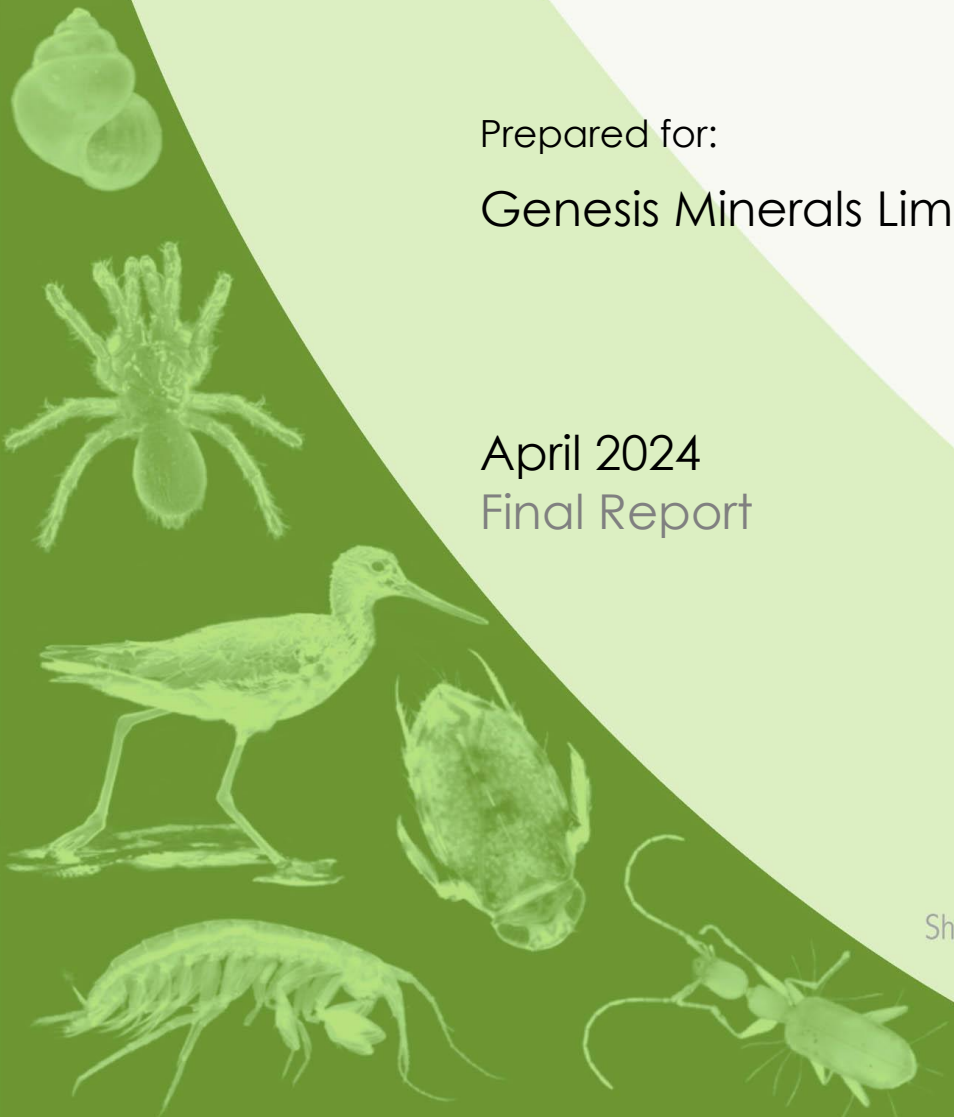
Genesis Minerals Limited

April 2024

Final Report

Short-Range Endemics | Subterranean Fauna

Waterbirds | Wetlands



Genesis Minerals – Tower Hill expansion SRE Fauna Survey Report

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K:\Projects\B_TE_16\8_Report\Survey\ClientComments\BEC_StBarbara_SRE_Survey_8.04.24_Final_V1_FOR_CLIENT.docx

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EXECUTIVE SUMMARY

In 2023, Genesis Minerals (Genesis) acquired the Gwalia mine and surrounding development opportunities (together Leonora Operations; hereafter “the Project”) and currently seeks to expand operations at the Tower Hill mine. The proposed expansion includes the development of the Tower Hill Open Pit, currently in care and maintenance, and associated infrastructure (such as waste rock landform, rom pad, and haul roads). The proposed expansion includes clearing of native vegetation, which may negatively affect populations of short-range endemic (SRE) species, terrestrial invertebrates with natural home ranges <10,000 km². Terrestrial Ecology commissioned Bennelongia to conduct a baseline SRE survey to determine the presence and composition of the SRE community at the Project.

Desktop assessment of an area 100 x 100 km centred on the Project recovered 157 records of animals from SRE Groups attributable to 45 known species. None of the SRE species in the search had sufficient taxonomic certainty and representation in collections to be classified as Confirmed SREs, but 9 species were categorised as Likely Potential SREs; 10 were categorised as Unlikely Potential SREs; 1 was categorised as Data Deficient; and 25 species were Widespread. A single invasive isopod was identified in the search area. The desktop assessment concluded that further survey was indicated.

Field survey was subsequently carried out from 28-31 March 2023. Habitat mapping identified eight habitats prospective for species from SRE Groups as occurring within the Project area. None of them is considered to be restricted to the survey area. A total of 61 specimens from at least 18 identifiable species belonging to SRE Groups were collected. Seven species were categorised as Widespread, and five species were categorised as Data Deficient. Six species were categorised as Potential SREs, three as Likely Potential SREs, and three as Unlikely Potential SREs:

The pseudoscorpion

- *Indolpium* `BPS496` - Likely Potential SRE;

The scorpions

- *Urodacus* `BSCO055` - Unlikely Potential SRE and
- *Urodacus* `BSCO070` - Unlikely Potential SRE;

And the mygalomorph spiders

- *Aname* `BMYG222` `melloso` group` - Likely Potential SRE,
- *Idiosoma* `BMYG221` - Likely Potential SRE, and
- *Idiosoma* `MYG256` - Unlikely Potential SRE.

Based on the current known distributions of these species, the broad distribution of their habitats, and the limited impact on those habitats expected from Project activities, no significant impacts on the populations of the Potential SREs or any other terrestrial invertebrate species are expected to result from the development of the Project.

CONTENTS

Executive Summary	ii
1. Introduction	5
1.1. Environmental Context	5
1.1.1. Regional Geology.....	5
1.1.2. Flora and Fauna.....	6
Recent Survey	6
1.2. Short Range Endemism	6
2. Desktop Assessment.....	10
2.1. Methods	10
2.2. Results	10
2.2.1. Listed Terrestrial Invertebrate Species, TECs, and PECs	10
2.2.2. Known SRE Records	10
Mygalomorph Spiders.....	11
Pseudoscorpions	11
Scorpions	11
Millipedes	13
2.3. Discussion	13
3. Field Survey	17
3.1. Methods	17
3.1.1. Sampling Techniques	17
3.1.2. SRE Habitat mapping	17
3.1.3. Preservation and Identification Techniques	18
3.1.4. Molecular Methods	18
3.1.5. Survey Timing and Limitations	19
3.1.6. Personnel	19
3.2. Survey Results	21
3.2.1. SRE Habitats in the Project area	21
3.2.2. Species Accounts	21
Land snails.....	22
Pseudoscorpions	22
Scorpions	22
Mygalomorph spiders	22
Centipedes.....	23
Millipedes	23
3.3. Discussion and conclusions	27
4. References.....	28
Appendix 1: Bennelongia SRE Categories	31
Appendix 2: Species identified in the desktop search area and their SRE status.....	32
Appendix 3: Photographs of Sites Sampled for SREs in March 2023	44
Appendix 4: Map of SRE Habitats inside and outside of the Project area	48

LIST OF FIGURES

Figure 1: Location of the Project and its operations. The proposed Tailings Storage Facility 5 site is 6 km south of Leonora, immediately south of the current Gwalia footprint.	7
Figure 2. Surface geology at the Project.	8
Figure 3: Vegetation associations at the Project.....	9
Figure 4: Desktop search area and records of animals belonging to SRE Groups.....	12
Figure 5: Location of Potential (Likely) SRE <i>Aname</i> spp. in the desktop search area.	14
Figure 6: Location of Potential (Likely) SRE pseudoscorpions in the desktop search area.....	15
Figure 7: Location of Potential (Likely) SRE scorpions and millipede in the desktop search area.	16
Figure 8. SRE sampling sites in the Project area.	20
Figure 9. Potential SRE species recovered from the field survey mapped over identified SRE habitats.	26

LIST OF TABLES

Table 1. Sites sampled for SREs during the field survey.....	19
Table 2. SRE Habitats identified as occurring in the Project area.	21
Table 3. Species from SRE Groups collected from the Project area.....	24

1. INTRODUCTION

The proposal includes the development of the Tower Hill Open Pit (Figure 1), currently in care and maintenance, and associated infrastructure (waste rock landform, rom pad, haul roads). The Tower Hill Open Pit was historically used to store hypersaline discharge from other mine sites; substantial dewatering (5 GL) is required as part of development.

The proposed expansion includes clearing of native vegetation, which may negatively affect populations of short-range endemic (SRE) species, terrestrial invertebrates with natural home ranges <10,000 km². Terrestrial Ecology commissioned Bennelongia to conduct a field survey and desktop assessment to determine the presence and composition of the SRE community at the Project. This report collates the findings of the survey and the desktop assessment. In line with the frameworks established by the EPA (2016a, b), the objectives of this report are:

- To identify potentially prospective habitats for SREs within the proposal area based on existing information about vegetation and the factors known to affect the occurrence of SREs.
- To collate pre-existing records of animals belonging to SRE Groups from the proposal area and surrounds to determine the likelihood of significant species occurring in or affected by the proposal area.
- To present and summarise results of a field survey in the area.
- Using the above information, as well as information about the Project and its operations, to assess whether the Project may have significant impacts on the persistence or population sizes of any SRE species.

1.1. Environmental Context

1.1.1. Regional Geology

The Project lies in the Eastern Murchison subregion of the Murchison bioregion in Western Australia's Goldfields. The Eastern Murchison is primarily used for grazing on native pastures (85.47% of the area; Cowan 2001). The climate in Leonora is arid. The highest daily mean maximum and minimum temperatures fall in January (37.0 °C and 21.8 °C respectively), and the lowest in July (18.4 °C and 6.1 °C). Mean rainfall is highest in February (30.9 mm) and lowest in September (8.9 mm), but the month with highest mean number of days with rain is June (3.5 days).

The Project lies in the Gwalia Domain, which comprises Archaean mafic to ultramafic greenstone units. The Gwalia Domain is bounded by the Mount George Shear Zone to the east, the Sons of Gwalia Shear Zone to the west and south, and the Clifford Fault to the north. Mafic volcanic extrusives up to 400 m wide make up much of the Gwalia Domain, interspersed with minor thin cherty or pelitic interflow sediments. Dolerite sills and dykes also occur.

Surface geology is particularly important to the distribution of SRE species, especially burrowing species like mygalomorph spiders and urodacid scorpions (Koch 1978; Rix *et al.* 2018a; Shorthouse and Marples 1980). Much of the Project area is categorised as anthropogenically disturbed, in this case cleared for mining. Nevertheless, significant disturbance does not necessarily result in the absence of SRE species. Specimens have been collected in areas of regrowth following clearing (Bennelongia 2022b) and in remnant patches of native vegetation on land heavily cleared for pastoral use (Bennelongia in prep).

Beyond the immediate impact zones of existing and historic mining operations, regolith comprises predominantly colluvium and alluvium, with small lacustrine areas or areas of exposed rock (Figure 2). Patchy distributions of regolith types, as occurs in the Project area, are conducive to hosting SRE species.

1.1.2. Flora and Fauna

According to the pre-European vegetation mapping conducted by Beard (1975), four vegetation types occur at the Project (Figure 3). Three of these types are dominated by *Acacia aneura* (mulga) and the fourth by *Halosarcia* (samphire). Each of the four vegetation types is associated with variations in landforms such as creek lines, low hills, and plains, landforms known to influence SRE distribution. However, long-term mining operations have cleared much of this native vegetation. Cleared areas do not constitute appropriate habitat for SRE species.

Recent Survey

Bennelongia has recently conducted several surveys (Bennelongia 2020, 2022a) in the desktop search area defined in Section 2.1, the results of which are incorporated into the desktop assessment (Section 2).

Spectrum Ecology (2022) conducted a flora site visit and terrestrial fauna assessment of the Project area in November 2021. While on site, Spectrum personnel photographed a number of mygalomorph spider burrows which appear to be constructed of moustache-like twig arrangements typical of *Idiosoma* species (Rix *et al.* 2018a; Rix *et al.* 2017b), but the use of similar burrows by other genera renders positive identification impossible. Additionally, many species have extremely cryptic burrow lids, so it is likely that other species of trapdoor spider exist within the Project area. The trapdoor spider findings from this survey were ambiguous and did not include a definitive classification, so no data from this survey were used in the desktop assessment.

1.2. Short Range Endemism

A short range endemic (SRE) is an epigeal terrestrial invertebrate species with a natural range of less than 10,000 km² (Harvey 2002). With its complex, ancient environments, Western Australia supports a rich diversity of SREs, and this diversity increases as awareness of SREs spreads. For instance, in recent years DNA barcoding techniques have revealed that taxa previously considered to be single species actually comprise complex cryptic lineages of multiple species (Cao *et al.* 2016; Rix *et al.* 2021).

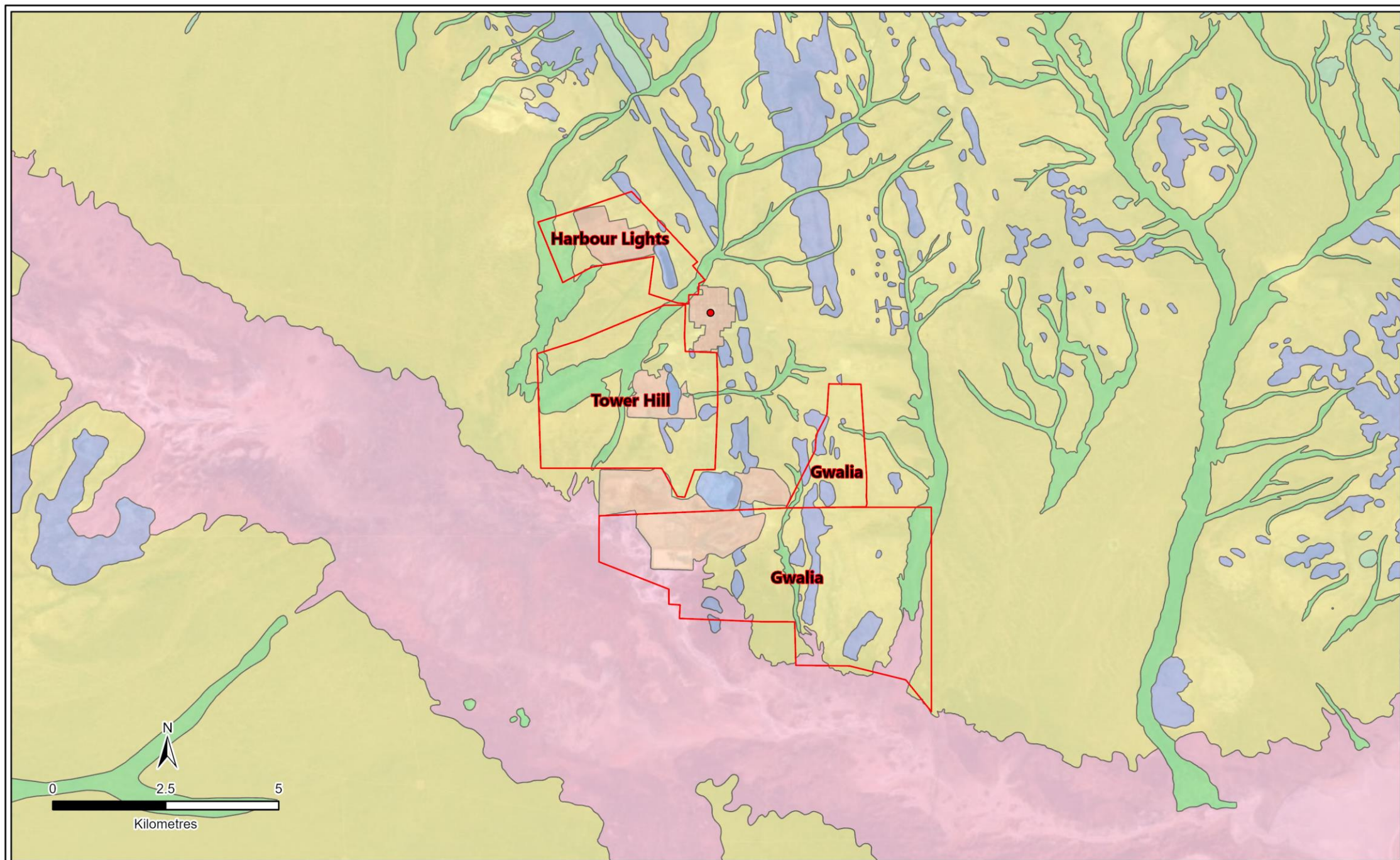
Short range endemic species are particularly susceptible to disturbances because they have short ranges, tend to live in discontinuous habitats, and often produce few offspring. The main sources of disturbances that threaten the stability of SRE communities include habitat removal or modification, changes in fire regimens, the introduction of weeds and pathogens, and changes in local hydrology. Because of their increased susceptibility to disturbances, SREs are identified by the *Environmental Protection Act 1986* as significant species and targets of protection (EPA 2016b, 2018).

Several groups of animals have been identified as probably or definitely containing SREs (EPA 2016b). Not all species in these groups are SREs, but when any member of those groups is detected, the literature must be consulted to identify its range. Species investigated in this way are categorised as Confirmed SREs, Potential SREs, or Widespread (see Appendix 1). Potential SREs are further differentiated as Likely or Unlikely Potential SREs; Data Deficient species are conservatively considered Likely Potential SREs (Appendix 1), but throughout this report will be treated as a separate category from Likely Potential SREs to allow for species-specific discussion.

Where SREs have not been directly sampled in the past, prospective habitats can be estimated by investigating the habit preferences of existing records and cross-referencing those habitat types with habitat present in the target area. In general, SREs tend to inhabit relictual, isolated, sheltered, and moist habitats, as well as specialist habitats including rock outcrops (EPA 2016b).



Figure 1. Location of the Project and its operations. The proposed Tailings Storage Facility 5 site is 6 km south of Leonora, immediately south of the current Gwalia footprint.



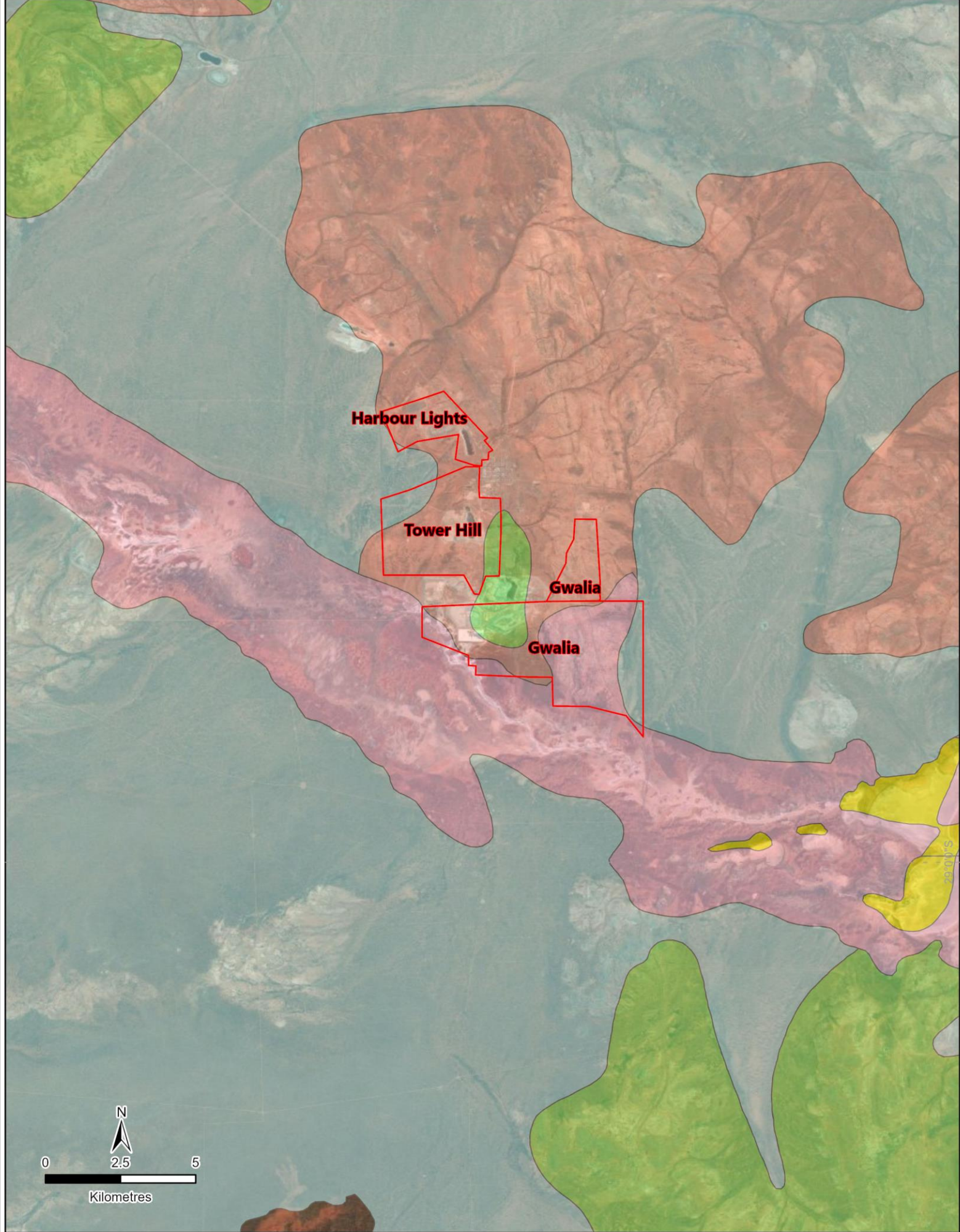
GCS GDA 1994
 Author: Rhare
 Date: 14/06/2023



Legend

- | | | |
|--------------|---------------------|-----------|
| Project Area | Anthropogenic areas | Residual |
| Leonora | Colluvium | Sandplain |
| Regolith | Exposed | |
| Alluvium | Lacustrine | |

Figure 2. Surface geology at the Project.



GCS GDA 1994
 Author: Rhare
 Date: 14/06/2023

Beard vegetation units

- 28: Open low woodland of mulga (*Acacia aneura*)
- 18: Low woodland of mulga (*Acacia aneura*) with eucalyptus
- 39: Shrublands of mulga (*Acacia aneura*) scrub
- 676: Succulent steppe of samphire (*Halosarcia* sp.)
- 125: Bare areas; salt lakes

Project Area

Figure 3. Vegetation associations at the Project

2. DESKTOP ASSESSMENT

2.1. Methods

The desktop assessment combined three sources of information using GIS mapping:

- Boundary information and description of Project activity was supplied by Terrestrial Ecosystems.
- Records of the occurrence of SREs in the vicinity of the project were derived from searching the Western Australia Museum and Bennelongia databases, as well as relevant consulting reports. For each identifiable taxon, the number of records (i.e. the number of times the taxon was found) and the number of individuals collected (i.e. how many were found in each record) from any or all of these sources was collated. Distribution patterns of identifiable taxa were cross-referenced with the Atlas of Living Australia.
- Publicly available habitat data such as vegetation and geological data, as well as descriptions in reports previously conducted at the area (Spectrum Ecology 2022), were consulted.

These sources were combined in order to assess the presence or likely presence of SREs, based on prior records and habitat information. Database searches covered an area of 10,000 km² centred on the Project (vertices at -28.4322, 120.8207 and -29.3341, 121.8410; Figure 4). Analysis and mapping were undertaken using ArcGIS Pro v2.9.

Following database searches, only those taxa belonging to groups known to contain SREs were retained downstream; other records were discarded. Where possible, each taxon retained downstream was categorised according to the Bennelongia classification schema (Appendix 1) using a combination of information concerning that taxon's distribution, habitat preferences, and biology.

2.2. Results

2.2.1. Listed Terrestrial Invertebrate Species, TECs, and PECs

No listed threatened or priority terrestrial invertebrate fauna species were identified as having previously been collected in the desktop search area. There are no Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) concerning terrestrial invertebrates in Project area.

2.2.2. Known SRE Records

The desktop search recovered 157 records attributable to 45 species from SRE Groups (Figure 4; Appendix 2). Groups represented include mygalomorph spiders, pseudoscorpions, scorpions, centipedes, millipedes, isopods, and snails. None of the SRE species in the search had sufficient taxonomic certainty and representation in collections to be classified as Confirmed SREs, but 8 species were categorised as Likely Potential SREs; 10 were categorised as Unlikely Potential SREs; 1 was categorised as Data Deficient; and 25 species were Widespread. A single invasive isopod was identified in the search area.

Twelve higher order records (highlighted orange in Appendix 2) may represent additional records of species already listed in the table and are therefore not assessed. Species shaded blue in Appendix 2 are also higher order identifications but constitute unique representatives of taxonomic groups not otherwise represented in the search area. These are more challenging to assess so a conservative approach has been taken based on broad knowledge of the groups to which they belong. Overall, while some "species" may in fact be complexes of multiple species, and others might have been listed twice or more due to taxonomic uncertainty, the results indicate a substantial SRE community within the search area.

Below is a brief account of the broad groups identified as a part of the desktop study with notes on likely habitats and the distribution of those habitats in the Project Area.

Mygalomorph Spiders

Mygalomorph spiders are increasingly recognised as exhibiting the traits conducive to short-range endemism such as limited dispersal ability (Bond and Stockman 2008; Main 2003; Rix *et al.* 2017a), long generation times (Rix *et al.* 2019), and microhabitat specificity (Rix *et al.* 2018a; Rix *et al.* 2019). The desktop search identified 16 species of mygalomorph spiders within the desktop search area. Of these, three are Likely Potential SREs, four are Unlikely Potential SREs, one is Data Deficient, and the remaining eight are Widespread.

All three Likely Potential SREs are from the genus *Aname*, namely *Aname* `Phoenix0055`, *Aname* `Phoenix0056`, *Aname* `Phoenix0058`. Members of this family are commonly referred to as open-holed trapdoor spiders because they do not cap their burrows with lids. This group of trapdoor spider (among others) lacks a rastellum, a structure that aids digging in compact soils, and as such tend to be restricted to loosely compacted soils such as sand (Main *et al.* 2000). The Data Deficient *Aname* `glenorn sp. 2` was collected in a widespread low mulga woodland with *Eucalyptus* on soils characterised by slope deposits including colluvium and sheetwash (Figure 5). Because it was collected as a singleton, it has been classified as Data Deficient.

The other three species of *Aname* (*A.* `Phoenix0055`, *A.* `Phoenix0056`, *A.* `Phoenix0058`) were collected in the more patchily distributed mulga shrubland (Figure 5) and are thus considered Likely Potential SREs. *Aname* `Phoenix0055` was collected from slope deposits while the other two species were collected from soils containing more exposed rock. It is not uncommon to find trapdoor spiders in microhabitats of accumulated soils amongst exposed rock.

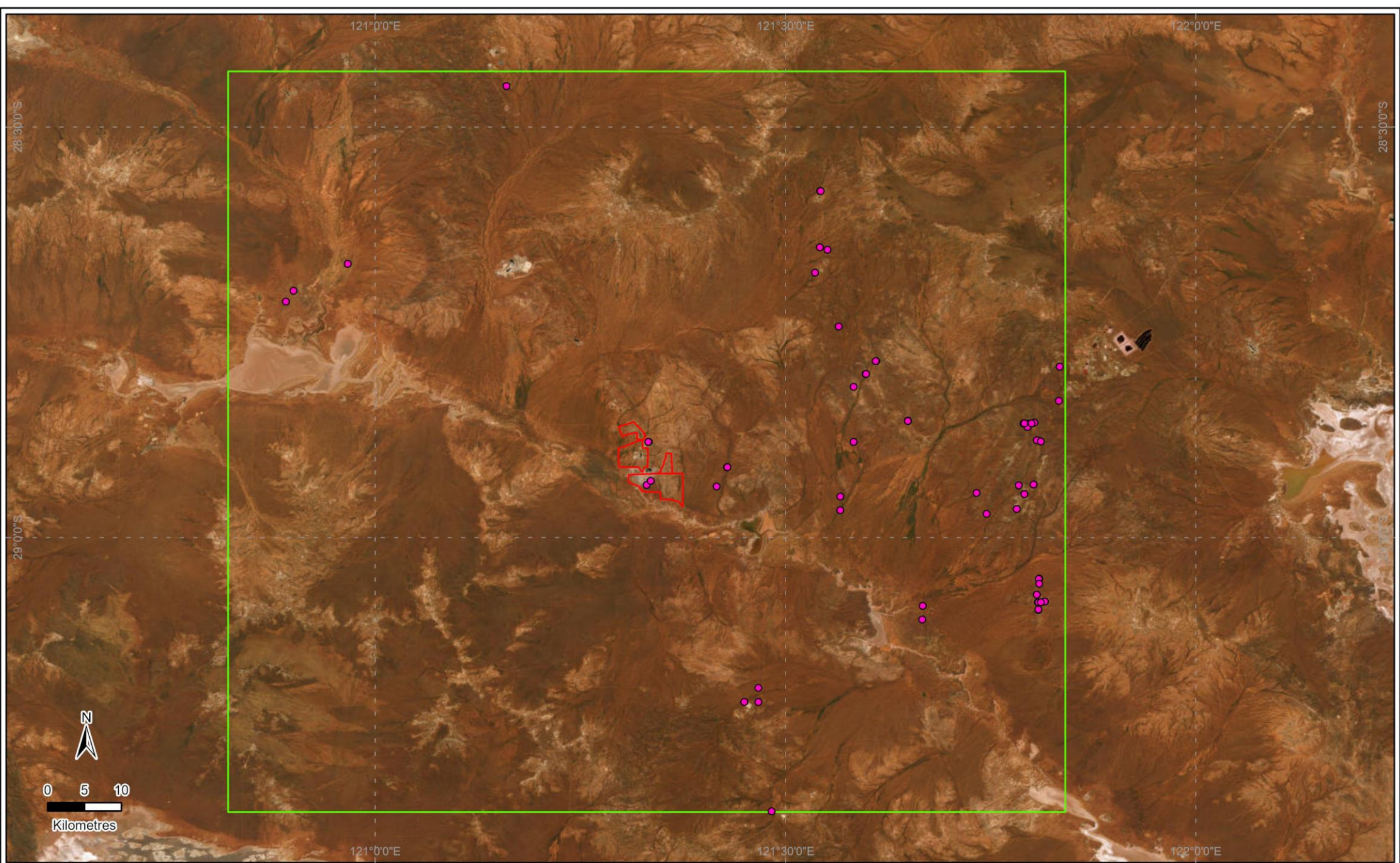
Four Unlikely Potential SRE spider species were recovered from the search area, namely *Kwonkan goongarriensis*, *Idiommata* sp., *Triattame* sp., and *Idiosoma* `occidentalis sp. group`. These species were recovered as occurring over widespread habitats, including some not expected to occur in the Project area. Therefore, they are not expected to have restricted distributions, and hence were categorised as Unlikely Potential SREs.

Pseudoscorpions

Eight species of pseudoscorpions were identified within the desktop search area, of which two are considered to be Likely Potential SREs. Both species (*Atemninae* sp. and *Nesidiochernes* sp.) are higher order identifications and are known from a mulga shrubland patches on alluvial soils associated with drainage lines (Figure 6). Since these are the only specimens from their respective family and genus, they are considered unique species, and because they were collected in patchy environments, they are considered Likely Potential SREs.

Scorpions

The taxonomic framework for scorpions in Australia needs revision. Relatively few species have been described, but many more remain undescribed in the WAM collection (Koch 1977; Volschenk *et al.* 2010; Volschenk *et al.* 2012; Volschenk *et al.* 2000). Many scorpion species are morphologically cryptic with some only distinguishable from each other after dissecting and examining internal organs such as the hemispermatophore (Buzatto *et al.* in prep). Broadly, the distribution of scorpions appears to be influenced by temperature and rainfall (Polis 1990; Smith 1995) but at a local scale soil and vegetation characteristics play a stronger role (Bradley 1986; Polis 1990).



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 Date: 14/06/2023



Legend

- Project Area
- Desktop Search Area
- SRE Group Records

Figure 4. Desktop search area and records of animals belonging to SRE Groups.

Nine species, representing all three families of scorpions present in Western Australia (Urodacidae, Buthidae, and Bothriuridae), were recovered in the desktop search. Two of the nine are considered Likely Potential SREs (*Cercophonius* sp. and *Urodacus* 'gibson 1?'); the remainder are Widespread or Unlikely Potential SREs.

Cercophonius sp. was collected in relatively patchy vegetation of succulent samphire steppe associated with inland lakes and playas (Figure 7). The soil group at this location is "Lacustrine lakes, playas, and fringing dunes." *Cercophonius* species appear susceptible to anthropomorphic disturbance: members of this genus have been completely lost in areas heavily cleared for farming (Koch 1977). Given its patchy habitat and susceptibility to disturbance, this species is regarded as a Likely Potential SRE.

Urodacus 'gibson 1?' was collected in a small patch of mulga scrub over colluvial slope deposits bordering drainage alluvials (Figure 7). The distribution of *Urodacus* species is influenced by substrate, with different species having morphological adaptations depending on their preferred substrate (Polis 1990). This can result in species utilising patchy areas of an apparently widespread habitat. *Urodacus* 'Gibson 1?' is categorised as a Likely Potential SRE due to the patchy nature of the vegetation at the collection point and a possible association with drainage lines, an inherently fragmented habitat type.

Millipedes

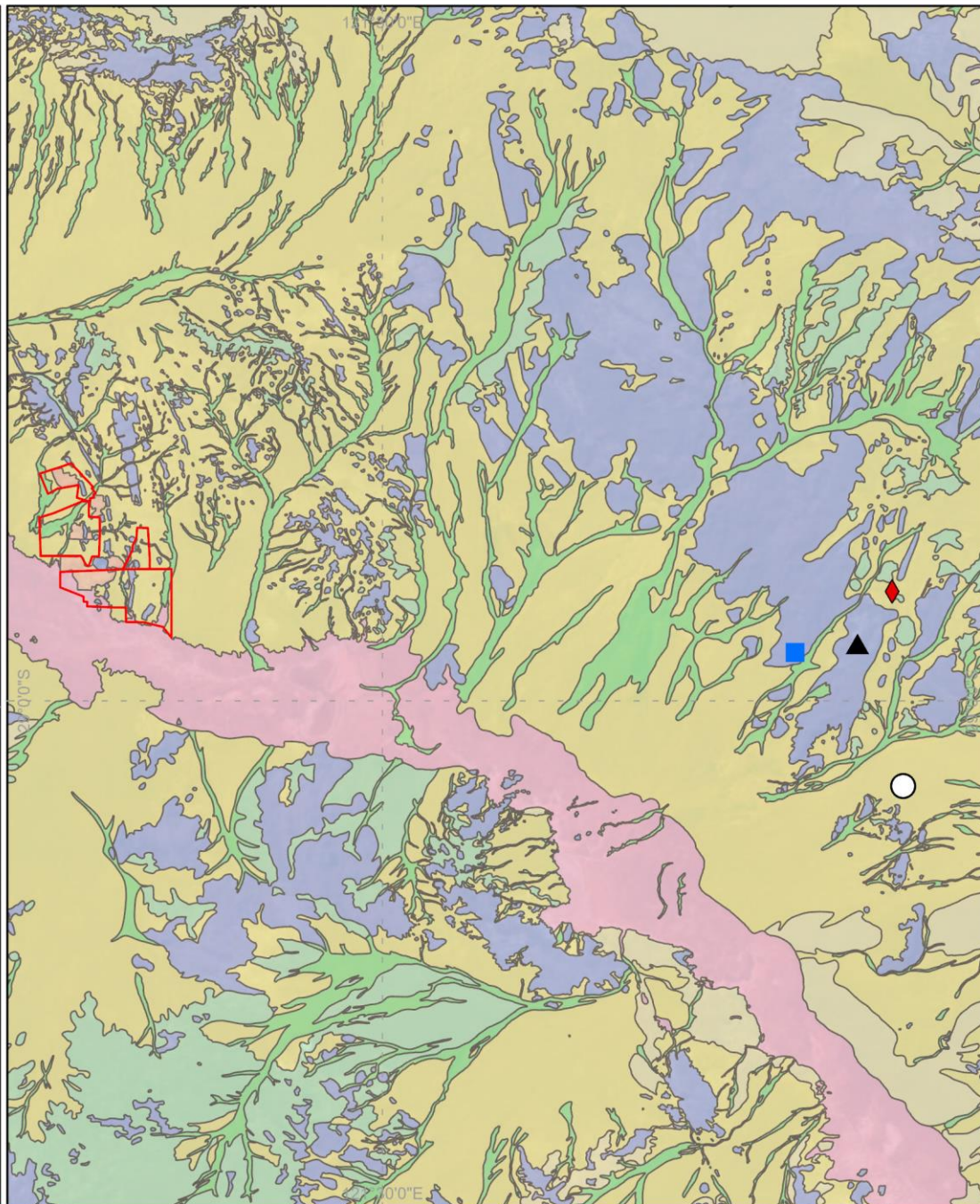
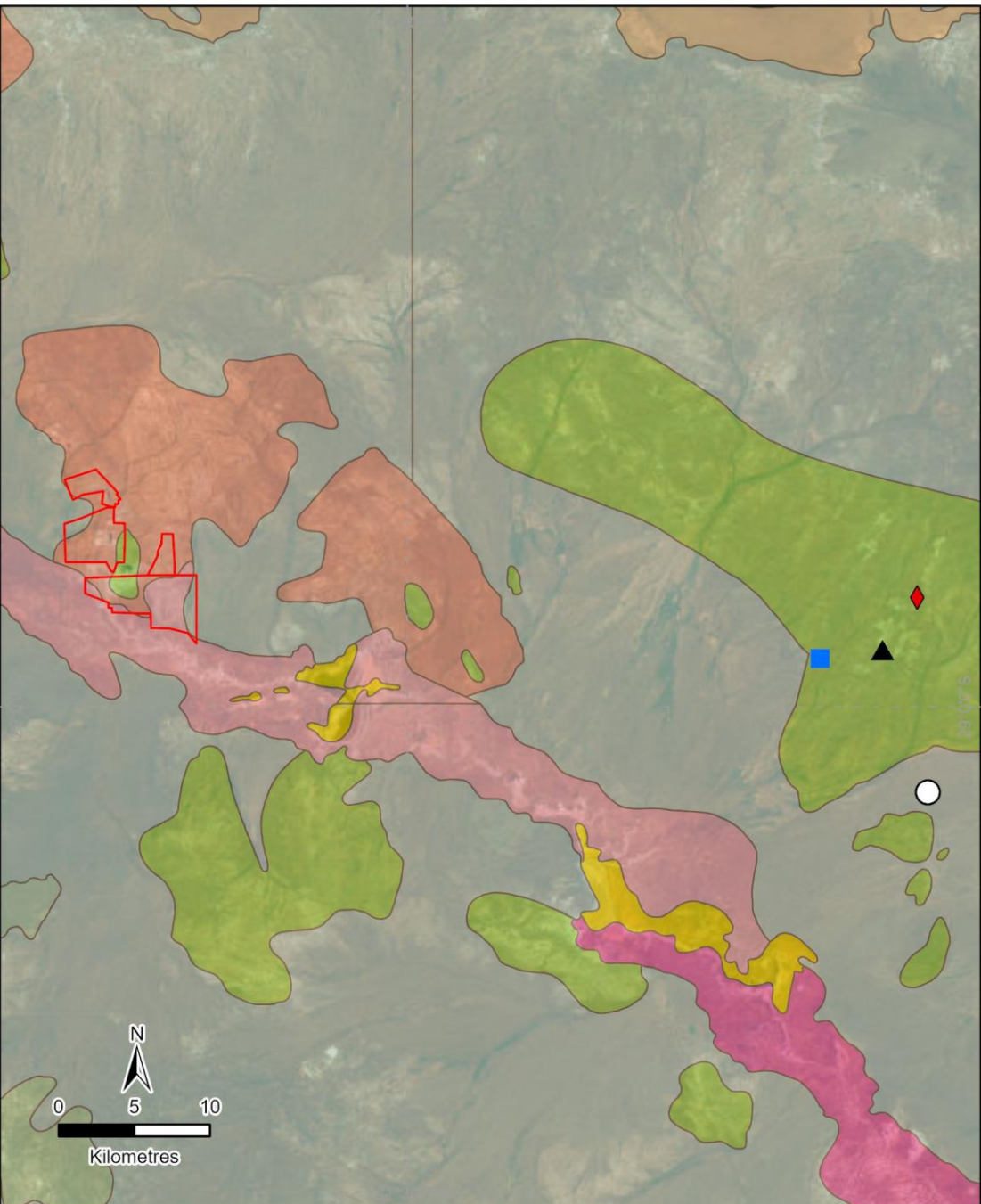
Millipedes, particularly of the genus *Antichiropus*, have a high incidence of short-range endemism (Car and Harvey 2014; Car *et al.* 2019; Car *et al.* 2013). This genus is predominately restricted to Western Australia with very few records known from east of the Nullarbor (Car *et al.* 2013). While recent work has described several new species of *Antichiropus*, many more remain to be described and new species are regularly being collected (Car and Harvey 2014; Car *et al.* 2019; Car *et al.* 2013). The specimen recorded here, identified to the level of *Antichiropus* sp., was collected in widespread mulga woodland on a patch of exposed rock (Figure 7). This being the sole known record of a genus known to contain SRE species, and having been collected on patchy soil, this specimen is categorised as a Likely Potential SRE.

2.3. Discussion

The desktop search supports the notion that animals belonging to SRE Groups will be present at the Project. The Project area is made up of multiple separate development envelopes, all of which have been at least partially disturbed by past mining activities. The remaining undisturbed areas comprise five geological units as defined by the regolith mapping (Figure 2) and four vegetation units (Figure 3). Both of these landscape features exhibit patchily distributed areas that may harbour SRE species.

Previous pilot studies (Spectrum Ecology 2022) identified the presence of mygalomorph spider burrows within the Project area based on the structure of conspicuous burrow lids. However, identification to a lower level than infraorder (Mygalomorphae) is impossible without the collection of a spider. It is likely that more spider species (including more cryptic species) and other SRE Group animals will be present at the Project beyond those detected by the desktop search. SRE animals are more likely to be collected following rainfall, which is difficult to predict and thus schedule around in regions like the Goldfields.

Overall, despite its close proximity to Leonora and the high level of historical anthropogenic disturbance, the Project hosts habitats likely to support SRE species. Additionally, evidence of SREs has been observed at the Project, indicating that a dedicated survey would identify further SRE species.



Bennelongia
Environmental Consultants

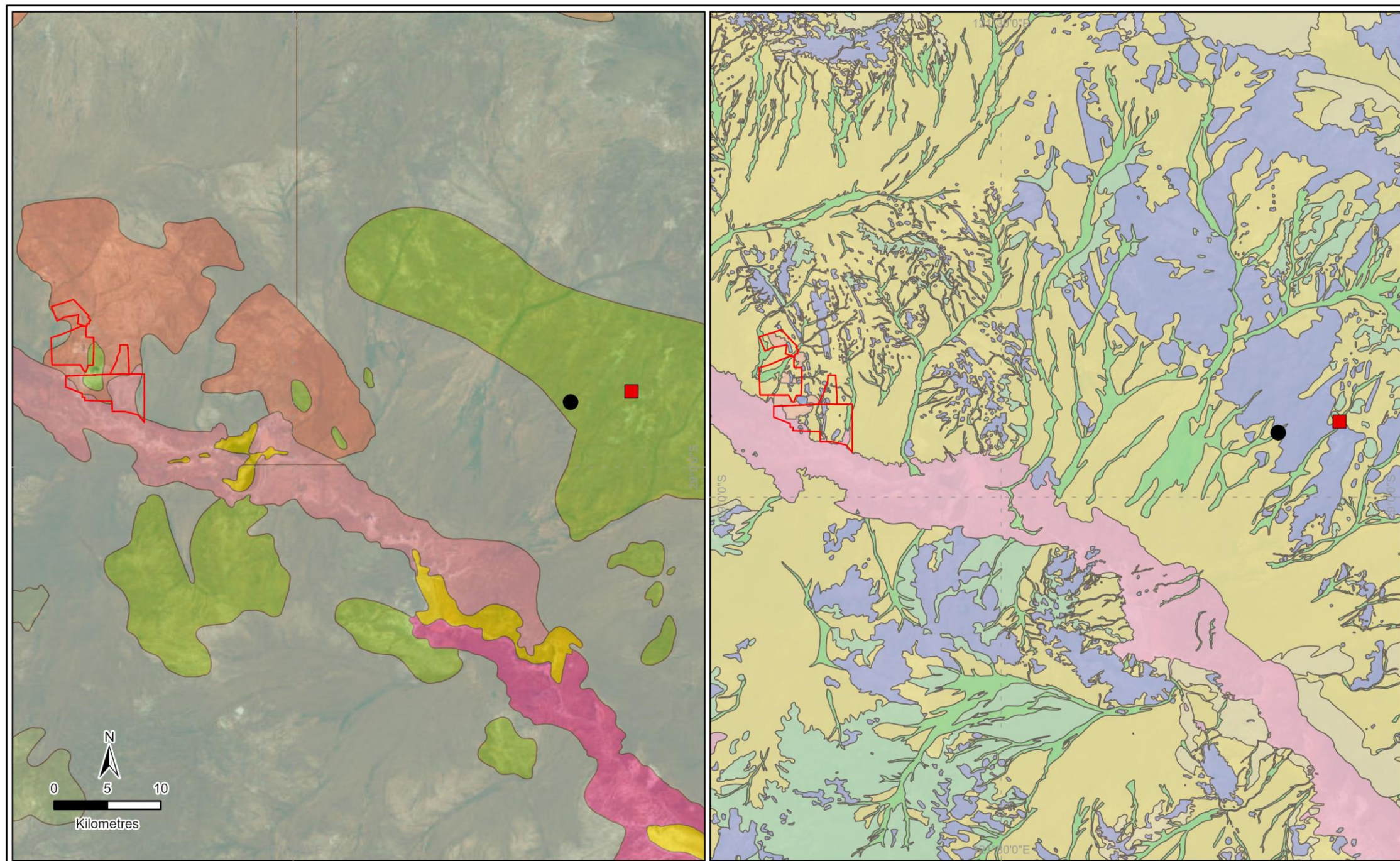
GCS GDA 1994
Author: Rhare
Date: 14/06/2023



Legend

Project Area	Aname 'Phoenix0056'	Aname 'glenorn sp. 2'	18	483	Anthropogenic areas	Lacustrine
Aname species	Aname 'Phoenix0058'	Vegetation	251	676	Calcrete	Residual
Aname 'Phoenix0055'		109	28	Regolith	Colluvium	Sandplain
		125	389	Alluvium	Exposed	
			39			

Figure 5. Location of Potential (Likely) SRE Aname spp. in the desktop search area

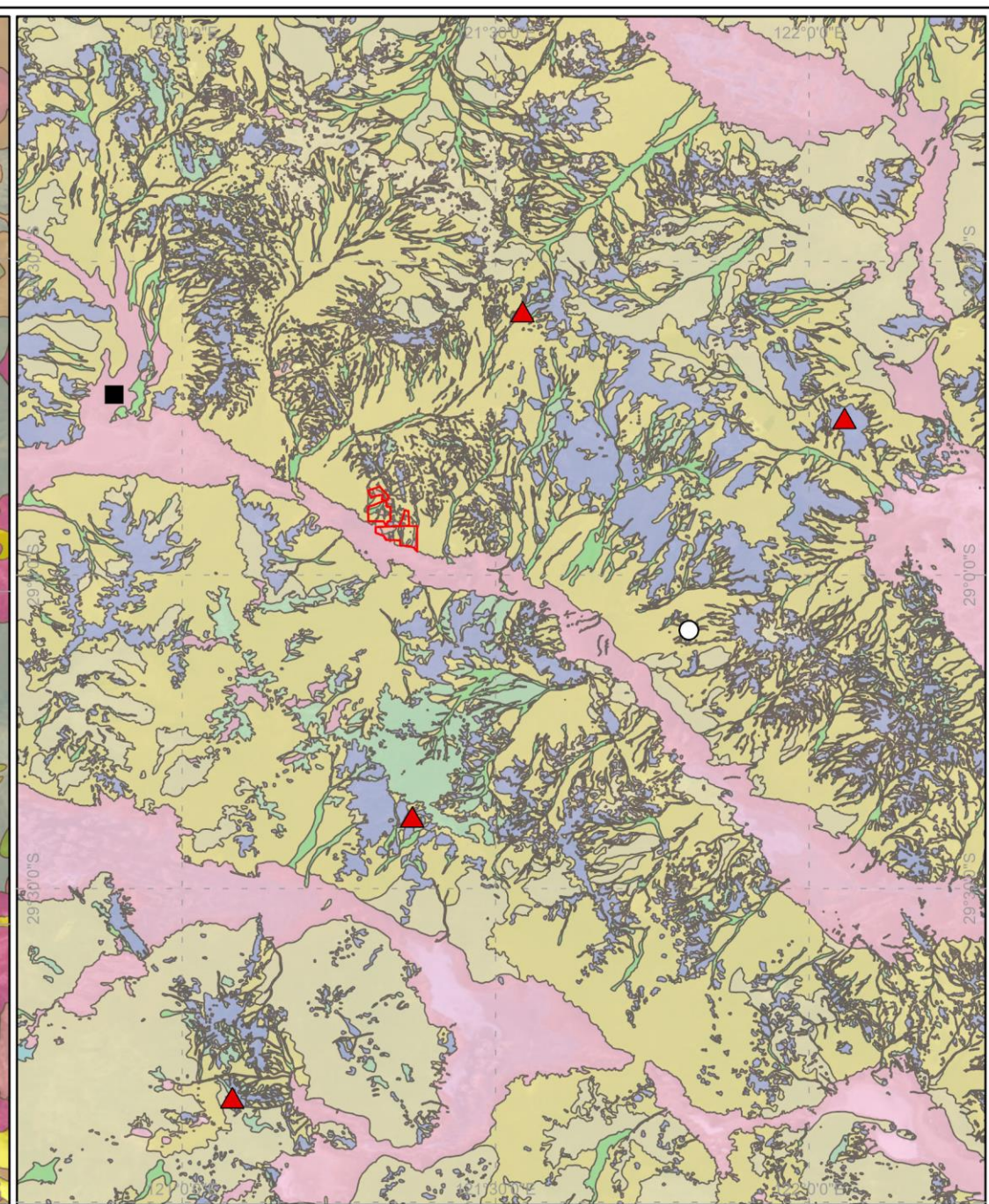
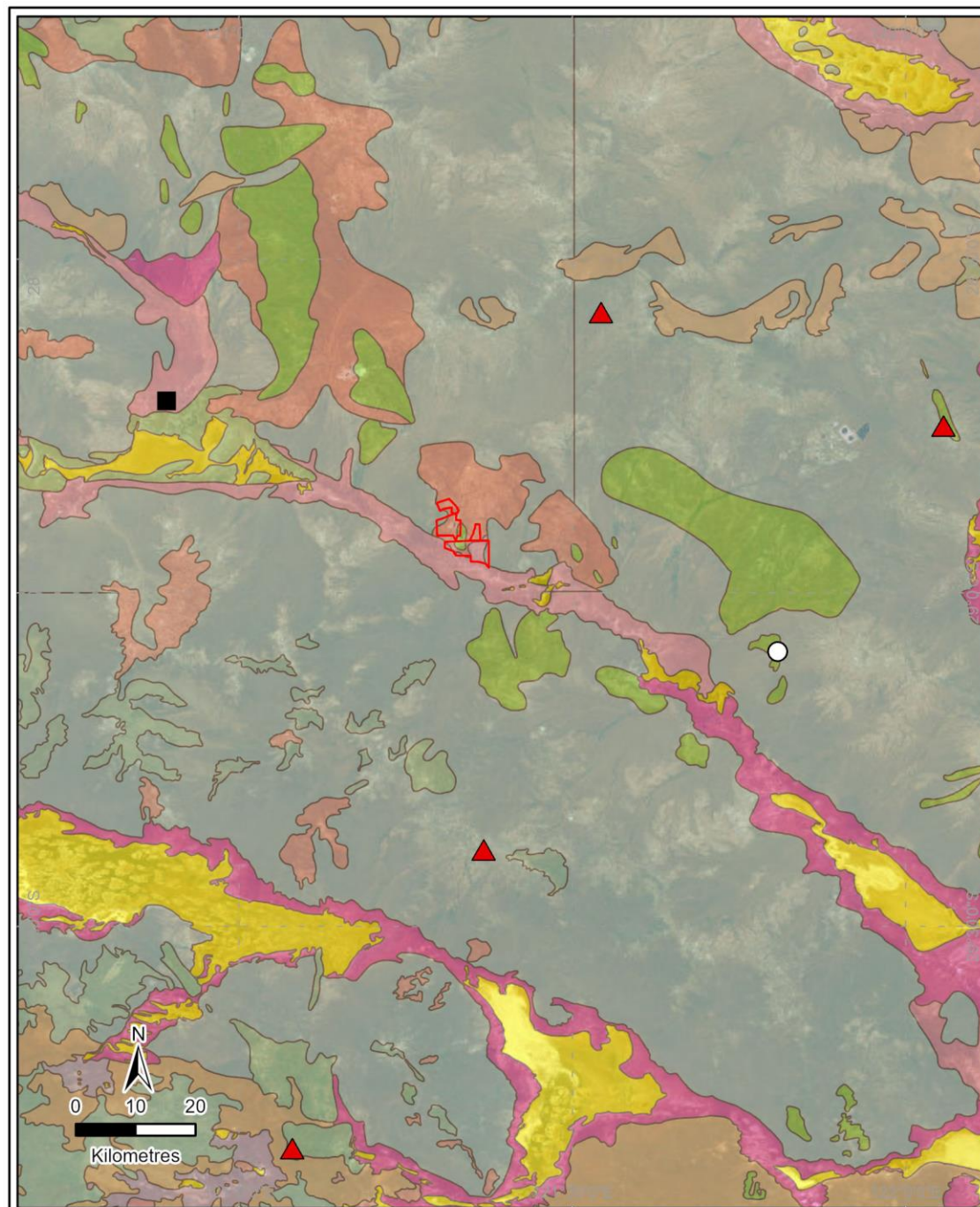


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Legend	
Project Area	Vegetation
Nesidiochernes sp.	109
Atemninae sp.	125
	18
	251
	28
	389
	39
	483
	676
Alluvium	Colluvium
Anthropogenic areas	Exposed
Calcrete	Lacustrine
	Residual
	Sandplain

Figure 6. Location of Potential (Likely) SRE pseudoscorpions in the desktop search area.



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Legend

- Project Area
- Millipedes
- ▲ Antichiropus sp.
- Urodacus 'gibson 1?'

- Scorpions**
- Cercophonius sp.
 - Urodacus 'gibson 1?'

- Vegetation**
- 109
 - 125
 - 1413
 - 1446
 - 18
 - 182
 - 20
 - 251
 - 28

- 29
- 389
- 39
- 400
- 483

- 484
- 501
- 676
- 84
- 936

- Regolith**
- Alluvium
 - Anthropogenic areas
 - Calcrete

- Colluvium**
- Exposed
 - Lacustrine
 - Residual
 - Sandplain

Figure 7. Location of Potential (Likely) SRE scorpions and millipede in the desktop search area.

3. FIELD SURVEY

3.1. Methods

A field survey targeting invertebrates belonging to SRE Groups was carried out from 28-31 March 2023. The aim of the survey was to collect species from recognised SRE Groups from representative habitat types in the vicinity of the Project, focussing on those species recovered during the desktop assessment. A total of 10 sites were sampled in the vicinity of the Project area, with an additional site opportunistically sampled for a mygalomorph burrow (Figure 8 and Table 1; see Appendix 2 for site photographs). Sampling used active search methods that varied at each site according to habitat, biology of target taxa, and visual observations of burrows or other tell-tale signs of target species.

3.1.1. Sampling Techniques

Sampling techniques followed published guidelines (EPA 2016b). At least one hour was spent on each site, with two team members conducting the different techniques depending on the site type. Hand foraging was the only sampling technique used. No wet nor dry traps were set during the field survey.

Hand foraging consisted of actively searching for taxa belonging to SRE Groups in their preferred habitats, making basic assumptions about the target species' (or Group's) biology. Hand foraging techniques included:

- Log flipping and raking: turning over and breaking apart logs and dead wood in search of isopods, myriapods, and pseudoscorpions. Raking also helps to uncover camouflaged mygalomorph spider burrows or to uncover buried land snails that may aestivate below the surface.
- Rock flipping: turning over rocks and other debris in search of harvestmen, centipedes, and isopods. Rocks were returned to their natural position when possible.
- Leaf litter sieving: sieving leaf litter to target litter- and soil-dwelling species. Leaf litter sieving also uncovers small-bodied SRE species (such as pseudoscorpions, millipedes, and land snails). Two leaf litter samples per site were collected and transported in cloth bags to the laboratory and placed in Tullgren funnels to collect litter-dwelling invertebrates. Leaf litter typically comprised *Eucalyptus* and/or *Banksia* leaves.
- Leaf blowing: hand-held leaf blowers were used to remove leaf litter and reveal mygalomorph spider burrows covered by litter or otherwise difficult to identify unaided. If found, burrows were examined; burrows likely to house a mygalomorph spider were then excavated.
- Bark peeling and tree digging: removing pieces of bark from trees with smooth and exfoliating bark for inspection, and removing dirt from the bases of trees to search for SRE taxa. These techniques were only applied at sites containing trees (i.e. not only shrubs or spinifex).
- Night searching: with the aid of ultraviolet torches, selected sites were visited at night in search of scorpions, which fluoresce under ultraviolet light and are thereby easily detected.
- Burrow excavating: once a mygalomorph or scorpion burrow was found, the soil around it was gently removed using trowels and knives to reveal its extent. If the animal did not exit the burrow during this process, the burrow was lifted gently from beneath to stimulate movement. The animal was collected and placed in a vial.

3.1.2. SRE Habitat mapping

Habitat was mapped by integrating recognised vegetation units (Beard *et al.* 2013) with publicly available soil and landscape spatial layers. These categories were erected with a focus on habitat characteristics that are exploitable by SRE species, rather than solely emphasising the unique attributes of individual vegetation units. The vegetation units defined by Beard *et al.* (2013) offer intricate insights into the dominant plant species and associated understory taxa. However, for the specific purpose of identifying habitats suitable for species belonging to SRE Groups, a broader categorization approach was necessary.

These vegetation units were amalgamated into more generalised groups such as woodlands, shrublands, or steppe, among others. The characteristics of these vegetation units were then cross-referenced with landform and soil conditions to discern distinct SRE habitats; only landforms exhibiting significant differences, such as clay-loam floodplains versus hillslopes or ridges, were considered distinct habitats. Synthesising both biotic and abiotic spatial data facilitated a finer delineation of habitats, enabling more accurate assessments of habitat suitability and distribution. Importantly, the grouping of vegetation units was not solely based on their rarity within the project area, but rather on their overall structural attributes and their relationship with abiotic factors. Overall, this combined approach is more accurate and relevant to SREs than either approach alone.

In essence, this integrated approach to habitat mapping offers a comprehensive framework for conservation and management strategies, allowing us to identify habitats that may be crucial for SRE species, and the likelihood of potential impacts on populations of SRE species as a result of habitat clearing or other development activities.

3.1.3. Preservation and Identification Techniques

Specimens collected in the field through hand foraging techniques were placed in 100% ethanol. Specimens collected via all foraging techniques were transported to Bennelongia's laboratory for identification. Specimens were first sorted and separated from by-catch. When a specimen belonging to an SRE Group was found during this process, it was transferred to a labelled vial of 100% ethanol for further identification. Samples were sorted under a dissecting microscope and, where necessary, dissected and examined under a differential interference contrast compound microscope.

Specimens were identified to described species where possible using available keys and species descriptions. In many cases among SRE Groups, species descriptions and taxonomic frameworks are lacking. In these cases, specimens may be identified morphologically and/or genomically as belonging to discrete putative species that await formal description; such species are usually assigned placeholder codes (e.g. 'B01'). When the taxonomic framework is exceptionally poor and/or the specimen in question is damaged, juvenile, or of the nondiagnostic sex, the specimen is classified to the lowest level possible. These specimens often carry the miscellaneous designation "sp."

3.1.4. Molecular Methods

During the identification process, unidentifiable specimens (e.g. juvenile or damaged specimens) were flagged for DNA sequencing. Fifteen animals from the survey were flagged in this way and were sequenced to improve taxonomic resolution. For all samples, DNA was extracted using a Qiagen DNeasy Blood & Tissue kit (Qiagen 2006). For smaller animals, legs and other body parts (e.g. sections of the abdomen) were used for DNA extraction. For larger animals, and where possible, muscle tissue was collected from the legs. Elute volumes varied from 50 μ L to 100 μ L, and were dependent on the age, condition, and quantity of material available.

Primer combinations used for PCR amplifications were LCO1490:HCO2198, C1J1718:HCO2198, and LCO1490:HCOoutout, targeting the COI region of the mitochondrial genome; and 16SAR-L:16SBR-H targeting the 16S gene (Folmer *et al.* 1994; Schwendinger and Giribet 2005). PCR products were sequenced using dual-direction Sanger sequencing carried out by the Australian Genome Research Facility (AGRF). The returned sequences were edited and aligned manually in Geneious (version 2022.2.2; Kearse *et al.* 2012). Geneious was also used to calculate neighbour-joining phylogenetic trees with 1,000 bootstrap permutations.

Tamura-Nei genetic distances were measured as uncorrected *p*-distances (total percentage of nucleotide differences between squares). Sequences on GenBank and in grey literature were included in the phylogenetic analysis to provide a framework for assessing intra- and interspecific variation.

3.1.5. Survey Timing and Limitations

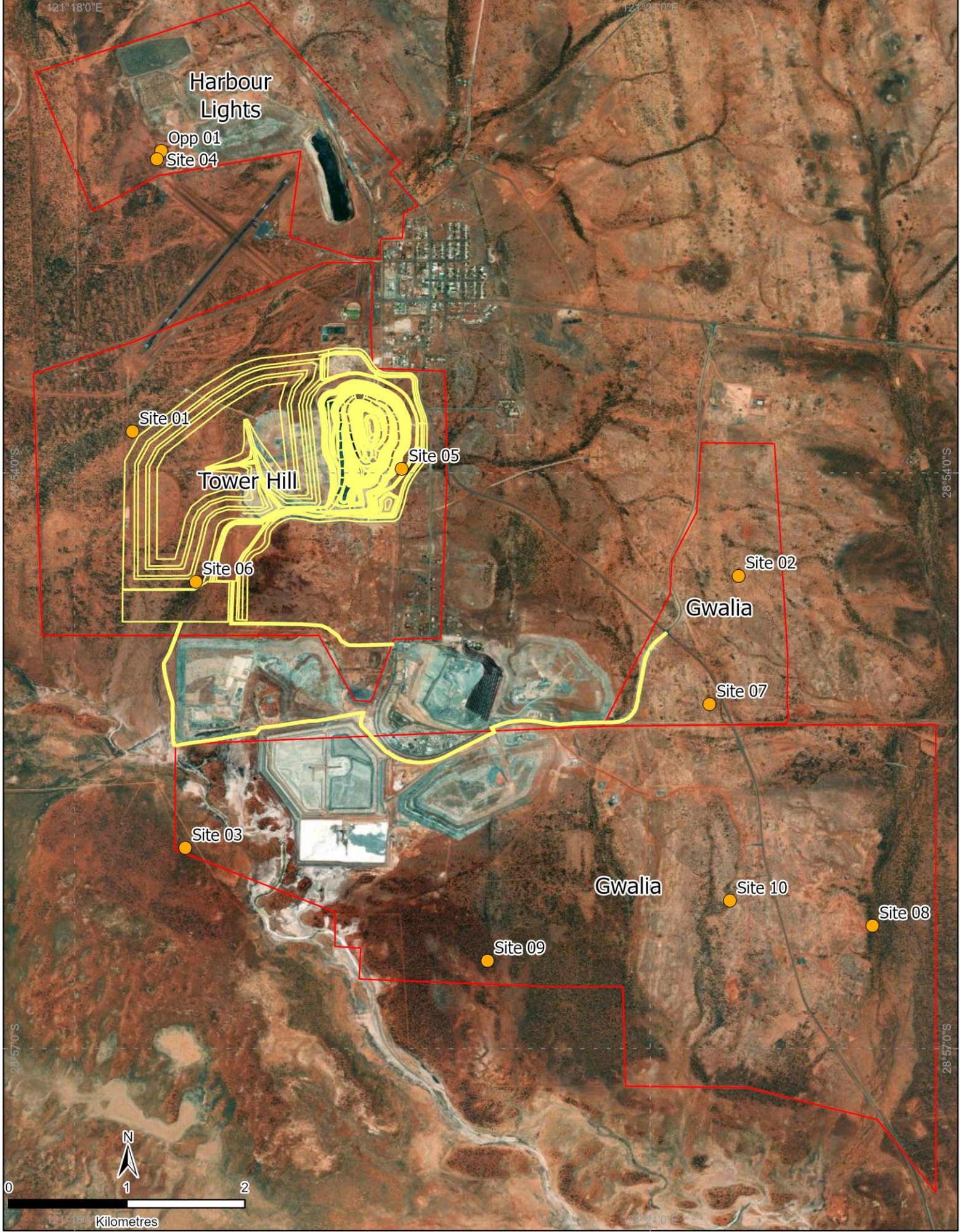
Many SRE Groups are active and therefore more likely to be collected during and immediately following substantial rainfall. Rainfall was recorded on the five days leading up to the survey (23-27 March; 8 mm total rainfall) and on two of the four survey days (2.2 mm on 30 March and 4.6 mm on 31 March), suggesting optimal survey timing.

3.1.6. Personnel

Field sampling was carried out by Vitor Marques and Jaxon Haines. Samples were sorted in the laboratory by Georgia Rice and Jaxon Haines. Samples were subsequently identified by Georgia Rice, Jaxon Haines, Kevin Sagastume Espinoza, Melanie McGellin, and Melita Pennifold. Molecular extraction was carried out by Heather McCletchie and analysis by Dan White.

Table 1. Sites sampled for SREs during the field survey.

Site Code	Lease	Latitude	Longitude	Date Visited	Soil Type
Site 01	Tower Hill	-28.8964	121.30504	28/03/2023	Alluvium drainage
Site 02	Gwalia	-28.90893	121.35768	29/03/2023	Colluvium
Site 03	Gwalia	-28.93257	121.30961	31/03/2023	Alluvium drainage
Site 04	Harbour Lights	-28.87273	121.30715	28/03/2023	Colluvium
Site 05	Tower Hill	-28.89965	121.32843	29/03/2023	Alluvium drainage
Site 06	Tower Hill	-28.90945	121.31053	31/03/2023	Alluvium drainage
Site 07	Gwalia	-28.92008	121.35516	29/03/2023	Exposed
Site 08	Gwalia	-28.93934	121.36929	29/03/2023	Alluvium drainage
Site 09	Gwalia	-28.94238	121.33588	29/03/2023	Lacustrine
Site 10	Gwalia	-28.93716	121.35694	29/03/2023	Colluvium
Opp 01	Harbour Lights	-28.87203	121.30752	28/03/2023	Colluvium near site 04






Legend	
	Project Area
	TWH LOM Impact area
	SRE Survey sites

Figure 8. SRE sampling sites in the Project area.

3.2. Survey Results

3.2.1. SRE Habitats in the Project area

Habitat mapping as described in section 3.1.2 identified nine general habitats in the Project area (Table 3; Figure 9). Of these, eight were moderately prospective for species belonging to SRE Groups, with disturbed areas (the ninth habitat) not considered prospective. All nine habitats also extended outside the Project area, where three additional habitats also occur (Table 2; Appendix 4).

The most abundant habitat within the Project area was the stony plains with bluebush shrubland, with over 1,690 ha, followed by disturbed areas, with over 550 ha (Table 3). The proposed impact area sits within three main habitats (excluding the already disturbed area): stony plains with bluebush shrubland, hardpan plains with mulga shrubland, and low greenstone hills and plains with mulga and chenopod shrublands (Figure 9), all of which are also abundant outside of the proposed impact areas.

Because of their extensive distribution, no significant impacts on the identified habitats are expected as a result of Project development.

Table 2. SRE Habitats identified as occurring in the Project area.

Grey highlighting represents habitats not found inside the Project area, but in close association to the same (see Appendix 4).

No.	SRE Habitat	Area (ha)
1	Stony plains with bluebush shrubland	1692.39
2	Sand and gravel flats adjacent in playa lakes or evaporation areas	0.92
3	Drainage lines	92.25
4	Hardpan plains with mulga shrubland	290.64
5	Low greenstone hills and plains with mulga and chenopod shrublands	161.09
6	Hardpan plains with sandy banks supporting tall mulga shrublands	143.10
7	Mixed dunes over alluvial deposits	215.95
8	Undulating plains and low stony hills with mulga and chenopod shrubland	324.88
9	Disturbed	554.54
10	Banded iron formation (BIF) ridges with mulga shrubland	NA
11	Stony hills on volcanic rocks with acacia shrublands	NA
12	Sandy plains with mulga shrubland	NA

3.2.2. Species Accounts

The survey collected 61 specimens from at least 18 identifiable species belonging to SRE Groups. Some specimens were immature or belonged to the nondiagnostic sex, so could not be identified to sufficient level to align them with other recorded species; such specimens are therefore not considered distinct species unless they are the only representatives of a higher taxonomic rank.

Recorded species comprise five mygalomorph spiders, three scorpions, three centipedes, one millipede, four pseudoscorpions, and two land snails (Table 3). Millipedes were the most abundant SRE group in the survey even though they were represented by only one identifiable species, along with several high order records from unidentified specimens. The least abundant groups were centipedes and land snails, with just five and six specimens, respectively (Table 3).

Of the 18 identifiable species collected from the field survey, 3 were categorised as Likely Potential SREs, 3 as Unlikely Potential SREs, 5 as Data Deficient Potential SREs, and 7 were Widespread. No Confirmed

SRE species have been identified as occurring in the Project area. Two of the Likely Potential SRE species are the undescribed mygalomorph spiders, *Aname* 'BMYG222' 'mellosa group' and *Idiosoma* 'BMYG221', and one is the undescribed pseudoscorpion species: *Indolpium* 'BPS496'.

Land snails

Two species of land snails were collected from the Project area, *Pupoides beltianus* and *Succinea* sp. Both species are categorised as Widespread and of no conservation concern for the purpose of the Project development.

Pseudoscorpions

Four species of pseudoscorpions were recovered from the Project area. Among them, three species (*Austrohorus* 'BPS498', *Beierolpium* 8/4 'BPS535', and *Indolpium* 'BPS497') were categorised as Data Deficient Potential SREs because they are known either from a single specimen or from a single collection location (Table 3) and available information is insufficient to provide further categorisation.

The other species, *Indolpium* 'BPS496', is currently known only from outside of the impact area. This species is known from a single habitat and is conservatively categorised as a Likely Potential SRE. However, despite a current lack of records, the species is expected to occur more abundantly outside the Project area: most samples have been collected from mulga trees, which are widespread and abundant inside and outside of the Project area.

Two pseudoscorpion specimens were only able to be identified to higher order Family level as they were juveniles and could not be identified further (Table 3).

Scorpions

Three species of scorpions were identified from the Project area: *Lychas* 'SCO039' (*annulatus* complex), *Urodacus* 'BSCO055', and *U.* 'BSCO070'. One of them, *Lychas* 'SCO039' (*annulatus* complex), is a Widespread species, but is likely a species complex comprising several cryptic, undescribed species. This species was collected from both inside and outside the impact area.

Both *Urodacus* species are categorised as Unlikely Potential SREs. *Urodacus* 'BSCO055' is known to occur approximately 75 km NE of the Project area and in the present survey was collected only from outside the impact area. *Urodacus* 'BSCO070' was collected only from inside the impact area in the present survey, but it is also known to occur approximately 170 km NE of the Project area. Given the currently known distributions of both species are relatively broad, they are not considered of conservation concern in the context of the Project.

Mygalomorph spiders

Five species of mygalomorph spiders were collected, from three families: Anamidae, Barychelidae, and Idiopidae. The family Barychelidae was represented by a single Widespread species (*Synothele arrakis*), while the families Anamidae and Idiopidae were each represented by two species: *Aname* 'BMYG222' 'mellosa group' and *A.* 'MYG629'; and *Idiosoma* 'BMYG221' and *I.* 'MYG256', respectively.

Aname 'BMYG222' 'mellosa group' was collected for the first time during the present survey. Morphological and molecular identification confirmed that it did not match any known species of *Aname*. This species is currently only known from the survey area, from sites inside and outside of the proposed impact area, and from a single habitat (Figure 9), so it is categorised as a Likely Potential SRE. *Aname* 'MYG629' is part of the *mellosa* group, has been collected previously from the Murchison Bioregion, and is considered Widespread (Rix *et al.* 2021).

The species *Idiosoma* 'MYG256' is categorised as an Unlikely Potential SRE as it has been previously collected from localities approximately 100 km NE of the Project area and so is unlikely to have a restricted distribution. By contrast, *Idiosoma* 'BMYG221' is currently known from only two localities

sharing a single habitat type: one in the proposed impact area and the other inside the Project boundary but outside the proposed impact area. Considering its small known distribution, we categorise this species as a Likely Potential SRE.

Centipedes

Three species of centipedes were collected from the Project area: *Scolopendra morsitans*, *Mecistocephalus* `BGE074`, and *Lamyctes* `BLITH003`. *Scolopendra morsitans* is a Widespread species distributed throughout most of Australia (Atlas of Living Australia 2024). The other two species, *Mecistocephalus* `BGE074` and *Lamyctes* `BLITH003`, were represented by singleton specimens collected from inside the impact area (Table 3); because they are singletons, they are categorised as Data Deficient Potential SREs. However, given the habitats where the species were collected, it is likely they will have wider distributions outside of both the impact area and the Project area.

Millipedes

A single species of millipede was collected from the Project area, the Widespread *Phryssonotus novaehollandiae*. This species is known to have the most widespread distribution of any native Australian millipede species (Short and Huynh 2009), and is therefore of no conservation concern. No records of the SRE genus *Antichiropus* were found from the Project area, even though the genus was recovered during the desktop assessment. It is likely the survey area lacks suitable habitat for this genus, or that, if the genus is present in the Project area, it might be so in low densities.

Table 3. Species from SRE Groups collected from the Project area.

Orange highlighting indicates Likely Potential SRE category. Blue highlighting indicates an Unlikely Potential SRE category. Grey highlighting indicates Data Deficient Potential SRE category.

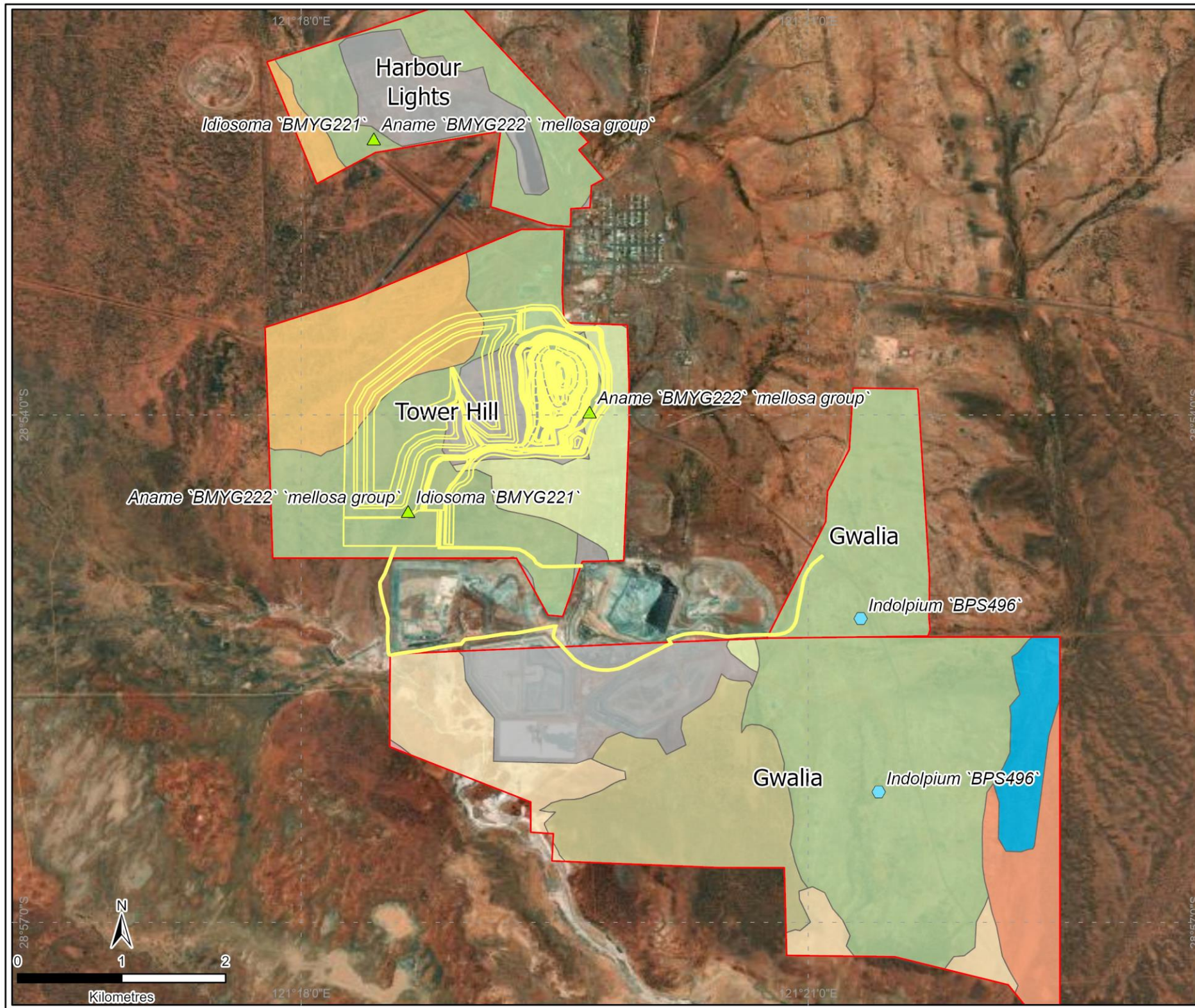
No	Lowest ID	Specimen count	SRE Status	Comments	Collection records and sites
Stylommatophora					
1	<i>Pupoides beltianus</i>	3	Widespread		
2	<i>Succinea</i> sp.	3	Widespread		
Pseudoscorpiones					
3	<i>Austrohorus</i> `BPS498`	1	Data Deficient Potential SRE	Singleton specimen.	Outside impact area; Site 2
4	<i>Beierolpium</i> 8/4 `BPS535`	4	Data Deficient Potential SRE	Single collection locality.	Outside impact area; Site 2
5	<i>Indolpium</i> `BPS496`	3	Likely Potential SRE	Currently only known from two localities outside of the impact area and from a single habitat.	Outside impact area; Sites 7 and 10
6	<i>Indolpium</i> `BPS497`	1	Data Deficient Potential SRE	Singleton specimen.	Outside impact area; Site 3
	Atemnidae sp.	1	Higher order ID		
	Olpiidae sp.	1	Higher order ID		
Scorpiones					
7	<i>Lychas</i> `SCO039` (<i>annulatus</i> complex)	6	Widespread	Widespread undescribed species likely to be part of a species complex.	Inside and Outside impact area; Sites 5, 7, and 9
8	<i>Urodacus</i> `BSCO055`	1	Unlikely Potential SRE	Known from localities approximately 75 km NE from the Project area.	Outside impact area; Site 4
9	<i>Urodacus</i> `BSCO070`	1	Unlikely Potential SRE	Known from localities approximately 170 km NE from the Project area.	Inside impact area; Site 6
Araneae					

No	Lowest ID	Specimen count	SRE Status	Comments	Collection records and sites
10	<i>Aname</i> `BMYG222` ` <i>melloso</i> group`	3	Likely Potential SRE	Currently only known from the survey area, however, it has been collected from outside of the proposed impact area. Collected from single habitat.	Inside and Outside impact area, also collected at sites on Harbour Lights; Sites 4, 5, and 6
11	<i>Aname</i> `MYG629`	1	Widespread	Recovered from desktop assessment.	Outside impact area; Site 7
12	<i>Idiosoma</i> `BMYG221`	4	Likely Potential SRE	Known only from two sites at a single habitat type.	Inside and Outside impact area, also collected at sites on Harbour Lights; Sites 4 and 6
13	<i>Idiosoma</i> `MYG256`	1	Unlikely Potential SRE	Known also from localities over 150 km from Project area.	Outside impact area; Site Opp 1
14	<i>Synothele arrakis</i>	1	Widespread	Closest records range between 30 linear km up to 160 linear km.	Outside impact area; Site 7
	Myriapoda				
	Scolopendrida				
15	<i>Scolopendra morsitans</i>	1	Widespread		Inside impact area; Site 6
	Geophilida				
16	<i>Mecistocephalus</i> `BGE074`	1	Data Deficient Potential SRE	Singleton specimen.	Inside impact area; Site 6
	Mecistocephalidae sp.	2	Higher order ID		
	Lithobiomorpha				
17	<i>Lamyctes</i> `BLITH003`	1	Data Deficient Potential SRE	Singleton specimen.	Inside impact area; Site 6
	Polyxenida				
18	<i>Phryssonotus novaehollandiae</i>	11	Widespread		Inside and Outside impact area; Sites 2, 4, 5, 7, and 8
	Polyxenidae sp.	10	Higher order ID		
	Total	61			

Figure 9. Potential SRE species recovered from the field survey mapped over SRE habitats.

Legend

- Project Area
- TWH LOM Impact area
- SRE Group**
- ▲ Araneae
- Pseudoscorpiones
- SRE Habitat**
- Disturbed
- Drainage lines
- Hardpan plains with mulga shrubland
- Hardpan plains with sandy banks supporting tall mulga shrublands
- Low greenstone hills and plains with mulga and chenopod shrublands
- Mixed dunes over alluvial deposits
- Sand and gravel flats adjacent in playa lakes or evaporation areas
- Stony plains with bluebush shrubland
- Undulating plains and low stony hills with mulga and chenopod shrubland



3.3. Discussion and conclusions

Numerous habitats potentially prospective for species from SRE Groups were identified in the Project area. Two habitats stand out as the most likely to host SRE species: stony plains with bluebush shrubland, and hardpan plains with mulga shrubland, both of which are abundant inside and outside the Project area (Appendix 4). These habitats are primarily dominated by grasses and shrublands with high densities of mulga (*Acacia* spp.), and soils characterised by combinations of gravel, sands, or silts from alluvium or colluvium. These habitats conditions are often ideal for species of burrowing animals such as mygalomorph spiders or burrowing scorpions. Additionally, the vegetation species found within these habitats are ideal for pseudoscorpion species as they often inhabit microhabitats under bark or among leaf litter. Other bark- or leaf-dwelling terrestrial invertebrate groups may also benefit from these habitat types, such as centipedes and millepedes. Drainage lines adjacent to these habitat types may also yield species from SRE Groups, particularly groups associated with more humid environments such as land snails and slaters. Overall, the presence of these two habitat types both within and beyond the Project boundaries suggest that Project activities will not significantly affect their availability, nor populations of SRE Groups restricted to those habitat types.

The field survey recovered relatively few species from SRE Groups (18). Slaters (Crustacea: Isopoda) are commonly collected during SRE surveys, and their absence here is noteworthy. It is possible the high sun exposure and low humidity in the general area render it less likely for slater species to occur; alternatively, if slaters do occur in the area, they might not have been collected because none of the survey sites occurred on drainage lines, with which slaters are typically associated. Nevertheless, representatives of all other major SRE Groups (excluding velvet worms) were recovered from the Project area. Thus, the absence of slaters and the relatively low diversity notwithstanding, the area is evidently capable of supporting SREs.

Six of the species collected were categorised as Potential SREs (Likely or Unlikely), five are Data Deficient, and the remainder are known or expected to have widespread distributions. None of the six Potential SRE species is expected to be significantly affected by Project development. One species, the Unlikely Potential SRE mygalomorph spider *Idiosoma* `MYG256`, is known to occur abundantly outside of the Project area and from numerous localities, some over 150 km from the Project area. The other two Unlikely Potential SRE species, the burrowing scorpions *Urodacus* `BSCO055` and *U.* `BSCO070`, also occur outside the Project area, in localities approximately 75 km and 170 km NE from the Project area, respectively. The three Likely Potential SRE species, the pseudoscorpion *Indolpium* `BPS496` and the mygalomorph spiders *Aname* `BMYG222` `mellosa group` and *Idiosoma* `BMYG221`, are currently only known from the Project area. However, all three were collected from widespread habitats and are expected to occur in other habitats which extend beyond the Project area.

Based on the current known distributions of these species, the size of the proposed impact area, and the limited impact on the identified habitats, it is not expected that there will be any significant impacts on the populations of the Potential SRE species due to the development of the Project.

4. REFERENCES

- Atlas of Living Australia (2024) Search and analysis tool. <https://bie.ala.org.au/>, retrieved 2024.
- Beard, J.S. (1975) The vegetation survey of Western Australia. *Plant Ecology* **30**(3): 179-187.
- Beard, J.S., Beeston, G.R., Harvey, J.M., Hopkins, A.J.M., and Shephard, D.P. (2013) The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second Edition. *Conservation Science Western Australia* **9**(1): 1-152.
- Bennelongia (2020) Ecological and conservation values of SREs in the BIF Ridge Project at Mt Morgans. Bennelongia, Jolimont WA 6014, 27 pp.
- Bennelongia (2022a) Ben Hur & King of Creation Short-Range Endemic Desktop and Baseline Survey.
- Bennelongia (2022b) Lots 802 and 803 Erindale Road, Hamersley: SRE Invertebrate Assessment DRAFT. Bennelongia Pty Ltd, Jolimont, 45 pp.
- Bennelongia (in prep) Balline Garnet Project Short Range Endemics Survey Report 2022. Bennelongia, Jolimont, WA,
- Bond, J.E., and Stockman, A.K. (2008) An integrative method for delimiting cohesion species: finding the population-species interface in a group of Californian trapdoor spiders with extreme genetic divergence and geographic structuring. *Systematic Biology* **57**: 628-646.
- Bradley, R.A. (1986) The relationship between population density of *Paruroctonus utahensis* (Scorpionida: Vaejovidae) and characteristics of its habitat. *Journal of Arid Environments* **11**(2): 165-171.
- Cao, X., Liu, J., Chen, J., Zheng, G., Kuntner, M., and Agnarsson, I., 2016. Rapid dissemination of taxonomic discoveries based on DNA barcoding and morphology.
- Car, C.A., and Harvey, M.S. (2014) The millipede genus *Antichiropus* (Diplopoda: Polydesmida: Paradoxosomatidae), part 2: species of the Great Western Woodlands region of Western Australia. *Records of the Western Australian Museum* **29**: 20-78.
- Car, C.A., Harvey, M.S., Hillyer, M.J., and Huey, J.A. (2019) The millipede genus *Antichiropus* (Diplopoda: Polydesmida: Paradoxosomatidae), part 3: species of the Pilbara bioregion of Western Australia. *Zootaxa* **4617**(1): 1-71.
- Car, C.A., Wojcieszek, J.M., and Harvey, M.S. (2013) The millipede genus *Antichiropus* (Diplopoda: Polydesmida: Paradoxosomatidae), part 1: redefinition of the genus and redescriptions of existing species. *Records of the Western Australian Museum* **28**: 83-118.
- Cowan, M., 2001. Murchison 1 (MUR 1 - East Murchison subregion), A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management, pp. 466-479.
- EPA (2016a) Statement of Environmental Principles, Factors and Objectives. Environmental Protection Authority, Perth, WA, 6 pp.
- EPA (2016b) Technical Guidance - Sampling of short range endemic invertebrate fauna. Environmental Protection Authority, Perth, WA, 35 pp.
- EPA (2018) Statement of Environmental Principles, Factors and Objectives. Environmental Protection Authority, Perth, WA, 6 pp.
- Folmer, O., Black, M., Hoeh, W., Lutz, R., and Vrijenhoek, R. (1994) DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology* **3**: 294-299.
- Harvey, M.S. (1986) The Australian Geogarypidae, new status, with a review of the generic classification (Arachnida, Pseudoscorpionida). *Australian Journal of Zoology* **34**(5): 753-778.
- Harvey, M.S. (2002) Short-range endemism amongst the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* **16**(4): 555-570.
- Hogg, H.R. (1902) On some additions to the Australian spiders of the suborder Mygalomorphae. *Proceedings of the Zoological Society of London*(2): 121-142.
- Kearse, M., Moir, R., Wilson, A., et al. (2012) Geneious Basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. *Bioinformatics* **28**: 1647-1649.

- Koch, L. (1983a) Morphological characters of Australian scolopendrid centipedes, and the taxonomy and distribution of *Scolopendra morsitans* L. (Chilopoda: Scolopendridae: Scolopendrinae). *Australian Journal of Zoology* **31**(1): 79-91.
- Koch, L.E. (1977) The taxonomy, geographic distribution and evolutionary radiation of Australo-Papuan scorpions. *Records of the Western Australian Museum* **5**: 83-367.
- Koch, L.E. (1978) A comparative study of the structure, function and adaptation to different habitats of burrows in the scorpion genus *Urodacus* (Scorpionida, Scorpionidae). *Records of the Western Australian Museum* **6**(2): 28.
- Koch, L.E., 1982. Taxonomy of the centipede *Scolopendra laeta* Haase (Chilopoda: Scolopendridae) in Australia.
- Koch, L.E. (1983b) Revision of the Australian centipedes of the genus *Cormocephalus* Newport (Chilopoda: Scolopendridae: Scolopendrinae). *Australian Journal of Zoology* **31**(5): 799-833.
- Koch, L.E. (1984) Australian species of the centipede genus *Arthrorhabdus* Pocock (Chilopoda: Scolopendridae: Scolopendrinae). *Journal of Natural History* **18**(3): 363-368.
- Main, B.Y. (1956) Taxonomy and biology of the genus *Isometroides* Keyserling (Scorpionida). *Australian Journal of Zoology* **4**(2): 158-164.
- Main, B.Y. (1983) Further studies on the systematics of Australian Diplurinae (Chelicerata: Mygalomorphae: Dipluridae): two new genera from south western Australia. *Journal of Natural History* **17**(6): 923-949.
- Main, B.Y. (2003) Demography of the shield-back trapdoor spider *Idiosoma nigrum* in remnant vegetation of the Western Australian Wheatbelt. *Records of the South Australian Museum Monograph Series* **7**: 179-185.
- Main, B.Y., Sampey, A., and West, P.L.J. (2000) Mygalomorph spiders of the Southern Carnarvon Basin, Western Australia. *Records of the Western Australian Museum* **61**: 13.
- Miglio, L.T., Harms, D., Framenau, V.W., and Harvey, M.S. (2014) Four new mouse spider species (Araneae, Mygalomorphae, Actinopodidae, *Missulena*) from Western Australia. *ZooKeys* **410**: 121-148.
- Polis, G.A., 1990. The biology of scorpions. Stanford University Press.
- Qiagen (2006) 'DNeasy blood & tissue handbook.' In (Qiagen) Available at <https://www.qiagen.com/au/resources/resourcedetail?id=6b09dfb8-6319-464d-996c-79e8c7045a50&lang=en>
- Raven, R.J. (1994) Mygalomorph spiders of the Barychelidae in Australia and the Western Pacific. *Memoirs of the Queensland Museum* **35**(2): 291-706.
- Rix, M.G., Huey, J.A., Cooper, S.J.B., Austin, A.D., and Harvey, M.S. (2018a) Conservation systematics of the shield-backed trapdoor spiders of the *nigrum*-group (Mygalomorphae, Idiopidae, *Idiosoma*): integrative taxonomy reveals a diverse and threatened fauna from south-western Australia. *ZooKeys* **756**.
- Rix, M.G., Huey, J.A., Main, B.Y., Waldock, J.M., Harrison, S.E., Comer, S., Austin, A.D., and Harvey, M.S. (2017a) Where have all the spiders gone? The decline of a poorly known invertebrate fauna in the agricultural and arid zones of southern Australia. *Austral Entomology* **56**(1): 14-22.
- Rix, M.G., Raven, R.J., and Harvey, M.S. (2018b) Systematics of the giant spiny trapdoor spiders of the genus *Gaius* Rainbow (Mygalomorphae: Idiopidae: Aganippini): documenting an iconic lineage of the Western Australian inland arid zone. *Journal of Arachnology* **46**: 35.
- Rix, M.G., Raven, R.J., Main, B.Y., Harrison, S.E., Austin, A.D., Cooper, S.J.B., and Harvey, M.S. (2017b) The Australasian spiny trapdoor spiders of the family Idiopidae (Mygalomorphae: Arbanitinae): a relimitation and revision at the generic level. *Invertebrate Systematics* **31**(5): 566-634.
- Rix, M.G., Wilson, J.D., Huey, J.A., Hillyer, M.J., Gruber, K., and Harvey, M.S. (2021) Diversification of the mygalomorph spider genus *Aname* (Araneae: Anamidae) across the Australian arid zone: Tracing the evolution and biogeography of a continent-wide radiation. *Mol Phylogenet Evol* **160**: 107127.
- Rix, M.G., Wilson, J.D., Rix, A.G., Wojcieszek, A.M., Huey, J.A., and Harvey, M.S. (2019) Population demography and biology of a new species of giant spiny trapdoor spider (Araneae: Idiopidae: *Euoplos*) from inland Queensland: developing a 'slow science' study system to address a conservation crisis. *Austral Entomology* **58**(2): 282-297.

- Schwendinger, P.J., and Giribet, G. (2005) The systematics of the south-east Asian genus *Fangensis* Rambla (Opiliones: Cyphophthalmi: Stylocellidae). *Invertebrate Systematics* **19**(4): 297-323.
- Short, M., and Huynh, C. (2009) *Phryssonotus novaehollandiae* Silvestri, 1923: the sole Australian representative of the millipede Family Synxenidae. *Soil Organisms* **81**(3): 695-700.
- Shorthouse, D.J., and Marples, T.G. (1980) Observations on the burrow and associated behaviour of the arid-zone scorpion *Urodacus yaschenkoi* (Birula). *Australian Journal of Zoology* **28**(4): 581-590.
- Smith, G.T. (1995) Species richness, habitat and conservation of scorpions in the Western Australian wheatbelt. *Records of the Western Australian Museum* **52**: 55-66.
- Spectrum Ecology (2022) Leonora Operations flora and vegetation site visit and basic terrestrial fauna assessment. Spectrum Ecology, Leederville, WA, 116 pp.
- Stanisic, J., Shea, M., Potter, D., and Griffiths, O., 2017. Australian Land Snails: Volume 2 A field guide to southern, central and western species. Bioculture Press for the Australian Museum, Mauritius.
- Vahtera, V., Edgecombe, G.D., and Giribet, G. (2013) Phylogenetics of scolopendromorph centipedes: can denser taxon sampling improve an artificial classification? *Invertebrate Systematics* **27**(5): 578-602.
- Volschenk, E.S., Burbidge, A.H., Durrant, B.J., and Harvey, M.S. (2010) Spatial distribution patterns of scorpions (Scorpiones) in the arid Pilbara region of Western Australia. A Biodiversity Survey of the Pilbara Region of Western Australia, 2002 – 2007. Records of the Western Australian Museum, Perth, WA, 271–284 pp. pp.
- Volschenk, E.S., Harvey, M.S., and Prendini, L. (2012) A new species of *Urodacus* (Scorpiones: Urodacidae) from Western Australia. *American Museum Novitates* **3748**: 1-18.
- Volschenk, E.S., Smith, G.T., and Harvey, M.S. (2000) A new species of *Urodacus* from Western Australia, with additional descriptive notes for *Urodacus megamastigus* (Scorpiones). *Records of the Western Australian Museum* **20**.

Appendix 1: Bennelongia SRE Categories

Bennelongia SRE categories (modified from WAM system).

	Taxonomic Certainty	Taxonomic Uncertainty
Distribution < 10,000 km ²	<p>Confirmed SRE</p> <ul style="list-style-type: none"> • A known distribution of < 10,000 km² • The taxonomy is well known. • The group is well represented in collections and/or via comprehensive sampling 	<p>Likely Potential SRE</p> <ul style="list-style-type: none"> • Category applies where there are significant knowledge gaps, e.g. <ul style="list-style-type: none"> ○ Patchy sampling has resulted in incomplete knowledge of geographic distribution ○ Incomplete taxonomic knowledge ○ The group is not well represented in collections
Distribution > 10,000 km ²	<p>Widespread (not an SRE)</p> <ul style="list-style-type: none"> • A known distribution of > 10,000 km² • The taxonomy is well known • The group is well represented in collections and/ or via comprehensive sampling 	<p>Likely or Unlikely Potential SRE, depending on:</p> <ul style="list-style-type: none"> A) Habitat Indicators B) Research & Expertise C) Morphology Indicators D) Molecular Evidence E) Data Deficient (Considered Likely as default)

Indicators used to assign Likely or Unlikely modifier to Potential SRE species.

	Likely Potential SRE	Unlikely Potential SRE
A) Habitat	Single habitat prospective for SREs	Multiple habitats including non-prospective habitats
B) Research & Expertise	Based on knowledge of the biology/ecology of related species, expert considers it to be an SRE	Based on knowledge of the biology/ecology of related species, expert considers it to be widespread
C) Morphology	Not applicable	Not applicable
D) Molecular Evidence	Very high genetic variability within small sampled area	Not applicable
E) Data Deficient	Information lacking; precautionary approach	Not applicable

Appendix 2: Species identified in the desktop search area and their SRE status.

Bolded values indicate higher taxonomic ranks. No. refers to the number of individuals recorded across all records. Orange highlighting indicates higher order identifications of specimens that may be representatives of species listed. Blue highlighting indicates higher order identifications of specimens that are not represented elsewhere in the list; these entries are considered discrete species. Grey highlighting indicates identification of invasive species. WAM: Western Australian Museum. ALA: Atlas of Living Australia (2024).

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
Arthropoda								
Arachnida								
Araneae								
Actinopodidae								
	<i>Missulena occatoria</i>	1	Australia wide	Multiple		Widespread	(Miglio <i>et al.</i> 2014)	
	<i>Missulena sp.</i>	4	Higher order ID					
Anamidae								
	<i>Aname`glenorn sp. 2`</i>	2	Singleton	One	Found in widespread habitat	Potential (Data Deficient)		

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Aname</i> `MYG629`	5	113 km	Two	Found in widespread habitats	Widespread		
	<i>Aname</i> `Phoenix0055`	5	Singleton	One	Found in a widespread but patchily distributed habitat	Potential (Likely)		
	<i>Aname</i> `Phoenix0056`	1	Singleton	One	Found in a widespread but patchily distributed habitat	Potential (Likely)		
	<i>Aname</i> `Phoenix0058`	2	Singleton	One	Found in a widespread but patchily distributed habitat	Potential (Likely)		
	<i>Aname</i> sp.	2	Higher order ID					

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Kwonkan goongariensis</i>	1	84 km	Two	Found in widespread habitats and habitats not identified at the Project	Potential (Unlikely)	(Main 1983)	
Barychelidae								
	<i>Idiommata</i> sp.	1	Higher order ID		Found in widespread habitats	Potential (Unlikely)		Based on other known distributions of similar species utilising similar habitat in the broader Goldfields region.
	<i>Synothele arrakis</i>	2	365 km	Multiple	Found in widespread habitats and habitats not identified at the Project	Widespread	(Raven 1994)	
	<i>Trittame</i> sp.	1	Higher order ID		Found in widespread habitats	Potential (Unlikely)		

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	Barychelidae sp.	1	Higher order ID					
Idiopidae								
	<i>Eucyrtops eremaeus</i>	3	121 km	Two	Found in widespread habitats	Widespread		
	<i>Gaius villosus</i>	4	750 km	Multiple	Found in widespread habitats and habitats not identified at the Project	Widespread	(Rix <i>et al.</i> 2018b)	
	<i>Idiosoma</i> `MYG014`	1	105 km	Two	Found in widespread habitats	Widespread		
	<i>Idiosoma</i> `occidentalis sp. group`	3	Singleton	One	Found in patchy habitats	Potential (Unlikely)		

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Idiosoma manstridgei</i>	1	850 km	Multiple	Found in patchily distributed habitats and habitats not identified at the Project	Widespread	(Rix <i>et al.</i> 2017b)	
	<i>Idiosoma sp.</i>	21	Higher order ID					
Theraphosidae								
	<i>Selenotholus foelschei</i>	2	480 km	Multiple	Found in widespread habitat and habitats not identified at the Project	Widespread	(Hogg 1902)	
Pseudoscorpiones								
Atemnidae	Atemninae sp	1	Higher order ID		Found in patchily distributed habitats	Potential (Likely)		
Chernetidae								
	<i>Nesidiochernes sp.</i>	1	Higher order ID		Found in patchily distributed habitats	Potential (Likely)		

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	Chernetidae sp.	2	Higher order ID					
Garypinidae								
	<i>Solinus</i> sp.	1	Higher order ID		Found in widespread habitats	Potential (Unlikely)		
Geogarypidae								
	<i>Geogarypus taylori</i>	2	Australia Wide	Multiple	Collected in Vic, SA, NSW, NT, and WA	Widespread	(Harvey 1986)	
Olpiidae								
	<i>Austrohorus</i> sp.	2	Higher order ID		Found in widespread habitats and habitats not identified at the Project	Widespread		Olpiids generally not considered to be SREs
	<i>Beierolpium</i> 8/3 sp.	1	Higher order ID		Found in widespread habitats	Widespread		Olpiids generally not considered to be SREs

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Euryolpium</i> sp.	2	Higher order ID		Found in patchily distributed habitats	Potential (Unlikely)		Conservative approach based on potential habitat restrictions
	<i>Indolpium</i> sp.	3	Higher order ID		Found in widespread habitats	Widespread		Olpiids generally not considered to be SREs
	Olpiidae sp.	3	Higher order ID					
	Pseudoscorpiones sp.	1	Higher order ID					
Scorpiones								
Bothriuridae								
	<i>Cercophonius</i> sp.	1	Higher order ID		Found in patchily distributed habitats	Potential (Likely)		
Buthidae								

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Isometroides</i> `MM1`	1	29 km	Two	Found in widespread habitats	Potential (Unlikely)		
	<i>Isometroides</i> sp.	2	Higher order ID					
	<i>Isometroides vescus</i>	1	Western Australian distribution	Multiple		Widespread	(Main 1956)	
	<i>Lychas</i> `annulatus complex`	1	Widespread Species Complex	Two	Found in widespread habitats	Widespread		
	<i>Lychas jonesae</i>	13	142 km	Two	Found in widespread habitats and habitats not identified at the Project	Widespread	WAM and ALA	
	<i>Lychas</i> sp.	3	Higher order ID					

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
Urodacidae								
	<i>Urodacus</i> `gibson 1?`	1	Singleton	One	Found in patchily distributed habitat	Potential (Likely)		
	<i>Urodacus</i> `yeelirrie?`	3	1.3 km	Two	Found in widespread habitats and habitats not identified at the Project	Potential (Unlikely)		
	<i>Urodacus armatus</i> s.l.	5	205 km	Multiple	Found in widespread habitats and habitats not identified at the Project	Widespread		
	<i>Urodacus hoplurus</i>	1	186 km	Multiple	Found in widespread habitats and habitats not identified at the Project	Widespread		
	<i>Urodacus</i> sp.	17	Higher order ID					

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
Chilopoda								
Geophilida								
Chilenophilidae	Chilenophilidae sp.	1	Higher order ID		Found in widespread habitats	Potential (Unlikely)		
Mecistocephalidae	Mecistocephalidae sp.	1	Higher order ID		Found in patchily distributed habitats	Widespread		Family not considered to contain SREs
	Geophilida sp.	3	Higher order ID					
Scolopendrida								
Scolopendridae								
	<i>Arthrorhabdus paucispinus</i>	1	800 km	Multiple		Widespread	(Koch 1984)	
	<i>Cormocephalus</i> sp.	1	Higher order ID					
	<i>Cormocephalus turneri</i>	1	Southern Australia	Multiple		Widespread	(Koch 1983b)	
	<i>Scolopendra laeta</i>	15	Australia Wide	Multiple		Widespread	(Koch 1982; Vahtera <i>et al.</i> 2013)	

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Scolopendra morsitans</i>	5	Australia Wide	Multiple		Widespread	(Koch 1983a)	
Scutigerida								
Scutigeridae								
	<i>Pilbarascutigera</i> sp.	1	Higher order ID		Found in patchily distributed habitats	Potential (Unlikely)		Scutigerids considered unlikely to be SREs
Diplopoda								
Polydesmida								
Paradoxosomatidae								
	<i>Antichiropus</i> sp.	1	Higher order ID		Found in widespread habitats	Potential (Likely)	(Car and Harvey 2014; Car <i>et al.</i> 2019; Car <i>et al.</i> 2013)	<i>Antichiropus</i> millipedes known to have a high number of SREs
Malacostraca								
Isopoda								
Armadillidae								

Higher order identification	Lowest identification	No.	Known distribution	Number of known habitats	Comments on habitats	SRE status	Reference	Comment
	<i>Buddelundia</i> `39`	2	240 km	Multiple	Found in patchily distributed habitats and habitats not identified at the Project	Widespread		
Porcellionidae								
	<i>Porcellionides pruinosus</i>	6	Invasive Species				(Stanisic <i>et al.</i> 2017)	
Mollusca								
Gastropoda								
Stylommatophora								
Pupillidae								
	<i>Pupoides cf. adelaidae</i>	15			Found in patchily distributed habitats	Widespread	(Stanisic <i>et al.</i> 2017)	Likely <i>Pupoides adelaidae</i>
Succineidae								
	<i>Succinea</i> sp.	12	Higher order ID		Found in widespread habitats	Widespread	(Stanisic <i>et al.</i> 2017)	Mainland succineids tend to be widespread

Appendix 3: Photographs of Sites Sampled for SREs in March 2023

Site 01



Site 01



Site 02



Site 02



Site 03



Site 03



Site 04



Site 04



Site 05



Site 05



Site 06



Site 06



Site 07



Site 07



Site 08



Site 08



Site 09



Site 09



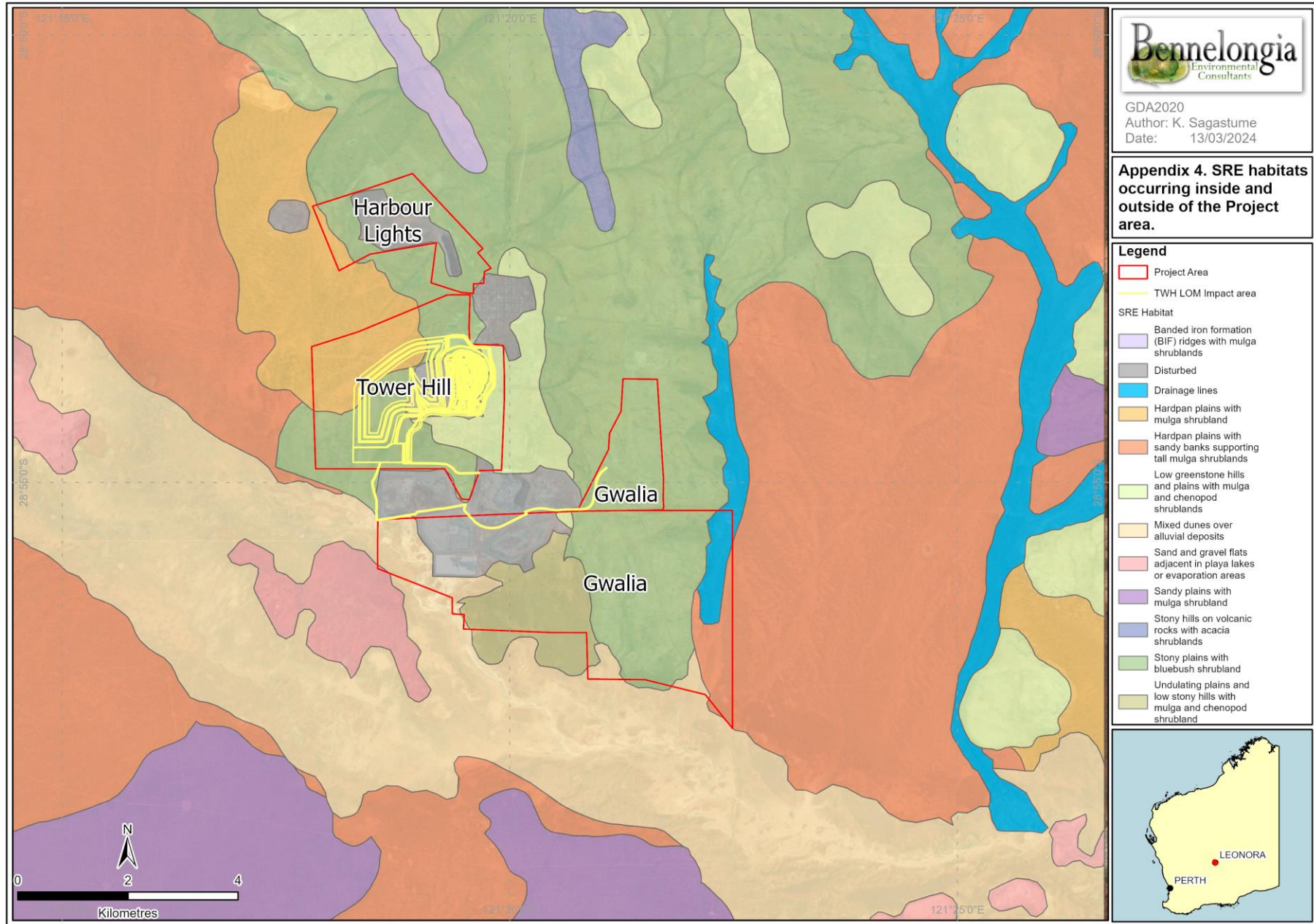
Site 10



Site 10



Appendix 4: Map of SRE Habitats inside and outside of the Project area





Assets | Engineering | Environment | Noise | Spatial | Waste

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