Great Central Road (SLK 52.2 – 101)

Biological Survey

Prepared for

mainroads
WESTERN AUSTRALIA

Version 2
September 2022

Prepared by
BOTANICA CONSULTING
33 Brewer St PERTH WA 6000 | 0419 916 034

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Disclaimer

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Cover Photo: Great Central Road survey area vegetation (taken 12th December 2021)

Prepared by: Lauren Pick
Senior Environmental Consultant
Botanica Consulting Pty Ltd

Reviewed by: Andrea Williams
Director
Botanica Consulting Pty Ltd

Approved by: Jim Williams
Director
Botanica Consulting Pty Ltd

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APPENDICES

1 EXECUTIVE SUMMARY

Main Roads Western Australia (Main Roads) is proposing to upgrade sections of the Great Central Road near the Cosmo Newberry community in the Shire of Laverton. Works for the proposal may include drainage improvements, road realignment, road widening and overlay on the Great Central Road. The biological survey is confined to the Great Central road reserve from SLK 52.2 – 101.

Botanica Consulting Pty Ltd (Botanica) was commissioned by Main Roads to undertake the following assessments of the Great Central Road (referred to as the 'study area'):

- Desktop assessment within a 40-kilometre (km) radius of the Great Central Road survey area (referred to as the 'desktop study area');
- Basic fauna survey of the Great Central Road survey area, covering an area of approximately 1,779 ha (referred to as the 'survey area'); and
- Targeted flora survey and detailed flora and vegetation survey of the Great Central Road survey area, covering an area of approximately 1,779 ha (referred to as the 'survey area').

Previous biological surveys were conducted within the survey area by Botanica from the 2nd to 6th December 2019, during which seven quadrats were established (50 m X 50 m). These quadrats were re-assessed during the current field survey conducted from the 12th to 13th December 2021. An additional eight quadrats (50 m X 50 m) were established during the current survey, giving a total of 15 quadrats within the current survey area.

Six vegetation types were identified within the survey area which were representative of two pre-European vegetation associations (association 18 and 1239) of the Great Victoria Desert System. These vegetation types were identified within two landform types and comprised of four major vegetation groups, which were represented by a total of 19 families, 33 genera and 68 taxa. No Threatened Flora or Threatened Ecological Communities listed under the Western Australian *Biodiversity Conservation (BC) Act 2016* and Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* was identified within the survey area.

Based on the vegetation condition rating scale specified in the Environmental Protection Authority (EPA) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016a), vegetation ranged from 'poor' to 'very good' with the majority of vegetation rated as 'good'. Disturbance in the area was a result of recent and/ or frequent fires and road siding of the Great Central Road. No introduced flora taxa were identified within the survey area.

No Priority Flora listed on the Department of Biodiversity, Conservation and Attractions (DBCA) database were identified as occurring within the survey area. The desktop assessment identified four Priority Flora taxa as possibly occurring within the survey area based on their broad habitat descriptions/ soil types including deep sand and sandplains. Based on the field assessment, no Priority Flora taxa were identified within the survey area and all Priority Flora identified as possible to occur from the desktop assessment were considered to be unlikely to occur within the survey area. No Priority Ecological Communities (as listed by DBCA) were identified within the survey area or the desktop study area.

Two fauna habitats were identified within the survey area. Results of the literature review identified 10 amphibians, 38 mammals (including ten bat species), 102 bird and 109 reptile species as having

been previously recorded in the general area, some of which have the potential to occur within the survey area.

Six significant fauna were identified as potentially occurring within the survey area based on their habitat preferences, including hummock grassland and sandplains:

1. Grey Falcon (*Falco hypoleucos*)-Threatened (Vulnerable EPBC Act and BC Act)
2. Princess Parrot (*Polytelis alexandrae*)-Threatened (Vulnerable EPBC Act) and Priority 4 (DBCA Priority Species)
3. Peregrine Falcon (*Falco peregrinus*)-Other specially protected species
4. Striated Grasswren (inland) (*Amytornis striatus* subsp*. striatus*)-Priority 4 (DBCA Priority Species)
5. Great Desert Skink (*Liopholis kintorei*)-Threatened (Vulnerable EPBC Act and BC Act)
6. Brush-tailed Mulgara *Dasycercus blythi* – P4 (DBCA Priority Species)

No Threatened fauna or other specially protected species as listed under the Western Australian BC Act or the Commonwealth EPBC Act was identified within the survey area. No Priority fauna as listed by DBCA were recorded within the survey area.

There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within the survey area nor proposed or gazetted conservation reserves within the survey area.

2 INTRODUCTION

Botanica Consulting Pty Ltd (Botanica) was commissioned by Main Roads Western Australia (Main Roads) to undertake the following assessments of the Great Central Road (referred to as the 'study area'):

- Desktop assessment within a 40-kilometre (km) radius of the Great Central Road survey area (referred to as the 'desktop study area');
- Basic fauna survey of the Great Central Road survey area, covering an area of approximately 1,779 ha (referred to as the 'survey area'); and
- Targeted flora survey and detailed flora and vegetation survey of the Great Central Road survey area, covering an area of approximately 1,779 ha (referred to as the 'survey area').

The survey area, extends for a length of approximately 34 km along the Great Central Road and 9km along the Cosmo bypass road located near the Cosmo Newberry community in the Shire of Laverton. The survey area is located approximately 50 km north-east of Laverton (Figure 2-1). Works for the proposal may include drainage improvements, road realignment, road widening and overlay on the Great Central Road. The biological survey is confined to the Great Central road reserve from SLK 52.2 – 101.

2.1 Objectives

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

1. Gather background information on flora and vegetation in the desktop study area (literature review, database and map-based searches);
2. Conduct a field survey to verify / ground truth the desktop assessment findings through reconnaissance survey;
3. Define and map vegetation communities of the survey area to a scale appropriate for the Bioregion and described according to the National Vegetation Information System (NVIS) classification (NVIS Level V – Association);
4. Record the species composition (abundance and diversity) of each vegetation community within the survey area and compile a species list for the survey area by vegetation type;
5. Provide quadrat-based data from plots representative of each vegetation type (minimum of three quadrats per vegetation type) according to Environmental Protection Authority (EPA) guidelines;
6. Assess the species composition of each quadrat;
7. Determine the local and regional significance of flora and vegetation within the survey area;
8. Identify and record the locations of any significant flora/vegetation within the survey area;
9. Identify and record the locations of any introduced flora species (including Declared Pests) within the survey area;
10. Provide a map showing the distribution of significant flora/vegetation within the survey area; and
11. Define and map the condition of vegetation within the survey area in accordance with the vegetation condition rating scale specified in the Environmental Protection Authority (EPA) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment – December 2016* (EPA, 2016a).

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

1. Gather background information on flora of significance in the local area (literature review, database and map-based searches);
2. Based on results of the desktop assessment, identify vegetation types within the survey area that have the potential to contain flora of conservation significance;
3. Conduct a field survey to identify flora of conservation significance within the survey area; and
4. Provide GPS records and spatial map showing the distribution of flora of conservation significance within the survey area and extent of population if extends beyond the survey area.

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

1. Undertake a literature review, including map-based information searches of all current and relevant literature sources and databases relating to the survey area;
2. Undertake a desktop investigation to identify any previously recorded occurrences of or potentially occurring Threatened and Priority listed fauna within the survey area;
3. Undertake searches on available databases for details relating to any Threatened and Priority listed fauna previously identified as occurring or potentially occurring within the survey area;
4. Conduct fauna habitat mapping and identify habitat types which are suitable for each significant fauna considered likely or possible to occur, or fauna recorded in the survey area;
5. Compile an inventory of fauna species occurrences within the survey area;
6. Undertake opportunistic, low intensity sampling of fauna; and
7. Report on the conservation status of species present using the Western Australian Museum and *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) databases for presence of Threatened and Priority listed fauna species within the survey area.

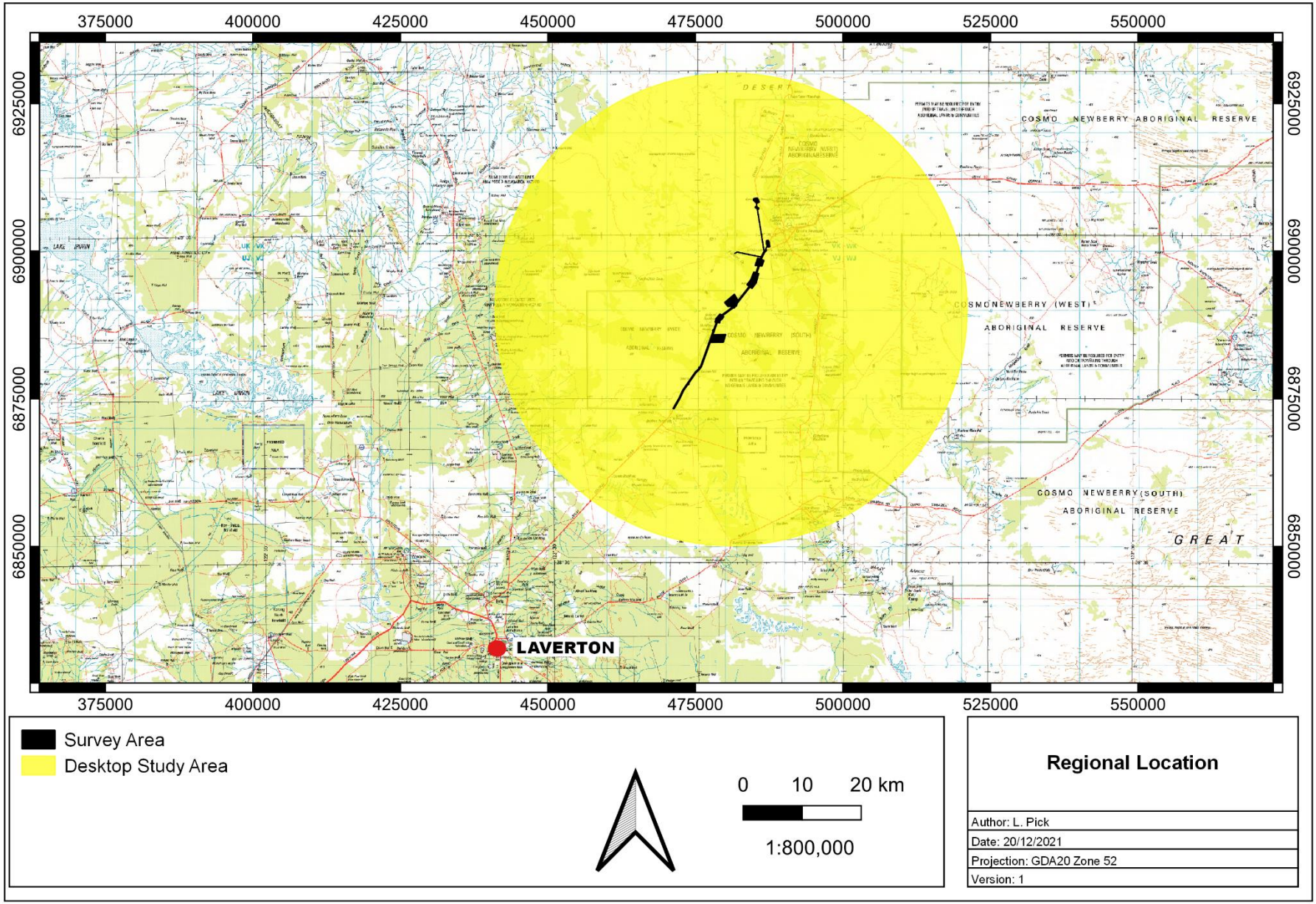


Figure 2-1: Regional map of the desktop study area/ survey area

3 REGIONAL BIOPHYSICAL ENVIRONMENT

3.1 Regional Environment

The study area lies within the Eremaean Province of WA. Based on the Interim Biogeographic Regionalisation of Australia (IBRA, Version 7) (DotEE, 2012) the study area is located within two Bioregions; Great Victoria Desert and Murchison. These Bioregions are further divided into subregions with the study area located within the East Murchison (MUR01) and Shield (GVD01) subregions. The survey area is located within the Shield (GVD01) subregion (Figure 3-1).

The Eastern Murchison (MUR01) subregion comprises the northern parts of the craton's Southern Cross and Eastern Goldfields Terrains and is characterised by internal drainage and extensive areas of elevated red desert sandplains with minimal dune development. Salt Lake systems are associated with the occluded paleodrainage system. Broad plains of red-brown soils and 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 and Samphire shrublands (McKenzie *et. al.,* 2002). The Eastern Murchison subregion comprises diverse mulga woodlands, which occur on low greenstone belts. The sand plains have red loamy earths and red deep sands are found on the sandy banks (Cowan, 2001).

The Shield (GVD01) subregion comprises salt lakes and major valley floors with lake derived dunes, sandplains with patches of seif dunes running east west and areas of moderate relief without-cropping and silcrete-capped mesas and plateaus (breakaways). The subregion contains a major palaeochannel of Ponton Creek. Spinifex (*Triodia* spp.) and mallee (*Eucalypt*us *kingsmillii, E. youngiana*) over hummock grassland dominated by *Triodia basedowii* occur on the aeolian sandplain. Scattered marble gum (*E. gongylocarpa*) and native pine (*Callitris*) occur on the deeper sands of the sand plains. Mulga and Acacia woodlands occur mainly on the colluvial and residual soils. Salt bush (*Atriplex*), Bluebush (*Maireana*), and samphire (*Tecticornia*) occur on the margins of salt lakes and in saline drainage areas (Barton & Cowan, 2001). The entire survey area and majority of the study area lies within the Shield (GVD01) subregion.

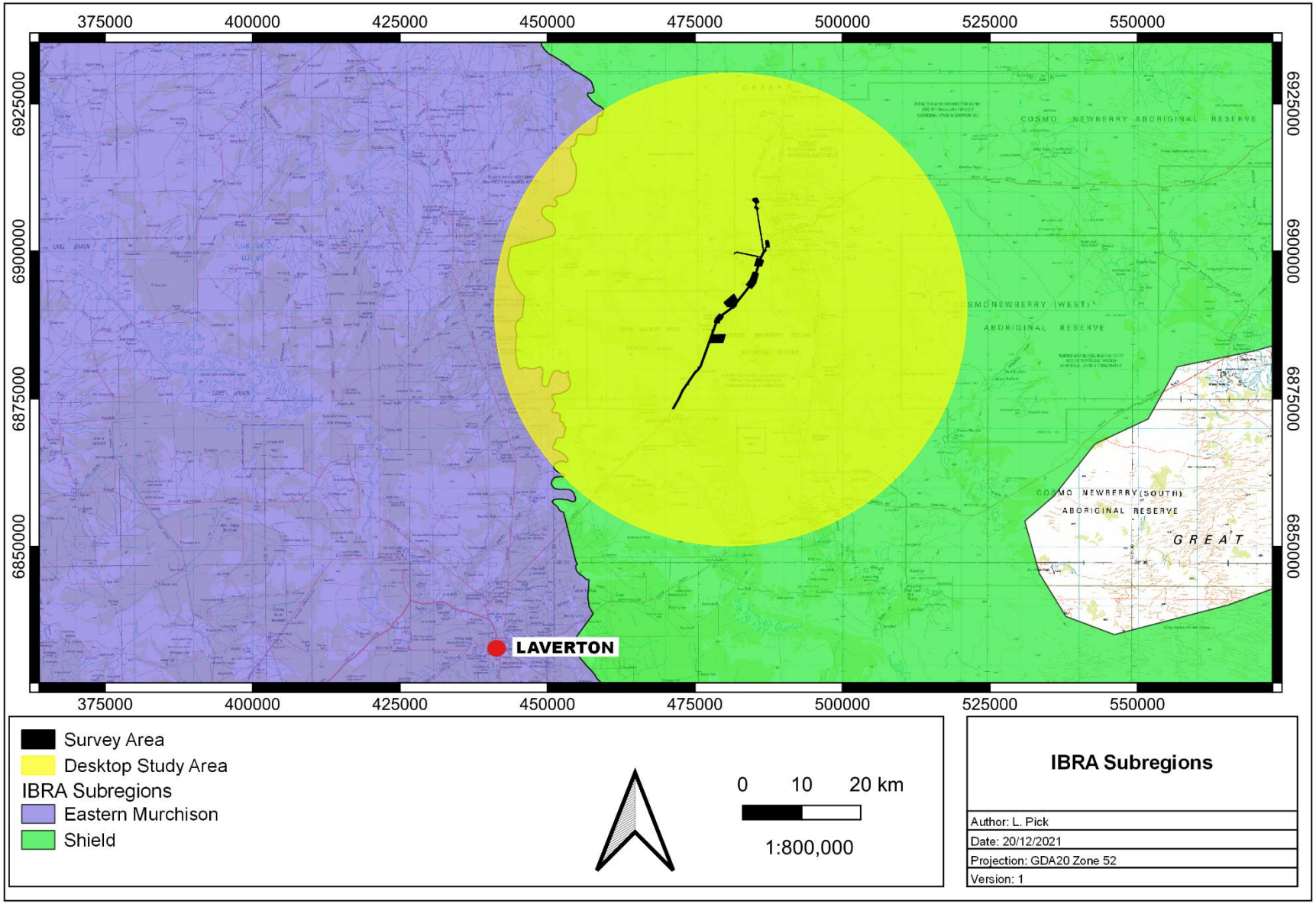


Figure 3-1: Map of IBRA subregions in relation to the desktop study area/ survey area

3.2 Soil Landscape Systems

Based on geographic information provided by Department of Primary Industries and Regional Development (DPIRD, 2018), the desktop study area is located within the Leemans Sandplain Zone (274) and Salinaland Plains Zone (279) of the Murchison Province (27). The survey area is located within the Leemans Sandplain Zone (274).

The Leemans Sandplain Zone (274) is characterised by sandplains (with some gravel plains, mesas and salt lakes) on granitic rocks of the Yilgarn Craton (Eastern Goldfields Superterrane). Soils consist of red sandy earths with red loamy earths and some red deep sands, red-brown hardpan shallow loams and calcareous loamy earths. Vegetation is predominantly spinifex grasslands with marble gum, mallee and mulga shrublands (and some halophytic shrublands). The zone is located in the south-western arid interior between Lake Wells and Lake Minigwal, to the east of Laverton (Tille, 2006).

The Salinaland Plains Zone (279) is characterised by sandplains (with hardpan wash plains and some mesas, stony plains and salt lakes) on granitic rocks (and some greenstone) of the Yilgarn Craton. Soils include red sandy earths, red deep sands, red shallow loams and red loamy earths with some red-brown hardpan shallow loams, salt lake soils and red shallow sandy duplexes. Vegetation is predominately mulga shrublands with spinifex grasslands (and some halophytic shrublands and eucalypt woodlands). This zone is located in the northern Goldfields from Lakes Barlee and Ballard to Wiluna and Laverton (Tille, 2006).

These zones are further divided into soil landscape systems within the desktop study area/ survey area described in Table 3-1 and shown in Figure 3-2 (ASRIS, 2014).

Table 3-1: Soil landscape systems within the desktop study area/ survey area

Zone	Landscape System/ Mapping Unit	Description
274 (Leemans Sandplain Zone)	Ararak System	Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses.
	Bandy System	Gritty-surfaced plains and low outcrops of granite with scattered acacia shrublands.
	Bullimore System	Gently undulating sandplain with occasional linear dunes and stripped surfaces supporting spinifex grasslands with mallees and acacia shrubs.
	Bevon System	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.
	BY7	Scarpland--low lateritic breakaways on granites and gneisses
	Carnegie System	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks, supporting halophytic shrublands and acacia tall shrublands.
	Challenge System	Gently undulating gritty and sandy surfaced plains, occasional granite hills, tors and low breakaways, supporting acacia shrublands and occasional halophytic shrublands.
	Cosmo System	Calcreted drainage tracts through sandplain with spinifex hummock grasslands and occasional black oak or mulga open woodlands.
	Crete System	Breakaways and lower plains based on weathered granites, supporting halophytic shrublands.
	Darlot System	Salt lakes, fringing saline alluvial plains, regularly arranged sandy banks and numerous claypans and swamps, supporting halophytic shrublands and spinifex and wanderrie grasslands.
	Gumbreak System	Low granite breakaways with extensive lower saline alluvial plains, supporting halophytic low shrublands.
	Gransal System	Stony plains and low rises based on granite supporting mainly halophytic low shrublands.
	Gundockerta System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.

Zone	Landscape System/ Mapping Unit	Description
	Laverton System	Greenstone hills and ridges with acacia shrublands.
	Melaleuca System	Sandy-surfaced plains and calcareous plains supporting spinifex or mulga shrublands with wanderrie grasses.
	Monitor System	Distributary alluvial fans and wash plains supporting mulga - chenopod shrublands.
	Pan System	Narrow unincised drainage tracts and claypans through sandplain supporting mulga shrublands and spinifex hummock grasslands.
	Sherwood System	Breakaways, kaolinised footslopes and extensive gently sloping plains on granite supporting mulga shrublands and minor halophytic shrublands.
	Sunrise System	Stony plains supporting mulga shrublands.
	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.
	Waguin System	Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains; supports bowgada and mulga shrublands with wanderrie grasses and minor halophytic shrublands.
	Windarra System	Gently undulating stony plains and low rises with quartz mantles on granite, supporting acacia-eremophila shrublands.
	Wyarri System	Granite domes, hills and tor fields with gritty-surfaced fringing plains supporting mulga and granite wattle shrublands.
	Yanganoo System	Almost flat hardpan wash plains, with or without small wanderrie banks and weak groving; supporting mulga shrublands and wanderrie grasses on banks.
279 (Salinaland Plains Zone)	Ararak System	Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses.
	Bevon System	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.
	Gransal System	Stony plains and low rises based on granite supporting mainly halophytic low shrublands.
	Jundee System	Hardpan plains with variable gravelly mantles and minor sandy banks supporting weakly groved mulga shrublands.
	Laverton System	Greenstone hills and ridges with acacia shrublands.
	Monk System	Hardpan plains with occasional sandy banks supporting mulga tall shrublands and wanderrie grasses.
	Nubev System	Gently undulating stony plains, minor limonitic low rises and drainage floors supporting mulga and halophytic shrublands.
	Sherwood System	Breakaways, kaolinised footslopes and extensive gently sloping plains on granite supporting mulga shrublands and minor halophytic shrublands.
	Sunrise System	Stony plains supporting mulga shrublands.
	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.
	Waguin System	Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains; supports bowgada and mulga shrublands with wanderrie grasses and minor halophytic shrublands.
	Windarra System	Gently undulating stony plains and low rises with quartz mantles on granite, supporting acacia-eremophila shrublands.
	Wyarri System	Granite domes, hills and tor fields with gritty-surfaced fringing plains supporting mulga and granite wattle shrublands.
Note 1: Green shaded cells indicate soil landscape system boundaries within the survey area		

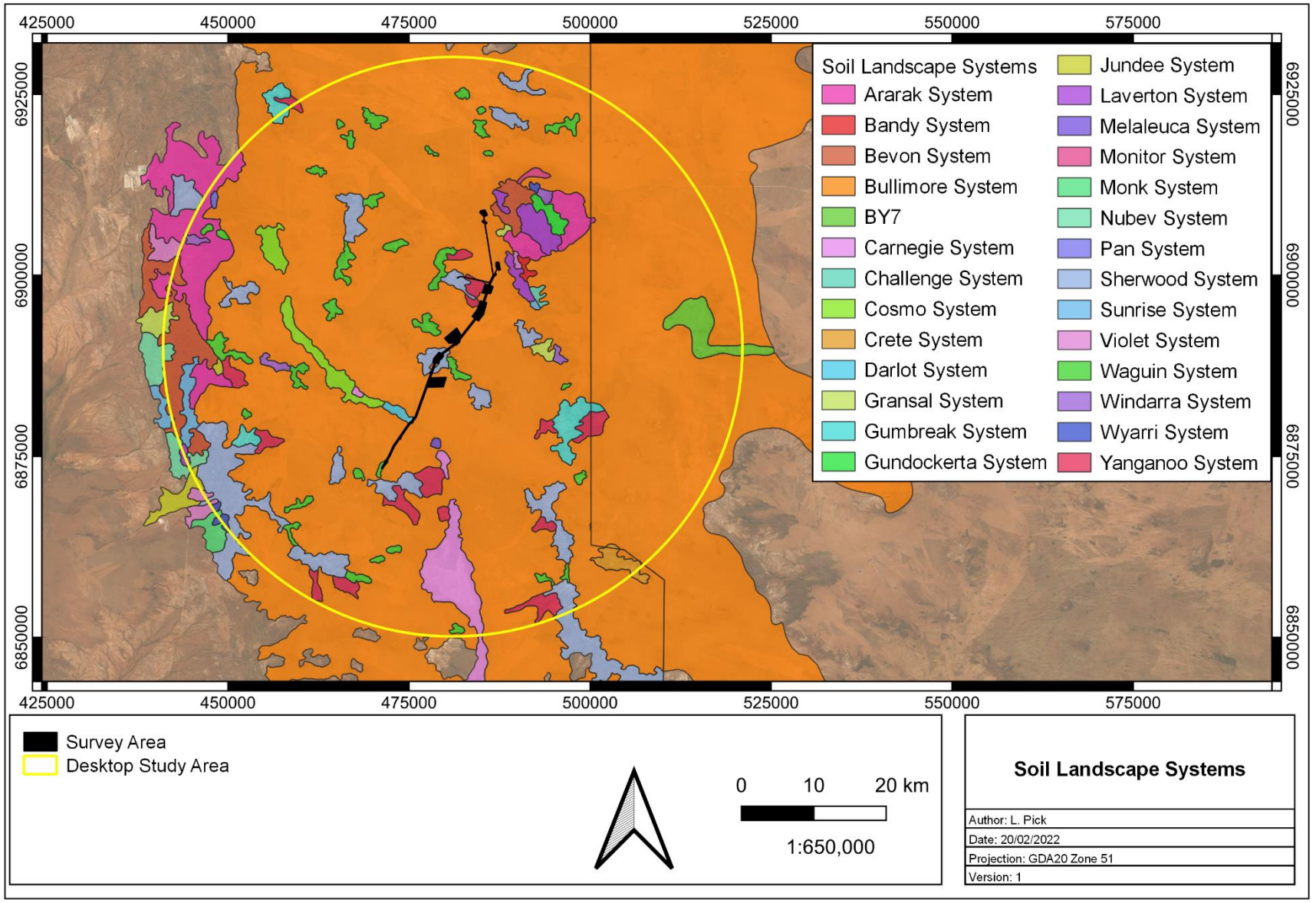


Figure 3-2: Map of soil landscape systems within the desktop study area*/* survey area

3.3 Vegetation

The DPIRD GIS file (2018) indicates that the desktop study area and survey area is located within Pre-European Beard vegetation associations of the Great Victoria Desert and Laverton systems of the Eastern Murchison and Great Victoria Desert subregions. The extent of these vegetation associations as specified in the *2018 Statewide Vegetation Statistics* (Government of Western Australia, 2019) is provided in Table 3-2 and shown in Figure 3-3.

Areas retaining less than 30% of their pre-European vegetation extent generally experience exponentially accelerated species loss, while areas with less than 10% are considered "endangered" (EPA, 2000).

Table 3-2: Beard vegetation associations within the desktop study area/ survey area

IBRA Subregion	Vegetation association	Current extent (Ha)	Pre-European extent remaining (%)	% of current extent within DBCA managed lands	Vegetation description (Beard, 1990)
MUR01	Great Victoria Desert 18	181,534.33	97.53	0	Low woodland; mulga (*Acacia aneura*)
GVD01	Laverton 18^	3,626.23	100.00	0	Low woodland; mulga (*Acacia aneura*)
	Great Victoria Desert 18	497,636.98	100.00	0.24	Low woodland; mulga (*Acacia aneura*)
	Great Victoria Desert 1239^	1,393,809.72	100.00	2.46	Hummock grasslands, open medium tree & mallee steppe; marble gum & mallee (*E. youngiana*) over hard spinifex *Triodia basedowii* on sandplain
	Great Victoria Desert 1446	12,896.30	100.00	0	Succulent steppe with scrub; mulga over bluebush

Note 1: Green shaded cells indicate pre-European vegetation association boundaries within the survey area
Note 2: ^ indicates pre-European vegetation associations represented by vegetation types identfiied during the field survey

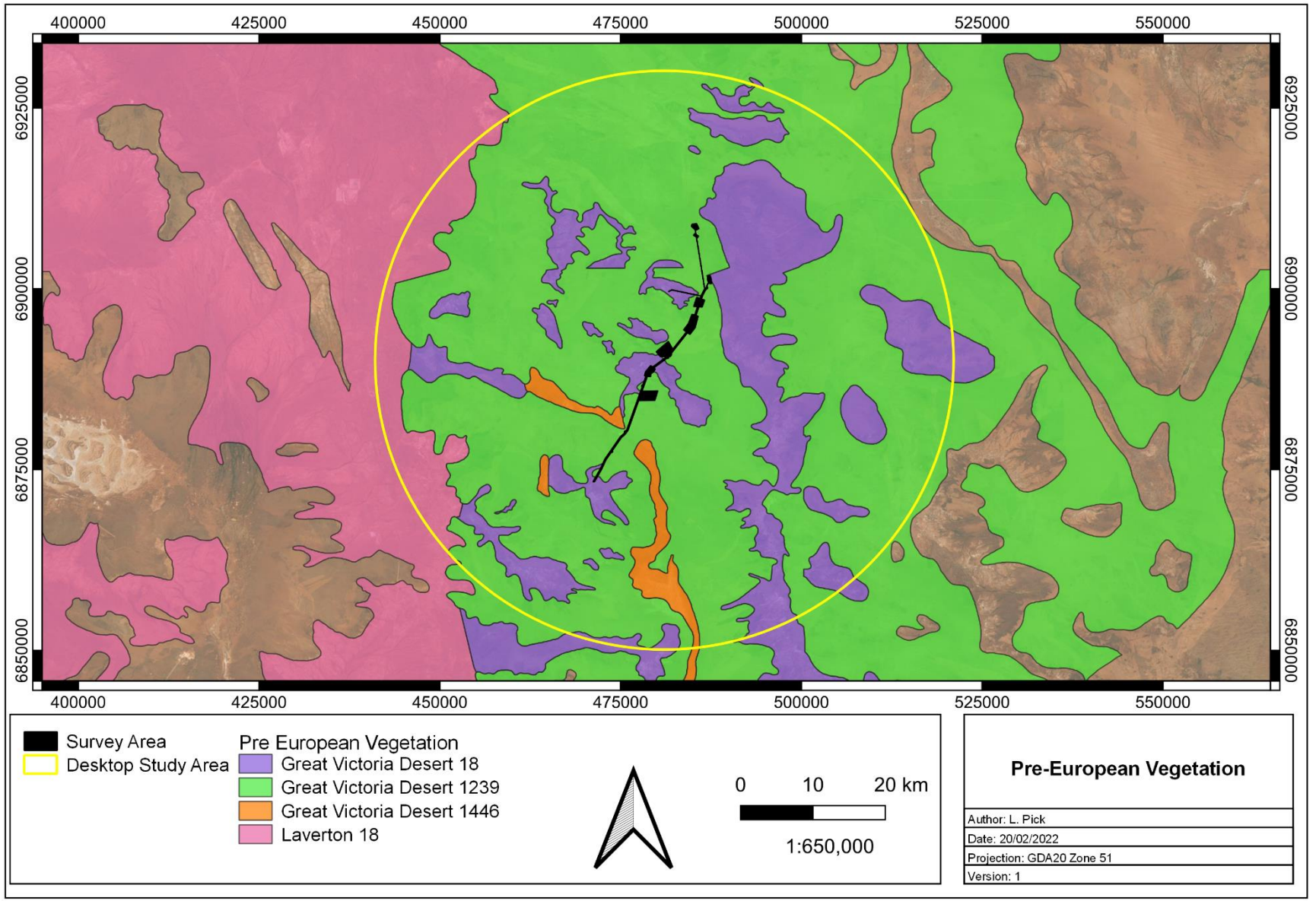
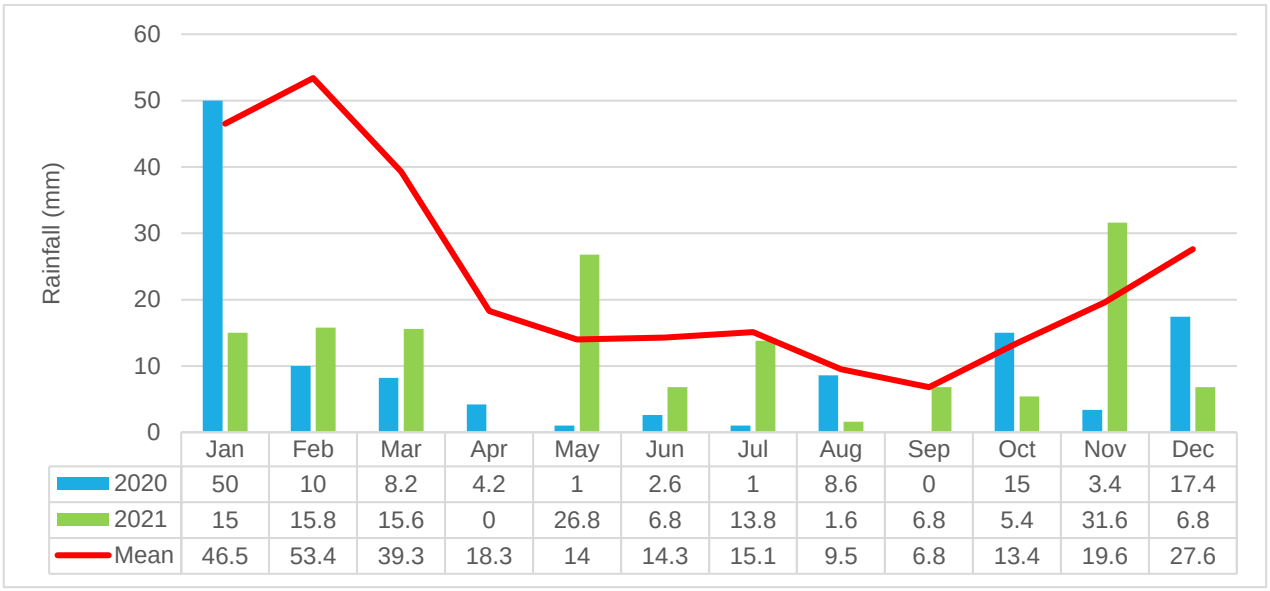


Figure 3-3: Pre-European vegetation associations within the desktop study area/ survey area

3.4 Climate

The climate of the Eastern Murchison subregion is characterised as an arid climate with mainly winter rainfall and annual rainfall of approximately 200 millimetres (mm) (Beard, 1990; Cowan, 2001). The climate of the Shield subregion is arid, with summer and winter rain averaging 150 –190 mm per annum (Barton & Cowan, 2001). Rainfall data for the Laverton weather station (#12305) located approximately 50km south-west of the survey area is shown in Figure 3-4 (BoM, 2022). Rainfall received in the month preceding the survey (November) was below average, with multiple annual species present during the field survey.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2020	50	10	8.2	4.2	1	2.6	1	8.6	0	15	3.4	17.4
2021	15	15.8	15.6	0	26.8	6.8	13.8	1.6	6.8	5.4	31.6	6.8
Mean	46.5	53.4	39.3	18.3	14	14.3	15.1	9.5	6.8	13.4	19.6	27.6

Figure 3-4: Monthly rainfall (January 2020 to December 2021) for the Laverton weather station (#12305) (BoM, 2022)

3.5 Land Use

The dominant land uses of the Eastern Murchison subregion have been defined as grazing – native pastures (85.47%), Unallocated Crown Land (UCL) and Crown Reserves (11.34%), mining (1.79%) and Conservation Reserves which account for 1.4% of the land use (Cowan, 2001). The Shield subregion dominant land uses include; Aboriginal reserves (12.3%), Conservation Reserves (7%), grazing-native pastures (24.8%), UCL and Crown Reserves (55.7%) and other-lake and major watercourses (0.1%) (Barton & Cowan, 2001).

3.6 Hydrology

According to the Geoscience Australia database (2015) there are multiple (non-perennial) drainage lines that intersect the survey area. No inland waters are located within the survey area (Figure 3-5). There are numerous non-perennial/ intermittent drainage lines located within the desktop study area and one un-named non-perennial inland water within the desktop study area (Figure 3-5).

Two paleochannels are located within the desktop study area; Lake Carey and Lake Wells paleochannel. The Lake Carey paleochannel extends through the southern section of the survey area and desktop study area (oriented north-west to south-east) covering an area of approximately 2,352,000 ha (Figure 3-5). The Lake Wells paleochannel extends through the north-east section of the desktop study area, covering an area of 595,300 ha (Figure 3-5).

According to the Department of Water and Environmental Regulation (DWER) groundwater salinity database (DWER, 2018), groundwater salinity in the desktop study area ranges from 100 mg/L to >14,000 mg/L. Groundwater in the region is a local flow system in Precambrian Rocks. The survey area is located within the Yilgarn-Goldfields Groundwater Province.

Groundwater Dependent Ecosystems (GDE) includes biological assemblages of species such as wetlands or woodlands that use groundwater either opportunistically or as their primary water source. For the purposes of this report, a GDE is defined as any vegetation community that derives part of its water budget from groundwater and must be assumed to have some degree of groundwater dependency. According to the BoM *Atlas of Groundwater Dependent Ecosystems* (BoM, 2021) database, there are no known aquatic or terrestrial GDEs located within the survey area; however, the GDE database (BoM, 2021) indicates the desktop study area has low-high potential to contain eleven terrestrial GDEs as listed in Table 3-3 and shown in Figure 3-5.

Table 3-3: Potential Terrestrial Groundwater Dependent Ecosystems within the survey area

Ecosystem Description	Potential Groundwater Dependence (BoM, 2021)
Almost flat hardpan wash plains, with or without small wanderrie banks and weak groving; supporting mulga shrublands and wanderrie grasses on banks.	Low Potential
Breakaways, kaolinised footslopes and extensive gently sloping plains on granite supporting mulga shrublands and minor halophytic shrublands.	Low Potential
Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses.	Low Potential
Distributary alluvial fans and wash plains supporting mulga - chenopod shrublands.	Low Potential
Extensive sand plains supporting spinifex hummock grasslands.	Low Potential
Gently undulating stony plains and low rises with quartz mantles on granite, supporting acacia-eremophila shrublands.	Low Potential
Gritty-surfaced plains and low outcrops of granite with scattered acacia shrublands.	Low Potential
Irregular low ironstone hills with stony lower slopes supporting mulga shrublands.	Low Potential
Low woodland; mulga (*Acacia aneura*).	Low Potential
Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains; supports bowgada and mulga shrublands.	Low Potential
Salt lakes with extensively fringing saline plains, dunes and sandy banks, supporting low halophytic shrublands and scattered tall acacia shrublands.	High Potential

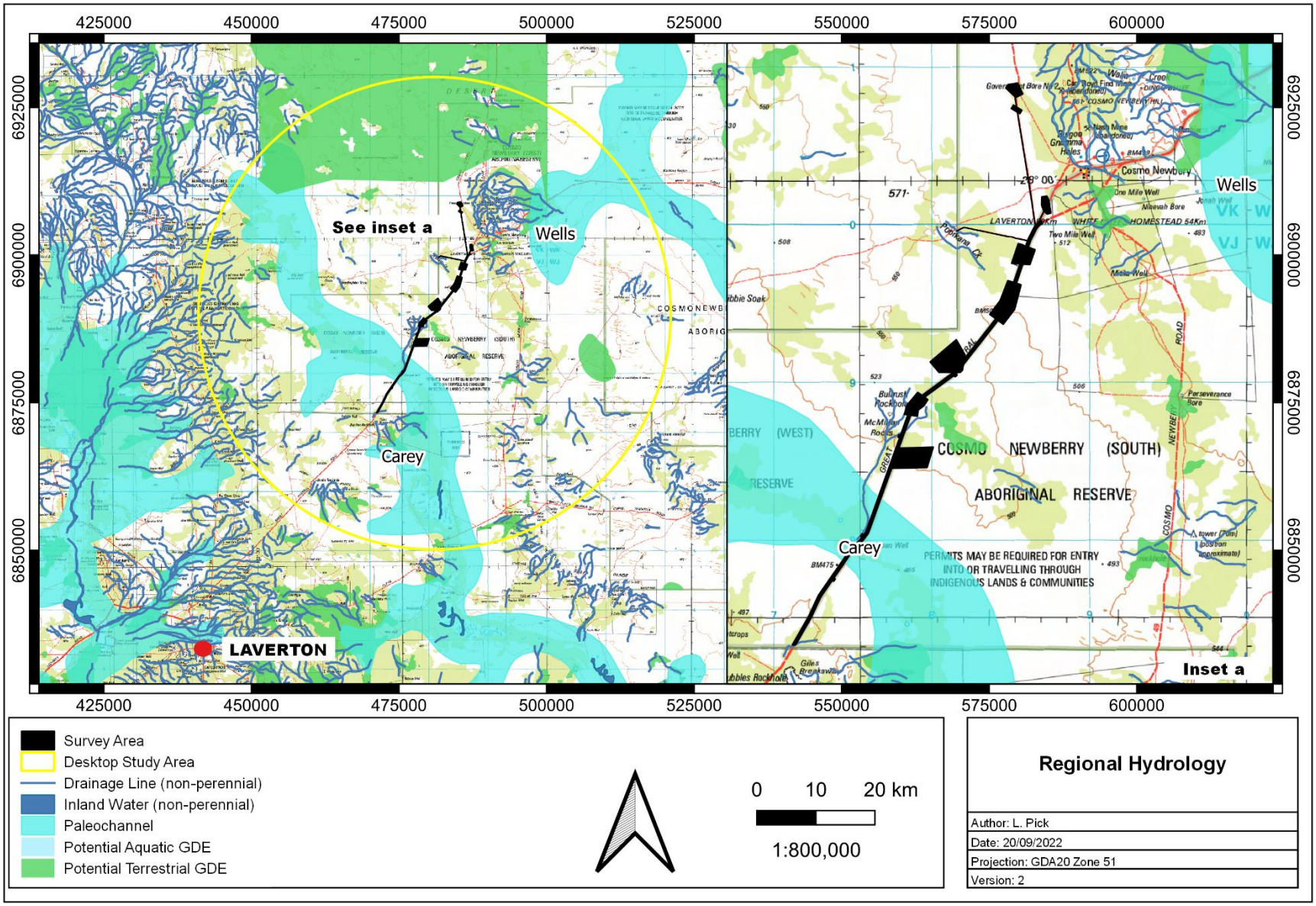


Figure 3-5: Regional hydrology of the desktop study area/ survey area

4 SURVEY METHODOLOGY

4.1 Desktop Assessment

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

- Botanica Consulting (2011). Level 1 Yamarna Proposed Haul Road Flora and Vegetation Survey.
- Botanica Consulting (2012). Level 2 Flora and Vegetation Survey, Yamarna Project.
- Botanica Consulting (2014a). Level 1 Flora and Vegetation Survey, Gruyere Project.
- Botanica Consulting (2014b). Level 1 Flora and Vegetation Survey, Murrin to Sunrise Dam Gold Mine Gas Pipeline.
- Botanica Consulting (2015). Level 2 Flora and Vegetation Survey of the Gruyere Project.
- Botanica Consulting (2017). Level 1 Flora & Fauna Survey Yamarna Gas Pipeline Project.
- Botanica Consulting (2020). Flora, Vegetation and Fauna Assessment of the Great Central Road Stage 1 Biological Survey. Prepared for Main Roads Western Australia.
- Harewood, G. (2011). Terrestrial Fauna Survey (Level 1) of Yamarna Gold Project (Central Bore, Attila, Alaric, Haul Road and Khan North). Unpublished report for Gold Road Resources. September 2011.
- Harewood G. (2014). Fauna Assessment (Level 1) Gruyere Project. Unpublished report for Gold Road Resources Ltd. July 2014.
- Keith Linbeck and Associates (2012). Fauna Assessment (Level 2) Yamarna Project. Unpublished report for Gold Road Resources. October 2012.

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

- Department of Biodiversity, Conservation and Attractions (DBCA) Priority/ Threatened Flora Database Search (DBCA, 2021a),
- DBCA Priority/ Threatened Fauna Database Search (DBCA, 2021b),
- DBCA Priority/ Threatened Ecological Communities Database Search (DBCA, 2021c)
- DBCA NatureMap Database (DBCA, 2021d); and
- Department of Agriculture, Water and Environment (DAWE) Protected Matters search tool (DAWE, 2021a).

The NatureMap and Protected Matters Searches were conducted for an area encompassing a 40 km radius of the centre coordinates; -28.1339 S 122.7850 E. It should be noted that these lists are based on observations from a broader area than the assessment area (40 km radius) and therefore may include taxa not present. The databases also often include very old records that may be incorrect or in some cases the taxa in question have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information also need to be taken into consideration when determining what actual species may be present within the specific area being investigated.

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

- *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*. Administered by the Australian Government (DAWE);
- *Biodiversity Conservation* (BC) *Act 2016*. Administered by the WA Government (DBCA);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List – the acronym derived from its former name of the

International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and

- Priority Flora/ Fauna list. A non-legislative list maintained by DBCA for management purposes (fauna list released 10th April 2019; flora list released 5th December 2018).

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

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

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

4.2 Flora and Vegetation Field Assessment

Botanica conducted a detailed flora and vegetation survey and targeted flora survey from the 12th to 13th December 2021. The survey area was traversed by two people via 4WD, ATV and on foot. Previous biological surveys were conducted within the survey area by Botanica from the 2nd to 6th December 2019, during which seven quadrats were established (50 m X 50 m). These quadrats were revisited during the current field survey. An additional eight quadrats (50 m X 50 m) were established during the current survey, giving a total of 15 quadrats within the current survey area (Figure 4-1).

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

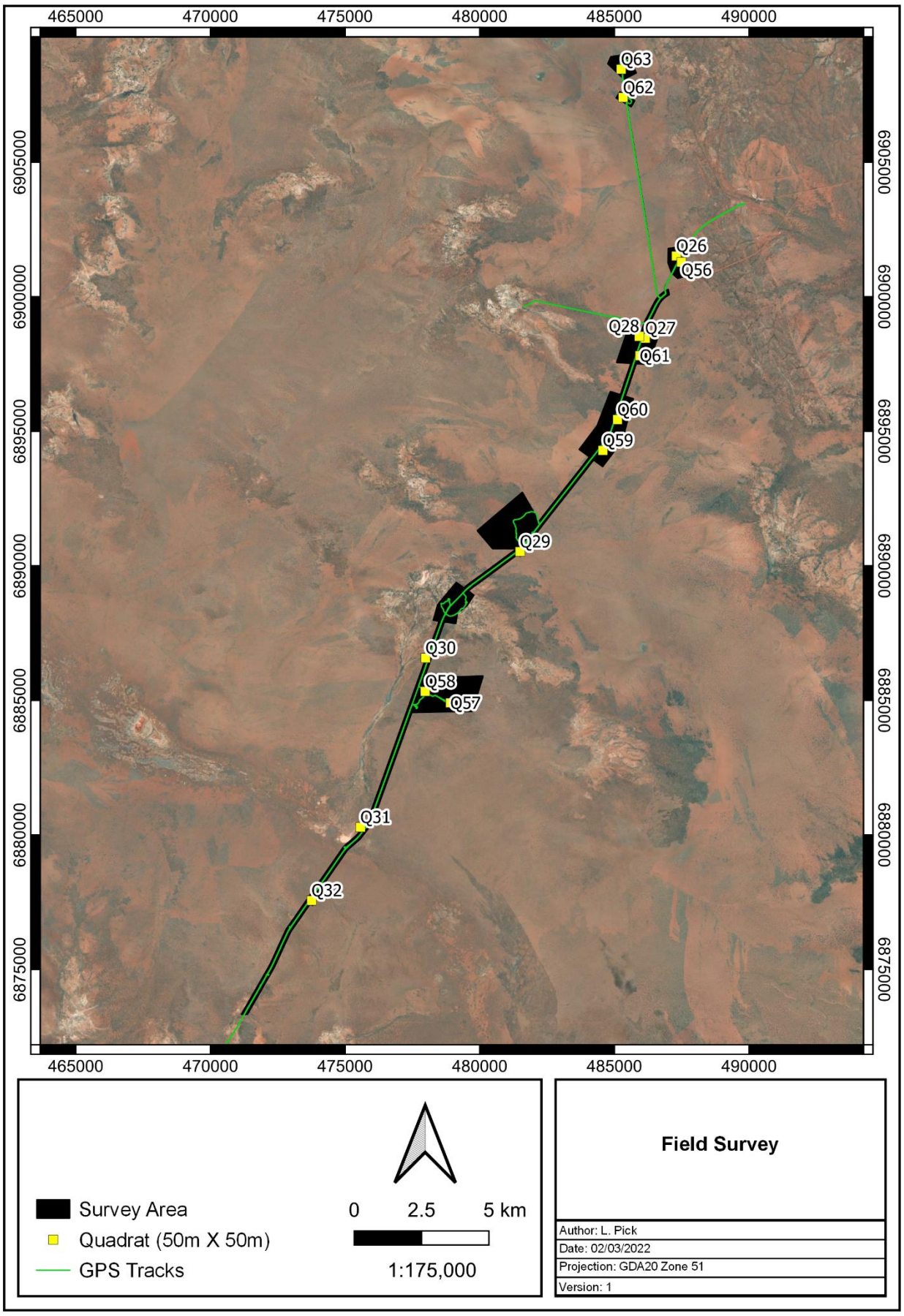


Figure 4-1: Quadrat locations, survey area boundary and GPS tracks traversed throughout the survey area

4.2.1 Vegetation Mapping

Prior to the commencement of field work, aerial photography was inspected and obvious differences in the vegetation assemblages were identified. The different vegetation types identified were then inspected during the field survey to assess their validity. A handheld GPS unit was used to record the coordinates of the boundaries between vegetation types.

At each sample point, the following information was recorded:

- GPS location;
- Photograph of vegetation;
- Dominant taxa for each stratum (including height and percentage cover of dominant taxa);
- All vascular taxa (including annual taxa);
- Landform classification;
- Vegetation condition rating;
- Collection and documentation of unknown plant specimens; and
- Collection of significant flora if encountered.

Vegetation types were classified in accordance with the NVIS Level V-Association classification.

4.2.2 Detailed Flora and Vegetation Survey

Fifteen 50 m X 50 m quadrats were established within the survey area (Figure 4-1 and Appendix F) in accordance with the recommended quadrat size specified in the Environmental Protection Authority (EPA) Guidelines for the Murchison and Great Victoria Desert Bioregions. The quadrats were established by inserting metal pickets into the NW corner, and measuring the length of the resultant boundaries to verify the quadrats were 50 m X 50 m (square quadrats). The objective was to have at least three quadrats per vegetation type to capture the floristic variations within the survey area.

Following their establishment and boundary verification, the NW corner of each quadrat was recorded by GPS (Appendix F) and three photographs of the quadrat were taken from the NW corner (Appendix H). All vascular plants within the quadrat were recorded (Appendix G). This included recording of dominant taxa from the upper, middle and lower stratum, and sampling of all unknown taxa. Unknown taxa were identified using Botanica's own reference herbarium and relevant taxonomic keys or by a taxonomic consultant. Data on level of disturbance, presence of coarse fragments on surface, topographical position, elevation, aspect, percentage litter, percentage bare ground, percentage surface rock (bedrock and surface deposits), soil types (colour, profile, field texture and surface type), and vegetation structure were collected from each quadrat (Appendix G). Methods of recording data from these quadrats largely follow those outlined in CSIRO's *Australian Soil and Land Survey Field Handbook* (McDonald *et al.* 1998) and in accordance with EPA Guidelines (2016). Presence/absence data of taxa from sample sites were used to compile the representative vegetation types.

4.2.3 Targeted Flora Survey

A targeted search for Threatened and Priority flora was conducted, including assessing the location of any DBCA records of Priority flora within the survey area. Potential habitats for Threatened and Priority Flora were searched on foot by two Botanica staff members to identify and record the locations of Threatened and Priority flora. Any locations of Threatened and Priority flora were recorded using a hand-held GPS and a simple plant count (not differentiated between juvenile/mature plants, flowering or non-flowering plants) was conducted for each record.

Flora of significance identified during the literature review and database searches as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the survey area. The rankings and criteria used were:

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

4.2.4 Flora Identification

Unknown specimens collected during the survey were identified with the aid of samples housed at the Botanica Herbarium and the Western Australian Herbarium.

4.3 Data Analysis Tools

Following field assessments, vegetation types and condition were mapped using the GIS program QGIS, and the hectare area/ percentage area of each vegetation type and condition within the survey area was calculated. Spatial maps illustrating the location of vegetation types and any significant flora/ vegetation and fauna were generated using QGIS.

4.3.1 PATN Analysis

The PATN software package was used to assess the similarities/ dissimilarities between quadrats based on presence/absence of species. Three annual taxa were recorded during the survey which were excluded from the analysis. Five sub-species were reconciled to two taxa. Singleton taxa were included in the analysis (20 taxa). A total of 50 taxa recorded within the quadrats were included in the analysis.

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

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

4.3.2 EstimateS

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

4.4 Terrestrial Fauna Field Assessment

Botanica conducted a basic fauna survey of the survey area from the 12th to 13th December 2021. The survey area was traversed by two people via 4WD and on foot (Figure 4-1). Fauna habitat types were identified across the survey area based on broad major vegetation groups and associated landform. A handheld GPS unit was used to record the coordinates of the boundaries between fauna habitats and each habitat was photographed.

The main aim of the fauna habitat assessment was to determine the likelihood of a species of significance utilising habitat within the survey area. The habitat information obtained was also used to aid in finalising the overall potential fauna list.

Available information on the habitat requirements of the species of significance listed as possibly occurring in the area (determined from the desktop assessment) was researched. During the field survey, the habitats within the survey area were assessed and specific elements identified, if present, to determine the likelihood of listed Threatened and Priority species utilising habitat within the survey area. Opportunistic observations of fauna species were made during all field survey work.

Fauna of significance identified during the literature review and database searches as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the survey area. The rankings and criteria used were:

- Would Not Occur: There is no suitable habitat for the species in the survey area and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).

- Locally Extinct: Populations no longer occur within a small part of the species natural range, in this case within 10 or 20 km of the survey area. Populations do however persist outside of this area.

- Regionally Extinct: Populations no longer occur in a large part of the species natural range, in this case within the goldfields region. Populations do however persist outside of this area.

- Unlikely to Occur: The survey area is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the site itself would not support a population or part population of the species.

- Possibly Occurs: Survey area is within the known distribution of the species in question and habitat of at least marginal quality was identified as likely to be present during the field survey and literature review, supported in some cases by recent records being documented in

literature from within or near the survey area. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- Known to Occur: The species in question has been positively identified as being present (for sedentary species) or as using the survey area as habitat for some other purpose (for non-sedentary/mobile species) during field surveys within or near the survey area. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. tracks, foraging debris, scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

4.5 Personnel Involved

Table 4-1: Personnel involved with the flora, vegetation and fauna survey/ reporting

Staff Member	Position/ Qualifications	Experience	Tasks conducted during survey
Jim Williams	Environmental Consultant/Botanist/ Director (Diploma of Horticulture)	30 years experience across WA	Project Management (Lead Botanist). Fauna survey-opportunistic fauna observations and fauna habitat assessments. Flora and vegetation survey- identifying flora species within quadrats and opportunistic flora observations. Identifying and recording vegetation types. Review of report.
Jennifer Jackson	Environmental Consultant (BSc-Honours Environmental Management)	15 years experience across WA	Fauna survey-opportunistic fauna observations and fauna habitat assessments. Flora and vegetation survey- identifying flora species within quadrats and opportunistic flora observations. Identifying and recording vegetation types.
Lauren Pick	Senior Environmental Consultant (BSc Conservation Biology)	13 years experience across WA	Reporting-flora and vegetation data entry/ analysis and reporting. Spatial mapping (flora, vegetation and fauna)

4.6 Scientific Licences

Table 4-2: Scientific Licences of Botanica Staff coordinating the survey

Licensed Staff	Permit Number	Valid
Jim Williams	FB20000108 (licence to take flora for scientific purposes)	27/05/2019-27/05/2022
Jennifer Jackson	FB62000309 (licence to take flora for scientific purposes)	18/02/2021-11/01/2024

4.7 Survey Limitations and Constraints

It is important to note that flora/ vegetation and fauna surveys will entail limitations notwithstanding careful planning and design. Potential limitations are listed in Table 4-3.

Table 4-3: Limitations and constraints associated with the flora/ vegetation and fauna survey

Variable	Potential Impact on Survey	Details
Access problems	Not a constraint	The survey was conducted via 4WD and on foot. Access was readily available with the Great Central Road extending through the survey area.
Competency/ Experience	Not a constraint	The Botanica personnel that conducted the survey were regarded as suitably qualified and experienced. **Coordinating Staff**: Jim Williams **Field Staff**: Jim Williams (Botanist) and Jennifer Jackson **Data Interpretation**: Jim Williams (Botanist), Jennifer Jackson (Botanist) and Lauren Pick (Senior Environmental Consultant).
Timing of survey, weather & season	Minor constraint	Fieldwork was conducted in December 2021, outside of the EPA recommended approximate timing (i.e. six-eight weeks post wet season) for the Murchison and Great Victoria Desert Bioregions. Rainfall received in the month preceding the survey (November 2021) was above average. Limited flowering material was available however multiple annual species were present during the survey.
Area disturbance	Not a constraint	The majority of the survey area was in good condition and comprised of native vegetation. Disturbance in the area was a result of road siding of the Great Central Road.
Survey Effort/ Extent	Not a constraint	Survey intensity was appropriate for the size/significance of the area with a detailed flora survey[2] and basic fauna survey completed to identify vegetation types/ fauna habitats and significant flora, fauna and vegetation. A targeted search to identify significant flora was conducted within potential habitats within the survey area.
Availability of contextual information at a regional and local scale	Not a constraint	Conservation significant flora database searches provided by the DBCA were used to identify any potential locations of Threatened/Priority flora species. BoM, DWER, DPIRD, DBCA and DAWE databases were reviewed to obtain appropriate regional desktop information on the biophysical environment of the local region. Botanica has conducted a number of surveys within Coolgardie Bioregion and was also able to obtain information about the area from previous research conducted within the area. Results of previous assessments in the local area were reviewed to provide context on the local environment.
Data Analysis	Minor constraint	Botanica staff conducting the PATN statistical analyses are not statistical analysts and have basic statistics training. These analyses were used to provide basic information on the relationships between vegetation communities delineated in the field.
Completeness	Not a constraint	In the opinion of Botanica, the survey area was covered sufficiently in order to identify vegetation assemblages. Despite being conducted outside EPAs recommended approximate timing for primary surveys for the Murchison and Great Victoria Desert Bioregions, all observed flora were able to be identified to species level and multiple annual species present. The vegetation associations for this study were based on visual descriptions of locations in the field. The distribution of these vegetation associations outside the study area is not known, however vegetation associations identified were categorised via comparison to vegetation distributions throughout WA given on NVIS (DotEE, 2017).

[2] Two vegetation types occupied a small area preventing three quadrats to be established as recommended by EPA (2016a) however based on the results of the floristic composition analysis, this is not a constraint.

5 RESULTS

5.1 Desktop Assessment

5.1.1 Flora/ Vegetation

According to the results of the NatureMap search (DBCA, 2021d), a total of 207 flora taxa have been recorded within a 40 km radius of the survey area. Dominant genera include *Acacia, Eremophila* and *Eucalyptus.* Results of database searches identified one introduced taxon as potentially occurring within a 40 km radius of the survey area; *Sisymbrium orientale* (Indian Hedge Mustard). This taxon is not listed as a Declared Pest under the BAM Act or a Weed of National Significance (WoNS) by the Commonwealth DAWE.

The results of the literature review, combined search of the DBCA's Flora of Conservation Significance databases (DBCA, 2021a), NatureMap search (DBCA, 2021d) and DAWE protected matters search (DAWE, 2021a) indicated that no Threatened Flora or Priority Flora species were previously recorded within the survey area. As listed in Table 5-2 below, no Threatened flora and 11 Priority flora were listed by the databases as potentially occurring within a 40 km radius of the survey area (map of flora locations provided in Appendix B). Of these, four species were identified as possibly occurring within the survey area.

Table 5-1: Likelihood of occurrence for Threatened and Priority flora within the survey area

Taxon	EPBC Act	BC Act	DBCA Priority Rating	Habitat Description (WAHERB, 2021; DBCA, 2021a)	Assessment	Likelihood of Occurrence
Bossiaea eremaea[1,2]			P3	Deep red sand.	Previously recorded within 10 km of survey area, habitat may be present	Possible
Calytrix hislopii[1,2]			P3	Recorded in the Sandstone, Laverton and Leonora areas on a lateritic ridge, the top of a breakaway and on granite (Rye, 2013).	Previously recorded ~30 km south-east of survey area, habitat may be present	Unlikely
Calytrix praecipua[1,2]			P3	Skeletal sandy soils over granite or laterite. Breakaways, outcrops.	Previously recorded ~30 km south of survey area, habitat may be present	Unlikely
Comesperma viscidulum[1,2]			P4	Sandplain, sand dune, lateritic plain, sandstone breakaway complex.	Previously recorded ~30 km north-east of survey area, habitat may be present	Possible
Conospermum toddii[1,2,3]			P4	Yellow sand. Sand dunes.	Previously recorded ~12 km west of survey area, habitat may be present	Possible
Frankenia glomerata[1,2]			P4	White sand.	Previously recorded ~30 km south-east of survey area, habitat unlikely to be present	Unlikely
Lechenaultia aphylla[1,2]			P1	Red sand. Slopes, drainage areas.	Previously recorded within 10 km of survey area, habitat may be present	Possible
Melaleuca apostiba[1]			P3	Red clayey sand, edge of salt lake/wetland.	Previously recorded ~20 km north-east of survey area, habitat unlikely to be present	Unlikely
Philotheca linearis[1]			P1	Yellow sand. Base of granite outcrop.	Previously recorded ~30 km south-east of survey area, habitat unlikely to be present	Unlikely
Philotheca tubiflora[1]			P1	Rocky rises & hills, outcrops.	Previously recorded ~20 km south-west of survey area, habitat unlikely to be present	Unlikely
Thryptomene nealensis[1,2,3]			P3	Lateritic breakaways.	Previously recorded within 10 km of survey area, habitat unlikely to be present	Unlikely

Note: [1] sourced from NatureMap database; [2] sourced from DBCA spatial database search; [3] sourced from literature review

The results of the DBCA's Priority/ Threatened Ecological Communities Database Search (DBCA, 2021c) identified no Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) as occurring within the survey area. Three PECs are listed as occurring within a 100 km radius of the survey area (map of PEC locations provided in Appendix B). A description of each PEC is provided in Table 5-2.

Table 5-2: Priority Ecological Communities within 100 km of the survey area

Priority Ecological Community	DBCA Priority Listing	Description
Laverton Downs calcrete groundwater assemblage type on Carey palaeodrainage on Laverton Downs Station	P1	Unique assemblages of invertebrates have been identified in the groundwater calcretes (DBCA, 2021c). Located approximately 45km south-west of the survey area.
Mount Jumbo Range vegetation complex (banded ironstone formation)	P3	Banded ironstone hill near Mt Jumbo south-west of Laverton in the south-eastern corner of the Laverton-Leonora Study Area which supported *Acacia aneura* Low Woodland. Growing on the slopes with *Acacia aneura* were sparse trees of *Casuarina cristata* and *Grevillea nematophylla*. Shrubs and ephemerals commonly recorded on banded ironstone hills included *Acacia ramulosa, Eremophila latrobei, Eriostemon brucei, Euphorbia boophthona, Maireana georgei, Sida filiformis, Symphyobasis macroplectra, Trachymene ornata* and *Wurmbea deserticola* (Hall *et. al.*,1994). Located approximately 56km south-west of the survey area.
Mount Morgan calcrete groundwater assemblage type on Carey palaeodrainage on Mt Weld Station	P1	Unique assemblages of invertebrates have been identified in the groundwater calcretes (DBCA, 2021c). Located approximately 69km south-west of the survey area.

5.1.2 Fauna

With respect to native vertebrate fauna, 10 amphibians, 38 mammals (including ten bat species), 102 bird and 109 reptile species have previously been recorded in the wider area, based on database search results and literature review (potential fauna list provided in Appendix J), some of which have the potential to occur in or utilise sections of the survey area at times. Ten species of introduced animals could also frequent the area as listed in Table 5-3.

Table 5-3: Introduced fauna potentially occurring within 40 km of the survey area

Taxon	Common Name
Bos taurus	European Cattle
Camelus dromedarius	Camel
Canis lupus familiaris	Domestic Dog
Equus asinus	Donkey
Equus caballus	Horse
Felis catus	Cat
Hemidactylus frenatus	Asian House Gecko
Mus musculus	House Mouse
Oryctolagus cuniculus	Rabbit
Vulpes vulpes	Fox

Of the 259 native vertebrate animals that are listed as potentially occurring, thirteen are considered to be Threatened or in need of special protection under State and/or Commonwealth law. These particular species are discussed in further detail in **Section 5.2.9**.

5.2 Field Assessment

5.2.1 Vegetation Types

Six vegetation types (not including cleared vegetation) were identified within the survey area. These vegetation types were located within two landform types and comprised of four major vegetation groups, which were represented by a total of 19 families, 33 genera and 68 taxa (inclusive of 56 flora taxa recorded within the quadrats and 12 opportunistic flora records). The total species list is provided in Appendix C. A map showing the vegetation types present in the survey area is provided in Figure 5-1. More detailed vegetation type maps are provided in Appendix D. A summary of vegetation types is presented in Table 5-4.

Table 5-4: Summary of vegetation types within the survey area

Landform	NVIS Major Vegetation Group	Vegetation Type	Vegetation Code	Quadrat	Area (ha)	Area (%)
Clay-Loam Plain	Acacia Forest and Woodland (MVG 6)	Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain	CLP-AFW1	Q30, Q62	212	11.9
	Acacia Open Woodland (MVG 13)	Low open woodland of *Acacia caesaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain	CLP-AOW1	Q31	11	0.6
Sandplain	Acacia Forest and Woodland (MVG 6)	Low woodland of *Acacia incurvaneura/ A. quadrimarginea* over mid open shrubland of *Eremophila latrobei subsp. glabra/ Eremophila latrobei* subsp. *latrobei* and hummock grassland of *Triodia basedowii* on sandplain	S-AFW2	Q61, Q63	374	21.0
	Eucalypt Woodland (MVG 5)	Low woodland of *Eucalyptus gongylocarpa* over mid shrubland of *Acacia ligulata* and hummock grassland of *Triodia basedowii* on sandplain	S-EW1	Q26, Q56, Q60	347	19.5
	Mallee Woodland and Shrubland (MVG 14)	Open mallee woodland of *Eucalyptus youngiana* over hummock grassland of *Triodia basedowii* on sandplain	S-MWS1	Q27, Q28, Q29, Q32, Q58, Q59	670	37.7
		Open mallee woodland of *Eucalyptus trivalva* over mid shrubland of *Acacia desertorum* and hummock grassland of *Triodia basedowii* on sandplain	S-MWS4	Q57	22	1.2
N/A	N/A	Cleared Vegetation	CV	N/A	143	8.0
TOTAL				**15**	**1779**	**100**

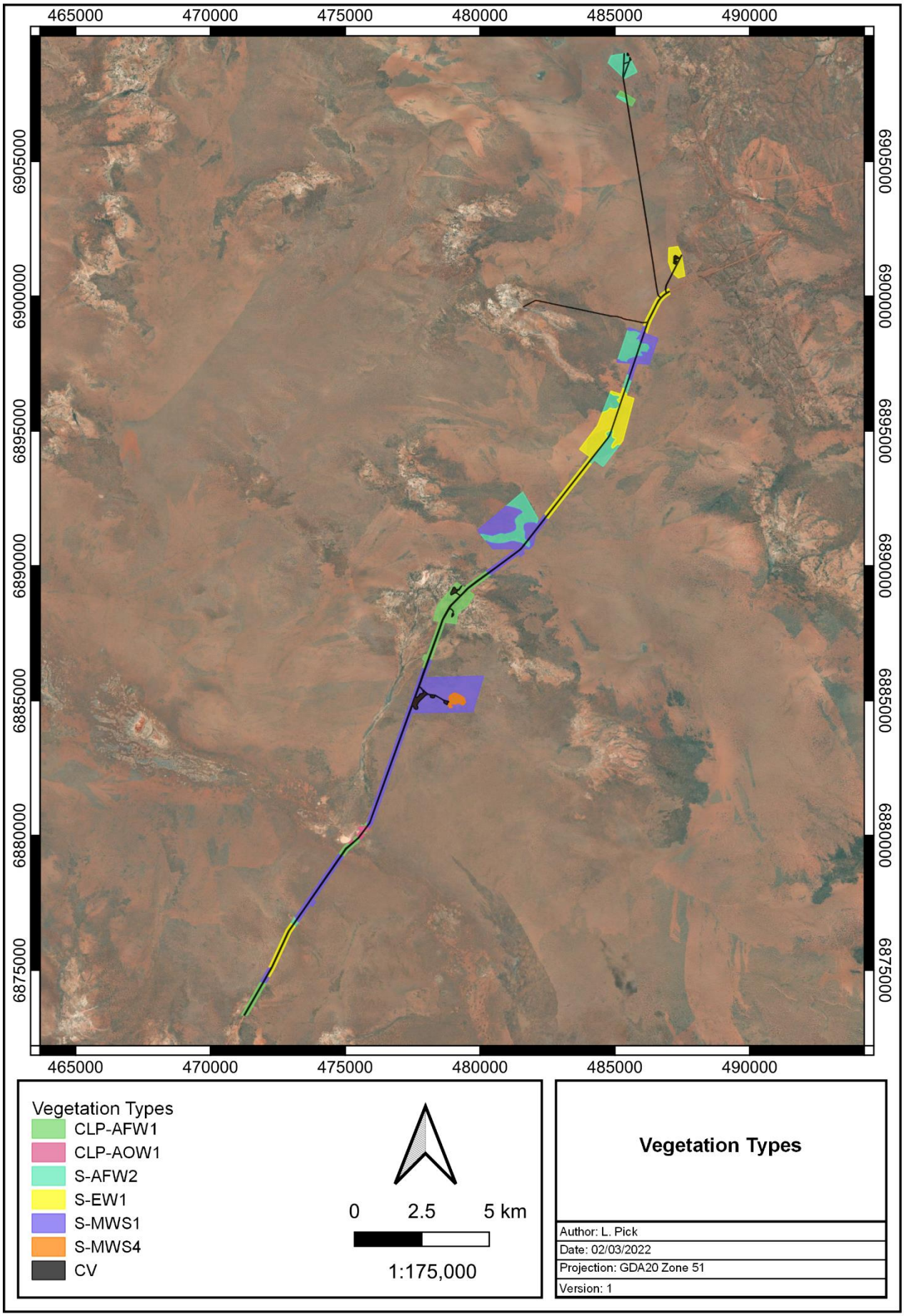


Figure 5-1: Vegetation types within the survey area

Clay-Loam Plain: Acacia Forest and Woodland

5.2.1.1 Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp*. x artemisioides/ Senna artemisioides* subsp*. helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain (CLP-AFW1)

The total flora recorded within this vegetation type was represented by a total of 13 families, 16 genera and 23 taxa (Plate 1 and Appendix C). Dominant taxa from the vegetation type are shown in Table 5-5. According to the NVIS, this vegetation type is best represented by the MVG 6 – Acacia Forest and Woodland (DotEE, 2017).

Table 5-5: Vegetation assemblage for Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp*. x artemisioides/ Senna artemisioides* subsp*. helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	10-30%	*Acacia caesaneura* *Acacia aptaneura* *Acacia incurvaneura*
Shrub 1-2m	30-70%	*Senna artemisioides* subsp. x *artemisioides* *Senna artemisioides* subsp. *helmsii*
Shrub <1m	30-70%	*Ptilotus obovatus*

Plate 1: Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp*. x artemisioides/ Senna artemisioides* subsp*. helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain

Clay-Loam Plain: Acacia Open Woodland

5.2.1.2 Low open woodland of *Acacia caesaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp*. x artemisioides/ Senna artemisioides* subsp*. helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain (CLP-AOW1)

The total flora recorded within this vegetation type was represented by a total of 5 families, 7 genera and 9 taxa (Plate 2 and Appendix C). Dominant taxa from the vegetation type are shown in Table 5-6. According to the NVIS, this vegetation type is best represented by the MVG 13 – Acacia Open Woodland (DotEE, 2017).

Table 5-6: Vegetation assemblage for Low open woodland of *Acacia caesaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp*. x artemisioides/ Senna artemisioides* subsp*. helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	5-10%	*Acacia caesaneura* *Acacia incurvaneura*
Shrub 1-2m	30-70%	*Senna artemisioides* subsp. x *artemisioides* *Senna artemisioides* subsp. *helmsii*
Shrub <1m	30-70%	*Ptilotus obovatus*

Plate 2: Low open woodland of *Acacia caesaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp*. x artemisioides/ Senna artemisioides* subsp*. helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain

Sandplain: Acacia Forest and Woodland

5.2.1.3 Low woodland of *Acacia incurvaneura/ A. quadrimarginea* over mid open shrubland of *Eremophila latrobei* subsp*. glabra/ Eremophila latrobei* subsp*. latrobei* and hummock grassland of *Triodia basedowii* on sandplain (S-AFW2)

The total flora recorded within this vegetation type was represented by a total of 16 families, 23 genera and 35 taxa (Plate 3 and Appendix C). Dominant taxa from the vegetation type are shown in Table 5-7. According to the NVIS, this vegetation type is best represented by the MVG 6 – Acacia Forest and Woodland (DotEE, 2017).

Table 5-7: Vegetation assemblage for Low woodland of *Acacia incurvaneura/ A. quadrimarginea* over mid open shrubland of *Eremophila latrobei* subsp*. glabra/ Eremophila latrobei* subsp*. latrobei* and hummock grassland of *Triodia basedowii* on sandplain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	10-30%	*Acacia incurvaneura* *Acacia quadrimarginea*
Tree <10m	10-30%	*Eremophila latrobei* subsp*. glabra* *Eremophila latrobei* subsp*. latrobei*
Hummock Grass <1m	30-70%	*Triodia basedowii*

Plate 3: Low woodland of *Acacia incurvaneura/ A. quadrimarginea* over mid open shrubland of *Eremophila latrobei* subsp*. glabra/ Eremophila latrobei* subsp*. latrobei* and hummock grassland of *Triodia basedowii* on sandplain

Sandplain: Eucalypt Woodland

5.2.1.4 Low woodland of *Eucalyptus gongylocarpa* over mid shrubland of *Acacia ligulata* and hummock grassland of *Triodia basedowii* on sandplain (S-EW1)

The total flora recorded within this vegetation type was represented by a total of 8 families, 11 genera and 21 taxa (Plate 4 and Appendix C). Dominant taxa from the vegetation type are shown in Table 5-8. According to the NVIS, this vegetation type is best represented by the MVG 5 – Eucalypt Woodland (DotEE, 2017).

Table 5-8: Vegetation assemblage for Low woodland of *Eucalyptus gongylocarpa* over mid shrubland of *Acacia ligulata* and hummock grassland of *Triodia basedowii* on sandplain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree <10m	10-30%	*Eucalyptus gongylocarpa*
Shrub 1-2m	30-70%	*Acacia ligulata*
Hummock Grass <1m	70-100%	*Triodia basedowii*

Plate 4: Low woodland of *Eucalyptus gongylocarpa* over mid shrubland of *Acacia ligulata* and hummock grassland of *Triodia basedowii* on sandplain

Sandplain: Mallee Woodland and Shrubland

5.2.1.5 Open mallee woodland of *Eucalyptus youngiana* over hummock grassland of *Triodia basedowii* on sandplain (S-MWS1)

The total flora recorded within this vegetation type was represented by a total of 8 families, 12 genera and 25 taxa (Plate 5 and Appendix C). Dominant taxa from the vegetation type are shown in Table 5-9. According to the NVIS, this vegetation type is best represented by the MVG 14 – Mallee Woodland and Shrubland (DotEE, 2017).

Table 5-9: Vegetation assemblage for Open mallee woodland of *Eucalyptus youngiana* over hummock grassland of *Triodia basedowii* on sandplain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree mallee <3m	5-10%	*Eucalyptus youngiana*
Hummock Grass <1m	30-70%	*Triodia basedowii*

Plate 5: Open mallee woodland of *Eucalyptus youngiana* over hummock grassland of *Triodia basedowii* on sandplain

5.2.1.6 Open mallee woodland of *Eucalyptus trivalva* over mid shrubland of *Acacia desertorum* and hummock grassland of *Triodia basedowii* on sandplain (S-MWS4)

The total flora recorded within this vegetation type was represented by a total of 6 families, 7 genera and 12 taxa (Plate 6 and Appendix C). Dominant taxa from the vegetation type are shown in Table 5-10. According to the NVIS, this vegetation type is best represented by the MVG 14 – Mallee Woodland and Shrubland (DotEE, 2017).

Table 5-10: Vegetation assemblage for Open mallee woodland of *Eucalyptus trivalva* over mid shrubland of *Acacia desertorum* and hummock grassland of *Triodia basedowii* on sandplain

Life Form/Height Class	Canopy Cover	Dominant Taxa
Tree Mallee <3m	10-30%	*Eucalyptus trivalva*
Shrub 1-2m	30-70%	*Acacia desertorum*
Hummock Grass <1m	30-70%	*Triodia basedowii*

Plate 6: Open mallee woodland of *Eucalyptus trivalva* over mid shrubland of *Acacia desertorum* and hummock grassland of *Triodia basedowii* on sandplain

5.2.2 Floristic Composition

Statistical analysis was conducted on quadrat data obtained from the survey to determine the similarities or differences in floristic composition between vegetation associations. Appendix I provides the dendrogram, two-way table and ordination graph generated from the PATN statistical analysis. A list of the 15quadrats and their respective vegetation associations are provided in Table 5-11 below. The PATN analysis produced a stress value of 0.1576.

Table 5-11: **Vegetation types with corresponding quadrats**

Vegetation Type	Vegetation Code	Quadrat
Low woodland of *Acacia caesaneura/ A. aptaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain	CLP-AFW1	Q30, Q62
Low open woodland of *Acacia caesaneura/ A. incurvaneura* over mid shrubland of *Senna artemisioides* subsp. x *artemisioides/ Senna artemisioides* subsp. *helmsii* and low shrubland of *Ptilotus obovatus* on clay-loam plain	CLP-AOW1	Q31
Low woodland of *Acacia incurvaneura/ A. quadrimarginea* over mid open shrubland of *Eremophila latrobei subsp. glabra/ Eremophila latrobei* subsp. *latrobei* and hummock grassland of *Triodia basedowii* on sandplain	S-AFW2	Q61, Q63
Low woodland of *Eucalyptus gongylocarpa* over mid shrubland of *Acacia ligulata* and hummock grassland of *Triodia basedowii* on sandplain	S-EW1	Q26, Q56, Q60
Open mallee woodland of *Eucalyptus youngiana* over hummock grassland of *Triodia basedowii* on sandplain	S-MWS1	Q27, Q28, Q29, Q32, Q58, Q59
Open mallee woodland of *Eucalyptus trivalva* over mid shrubland of *Acacia desertorum* and hummock grassland of *Triodia basedowii* on sandplain	S-MWS4	Q57

Six species groups were identified in the analysis (species group A to F) as shown in the two-way table (Appendix I).

The first floristic group comprised of seven quadrats, including majority of the S-MWS1 quadrats (four quadrats) and all three S-EW1 quadrats. This floristic group was characterised by species group D (see two-way table provided in Appendix I) with an average species richness of nine taxa per quadrat (ranged from six to 13 taxa per quadrat).

The second floristic group comprised of one SLP-MWS1 quadrat. This floristic group was characterised by species group A and D (Appendix I) with a species richness of eight species per quadrat.

The third floristic group comprised of one SLP-MWS1 and one SLP-MWS4 quadrat. This floristic group was mostly characterised by species group D (Appendix I). This floristic group had an average species richness of five taxa per quadrat (ranged from three to six taxa per quadrat).

The fourth floristic group comprised of the remaining both CLP-AFW1 quadrats and one S-AFW2 quadrat. This floristic group was mostly characterised by species group D and E (Appendix I). This floristic group had an average species richness of ten taxa per quadrat (ranged from six to twelve taxa per quadrat).

The fifth floristic group comprised of one S-AFW2 quadrat. This floristic group was characterised by species group E and F (Appendix I) with a species richness of 18 species per quadrat.

The sixth floristic group comprised of the single CLP-AOW1 quadrat. This floristic group was mostly characterised by species group B (Appendix I) with a species richness of nine species per quadrat.

Results of the PATN analysis indicate there was minimal heterogeneity in species composition of the clay-loam plain and sandplain vegetation types, with the majority of quadrats from these vegetation types intermixed into floristic groups despite differences in dominant stratum taxa.

Species Richness and Accumulation Estimates

The Chao 2 richness estimator provided an estimated species richness of 69 species in 30 sample sites (quadrats). Species richness recorded for the 15 quadrats surveyed was 56 species. A species accumulation curve was created to display the rate of species accumulation. The R^2 value (0.98) suggests that the data "fits" the species accumulation curve shown in Figure 5-2. Species accumulation ranged from seven to two species per quadrat from 1-15 sample sites and one species per quadrat beyond 16 sample sites. Botanica has determined that according to this data a sufficient number of quadrats were established in the survey area to adequately assess the floristic composition of the area.

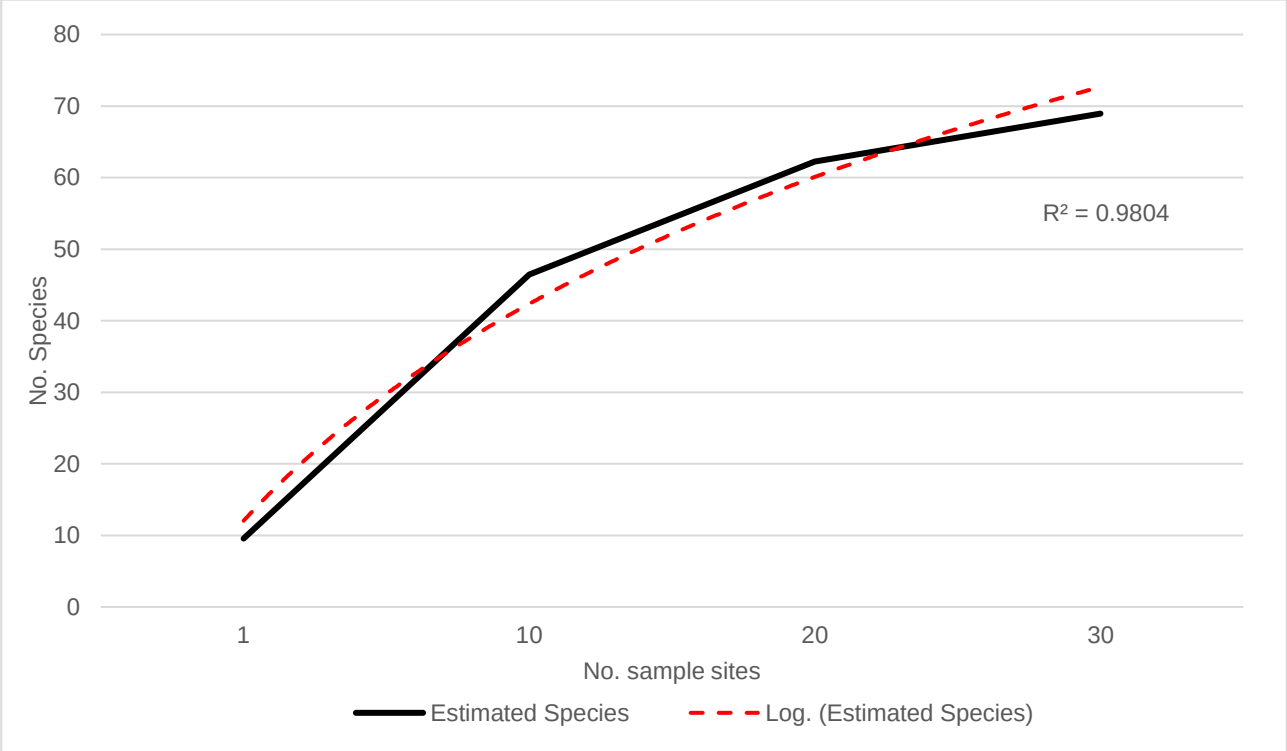


Figure 5-2: Species accumulation curve

5.2.3 Significant Flora

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

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

No Threatened flora taxa listed under Commonwealth or State legislation were identified within the survey area. No Priority Flora were identified within the survey area. Based on the results of the field survey, four of the eleven Priority Flora identified in the desktop assessment as possible to occur within the survey area are considered as unlikely to occur, as described in Table 5-12 below. No endemic, new or anomalous species, relictual or unusual species were identified within the survey area. One taxon recorded at the limit of its known range was recorded during the survey; *Acacia desertorum.*

Table 5-12: Post survey significant flora likelihood of occurrence assessment

Taxon	BC Act	EPBC Act	DBCA Priority Rating	Post Survey Likelihood Assessment	Assessment
Bossiaea eremaea			P3	Unlikely to occur	Preferred habitat for this taxon is deep red sand which was not present within the survey area. it is a non-cryptic and perennial species that was actively searched for during the field assessment and not located.
Comesperma viscidulum			P4	Unlikely to occur	Preferred habitat for this taxon includes sandplain, sand dune, lateritic plain and sandstone breakaway complex. Sandplain habitat was present within the survey area, however it is a non-cryptic and perennial species that was actively searched for during the field assessment and not located.
Conospermum toddii			P4	Unlikely to occur	Preferred habitat for this taxon includes yellow sands of sand dunes which were not present within the survey area. It is a non-cryptic and perennial species that was actively searched for during the field assessment and not located.
Lechenaultia aphylla			P1	Unlikely to occur	This taxon is known from very few records. Preferred habitat for this taxon is red sand of slopes and drainage areas which were not present within the survey area. It is a non-cryptic and perennial species that was actively searched for during the field assessment and not located.

5.2.4 Significant Vegetation

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

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

No TEC or PEC, restricted vegetation, highly disturbed vegetation, vegetation providing important refuge or significant ecological function was identified within the survey area. According to the BoM Atlas of Groundwater Dependent Ecosystems (BoM, 2021) database, there are no known or potential aquatic or terrestrial GDEs located within the survey area (refer to **Section 3.6**). No potential GDE vegetation was identified during the field survey.

5.2.5 Vegetation Condition

Based on the vegetation condition rating scale obtained from the EPA (2016a) provided in Appendix E, vegetation ranged from 'poor to 'very good' condition with the majority of vegetation in 'good' condition (Table 5-13). Disturbance in the area was a result of recent and/ or frequent fires and road siding of the Great Central Road. Maps of the vegetation condition across the survey area is provided in Figure 5-3. More detailed vegetation condition maps are provided in Appendix D.

Table 5-13: Vegetation condition rating within the survey area

Condition rating	Description (EPA, 2016a)	Area (ha)	Area (%)
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.	74	4.2
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.	1,551	87.2
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.	11	0.6
Cleared Vegetation	Existing Clearing (Great Central Road and gravel pits)	143	8.0
TOTAL		**1779**	**100**

Figure 5-3: Vegetation condition rating of the survey area

5.2.6 Introduced Flora

No introduced species were identified within the survey area (no opportunistic records and no taxa recorded in quadrats).

5.2.7 Fauna Habitat

Two broad scale terrestrial fauna habitat (not including cleared vegetation) were identified within the survey area. The extent of the identified fauna habitat and a summary description is provided in Table 5-14 below. A map of fauna habitats across the survey area is provided in Figure 5-4. More detailed fauna habitat maps are provided in Appendix D.

Table 5-14: Main terrestrial fauna habitats within the survey area

Fauna Habitat	Description	Representative Fauna Attributes	Significant Species that possibly occur in habitat	Example Image
<u>Clay-Loam Plain</u> Acacia Woodland Area= 223 ha (12.5%)	Clay-loam plain comprising of Acacia woodland over low mixed shrubs	• Ground not especially suited to burrowing species. • Moderately diverse vegetation strata supporting diverse avifauna assemblage. • Moderately dense vegetation and low to moderate leaf litter.	Peregrine Falcon *Falco peregrinus*	
<u>Sandplain</u> Acacia Woodland/ Eucalypt Woodland/ Mallee Woodland Area= 1413 ha (79.4%)	Sandplain comprising of Acacia/ Eucalypt Woodland/ Mallee woodland over low mixed shrubs and spinifex grassland	• Substrate very well suited to a variety of burrowing small mammals and reptiles. • Less diverse vegetation strata supporting a less diverse avifauna assemblage.	Princess Parrot *Polytelis alexandrae* Night Parrot *Pezoporus occidentalis* Peregrine Falcon *Falco peregrinus* Striated Grasswren (inland) *Amytornis striatus* subsp. *striatus* Brush-tailed Mulgara *Dasycercus blythi* Great Desert Skink *Liopholis kintorei*	

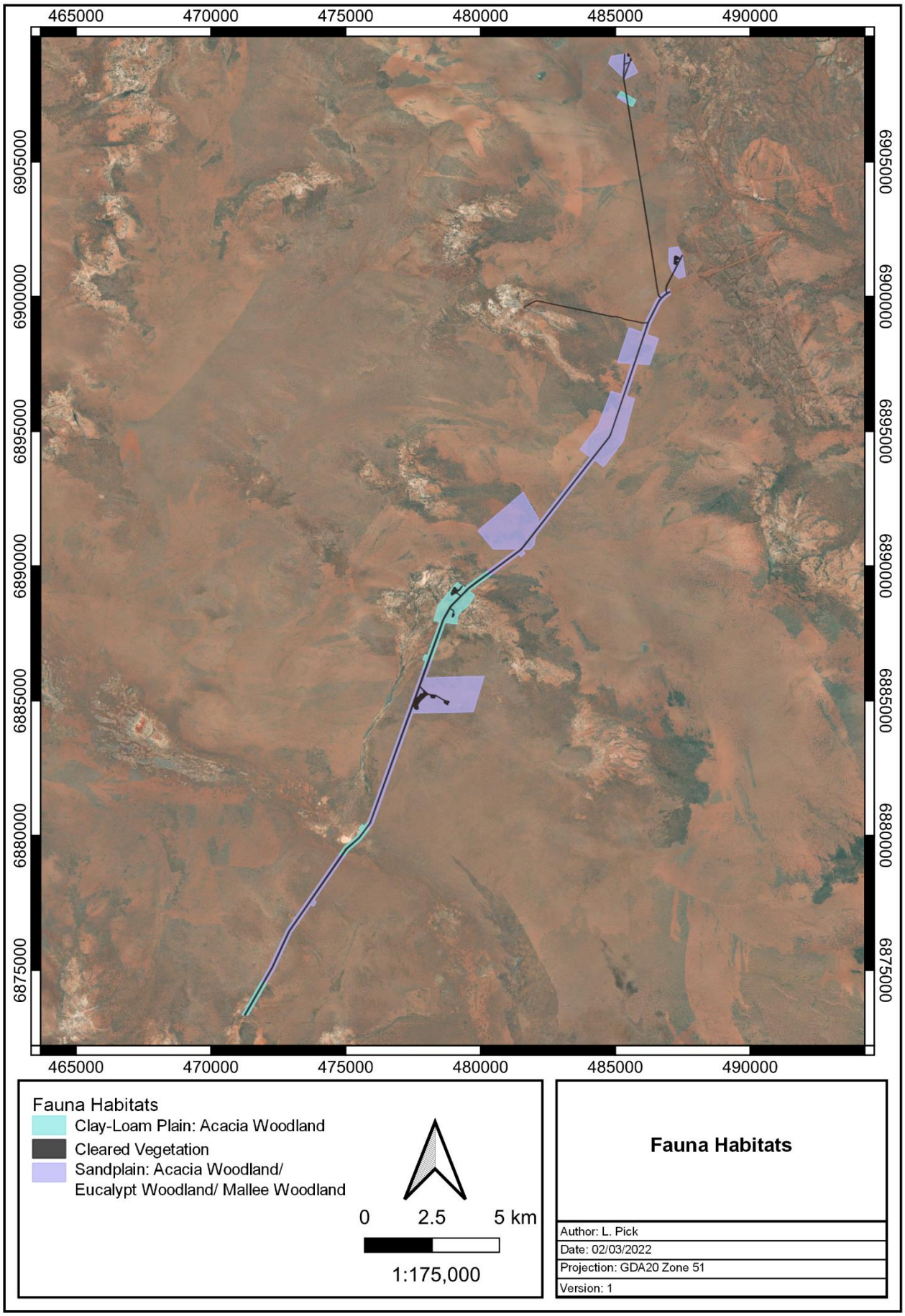


Figure 5-4: Fauna habitats within the survey area

5.2.8 Fauna Species

Table 5-15 summarises the number of fauna species potentially occurring within or utilising at times the survey area, based on results from the literature review and observations made during the field assessment. A complete list of fauna possibly inhabiting or frequenting the survey area is provided in Appendix J. A list of fauna species observed during the field survey is provided in Table 5-16.

Table 5-15: Summary of potential vertebrate fauna species

Group	Total number of Potential species	Potential number of Specially Protected species	Potential number of Migratory species	Potential number of Priority species	Number of species recorded during Field Survey
Amphibians	10	0	0	0	0
Birds	109	4	3	2	2
Non-Volant Mammals	102	2	0	2	40
Volant Mammals (Bats)	28[8]	0	0	0	10[5]
Reptiles	10	1	0	1	7
Total	**259[8]**	**7**	**3**	**5**	59[7]

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

Table 5-16: Fauna species observed during the field survey

Taxon Name	Common Name
Birds	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater
Acanthiza apicalis	Broad-tailed Thornbill
Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Acanthiza robustirostris	Slaty-backed Thornbill
Acanthiza uropygialis	Chestnut-rumped Thornbill
Anthus australis	Australian Pipit
Aphelocephala leucopsis	Southern Whiteface
Ardeotis australis	Australian Bustard
Aquila audax	Wedge-tailed Eagle
Cacatua roseicapilla	Galah
Colluricincla harmonica	Grey Shrike-thrush
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Corvus bennetti	Little Crow
Corvus orru	Torresian Crow
Cracticus nigrogularis	Pied Butcherbird
Cracticus tibicen	Australian Magpie
Cracticus torquatus	Grey Butcherbird
Dromaius novaehollandiae	Emu
Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel
Hirundo neoxena	Welcome Swallow

Taxon Name	Common Name
Lichenostomus plumulus	Grey-fronted Honeyeater
Lichenostomus virescens	Singing Honeyeater
Malurus lamberti	Variegated Fairywren
Malurus leucopterus	White-winged Fairywren
Malurus splendens	Splendid Fairywren
Manorina flavigula	Yellow-throated Miner
Microeca fascinans	Jacky Winter
Neophema bourkii	Bourke's Parrot
Ocyphaps lophotes	Crested Pigeon
Oreoica gutturalis	Crested Bellbird
Pachycephala rufiventris	Rufous Whistler
Petroica goodenovii	Red-capped Robin
Platycercus varius	Mulga Parrot
Platycercus zonarius	Australian Ringneck
Pomatostomus superciliosus	White-browed Babbler
Ptilonorhynchus maculatus	Western Bowerbird
Pyrrholaemus brunneus	Redthroat
Rhipidura leucophrys	Willie Wagtail
Smicrornis brevirostris	Weebill
Mammals	
Austronomus australis	White-striped Freetail-bat
Bos taurus	European Cattle
Camelus dromedarius	Camel
Canis lupis	Dingo/ Dog
Felis catus	Cat
Macropus fuliginosus	Western Grey Kangaroo
Macropus robustus	Euro
Macropus rufus	Red Kangaroo
Oryctolagus cuniculus	Rabbit
Ozimops petersi	Inland Freetail-bat
Tachyglossus aculeatus	Echidna
Vulpes vulpes	Red Fox
Reptiles	
Ctenophorus cristatus	Bicycle Dragon
Ctenophorus Isolepis	Central Military Dragon
Ctenophorus nuchalis	Central Netted Dragon
Ctenophorus reticulatus	Western Netted Dragon
Ctenotus leonhardii	
Moloch horridus	Thorny Devil
Varanus gouldii	Bungarra

5.2.9 Significant Fauna

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

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

Table 5-17 below provides an assessment of the likelihood of occurrence of fauna species of significance previously recorded in the general area and reasons for the inclusion and omission from the potential fauna list. No significant fauna taxa were confirmed as occurring within the survey area. The current status of some species on site and/or in the general area is difficult to determine, however, based on the habitats present and/ or recent nearby records, the following species of conservation significance can be regarded as possibly occurring in the wider area (but not necessarily within the survey area):

- **Great Desert Skink *Liopholis kintorei*** – Vulnerable (BC Act), Vulnerable (EPBC Act)
  The sandplains within the survey areas represent potential habitat for this species. Closest, most recent records ~ 60km north near Lake Wells in 2018 (DBCA, 2021dc. Possibly occurs in the wider area however no evidence found within areas surveyed.

- **Princess Parrot *Polytelis alexandrae* –** P4 (DBCA Priority Species), Vulnerable (EPBC Act)
  Woodlands and shrubland represent possible foraging habitat for this species depending on species composition. The small areas of marbled gum eucalypt woodland may contain potential breeding habitat (i.e. trees with hollows) though none observed. Closest, most recent records ~ 80km south east of the eastern end of the survey area from 2011 (DBCA, 2021c). A wide-ranging nomadic species so considered as possibly occurring but would only be very occasionally and for short periods.

- **Grey Falcon *Falco hypoleucos***– Vulnerable (EPBC Act and BC Act)
  Survey area may form part of larger home range and has potential to pass through the survey area. No potential nest sites/ direct bird observations identified during the field survey.

- **Peregrine Falcon *Falco peregrinus*** – Other Specially Protected (BC Act)
  Open air space over all areas represent potential foraging habitat for this species. The species potentially utilises some sections of the survey area as part of a much larger home range, though records in this area are rare and therefore it is likely to only be present occasionally. Closest, most recent record ~ 60km south west of the western end of the survey area from 2012 (DBCA, 2021c). No potential nest sites observed.

- **Striated Grasswren (sandplain) *Amytornis striatus striatus*** – P4 (DBCA Priority Species)
  Spinifex covered sandplains and some shrublands within the survey areas represent potential habitat for this species. No recent nearby records but under surveyed and cryptic (i.e. difficult to detect). Possibly occurs in wider area however no evidence found within areas surveyed.

- **Brush-tailed Mulgara *Dasycercus blythi*** – P4 (DBCA Priority Species)
  The sandplains within the survey areas represent potential habitat for this species. Closest, most recent records ~ 60km north near Lake Wells in 2018 (DBCA, 2021c). Possibly occurs in the wider area however no evidence found within areas surveyed.

It should be noted that while habitats onsite for the species listed above are considered possibly suitable, some or all may be marginal in extent/quality and therefore the fauna species considered as possibly occurring may in fact only visit the area for short periods as infrequent vagrants. The result of the literature review and observations made during the field survey suggest that the probability of any of the above-mentioned fauna species actually occurring with the survey area would be low.

Table 5-17: Likelihood of occurrence for fauna of conservation significance within the survey area

Taxon	Conservation Status			Habitat description	Likelihood of occurrence (pre-survey)	Likelihood of occurrence (post-survey)
	EPBC Act	BC Act	DBCA Priority			
Buff-snouted Blind Snake *Anilios margaretae*	-	-	P2	Previously recorded in playa and sheoak habitat and *Acacia* shrublands on the border of tree and shrub steppe between sandhills and sandplains.	Unlikely to occur. Habitat appears to be marginal/ unsuitable.	Unlikely to occur. Habitat marginal/ unsuitable.
Great Desert Skink *Liopholis kintorei*	VU	VU	-	The Great Desert Skink generally occurs on red sandplains and sand ridges. Vegetation usually consists of hummock grassland (*Triodia basedowii, Triodia pungens* and *Triodia schinzii*), with some scattered shrubs and occasional trees (e.g. *Acacia* spp., *Eucalyptus* spp., *Hakea* spp., *Grevillea* spp. and *Allocasuarina decaisneana*) (DAWE, 2019).	Possibly occurs. Within known range and suitable habitat may be present.	Possibly occurs. Suitable habitat present and possible occurs within the wider area, however no evidence found within areas surveyed.
Malleefowl *Leipoa ocellata*	VU	VU	-	Scrublands and woodlands dominated by mallee and wattle species (DAWE 2019).	Unlikely to occur. Habitat appears to be marginal/ unsuitable. Area is outside of main documented range – very occasional transients only.	Unlikely to occur. Habitat marginal and unsuitable for breeding.
Princess Parrot *Polytelis alexandrae*	VU	-	P4	Inhabits sand dunes and sand flats in the arid zone of western and central Australia. It occurs in open savanna woodlands and shrublands that usually consist of scattered stands of *Eucalyptus* (including *E. gongylocarpa*, *E. chippendalei* and mallee species), *Casuarina* or *Allocasuarina* trees; an understorey of shrubs such as *Acacia* (especially *A. aneura*), *Cassia*, *Eremophila*, *Grevillea*, *Hakea* and *Senna*; and a ground cover dominated by *Triodia* species (DAWE, 2019).	Possibly occurs. Uncommon and wide ranging – may occur occasionally and for short periods.	Possibly occurs. However most areas lack possible breeding habitat.
Night Parrot *Pezoporus occidentalis*	EN	CR	-	Broad habitat requirements include areas of old-growth spinifex (*Triodia*) for roosting and nesting, together with foraging habitats that are likely to include various native grasses and herbs, and may or may not contain shrubs or low trees. (DPaW, 2017).	Unlikely to occur. Habitat appears to be marginal/ unsuitable.	Unlikely to occur. Habitat marginal and unsuitable for breeding.

Taxon	Conservation Status			Habitat description	Likelihood of occurrence (pre-survey)	Likelihood of occurrence (post-survey)
	EPBC Act	BC Act	DBCA Priority			
Grey Falcon *Falco hypoleucos*	VU	VU		The Grey Falcon occurs at low densities across inland Australia. The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. The species has been observed hunting in treeless areas and frequents tussock grassland and open woodland, especially in winter. While breeding Grey Falcons feed almost exclusively on birds (DAWE, 2021b)..	Possibly occurs. Survey area may form part of larger home range. .	Possibly occurs. Potential to pass through the survey area however no potential breeding sites observed.
Peregrine Falcon *Falco peregrinus*	-	OS	-	The Peregrine Falcon is found in most habitats, from rainforests to the arid zone, and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water, and may even be found nesting on high city buildings (Birdlife Australia, 2018).	Possibly occurs. Survey area may form part of larger home range but unlikely to breed in area.	Possibly occurs. May occur aerially over survey area but unlikely to breed in the area.
Migratory Shorebirds	MI	IA	-	Prefer muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland (DotEE, 2018).	Would Not Occur. No suitable habitat.	Would Not Occur. No suitable habitat.
Striated Grasswren (sandplain) *Amytornis striatus striatus*	-	-	P4	Mainly spinifex, with or without low shrubs and herbage, on sandy or loamy plains; also bushy acacias on sandridges and interdunes, usually with spinifex.	Possibly occurs. Within known range and suitable habitat may be present.	Possibly occurs. Suitable habitat present. No evidence found within areas surveyed.
Grey Wagtail *Motacilla cinerea*	MI	IA	-	Running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Morecombe 2004).	Would Not Occur. No suitable habitat.	Would Not Occur. No suitable habitat.
Yellow Wagtail *Motacilla flava*	MI	IA	-	Occurs in a variety of damp or wet habitats with low vegetation, from rushy pastures, meadows, hay fields and marshes to damp steppe and grassy tundra (Morecombe 2004).	Would Not Occur. No suitable habitat.	Would Not Occur. No suitable habitat.
Southern Marsupial Mole *Notoryctes typhlops*	-	-	P4	Most often recorded in sandy dunes with various Acacias and other shrubs.	Unlikely to occur. Within known range, however habitat appears to be marginal/unsuitable being located along existing Great Central Road.	Unlikely to occur. Suitable habitat (sand dunes) not present within survey area.

Taxon	Conservation Status			Habitat description	Likelihood of occurrence (pre-survey)	Likelihood of occurrence (post-survey)
	EPBC Act	BC Act	DBCA Priority			
Sandhill Dunnart *Sminthopsis psammophila*	EN	EN	-	The sandhill dunnart occurs in isolated sandy arid and semi-arid areas in the Great Victoria Desert and the Eyre Peninsula. It occurs in vegetation dominated by hummock (*Triodia*) grassland. The species shelters during the day in nests in the centre of large hummocks, especially in hummocks that have started to die off in the centre, where they dig a circular depression (DAWE, 2019).	Unlikely to occur. Outside of known range and habitat appears marginal/unsuitable.	Would not occur. Limited old growth spinifex present within the survey area.
Brush-tailed Mulgara *Dasycercus blythi*	-	-	P4	Occurs on sand dunes with sparse cover of sandhill caingrass or areas around salt lakes (DAWE, 2019).	Possibly occurs. Within known range and suitable habitat may be present.	Possibly occurs. Habitat within survey area is marginal and no evidence found within areas surveyed.
Bilby *Macrotis lagotis*	VU	VU	-	Bilby distribution is now largely restricted to two broad habitat types: mulga woodlands with lateritic red earth and spinifex grasslands with high fire frequency, again with the red earth (Johnson 1989, Southgate 1990).	Unlikely to occur. The survey area falls within the historical distribution of this species but the lack of records in recent times suggest it is very likely locally extinct.	Unlikely to occur. Habitat marginal/ unsuitable.

5.2.10 Other areas of Conservation Significance

The DBCA lists 'Priority' species and communities which are under consideration for declaration as 'Threatened' under the BC Act. These Priority species/ communities have no formal legal protection until they are endorsed by the Minister as being Threatened.

No Priority species or PEC as listed DBCA were identified within the survey area. There are no wetlands of international importance (Ramsar Wetlands) or national importance (Australian Nature Conservation Agency Wetlands) within the survey area.

There are no proposed or gazetted conservation reserves within the survey area. Both proposed and gazetted conservation reserves are managed by DBCA with gazetted conservation reserves vested with the Conservation and Parks Commission of Western Australia. The Conservation and Parks Commission is an independent statutory authority that was established under the Conservation and Land Management (CALM) Act 1984 in November 2000 and is the controlling body in which the State's conservation estate, including national parks, conservation parks, nature reserves, state forests and timber reserves, are vested. The Conservation and Parks Commission develops policies and provides independent advice to the Minister for Environment with respect to conservation, the management of ecological biodiversity and the application of ecologically sustainable forest management. The DBCA manages land on behalf of the Conservation and Parks Commission.

The closest known Environmentally Sensitive Area (ESA) as listed under the *Environmental Protection Act 1986* (EP Act) is the Yeo Lake Nature Reserve, located approximately 110km east of the survey area.

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

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

Definitions of Conservation Significant Species

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

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

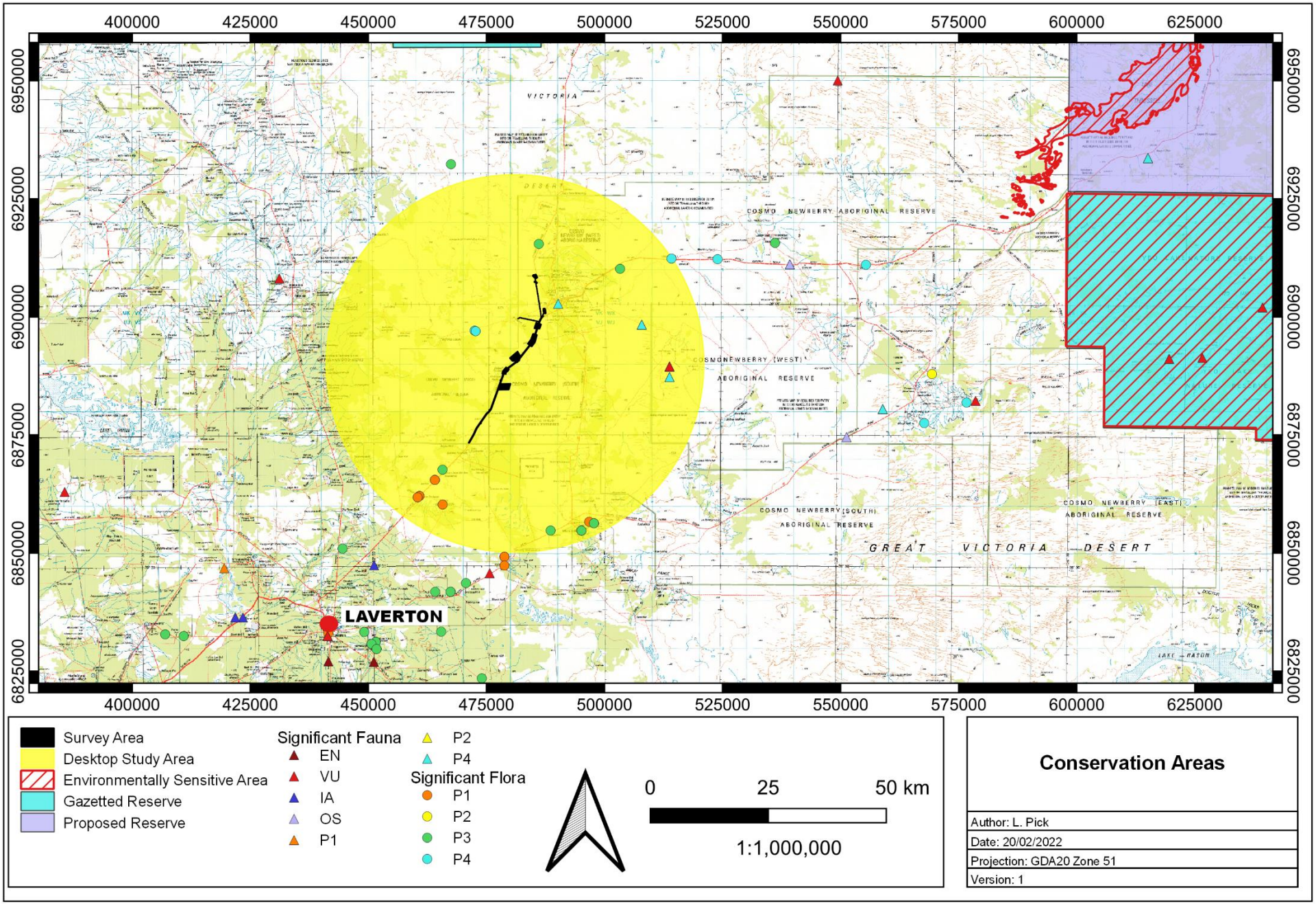
Code	Category
	Taxa where it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame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

Definitions of conservation significant communities

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

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

Appendix B:
Regional maps of the desktop study area/ survey area in relation to areas of conservation significance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VICTORIA
COSMO NEWBERRY ABORIGINAL RESERVE
COSMO NEWBERRY (WEST) ABORIGINAL RESERVE
COSMO NEWBERRY (SOUTH) ABORIGINAL RESERVE
COSMO NEWBERRY (EAST) ABORIGINAL RESERVE
GREAT VICTORIA DESERT
LAKE RASON
LAVERTON
Survey Area
Desktop Study Area
Environmentally Sensitive Area
Gazetted Reserve
Proposed Reserve
Significant Fauna
EN
VU
IA
OS
P1
P2
P4
Significant Flora
P1
P2
P3
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Conservation Areas
Author: L. Pick
Date: 20/02/2022
Projection: GDA20 Zone 51
Version: 1

Appendix C:
List of species identified within each vegetation type

(A) and blue text-denotes annual taxa (WAHERB, 2022)

Family	Genus	Taxon	CLP-AFW1	CLP-AOW1	S-AFW2	S-EW1	S-MWS1	S-MWS4
Amaranthaceae	*Ptilotus*	*exaltatus*			*			
Amaranthaceae	*Ptilotus*	*obovatus*			*		*	
Amaranthaceae	*Ptilotus*	*schwartzii*	*					
Apocynaceae	*Leichardtia*	*australis*			*			
Chenopodiaceae	*Atriplex*	*bunburyana*		*				
Chenopodiaceae	*Dysphania*	*kalpari (A)*	*		*			
Chenopodiaceae	*Enchylaena*	*tomentosa*	*		*			
Chenopodiaceae	*Maireana*	*triptera*			*			
Chenopodiaceae	*Maireana*	*pyramidata*		*	*			
Chenopodiaceae	*Sclerolaena*	*patenticuspis*	*					
Fabaceae	*Acacia*	*ayersiana*		*			*	
Fabaceae	*Acacia*	*burkittii*			*		*	
Fabaceae	*Acacia*	*caesaneura*	*	*			*	
Fabaceae	*Acacia*	*desertorum*				*	*	*
Fabaceae	*Acacia*	*doreta*				*	*	
Fabaceae	*Acacia*	*incurvaneura*	*	*	*	*		*
Fabaceae	*Acacia*	*kempeana*	*					
Fabaceae	*Acacia*	*ligulata*				*	*	*
Fabaceae	*Acacia*	*murrayana*						*
Fabaceae	*Acacia*	*pachyacra*					*	
Fabaceae	*Acacia*	*quadrimarginea*	*		*			
Fabaceae	*Acacia*	*ramulosa* var. *ramulosa*			*			
Fabaceae	*Acacia*	*tetragonophylla*	*		*			
Fabaceae	*Leptosema*	*chambersii*				*	*	
Fabaceae	*Senna*	*artemisioides* subsp. *filifolia*		*	*	*	*	*
Fabaceae	*Senna*	*artemisioides* subsp. *helmsii*				*		
Fabaceae	*Senna*	*artemisioides* subsp. *x artemisioides*	*		*	*	*	
Frankeniaceae	*Frankenia*	*setosa*	*		*			
Goodeniaceae	*Brunonia*	*australis (A)*			*			
Goodeniaceae	*Scaevola*	*spinescens*	*		*			*
Hemerocallidaceae	*Dianella*	*revoluta*	*					
Lamiaceae	*Dicrastylis*	*exsuccosa*					*	
Lamiaceae	*Teucrium*	*teucriiflorum*	*		*	*		
Malvaceae	*Sida*	*calyxhymenia*	*					
Myrtaceae	*Aluta*	*maisonneuvei* subsp. *auriculata*				*	*	

Family	Genus	Taxon	CLP-AFW1	CLP-AOW1	S-AFW2	S-EW1	S-MWS1	S-MWS4
Myrtaceae	*Eucalyptus*	*concinna*						*
Myrtaceae	*Eucalyptus*	*leptopoda* subsp. *elevata*					*	
Myrtaceae	*Eucalyptus*	*gongylocarpa*				*	*	*
Myrtaceae	*Eucalyptus*	*trivalva*					*	*
Myrtaceae	*Eucalyptus*	*youngiana*			*	*	*	
Myrtaceae	*Melaleuca*	*interioris*			*			
Myrtaceae	*Melaleuca*	*leiocarpa*		*				
Poaceae	*Aristida*	*contorta (A)*			*			
Poaceae	*Enneapogon*	*caerulescens*			*			
Poaceae	*Triodia*	*basedowii*	*		*	*	*	*
Proteaceae	*Grevillea*	*juncifolia* subsp. *juncifolia*				*	*	
Proteaceae	*Grevillea*	*acacioides*				*	*	
Proteaceae	*Grevillea*	*sarissa*			*			
Proteaceae	*Hakea*	*francisiana*					*	
Proteaceae	*Hakea*	*recurva*					*	
Rubiaceae	*Psydrax*	*latifolia*					*	*
Rubiaceae	*Psydrax*	*suaveolens*	*		*	*	*	
Santalaceae	*Exocarpos*	*sparteus*				*		
Santalaceae	*Santalum*	*spicatum*	*		*			
Sapindaceae	*Dodonaea*	*lobulata*			*			
Sapindaceae	*Dodonaea*	*rigida*	*		*			
Scrophulariaceae	*Eremophila*	*homoplastica*	*					
Scrophulariaceae	*Eremophila*	*forrestii* subsp. *forrestii*			*	*	*	
Scrophulariaceae	*Eremophila*	*gilesii*	*		*			
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *glabra*	*			*		
Scrophulariaceae	*Eremophila*	*latrobei* subsp. *latrobei*	*		*			
Scrophulariaceae	*Eremophila*	*longifolia*		*				
Scrophulariaceae	*Eremophila*	*platythamnos*				*		*
Scrophulariaceae	*Eremophila*	*alternifolia*			*			
Scrophulariaceae	*Eremophila*	*deserti*				*		
Scrophulariaceae	*Eremophila*	*oldfieldii* subsp. *angustifolia*			*			
Solanum	*Solanum*	*lasiophyllum*		*	*			
Zygophyllaceae	*Roepera*	*eremaea (A)*			*			

Appendix D:
Vegetation Type and Vegetation Condition Maps/ Fauna Habitat Maps

Appendix E:
Vegetation Condition Rating

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

Appendix F:
Quadrat Locations (NW Corner-GDA94)

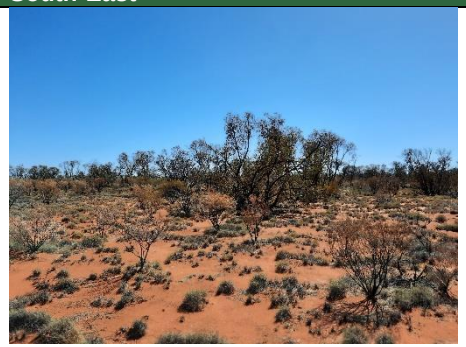
Quadrat	Vegetation Code	Zone	Easting	Northing	Elevation
Q26	S-EW1	51 J	487304	6901516	517 m
Q27	S-MWS1	51 J	486149	6898461	509 m
Q28	S-MWS1	51 J	485924	6898531	512 m
Q29	S-MWS1	51 J	481499	6890527	511 m
Q30	CLP-AFW1	51 J	477991	6886576	501 m
Q31	CLP-AOW1	51 J	475573	6880285	466 m
Q32	S-MWS1	51 J	473761	6877562	479 m
Q56	S-EW1	51 J	487493	6901286	517 m
Q57	S-MWS4	51 J	478912	6884907	504 m
Q58	S-MWS1	51 J	477977	6885333	497 m
Q59	S-MWS1	51 J	484575	6894290	496 m
Q60	S-EW1	51 J	485119	6895436	495 m
Q61	S-AFW2	51 J	485950	6897811	505 m
Q62	CLP-AFW1	51 J	485328	6907408	532 m
Q63	S-AFW2	51 J	485254	6908457	535 m

Appendix G:
Quadrat Datasheets

Appendix H:
Quadrat Photographs

Quadrat 26			
Direction	**East**	**South-East**	**South**
Quadrat 27			
Direction	**East**	**South-East**	**South**
Quadrat 28			
Direction	**East**	**South-East**	**South**

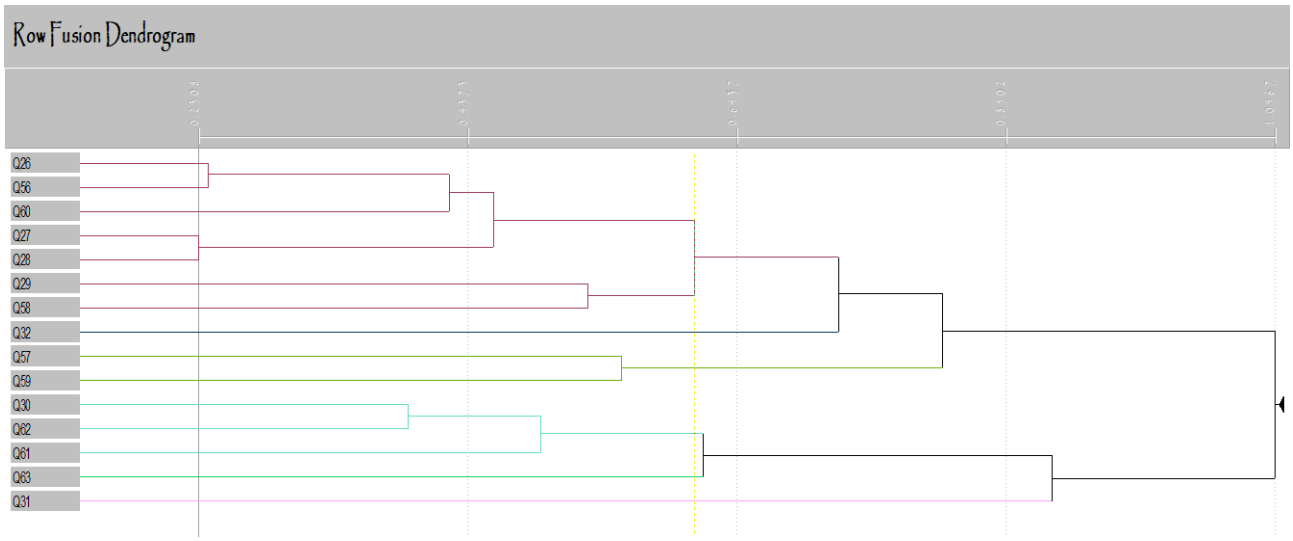
Quadrat 29			
Direction	**East**	**South-East**	**South**
Quadrat 30			
Direction	**East**	**South-East**	**South**
Quadrat 31			
Direction	**East**	**South-East**	**South**

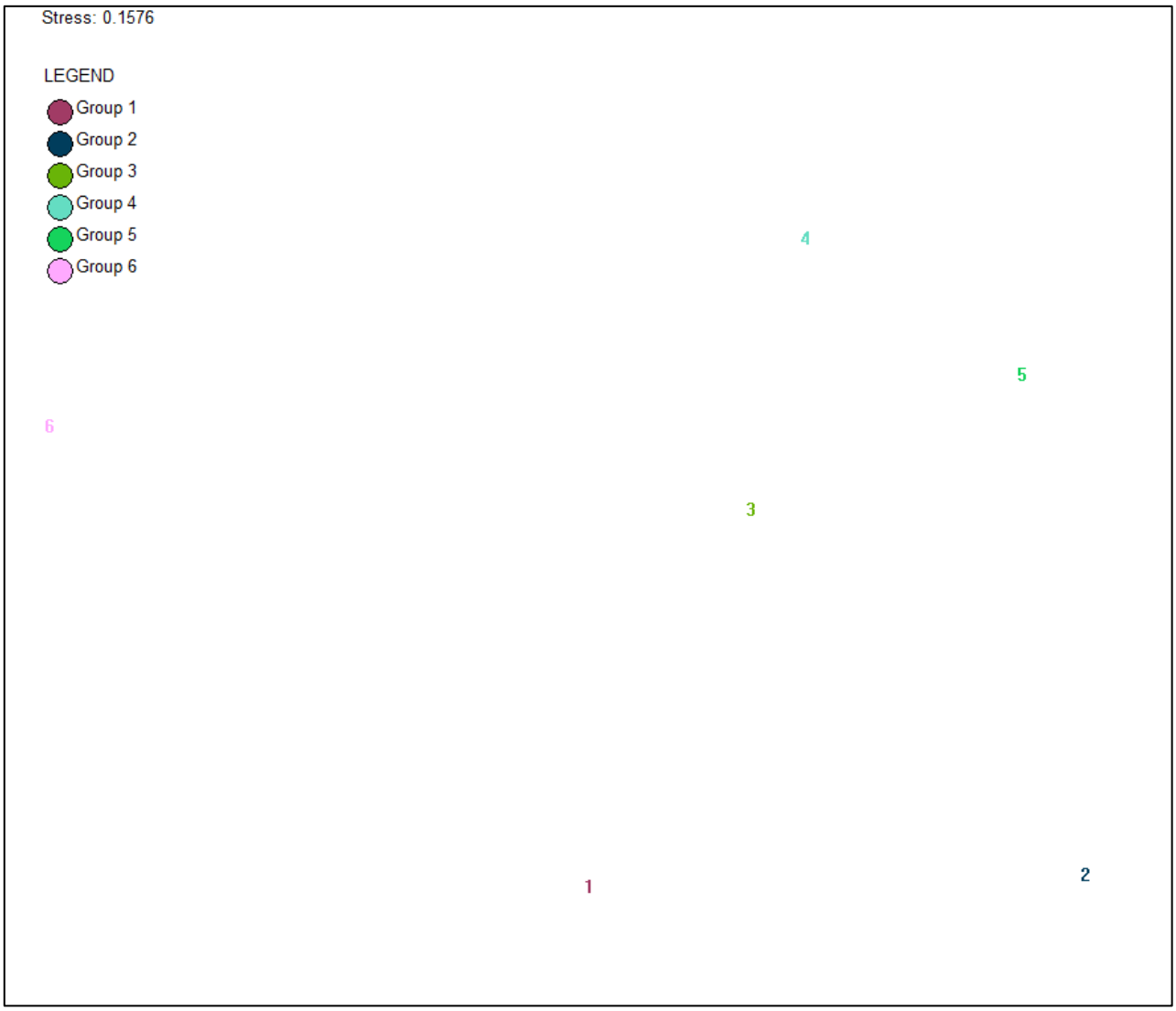
Quadrat 32			
Direction	**East**	**South-East**	**South**
Quadrat 56			
Direction	**East**	**South-East**	**South**
Quadrat 57			
Direction	**East**	**South-East**	**South**

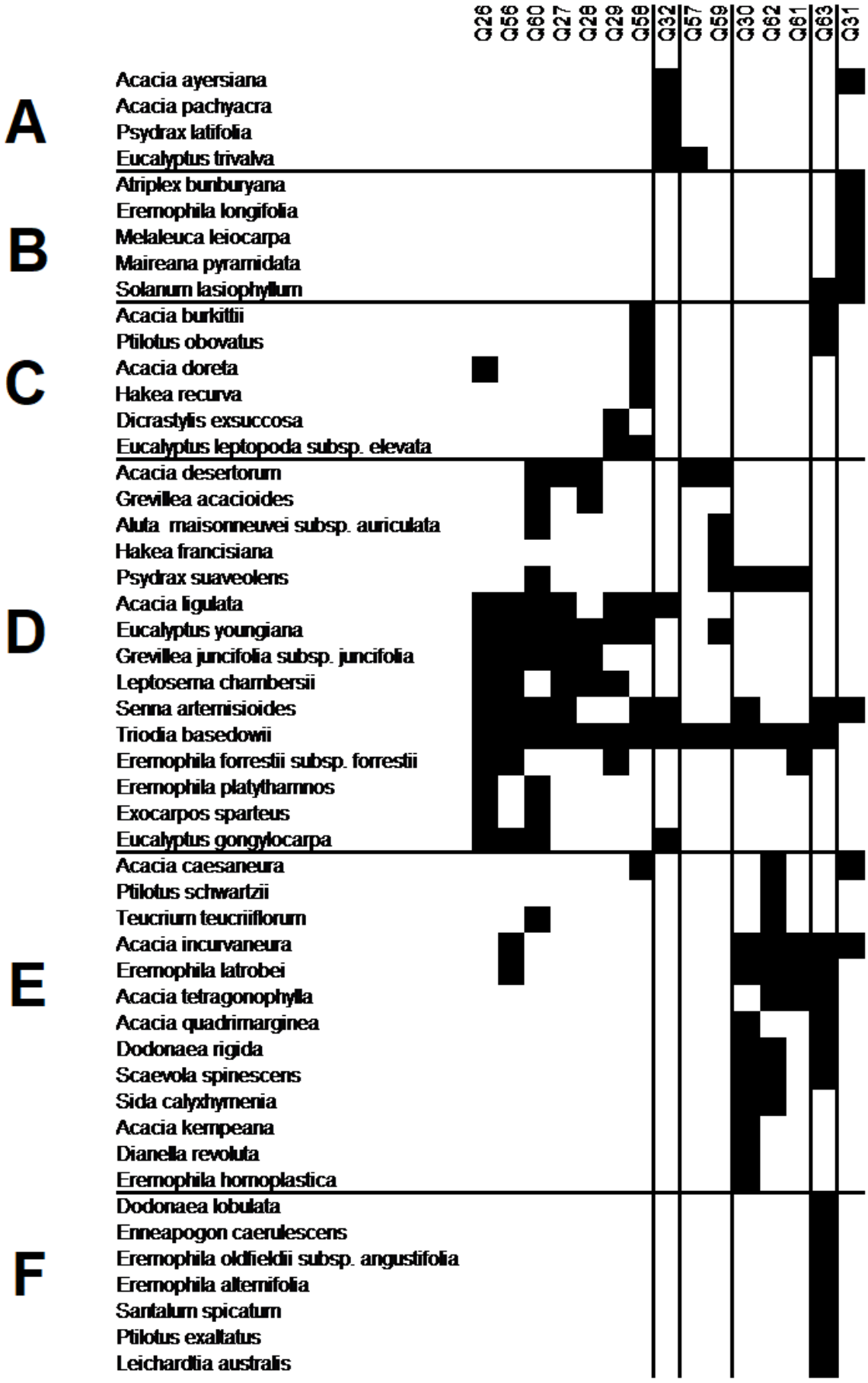
Quadrat 58			
Direction	**East**	**South-East**	**South**
Quadrat 59			
Direction	**East**	**South-East**	**South**
Quadrat 60			
Direction	**East**	**South-East**	**South**

Quadrat 61			
Direction	**East**	**South-East**	**South**
Quadrat 62			
Direction	**East**	**South-East**	**South**
Quadrat 63			
Direction	**East**	**South-East**	**South**

Appendix I:
PATN Analysis Results


Row Fusion Dendrogram
Q26
Q56
Q60
Q27
Q28
Q29
Q58
Q32
Q57
Q59
Q30
Q62
Q61
Q63
Q31


Stress: 0.1576
LEGEND
Group 1
Group 2
Group 3
Group 4
Group 5
Group 6
4
5
6
3
1
2


Q26
Q56
Q60
Q27
Q28
Q29
Q58
Q32
Q57
Q59
Q30
Q62
Q61
Q63
Q31
A
Acacia ayersiana
Acacia pachyacra
Psydrax latifolia
Eucalyptus trivalva
B
Atriplex bunburyana
Eremophila longifolia
Melaleuca leiocarpa
Maireana pyramidata
Solanum lasiophyllum
C
Acacia burkittii
Ptilotus obovatus
Acacia doreta
Hakea recurva
Dicrastylis exsuccosa
Eucalyptus leptopoda subsp. elevata
D
Acacia desertorum
Grevillea acacioides
Aluta maisonneuvei subsp. auriculata
Hakea francisiana
Psydrax suaveolens
Acacia ligulata
Eucalyptus youngiana
Grevillea juncifolia subsp. juncifolia
Leptosema chambersii
Senna artemisioides
Triodia basedowii
Eremophila forrestii subsp. forrestii
Eremophila platythamnos
Exocarpos sparteus
Eucalyptus gongylocarpa
E
Acacia caesaneura
Ptilotus schwartzii
Teucrium teucriiflorum
Acacia incurvaneura
Eremophila latrobei
Acacia tetragonophylla
Acacia quadrimarginea
Dodonaea rigida
Scaevola spinescens
Sida calyxhymenia
Acacia kempeana
Dianella revoluta
Eremophila homoplastica
F
Dodonaea lobulata
Enneapogon caerulescens
Eremophila oldfieldii subsp. angustifolia
Eremophila alternifolia
Santalum spicatum
Ptilotus exaltatus
Leichardtia australis

Appendix J:
Potential Fauna List