



**Reconnaissance**  
**Flora and Vegetation Survey of the**  
**Eureka Gold Project- May 2022**

Prepared for  
Warriedar Mining Pty Ltd  
under



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Prepared by:  
**Native Vegetation Solutions**  
PO Box 41  
KALGOORLIE  
Ph: (08) 9021 5818  
Mob: 0407 998 953  
Email: [eren@nativevegsolutions.com.au](mailto:eren@nativevegsolutions.com.au)

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## 1 INTRODUCTION

Warriedar Mining Pty Ltd is a subsidiary company of Red Dirt Metals Ltd (ASX: RDT) who are focused on exploration and development of lithium, gold and copper assets in Western Australia's Eastern Goldfields region and is the owner of its Eureka Gold Project.

Native Vegetation Solutions (NVS) was supplied with a survey area located approximately 50 km north of Kalgoorlie, in the Murchison Region (MUR) of Western Australia (Figure 1). The Eureka Gold Project comprises of 5 tenements located 51.5km North of Kalgoorlie at the existing Eureka mine site.

The total survey area received from Red Dirt Metals covers approximately 721.5 ha. The survey area lies within Mining Tenements M 24/189, M 24/586, M 24/584 and M 24/585, Prospecting Tenement P 24/5116, and Miscellaneous Tenements L 24/234 and L 24/247. Actual disturbance footprints are not yet defined; however, clearing required within the boundary of the survey area is anticipated to be less than the total survey area.

This report will encompass results of the reconnaissance flora and vegetation survey within the Eureka Project survey area.

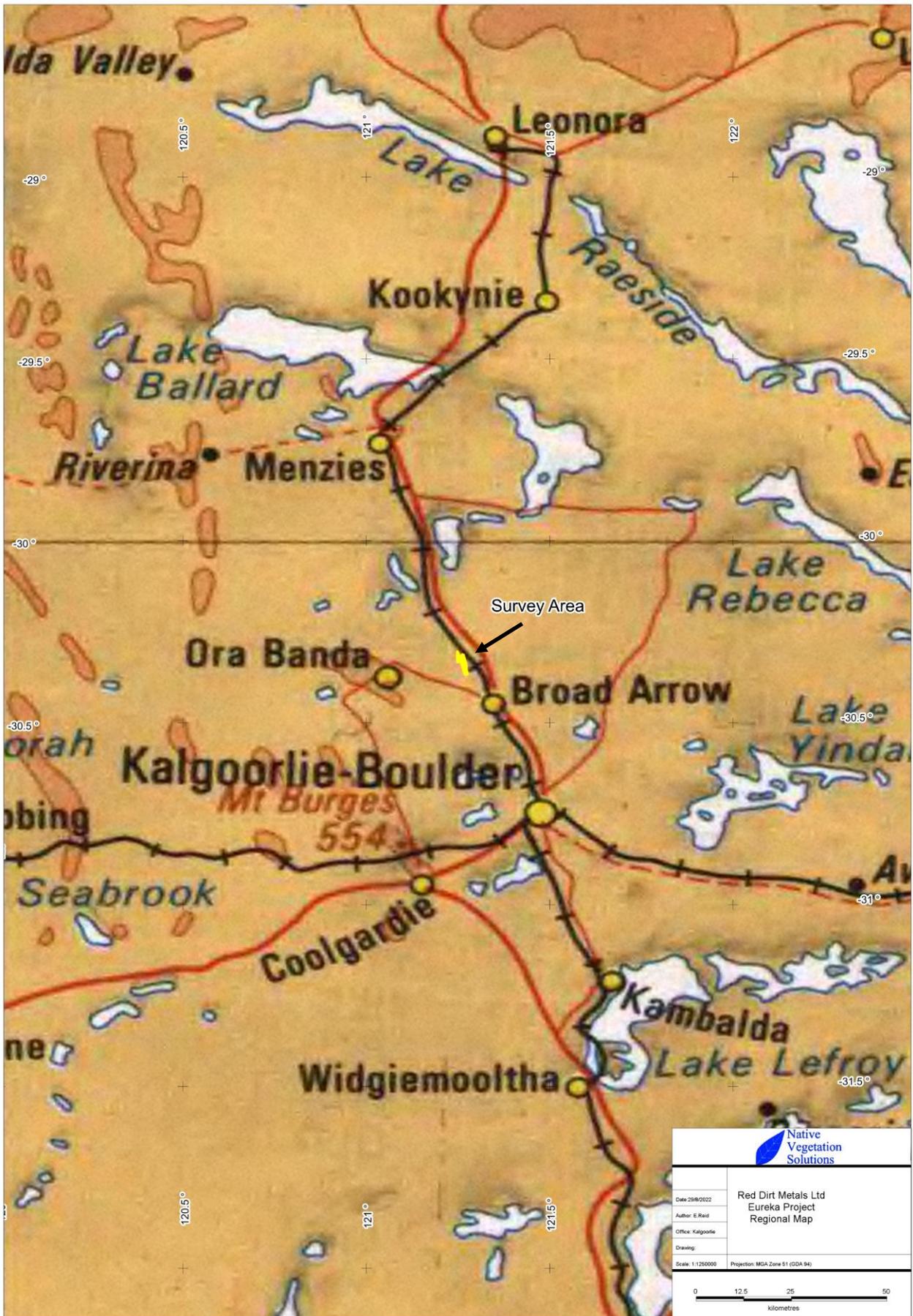


Figure 1: Regional map of survey location

## 1.1 Objectives

The objective of this report is to document the results of the flora and vegetation component of a reconnaissance assessment conducted in accordance with:

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

A reconnaissance assessment has two components:

- 1). Desktop study which includes a literature review and a search of the relevant databases;
- 2). Reconnaissance survey of the survey area to verify the desktop survey, to define vegetation units present in the area, search for species of conservation significance and to determine potential sensitivity to impact.

As part of the reporting for the reconnaissance assessment, NVS has conducted a flora and vegetation survey which includes broad-scale vegetation mapping and vegetation condition mapping of the survey area.

The scope of work for the reconnaissance flora and vegetation survey was to:

- conduct a desktop study that includes a literature review and search of the relevant databases;
- describe the vegetation associations in the survey area;
- prepare an inventory of species occurring in the survey area;
- identify any vegetation communities or flora species of conservation significance;
- map broad-scale vegetation groups found within the survey area, including vegetation condition; and
- provide recommendations, including the management of perceived impacts to flora and vegetation within the survey area.

## 1.2 Geology and Vegetation

The survey area lies in the Murchison (MUR) Interim Biogeographic regionalisation of Australia (IBRA) bioregion, more specifically the Eastern Murchison (MUR01) subregion. The Eastern Murchison subregion covers over 7 million hectares and contains the northern parts of the 'Southern Cross' and 'Eastern Goldfields' Terrains of the Yilgarn Craton. The landscape is characterised by extensive areas of elevated red desert sandplains with minimal dune development and internal drainage. The occluded Paleodrainage system generates Salt lake systems. Other features include broad plains of red-brown soils, breakaway complexes, and red sandplains. Mulga woodlands often rich in ephemerals; hummock grasslands, saltbush shrublands and *Tecticornia* shrublands dominate the vegetation (CALM, 2002)

## 1.3 Climate

The climate is classified as Arid with 200-300 mm of rainfall, sometimes in summer but usually in winter (CALM, 2002). The nearest official meteorological weather station with the most complete and up to date temperature information is Kalgoorlie-Boulder Airport (station number 012038), which is located approximately 53 km south of the survey area.

### 1.3.1 Temperature

Mean annual minimum temperature at Kalgoorlie-Boulder Airport is 11.8°C and mean annual maximum temperature is 25.3°C (BOM, 2022). The coldest temperatures are attained in July (mean minimum temperature 5.1°C), the hottest is January (mean maximum temperature 33.7°C) and diurnal temperature variations are relatively consistent throughout the year (Figure 2).

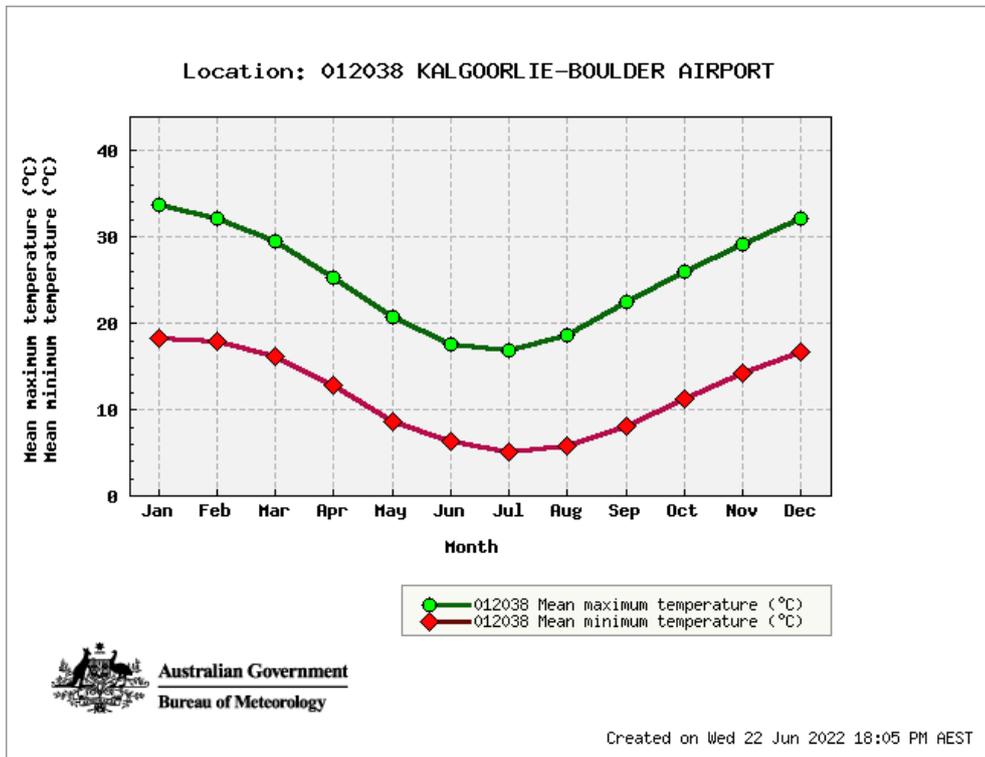


Figure 2: Mean temperature ranges for Kalgoorlie-Boulder Airport weather station

### 1.3.2 Rainfall

The annual average rainfall at Kalgoorlie-Boulder Airport is 265.6 mm, which falls (>1 mm) on an average of 39.1 rain-days (BOM, 2022). Larger rainfall events occur from January to March and May to July (Figure 3). Prior to the survey in 2022, rainfall in April exceeded monthly averages while rainfall for all other months remained below monthly averages (BOM, 2022).

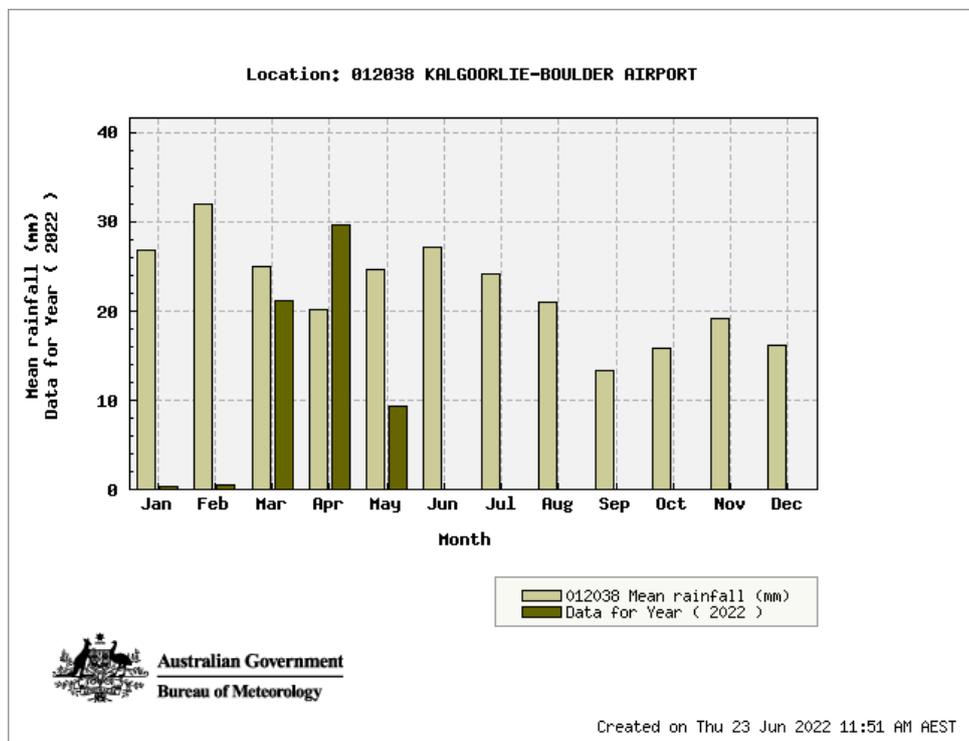


Figure 3: Monthly and mean rainfall for Kalgoorlie-Boulder Airport weather station

## 2. ASSESSMENT METHODOLOGY

### 2.1 Personnel and Reporting

The following personnel were involved in the Reconnaissance flora and vegetation survey:

- Mr Eren Reid (*BSc- Biological Science*), Principal Botanist, Native Vegetation Solutions, undertook the survey, vegetation mapping, data collation, field identification of flora, preparation and review of the report. Mr Eren Reid has over 18 years' experience in botanical surveys throughout the Murchison region and over a variety of environments across Western Australia.
- Ms Adele Thomasz (*BSc- Conservation and Wildlife Biology*), Native Vegetation Solutions, data collation and preparation of the report. Adele Thomasz has over 5 years' experience working in the conservation sector and one year specifically working on botanical survey reporting; and
- Mr Frank Obbens (*BSc*), Consultant Botanist, Bushtech Consultancy, undertook identification of unknown samples collected in the field. Mr Frank Obbens has over 22 years' experience offering botanical identification and conducting taxonomic investigations to consultancies and industry.

### 2.2 Preliminary Desktop Study

A preliminary assessment of the survey area and its potential constraints was undertaken by reviewing relevant government agency managed databases (Sections 2.2.1 to 2.2.6, and Appendices 1 & 2) and consulting with government agencies where necessary. The following sections provide a summary of desktop searches undertaken for the project.

#### 2.2.1 *Environment Protection and Biodiversity Conservation Act Protected Matters*

The *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* Protected Matters Search tool was utilised to identify Matters of National Environmental Significance (MNES) within the survey area and up to a 3 km buffer (DAWE, 2022).

#### 2.2.2 Threatened Flora and Communities

The Threatened and Priority Flora Database managed by the Department of Biodiversity, Conservation and Attractions (DBCA) was searched for threatened and priority flora within a 10km radial area of the survey area (DBCA, 2022a).

The Threatened and Priority Ecological Communities (TECs and PECs) database was searched to determine the presence of PECs or TECs (DBCA, 2022), with Geographic Information System (GIS) data supplied for assessment, within a 20 km radial area of the survey area.

#### 2.2.3 Environmentally Sensitive Areas (ESAs) and Conservation Reserves

The Department of Water and Environmental Regulation (DWER, 2022) Clearing Permit System Map Viewer was used to determine the location of any ESAs and Conservation Reserves.

#### 2.2.4 Land Systems

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

### **2.2.5 Vegetation Type, Extent and Status**

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

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

### **2.2.6 Wetlands**

The potential of wetlands within the project area was determined by examining DWER's Clearing Permit System Map Viewer (DWER, 2022).

### **2.2.7 Dieback**

Dieback is only considered a potential issue for any project if both of the below factors are relevant for the project (CALM, 2003):

- the project area lies within the Southwest Land Division; and
- the mean annual rainfall of the area is greater than 400 mm.

## **2.3 Site Investigation**

A site visit of the Eureka Project survey area was carried out by Botanist Eren Reid from Native Vegetation Solutions on the 10<sup>th</sup> and 11<sup>th</sup> of May 2022 to examine the flora and vegetation groups contained within the survey area. A total of 18 hours was spent on site traversing the survey area, by Yamaha Viking and on foot.

The survey was conducted in accordance with relevant Environmental Protection Authority's (EPA's) Statements and Technical Guidance (Section 1.1).

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

### **2.3.1 Licenses**

Field work was conducted under Scientific License FB62000171, held by Mr Eren Reid with expiry 08/10/2022.

### **2.3.2 Field Methods**

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

In the field, 20m x 20m relevé sites were established at these sites, taking into account representation of surrounding vegetation and vegetation boundaries. Relevé sites are represented in Appendix 4.

Each relevé site was captured on a TwoNav Aventura GPS at ±4m accuracy, using Universal Transverse Mercator location on GDA94 datum. Digital photographs were taken of each representative vegetation group present in the survey area.

Data collected at each relevé included:

- Photograph of representative vegetation group;
- GPS Location;
- Species Present;
- Population Count/Estimate of Conservation Significant Flora (if present);
- Disturbance Level; and
- Vegetation Condition.

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

The vegetation structure was assessed using the method developed by Muir (1977). Definitions of the vegetation structure are presented in Appendix 3.

The condition of each relevé was assessed using the method developed by Keighery (1994). Definitions of the condition scale are presented in Appendix 3.

Vegetation groups were mapped using the methods listed in section 2.3.4 below.

Opportunistic sampling of plant taxa and vegetation group mapping was also utilised in the survey area between relevé sampling points, via wandering traverses. Smaller singular relevé sites were also utilised as opportunistic sample sites to collect flora specimens and assist in mapping vegetation groups.

All sample sites and GPS tracks are included in Appendix 4.

### **2.3.3 Post-Field Methods**

Unknown specimens collected in the field were identified post field work by Frank Obbens (Bushtech Consultancy) and Eren Reid (NVS) with reference to published keys, WAHERB reference herbarium and information published on Florabase (WAHERB, 2022). Threatened flora range extensions and new locations were submitted to the Western Australian Herbarium (WAHERB) as per the EPA Technical Guidelines (EPA 2016a).

Species information was transferred into Microsoft Excel<sup>®</sup> worksheets representing presence/absence of species per vegetation group.

### **2.3.4 Mapping**

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

Vegetation Health Condition was assessed in the field with reference to Keighery (1994).

GPS tracks and waypoints recorded during field work are presented in Appendix 4.

### **2.3.5 IBSA Data Package**

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

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

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

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

## **2.4 Nomenclature And Taxonomy**

Nomenclature follows that used by the WAHERB.

The WAHERB has updated its sequence and arrangement of collections to conform to the systematic sequence of the Angiosperm Phylogeny Group (APGIII), with the result that many Families and Genera have been moved or renamed. This report attempts to follow those changes in relation to species recorded during this survey. Definitions of Threatened Flora are also included in Section 6 below.

## 2.5 Limitations

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

**Table 1: List of potential survey limitations**

Potential Limitations	Constraint (Y/N)	Comment
Competency and experience of the consultants undertaking the survey	N	Experienced and competent personnel conducted the survey. Eren Reid has over 18 years' experience in botanical surveys throughout the Murchison Region and over a variety of environments across Western Australia.
Scope	N	The Scope of work was adequately defined. Vascular flora species were the focus of the survey and were thoroughly sampled.
Proportion of flora identified during survey	N	As the survey was planned to target species of conservation significance and flora within a defined survey area, a complete census of the species present was attempted (Approx. 95%). Sufficient identifications were made to allow vegetation descriptions to be made.
Sources of information	N	Threatened and Priority Flora GIS information was available from DBCA.
Proportion of the task achieved	N	All tasks completed.
Timing/Season	N	The reconnaissance flora and vegetation survey was conducted in Autumn 2022. Flowering annual species were present within the survey area, suggesting recent above average rainfall in April 2022 was sufficient for the period of survey.
Disturbance in survey area	N	Minimal disturbance (mining areas, historical exploration and access tracks) was observed within the survey area, however, did not compromise the results of the survey as these areas were avoided whilst collecting data.
Intensity of survey effort	N	The survey intensity is considered to have been sufficient for a reconnaissance survey according to EPA (2016) guidelines. Areas most likely to contain threatened and priority species were targeted. Vegetation mapping sites were selected to provide adequate coverage of the survey area.
Resources	N	Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the reconnaissance survey.
Access problems	N	All the areas in need of survey were easily accessible from existing tracks, or by foot.
Availability of contextual information on the region	N	Contextual information regarding vegetation and flora of the Murchison bioregion is readily available. Adequate information was able to be accessed from available databases.

### **3. RESULTS**

#### **3.1 Preliminary Desktop Assessment**

##### **3.1.1 EPBC Act Protected Matters**

Results of the EPBC Protected Matters search tool are included in Appendix 1. The results revealed that the Eureka Project survey area could possibly contain suitable habitat for the weed species *Carrichtera annua* (Ward's Weed) and *Cenchrus ciliaris* (Buffel grass) (DAWE, 2022a).

*Carrichtera annua* was introduced into Australia from the eastern Mediterranean, and is now widespread throughout South Australia, the Interior, and Western Australia (Lamp & Collet, 1989). This species is not listed as a declared plant by DPIRD (2022), however according to the EPBC search tool this invasive weed species is considered a threat to the rangeland biodiversity within the Southern Australian Sheep and Cattle Grazing Land Management Zone (DAWE, 2022a).

*Cenchrus ciliaris* is native to Africa and India, was widely planted in Western Australian pastoral regions as a pasture grass, and has become a widespread weed of roadsides, creeklines, river edges and most vegetation types from Geraldton to the Pilbara, Kimberley and adjacent desert (Hussey, 2007). In the Murchison region it often colonises roadside table drains, excluding native everlastings. It seriously alters the fire characteristics of invaded plant cover by generating highly flammable fuel that is prone to more frequent fires.

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

##### **3.1.2 Threatened Flora and Communities**

The DBCA database searches revealed a potential for no Threatened and two Priority Flora species to occur within a 10km radius of the survey area (DBCA, 2022a). No known locations of Threatened or Priority Flora occur within the survey area, with the closest Priority Flora located approximately 1.2 km east of the survey area.

Results of the threatened flora database search are included in Appendix 2, which includes the likelihood of each species to occur within the survey area.

The PEC/TEC search (DBCA, 2022) revealed that no PECs or TECs fall within the survey area. One Priority 3 Ecological Community falls within a 20 km radius of the survey area; Emu Land System; and is located approximately 13 km to the northwest of the survey area. There are no TECs within 20 km of the survey area.

##### **3.1.3 Environmentally Sensitive Areas and Conservation Reserves**

The survey area does not lie within or contain any Environmentally Sensitive Areas (ESA) or Conservation Reserves (DWER, 2022).

### 3.1.4 Land Systems

As part of the Rangeland resource surveys, the Department of Agriculture mapped the Land Systems of Western Australia (DPIRD, 2017). The Land Systems occurring within the survey area are listed in Table 2 below and displayed in Appendix 4.

**Table 2: Land Systems occurring within the survey area (DPIRD, 2017)**

Land System	Description	Extent of Survey Area (ha)	% Of Survey Area (%)
Bunyip System	Gilgaid drainage tract, draining greenstone hills supporting mixed halophytic shrublands occasionally with a black oak overstorey.	163.40	22.65
Campsite System	Alluvial plains supporting eucalypt woodlands with halophytic understoreys and acacia shrublands.	213.14	29.54
Gumland System	Extensive pedeplains supporting eucalypt woodlands with halophytic and non-halophytic shrub understoreys.	88.90	12.32
Gundockerta System	Extensive, gently undulating calcareous stony plains supporting bluebush shrublands.	126.76	17.57
Illaara System	Plains with ironstone gravel or calcrete mantles supporting eucalypt woodlands and mulga-casuarina shrublands.	17.35	2.40
Leonora System	Low greenstone hills and stony plains supporting mixed chenopod shrublands.	8.03	1.11
Moriarty System	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.	103.92	14.40

### 3.1.5 Vegetation Type, Extent and Status

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

Information relating to the known Beard (1990) vegetation unit within the survey area has been summarised in Table 3 and Table 4 below. This information has been compiled through both desktop assessments and the site visit.

The extent of Beard vegetation unit 2,903 within the survey area is less than 3% of the total area at each scale (Table 3), and each are above the 30% threshold at a State, bioregional and subregional level (Table 4).

**Table 3: Extent of Beard Associations within the survey area**

Beard Vegetation Association	Extent within survey area (ha)	% of survey area (%)	By Association WA	By Association WA	By IBRA Region (MUR)	By IBRA Sub-region (MUR01)	By Shire (City of Kalgoorlie-Boulder)
2,903	721.5	100	2.54%	2.55%	2.55%	2.55%	2.61%

**Table 4: Summary of information regarding Pre-European and current vegetation extent of Vegetation Association 2,903 within the survey area**

Factor	Value				
Beard Vegetation Association*	2,903				
Vegetation Association Description*	Medium woodland; Salmon gum ( <i>Eucalyptus salmonophloia</i> ), goldfields blackbutt ( <i>Eucalyptus lesouefii</i> ), gimlet ( <i>Eucalyptus salubris</i> ) & <i>Allocasuarina cristata</i>				
Pre-European Extent (ha)	Scale				
	<b>By Association (WA)</b>	<b>By Association (WA)</b>	<b>By IBRA Region (MUR)</b>	<b>By IBRA Sub-region (MUR01)</b>	<b>By Shire (City of Kalgoorlie-Boulder)</b>
	28,423*	28,308.84**	28,295.17**	28,295.17**	27,634.01**
% Pre-European Extent Remaining	100.00%*	96.55%**	96.54%**	96.54%**	96.46%**
Surrounding Land Use***	Mining, Exploration, Pastoral Lease				
Weed prevalence***	Low				

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

\*\*Source: DBCA, (2019)

\*\*\*Source: Field Assessment

### 3.1.6 Wetlands

The DWER Clearing Permit System Map Viewer revealed no waterbodies within the survey area (DWER, 2022). The closest waterbody lies approximately 23 km to the northwest of the survey area (DWER, 2022).

### 3.1.7 Dieback

The survey area receives average annual rainfall of approximately 265.6 mm (BOM, 2022). There is no record of *Phytophthora cinnamomi* establishing in natural ecosystems in regions receiving less than 400mm of rainfall per annum (CALM, 2003).

Given the above, Dieback is not considered an issue for this survey area, however all measures should be taken to prevent any possible soil contamination (seeds of non-native species *etc.*) which poses a risk in the survey area during seasonally favourable conditions.

## 3.2 Field Assessment

### 3.2.1 Threatened Flora

No Priority or Threatened Flora were recorded in the survey area.

### 3.2.2 Vegetation Type, Extent and Status

A total of 26 Families, 52 Genera and 110 Species were recorded within the survey area. 12 major vegetation groups were recorded in the survey area and range from Degraded to Excellent condition (using the scale of Keighery 1994, see Appendix 3). Existing disturbance within the survey area is comprised mining areas, historic exploration and access roads

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Murchison subregion.

The summary of vegetation groups contained within the survey area is summarised in Table 5 below. Maps of the survey area can be seen in Appendix 4.

**Table 5: Vegetation Group Summary**

Vegetation Group	Veg Group Code	Families	Genera	Species	Area (ha)	Percentage of survey area (%)
<i>Casuarina pauper</i> thicket over sclerophyll shrubland in broad drainage lines	A	12	17	28	4.61	0.64
Open <i>Eucalyptus salmonophloia</i> woodland	B	16	25	47	308.65	42.78
<i>Acacia acuminata</i> shrubland	C	9	13	22	8.22	1.14
Sclerophyll shrubland	D	12	24	31	128.39	17.79
<i>Eucalyptus ravida</i> woodland	E	12	18	27	61.51	8.52
<i>Acacia acuminata</i> and <i>Acacia quadrimarginea</i> shrubland over rocky rises	F	16	21	28	3.55	0.49
Mixed <i>Eucalyptus</i> woodland over mixed sclerophyll shrubland	G	16	21	45	94.84	13.14
<i>Acacia acuminata</i> shrubland with emergent <i>Eucalyptus griffithsii</i>	H	10	14	23	4.85	0.67
<i>Acacia acuminata</i> shrubland on granite hills	I	9	10	12	3.71	0.51
Mixed <i>Eucalyptus</i> woodland over dense sclerophyll shrubland within broad drainage lines	J	12	21	42	44.51	6.17
Mulga shrubland	K	4	5	10	0.90	0.13
<i>Eucalyptus griffithsii</i> thicket over sclerophyll shrubland	L	9	13	20	0.89	0.12
Existing Disturbance	N/A	N/A	N/A	N/A	56.89	7.89
<b>Total</b>		<b>26*</b>	<b>52*</b>	<b>110*</b>	<b>721.5#</b>	<b>100%#</b>

Note: \* Within total survey area (not sum of column)  
# Sum of column

The Eureka Project vegetation groups are described in more detail below.

### **3.2.2.1 *Casuarina pauper* thicket over sclerophyll shrubland in broad drainage lines (A)**

This Thicket (Muir, 1977) consisted of 12 Families, 17 Genera and 28 Species. The vegetation group was approximately 4.61 ha which makes up 0.64% of the survey area.



**Figure 4: Vegetation Group A within the survey area**

### 3.2.2.2 Open *Eucalyptus salmonophloia* woodland (B)

This Woodland (Muir, 1977) consisted of 16 Families, 25 Genera and 47 Species. The vegetation group was approximately 308.65 ha which makes up 42.78% of the survey area.



**Figure 5: Vegetation Group B within the survey area**

### 3.2.2.3 *Acacia acuminata* shrubland (C)

This Scrub (Muir, 1977) consisted of 9 Families, 13 Genera and 22 Species. The vegetation group was approximately 8.22 ha which makes up 1.14% of the survey area.



Figure 6: Vegetation Group C within the survey area

### 3.2.2.4 Sclerophyll shrubland (D)

This Heath A (Muir, 1977) consisted of 12 Families, 24 Genera and 31 Species. The vegetation group was approximately 128.39 ha which makes up 17.79% of the survey area.



Figure 7: Vegetation Group D within the survey area

### 3.2.2.5 *Eucalyptus ravid* woodland (E)

This Low Woodland A (Muir, 1977) consisted of 12 Families, 18 Genera and 27 Species. The vegetation group was approximately 61.51 ha which makes up 8.52% of the survey area.



Figure 8: Vegetation Group E within the survey area

### 3.2.2.6 *Acacia acuminata* and *Acacia quadrimarginea* shrubland over rocky rises (F)

This Heath A (Muir, 1977) consisted of 16 Families, 21 Genera and 28 Species. The vegetation group was approximately 3.55 ha which makes up 0.49% of the survey area.



Figure 9: Vegetation Group F within the survey area

### 3.2.2.7 Mixed Eucalyptus woodland over mixed sclerophyll shrubland (G)

This Low Woodland A (Muir, 1977) consisted of 16 Families, 21 Genera and 45 Species. The vegetation group was approximately 94.84 ha which makes up 13.14% of the survey area.



Figure 10: Vegetation Group G within the survey area

### 3.2.2.8 *Acacia acuminata* shrubland with emergent *Eucalyptus griffithsii* (H)

This Tree Mallee (Muir, 1977) consisted of 10 Families, 14 Genera and 23 Species. The vegetation group was approximately 4.85 ha which makes up 0.67% of the survey area.



Figure 11: Vegetation Group H within the survey area

### 3.2.2.9 *Acacia acuminata* shrubland on granite hills (I)

This Heath A (Muir, 1977) consisted of 9 Families, 10 Genera and 12 Species. The vegetation group was approximately 3.71 ha which makes up 0.51% of the survey area.



Figure 12: Vegetation Group I within the survey area

### 3.2.2.10 Mixed Eucalyptus woodland over dense sclerophyll shrubland within broad drainage lines (J)

This Forest (Muir, 1977) consisted of 12 Families, 21 Genera and 42 Species. The vegetation group was approximately 44.51 ha which makes up 6.17% of the survey area.



Figure 13: Vegetation Group J within the survey area

### 3.2.2.11 Mulga shrubland (K)

This Thicket (Muir, 1977) consisted of 4 Families, 5 Genera and 10 Species. The vegetation group was approximately 0.90 ha which makes up 0.13% of the survey area.



Figure 14: Vegetation Group K within the survey area

### 3.2.2.12 *Eucalyptus griffithsii* thicket over sclerophyll shrubland (L)

This Tree Mallee (Muir, 1977) consisted of 9 Families, 13 Genera and 20 Species. The vegetation group was approximately 0.89 ha which makes up 0.12% of the survey area.



Figure 15: Vegetation Group L within the survey area

### 3.2.2.13 Existing Disturbance

Existing disturbance within the survey area consisted of mining areas, historic exploration and access roads and was approximately 56.89 ha which makes up 7.89% of the survey area.



**Figure 16: Existing disturbance within the survey area**

### **3.2.3 Weeds**

Two weed species was recorded within the survey area, *Carrichtera annua* (Ward's Weed) and *Salvia verbenaca* (Wild Sage). Neither species are considered Declared Pests (DPIRD, 2022).

### **3.2.4 Vegetation Condition**

Evidence of historic exploration, mining activities and access roads were observed during the field assessment.

Overall, the condition of the vegetation was determined to range from "Degraded" to "Excellent" with most of the area falling into the "Good" or "Very good" categories. Areas which were affected by historic exploration were deemed in "Good" condition, while areas affected by mining activities were deemed "Degraded". A map of the vegetation condition within the survey is depicted in Appendix 4.

#### 4. DISCUSSION

The field assessment established that the condition of the vegetation in the proposed disturbance area ranged from “Degraded” to “Excellent” with most of the area falling into the “Good” or “Very good” Categories. Areas which were affected by historic exploration were deemed in “Good” condition, while areas affected by mining activities were deemed “Degraded”. No areas of vegetation were assessed to be in “Pristine” condition.

Two weed species was recorded within the survey area, *Carrichtera annua* (Ward’s Weed) and *Salvia verbenaca* (Wild Sage). Neither species are considered Declared Pests (DPIRD, 2022).

No Priority or Threatened Flora were recorded in the survey area, (DBCA, 2022a).

No TECs or PECs were recorded in the survey area.

No unique or restricted vegetation communities were identified, and all vegetation types/communities are common, widespread and well represented in the Eastern Murchison subregion.

Any proposed disturbance/clearing of vegetation will result in a loss of species. However, given the size of the area and the extent of the Beard (1990) vegetation association elsewhere, the impact on the vegetation and its component flora will not affect the conservation values of either, or create fragmentation or patches of remnant vegetation.

The following recommendations arise from the reconnaissance flora survey:

- Impact assessment is recommended for Priority Flora in the survey area. This will rely heavily on the actual finalised disturbance footprint;
- Weed control measures should be implemented during and following earthworks; and
- Dust control measures should be implemented during earthworks.

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## 6. GLOSSARY

### Acronyms:

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

### Definitions:

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

#### T Threatened species:

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

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

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

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

#### CR Critically endangered species

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

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

**EN Endangered species**

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

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

**VU Vulnerable species**

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

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

**Extinct species:**

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

**EX Extinct species**

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

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

**EW Extinct in the wild species**

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

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

**Specially protected species**

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

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

**MI Migratory species**

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

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

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

**CD Species of special conservation interest (conservation dependent fauna)**

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

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

## **OS Other specially protected species**

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

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

## **P Priority Species**

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

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

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

### **Priority 1: Poorly-known species**

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

### **Priority 2: Poorly-known species**

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

### **Priority 3: Poorly-known species**

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

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

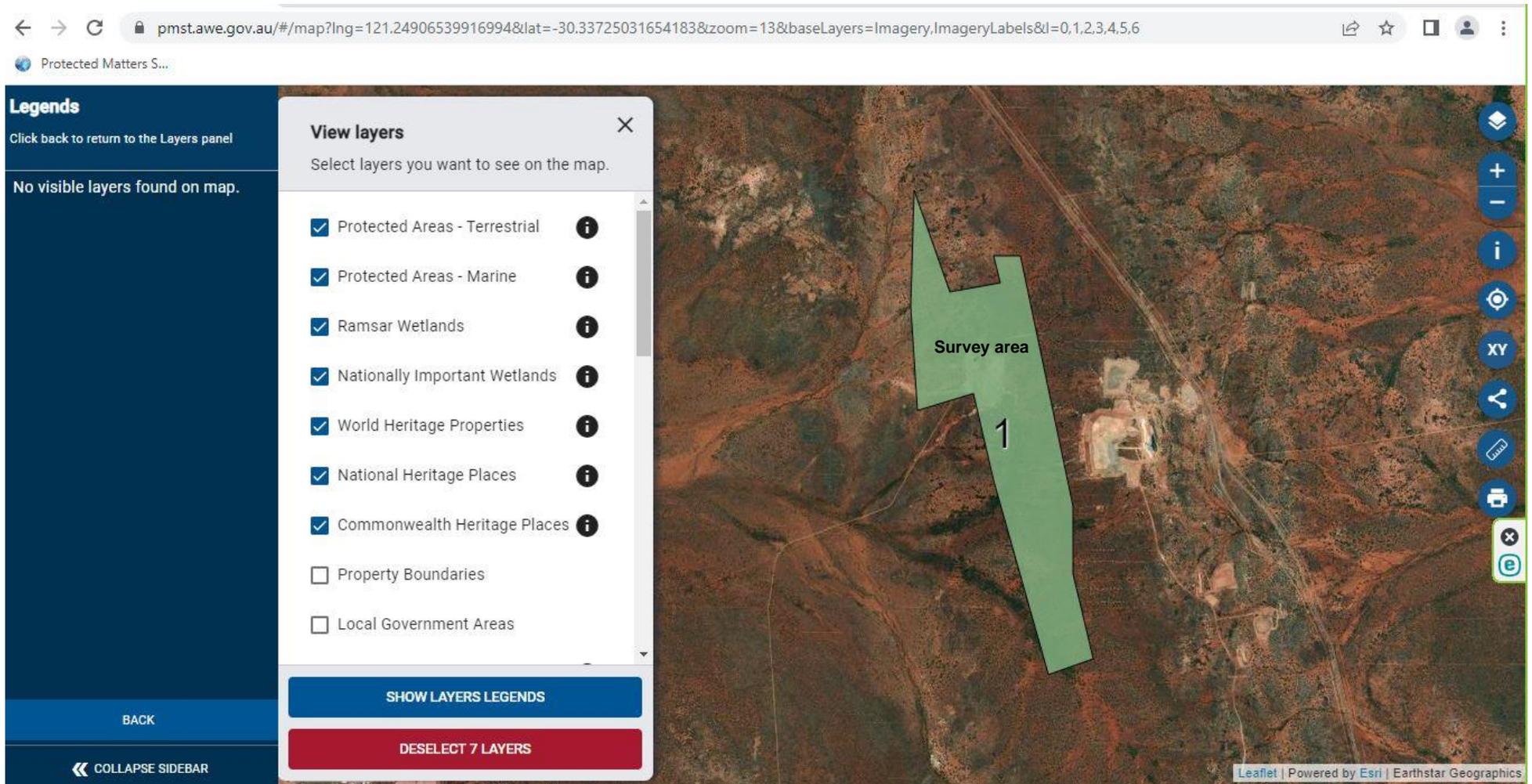
(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation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

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

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

## **Appendix 1**

### **Relevant Government Database Search Results**



The EPBC Protected Matters Search Tool showing no TECs or Commonwealth Reserves within the survey area (DAWE, 2022a)



## EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 23/06/22 12:22:44

[Summary](#)

[Details](#)

[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

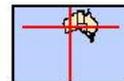
[Acknowledgements](#)



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[Coordinates](#)

Buffer: 3.0Km



## Summary

### Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	5
<a href="#">Listed Migratory Species:</a>	6

### Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	8
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

### Extra Information

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

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	11
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

## Details

### Matters of National Environmental Significance

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Pezoporus occidentalis</a> Night Parrot [59350]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus geoffroi</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[ Resource Information ]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area

#### Other Matters Protected by the EPBC Act

##### Listed Marine Species [ Resource Information ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<a href="#">Chrysococcyx osculans</a> Black-eared Cuckoo [705]		Species or species habitat known to occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area

## Extra Information

### Invasive Species

[ [Resource Information](#) ]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
<b>Birds</b>		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove, Spotted Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Carrichtera annua Ward's Weed [9511]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

## Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

## Coordinates

-30.304 121.2486,-30.313 121.26479,-30.346 121.27298,-30.366 121.27607,-30.368 121.2692,-30.333 121.24907,-30.304 121.2486

## Acknowledgements

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

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

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

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

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Department of Agriculture Water and the Environment  
GPO Box 858  
Canberra City ACT 2601 Australia  
+61 2 6274 1111

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Goldfields Hwy

**Survey area**

Murchison

5 km

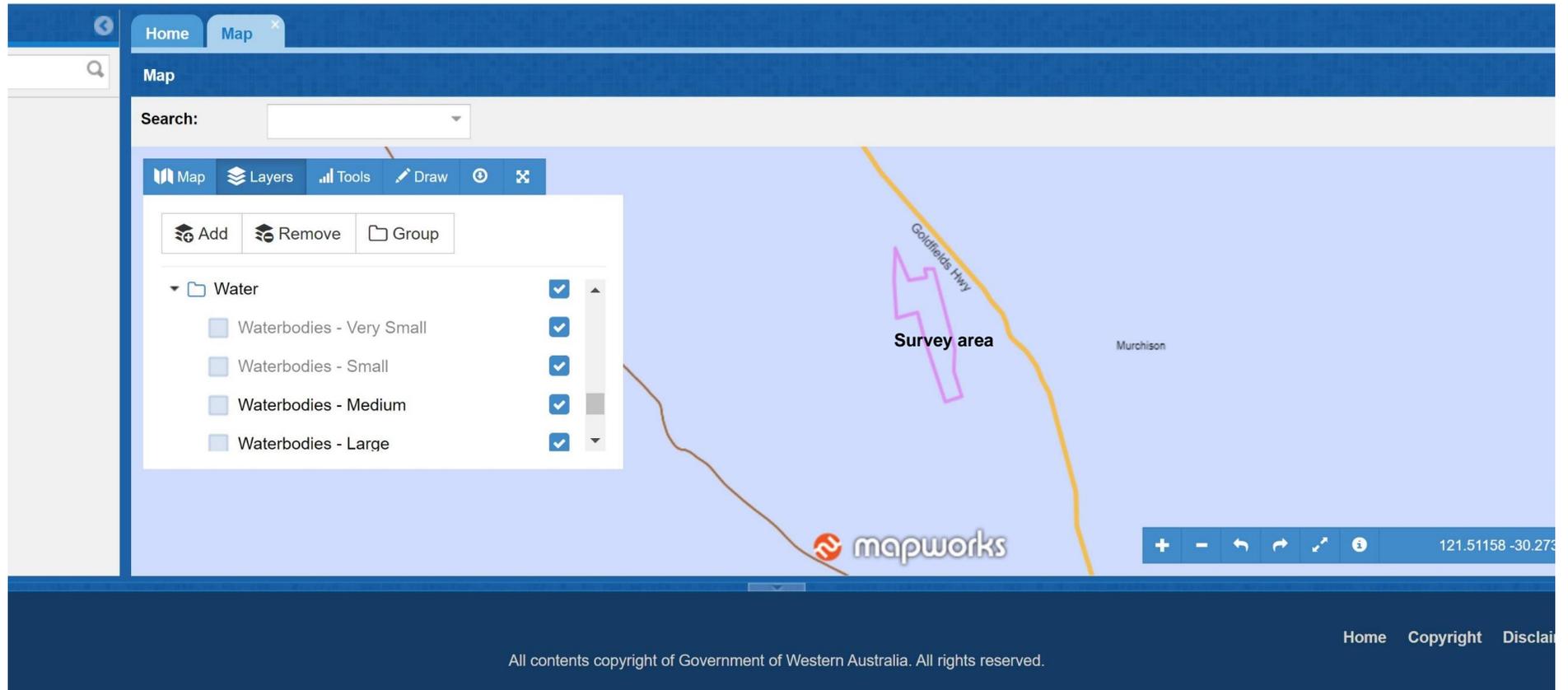
mapworks

121.109955 -30.263658

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DWER's Clearing Permit System Map Viewer showing no ESA's (dark green shaded areas) within the survey area (DWER, 2022)



DWER Clearing Permit System Map Viewer showing no waterbodies within the survey area (DWER, 2022)

## **Appendix 2**

### **Threatened Flora Databases Search Results**

GIS information provided in the Search results (Reference: 05\_0522FL) listed the following species within a 10km radius of the survey area (DBCA, 2022a):

Taxon	Conservation Code	Comment (Post field work)
<i>Acacia epedunculata</i>	P1	No suitable habitat
<i>Eucalyptus jutsonii</i> subsp. <i>jutsonii</i>	P4	No suitable habitat

## **Appendix 3**

### **Vegetation Definitions**

## Vegetation Condition Definitions (Keighery, 1994)

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

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

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

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

Retains basic vegetation structure or ability to regenerate it.

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

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

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

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

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

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

## Vegetation Structure Definitions (Muir, 1977)

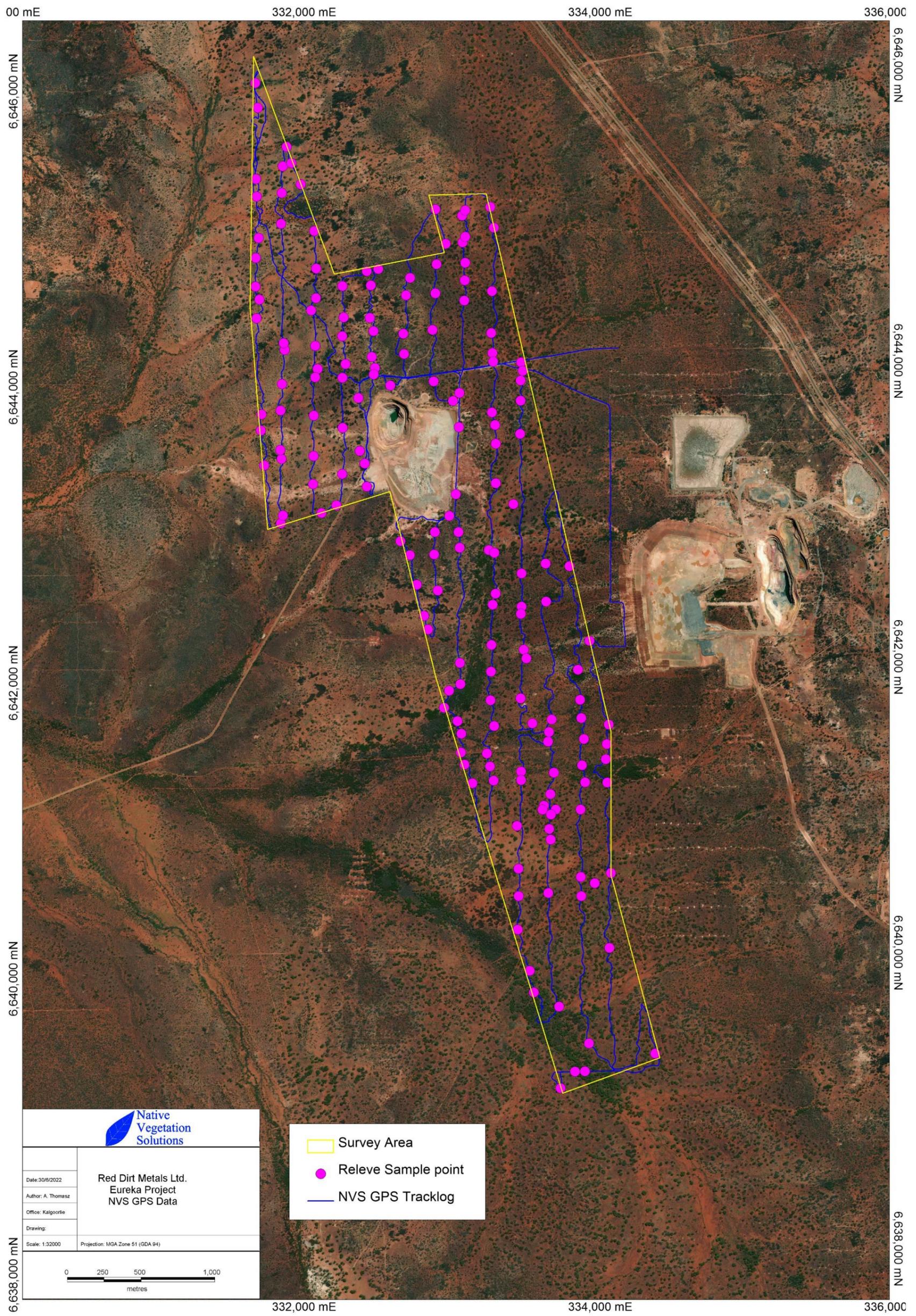
Life Form/Height Class	Canopy Cover			
	Dense 70-100% d	Mid-Dense 30-70% c	Sparse 10-30% i	Very Sparse 2-10% r
T Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland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

# **Appendix 4**

## **Vegetation Mapping**



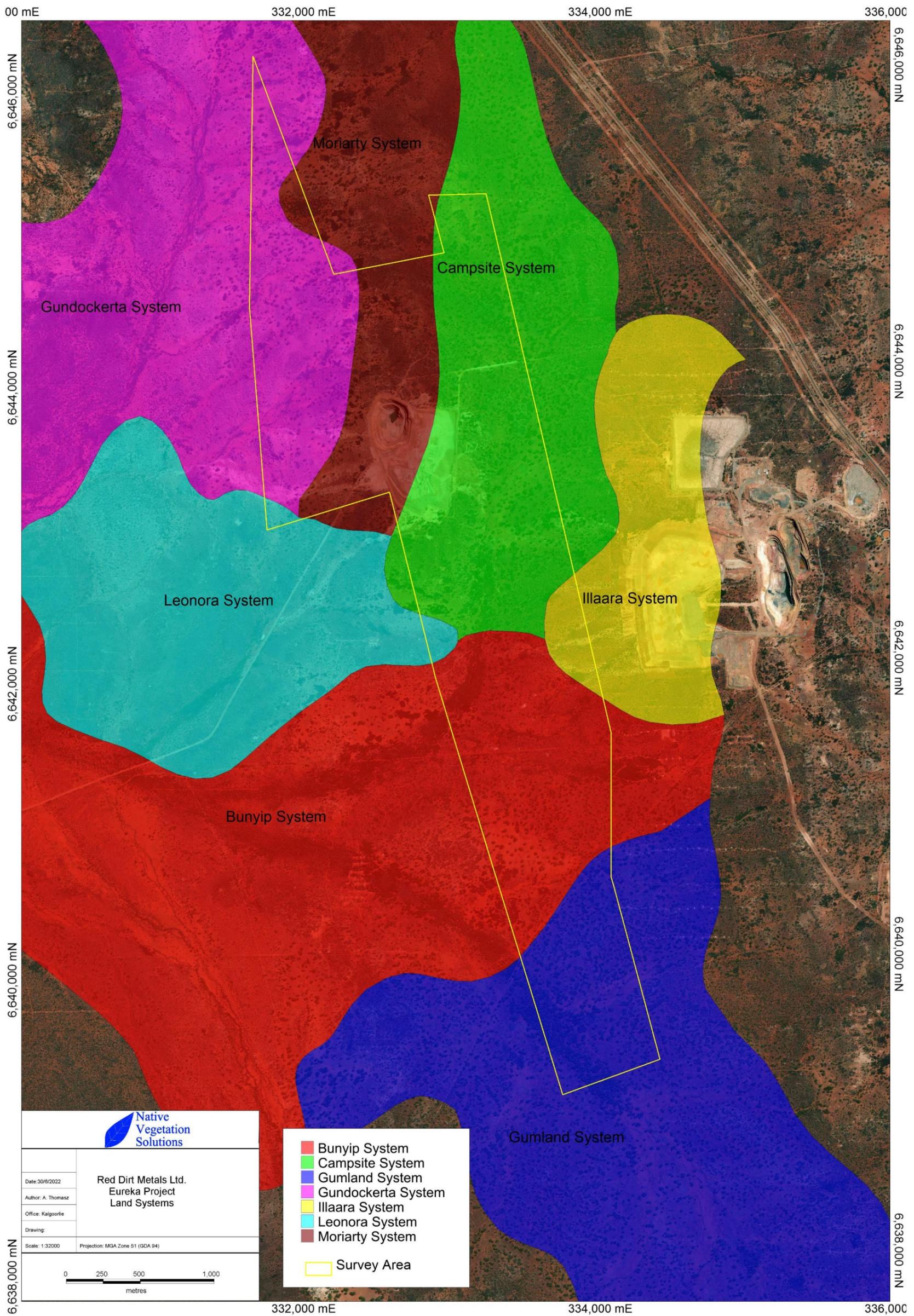
**Map 1: Eureka Project survey area**



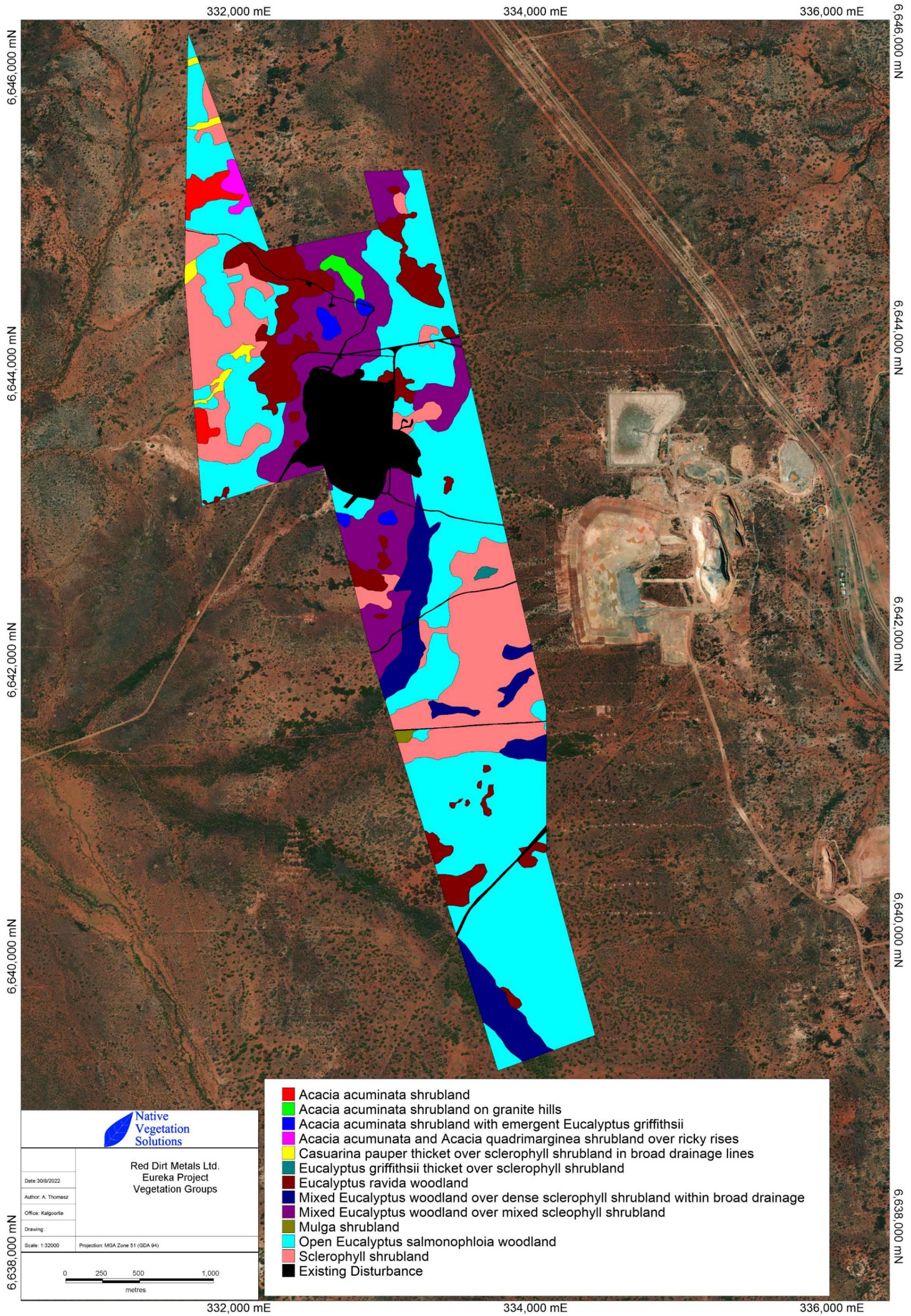
**Map 2: NVS GPS Data for the Eureka Project survey area**



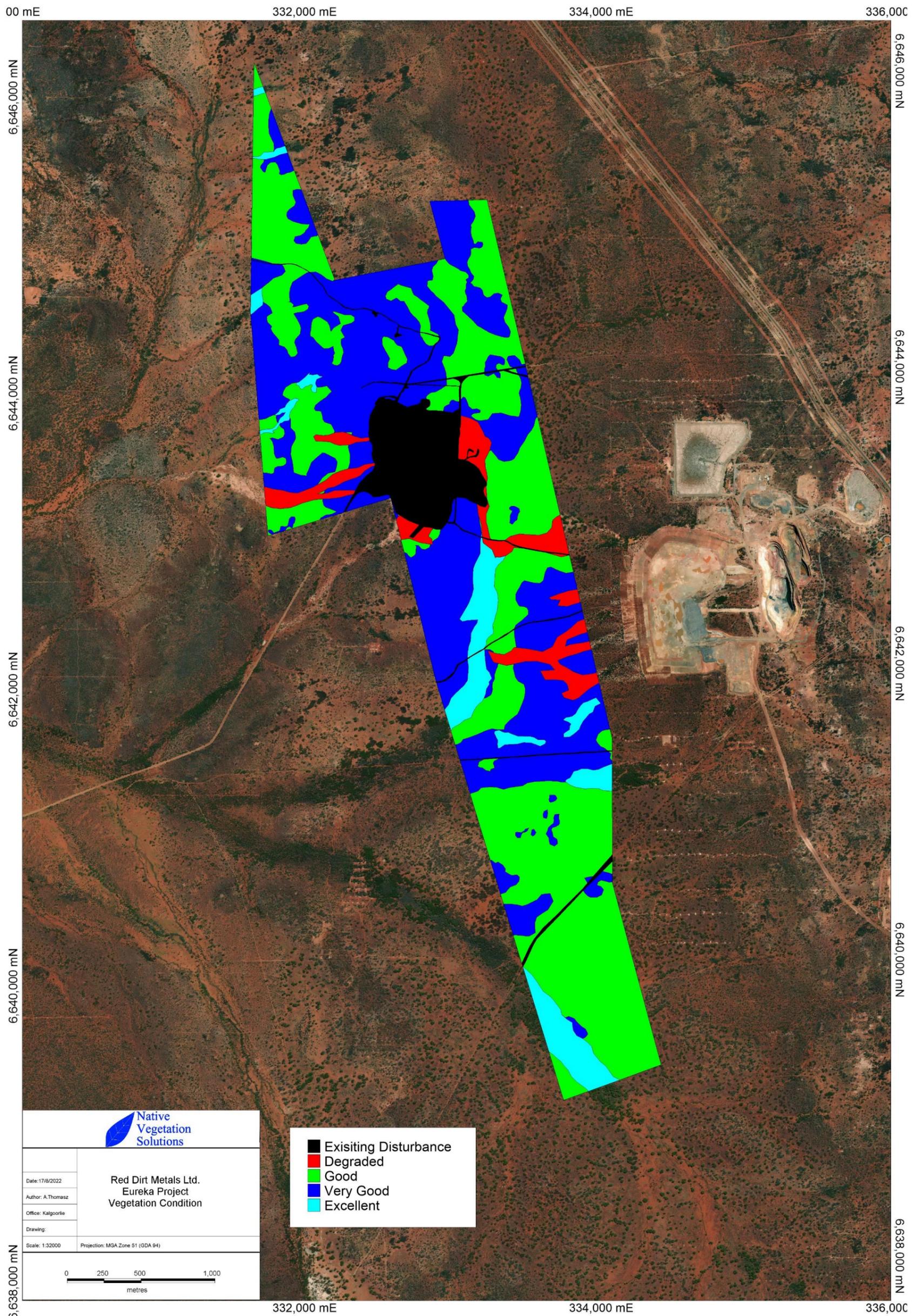
**Map 3: DBCA Database search results showing Threatened and Priority flora within 10 km and PEC/PEC within 20 km of Eureka Project survey area**



**Map 4: Land Systems for Eureka Project survey area**



Map 5: Vegetation Groups for Eureka Project survey area



**Map 6: Vegetation Condition for Eureka Project survey area**

# **Appendix 5**

## **Species List**

## Species List per Vegetation Group

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L
Aizoaceae	<i>Gunniopsis</i>	<i>Gunniopsis propinqua</i>							*					
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus aevoides</i>		*										
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus exaltatus</i>		*			*							
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus obovatus</i>	*		*	*	*	*		*		*		*
Apocynaceae	<i>Alyxia</i>	<i>Alyxia buxifolia</i>							*					
Apocynaceae	<i>Leichhardtia</i>	<i>Leichhardtia australis</i>	*	*								*		
Asteraceae	<i>Chrysocephalum</i>	<i>Chrysocephalum puteale</i>						*						
Asteraceae	<i>Cratystylis</i>	<i>Cratystylis subspinescens</i>	*			*								
Asteraceae	<i>Olearia</i>	<i>Olearia muelleri</i>		*		*			*					*
Boraginaceae	<i>Halgania</i>	<i>Halgania andromedifolia</i>							*					
Brassicaceae	<i>Carrichtera</i>	<i>Carrichtera annua</i> *		*				*						
Casuarinaceae	<i>Allocasuarina</i>	<i>Allocasuarina campestris</i>									*			
Casuarinaceae	<i>Casuarina</i>	<i>Casuarina pauper</i>	*	*	*	*		*	*	*		*		*
Chenopodiaceae	<i>Atriplex</i>	<i>Atriplex bunburyana</i>	*	*	*	*	*			*		*		*
Chenopodiaceae	<i>Atriplex</i>	<i>Atriplex nummularia</i> subsp. <i>Spathulata</i>		*										
Chenopodiaceae	<i>Atriplex</i>	<i>Atriplex stipitata</i>	*						*					
Chenopodiaceae	<i>Atriplex</i>	<i>Atriplex vesicaria</i>	*						*			*		
Chenopodiaceae	<i>Chenopodium</i>	<i>Chenopodium gaudichaudianum</i>		*	*					*		*		
Chenopodiaceae	<i>Enchylaena</i>	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	*	*			*					*		
Chenopodiaceae	<i>Eriochiton</i>	<i>Eriochiton sclerolaenoides</i>		*								*		
Chenopodiaceae	<i>Maireana</i>	<i>Maireana carnosa</i>		*										
Chenopodiaceae	<i>Maireana</i>	<i>Maireana georgei</i>	*	*	*	*				*			*	*
Chenopodiaceae	<i>Maireana</i>	<i>Maireana pentatropis</i>		*										
Chenopodiaceae	<i>Maireana</i>	<i>Maireana pyramidata</i>	*	*		*								
Chenopodiaceae	<i>Maireana</i>	<i>Maireana sedifolia</i>		*		*								*
Chenopodiaceae	<i>Maireana</i>	<i>Maireana tomentosa</i>	*	*		*	*	*				*		*
Chenopodiaceae	<i>Maireana</i>	<i>Maireana trichoptera</i>	*	*			*	*	*					
Chenopodiaceae	<i>Maireana</i>	<i>Maireana triptera</i>	*	*	*	*	*	*	*			*	*	*
Chenopodiaceae	<i>Rhagodia</i>	<i>Rhagodia drummondii</i>	*	*		*	*					*		*
Chenopodiaceae	<i>Rhagodia</i>	<i>Rhagodia eremaea</i>										*		
Chenopodiaceae	<i>Salsola</i>	<i>Salsola australis</i>				*						*		
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena cuneata</i>					*	*	*					
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena densiflora</i>	*	*	*	*	*	*	*	*				*
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena diacantha</i>	*	*	*			*	*	*		*		
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena ericantha</i>										*		
Chenopodiaceae	<i>Sclerolaena</i>	<i>Sclerolaena eurotioides</i>		*					*					
Fabaceae	<i>Acacia</i>	<i>Acacia acuminata</i>			*	*		*	*	*	*	*	*	*
Fabaceae	<i>Acacia</i>	<i>Acacia aneura</i>			*					*			*	*
Fabaceae	<i>Acacia</i>	<i>Acacia colletioides</i>										*		
Fabaceae	<i>Acacia</i>	<i>Acacia craspedocarpa</i>							*				*	
Fabaceae	<i>Acacia</i>	<i>Acacia erinacea</i>		*			*	*						
Fabaceae	<i>Acacia</i>	<i>Acacia hemiteles</i>	*	*	*		*	*	*	*		*	*	
Fabaceae	<i>Acacia</i>	<i>Acacia mulganeura</i>			*					*			*	*
Fabaceae	<i>Acacia</i>	<i>Acacia oswaldii</i>		*										
Fabaceae	<i>Acacia</i>	<i>Acacia quadrimarginea</i>			*			*		*		*		
Fabaceae	<i>Acacia</i>	<i>Acacia sibirica</i>							*		*			
Fabaceae	<i>Acacia</i>	<i>Acacia tetragonophylla</i>	*		*			*	*	*		*		
Fabaceae	<i>Daviesia</i>	<i>Daviesia aphylla</i>				*								
Fabaceae	<i>Senna</i>	<i>Senna artemisioides</i> subsp. <i>xartemisioides</i>	*	*	*					*		*		
Fabaceae	<i>Senna</i>	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	*	*	*	*	*	*	*	*		*	*	*
Fabaceae	<i>Senna</i>	<i>Senna cardiosperma</i>	*									*		
Goodeniaceae	<i>Goodenia</i>	<i>Goodenia havilandii</i>						*						
Goodeniaceae	<i>Scaevola</i>	<i>Scaevola spinescens</i>	*	*		*		*	*		*			*
Lamiaceae	<i>Prostanthera</i>	<i>Prostanthera althoferi</i> subsp. <i>althoferi</i>						*						
Lamiaceae	<i>Prostanthera</i>	<i>Prostanthera grylloana</i>									*			
Lamiaceae	<i>Salvia</i>	<i>Salvia verbenaca</i> *		*	*		*			*				
Lamiaceae	<i>Westringia</i>	<i>Westringia cephalantha</i>							*					
Lamiaceae	<i>Westringia</i>	<i>Westringia rigida</i>							*					
Malvaceae	<i>Brachychiton</i>	<i>Brachychiton gregorii</i>						*						

Family	Genus	Taxon	A	B	C	D	E	F	G	H	I	J	K	L
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus campaspe</i>		*			*					*		
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus celastroides</i>							*					
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus clelandiorum</i>				*			*			*		
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus griffithsii</i>				*			*	*		*		*
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus lesouefii</i>		*					*			*		
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus oleosa</i> subsp. <i>oleosa</i>							*					
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus ravida</i>					*					*		
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus salmonophloia</i>		*		*						*		*
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus salubris</i>					*					*		
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus transcontinentalis</i>		*					*					
Myrtaceae	<i>Eucalyptus</i>	<i>Eucalyptus yilgarnensis</i>							*					
Myrtaceae	<i>Melaleuca</i>	<i>Melaleuca uncinata</i>									*			
Nitrariaceae	<i>Nitraria</i>	<i>Nitraria billardierei</i>	*											
Pittosporaceae	<i>Pittosporum</i>	<i>Pittosporum angustifolium</i>	*	*	*		*	*		*		*		
Poaceae	<i>Aristida</i>	<i>Aristida contorta</i>					*	*						
Poaceae	<i>Austrostipa</i>	<i>Austrostipa elegantissima</i>		*		*						*		*
Poaceae	<i>Austrostipa</i>	<i>Austrostipa nitida</i>		*		*		*						*
Poaceae	<i>Enneapogon</i>	<i>Enneapogon caerulescens</i>				*								
Poaceae	<i>Eragrostis</i>	<i>Eragrostis eriopoda</i>				*								
Poaceae	<i>Eriachne</i>	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>				*								
Poaceae	<i>Monachather</i>	<i>Monachather paradoxus</i>					*					*		
Proteaceae	<i>Grevillea</i>	<i>Grevillea acuaria</i>					*		*			*		
Proteaceae	<i>Grevillea</i>	<i>Grevillea nematophylla</i>							*		*			
Pteridaceae	<i>Cheilanthes</i>	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>						*						
Rhamnaceae	<i>Cryptandra</i>	<i>Cryptandra aridicola</i>							*					
Rhamnaceae	<i>Trymalium</i>	<i>Trymalium myrtillus</i> subsp. <i>myrtillus</i>							*					
Rutaceae	<i>Phebalium</i>	<i>Phebalium filifolium</i>									*			
Rutaceae	<i>Philotheca</i>	<i>Philotheca brucei</i> subsp. <i>brucei</i>							*		*			
Santalaceae	<i>Exocarpos</i>	<i>Exocarpos aphyllus</i>		*		*	*		*					
Santalaceae	<i>Santalum</i>	<i>Santalum acuminatum</i>		*		*								
Santalaceae	<i>Santalum</i>	<i>Santalum spicatum</i>							*			*		
Sapindaceae	<i>Alectryon</i>	<i>Alectryon oleifolius</i>		*				*						
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea lobulata</i>	*	*	*	*	*	*	*	*	*		*	*
Sapindaceae	<i>Dodonaea</i>	<i>Dodonaea rigida</i>									*			
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila alternifolia</i>							*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila decipiens</i> subsp. <i>decipiens</i>	*		*		*			*		*		
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila dempsteri</i>				*	*					*		
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila glutinosa</i>			*			*		*	*	*	*	
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila granitica</i>										*		
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila interstans</i> subsp. <i>virgata</i>										*		
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila ionantha</i>										*		
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oldfieldii</i> subsp. <i>angustifolia</i>		*				*	*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>							*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila pantonii</i>		*										
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila parvifolia</i> subsp. <i>auricampa</i>		*					*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila pustulata</i>		*					*					
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila scoparia</i>	*	*			*		*			*		
Scrophulariaceae	<i>Eremophila</i>	<i>Eremophila</i> sp. Mt Jackson							*					
Solanaceae	<i>Solanum</i>	<i>Solanum lasiophyllum</i>			*	*	*	*		*				
Thymelaeaceae	<i>Pimelea</i>	<i>Pimelea microcephala</i> subsp. <i>microcephala</i>	*									*		
Zygophyllaceae	<i>Roepera</i>	<i>Roepera eremaea</i>		*				*						