Detailed vegetation and flora survey in the Riverina area to support the amendment of Clearing Permit CPS 8854-1

for

OraBanda Mining Ltd

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Executive Summary

Jenny Borger Botanical Consulting (JBBC) was commissioned by Ora Banda Mining Ltd (OBM) to undertake a vegetation and flora survey to support the expansion of the proposed development area (PDA) at the active Riverina Minesite. The supplementary survey will cover the expansion of the proposed Riverina western Waste Rock Landform, development of two open pits to the south of the existing Riverina Open Pit and associated Waste Rock Landforms and the extension of the existing Riverina Airstrip. This Stage 2 vegetation and flora survey compliments previous adjoining surveys (JBBC 2017; 2019) and is prepared to support amendments to the current Clearing Permit CPS 8854-1.

The environmental survey area (ESA), covering an area of 563.85 hectares (ha), is located at the Riverina Minesite, 42 km west of Menzies. The ESA is located within tenements M30/256, M30/157, E30/333, E30/468, E30/491 and G30/9. This vegetation and flora survey was undertaken between the 12th and 14th January 2021. A total of 83 taxa from 24 families and 40 genera were recorded. The best represented families were Fabaceae (20 taxa; 15 *Acacia*, 4 *Senna* and 1 *Mirbelia*), Chenopodiaceae (12 species; 7 *Maireana*, 2 *Sclerolaena*, 1 *Atriplex,* 1 *Enchylaena*, 1 *Rhagodia*), Scrophulariaceae (8 species; 7 *Eremophila*, 1 *Myoporum* (tentative)) and Myrtaceae (6 *Eucalyptus*). One priority species (tentative identification; vegetative) – *Acacia epedunculata* P1 – was recorded in the north western area of the ESA which, if confirmed, will be a range extension of 105 km. Nine vegetation types including 16 sub-types were described for the survey area from 10 quadrats and 47 relevés. Vegetation on the greenstone hills was dominated by *Casuarina pauper* and *Acacia quadrimarginea*.

The condition of the vegetation was much less impacted on the mid to upper slopes of the greenstone hills on the western side of the ESA and rated very good to excellent. Historic and current pastoral and mining impacts have been quite significant in the central and eastern areas with much of these areas being rated as degraded to good. The expansion of the PDA will likely impact lower to midslopes of the greenstone hills. A number of minor drainage lines are present within this area and a surface hydrological assessment may be needed prior to disturbance in this area.

OBM propose to upgrade the airstrip located north east of the PDA, east of Snake Hill – Riverina Rd. The survey of this area found that there have been moderate to high impacts from pastoral activities and upgrading the airstrip is unlikely to cause significant impact to the vegetation.

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1.1 Background

Jenny Borger Botanical Consulting (JBBC) was commissioned by Ora Banda Mining Ltd (OBM) to undertake a vegetation and flora survey to support the expansion within the proposed development area (PDA) at the active Riverina Minesite. The supplementary survey will cover the expansion of the Riverina western Waste Rock Landform, development of two open pits to the south of the existing Riverina Open Pit and associated Waste Rock Landforms and the extension of the existing Riverina Airstrip. This vegetation and flora survey complements previous adjoining surveys (JBBC 2017; 2019) and will support the amendment of the current Clearing Permit CPS 8854-1.

Ora Banda Mining Limited (OBM) propose to expand mining operations through their wholly owned subsidiary, Carnegie Gold Pty Ltd (CGPL) at the Riverina Gold Operations (RGO), located 45 km west of Menzies and 125 km north of Coolgardie (Figure 1). The historic mining complex is located at the intersection of Riverina - Snake Hill and Menzies - Evanston Roads in the Shire of Menzies on Crown Land, within mining tenements M30/256, M30/157, E30/333, E30/468, E30/491 and G30/9. Mining commenced in the area in 1896 after a gold deposit was discovered by a syndicate from the NSW Riverina district, hence the name given to the site. Several mining campaigns have been undertaken by different companies during the following century for gold and more recently exploration attention turned to nickel in 2006 and 2007. Carnegie Gold Pty Ltd (CGPL) received approval to recommence pit and underground mining in 2020.

The survey area, covering an area of 563.85 ha, includes low greenstone hills on the western side of the current mine development with lower slopes in the south grading to alluvial plains south of the Evanston – Menzies diversion road. Areas on the eastern side include extensions of the stony and alluvial plains east of Snake Hill Road including areas adjacent to the airstrip (Figure 2).

JBBC has undertaken vegetation and flora surveys of the Riverina area in 2017 (Eastern Goldfields) and 2019 (OBM). This survey was undertaken from the 12th to the 14th January 2021 in conjunction with a Fauna and Habitat Reconnaissance Survey which is reported separately.

The main objectives of the survey included:

- Completing a desktop study of the Stage 2 Environmental Survey Area (ESA) and surrounding areas,
- Undertaking a pedestrian survey and identify and describe the vegetation types present
- Comparing the results with threatened and priority ecological communities (TEC & PEC)
- Recording the presence of threatened and priority taxa which may occur
- Describing and mapping the condition of the site and threats to the vegetation
- Assess the proposal against the 10 clearing principles

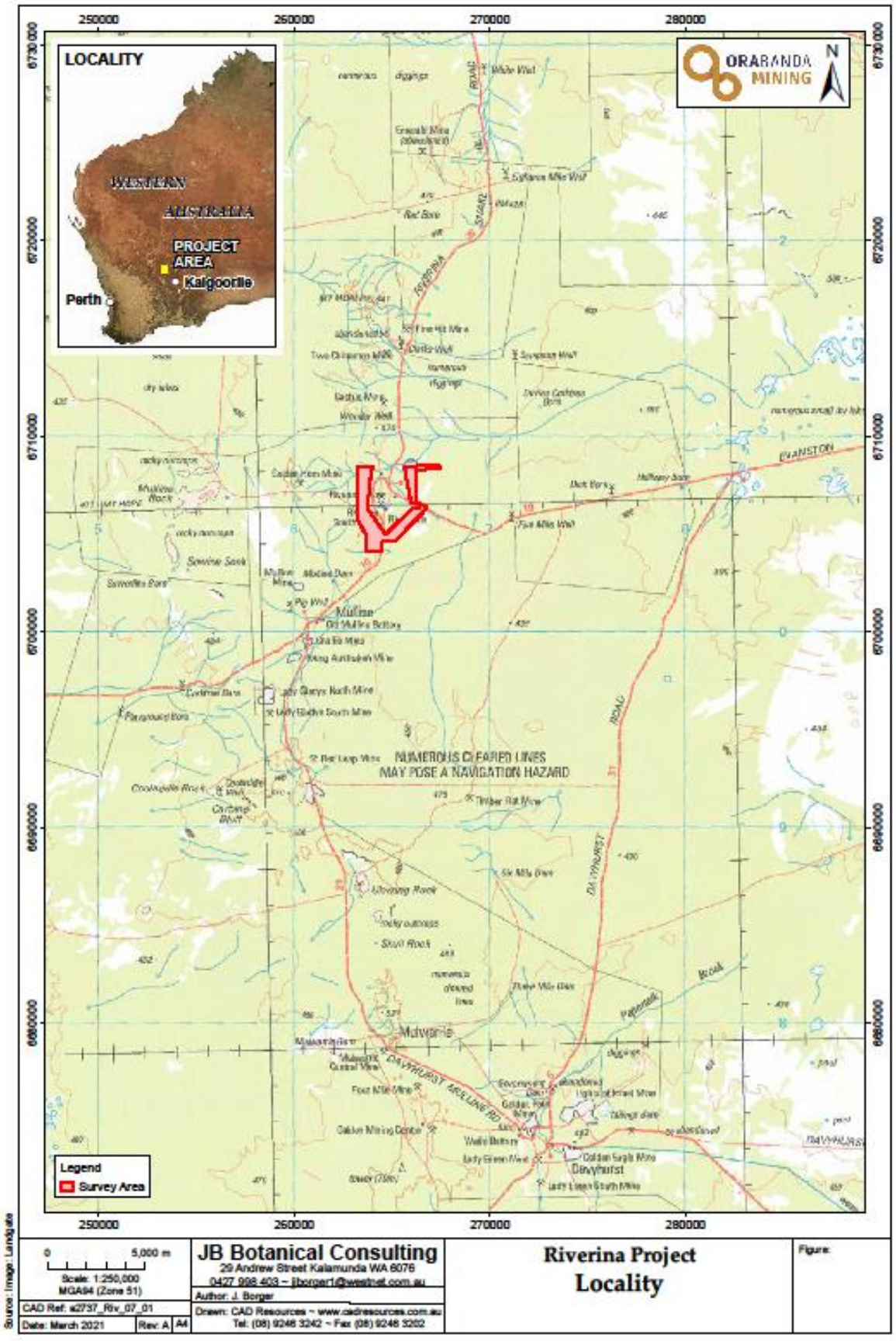


Figure 1: Riverina Project Regional Location and the Stage 2 Environmental Survey Area

Figure 2: Riverina Stage 2 – Flora and Fauna Environmental Survey Area - 2021

1.2 Environmental Setting

1.2.1 Climate

There are no dedicated climate recording stations near Riverina, therefore an overview of the climate will be compiled from Bureau of Meteorology (BOM) Stations in the broader region. Riverina is located 45 km east of Menzies, 82 km north of Credo Station and 120 km SW of Leonora. Menzies has inconsistent data for the last 10 years; however, records were started at Menzies in 1896 (mean annual rainfall 254 mm) which are useful for viewing long term means. Rainfall was recorded at Riverina (BOM Station No. 12205) from 1964 until 2009 and has a mean annual rainfall of 270.5 mm which lies closer to records at Credo Station (mean annual rainfall 274.3 mm). The survey was undertaken in mid-January 2021, with 6.8 mm (Credo Station) and 1 mm (Leonora) recorded prior to the survey period.

The Riverina area experiences a semi-arid climate with hot summers and cool winters with highest rainfall recorded from January to March. Significant falls in January and February usually result from ex-tropical lows moving south east over the state. The driest period is from April to October with a slight increase recorded from June to August which links with cold fronts moving north (Table 1, Figure 3).

Annual rainfall received at Credo Station and Leonora Aero during the period 2017 – 2020 (Table 1, Figures 3 & 4) shows that 2017 and 2018 were well above average, and 2019 and 2020 have been below average. The two dry years are likely to have had an impact on vegetation health and diversity.

Table 1: Monthly rainfall recorded at Leonora (Le) and Credo Station (Cr) with long term means

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2017 Le	94.8	77	195.8	13.4	0.6	0.4	7.8	26.4	5.8	12.8	1.8	1.4	438
2018 Le	76.6	48.6	10.6	3.4	0	7	7.2	17.8	3.6	21	71.4	53.2	320.4
2019 Le	3.8	12.6	22.8	14.4	0.2	16.4	0.8	6.2	0	0	0.2	10.4	87.8
2020 Le	56.4	6.2	30.2	0.6	0.6	6.8	0.8	13.4	0	4.4	4.2	3.2	126.8
Mean Le	45.2	38.5	44.2	14.7	8.9	14	15	11.1	6.3	10.5	20.5	16	254.1
2020 Cr	25.6	70.5	9.7	0.4	5.1	10.6	11.1	19.3	6	1.5	40.4	3.7	203.9
Mean Cr	58.2	40.4	37.7	12.6	13.7	19.3	24.5	20.2	11.8	20.5	33.5	18.9	274.3

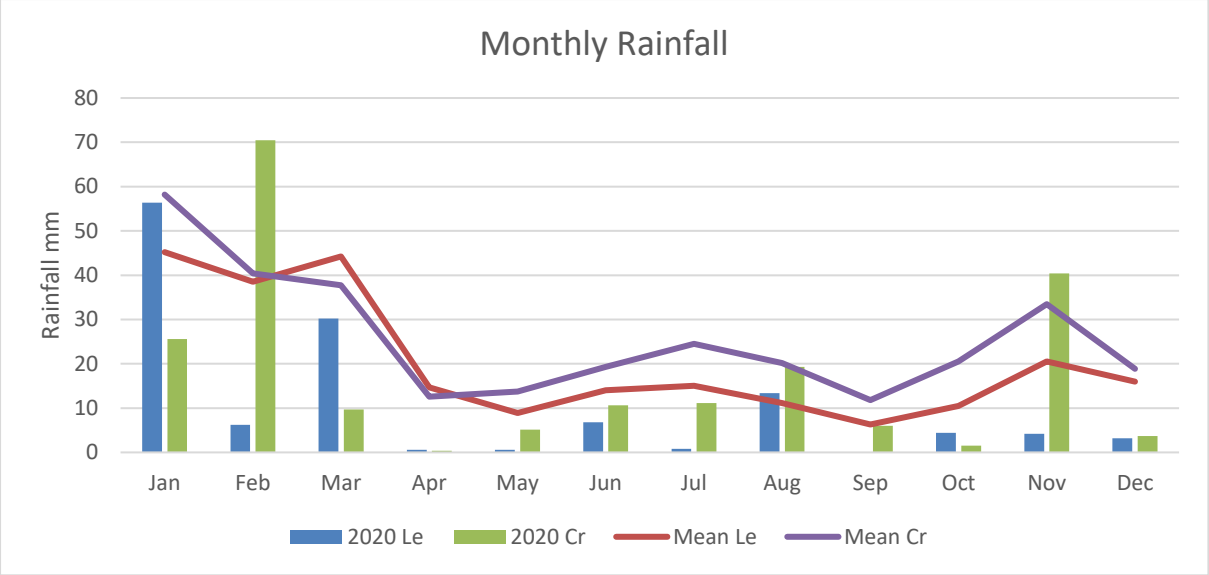


Figure 3: Monthly rainfall totals for Credo Station and Leonora Aero – 2020

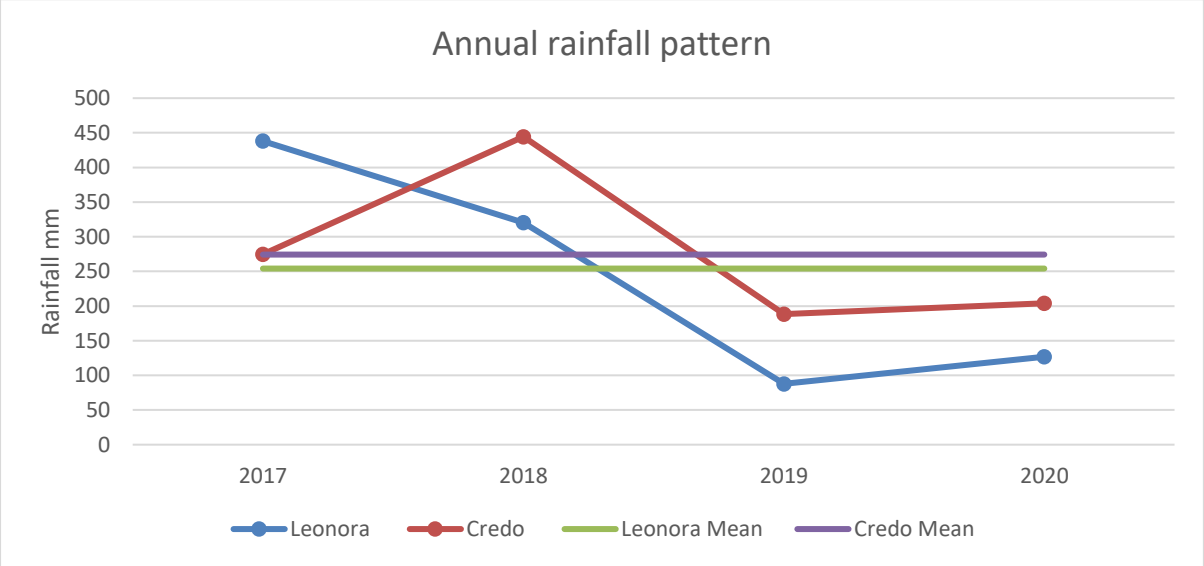


Figure 4: Four year rainfall pattern at Credo and Leonora with long term mean annual rainfall

Mean monthly maximum and minimum temperatures recorded at Leonora Aero are presented in Figure 5. Consistent temperature data is not available at other stations closer to Riverina. Maximum temperatures were mostly above average in 2019 and 2020, while minimum temperatures were above average in autumn and spring in 2019, and slightly cooler in July; while minimum temperatures in 2020 were closer to average, although warmer in winter.

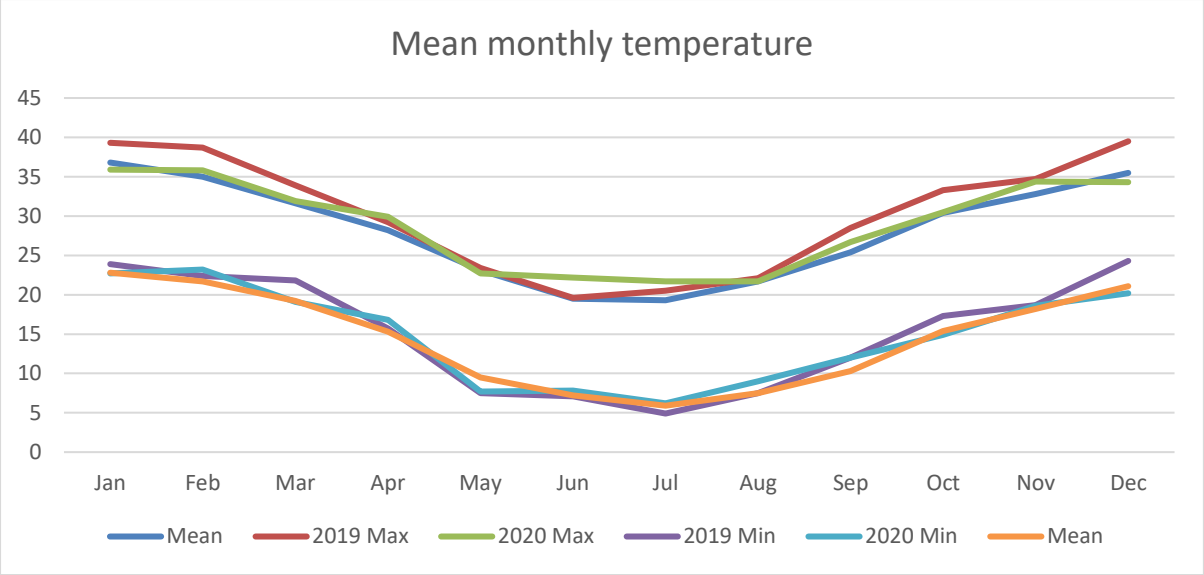


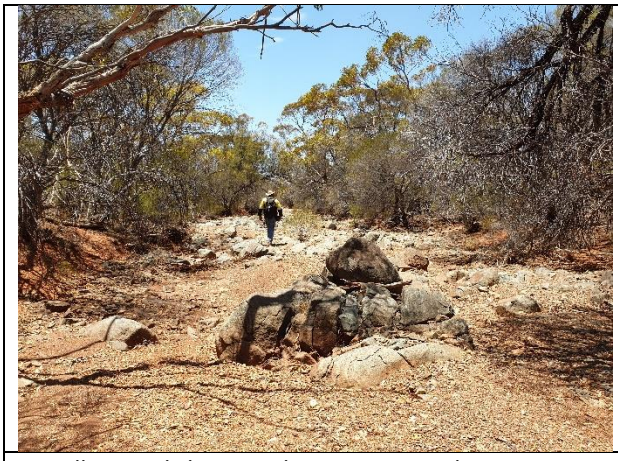
Figure 5: Mean monthly maximum and minimum temperatures recorded at Leonora with long term means.

1.2.2 Geology, Hydrology and Land Systems

Riverina is located within the western area of the Eastern Goldfields Province of the Yilgarn Craton and comprises linear to arcuate (curved) north west trending belts of greenstone and gneissic rocks intruded by Archean granitoid rocks. The rock units are overlain by Cainozoic alluvium, colluvium, aeolian or lacustrine deposits. The Cainozoic deposits are generally thin and variable with the exception of the paleo-drainage lines where sediments can be up to 120 m deep. (Pringle et al. 1994)

The geology of Riverina broadly comprises a low range of hills on the western side of metamorphosed mafic and ultramafic rocks lying between the Ida and Ballard faults with mineralized zones east (PDA) of the range. The eastern area comprises ironstone and stony plains and broad shallow drainage lines.

The greenstone hills have narrow crests and ridges which are generally rocky, some with outcropping bedrock. Midslopes are generally gentle to moderately steep with varying cover of mainly loose surface rock (mafic and ultramafic rock types). The hills have been incised by minor ephemeral drainage lines which discharge water mostly to the east, with some flow to the west and north. A defined incised drainage line with the main channel up to 10 m wide (referred to as North creek; Figure 6) is located north of the mine development area and will not be impacted by the proposed development extensions. The drainage line is one of several tributaries that flow eastwards onto the alluvial east of the PDA, which then drains north into Lake Ballard.



A well incised drainage line separates the two ranges on the western side of the survey area (North creek). The northern bank (right) was close to 2 m high at the western end with evidence of recent undercutting. Flows into the creek would be quite high from surrounding greenstone hills following significant rainfall events. The creek bed has a high cover of surface rock and some outcrops.

Figure 6: A defined creek line is located between the north and south ranges. It has been referred to as North Creek in this report.

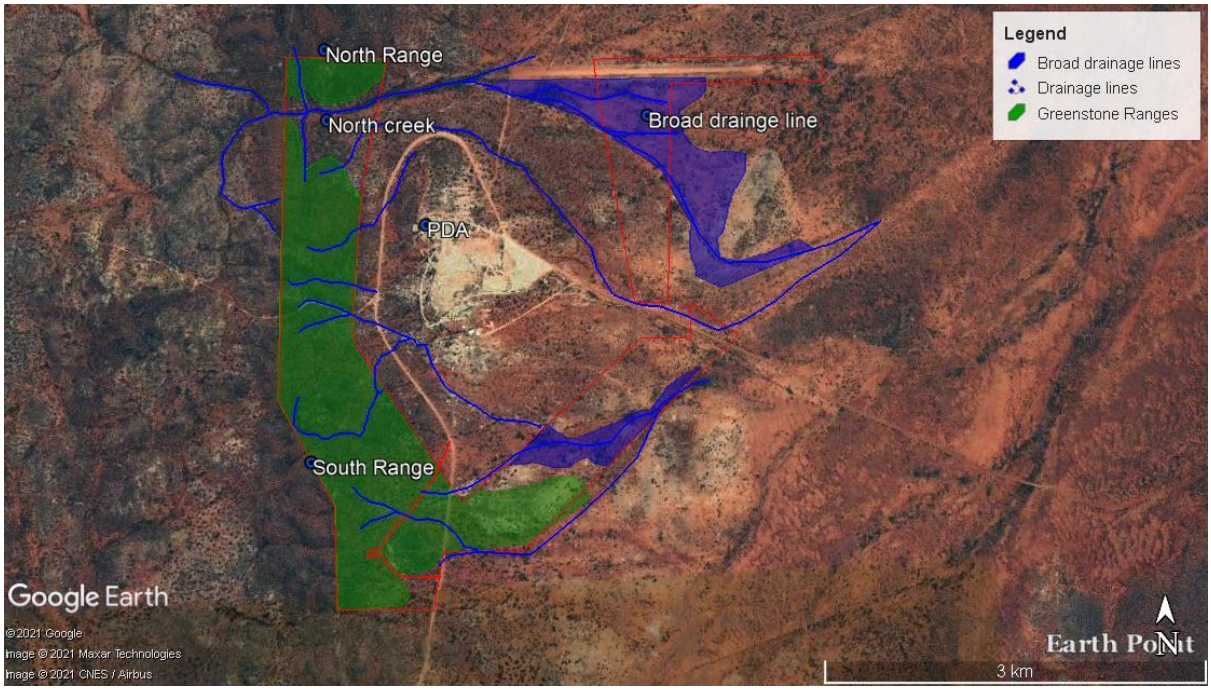


Figure 7: Surface drainage in the Riverina survey area. A range of greenstone hills is present on the western side, with most drainage to the east. North creek separates the two ranges and is a well-formed creek line with low to medium banks and a rocky bed. Landforms in the eastern part are mostly gently sloping to almost flat laterite covered or stony plains with broad drainage lines.

Land system (LS) mapping for the north-eastern Goldfields was undertaken by the Department of Agriculture Western Australia (Pringle et al. 1994). The survey area is mapped as three land systems (Figure 8). The western part of the survey area is mostly located within the Lawrence LS (265Lw) which is described as low greenstone hills with ironstone ridges supporting pearl bluebush (*Maireana sedifolia*) shrublands and eucalypt woodlands with halophytic undershrubs (Table 2).

The central portion of the survey area is located in the Moriarty LS (265 Mo) which is described as low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys, and the north eastern area is mapped as the Bunyip LS (265 By) comprising saline alluvial plains with self-mulching clays (gilgaied) in central drainage tracts with extensive halophytic shrublands. Each LS is further divided into landforms or terrain units which are described in more detail in Table 2.

The survey area is located within a pastoral lease (Riverina) which has been subjected to varying levels of pastoral and mining impacts for more than 100 years. Species of plants can have variable responses to grazing pressure which were assigned different species indicator values by Pringle et al (1994). These are 'decreaser' (sensitive to grazing), 'increaser' (less palatable), 'intermediate' and 'non-responsive' or 'no value'. Increaser and decreaser species are listed in Table 3 with the land system in which they occur. These will be discussed further in the results section. Species have been updated to current names, with the exception of *Eremophila delisseri* which is currently only recorded in South Australia.

Under increasing grazing pressure, 'intermediates' initially increase and subsequently decrease as grazing pressure becomes concentrated on them, 'decreasers' decrease in density and 'increasers' increase.

Table 2: Land system descriptions with current survey vegetation mapping

Landform	Description	Vegetation	Current Survey Vegetation types
Lawrence Land System: Low greenstone hills with ironstone ridges supporting pearl bluebush (Maireana sedifolia) shrublands with mixed Eucalypt overstoreys on Archean greenstones, basalts and ironstone formations.			
Ridges 10 %	Low banded ironstone ridges with platy angular pebble mantles; Soil - lithosols (stony and very shallow)	Stony ironstone mulga shrublands – *Acacia aneura (complex), A. ramulosa, A. tetragonophylla* tall open shrubland; *A. aneura, A. quadrimarginea, A. burkittii* tall open shrubland/ *Acacia, Senna, Dodonaea lobulata, D. rigida* mid shrubland/ *Ptilotus obovatus, Eremophila latrobei, E. forrestii, Maireana georgei, M. triptera, Sida calyxhymenia, Solanum lasiophyllum* low shrubland	5 – *Acacia fuscaneura* low forest on laterite cap 7 – Acacia caesaneura tall shrubland on outcropping metabasalt/ dolerite
Hills & slopes 50 %	Often linearly arranged low rounded hills and rises of greenstone. Soil - lithosols; outcrops extensive	*A. aneura (complex), A. quadrimarginea, A. burkittii* tall open shrubland/ *Acacia, Senna, Dodonaea lobulata, D. rigida* mid shrubland/ *Ptilotus obovatus, Eremophila latrobei, E. forrestii, Maireana georgei, M. triptera, Sida calyxhymenia, Solanum lasiophyllum* low shrubland; *Eucalyptus* woodlands over *Maireana sedifolia* on lower slopes	Riverina lacks *Acacia aneura* (complex) on the range; *A. quadrimarginea* common with *Casuarina pauper; M. sedifolia* absent – grazing impact? 4A, 4B, 4C, 4D, 4E, 8, 9B (Eucalypt woodland)
Footslopes 30 %	Gently inclined lower slopes with abundant mantles of greenstone and ironstone pebbles; Soil - lithosols	*Eucalyptus lesouefii, E. salmonophloia, E. salubris* or *Casuarina pauper* woodlands over chenopod shrublands dominated by either *Maireana sedifolia, M. pyramidata* or *Atriplex vesicaria* or *A. bunburyana.*	*Eucalyptus clelandiorum* was more common; small area of E. salubris/ Maireana and Atriplex 6A
Drainage tracts 10 %	Narrow drainage tracts, generally level unincised; red clay	*Eucalyptus* woodlands/ *Atriplex vesicaria* or *A. bunburyana; Atriplex vesicaria* low shrubland with *Cratystylis* and *Maireana* spp.	3A 3B
Moriarty Land System: low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys			
1. Low rises – (^ 20m relief) 20%	Greenstone, often with ferruginous duricrust and moderate to abundant mixed mantles of greenstone, quartz and ironstone pebbles and cobbles Lithosols or red earths on calcrete veneer over greenstone	Prominent *Casuarina cristata (C. pauper)* overstoreys with *Acacia aneura* (mulga) or eucalypts over either *Maireana sedifolia* understoreys or non-halophytic shrubs	6A, 6B
2. Stony plains 35%	Gently undulating plains with moderate to abundant mantles of quartz, ironstone and locally calcrete pebbles and cobbles 1. Calcareous red earth on greenstone 2. Shallow red earth on greenstone	1. (25%) Scattered *M. sedifolia* shrublands with *C. pauper* trees and occasional eucalypts *(E. salubris, E. lesouefii)* 2. (10%) Scattered *A. aneura* shrublands with occasional *C. pauper* trees	2
3. Lateritic plains 20%	Level to gently undulating plains with moderate mantles of fine ironstone gavel and occasional calcrete rubble Red sand with ferruginous gravel or shallow red earth on greenstone	Scattered to moderately close *A. aneura* tall shrublands occasionally with *C. pauper* in more calcareous areas	1B

4. Alluvial plains 20%	Level to very gently inclined plains with sparse mantles of quartz and ironstone small pebbles, occasionally with gilgai micro-relief Deep red clay, duplex on greenstone or sandy-surfaced saline duplex, cracking clay on gilgai	Scattered variable halophytic low to mid shrublands often with eucalypt or *C. pauper* overstoreys	1A
5. Drainage zones 5%	Unchannelled central drainage tracts to 400 m wide receiving concentrated run-on; minor rills and gutters Shallow duplex on greenstone	Scattered (10 – 20 % PFC) chenopod low shrublands, often dominated by *Atriplex* spp. and locally with *E. salubris* overstoreys	
Bunyip Land System Gilgaied tracts draining greenstone hills, supporting mixed halophytic shrublands occasionally with a Casuarina pauper overstorey			
1. Gilgaied Alluvial Plains 40%	Level plains with irregular patches of gilgai (10%) (cracking clay) often with fine ironstone gravel (red clay)	Very scattered *Acacia aneura* tall shrublands with abundant woody herbs on gilgais; scattered low halophytic shrublands occasionally with a *Casuarina pauper* or *Eucalyptus* overstorey on inter-gilgai areas	3D
2. Loamy plains 15%	Level plains slightly higher than unit 1, sparse mixed mantle of quartz and ironstone pebbles; deep duplex soils	Scattered Eucalypt-Acacia shrublands	
3. Lateritic Plains 25%	Slightly higher plains with an abundant mantle of fine ironstone gravel; deep or shallow duplex soils on greenstone or shallow red earth on hardpan	Scattered low halophytic shrublands with *Acacia* (Mulga) or *Casuarina* overstorey	2
4. Calcrete Plains 5%	Level plains with calcrete rubble; shallow calcareous red earth on calcrete	Scattered *Casuarina pauper* woodlands	
5. Drainage tracts 15%	Drainage floors which may be > 500m wide; red clay	Moderately close *Acacia* shrublands; *A. aneura* (complex) dominant	3C – 3E

Table 3: Increaser and decreaser species in vegetation subjected to grazing pressure (Pringle et al 1994)

Species	Land System			Survey area
Decreaser species				
Atriplex bunburyana			Bunyip	Not recorded
Atriplex vesicaria	Lawrence	Moriarty	Bunyip	Present
Austrostipa elegantissima	Lawrence	Moriarty	Bunyip	Isolated
Chenopodium curvispicatum	Lawrence	Moriarty		Not recorded
Chenopodium gaudichaudianum			Bunyip	Not recorded
Cratystylis subspinescens	Lawrence	Moriarty	Bunyip	Present; mostly isolated shrubs on plains
Dodonaea rigida	Lawrence			Restricted to greenstone range area
Enchylaena tomentosa	Lawrence	Moriarty	Bunyip	Uncommon
Eremophila forrestii	Lawrence		Bunyip	Not recorded (isolated records 2017 survey in PDA area)
Eremophila georgei	Lawrence		Bunyip	Not recorded
Eremophila latrobei	Lawrence		Bunyip	Common on hills; few in less disturbed areas on plains
Maireana atkinsiana	Lawrence	Moriarty	Bunyip	Not recorded
Maireana convexa	Lawrence			Not recorded
Maireana georgei	Lawrence	Moriarty	Bunyip	Isolated
Maireana platycarpa	Lawrence	Moriarty	Bunyip	Not recorded
Maireana triptera	Lawrence			Isolated
Maireana villosa	Lawrence		Bunyip	Not recorded
Psydrax suaveolens	Lawrence		Bunyip	Not recorded
Ptilotus obovatus	Lawrence	Moriarty	Bunyip	Common; also listed as an intermediate species
Ptilotus schwartzii	Lawrence			Not recorded
Sida calyxhymenia	Lawrence		Bunyip	Isolated on hills
Spartothamnella teucriiflora			Bunyip	Not recorded

Increaser species				
Acacia hemiteles	Lawrence	Moriarty	Bunyip	Present on plains (Moriarty and Bunyip)
Acacia victoriae			Bunyip	Present on plains
Dodonaea lobulata	Lawrence	Moriarty	Bunyip	Very common
*Eremophila delisseri** (Excluded name) ?			Bunyip	Not sure of correct species
Eremophila scoparia	Lawrence	Moriarty	Bunyip	Isolated
Hakea preissii	Lawrence	Moriarty	Bunyip	Present on plains
Maireana sedifolia	Lawrence	Moriarty*		Often dominant species on plains although sparse
Senna artemisioides complex *(Cassia nemophila)*	Lawrence	Moriarty	Bunyip	Common
Senna artemisioides subsp. *sturtii*	Lawrence			Not recorded
Senna artemisioides subsp. *x artemisioides*	Lawrence	Moriarty		Common
Solanum orbiculatum			Bunyip	Isolated on plains

* not present in WA, occurs in SA

The number of decreaser species exceeds the increaser species so it assumed that species diversity will likely decline following several decades of grazing impacts.

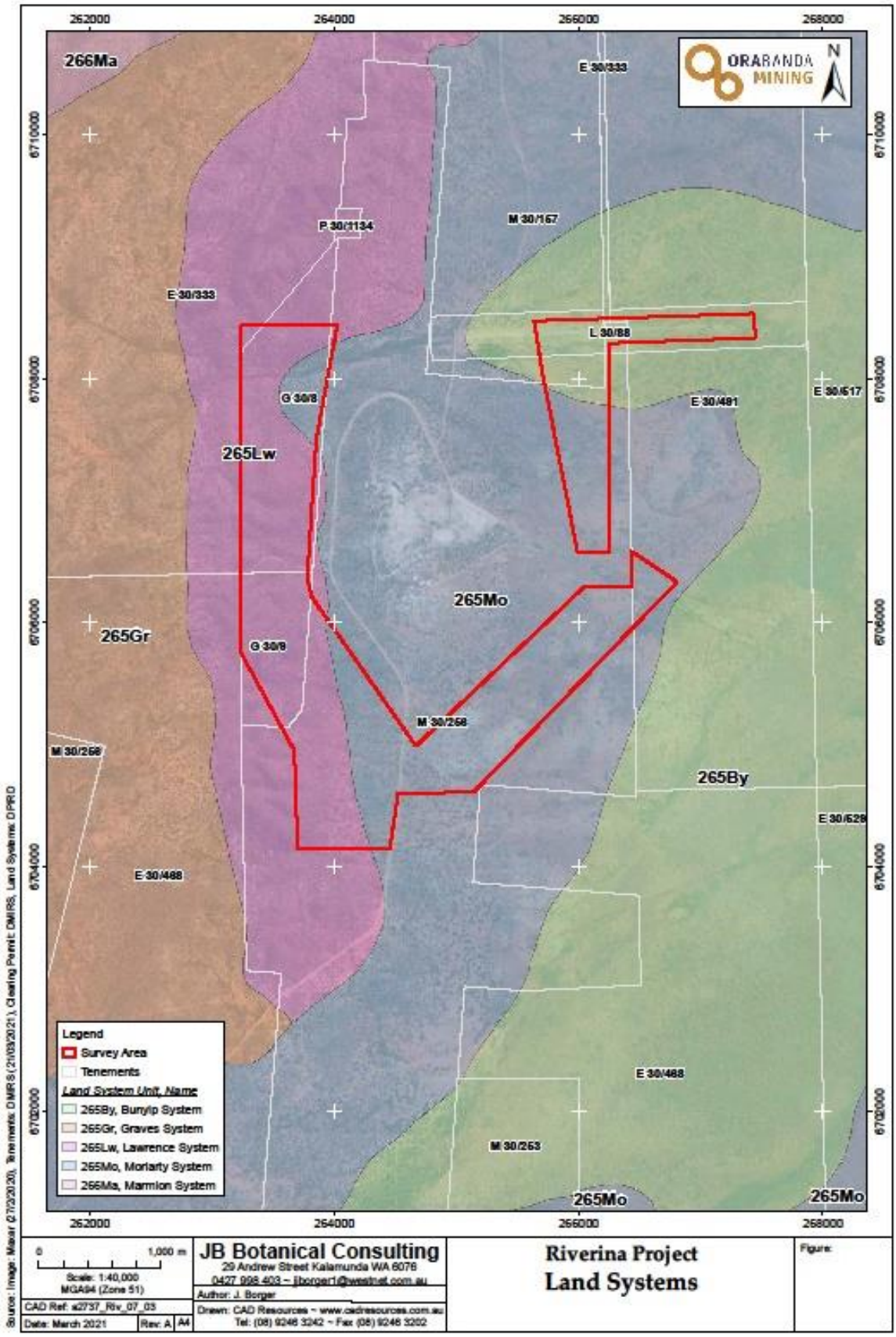


Figure 8: Land system mapping

1.2.3 Regional Vegetation

Mapping of the Interim Biogeographic Regionalisation for Australia (IBRA) places the site within the Murchison IBRA bioregion in the Eastern Murchison (MUR01) IBRA sub-region (Thackway and Creswell 2017). MUR01 comprises the northern parts of the Yilgarn Craton and is characterized by extensive areas of elevated red desert sandplains with internal drainage, salt-lake systems and broad plains of red-brown soils and breakaways. Vegetation is dominated by mulga (*Acacia aneura* complex) woodlands and is often rich in ephemerals, hummock grasslands (*Triodia* spp.), saltbush shrublands and *Halosarcia* (*Tecticornia*) shrublands. The survey area is 20 km north of the Coolgardie bioregion boundary which includes the mulga/ spinifex complexes as well as Eucalypt woodlands. Pre-European and current extents have been sourced from 2018 statewide vegetation statistics (formerly the CAR Reserve Analysis) (DBCA 2019).

Beard (1990) mapped the vegetation at a regional scale (Figure 9), within the Riverina survey area as:

- Barlee 502.1 – Goldfields medium woodland; Goldfields blackbutt and red mallee (original description); *E. oleosa* & *E. lesouefii Eucalyptus* woodlands over *Acacia hemiteles, Senna artemisioides* subsp. *petiolaris* and *Eremophila decipiens* shrubland over *Maireana sedifolia* and *Ptilotus obovatus* chenopod shrubland; pre-European mapped extent 13,400 hectares of which 13,267 ha (99 %) remains. 6,932.62 ha are currently protected (51.73 %). This vegetation type is mapped south of the bypass road with minor areas in the north and west.

- Barlee 20.2 Low woodland, open low woodland or sparse woodland; Mulga (*Acacia aneura* complex), *Allocasuarina cristata (Casuarina pauper)* and *Eucalyptus* species (original description); *Acacia aneura, Callitris columellaris* and *Eucalyptus oleosa* low woodland/ open woodland over *Acacia hemiteles, Senna artemisioides* subsp. *petiolaris* and *Eremophila decipiens* shrubland over *Maireana sedifolia* and *Ptilotus obovatus* chenopod shrubland; mapped extent 1,172, 537 hectares which is 99.78 % of pre-European extent (1,169,909 ha). Currently 181,845.19 ha are in lands managed by DBCA (15.54 %). This vegetation type is mapped as occurring on the eastern central side.

- Barlee 251.1 Low woodland; *Acacia aneura* complex (mulga) and *Casuarina pauper*. The pre-European extent is recorded as 58,012 ha, with 57780.45 ha (99.6 %) remaining. Currently 543.53 ha (0.94 %) is protected. The western part of the ESA – greenstone hills – is mapped as this unit.

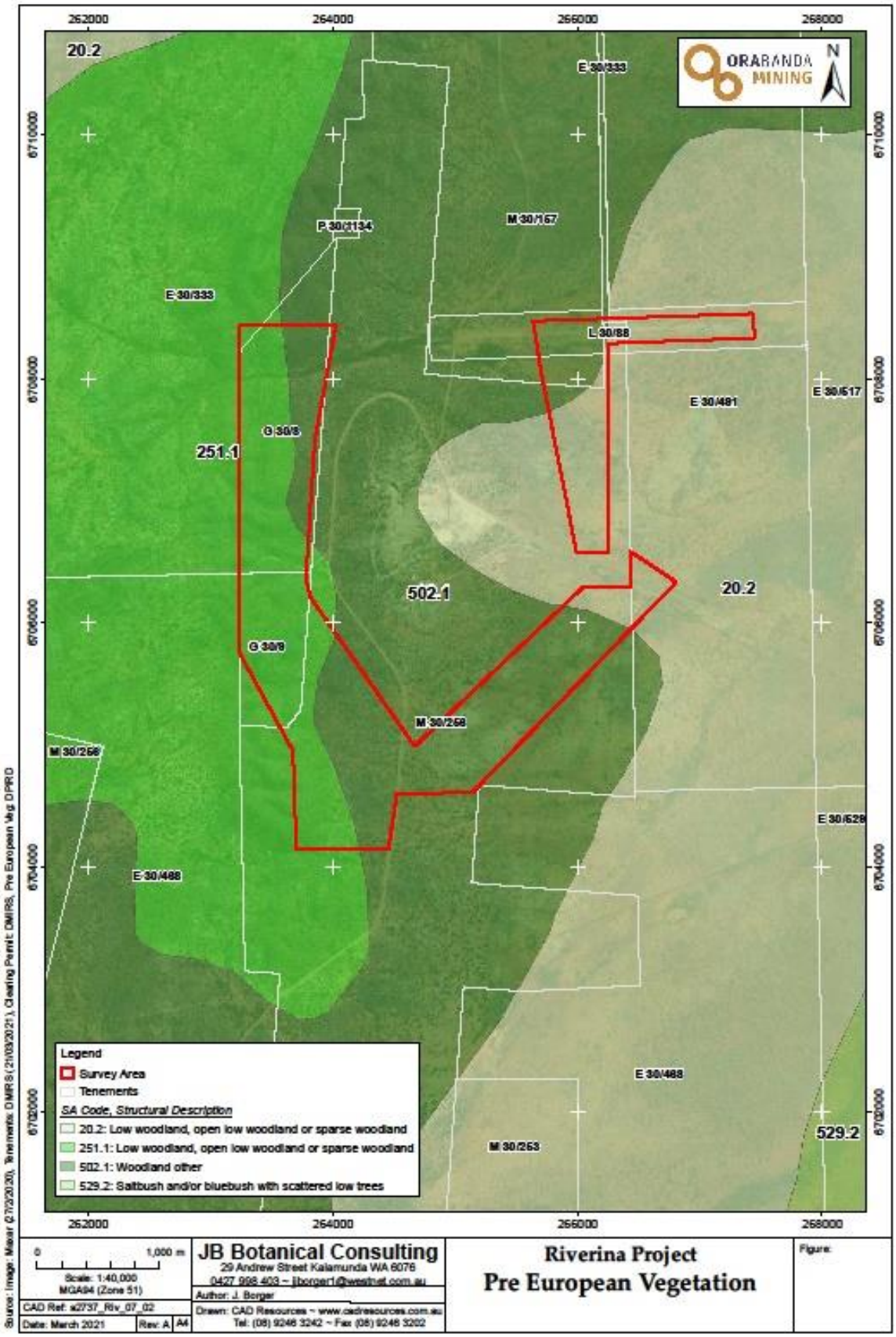


Figure 9: Pre-European vegetation mapping based on Beard's mapping.

JBBC (2019) surveyed areas adjacent to the current survey area in 2017 and 2019 from which six vegetation types and two sub-types were described. A summary is presented in Table 4.

Table 4: Vegetation types described from previous surveys at Riverina in 2017 and 2019

VT & landform	Description
1 **Plain**	*Eucalyptus oleosa, E. lesouefii, Casuarina pauper* woodland to open woodland over *Eremophila longifolia, E. decipiens, Acacia burkittii, A. tetragonophylla, Scaevola spinescens* and/ or *Senna artemisioides* subsp. filifolia open shrubland over *Ptilotus obovatus, Scaevola spinescens, Solanum lasiophyllum*, *Maireana sedifolia, M. georgei, M. pyramidata* low sparse shrubland over *Sclerolaena diacantha, Sida spodachroma, Ptilotus obovatus* low sparse forbland
2 **Lateritic Plain**	*Acacia fuscaneura, Casuarina pauper, Acacia aptaneura* low open woodland over *Acacia tetragonophylla, A. burkittii, A. fuscaneura, A. ramulosa* tall open shrubland over *Dodonaea lobulata, Eremophila latrobei, E.* sp. Mt Jackson*, Scaevola spinescens* open shrubland over *Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Solanum lasiophyllum, S. nummularium, Maireana georgei, M. pyramidata, Sida calyxhymenia, S. spodachroma*, S. sp. Excedentifolia low open shrubland
3A **Regional drainage line**	*Casuarina pauper, Eucalyptus oleosa, Pittosporum angustifolium* open woodland over *Acacia burkittii, Santalum spicatum, S. acuminatum, Eremophila oldfieldii* tall shrubland/ low open forest over *Acacia tetragonophylla, A. murrayana, A. burkittii, Santalum spicatum, Dodonaea lobulata* tall open shrubland over *Senna artemisioides* subsp. *filifolia, Acacia murrayana* open shrubland over *Senna artemisioides subsp. filifolia, Ptilotus obovatus, Maireana georgei, M. tomentosa* low sparse shrubland over *Abutilon oxycarpum, Euphorbia drummondii, Ptilotus obovatus, Monachather paradoxus* low open forbland
3B **Minor drainage line**	*Eucalyptus oleosa* woodland or *Casuarina pauper* forest (10 – 14m) over *Alectryon oleifolius* subsp. *canescens, Exocarpos aphyllus, Acacia tetragonophylla* tall open shrubland (occasional) over *Eremophila* sp. Mt Jackson, *E. alternifolia, Casuarina pauper, Acacia burkittii, Scaevola spinescens* open shrubland over *Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Acacia fuscaneura, A. erinacea, Maireana georgei, Olearia muelleri* low open shrubland
4A **Stony greenstone hills and rises**	*Casuarina pauper* low woodland to open woodland with scattered *Eucalyptus oleosa* trees over *Eremophila* sp. Mt Jackson*, E. alternifolia, Acacia tetragonophylla, A. hemiteles, Senna artemisioides subsp. filifolia* tall sparse shrubland over *Casuarina pauper, Scaevola spinescens, Acacia tetragonophylla, Dodonaea lobulata, Eremophila* sp. Mt Jackson open shrubland over *Ptilotus obovatus, Casuarina pauper, Olearia muelleri, Dodonaea lobulata, Scaevola spinescens* low sparse shrubland over *Ptilotus obovatus, Maireana trichoptera, Austrostipa elegantissima, Casuarina pauper* low sparse shrubland with isolated grass tussocks Yellowish red (5YR 5/8) sandy clay loam; surface rock ~90 % (quartz, greenstone, ironstone; 2 – 200 mm
4B **Greenstone hills**	*Acacia quadrimarginea, A. burkittii, Eremophila oldfieldii* subsp. *angustifolia, Allocasuarina acutivalvis* subsp. *acutivalvis, Acacia ramulosa* var. *ramulosa* low open woodland over *Ptilotus obovatus* low open shrubland over *Cheilanthes sieberi, Monachather paradoxus, Maireana* spp., and *Sclerolaena* spp. low open fernland with germinating grasses and shrubs
5 Laterite on greenstone hills	*Grevillea nematophylla* subsp. *nematophylla* isolated medium trees over *Acacia incurvaneura* low open forest over *Acacia burkittii, Acacia tetragonophylla, Acacia ramulosa var. ramulosa, Eremophila clarkei, Casuarina pauper* tall open shrubland over *Philotheca brucei* subsp*. brucei, Eremophila clarkei, Dodonaea lobulata, Dodonaea rigida, Scaevola spinescens sparse shrubland over Hybanthus floribundus* subsp. *curvifolius, Philotheca brucei* subsp. *brucei, Dodonaea rigida, Eremophila clarkei, Scaevola spinescens* low open shrubland Yellowish red (5YR 5/8) sandy clay loam; surface rock – laterite (5 – 500 mm) 65 – 70
6 **Greenstone hills**	*Eucalyptus clelandiorum, E. lesouefii* open forest over *Eremophila* sp. Mt Jackson tall sparse shrubland or *Alectryon oleifolius, Acacia burkittii, A. quadrimarginea, A. tetragonophylla* tall sparse shrubland over *Eremophila pustulata, Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia, Scaevola spinescens* sparse shrubland over *Eremophila sp. Mt Jackson, Olearia muelleri, Eremophila pustulata, Scaevola spinescens, Ptilotus obovatus*, *Maireana sedifolia, M. triptera, M. trichoptera* low sparse shrubland

Surveys of Yilgarn greenstone and banded ironstone ranges were undertaken by the former Departments of Environment and Conservation (DEC) and Dept. of Parks and Wildlife (DPAW) which are currently known as the Department of Biodiversity, Conservation and Attractions (DBCA). Three surveys are located in the Riverina region.

Credo Station – vegetation on greenstone ranges

Meissner and Coppen (DPAW 2013) undertook a survey of the flora and vegetation of the greenstone ranges occurring on Credo Station in 2011, with the closest site 9 km south of Riverina. Six community groups were described (Table 5). Communities 1 – 4 occurred on basalt geology, and 5 and 6 occurred on laterised or ironstone geology. *Senna artemisioides* subsp. *filifolia, Austrostipa nitida* and *Eriochiton sclerolaenoides* were all indicator species for communities 1 – 4. Species names have been updated.

Table 5: Credo greenstone range vegetation communities (VC) (Meissner & Coppen 2013).

VC	Description
1	Open woodlands to open forest of *Eucalyptus oleosa* subsp. *oleosa, E. clelandiorum or E. dundasii* over open to sparse shrublands of *Eremophila* sp. Mt Jackson and *Senna artemisioides* subsp. *filifolia* over low sparse shrubland of *Ptilotus obovatus, Acacia erinacea* and *Olearia muelleri* or isolated *Roepera ovata*. Gentle or lower slopes of basalt hills. IS* = 0
2	Open woodlands of either *Eucalyptus griffithsii* or *E. celastroides* over sparse shrubland of *Eremophila* sp. Mt Jackson and other *Eremophila* spp. (*E. interstans* subsp*. interstans or E. scoparia*), over low sparse shrubland of *Olearia muelleri*. Gentle slopes of basalt. IS = 0
3	Open to sparse woodlands of *Casuarina pauper* or *Eucalyptus griffithsii* over shrubland to open shrubland of *Dodonaea lobulata, Eremophila oldfieldii* subsp. *angustifolia, Senna artemisioides* subsp. *filifolia and Scaevola spinescens* over open to sparse low shrublands of *Ptilotus obovatus*. Crests and slopes of basalt hills. IS: *Enchylaena tomentosa*
4	Open forests to open woodlands of *Eucalyptus* spp. (*E. clelandiorum, E. celastroides, E. griffithsii*) and occasional *Casuarina pauper*, over shrublands to sparse shrublands of *Eremophila* spp. (*E. oldfieldii, E. interstans* and *E. scoparia*), *Senna artemisioides* subsp. *filifolia* and *Dodonaea lobulata* over open to sparse low shrublands of *Acacia erinacea, Olearia muelleri* and *Ptilotus obovatus* and isolated *Roepera ovata* forbs. Slopes and crests of the basalt hills. IS = 0
5	Open forest to open woodland of several dominant taxa *(Acacia burkittii, Allocasuarina eriochlamys, Grevillea oligomera, Eucalyptus oleosa*) over shrublands of to open shrublands of *Philotheca brucei* subsp. *brucei, Prostanthera grylloana* and *Dodonaea microzyga* subsp. *acrolobata*. Laterised basalt within the greenstone hills. IS = *Eremophila clarkei, Grevillea oligomera, Prostanthera grylloana, Allocasuarina eriochlamys* and *Dodonaea microzyga*; *Philotheca brucei* subsp*. brucei* and *Acacia burkittii* (Com. 5 & 6)
6	Either open tall shrubland or woodland of *Acacia burkittii* or *Allocasuarina dielsiana* over open to sparse shrublands of *Philotheca brucei* subsp. *brucei, Prostanthera althoferi* subsp. *althoferi* over sparse to isolated forbland or grassland of *Ptilotus helipteroides* and *Aristida contorta*. Ironstone geology. IS = *Cheilanthes sieberi* subsp. *sieberi; Philotheca brucei* subsp. *brucei* and *Acacia burkittii* (Com. 5 & 6)

IS = Indicator species; no IS were confined to communities 1, 2 and 4.

Illaara greenstone belt

Meissner and Wright (DEC 2010) undertook surveys in 2008 of the flora and vegetation on banded ironstone formations of the southern Illaara greenstone belt which extends for 80 km, with the southernmost survey point 45 km NW of Riverina. Four community types were described with communities 1 & 2 occurring on laterite and banded ironstone formations and 3 & 4 occurring on a mixture of banded ironstone and mafic substrate. These are summarised in Table 6. *Acacia aneura*

has since been described as several separate species. One rare and one priority species were recorded: *Ricinocarpos brevis* T, and *Banksia arborea* P1 on banded ironstone outcrops.

Table 6: South Illaara Range vegetation communities (Meissner & Wright 2010)

VC	Description
1	Ferruginous duricrust Open to mid-dense shrubland of *Acacia* spp. (*A. cockertoniana, A. effusifolia, A. stowardii* and *A. aneura*) over open to mid-dense shrubland of *Eremophila forrestii* and *Baeckea elderiana* over sparse to open shrubland of *Prostanthera althoferi* and *Mirbelia microphylla*.
2	Crests and slopes of banded ironstone Open to mid-dense shrublands of *A. aneura* and other *Acacia* spp. (*A. cockertoniana* or *A. quadrimarginea*) over open to mid-dense shrubland of *Philotheca brucei* subsp. *brucei, Olearia humilis* and *Eremophila* spp. (*E. latrobei, E. glutinosa* and *E. forrestii*) over isolated to sparse shrubland of *Sida* sp. Golden calyces glabrous (H.N. Foote 32) and *Cheilanthes sieberi* subsp. *sieberi.*
3	Crest and slopes across the range primarily on banded ironstone, but also on a mixture of ironstone and mafic lithologies Open to sparse shrubland of *A. aneura* and *Acacia* spp. (*A. quadrimarginea* and/or *A. tetragonophylla*) over sparse to open shrublands of *Sida ectogama*, *Dodonaea rigida, Eremophila* spp. (*E. latrobei* and *E. forrestii*), *Scaevola spinescens* and *P. brucei* subsp. *brucei* over isolate to sparse shrublands and fernland of *Ptilotus obovatus* and *Cheilanthes sieberi* subsp. *sieberi.*
4	Slopes and crests of banded ironstone and mafic geology *Eucalyptus* spp. (*Eucalyptus salubris* or *E*. aff. *griffithsii*) and *Acacia duriuscula* over open to mid-dense shrubland of *Eremophila* spp. (*E. oldfieldii* and *E. pantonii*) and *A. tetragonophylla* over open to sparse shrubland of *P. obovatus* and *Lepidium platypetalum*.

Mt Ida Greenstone belt and Mt Hope

Meissner & Rowe (2010) undertook surveys of flora and vegetation on banded ironstone formations of the Mt Ida greenstone belt which is 52 km north of Riverina and comprised the northern Mt Mason Range (metamorphosed BIF) and southern Mt Ida range (BIF intercalated with minor mafic rock), and Mt Hope (unnamed greenstone belt), which is located 13 km west of Riverina. Four plant communities were described and presented in Table 7. One priority species was recorded – *Calytrix erosipetala* – however, this has since been delisted. *Acacia aneura* refers to the *A. aneura* complex.

Table 7: Mt Ida Greenstone belt and Mt Hope vegetation communities

VC	Description
1	Lower slopes and flats associated with the ironstone ranges of Mt Ida and Mt Mason. Open shrublands and mallee shrublands of *A. quadrimarginea, A. aneura, A. ramulosa* var. *ramulosa, Allocasuarina dielsiana* and *Eucalyptus rigidula* over open to sparse shrublands of *Eremophila forrestii* subsp. *forrestii* and *P. althoferi* over shrubland of *Ptilotus obovatus*. The community was typified by *A. aneura, A. quadrimarginea* and *E. forrestii*.
2	Crests and slopes of the ranges. Open to sparse shrublands dominated by *A. aneura* and other *Acacia* spp. (A. *cockertoniana, A. quadrimarginea* and *A. minyura*) over open to sparse shrublands of *Eremophila* spp. (*E. forrestii* subsp. *forrestii, E. latrobei* subsp. *latrobei, E. georgei, E. glutinosa*), *P. althoferi* subsp. *althoferi, Olearia humilis, P. brucei* subsp. *brucei, Allocasuarina acutivalvis* subsp. *acutivalvis* and *Dodonaea lobulata.* Typical species were *A. quadrimarginea, E. georgei, E. latrobei* subsp. *latrobei, O. humilis, P. brucei* subsp. *brucei* and *P. althoferi* subsp. *althoferi*

3	Mid- to lower slopes of the banded ironstone ranges. (Mt Hope sites MTHP 01, 03 – 06) Open to sparse shrubland of *A. aneura, Casuarina pauper, A. quadrimarginea, A. ramulosa* var. *ramulosa* and *Allocasuarina dielsiana* over sparse to open shrubland of *Acacia tetragonophylla, A. ramulosa* var. *ramulosa, Scaevola spinescens, E. latrobei* subsp. *latrobei, P. brucei* subsp. *brucei, Sida ectogama, Dodonaea rigida, Dodonaea lobulata, Scaevola spinescens* and *E. forrestii* subsp. *forrestii* over shrublands of *Ptilotus obovatus*. The typifying species were *A. incurvaneura, A. tetragonophylla, E. forrestii, E. latrobei* subsp. *latrobei, Ptilotus obovatus* and *Scaevola spinescens*.
4	Low terrain, on mid, lower and colluvial slopes and crests of banded ironstone of the ranges. Open to sparse shrublands of *A. aneura, A. quadrimarginea* and *A. cockertoniana* over open shrubland of *E. forrestii* subsp. *forrestii* and *E. georgei* over sparse shrubland of *Ptilotus obovatus, Solanum lasiophyllum* and *Sida* sp. Golden calyces glabrous H.N. Foote 32. Typifying species, *E. forrestii* and *Sida* sp. Golden calyces glabrous H.N. Foote 32.

1.2.4 Conservation significant flora

A desktop survey of databases of threatened and priority taxa was undertaken (FloraBase, NatureMap, Meissner & Wright (2010), Meissner & Coppen (2013), Gibson & Langley (2012) and DBCA database search (04-0121) to determine the likelihood of conservation significant flora (CSF) occurring within the proposal area. These are listed in Table 8. Three threatened species have been recorded within 50 km. *Ricinocarpos brevis*, recorded on the Illaara Range, is the only one which occurs on similar habitat. Seven species recorded in the area are herbs which may not be present due to climatic conditions and/ or grazing pressure. A description of conservation codes is presented in Appendix 6. The DBCA database search covered an extended area south to Credo Station and results are presented in Appendix 6.

1.2.5 Threatened and priority ecological communities

No Threatened Ecological Communities (TEC) are located in the area. Four Priority Ecological Communities (PEC) are recorded within 60 km – Helena and Aurora Range vegetation complexes (banded ironstone formation (BIF)); Hunt Range vegetation complex (BIF); Mount Manning Range vegetation complex (BIF) and Lake Giles (northern Yerilgee Hills) vegetation complexes (BIF). Vegetation complexes recorded in these sites are unlikely to occur within the Riverina prospect as there are very minor outcrops of ironstone.

Table 8: Conservation significant flora recorded within 50 km of the Riverina Prospect

Scientific Name	Code	Habitat	LOC[1]
Eucalyptus crucis subsp. crucis	T	Mallee, Granite outcrops	N
Myriophyllum lapidicola	T	Herb; water holes on granite outcrops	N
Ricinocarpos brevis	T	Shrub, rocky hillslopes, and rock outcrops associated with ironstone, banded ironstone formation; Illaara Range is closest record	L
Pterostylis elegantissima[2]	P1	Orchid, patches of woodland dominated by *Eucalyptus orbifolia*; granitic sand over granite	N
Pterostylis xerampelina	P1	Orchid, granite outcrops	N
Newcastelia insignis	P2	Shrub; Red or yellow sandy soils; fire or mechanical disturbance species	N
Thysanotus brachyantherus	P2	Herb, Clay over limestone, loam; < 10 km in gilgai holes, brown clay.	M – H
Eutaxia nanophylla	P3	Straggly rounded shrub; flowers Oct – Nov. Foliage quite distinctive; variety of habitats; wide distribution; previous record from Riverina 1990 on red loam of gilgai plain; not found in two recent surveys of the area	M – H
Menkea draboides	P3	Prostrate spreading herb; wide distribution; flowers Aug – Sept; variety of habitats	M
Pterostylis virens	P3	Orchid, patches of woodland dominated by *Eucalyptus orbifolia*; granitic sand over granite; granitic domes	N
Banksia arborea	P4	Banded ironstone formation; ironstone hills; Illaara Range	L
Goodenia berringbinensis	P4	Herb; south end of wide distribution; along watercourses, clay pans	L – M
Grevillea secunda	P4	Shrub; Red or yellow sand/ sand dunes & sandplains	N
Wurmbea murchisoniana	P4	Cormous perennial herb; flowers Jul – Sep; rock pools; seasonally inundated clay hollows	L

1. LOC – Likelihood of occurrence; N = Nil; L = low; M = medium; H = high
2. This is an incorrect identification, and is *Pterostylis tryphera* (pers comm Dr Andrew Brown)

2. Methods

2.1 Desktop survey

OBM provided a map and shapefiles of the Stage 2 Environmental Survey Area. A desktop survey was undertaken prior to the site visit to collect information on vegetation and flora, including threatened and priority flora and ecological communities which may occur in the area. The results of the desktop survey are described in Section 1. Images of the conservation flora were stored on mobile phones and printed with descriptions for reference in the field if required. Some field guide books/ notes were also taken in the field for identification/ verification of *Eremophila* and *Eucalyptus* species as required.

2.2 Field survey

Some sites were pre-selected for the current survey and further sites were chosen in the field. Limited survey has been undertaken on the greenstone range and sites on lower, mid and upper slopes were chosen to capture changes in vegetation which may occur at different elevations and soils types. The greenstone hills are located in the Lawrence LS which has a restricted distribution and the vegetation is likely to vary from other greenstone sites in the region. 20 m x 20 m quadrats were established and surveyed using the bushland quadrat methodology (Keighery 1994) and also described using the National Vegetation Information System (NVIS) codes described in Tables 9 – 11 (NVIS Technical Working Group 2017). More information can be sourced from the NVIS manual. Height classes and growth forms in brackets are currently allowed but not recommended.

Other sites were described as relevés and opportunistic finds. *Santalum spicatum* is a registered species and were recorded by GPS. Landform and land surface information were recorded for all quadrat sites and most relevé sites. The condition of the vegetation was based on the descriptions in Table 12 (EPA 2018).

Table 9: NVIS foliage cover codes.

Cover Characteristics					
Foliage cover	70 – 100	30 – 70	10 – 30	< 10	~ 0 (<2)
Crown cover	>80	50 – 80	20 – 50	0.25 – 20	<0.25
% cover	>80	50 – 80	20 – 50	0.25 - <20	<0.25
Cover code	d	c	i	r	bi

Table 10: Height classes defined for the NVIS.

Height		**Growth Form**				
Height Class	Height Range (m)	Tree	Shrub, chenopod shrub	Tree mallee, mallee shrub	Tussock grass	Bryophyte, lichen
8	>30	Tall	N/A	N/A	N/A	N/A
7	10 – 30	Mid	N/A	Tall	N/A	N/A
6	< 10	Low	N/A	Mid	N/A	N/A
5	<3	N/A	N/A	Low	N/A	N/A
4	>2	N/A	Tall	N/A	Tall	N/A
3	1 – 2	N/A	Mid	N/A	Tall	N/A
2	0.5 – 1	N/A	Low	N/A	Mid	Tall
1	< 0.5	N/A	Low	N/A	Low	Low

Table 11: Summary of NVIS strata codes.

NVIS stratum code	NVIS sub-stratum	Description	Growth forms	Height classes
U	U1	Tallest stratum	Tree, tree mallees (mallee shrubs)	8, 7, 6, (5)
	U2	Sub-canopy layer, second tree layer		
	U3	Sub-canopy layer, third tree layer		
M	M1	Tallest shrub layer	Shrubs, low trees, mallee shrubs, low shrubs, vines	(6), 5, 4, 3
	M2	Next shrub layer		
	M3	Third shrub layer		
G	G1	Tallest ground species	Grasses, forbs, sedges, rushes, vines, lichens, low shrubs	(4, 3), 2, 1
	G2	Ground		

Survey specific issues/ limitations have been addressed in Table 12. Climatic conditions and disturbance were the two main limiting factors.

Table 12: Vegetation Condition ratings recommended for the Eremaean Province (EPA 2018).

Condition	Description
Excellent	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
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
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.
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	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	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.

Table 13: Survey limitations.

Potential Limitation	Extent
Contextual information at a regional and local scale	**Not limiting** The results of surveys in or near the proposal area were available to study prior to the field survey. Regional surveys of the greenstone hills were undertaken by the Department of Parks and Wildlife in 2011 (Meissner and Coppen 2013) and 2008 (Meissner & Wright 2010) and 2007 (Meissner & Owen 2010). JBBC undertook a survey of adjacent areas in 2017 and 2019. The land system mapping surveys (Pringle et. al. 1994) described the soils and landforms for the proposal area. Conservation significant species listed in Table 8 were researched prior to the survey with photographs taken of specimens at the Western Australian Herbarium, as well descriptions and imagery contained in published documents (Nuytsia Journal for example).
Competency/ experience	**Not limiting** The survey team included a botanist (J Borger) and an ecologist (J Shepherdson) who have undertaken surveying and monitoring work in the Ora Banda – Davyhurst area over several years, with at least 15 years' experience each in vegetation surveys in the state.
Proportion of flora recorded and/ or collected, any identification issues	**Partly limiting** Significant areas of the proposal in the southern and eastern areas were in a degraded to good condition with a high level of disturbance from current and historical pastoral and mining impacts. Annual species and grasses were mostly absent due climatic conditions and historical impacts from pastoral and feral grazers. Some grasses were present as grazed off tussocks which were not identifiable. Some perennial species were vegetative so identification was based on leaf/ phyllode and other characteristics where possible.
Was the appropriate area fully surveyed	**Not limiting** JBBC was provided with maps and GPS coordinates of the area to be surveyed. Different vegetation patterns were identified and surveyed through the combination of quadrats, relevés and observations. There are areas within the greenstone ranges which may support flora not recorded; however, the suite of species recorded were mostly present at multiple sites throughout the ranges and enough data were recorded for the purpose of vegetation mapping to NVIS V.
Access restrictions within the survey area	**Not limiting.** The survey area was accessed by existing roads or tracks and by foot. The land surface was dry so there were no issues with becoming bogged.
Survey timing, rainfall, season	**Partly limiting** Under normal conditions most annuals and grasses would be present (drying off); however due to below average rainfall and warmer than normal temperatures ground cover was very sparse. Grazing probably had greater impact than climate. Very few plants were in flower or fruit. Fruit were present on Eucalyptus spp., which aided in identification.
Disturbance that may have affected the results such as fire, flood or clearing	**Limiting** The area has been subject to multiple disturbances from mining and pastoral activities over several decades which have resulted in clearing and partial clearing as well as poor recruitment and survival. Some areas were in better condition than others. Many signs were noted of donkeys, cattle and rabbits within the vegetation. The absence of some species and vegetation strata may have some impact on the description and mapping of the vegetation types. There were no signs of fire under 20 years or longer.

3. Results

3.1 Flora

A total of 83 taxa from 24 families and 40 genera were recorded in the environmental survey areas at Riverina. The best represented families were Fabaceae (20 taxa; 15 *Acacia*, 4 *Senna* and 1 *Mirbelia*), Chenopodiaceae (12 species; 7 *Maireana*, 2 *Sclerolaena*, 1 *Atriplex,* 1 *Enchylaena*, 1 *Rhagodia*), Scrophulariaceae (8 species; 7 *Eremophila*, 1 *Myoporum* (tentative)) and Myrtaceae (6 *Eucalyptus*). The most common species were *Dodonaea lobulata, Ptilotus obovatus*, *Casuarina pauper, Senna artemisioides* subsp. *filifolia* and *Acacia tetragonophylla* which were recorded within most vegetation types. *Acacia quadrimarginea* was very common on the greenstone hills but did not occur on the plains.

Perennial species with restricted occurrences include *Mirbelia depressa*, *Lepidosperma* sp., *Acacia epedunculata* P1 (tentative; vegetative), *Olearia humilis, Eucalyptus leptopoda* and *Hybanthus floribundus*. *Acacia epedunculata* (Figure 10) will need to be collected when in flower/ fruit for verification. There are 7 records approximately 130 km south, 40 km west of Coolgardie in *Callitris, Banksia, Casuarina* over *Triodia* on yellow sandplain near Caenyie Rock, and one record 40 km north of Kalgoorlie (105 km SE of the Riverina site) recorded in Mallee woodland of *Eucalyptus griffithsii* over shrubland of *Acacia aneura, A. burkittii* and *Senna artemisioides* subsp. *filifolia* on greenstone geology. The shrubs are described as multistemmed from the base with silvery green foliage. It was recorded flowering in August, and fruiting in November at two sites near Caenyie Rock.

Fabaceae
Acacia epedunculata P1 (tentative)

Low multistemmed spreading shrub (below right); 0.5 m high; silvery green phyllodes have 3 veins (left)

Riverina habitat (below left): *Eucalyptus clelandiorum* woodland on a rocky ridge (Quadrat 6)
A specimen was compared with a collection at the WA Herbarium and is very similar.

Figure 10: *Acacia epedunculata*

3.2 Vegetation

Nine vegetation types (VT) including 16 sub-types were described for the survey area (Table 15; Figures 11 – 13) from 10 quadrats (20 m x 20 m) and 47 relevé sites and observations (Appendix 4). A Bray Curtis two way cluster analysis was undertaken using presence/ absence flora data (Appendices 3A – 3C). Two species were present in most sites – *Casuarina pauper* and *Ptilotus obovatus* – and other common species were *Acacia tetragonophylla, A. burkittii, Senna artemisioides* subsp. *filifolia* and *Dodonaea lobulata*. The latter two species are listed by Pringle et al (1994) *as increaser species under grazing pressure. Acacia quadrimarginea, Brachychiton gregorii, Eremophila latrobei* subsp*. latrobei* and *Senna cardiosperma* occurred together in one block of sites – Relevés 3, 5 – 7, 12, 17 and 20. These sites fall within VTs 4B with the exception of R6 which was dominated by *Acacia caesaneura* with isolated *Acacia quadrimarginea* at the edges.

Vegetation types 1 – 3 mostly occur on the central to eastern area and include alluvial plains, stony plains and drainage lines. These areas are close to the original Riverina pastoral lease homestead area and have been subjected to varying levels of historic and current grazing impacts from cattle, donkeys, camels and rabbits. Several areas have also been impacted from historic mining activities including drilling, clearing (timber cutting), camping, and access tracks. Vegetation types 4 – 9 were restricted to the greenstone range mostly within the Lawrence land system (LS) area. VTs 4A, 4B and 6A extend into the western area of the mapped Moriarty LS.

Areas of each VT are presented in Table 14.

VTs 1 & 2

VT1 includes alluvial plains with varying cover of fine ironstone gravel which best fits within Moriarty LS Eucalypt Chenopod woodlands. VT1A has higher surface rock cover of fine ironstone gravel than VT1B. VT1B is adjacent to North Creek and has less impacts to the vegetation. The vegetation in VT1 is broadly open woodlands (or isolated trees) over an open shrubland of chenopod species and Senna. Pringle et al (1994) describe grazing impacts as: In poor condition you might expect a relative abundance of increaser species such as *Cassia nemophila* (*Senna artemisioides* complex), *Acacia hemiteles, Dodonaea lobulata* and *Eremophila scoparia*. In good condition you might expect *Austrostipa elegantissima*, a mix of palatable bluebush species such as *M. georgei*, and saltbush species. The almost sole presence of *Maireana sedifolia* in the understorey reflects overgrazing. *Austrostipa* was absent from VT1 areas surveyed in January; however, it was present in isolated locations in VT2. The plains were dominated by *Senna artemisioides* subsp. *filifolia* in many areas (Figure 14).

VT2 occurs on broad stony plains which are slightly higher in the landscape than VT1 and supports *Eucalyptus* woodland patches within tall *Acacia* shrublands. Significant areas of VT2 were in good to very good condition with less obvious pastoral impacts.

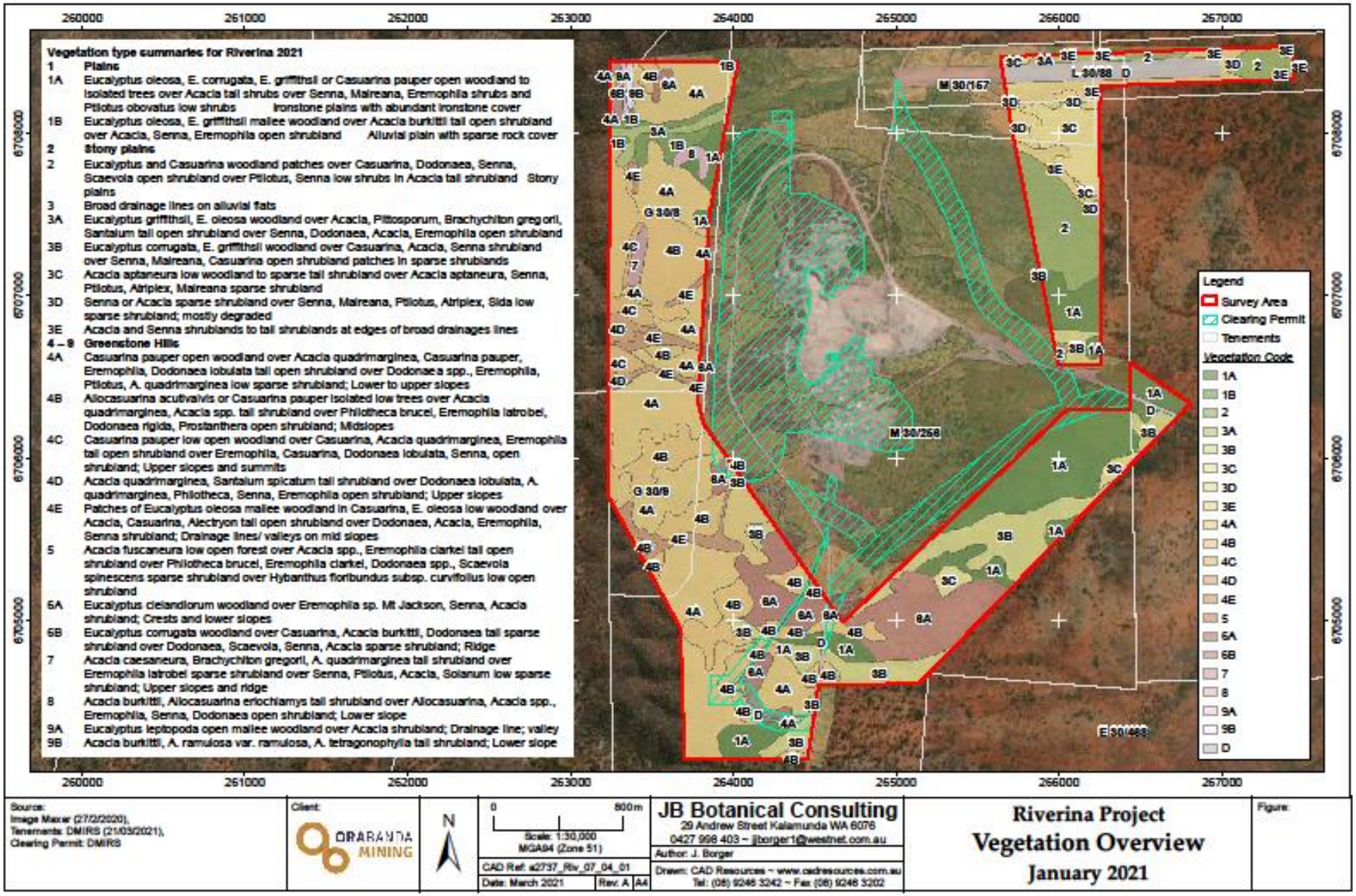


Figure 11: Vegetation Mapping Overview and legend

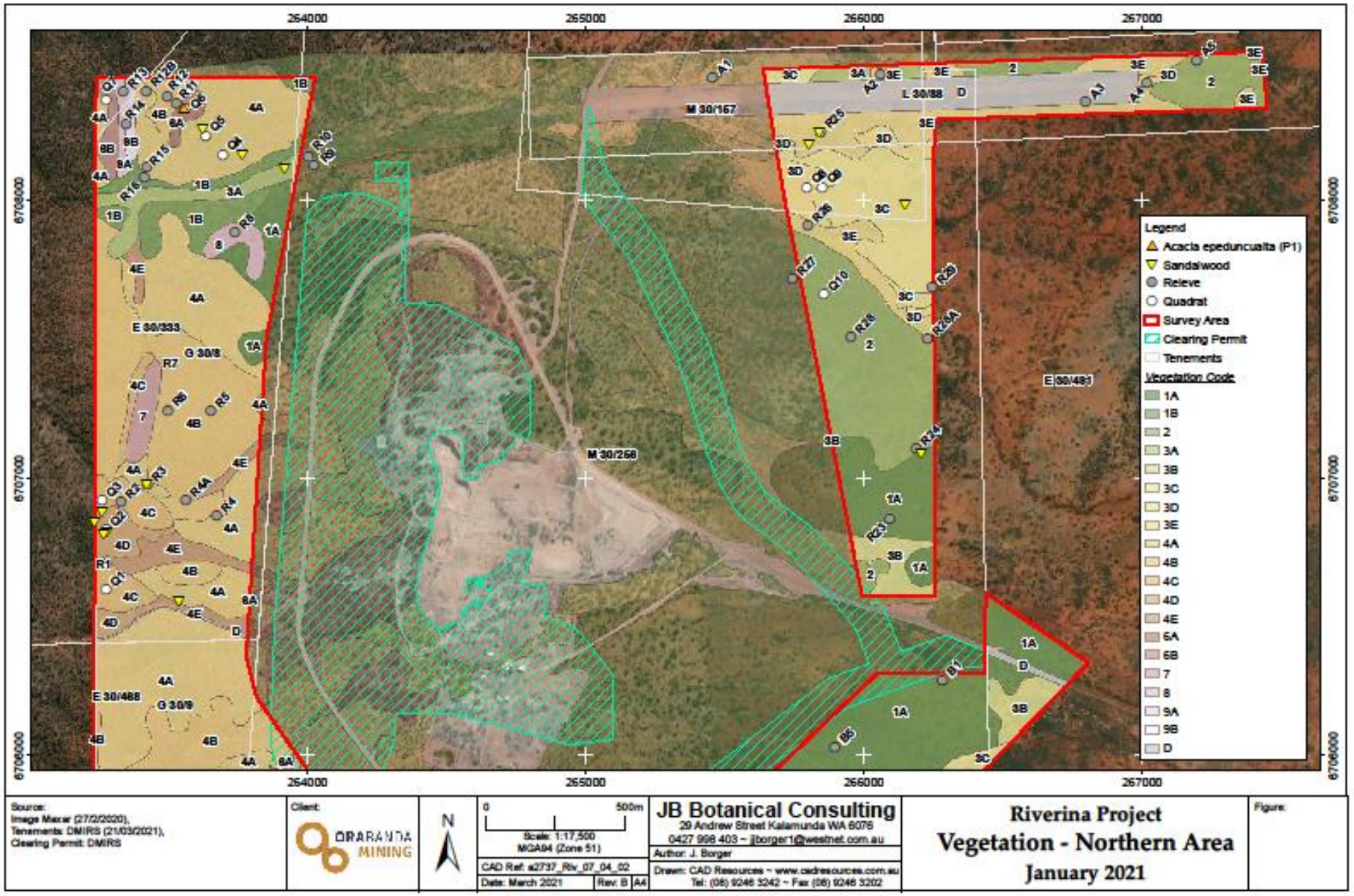


Figure 12: Vegetation mapping for the northern section – enlarged

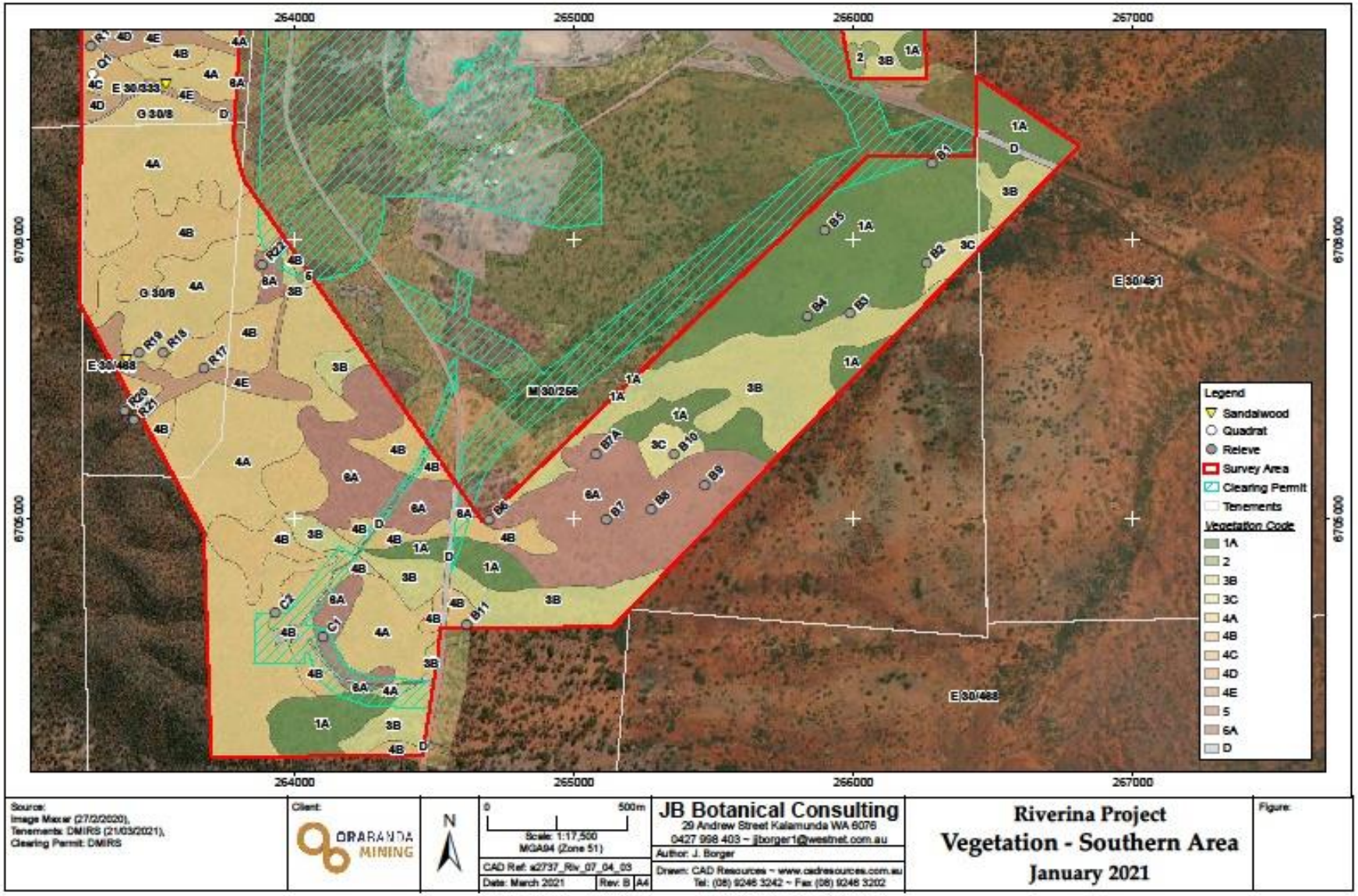


Figure 13: Vegetation mapping for the southern section – enlarged

	
B5 area: Dense stands of *Senna artemisiodies* were present in many areas south of diversion road indicating a high level of grazing impact over many years. Isolated *Maireana sedifolia, M. triptera, Atriplex vesicaria* were present within the *Senna* shrubland.	B4: Isolated Eucalypts remain over *Senna artemisioides* subsp*. filifolia, Maireana sedifolia, Acacia tetragonophylla* isolated shrubs. No *Ptilotus obovatus* were recorded in this area.

Figure 14: Vegetation within VT1 area south of the southern diversion road (Relevés B1, B2, B4 and B5 areas).

VT3 (A – E)

VT3 includes 5 subtypes all occurring within broad drainage lines. High levels of impact were noted in most of these areas, and the vegetation mapping reflects the level of impacts to some degree.

3A is in the best condition, with most occurrences mapped in the north to north west of the survey area. The western end of North creek supported *Eucalyptus oleosa* or *E. griffithsii* woodlands over an intact understorey of *Acacia*, *Brachychiton, Santalum*, *Eremophila* and *Senna* species. These areas generally had high levels of litter and higher cover of fallen timber than the more degraded areas. An incised drainage line with a rocky bed was present within broad gently sloping banks of alluvium. Several water holes (dry at time of survey) were within the creek bed which would likely hold water for several weeks when filled. VT3A is important as fauna habitat.

3B had higher levels of impacts and is described as patches of *Eucalyptus* and *Casuarina* pauper woodland over tall shrubland within sparse shrubland in broad drainage lines. Current grazing impacts were noted within these areas; however, there does appear to be some regrowth in denser areas. 3C and 3D were the most degraded and occurred in the middle of broad drainage tracts in the north east of the survey area (Bunyip LS). Under good conditions a *Maireana, Atriplex* shrubland would be expected; however, most of the area was denuded of vegetation with the exception of patches of *Acacia aptaneura* tall shrubland. Q9 was located within 3C and is described as an *Acacia aptaneura* open woodland over *A. tetragonophylla, Senna artemisioides* subsp. x *artemisioides, Ptilotus obovatus, Atriplex vesicaria* open shrubland. The total stem count for the quadrat was 379, of which 267 shrubs were under 0.5 m. Some had signs of grazing. The high density (but low foliage cover) of low shrubs indicates there may be some recent reduction in grazing pressure and the area

is starting to recover. 3C and 3D best fit within Bunyip code 5: Drainage tracts – moderately close Acacia tall shrublands with Acacia aneura (complex) dominant in the upper stratum (20 – 30 %) over a midstratum of *Acacia aneura, A. tetragonophylla, Eremophila forrestii* and *Rhagodia* over a low shrub stratum of *Ptilotus obovatus, Maireana, Enchylaena, Sida, Solanum* and *Eragrostis eriopoda* (grass). Many of these species were absent from the drainage area. *Eragrostis eriopoda* was present within the fenced airstrip section. Q8 was established in 3D. Very little intact vegetation remained in the area mapped as this type. Erosion was active – sheet erosion with significant areas of pedestalling (plants appear to sit above the landscape on small islands of soil remaining after erosion processes).

3E is described as *Acacia* and *Senna* shrublands to tall shrublands mostly at the edges of the broad drainage line associated with VTs 3C and 3D. These areas are likely to be either regrowth or patches of denser vegetation which have had fewer pastoral impacts. The areas were being used by stock (cattle, donkeys and camels) with many resting areas and tracks established within the vegetation.

VT4 (A – E)

Indicator species: *Acacia quadrimarginea*

The vegetation community 4 complex occurs on the greenstone hills and is underlain by dolerite (more common on the slopes), ultramafics (mostly on upper slopes and ridges) and minor areas of banded ironstone formation and quartz veins. VTs 4A – 4D are dominated by either *Casuarina pauper* or *Acacia quadrimarginea*. 4A and 4B occur mainly on slopes, with *Casuarina pauper* dominant in in 4A and *C. pauper* or *Allocasuarina acutivalvis* occurring as isolated trees or open woodland over an *Acacia quadrimarginea*, *A. ramulosa* var. *ramulosa* tall open shrub layer in 4B. *Brachychiton gregorii* was more common in 4B. Mid stratum species present in 4B include *Prostanthera althoferi* subsp. *althoferi, Mirbelia depressa* and *Philotheca brucei* subsp. *brucei* which were less common in 4A.

Vegetation on the upper slopes and crests (4C) generally supported *C. pauper* open woodland over an open shrub layer dominated by *Casuarina, Eremophila* and less *Acacia*, with *Senna artemisioides* subsp. *filifolia* and *Dodonaea lobulata* dominant in the lower shrub layer. Q3 was located in 4C on a ridge with outcropping metamorphosed rock. Disturbance from stock was low in these areas. Several fauna sightings or recent signs were in the area including pygmy spiny tailed skinks, Echidna and monitor lizards.

4D (Quadrat 2) is described as an *Acacia quadrimarginea* and *Santalum spicatum* tall shrubland over a shrubland dominated by *Dodonaea lobulata* and *Philotheca brucei* subsp. *brucei*. Ferns (*Cheilanthes sieberi*) were dominant in the groundcover. 4E occurred in valleys along narrow drainage tracts on mid to upper slopes of the greenstone hills. The presence of *Eucalyptus* species (mainly *E. oleosa*) distinguished this VT from the other types. Minor areas dominated by *Acacia incurvaneura* tall shrubland were recorded on the western side on midslopes with *Prostanthera campbellii* in the understorey. These areas are too small to map separately. 4E grades into VT 3B on lower slopes on broader drainage tracts where *Eucalyptus* spp. become dominant.

VT5 – restricted occurrence (2019 survey area)

Indicator species: *Acacia fuscaneura, Eremophila clarkei, Hybanthus floribundus*

VT5, *Acacia fuscaneura* low open forest over *Acacia burkittii, Acacia tetragonophylla, Acacia ramulosa* var. *ramulosa* and *Eremophila clarkei* open shrubland was described from a survey in 2019 and occurred on a laterite cap over greenstone. It was not recorded within the 2021 survey area and occurs on the eastern edge of the greenstone hills survey area. *Eremophila clarkei* was not recorded at other sites. *Hybanthus floribundus* subsp. *curvifolius* was common in this VT and was only recorded at one site in 2021 at the base of the northern range.

VT6 (A & B)

VT6A are *Eucalyptus* dominated woodlands mainly on lower slopes including *E. clelandiorum, E. salubris, E. corrugata* or *E. oleosa* subsp. *oleosa* over sparse shrublands. Most of the areas south of the southern bypass road had high levels of impacts from historic mining and pastoral activities but were in better condition further west. A minor area of *Eucalyptus clelandiorum* open forest was mapped on a ridge (Quadrat 2) on the northern range with many species in the understorey the same as *E. clelandiorum* woodlands on lower slopes including *Eremophila* sp. Mt Jackson. One potential priority species (*Acacia epedunculata* P1; tentative ID) was recorded. The condition of this site was rated as excellent.

VT6B is a *Eucalyptus corrugata* woodland over *Acacia burkittii, Dodonaea lobulata* tall sparse shrubland and restricted to the north west of the area.

VT7 – restricted occurrence

Indicator species: *Acacia caesaneura*

VT7 was recorded on a ridge with outcrops of ultramafics and dolerite at the northern end of the south range above VT 4B. *Acacia caesaneura* was the dominant species over a sparse shrubland of *Eremophila latrobei* over *Senna cardiosperma, Ptilotus obovatus, Acacia caesaneura* and *Solanum lasiophyllum* with *Cheilanthes lasiophylla* ferns.

VT8 – restricted occurrence

Indicator species: *Allocasuarina eriochlamys* subsp. *eriochlamys*

Acacia burkittii, Allocasuarina eriochlamys subsp. *eriochlamys* tall shrubland over *Allocasuarina eriochlamys, Acacia burkittii, Eremophila decipiens* subsp. *decipiens, Senna artemisioides* subsp. *filifolia, Dodonaea lobulata, Acacia tetragonophylla* open shrubland *Ptilotus obovatus, Acacia tetragonophylla* low sparse shrubland was recorded on a lower slope at the northern end of the south range. This was the only site with *Allocasuarina eriochlamys*.

VT9 (A & B) Restricted occurrence

VT9A Indicator species: *Eucalyptus leptopoda* subsp. *subluta*

VT9A *Eucalyptus leptopoda* subsp. *subluta, E. oleosa* subsp. *oleosa, Acacia burkittii* open mallee woodland *over Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall open shrubland over Acacia assimilis subsp. assimilis, A. burkittii, A. ramulosa var. ramulosa sparse shrubland* was recorded along eastern slopes of a small valley in the northern range with VT9B occurring along gently sloping alluvium on the valley floor. Pastoral impacts were higher on the valley floor with the

vegetation dominated by tall *Acacia* shrubs with low recruitment occurring. The land surface was disturbed and erosion was active.

Table 14: Mapped extent (ha) for each vegetation type/ subtype

VT	mapped extent (ha)	VT	mapped extent (ha)
1A	83.59	4D	4.20
1B	9.42	4E	13.75
2	35.06	5	0.15
3A	6.81	6A	55.5
3B	54.99	6B	2.01
3C	22.58	7	2.65
3D	5.51	8	2.32
3E	18.17	9A	1.11
4A	134.68	9B	1.06
4B	84.41	D	18.84 (Degraded/ cleared)
4C	7.05	**Total**	**563.85**

Table 15: Vegetation type descriptions

VT	Site/s	Description	Image
1A	B1, B2, B4, B5, R23 LS: Moriarty Condition: degraded to good	**Gently sloping lateritic plain (abundant mantle of fine ironstone gravel)** Almost level lateritic plain with abundant fine ironstone gravel High levels of pastoral impacts *Eucalyptus oleosa subsp. oleosa, E. corrugata, E. griffithsii, Casuarina pauper* open woodland to isolated trees over *Acacia burkittii, A. tetragonophylla* tall shrubland patches over *Senna artemisioides subsp. filifolia, Maireana sedifolia, Eremophila decipiens subsp. decipiens, Maireana pyramidata, Scaevola spinescens* sparse shrubland over *Ptilotus obovatus* low isolated shrubs	
1B	R16, R22 LS: Lawrence/ Moriarty Condition: Very good	**Gently sloping alluvium at base of greenstone hills**; less ironstone gravel in these areas; low levels of pastoral impacts on northern side; historic mining and current pastoral impacts on southern side of drainage line (R16) *Eucalyptus oleosa subsp. oleosa, E. griffithsii mallee woodland over Acacia burkittii, A. caesaneura* tall open shrubland over *Acacia burkittii, Senna artemisioides subsp. filifolia, Eremophila decipiens* subsp*. decipiens, Hybanthus floribundus* subsp. *curvifolius* sparse shrubland Species of interest: *Hybanthus floribundus* subsp. *curvifolius* (R16)	
2	Q10, R24, R24a, R27, R28 Moriarty Condition: good to very good	**Gently sloping stony plain (abundant mantles of quartz, ironstone, calcrete)** surface rock (ironstone gravel, quartz, basalt/ greenstone) 0.5 – 5 cm, 60 – 80 % Stands of *Eucalyptus corrugata* and *Casuarina* pauper *open mallee forest over Casuarina pauper, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Scaevola spinescens, Acacia tetragonophylla* open shrubland over *Casuarina pauper, Dodonaea lobulata, Ptilotus obovatus, Scaevola spinescens, Senna artemisioides subsp. x artemisioides low open shrubland in Acacia burkittii, A. caesaneura, Dodonaea lobulata, A. tetragonophylla, Senna artemisioides* subsp. *filifolia* open shrubland over *Ptilotus obovatus, Senna artemisioides* subsp. filifolia *over Ptilotus obovatus, Acacia tetragonophylla low sparse shrubland*	

3		**Broad drainage lines on alluvial flats**	
3A	R 9, R10 Lawrence/ Moriarty Condition: very good to excellent	*Eucalyptus griffithsii, E. oleosa subsp. oleosa woodland over Acacia burkittii, A. assimilis subsp. assimilis, Pittosporum angustifolium, Brachychiton gregorii, Santalum spicatum tall open shrubland over Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia burkittii, Eremophila interstans subsp. interstans, E. decipiens subsp. decipiens open shrubland over Maireana georgei, Solanum lasiophyllum, Senna artemisioides subsp. filifolia low open shrubland*	
3B	B3 Moriarty Good to very good	Broad drainage line on alluvial plain; denser patches of vegetation in depressions surrounded by tall open shrubland or open shrubland with isolated trees *Eucalyptus corrugata, E. griffithsii woodland over Casuarina pauper, Acacia synchronicia?, Eucalyptus corrugata low open woodland over Acacia murrayana, A. tetragonophylla, Casuarina pauper, Senna artemisioides subsp. filifolia shrubland over Senna artemisioides subsp. filifolia, Maireana sedifolia, Casuarina pauper, Eremophila decipiens subsp. decipiens*	
3C	Q9, R29A (Image), B2, B10 Bunyip Poor to good	Broad drainage line on alluvial plain Patches of *Acacia aptaneura* tall shrubland or low open woodland *Acacia aptaneura* low open woodland over *Acacia aptaneura* tall open shrubland over *Acacia aptaneura, A. tetragonophylla, Senna artemisioides subsp. x artemisioides, Ptilotus obovatus, Atriplex vesicaria* open shrubland over *Ptilotus obovatus, Acacia aptaneura, Maireana tomentosa, Sida sp, Senna artemisioides subsp. x artemisioides* low sparse shrubland over *Enneapogon sp., Sida sp, Senna artemisioides subsp. x artemisioides* low sparse tussock grassland	

3D	Q8 (image), R29 Bunyip Degraded to poor	Broad drainage line; alluvial plain Dark red silty clay loam; surface rock < 2% *Senna artemisioides subsp. x artemisioides, Acacia tetragonophylla sparse shrubland over Senna artemisioides subsp. x artemisioides, Maireana pyramidata low sparse shrubland over Ptilotus obovatus, Maireana thesioides, Sida sp., Atriplex vesicaria, Enneapogon sp. low sparse shrubland*	
3E	R25 (image), A2, A3 Bunyip Degraded to good	Broad drainage line on alluvial plain; Yellowish red silty clay loam; surface rock (washed gravel) < 5 % *Acacia* and *Senna* shrublands to tall shrublands at edges of broad drainages lines; likely to be regrowth in some areas R25: *Acacia burkittii, Acacia aptaneura, A. murrayana, Santalum spicatum tall shrubland over Senna artemisioides subsp. x artemisioides, Senna artemisioides subsp. filifolia, Acacia murrayana, Senna pleurocarpa var. pleurocarpa, Pimelea microcephala shrubland over Senna artemisioides subsp. filifolia, Ptilotus obovatus low open to sparse shrubland*	

4 – 9	**Greenstone hills**		
4A	R12, R18, R19, Q4, Q5 (image) Lawrence Condition: very good to excellent	Greenstone hills; midslopes; aspect variable – better condition on south facing slopes Red clay loam; surface rock (dolerite scree) 60 – > 80 %, ultramafics on upper slopes; minor outcrop of banded ironstone near R19 *Casuarina pauper open woodland over Acacia quadrimarginea, Casuarina pauper low open forest over Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia, Dodonaea lobulata, Acacia burkittii tall open shrubland over Dodonaea lobulata, Dodonaea rigida, Eremophila oldfieldii subsp. angustifolia open shrubland over Dodonaea lobulata, Dodonaea rigida, Ptilotus obovatus, Acacia quadrimarginea, low sparse shrubland over Cheilanthes lasiophylla, Enneapogon sp, Haloragis trigonocarpa, Solanum lasiophyllum low sparse fernland*	
4B	R3, 4A, R5 (image), R7, R20 R4 (edge) Lawrence Condition: very good to excellent	Greenstone hills; midslopes; mostly eastern or northern aspects; mostly on dolerite *Allocasuarina acutivalvis subsp. acutivalvis or Casuarina pauper* isolated low trees (8 – 9 m) over *Acacia ramulosa* var. *ramulosa, A. quadrimarginea, A. caesaneura* tall shrubland over *Philotheca brucei* subsp. *brucei*, *Eremophila latrobei subsp. latrobei, Dodonaea rigida, Prostanthera althoferi* subsp. *althoferi* open shrubland Species of interest: *Dodonaea rigida, Prostanthera althoferi* subsp. *althoferi, Lepidosperma sp., Mirbelia depressa* (R5)	
4C	Q1, Q3 (image), R2 Lawrence Condition: very good to excellent	Crests and upper slopes of greenstone hills Yellowish red silty clay loam or clay loam; surface rock (dolerite, metabasalt, chert, quartz) 60 – 80 %, fragment size 1 cm - > 30cm; some outcropping rock *Casuarina pauper* low open woodland over *Casuarina pauper, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia tall open shrubland over Eremophila oldfieldii subsp. angustifolia, Casuarina pauper, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Acacia tetragonophylla open shrubland over Ptilotus obovatus, Dodonaea lobulata, Senna artemisioides subsp. filifolia low open shrubland*	

4D	Q2 Lawrence Condition: excellent	Upper slopes; Red clay loam; surface rock (dolerite, quartz, calcrete) 50 – 60 % *Acacia quadrimarginea* tall shrubland over *Dodonaea, Philotheca, Senna and Eremophila* open shrubland *Acacia quadrimarginea, Santalum spicatum* tall shrubland over *Dodonaea lobulata, Acacia quadrimarginea, Philotheca brucei* subsp. *brucei, Senna cardiosperma, Eremophila oldfieldii* subsp. *angustifolia* open shrubland over *Ptilotus obovatus, Dodonaea lobulata, Acacia quadrimarginea, Sida calyxhymenia, Senna cardiosperma* low sparse shrubland over low isolated *Cheilanthes sieberi subsp. sieberi, Enneapogon sp., Haloragis trigonocarpa, Marsdenia australis, Vincetoxicum lineare*		
4E	Lawrence Condition: very good to excellent	Drainage lines, valleys on mid to upper slopes; usually incised. R1, R3 area The vegetation is denser than 4A and 4B, with occurrences of *Eucalyptus oleosa*. It grades into 3B on lower slopes where Eucalypt species become more dominant. A minor area of *Acacia incurvaneura* tall shrubland was recorded at one site.	 Patches of *Eucalyptus oleosa* subsp. *oleosa* mallee woodland in *Casuarina pauper, Eucalyptus oleosa subsp. oleosa low woodland over Acacia assimilis* subsp. *assimilis, Casuarina pauper, Alectryon oleifolius subsp. canescens tall open shrubland over Dodonaea lobulata, Acacia assimilis* subsp. *assimilis, Acacia quadrimarginea, Eremophila longifolia, Acacia tetragonophylla, Senna cardiosperma shrubland over Casuarina pauper, Ptilotus obovatus, Dodonaea lobulata low sparse shrubland*	 *Acacia incurvaneura* tall shrubland over *Senna cardiosperma, Prostanthera campbellii, Eremophila latrobei subsp. latrobei, Casuarina pauper open shrubland; areas of Acacia/ Casuarina tall shrubland* Recorded at one site in central western areas Yellowish red clay loam R21, R17 area

5 2019	Q2 (2019) Not recorded in surveyed areas in 2021	Ridge, south facing slope; laterite cap on greenstone *Grevillea nematophylla* subsp. *nematophylla* isolated medium trees over *Acacia fuscaneura* low open forest over *Acacia burkittii, Acacia tetragonophylla, Acacia ramulosa* var. *ramulosa, Eremophila clarkei, Casuarina pauper* tall open shrubland over *Philotheca brucei* subsp. *brucei, Eremophila clarkei, Dodonaea lobulata, Dodonaea rigida, Scaevola spinescens sparse shrubland over Hybanthus floribundus* subsp. *curvifolius, Philotheca brucei subsp. brucei, Dodonaea rigida, Eremophila clarkei, Scaevola spinescens* low open shrubland	
6A	B6 – B9; C1, Q6, R22 Moriarty/ Lawrence Condition: poor to good on lower slopes; excellent at Q6	Greenstone hills; mostly lower slopes; one on ridge on north range; red clay loam; surface rock (calcrete, dolerite, quartz, ironstone gravel) 40 – 50 % *Eucalyptus clelandiorum, E. corrugata, E. oleosa or E. salubris woodlands over Eremophila sp. Mt Jackson, E. oldfieldii subsp. angustifolia tall sparse shrubland over Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia sparse shrubland over Ptilotus obovatus, Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia, Maireana spp., Casuarina pauper low sparse shrubland*	
6B	Q7, R11 (small patch near Q6) Lawrence Condition: very good to excellent	Greenstone hills; ridge; Reddish brown silty clay loam; surface rock (dolerite, ultramafics, quartz, magnesite) 30 - >70 % North part of survey area – northern range *Eucalyptus corrugata* woodland over *Eucalyptus corrugata, Casuarina pauper low open woodland over Acacia burkittii, Dodonaea lobulata tall sparse shrubland over Dodonaea lobulata, Scaevola spinescens, Senna artemisioides subsp. filifolia, Acacia burkittii, Casuarina pauper sparse shrubland over Dodonaea lobulata, Ptilotus obovatus, Senna artemisioides subsp. filifolia, Eremophila decipiens subsp. decipiens, Acacia tetragonophylla low sparse shrubland*	

7	R6 Lawrence Condition: excellent	Greenstone hills; summit; Red clay loam; surface rock (dolerite, ultramafics, calcrete) > 70 %; outcrops of ultramafics *Acacia caesaneura, Brachychiton gregorii, Acacia quadrimarginea tall shrubland over Eremophila latrobei subsp. latrobei sparse shrubland over Senna cardiosperma, Ptilotus obovatus, Acacia caesaneura, Solanum lasiophyllum low sparse shrubland over Cheilanthes lasiophylla low open fernland*	
8	R8 Lawrence Condition: very good	Greenstone hills, outwash slope; valley Restricted occurrence in survey area *Casuarina pauper low isolated trees over Acacia burkittii, Allocasuarina eriochlamys subsp. eriochlamys, Pittosporum angustifolium tall shrubland over Allocasuarina eriochlamys subsp. eriochlamys, Acacia burkittii, Eremophila decipiens subsp. decipiens, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia tetragonophylla open shrubland Ptilotus obovatus, Acacia tetragonophylla low sparse shrubland*	
9A	R13B, R14A Lawrence Condition: very good	Incised drainage line; valley western slope; reddish brown clay loam; surface rock < 2 %; *Eucalyptus leptopoda subsp. subluta, E. oleosa subsp. oleosa, Acacia burkittii, Casuarina pauper open mallee woodland over Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall open shrubland over Acacia assimilis subsp. assimilis, A. burkittii, A. ramulosa var. ramulosa sparse shrubland over Ptilotus obovatus low isolated shrubs*	

9B	R13A, R14B Lawrence Condition: poor to good	Valley; lower to midslopes; alluvial slopes adjacent to drainage line Higher grazing impacts than 9A *Casuarina pauper isolated low trees over Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall shrubland* Low diversity	

3.3 Vegetation condition

The condition of the vegetation within the survey area had a marked contrast between the western and eastern areas, the latter having moderate to high levels of historic and current mining and pastoral (timber cutting, old drill sites and access tracks, cattle, donkeys, camels and rabbits) impacts (Figures 15 and 16). Historical mining impacts were present within the greenstone range. There were low current pastoral impacts in the ranges; however, cattle were present and there were signs of recent grazing, particularly on *Casuarina pauper* on lower slopes. Recent signs of donkeys were also noted on lower slopes. Grasses and herbs were very isolated which is most likely a result of grazing impacts rather than climatic conditions. Under low impact conditions it would be expected to have dried off herbs present and a more diverse range of grass species. The assessment of the sites on the greenstone ranges for condition rating (Table 12, EPA 2018) was difficult due to a lack of sites with comparable vegetation with very low impacts. The mid to upper slopes of the ranges has been mapped as excellent due to the perennial structure being intact, the value as fauna habitat and very low rates of active erosion. Most areas were stable largely due to high cover of surface rock. The presence and density of increaser and decreaser species under low impact conditions is not known.

Stumps remaining from timber cutting were common in VT3C – *Acacia aptaneura* shrublands. Sheet erosion is active in these areas.

Sheet erosion and gullying in VT9B (Acacia tall shrublands). Very low levels of recruitment are occurring in this area.

A degraded area in VT6A on a low rise south of the diversion road. Regrowth of *Maireana sedifolia, Senna artemisioides* subsp. *filifolia* open shrubland on old mining impacts.

Semi mature regrowth dominated by Casuarina pauper in VT4A on the greenstone hills in an area with historic mining impact

Figure 15: Impacts on vegetation condition

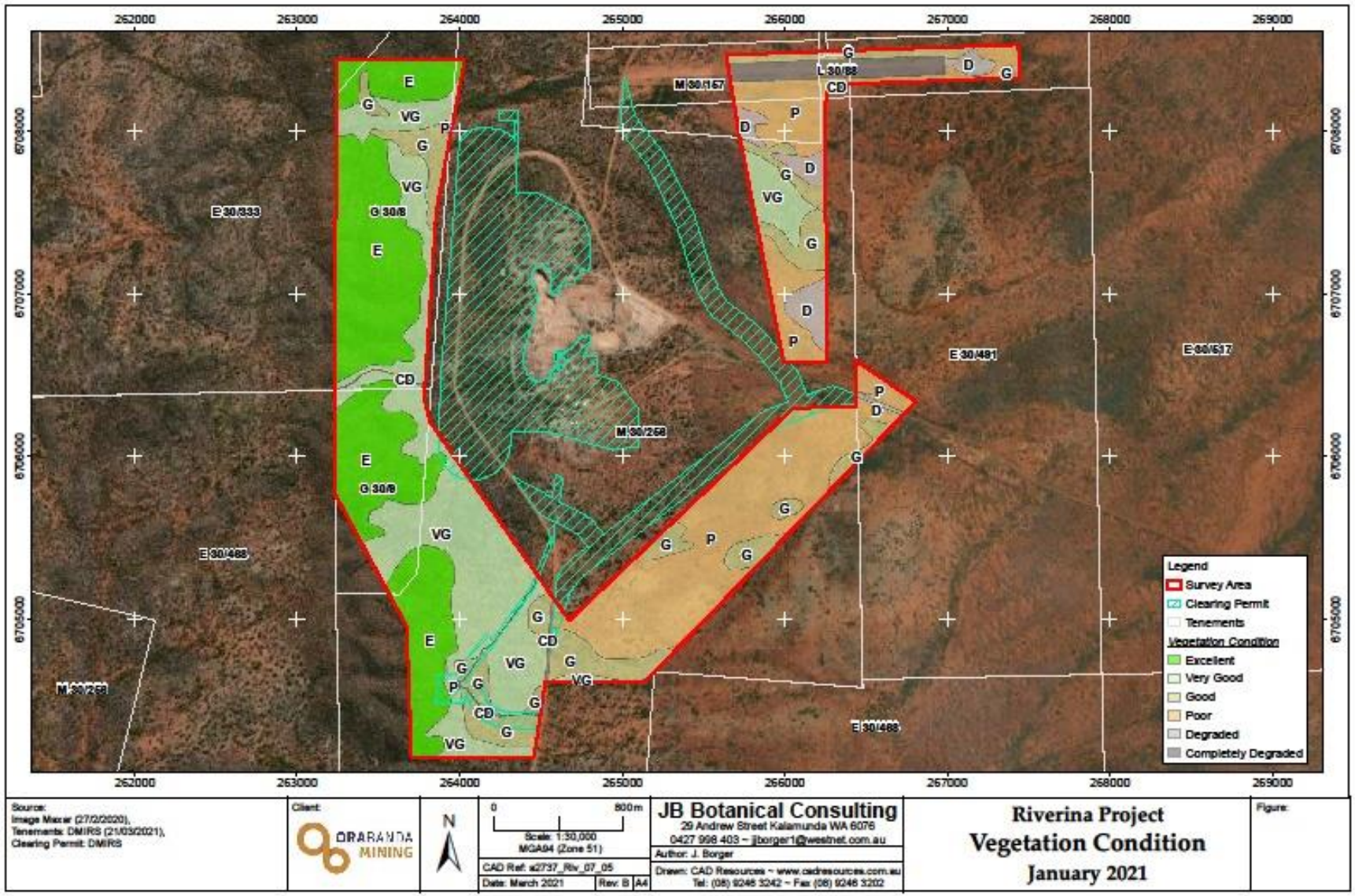


Figure 16: Vegetation condition mapping for the Riverina ESA. Vegetation was less impacted on the western side along the ranges.

Erosion was more active on the plains where there has been a long history (100 years +) of impacts and was particularly noted in VTs 1, 3 and woodland areas (6) on the low rises south of the western junction of the southern diversion road and Riverina – Menzies Road. The woodland areas had high impacts from historic mining activities (Figure 15). VT3D (Quadrat 8) was very degraded and very little vegetation remains in the area. Increaser species were dominant in these areas.

3.4 Regional vegetation mapping

Two regional mapping descriptions are available for the Riverina area 1) Land systems and 2) Beard's pre-European mapping (Section 1.3). Both LS and Beard's mapping include *Acacia aneura* (complex) as a main component within the Lawrence LS and PEV 251.1 on greenstone hills. *Acacia aneura* (*A. caesaneura* and *A. fuscaneura*) shrublands were present as minor VT units on ridges and mostly absent from the remaining VTs on the hills. Minor occurrences of *Acacia incurvaneura* were present in a drainage line in the central west area.

Land system mapping

Vegetation mapping from this survey has been compared with LS units in Table 2 in Section 1.3.

Vegetation on the ridges of greenstone hills within the Lawrence LS are described as Stony ironstone mulga shrublands – VTs 5 and 7 closely align with this description. The vegetation on the slopes is close to the Lawrence LS description but lacks species within the *Acacia aneura* group. VTs 3C – 3E are mapped in the Bunyip LS

Pre-European vegetation mapping

Barlee 251.1 Low woodland; *Acacia aneura* complex (mulga) and *Casuarina pauper* aligns with the Lawrence LS. Species within the *A. aneura* complex were not common in the surveyed vegetation types. Barlee 502.1 – Goldfields medium woodland; Goldfields blackbutt and red mallee (original description); *E. oleosa* & *E. lesouefii Eucalyptus* woodlands over *Acacia hemiteles, Senna artemisioides* subsp. *petiolaris* and *Eremophila decipiens* shrubland over *Maireana sedifolia* and *Ptilotus obovatus* chenopod shrubland is broadly representative of the vegetation present in that area, and Barlee 20.2 Low woodland, open low woodland or sparse woodland; Mulga (*Acacia aneura* complex), *Allocasuarina cristata (Casuarina pauper)* and *Eucalyptus* species (original description); *Acacia aneura, Callitris columellaris* and *Eucalyptus oleosa* low woodland/ open woodland over *Acacia hemiteles, Senna artemisioides* subsp. *petiolaris* and *Eremophila decipiens* shrubland over *Maireana sedifolia* and *Ptilotus obovatus* chenopod shrubland is mapped as occurring in the eastern area and is representative of VT2. *Callitris columellaris* was absent from the surveyed areas. Barlee 502.1 and 20.2 areas have been subjected to moderate to high levels of impacts which may have resulted in changes to the vegetation composition and structure.

Yilgarn Surveys (DEC/ DPAW)

Three surveys undertaken by the DEC/ DPAW are located in the Riverina region, with the Credo survey on greenstone hills extending to areas just south of Riverina, the Illaara Range ironstone survey 45 km NW at its closest point and the Mt Ida 52 km north, and Mt Hope 13 km west.

Illaara ironstone survey

Four vegetation communities were described from the Illaara surveys, with 3 & 4 occurring on a mixture of banded ironstone and mafic substrate which are likely to be closer to the Riverina range vegetation complexes. *Casuarina pauper* and *Senna* spp. were absent from most of the Illaara survey. Site descriptions for the two surveys are available on NatureMap – Yilgarn surveys.

Community 3 (crests and slopes) Open to sparse shrubland of *A. aneura* and *Acacia* spp. (*A. quadrimarginea* and/or *A. tetragonophylla*) over sparse to open shrublands of *Sida ectogama*, *Dodonaea rigida, Eremophila* spp. (*E. latrobei* and *E. forrestii*), *Scaevola spinescens* and *P. brucei* subsp. *brucei* over isolate to sparse shrublands and fernland of *Ptilotus obovatus* and *Cheilanthes sieberi* subsp. *sieberi* is potentially closest, although *A. aneura (complex)* and *Eremophila forrestii* are largely absent from Riverina. Typical taxa listed for Communities 3 and 4 are presented in Table 16.

Table 16: Typical taxa in Illaara Communities 3 and 4

Typical taxa Illaara Community 3	Typical taxa Illaara Community 4
Acacia tetragonophylla *Dodonaea rigida* *Ptilotus obovatus* *Scaevola spinescens* *Sida ectogama*	*Acacia duriuscula* *Acacia tetragonophylla* *Enchylaena tomentosa* *Eremophila pantonii* *Eucalyptus salubris* *Lepidium platypetalum* *Olearia muelleri* *Ptilotus obovatus* *Santalum spicatum* *Scaevola spinescens*

The first 4 species in community 3 occur in several VTs at Riverina on greenstone. Sida spp. were mostly absent from the survey area due to pastoral impacts or climatic conditions. One quadrat SHIL 30: Open shrubland of *Acacia quadrimarginea* and *Acacia aneura* over sparse shrubland of *Sida ectogama* and *Eremophila latrobei* subsp. *latrobei* over sparse shrubland of *Ptilotus obovatus* has a number of taxa in common. Quadrat SHIL 39: Open shrubland of *Acacia quadrimarginea* and *Acacia caesaneura* over sparse shrubland of *Sida ectogama* and *Eremophila latrobei* subsp. *latrobei* over sparse shrubland of *Ptilotus obovatus is similar to Riverina VT7, which is dominated by A. caesaneura with A. quadrimarginea at edges where it grades into 4B.*

The Community 3 vegetation at Illaara Range is generally sparser than Riverina. Mean annual rainfall for the area is close to 253 mm, with rainfall records from 75 km NW of the range, which is slightly drier than Riverina.

A quadrat from Community 4 (SHIL48) is located on north-west facing gently inclined crest of banded ironstone, quartz and minor mafics, and is described as a sparse shrubland of *Acacia quadrimarginea* over mid-dense shrubland of *Acacia duriuscula, Eremophila oldfieldii, Dodonaea lobulata* and *Acacia tetragonophylla* over sparse shrubland of *Ptilotus obovatus.* With the exception of *Acacia duriuscula,* the broad description is similar to Riverina 4B sites. Most vegetation types in Illaara Community 4 were not close to Riverina sites.

Credo Greenstone Survey

An analysis of 2019 Riverina sites (JBBC 2019) against Credo sites found there was a high association between Credo Community 4 and Riverina vegetation type 6 - *Eucalyptus clelandiorum, E. lesouefii* woodland on basalt hills. This VT is mapped as VT6A in the 2021 survey and mostly occurs on lower slopes with one exception (Q6) which occurs on a ridge on the north range. Credo Greenstone Community 4 is described as: Open forests to open woodlands of *Eucalyptus* spp. (*E. clelandiorum, E. celastroides, E. griffithsii*) and occasional *Casuarina pauper*, over shrublands to sparse shrublands of *Eremophila* spp. (*E. oldfieldii, E. interstans* and *E. scoparia*), *Senna artemisioides* subsp. *filifolia* and *Dodonaea lobulata* over open to sparse low shrublands of *Acacia erinacea, Olearia muelleri* and *Ptilotus obovatus* and isolated *Roepera ovata* forbs on slopes and crests of the basalt hills.

Mt Ida Greenstone belt and Mt Hope

Acacia quadrimarginea was present in all four communities and most closely aligned with VT 4 complex at Riverina. Community 3 is represented by several sites on Mt Hope (1, 3 – 6), which has BIF and minor mafic occurrences. The species composition in the Mt Ida communities is quite similar with the exception of *Eremophila forrestii* and *E. georgei*, *Acacia sibirica* (not recorded within VT 4 (Riverina)), *Acacia incurvaneura* (not common) and *Sida* species (not common). *Casuarina pauper* was mostly present within Mt Ida community 3.

Table 17: Typical taxa recorded in communities 3 and 4 (Mt Ida greenstone belt)

Typical taxa community 3 (Mt Hope 1, 3 – 6)	**Typical taxa community 4 Mt Hope 2**
Acacia incurvaneura *Acacia tetragonophylla* *Eremophila forrestii* *Eremophila latrobei* subsp. *latrobei* *Ptilotus obovatus* *Scaevola spinescens*	*Eremophila forrestii* *Sida* sp. Golden calyces glabrous (H.N.Foote 32)

The overall trend in the vegetation described on greenstone ranges is for *Eucalyptus* woodlands being more common further south (Credo), *Casuarina pauper* and *Acacia quadrimarginea* dominant at Riverina and most sites at Mt Hope, and *Acacia aneura* complex and *Eremophila forrestii* increasingly dominant to the north (Mt Ida/ Mt Mason) and north west (Illaara) on the ranges with *C. pauper* becoming less dominant.

4. Discussion

No vegetation representative of priority or threatened ecological communities was described for the Riverina environmental survey area (ESA). One priority species – *Acacia epedunculata* (P1) is potentially present in the north west of the ESA which is outside the area of impact from the proposed expansion of the PDA. No weeds were recorded during the survey. A comparison of diversity between the current survey and other surveys at the site and broader region show similar results for similar sized areas (Table 18).

Table 18: Comparison of diversity between survey areas

Survey (North – south distance)	**Total No. species**	**Families**	**Genera**	**Fabaceae**	**Chenopodiaceae**	**Scrophulariaceae**	**Myrtaceae**	**Poaceae**	**Asteraceae**	**Annuals**	**Weeds**
Riverina 2021 (4km)	83	24	40	20	12	8	6	5	2	1	0
Riverina 2019 (3 km)	95	26	41	18	14	14	8	4	2	6	2
Mt Ida, Mt Hope, (50 km + Mt Hope)	87	26	39	19	4	9	10	8	2	0	0
Credo (~80 km)	186	42	96	20	15	15	11	13	15	62	3
Illaara (80 km)	145	39	79	27	12	7	11	12	11	20	0

The Riverina 2021 results are close to Riverina 2019 and the Mt Ida, Mt Hope survey. The Fabaceae family were the best represented at all sites and followed by Chenopodiaceae, Scrophulariaceae and Myrtaceae at most sites. There were less *Eremophila* species recorded in the 2021 Riverina survey area in comparison to 2019. This is most likely a result of less woodland areas being present within the 2021 ESA in which species such as *E. pustulata* were recorded. *E. forrestii* was recorded at the edge of a woodland area in 2019, and *E. clarkei* was recorded within VT 5 which is mostly absent from the 2021 area. Annuals were poorly represented at Riverina and Mt Ida. The survey at Credo station included the results from 50 quadrats, the same number as the other two DEC/ DPAW sites. Significantly higher numbers of annuals were recorded at Credo, which is likely to be a result of climatic conditions as well as diversity of habitats. The number of perennial taxa recorded from the Illaara Range survey (125) was a lot higher than Riverina and Mt Ida which could be a result of the longer survey area. The number of perennial taxa at Credo is 124 – comparable with a similar survey length at Illaara.

The condition of the vegetation is considerably better along the ranges than the areas on the plains in the central and eastern areas of the ESA which have been impacted by historical and current pastoral and mining impacts over several decades. The condition of North Creek is mostly very good with some areas close to excellent. The expansion of the PDA will not directly impact this drainage line; however, diversion of runoff from the greenstone hills may have some impact on this area, particularly during intense rainfall events.

Table 19: Assessment of the Riverina proposal against the Department of Water and Environmental Regulation's 10 clearing principles (EPA 1986)

Clearing Principle		Comment
1	Native vegetation should not be cleared if it comprises a high level of biological diversity.	**Proposal is unlikely to be at variance with this principle** The species diversity would not be considered high with a total of 83 taxa recorded over 536 hectares. Comparing results with other regional surveys there is a deficit of grass and annual species which is largely a result of pastoral impacts over > 120 years. Many areas of the plains support large populations of increaser species as described by Pringle et al (1994) and very low numbers of decreaser species which tend to disappear from the landscape following intense grazing pressure.
2	Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for, the maintenance of a significant habitat for fauna indigenous to Western Australia.	**Proposal is unlikely to be at variance with this principle** The vegetation communities present within the Riverina environmental survey area (ESA) are unlikely to be regionally restricted based on land system and Beard's Pre-European vegetation mapping. The vegetation types recorded on the greenstone hills (VTs 4 – 9) form a transitional vegetation from the southern types dominated by *Eucalyptus* woodlands on Credo Station to the drier types recorded further north and north west with mulga and *Eremophila* species becoming dominant. Vegetation present on the plains has a broad distribution. Although there is some potentially suitable habitat for several species of conservation-significant fauna in the Riverina project area, the area is not considered to provide habitat necessary for the survival of any these species. All fauna habitat in the surveyed area has been subject to some degree of mining or pastoral disturbance. Clearing of native vegetation within the Riverina project area is therefore not considered to pose a significant threat to the survival of any threatened fauna species.
3	Native vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora	**Proposal is unlikely to be at variance with this principle** No threatened flora have been recorded within the Riverina ESA. Of the 3 species recorded within 50 km, only one has the potential for occurring in the Riverina ESA. *Ricinocarpos brevis has been recorded from rocky hillslopes and rock outcrops associated with banded ironstone formation which is not present at Riverina. Very minor outcrops of ironstone were noted at one location; however, the predominant geology of the site is mafic and ultramafic outcrops or underlying geology.* One priority species (to be confirmed) – *Acacia epedunculata* P1 – was recorded in the NW area and will not be impacted.

Clearing Principle		Comment
4	Native vegetation should not be cleared if it compromises the whole or part of, or is necessary for the maintenance of a threatened ecological community	**Proposal is not at variance with this principle** No threatened ecological communities are recorded in or near the proposal.
5	Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	**Proposal is not at variance with this principle** The application area falls with the Murchison Biogeographic Regionalisation of Australia (IBRA) bioregion in which approximately 100% of the pre-European vegetation remains (GWA 2018), although this does not take into account passive clearing through pastoral grazing. The pre-European vegetation associations mapped as occurring within the proposal are not restricted. The surrounding area has not been extensively cleared. Remnant vegetation in the area has been variously impacted through pastoral and mining activities, but the recent acquisition of ex-pastoral lease – Credo Station will provide similar habitat which will be managed for conservation purposes.
6	Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	**Proposal unlikely to be at variance with this principle** The drainage lines in or near the ESA are ephemeral and do not support riparian vegetation. The main drainage line (referred to as North Creek) is located outside the PDA and proposed disturbance area. The vegetation within the western area of the ESA is mostly intact, and in very good condition. The drainage line is deeply incised on the western side and banks could be prone to erosion if there is any disturbance to the vegetation. The drainage line becomes a broad almost level channel on the eastern side and has a high level of disturbance with much of the area classed as degraded to good condition. Drainage lines on lower slopes and plains have high levels of disturbance with small patches of vegetation in good condition within extensive areas in poor condition (Figure 16).
7	Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area	**Proposal unlikely to be at variance with this principle** There are no conservation areas nearby. Credo Station, 10 km south of the project, is being managed for conservation; however, it is not a nature reserve at present. Drainage from the Riverina mining project area flows east, then north to Lake Ballard and highly unlikely to impact on Credo Station.

Clearing Principle		Comment
8	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	**Proposal is unlikely to be at variance with this principle.** The eastern and southern areas of the Riverina survey area have an existing moderate to high level of disturbance (condition degraded to good). Much of the plains area show recent signs of sheet erosion and deposition, grazing (stock and feral animals) and historical mining activities. The condition of the vegetation and land surfaces within the greenstone hills is less impacted than the areas mentioned above, with most areas mapped as very good to excellent. There are signs of impacts (pastoral, historical mining) however most of the vegetation structure is intact although ground cover is sparse or absent in much of the area. Areas from the mid to upper slopes had some groundcover such as ferns or grass tussocks present. Provided OBM adopt a progressive approach to land clearing and rehabilitation the proposal is unlikely to cause appreciable land degradation.
9	Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water	**Proposal is unlikely to be at variance with this principle** Drainage systems within and near the proposal are ephemeral, generally not holding water for long periods of time. The area of clearing is unlikely to have an impact on groundwater quality, as the region supports mainly intact vegetation, with no extensive cleared areas. The average annual evaporation rate is approximately 2600 mm which far exceeds the average annual rainfall (254 mm at Menzies), so recharge to the groundwater would be expected to be minimal, thereby reducing the likelihood of raised saline water tables. A hydrological assessment of the sites' underlying geology (Rockwater 2020) shows that there are few groundwater surficial deposits which provide local aquifer resources, fewer minor to major groundwater resources (oxide/fresh rock interface) and no sedimentary aquifers in paleo channels which provide major aquifer and groundwater resources.
10	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding	**Proposal is unlikely to be at variance with this principle** The site is located within the semi-arid zone with a mean annual rainfall of around 250 mm and annual evaporation rate of approximately 2600 mm from which there is likely to be little surface flow during normal seasonal rains. Major rain events which could cause flooding to occur irregularly. A surface water assessment undertaken by Rockwater (2020) will be revised to include planned new development and to reduce the potential for flooding associated with the project through the design of earthworks and water management within the proximity of the project. It is unlikely that the proposal would lead to an increase in incidence or intensity of flooding due to the area of clearing, and small catchment area. Historic Tailings Storage Facilities and the pit will also provide some temporary surface water storage during significant rainfall events. Establishment and management of rehabilitation areas will also reduce runoff from the site. Storm runoff diversion around mining infrastructure will be implemented once mining has commenced.

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Appendix 1: Vascular flora

Family	Scientific Name	Code
Amaranthaceae	*Ptilotus obovatus*	
Apocynaceae	*Alyxia buxifolia*	
	Marsdenia australis	
	Vincetoxicum lineare	
Asparagaceae	*Thysanotus manglesianus*	
Asteraceae	*Olearia humilis*	
	Olearia muelleri	
Casuarinaceae	*Allocasuarina acutivalvis* subsp. *acutivalvis*	
	Allocasuarina eriochlamys subsp. eriochlamys	
	Casuarina pauper	
Chenopodiaceae	*Atriplex vesicaria*	
	Enchylaena tomentosa	
	Maireana georgei	
	Maireana pyramidata	
	Maireana sedifolia	
	Maireana sp.	
	Maireana thesioides	
	Maireana tomentosa	
	Maireana triptera	
	Rhagodia drummondii	
	Sclerolaena diacantha	
	Sclerolaena fusiformis	
Cyperaceae	*Lepidosperma sp.*	
Fabaceae	*Acacia aptaneura*	
	Acacia assimilis subsp. *assimilis*	
	Acacia burkittii	
	Acacia caesaneura	
	Acacia epedunculata (tent)	P1
	Acacia erinacea	
	Acacia fuscaneura	
	Acacia hemiteles	
	Acacia incurvaneura	
	Acacia ligulata	
	Acacia murrayana	
	Acacia quadrimarginea	
	Acacia ramulosa var. ramulosa	
	Acacia synchronicia (tent)	
	Acacia tetragonophylla	
	Mirbelia depressa	
	Senna artemisioides subsp. filifolia	
	Senna artemisioides subsp. x artemisioides	
	Senna cardiosperma	

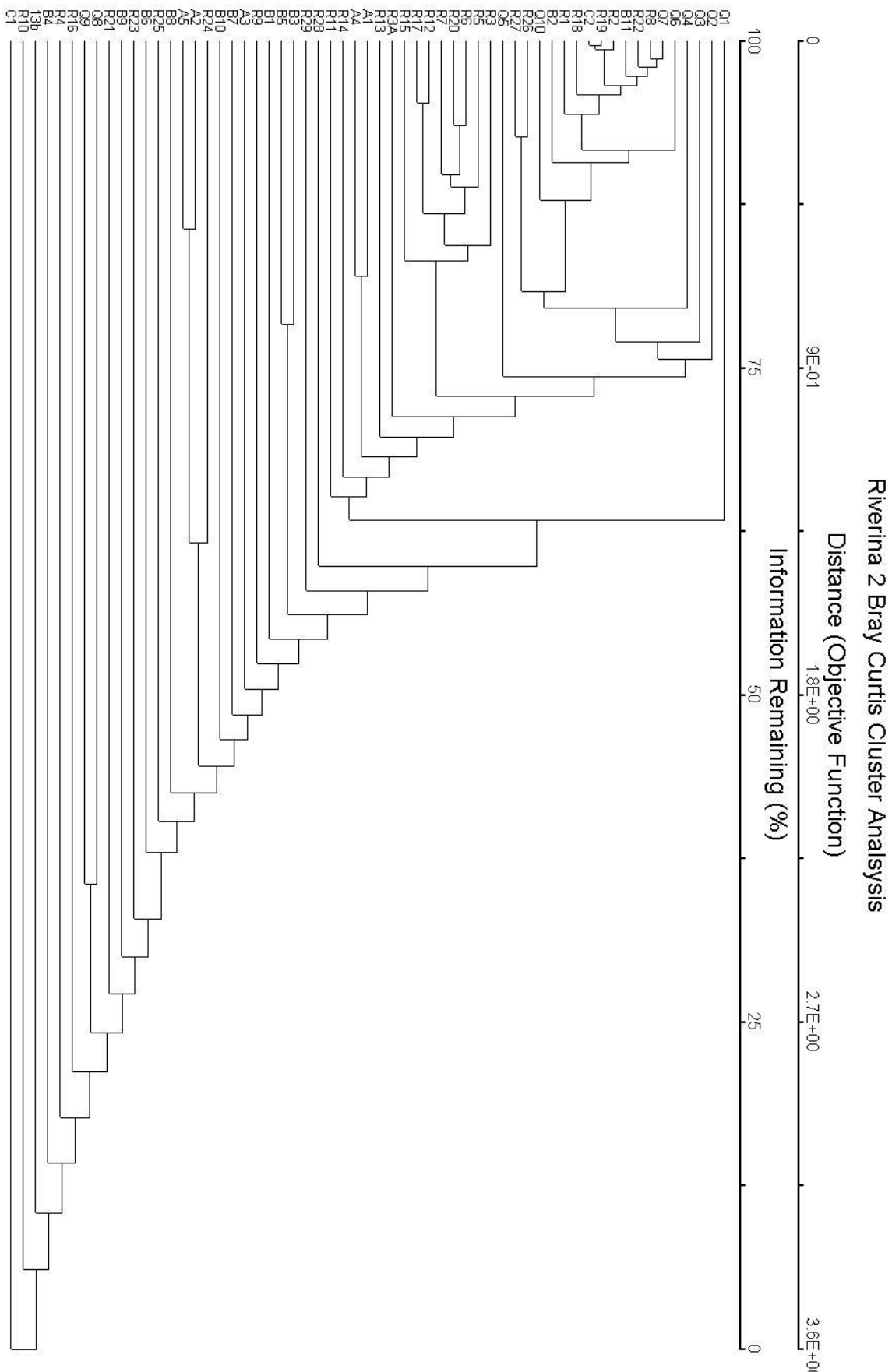
Family	Scientific Name	Code
Fabaceae	*Senna pleurocarpa var. pleurocarpa*	
Goodeniaceae	*Scaevola spinescens*	
Haloragaceae	*Haloragis trigonocarpa*	
Lamiaceae	*Prostanthera althoferi subsp. althoferi*	
	Prostanthera campbellii	
Loranthaceae	*Amyema benthamii*	
	Amyema fitzgeraldii	
Malvaceae	*Brachychiton gregorii*	
	Sida calyxhymenia	
	Sida sp	
Myrtaceae	*Eucalyptus clelandiorum*	
	Eucalyptus corrugata	
	Eucalyptus griffithsii	
	Eucalyptus leptopoda subsp. *subluta*	
	Eucalyptus oleosa subsp. *oleosa*	
	Eucalyptus salubris	
Pittosporaceae	*Pittosporum angustifolium*	
Poaceae	*Aristida contorta*	
	Austrostipa elegantissima	
	Austrostipa sp	
	Enneapogon sp.	
	Eragrostis setifolia	
Pteridaceae	*Cheilanthes lasiophylla*	
	Cheilanthes sieberi subsp. *sieberi*	
Rutaceae	*Philotheca brucei subsp. brucei*	
Santalaceae	*Exocarpos aphyllus*	
	Santalum spicatum	
Sapindaceae	*Alectryon oleifolius subsp. oleifolius*	
	Dodonaea lobulata	
	Dodonaea rigida	
Scrophulariaceae	*Eremophila decipiens* subsp. *decipiens*	
	Eremophila interstans subsp. interstans	
	Eremophila latrobei subsp. latrobei	
	Eremophila longifolia	
	Eremophila oldfieldii subsp. angustifolia	
	Eremophila scoparia	
	Eremophila sp. Mt Jackson	
	Myoporum sp.	
Solanaceae	*Solanum lasiophyllum*	
Thymelaeaceae	*Pimelea microcephala*	
Violaceae	*Hybanthus floribundus subsp. curvifolius*	

Appendix 2: Locations of Santalum spicatum and Acacia epedunculata P1

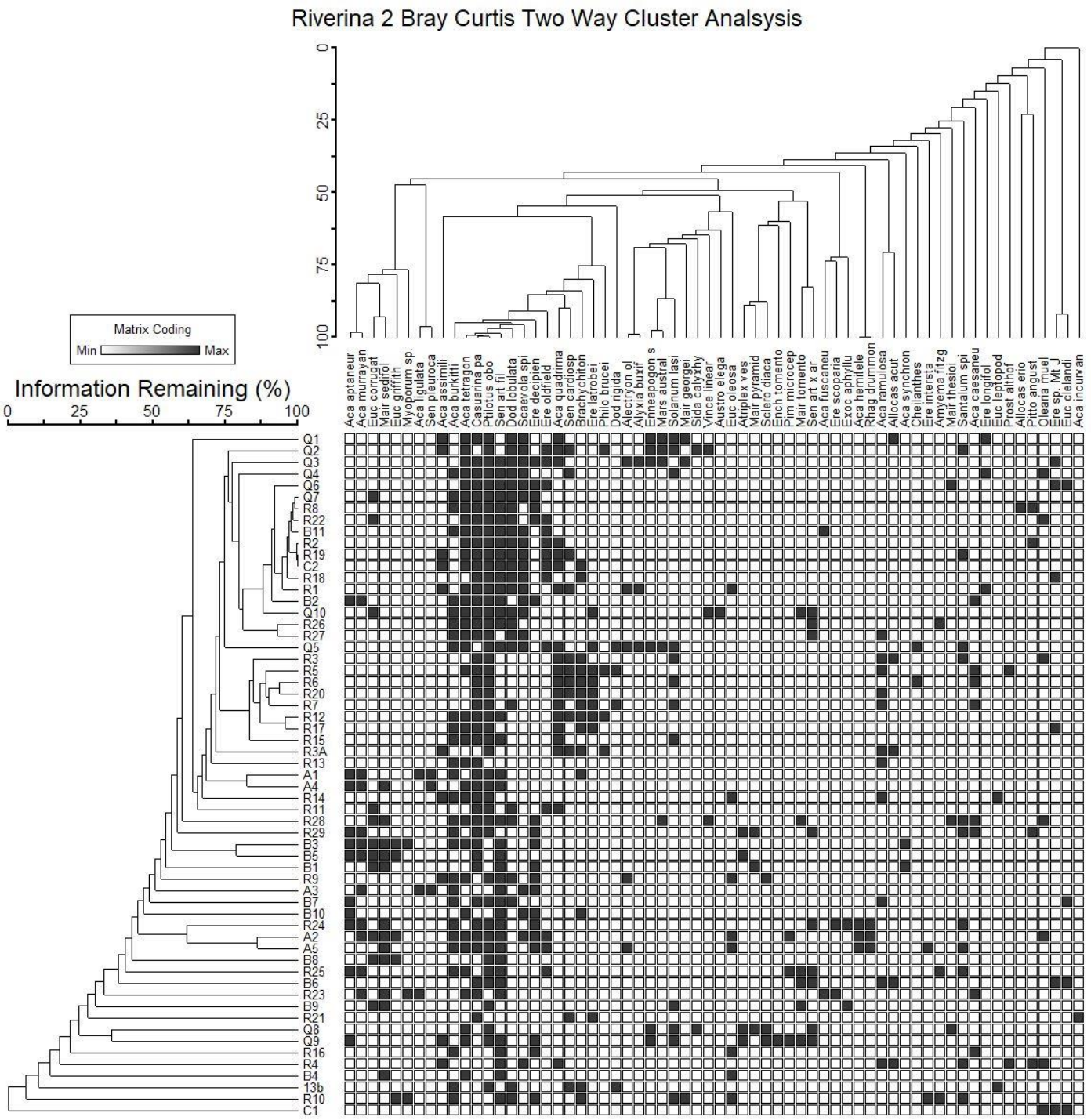
Scientific Name	Zone	Easting	Northing	No.
Santalum spicatum	51J	263235	6706840	1
Santalum spicatum	51J	263263	6706876	1
Santalum spicatum	51J	263423	6706974	1
Santalum spicatum	51J	263538	6706555	1
Santalum spicatum	51J	266208	6707088	1
Santalum spicatum	51J	265842	6708240	2
Santalum spicatum	51J	265805	6708200	6
Santalum spicatum	51J	266261	6707523	1
Santalum spicatum	51J	266150	6707980	1
Santalum spicatum	51J	263920	6708114	2
Santalum spicatum	51J	263767	6708162	1
Santalum spicatum	51J	263625	6708253	2
Santalum spicatum	51J	263398	6705573	1
Santalum spicatum	51J	263389	6705545	1
Santalum spicatum	51J	263279	6706801	1
Santalum spicatum	51J	263267	6706797	1

Scientific Name	Code	Zone	Easting	Northing	No.
Acacia epedunculata	P1	51J	263555	6708325	1

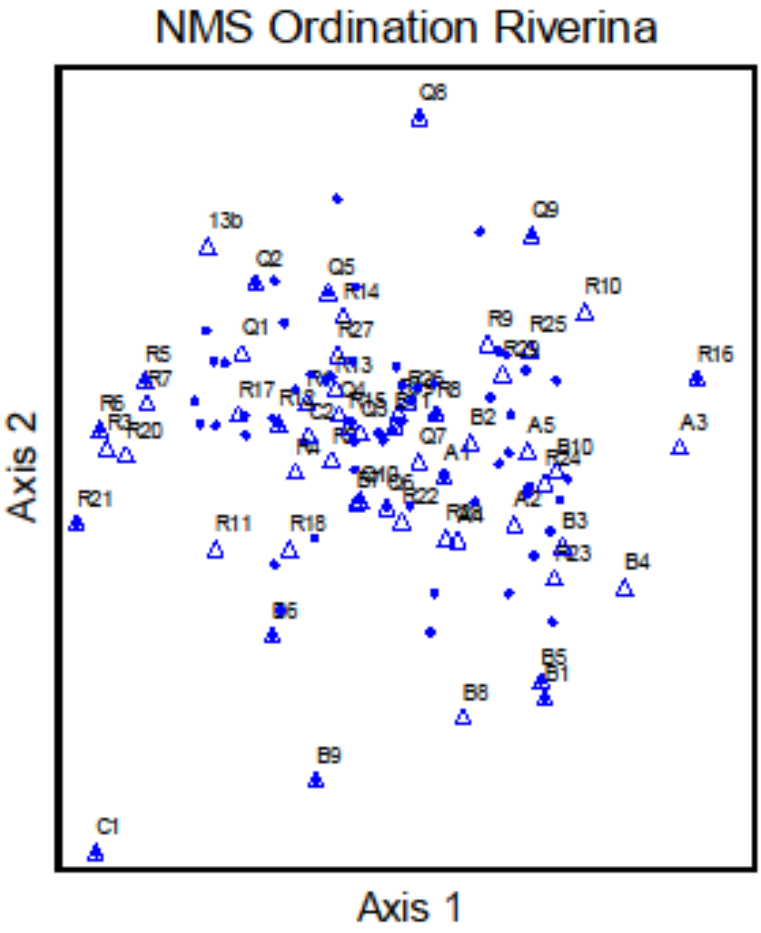
Appendix 3A: Bray Curtis Cluster Analysis between recording sites (See Appendix 4)



Appendix 3B: Bray Curtis Two Way Cluster Analysis



Appendix 3C: NMS Ordination



Appendix 4: Site Descriptions

Site Descriptions

Q – Quadrat 20 m x 20 m

R – Relevé

A – Relevé near airstrip

B – Relevé south of southern diversion road (SRD)

C – Relevé near Riverina camp

Riverina Quadrat Q1

Date: 12/01/2021 VT 4C Area: 20m x 20m (400m^2)

GPS: 263275 E/ 6706597 N	Location: Western side	Landform: Low range of hills; Aspect NE; upper slope
Land surface: Yellowish red (5YR4/6) clay loam; surface rock (dolerite; 1 – 20 cm; ^ 40 cm) 60 – 80 %; litter 25 – 30 %, 1 – 2 cm; fallen timber 2 – 3 %; cryptogam cover (lichen) 10 – 30 %; bare ground < 1%; surface dry		
Condition: Excellent; some historic pastoral and mining impacts; erosion mostly stable; sediment traps stable; cryptogam cover present on sediment		
Disturbance: Historic mining; current stock/ feral grazers; very dry; termite mounds, skinks in area		
NVIS VI: *U^ Acacia quadrimarginea, Casuarina pauper, Acacia tetragonophylla\Acacia\^shrub, tree\4\r; M1+^ Dodonaea lobulata, Scaevola spinescens, Acacia tetragonophylla, Acacia quadrimarginea\Dodonaea\^shrub\3\i; M2^ Dodonaea lobulata, Scaevola spinescens, Eremophila oppositifolia subsp. angustifolia\^Dodonaea\^shrub\2\bi; M3^ Ptilotus obovatus, Dodonaea lobulata, Scaevola spinescens, Maireana georgei, Solanum lasiophyllum\^Dodonaea\^shrub\1\i*		

Height (m)	Crown cover %	Habit	Species	No.
3 – 4.5	3 – 5	S, T	*Acacia quadrimarginea (2), Casuarina pauper (1), A. tetragonophylla (1)*	4
1 – 2	20 – 30	S	*Dodonaea lobulata (22), Scaevola spinescens (5), Acacia tetragonophylla (2), A. quadrimarginea (1)*	30
0.5 – 1	< 2	S	*Dodonaea lobulata (24), Scaevola spinescens (2), Eremophila oppositifolia* subsp*. angustifolia (1)*	27
< 0.5	10 – 20	S	*Ptilotus obovatus (235), Dodonaea lobulata (13), Scaevola spinescens (2), Maireana georgei (1), Solanum lasiophyllum (1)*	252
<0.5	<1	G	*Enneapogon sp. (dried)*	
<0.5	<1	V	*Marsdenia australis (1)*	1
				314

Stem density: 313/ 400 m^2; 78.25/ 100 m^2

Other species: *Acacia assimilis* subsp. *assimilis, Allocasuarina acutivalvis* subsp. *acutivalvis, Haloragis trigonocarpa (red herb)*, *Senna artemisioides* subsp. *filifolia*

Vegetation: *Acacia quadrimarginea, Casuarina pauper, Acacia tetragonophylla tall sparse shrubland over Dodonaea lobulata, Scaevola spinescens, Acacia tetragonophylla* open shrubland over *Ptilotus obovatus, Dodonaea lobulata, Scaevola spinescens* low open shrubland over *Enneapogon sp.* low isolated grass tussocks

Species list (quadrat)	**(outside)**
Acacia quadrimarginea	*Acacia assimilis* subsp. *assimilis*
Acacia tetragonophylla	*Allocasuarina acutivalvis* subsp. *acutivalvis*
Casuarina pauper	*Haloragis trigonocarpa*
Dodonaea lobulata	*Senna artemisioides* subsp. *filifolia*
Enneapogon sp.	
Eremophila oppositifolia subsp. angustifolia	
Maireana georgei	
Marsdenia australis	
Ptilotus obovatus	
Scaevola spinescens	
Solanum lasiophyllum	

Riverina Quadrat Q2		
Date: 12/01/2021 VTD		Area: 20m x 20m (400m^2)
GPS: 263275 E/ 6706811 N Elevation: 483 m a s l	**Location: West of PDA**	**Landform: Low range of hills; aspect East; upper slope**
Land surface: Red (2.5YR 4/6) clay loam; surface rock (dolerite, quartz, calcrete) 50 – 60 %, 1 - > 30cm; litter 30 – 50 % ^5cm; fallen timber 4 – 5 %; cryptogams (lichen) 5 – 10 %; bare ground 2 – 10 %; surface wet – light shower during survey		
Condition: Excellent; moderate drought impacts; good level of recruitment in lower strata; many signs of fauna – skinks, Echidna, monitor lizards		
Disturbance: Historic mining – old overgrown tracks in broader area; feral grazers – low impact		
NVIS VI: *U1+ ^ Acacia quadrimarginea, Santalum spicatum\Acacia\^shrub, tree\4\c; M1^ Dodonaea lobulata, Acacia quadrimarginea, Philotheca brucei subsp. brucei, Senna cardiosperma, Eremophila oldfieldii subsp. angustifolia\Dodonaea\^shrub\3\i; M2^ Dodonaea lobulata, Acacia quadrimarginea\Dodonaea\^shrub\2\r; G1^ Ptilotus obovatus, Dodonaea lobulata, Acacia quadrimarginea, Sida calyxhymenia, Senna cardiosperma\Ptilotus\^shrub\1\r; G2^ Cheilanthes sieberi* subsp*. sieberi, Enneapogon sp., Haloragis trigonocarpa, Marsdenia australis, Vincetoxicum lineare\Cheilanthes\^fern, tussock grass, forb, vine\1\bi*		

Height (m)	Crown cover %	Habit	Species	No.
3 – 5	40 – 50	S	*Acacia quadrimarginea (23), Santalum spicatum (1)*	24
2 – 3	< 2	S	*Dodonaea lobulata (2), Acacia quadrimarginea (1)*	3
1 – 2	20 – 30	S	*Dodonaea lobulata (31), Acacia quadrimarginea (7), Philotheca brucei subsp. brucei (7), Senna cardiosperma (2), Eremophila oldfieldii subsp. angustifolia (1), Acacia assimilis subsp. assimilis (1), Scaevola spinescens (1)*	50
0.5 – 1	2 – 5	S	*Dodonaea lobulata (16); Acacia quadrimarginea (1)*	17
< 0.5	5 – 10	S	*Ptilotus obovatus (68), Dodonaea lobulata (23), Acacia quadrimarginea (8), Sida calyxhymenia (20), Senna cardiosperma (5), Solanum lasiophyllum (9)*	133
< 0.3	< 1	V	*Marsdenia australis (1), Vincetoxicum lineare (1)*	2
<0.2	< 1	Grass	*Enneapogon sp.*	
<0.2	< 1	Fern	*Cheilanthes sieberi* subsp*. sieberi*	
<0.3	<1	Forb	*Haloragis trigonocarpa*	
				229

Combined < 0.3 ground cover 1 – 2 %

Stem density: 229/ 400 m^2

Other species: *Santalum spicatum* – 263279/6706801 (1); 263267/ 6706797 (1)

Vegetation: *Acacia quadrimarginea, Santalum spicatum* tall shrubland over *Dodonaea lobulata, Acacia quadrimarginea, Philotheca brucei* subsp. *brucei, Senna cardiosperma, Eremophila oldfieldii* subsp*. angustifolia* open shrubland over *Ptilotus obovatus, Dodonaea lobulata, Acacia quadrimarginea, Sida calyxhymenia, Senna cardiosperma* low sparse shrubland over *Cheilanthes sieberi subsp. sieberi, Enneapogon sp., Haloragis trigonocarpa, Marsdenia australis, Vincetoxicum lineare* low isolated ferns, grass tussocks, forbs and vines

Species list (quadrat)	**(outside – upslope ridge)**
Acacia assimilis subsp. assimilis *Acacia quadrimarginea* *Cheilanthes sieberi* subsp*. sieberi* *Dodonaea lobulata* *Enneapogon sp.* *Eremophila oldfieldii subsp. angustifolia* *Haloragis trigonocarpa* *Marsdenia australis* *Philotheca brucei subsp. brucei* *Ptilotus obovatus* *Santalum spicatum* *Scaevola spinescens* *Senna cardiosperma* *Sida calyxhymenia* *Solanum lasiophyllum* *Vincetoxicum lineare*	*Casuarina pauper open woodland*

Riverina Quadrat Q3

Date: 12th January 2021 VT 4C Area: 20m x 20m (400m^2)

GPS: 263261 E/ 6706916 N	Location: Low hills west of mining area	Landform: Hill; top of ridge; catchment divide, gentle slope, slight westerly aspect
Land surface: Yellowish red (5YR4/6) silty clay loam; surface rock (dolerite, metabasalt, chert, quartz) 60 – 70 %, fragment size 1 cm - > 30cm; litter 30 – 40 %; fallen timber 5 – 10 %; cryptogam cover (lichen) 20 – 30 %; bare ground < 5 %; surface moist – recent shower, dry at depth		
Condition: Excellent; family of pygmy spiny tailed skinks living in hollow log; recent signs of echidna; large monitor lizard burrow near logs		
Disturbance: Historic mining impacts; low current feral grazing impact		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\6\r; M1+^ Casuarina pauper, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia, Senna artemisioides subsp. filifolia, Alectryon oleifolius subsp. oleifolius\Casuarina\^tree, shrub\6\i; M1^ Eremophila oldfieldii subsp. angustifolia, Casuarina pauper, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Acacia tetragonophylla\Eremophila\^shrub\3\i; M2^Dodonaea lobulata, Senna artemisioides subsp. filifolia, Scaevola spinescens, Eremophila oldfieldii subsp. angustifolia, Casuarina pauper\Dodonaea\ ^shrub\2\r; G1^Ptilotus obovatus, Casuarina pauper, Eremophila oldfieldii subsp. angustifolia, Dodonaea lobulata, Scaevola spinescens\Ptilotus\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species	No.
6 – 10	8 – 10	T	*Casuarina pauper (4)*	4
2 – 5	10 – 15	T, S	*Casuarina pauper (10), Acacia quadrimarginea (1), Eremophila oldfieldii subsp. angustifolia (3), Senna artemisioides subsp. filifolia (3), Alectryon oleifolius subsp. oleifolius (1), Dodonaea lobulata (1)*	19
1 – 2	10 – 15	S	*Eremophila oldfieldii subsp. angustifolia (11), Casuarina pauper (8), Dodonaea lobulata (13), Senna artemisioides subsp. filifolia (10), Acacia tetragonophylla (3), Scaevola spinescens (1)*	46
0.5 – 1	5 – 10	S	*Dodonaea lobulata (8), Senna artemisioides subsp. filifolia (6), Scaevola spinescens (4), Eremophila oldfieldii subsp. angustifolia (3), Casuarina pauper (2), Acacia tetragonophylla (2), Eremophila* sp. Mt Jackson *(1)*	26
< 0.5	8 – 10	S	*Ptilotus obovatus (90), Casuarina pauper (5), Eremophila oldfieldii subsp. angustifolia (5), Dodonaea lobulata (3), Scaevola spinescens (1), Alyxia buxifolia (1), Maireana georgei (1)*	106
< 1	< 1	V	*Marsdenia australis (1)*	1
< 0.2	< 1	GT	*Enneapogon sp.*	
				202

Stem density: 202/ 400 m^2; 50.5/ 100 m^2

Other species: *Eremophila decipiens* subsp. *decipiens*

Vegetation: *Casuarina pauper* low open woodland over *Casuarina pauper, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia, Senna artemisioides subsp. filifolia, Alectryon oleifolius subsp. oleifolius tall open shrubland over Eremophila oldfieldii subsp. angustifolia, Casuarina pauper, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Acacia tetragonophylla open shrubland over Ptilotus obovatus, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Scaevola spinescens, Eremophila oldfieldii subsp. angustifolia, Casuarina pauper low open shrubland*

Species list (quadrat)	**(outside)**
Acacia quadrimarginea *Acacia tetragonophylla* *Alectryon oleifolius subsp. oleifolius* *Alyxia buxifolia* *Casuarina pauper* *Dodonaea lobulata* *Enneapogon sp* *Eremophila oldfieldii subsp. angustifolia* *Eremophila* sp. Mt Jackson *Marsdenia australis* *Maireana georgei* *Ptilotus obovatus* *Scaevola spinescens* *Senna artemisioides subsp. filifolia*	*Eremophila decipiens* subsp. *decipiens*

Riverina Quadrat Q4

Date: 13/01/2021 VT 4A Area: 20m x 20m (400m^2)

GPS: 263696 E/ 6708161 N 457 masl	Location: North side of mining operation	Landform: Low hill; south lower slope
Land surface: Red (2.5YR 4/6) clay loam; surface rock (dolerite, quartz, calcrete) scree slope > 80 % 2 - > 20 cm; litter 40 – 50 % ^ 25 cm; fallen timber 10 – 15 %; cryptogams (lichen) 10 – 20 %; bare ground < 1 %; surface moist, showers on previous day		
Condition: Excellent; minor recent stock impacts; low erosion; some recent deaths due to drought; good recruitment in low shrub layer		
Disturbance: Stock in area; rabbits; historic mining (many years ago)		
NVIS VI: U1^ *Casuarina pauper, Acacia burkittii\Casuarina\^tree\6\r; M1+^Acacia burkittii, Casuarina pauper, Eremophila oldfieldii subsp. angustifolia, Dodonaea lobulata, Acacia tetragonophylla\Acacia\^shrub, tree\4\c; M2^ Acacia burkittii, Dodonaea lobulata, Scaevola spinescens, Senna artemisioides subsp. filifolia\Acacia\^shrub\3\i; M3^ Ptilotus obovatus, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Olearia muelleri, Eremophila oldfieldii subsp. angustifolia\Ptilotus\^shrub\2\r*		

Height (m)	Crown cover %	Habit	Species	No.
7 – 8	8 – 10	Tree	*Casuarina pauper (1), Acacia burkittii (1)*	2
4 – 6	30 – 40	S, T	*Acacia burkittii (22), Casuarina pauper (2), Eremophila oldfieldii subsp. angustifolia (2), Dodonaea lobulata (6), Acacia tetragonophylla (1)*	33
1 – 2	20 – 30	S	*Acacia burkittii (9), Dodonaea lobulata (14), Scaevola spinescens (5), Senna artemisioides subsp. filifolia (4)*	32
0.5 – 1	2 – 3	S	*Dodonaea lobulata (9), Casuarina pauper (1), Senna artemisioides subsp. filifolia (2), Olearia muelleri (1), Eremophila oldfieldii subsp. angustifolia (1), Acacia burkittii (1)*	15
<0.5	2 – 3	S	*Ptilotus obovatus (56), Dodonaea lobulata (5), Scaevola spinescens (2), Casuarina pauper (2), Senna artemisioides subsp. filifolia (2), Acacia burkittii (1), Senna cardiosperma (1), Solanum lasiophyllum (1)*	70
				162

Stem density: 162/ 400 m^2, 40.5/ 100 m^2

Vegetation: *Casuarina pauper, Acacia burkittii* low open woodland over *Acacia burkittii, Casuarina pauper, Eremophila oldfieldii subsp. angustifolia, Dodonaea lobulata, Acacia tetragonophylla* tall shrubland over *Acacia burkittii, Dodonaea lobulata, Scaevola spinescens, Senna artemisioides subsp. filifolia* open shrubland over *Ptilotus obovatus, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Olearia muelleri, Eremophila oldfieldii subsp. angustifolia* low sparse shrubland

Species list (quadrat)	
Acacia burkittii	*Ptilotus obovatus*
Acacia tetragonophylla	*Scaevola spinescens*
Casuarina pauper	*Senna cardiosperma*
Dodonaea lobulata	*Senna artemisioides subsp. filifolia*
Eremophila oldfieldii subsp. angustifolia	*Solanum lasiophyllum*
Olearia muelleri	

Riverina Quadrat Q5

Date: 13th January 2021 VT 4A Area: 20m x 20m (400m^2)

GPS: 263633 E/ 6708231 N **463 masl**	**Location: Low hill, north of drainage line and north of mining area**	**Landform: Low hill; mid-slope; aspect south**
Land surface: Red (2.5YR 4/6) clay loam; surface rock (dolerite scree) > 80 %, 5 – 25 (40) cm; litter 50 – 60 % ^ 25 cm deep; fallen timber 1 – 2 %; surface slightly moist, showers previous day		
Condition: Excellent; land surface stable; signs of echidnas		
Disturbance: Rabbits – scats in area (not fresh); cattle – could be some grazing impacts		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\7\r; U2+^Acacia quadrimarginea, Casuarina pauper\ Acacia\^tree, shrub\6\c; M1^ Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia, Dodonaea lobulata, Acacia burkittii, Santalum spicatum\Acacia\^shrub, tree\4\i; M2^ Dodonaea lobulata, Dodonaea rigida, Eremophila oldfieldii subsp. angustifolia, Acacia quadrimarginea, Casuarina pauper\Dodonaea\^shrub\3\i\ M3^ Dodonaea lobulata, Dodonaea rigida, Ptilotus obovatus, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia\ Dodonaea\^shrub\2\r; G1^ Cheilanthes lasiophylla, Enneapogon sp, Haloragis trigonocarpa, Solanum lasiophyllum\Cheilanthes\^fern, tussock grass, forb, shrub\1\r*		

Height (m)	**Crown cover %**	**Habit**	**Species**	**No.**
13 – 14	8 – 10	T	*Casuarina pauper (1)*	1
5 – 8	40 – 50	T, S	*Acacia quadrimarginea (8), Casuarina pauper (2)*	10
2 – 4	20 – 30	S, T	*Acacia quadrimarginea (5), Eremophila oldfieldii subsp. angustifolia (5), Dodonaea lobulata (8), Acacia burkittii (2), Santalum spicatum (2), Eremophila latrobei subsp. latrobei (2), Casuarina pauper (1)*	25
1 – 2	10 – 15	S	*Dodonaea lobulata (22), Dodonaea rigida (10), Eremophila oldfieldii subsp. angustifolia (4), Acacia quadrimarginea (2), Casuarina pauper (1), Eremophila latrobei subsp. latrobei (1)*	40
0.5 – 1	5 – 10	S	*Dodonaea lobulata (29), Dodonaea rigida (7), Acacia quadrimarginea (1), Eremophila oldfieldii subsp. angustifolia (2), Senna artemisioides subsp. filifolia (2), Acacia tetragonophylla (1)*	42
< 0.5	2 – 5	S	*Dodonaea lobulata (41), Ptilotus obovatus (19), Acacia quadrimarginea (8), Eremophila oldfieldii subsp. angustifolia (3), Casuarina pauper (2), Senna artemisioides subsp. filifolia (1), Solanum lasiophyllum (2)*	76
< 1	< 1	Vine	*Marsdenia australis (2), Thysanotus manglesianus (1)*	3
< 0.5	<1	GT	*Enneapogon sp*	
< 0.5	< 1	Fern	*Cheilanthes lasiophylla*	
< 0.5	< 1	Forb	*Haloragis trigonocarpa*	
				197

Combined tall shrub 50 – 60 %

Stem density: 197/ 400 m^2; 49.25/ 100 m^2

Vegetation: *Casuarina pauper open woodland over Acacia quadrimarginea, Casuarina pauper low open forest over Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia, Dodonaea lobulata, Acacia burkittii, Santalum spicatum tall open shrubland over Dodonaea lobulata, Dodonaea rigida, Eremophila oldfieldii subsp. angustifolia, Acacia quadrimarginea, Casuarina pauper open shrubland over Dodonaea lobulata, Dodonaea rigida, Ptilotus obovatus, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia low sparse shrubland over Cheilanthes lasiophylla, Enneapogon sp, Haloragis trigonocarpa, Solanum lasiophyllum low sparse fernland*

Species list (quadrat)	**(outside)**
Acacia burkittii	*Alectryon oleifolius* subsp*. oleifolius*
Acacia quadrimarginea	*Alyxia buxifolia*
Acacia tetragonophylla	*Scaevola spinescens*
Casuarina pauper	*Santalum spicatum*
Cheilanthes lasiophylla	
Dodonaea lobulata	
Dodonaea rigida	
Enneapogon sp	
Eremophila latrobei subsp. latrobei	
Haloragis trigonocarpa	
Marsdenia australis	
Ptilotus obovatus	
Santalum spicatum	
Senna artemisioides subsp. filifolia	
Solanum lasiophyllum	
Thysanotus manglesianus	

Riverina Quadrat Q6

Date: 13th January 2021 VT 6A Area: 20m x 20m (400m^2)

GPS: 263560 E/ 6708327 N **466 m a s l**	**Location: range of low hills north of mining area; north of drainage line**	**Landform: Hill; summit – broad ridge; upper catchment; southerly aspect, gentle slope**
Land surface: Reddish brown (5YR 5/4) clay loam; surface rock (dolerite, calcrete, quartz) 60 – 80 %, calcrete 1 – 2 cm, basalt/ dolerite 4 – 20 cm; litter 60 – 70 % ^ 25 cm; fallen timber 4 – 5 %; cryptogam cover (lichen) 10 – 20 %; bare ground < 1 %; surface moist – showers previous day		
Condition: Excellent		
Disturbance: Historic timber cutting, pastoral/ feral grazers		
NVIS VI: U1+^ *Eucalyptus clelandiorum\Eucalyptus\^tree\7\c; M1 ^Eremophila sp. Mt Jackson, E. oldfieldii subsp. angustifolia\Eremophila\^shrub\4\r; M2 ^ Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia, Acacia tetragonophylla\Eremophila\^shrub\3\r; G1^ Ptilotus obovatus, Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia, Maireana thesioides, Casuarina pauper\Ptilotus\^shrub\1\r*		

Height (m)	**Crown cover %**	**Habit**	**Species**	**No.**
12 – 15	40 – 50	T	*Eucalyptus clelandiorum (3)*	3
2 – 4	8 – 10	S	*Eremophila sp. Mt Jackson (11), E. oldfieldii subsp. angustifolia (1)*	12
1 – 2	< 2	S	*Eremophila sp. Mt Jackson (4), Senna artemisioides subsp. filifolia (2), Acacia tetragonophylla (1)*	7
0.5 – 1	2 – 3	S	*Eremophila sp. Mt Jackson (5), Senna artemisioides subsp. filifolia (3), Casuarina pauper (2), Ptilotus obovatus (1)*	11
< 0.5	1 – 2	S	*Ptilotus obovatus (61), Eremophila sp. Mt Jackson (14), Senna artemisioides subsp. filifolia (10), Casuarina pauper (4), Maireana thesioides (2), Eremophila oldfieldii subsp. angustifolia (2), E. decipiens subsp. decipiens (1), Dodonaea lobulata (1), Acacia ?epedunculata* P1 *(1)*	96

Stem density: 129/ 400 m^2, 32.25/ 100 m^2

Other species: Scaevola spinescens

Acacia epedunculata P1 – tentative ID; need to see flowering/ fruiting specimen

Vegetation: *Eucalyptus clelandiorum open forest over Eremophila sp. Mt Jackson, E. oldfieldii subsp. angustifolia tall sparse shrubland over Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia, Acacia tetragonophylla isolated shrubs over Ptilotus obovatus, Eremophila sp. Mt Jackson, Senna artemisioides subsp. filifolia, Maireana thesioides, Casuarina pauper low sparse shrubland*

Species list (quadrat)	*Acacia epedunculata* (Tentative identification)
Acacia tetragonophylla *Acacia epedunculata P1* (right) *Casuarina pauper* *Dodonaea lobulata* *Eucalyptus clelandiorum* *E. decipiens subsp. decipiens* *Eremophila sp. Mt Jackson* *E. oldfieldii subsp. angustifolia* *Maireana thesioides* *Ptilotus obovatus* *Senna artemisioides subsp. filifolia* *Scaevola spinescens* (outside)	

Riverina Quadrat Q7

Date: 13th January 2021 VT 6B Area: 20m x 20m (400m^2)

GPS: 263275 E/ 6708359 N 462 masl	Location: North of Riverina Mining operation	Landform: Hill; ridge, midslope, southern aspect
Land surface: Reddish brown (5YR 4/4) silty clay loam; surface rock (dolerite, ultramafic, magnesite, quartz) > 70 % of mostly small fragments 1 – 2 cm with some outcropping ultramafics and fragments 20 – 30 cm long x 5 cm wide; litter 40 – 50 % ^ 15 cm deep; fallen timber 20 – 30 %; cryptogam cover (lichen) 20 – 30 %; bare ground < 0.5 %; surface slightly moist following showers on the previous day		
Condition: Excellent		
Disturbance: low pastoral impacts although many signs observed in valley downslope from site; no obvious mining impacts		
NVIS VI: *U1+^Eucalyptus corrugata\Eucalyptus \^tree\7\i; U2 ^Eucalyptus corrugata, Casuarina pauper\Eucalyptus\6\r; M1^Acacia burkittii, Dodonaea lobulata\Acacia\^shrub\4\r; M2^Dodonaea lobulata, Scaevola spinescens, Senna artemisioides subsp. filifolia, Acacia burkittii, Casuarina pauper \Dodonaea\^shrub \2\r; G1^ Ptilotus obovatus, Dodonaea lobulata, Acacia tetragonophylla, Scaevola spinescens, Senna artemisioides subsp. filifolia \Ptilotus\1\r*		

Height (m)	Crown cover %	Habit	Species	No.
12 – 14	25 – 30	T	*Eucalyptus corrugata (2)*	2
4 – 8	5 – 6	T	*Eucalyptus corrugata (2), Casuarina pauper (1)*	3
2 – 3	8 – 10	S	*Acacia burkittii (9), Dodonaea lobulata (2)*	11
1 – 2	3 – 5	S	*Senna artemisioides subsp. filifolia (6), Dodonaea lobulata (6), Scaevola spinescens (2), Acacia burkittii (2), Casuarina pauper (1)*	17
0.5 – 1	5 – 6	S	*Dodonaea lobulata (12), Scaevola spinescens (7), Senna artemisioides subsp. filifolia (4), Eremophila decipiens subsp. decipiens (1), Casuarina pauper (1)*	25
< 0.5	3 – 4	S	*Ptilotus obovatus (81), Dodonaea lobulata (20), Acacia tetragonophylla (2), Scaevola spinescens (1), Senna artemisioides subsp. filifolia (1)*	105
				163

Stem density: 163/ 400 m^2, 40.75/ 100 m^2

Vegetation: *Eucalyptus corrugata* woodland over *Eucalyptus corrugata, Casuarina pauper low open woodland over Acacia burkittii, Dodonaea lobulata tall sparse shrubland over Dodonaea lobulata, Scaevola spinescens, Senna artemisioides subsp. filifolia, Acacia burkittii, Casuarina pauper sparse shrubland over Dodonaea lobulata, Ptilotus obovatus, Senna artemisioides subsp. filifolia, Eremophila decipiens subsp. decipiens, Acacia tetragonophylla low sparse shrubland*

Denser areas of Acacia shrublands (A. burkittii, a. tetragonophylla) at edges.

Species list (quadrat)	Magnesite – magnesium carbonate – a weathering product of magnesium rich rocks
Acacia burkittii *Acacia tetragonophylla* *Casuarina pauper* *Dodonaea lobulata* *Eremophila decipiens subsp. decipiens* *Eucalyptus corrugata* *Ptilotus obovatus* *Scaevola spinescens* *Senna artemisioides subsp. filifolia*	

Riverina Quadrat Q8

Date: 14th January 2021 VT 3D Alluvial/ drainage Area: 20m x 20m (400m^2)

GPS: 265795 E/ 6708043 N	Location: East of Riverina – Rd; south of airstrip	Landform: Gently undulating alluvial plain; broad regional drainage line
Land surface: Dark red (2.5 YR 3/6) silty clay loam; surface rock (fine ironstone gravel, calcrete) < 1 %; litter 2 – 10 % ^ 2cm under shrubs; fallen timber < 1 %; cryptogam cover – 0%; bare ground > 70 %; soil surface slightly moist – showers 2 days prior		
Condition: Degraded; drought impacts – numerous deaths		
Disturbance: High level of pastoral/ feral grazing (cattle, donkeys, camels) impacts – erosion – sheet erosion, pedestalling ^ 10 cm		
NVIS VI: M1+^ *Senna artemisioides subsp. x artemisioides, Acacia tetragonophylla\Senna\ ^shrub\3\r; M2 ^Senna artemisioides subsp. x artemisioides, Maireana pyramidata\Senna\^shrub, chenopod shrub\2\r; G1^ Ptilotus obovatus, Maireana thesioides, Sida calyxhymenia, Atriplex vesicaria, Enneapogon sp.\Ptilotus\^shrub, chenopod shrub, tussock grass\1\r*		

Height (m)	Crown cover %	Habit	Species	No.
1 – 2	2 – 3	S	*Senna artemisioides subsp. x artemisioides (4), Acacia tetragonophylla (1)*	5
0.5 – 1	2 – 3	S	*Senna artemisioides subsp. x artemisioides (22), Maireana pyramidata (2)*	24
< 0.5	2 – 3	S, F	*Ptilotus obovatus (82), Maireana thesioides (59), Sida calyxhymenia (52), Atriplex vesicaria (14), Sclerolaena diacantha (12), Maireana sp. (6), Senna artemisioides subsp. x artemisioides (5), Solanum lasiophyllum (4)*	234
< 0.5	1 – 2	G	*Enneapogon sp. (dried tussocks 1 – 2 cm high)*	
				263

Stem density: 263/ 400 m^2; 65.75/ 100 m^2

Vegetation: *Senna artemisioides subsp. x artemisioides, Acacia tetragonophylla sparse shrubland over Senna artemisioides subsp. x artemisioides, Maireana pyramidata low sparse shrubland over Ptilotus obovatus, Maireana thesioides, Sida calyxhymenia, Atriplex vesicaria, Enneapogon sp. low sparse shrubland*

Species list
Acacia tetragonophylla
Atriplex vesicaria
Enneapogon sp.
Maireana pyramidata
Maireana sp.
Maireana thesioides
Ptilotus obovatus
Sclerolaena diacantha
Senna artemisioides subsp. x artemisioides
Solanum lasiophyllum
Sida calyxhymenia

Riverina Quadrat Q9

Date: 14th January 2021 VT 3C Alluvial/ drainage Area: 20m x 20m (400m^2)

GPS: 265851 E/ 6708042 N Elevation: 432 m a s l	Location: South of airstrip; east of Riverina – Snake Hill Road	Landform: Floodplain; broad, very flat; drainage to east; lower catchment
Land surface: Red (2.5 YR 4/6) clay loam; surface rock (fine ironstone gravel) < 1 %; litter 5 – 10 % ^ 3cm deep; fallen timber < 1 %; cryptogam cover (lichen) < 1 %; bare ground > 80 %		
Condition: Good; some structure still present; some recent germinations		
Disturbance: High level of grazing/ feral impacts; erosion – sheet erosion, pedestalling 10 – 30 cm Grazing on Atriplex vesicaria, Senna, Acacia, Eremophila; signs of cattle and donkeys common in area		
NVIS VI: U1+^ *Acacia aptaneura\Acacia\^tree\6\r; M1^ Acacia aptaneura\Acacia\^shrub, tree\4\i; M2^ Acacia aptaneura, A. tetragonophylla, Senna artemisioides subsp. x artemisioides, Ptilotus obovatus, Atriplex vesicaria\Acacia\^shrub\3\i; G1 ^Ptilotus obovatus, Acacia aptaneura, Maireana tomentosa, Sida sp, Senna artemisioides subsp. x artemisioides\Ptilotus\^shrub\1\r\ G2 ^ Enneapogon sp., Sida sp, Senna artemisioides subsp. x artemisioides \^Enneapogon\^tussock grass, shrub\1\r*		

Height (m)	Crown cover %	Habit	Species	No.
6 – 7	8 – 10	Tree	*Acacia aptaneura (2)*	2
2 – 3	10 – 15	Shrub, tree	*Acacia aptaneura (10)*	10
1 – 2	8 – 10	Shrub	*Acacia aptaneura (24), A. tetragonophylla (1)*	25
0.5 – 1	3 – 4	Shrub	*Acacia aptaneura (61), Senna artemisioides subsp. x artemisioides (9), Ptilotus obovatus (4), Atriplex vesicaria (1)*	75
< 0.5	2 – 3	Shrub	*Ptilotus obovatus (81), Acacia aptaneura (56), Maireana tomentosa (43), Sida sp. (62), Senna artemisioides subsp. x artemisioides (10), Atriplex vesicaria (5), Solanum lasiophyllum (6), Sclerolaena diacantha (1), Eremophila decipiens subsp. decipiens (grazed) (1), Pimelea microcephala (1), Enchylaena tomentosa (1)*	267
< 0.2	2 – 3	Tussock grass	*Enneapogon sp.*	
				379

May be some recent reductions in grazing pressure with high number of plants < 0.5; *Atriplex vesicaria* present in low numbers

Stem density: 379/ 400 m^2, 94.75/ 100 m^2

Other species: *Acacia assimilis* subsp. *assimilis, Senna artemisioides* subsp. *filifolia*

Vegetation: *Acacia aptaneura* low open woodland over *Acacia aptaneura* tall open shrubland over *Acacia aptaneura, A. tetragonophylla, Senna artemisioides subsp. x artemisioides, Ptilotus obovatus, Atriplex vesicaria* open shrubland over *Ptilotus obovatus, Acacia aptaneura, Maireana tomentosa, Sida sp, Senna artemisioides subsp. x artemisioides* low sparse shrubland over *Enneapogon sp., Sida sp, Senna artemisioides subsp. x artemisioides* low sparse tussock grassland

Species list (quadrat)	**(outside)**
Senna artemisioides subsp. x artemisioides *Ptilotus obovatus* *Atriplex vesicaria (grazed)* *Maireana tomentosa* *Sida sp. (grazed; recent germinations)* *Solanum lasiophyllum* *Sclerolaena diacantha* *Pimelea microcephala* *Enchylaena tomentosa* *Enneapogon sp. (dried off tussocks; grazed)* *Eremophila decipiens* subsp. *decipiens (grazed)*	*Acacia assimilis* subsp. *assimilis* *Senna artemisioides* subsp. *filifolia*

Riverina Quadrat Q10

Date: 14th January 2021 VT 2 Area: 20m x 20m (400m^2)

GPS: 265856 E/ 6707659 N Elevation: 433 m	Location: South of airstrip (500m); east of Snake Hill Road	Landform: Floodplain; slightly raised area
Land surface: Red (2.5 YR 4/8) silty clay loam; surface rock (ironstone gravel, quartz, basalt/ greenstone) 0.5 – 5 cm, 60 – 70 %; litter > 80 %, ^ 15 cm under trees; fallen timber 15 – 20 %; cryptogam cover (lichen) < 10 %; bare ground < 1 %; surface slightly moist – showers previous day		
Condition: Very good; some drought impacts		
Disturbance: Historic and current pastoral/ feral grazing – signs of cattle, donkeys and camels		
NVIS VI: U1+^ *Eucalyptus corrugata, Casuarina pauper\Eucalyptus\^mallee, tree\6\c; M1 ^ Casuarina pauper, Dodonaea lobulata, Senna artemisioides subsp. filifolia, Scaevola spinescens, Acacia tetragonophylla\Casuarina\^shrub\3\i; M2^ Casuarina pauper, Dodonaea lobulata, Ptilotus obovatus, Scaevola spinescens, Senna artemisioides subsp. x artemisioides\Casuarina\^shrub\2\i*		

Height (m)	Crown cover %	Habit	Species	No.
9 – 11	40 – 50	Mallee, tree	*Eucalyptus corrugata (6), Casuarina pauper (1)*	7
2 – 3	1 – 2	Tree	*Casuarina pauper (2)*	2
1 – 2	10 – 15	Shrub	*Casuarina pauper (22), Dodonaea lobulata (14), Senna artemisioides subsp. filifolia (7), Scaevola spinescens (4), Acacia tetragonophylla (3), A. burkittii (2), Eremophila latrobei subsp. latrobei (1)*	53
0.5 – 1	8 – 10	Shrub	*Casuarina pauper (54), Dodonaea lobulata (12), Scaevola spinescens (8), Senna artemisioides subsp. x artemisioides (3), S. artemisioides subsp. filifolia (2), Acacia burkittii (1), A. tetragonophylla (1)*	81
< 0.5	3 – 4	Shrub	*Casuarina pauper (23), Ptilotus obovatus (17), Senna artemisioides subsp. filifolia (7), Scaevola spinescens (6), Acacia tetragonophylla (2), Maireana tomentosa (1), Dodonaea lobulata (1)*	57
< 0.5	< 1	Vine	*Vincetoxicum lineare (3)*	3
< 0.6	< 1	Grass	*Austrostipa elegantissima (1)*	
				203

Stem density: 203/ 400m^2

Other species:

Vegetation (NVIS VI): *Eucalyptus corrugata, Casuarina pauper* open mallee forest over *Casuarina pauper, Dodonaea lobulata, Senna* artemisioides subsp. *filifolia, Scaevola spinescens, Acacia tetragonophylla open shrubland over Casuarina pauper, Dodonaea lobulata, Ptilotus obovatus, Scaevola spinescens, Senna artemisioides subsp. x artemisioides* low open shrubland

Species list (quadrat)	
Acacia burkittii	*Maireana tomentosa*
Acacia tetragonophylla	*Ptilotus obovatus*
Austrostipa elegantissima	*Scaevola spinescens*
Casuarina pauper	*Senna artemisioides subsp. filifolia*
Dodonaea lobulata	*Senna artemisioides subsp. x artemisioides*
Eremophila latrobei subsp. latrobei	*Vincetoxicum lineare*
Eucalyptus corrugata	

Riverina Relevé R1

Date: 12/01/21 VT 4E

GPS: 263268 E/ 6706691 N	Location: West of Riverina Mining operation; between Q1 – Q2	Landform: Low hill; upper slope; drainage line; aspect East
Land surface: Red clay loam; surface rock (calcrete, dolerite) 50 – 60 %; litter 40 – 50 (60) %; fallen timber 5 – 10 %		
Condition: Excellent		
Disturbance: Minor historic mining; low pastoral/ feral grazing		
NVIS VI: U1+^ *Casuarina pauper, Eucalyptus oleosa subsp. oleosa\Casuarina\^tree\6\i; Acacia assimilis* subsp. *assimilis, Casuarina pauper, Alectryon oleifolius subsp. oleifolius\Acacia\^shrub, tree\4\i; Dodonaea lobulata, Acacia assimilis* subsp. *assimilis, Acacia quadrimarginea, Eremophila longifolia, Acacia tetragonophylla, Senna cardiosperma\Dodonaea\^shrub\3\c; G1^ Casuarina pauper, Eucalyptus oleosa subsp. oleosa\Casuarina\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
< 10	20 – 30	T	*Casuarina pauper, Eucalyptus oleosa subsp. oleosa*
2 – 4	10 – 30	S, T	*Acacia assimilis* subsp. *assimilis, Casuarina pauper, Alectryon oleifolius subsp. canescens*
1 – 2	30 – 40	S	*Dodonaea lobulata, Acacia assimilis* subsp. *assimilis, Acacia quadrimarginea, Eremophila longifolia, Acacia tetragonophylla, Senna cardiosperma*
< 0.5	2 – 10	S	*Casuarina pauper, Ptilotus obovatus, Dodonaea lobulata*

Vegetation: *Casuarina pauper, Eucalyptus oleosa subsp. oleosa low woodland over Acacia assimilis* subsp. *assimilis, Casuarina pauper, Alectryon oleifolius subsp. canescens tall open shrubland over Dodonaea lobulata, Acacia assimilis* subsp. *assimilis, Acacia quadrimarginea, Eremophila longifolia, Acacia tetragonophylla, Senna cardiosperma shrubland over Casuarina pauper, Ptilotus obovatus, Dodonaea lobulata low sparse shrubland*

Species list
Acacia quadrimarginea
Acacia tetragonophylla
Alyxia buxifolia
Casuarina pauper
Eremophila longifolia
Eucalyptus oleosa subsp. oleosa
Acacia assimilis subsp. *assimilis*
Alectryon oleifolius subsp. canescens
Dodonaea lobulata
Senna cardiosperma
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. *filifolia*

Riverina Relevé R2

Date: 12/01/2021 VT4C

GPS: 263330 E/ 6706911 N	Location: West of Mining operation; upslope from Q2	Landform: Low greenstone hill; ridge
Land surface: surface rock (quartz, quartzite, schist, calcrete) 30 – 40 %; litter 50 – 60 %; fallen timber 5 – 10 %; Other: quartz patch 263363/ 6706909		
Condition: Excellent		
Disturbance: Low		

Height (m)	Crown cover %	Habit	Species
> 10	10 – 20	Tree	*Casuarina pauper*
2 – 6	5 – 10	Tree, shrub	*Casuarina pauper, Dodonaea lobulata, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia tall sparse shrubland*
0.7 – 2	10 – 20	Shrub	*Senna artemisioides subsp. filifolia, Casuarina pauper, Acacia tetragonophylla, Scaevola spinescens open shrubland*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus, Dodonaea lobulata, Senna artemisioides subsp. filifolia low sparse shrubland*

Vegetation: *Casuarina pauper woodland over Casuarina pauper, Dodonaea lobulata, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia tall sparse shrubland over Senna artemisioides subsp. filifolia, Casuarina pauper, Acacia tetragonophylla, Scaevola spinescens open shrubland over Ptilotus obovatus, Dodonaea lobulata, Senna artemisioides subsp. filifolia low sparse shrubland*

	
Relevé 2	Ultramafic rocks

Species list	
Acacia quadrimarginea	*Pittosporum angustifolium*
Acacia tetragonophylla	*Ptilotus obovatus*
Casuarina pauper	*Scaevola spinescens*
Dodonaea lobulata	*Senna artemisioides subsp. filifolia*
Eremophila oldfieldii subsp. angustifolia	

Riverina Relevé 3

Date: 12th January 2021 VT 4B

GPS: 263444 E/ 6707000 N	Location: West of mining operation	Landform: Low greenstone hill; upper slope; aspect SW
Land surface: Red clay loam; surface rock (dolerite, chert, quartz) 50 – 70 %; litter 50 – 60 %; fallen timber 2 – 5 %		
Condition: Excellent		
Disturbance: Low pastoral impacts		
NVIS V: U1^ *Allocasuarina acutivalvis subsp. acutivalvis, Casuarina pauper, Brachychiton gregorii\Allocasuarina\^tree\6\r; M1+^Acacia quadrimarginea\Acacia\^shrub\4\c; M2^ Acacia quadrimarginea, A. ramulosa var. ramulosa, Senna cardiosperma\Acacia\^shrub\3\i; G1^ Ptilotus obovatus, Senna cardiosperma, Solanum lasiophyllum\Ptilotus\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
6 – 12	8 – 10	Tree	*Allocasuarina acutivalvis subsp. acutivalvis, Casuarina pauper, Brachychiton gregorii*
3 – 5	30 – 50	Shrub	*Acacia quadrimarginea*
1 – 2	20 – 30	Shrub	*Acacia quadrimarginea, A. ramulosa var. ramulosa, Senna cardiosperma*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus, Senna cardiosperma, Solanum lasiophyllum*

Vegetation: *Allocasuarina acutivalvis subsp. acutivalvis, Casuarina pauper, Brachychiton gregorii* low open woodland over *Acacia quadrimarginea* tall shrubland over *Acacia quadrimarginea, A. ramulosa* var. *ramulosa, Senna cardiosperma* open shrubland over *Ptilotus obovatus, Senna cardiosperma, Solanum lasiophyllum* low sparse shrubland

Acacia quadrimarginea
Acacia ramulosa var. ramulosa
Allocasuarina acutivalvis subsp. acutivalvis
Brachychiton gregorii
Casuarina pauper
Olearia muelleri
Ptilotus obovatus
Santalum spicatum
Senna cardiosperma
Solanum lasiophyllum

3A: Drainage line; valley 263513 E/ 6706945 N (VT 4B)

Brachychiton gregorii, Allocasuarina acutivalvis subsp. *acutivalvis* isolated trees over *Acacia ramulosa* var. *ramulosa, A. assimilis* subsp. *assimilis, Philotheca brucei* subsp. *brucei, Acacia quadrimarginea, Senna cardiosperma* open shrubland over *Senna cardiosperma, Ptilotus obovatus, Allocasuarina acutivalvis* low sparse shrubland

Riverina Relevé 4

Date: 12/01/21 VT 4B

GPS: 263673 E/ 6706862 N	Location: West of mining operation	Landform: Greenstone hills; midslope
Land surface: surface rock (dolerite) > 80 %		
Condition: Excellent		
Disturbance:		
Mallee fowl mound (extinct) 263582 E/ 6076707		

Height (m)	Crown cover %	Habit	Species
6 – 10	10 – 20	Tree	*Allocasuarina acutivalvis low woodland*
2 – 3	20 – 30	Shrub	*Acacia assimilis subsp. assimilis, A. quadrimarginea, A. ramulosa var. ramulosa, Pittosporum angustifolium tall open shrubland*
0.5 – 1	10 – 20	Shrub	*Senna artemisioides subsp. filifolia, Scaevola spinescens, Olearia muelleri open shrubland*

Other species: *Santalum spicatum* (creekline) 263538 E/ 6075555 *N*

Species list	
Acacia assimilis subsp. assimilis *A. quadrimarginea* *A. ramulosa var. ramulosa* *Allocasuarina acutivalvis* *Olearia muelleri* *Pittosporum angustifolium* *Santalum spicatum* *Scaevola spinescens* *Senna artemisioides subsp. filifolia* Mallee fowl mound (right)	

4A: 263563 E/ 6706916 N

Allocasuarina acutivalvis isolated low trees (8 – 9 m) over *Acacia ramulosa* var. *ramulosa, A. quadrimarginea* tall shrubland over *Prostanthera althoferi* subsp. *althoferi* open shrubland

Riverina Relevé R5

Date: 12/01/21 VT 4B

GPS: 263652 E/ 6707238 N	Location: West of mining area	Landform: Greenstone hills; upper mid slope, aspect east
Land surface: Red clay loam to clay; surface rock (dolerite); dolerite outcropping > 70 %; litter – patches dense under Acacia ramulosa, 20 – 25 %; fallen timber 10 – 15 %		
Condition: Very good to excellent		
Disturbance: Historic mining clearing – drill lines; partly regrown; in area		
NVIS V: U1^ *Casuarina pauper\Casuarina\^tree\6\r; M1 +^Acacia quadrimarginea, A. ramulosa var. ramulosa, A. tetragonophylla\Acacia\^shrub\4\i; Eremophila latrobei subsp. latrobei, Dodonaea viscosa subsp. angustissima, Prostanthera althoferi subsp. althoferi\Eremophila\^shrub*		

Height (m)	Crown cover %	Habit	Species
< 10	2 – 10	tree	*Casuarina pauper low open woodland to isolated trees*
2 – 5	20 – 30	Shrub	*Acacia quadrimarginea, A. ramulosa var. ramulosa, A. tetragonophylla tall open shrubland*
<1	5 – 10 (20)	Shrub	*Eremophila latrobei subsp. latrobei, Dodonaea viscosa subsp. angustissima, Prostanthera althoferi subsp. althoferi low sparse shrubland*

Other species: *Philotheca brucei* subsp. *brucei, Brachychiton gregorii, Senna cardiosperma, Mirbelia depressa*

263609 E/ 6707261 N: Dolerite outcrop, scree slope; Low shrubland patch (A) in taller shrubland (B)

(A) *Mirbelia depressa*, *Ptilotus obovatus, Eremophila latrobei* subsp. *latrobei, Prostanthera althoferi* subsp. *althoferi*

(B) *Casuarina pauper* isolated trees over *Acacia quadrimarginea, A. ramulosa* var. *ramulosa, A. caesaneura* tall shrubland over *Eremophila latrobei subsp. latrobei, Dodonaea rigida, Prostanthera althoferi subsp. althoferi, Acacia caesaneura low shrubland over Lepidosperma sp. low open forbland*

Species list R5	
Acacia caesaneura	*Eremophila latrobei subsp. latrobei*
Acacia quadrimarginea	*Lepidosperma sp*
A. ramulosa var. ramulosa	*Mirbelia* sp.
A. tetragonophylla	*Senna cardiosperma*
Brachychiton gregorii	*Philotheca brucei* subsp. *brucei*
Casuarina pauper	*Prostanthera althoferi subsp. althoferi*
Dodonaea rigida	*Ptilotus obovatus*

Riverina Relevé R6

Date: 12/01/21 VT 7

GPS: 263497 E/ 6707242 N	Location: West of mining area	Landform: Greenstone hills; summit
Land surface: Red clay loam; surface rock (dolerite, ultramafics, calcrete) > 70 %; litter 50 – 60 %; fallen timber 5 – 10 %		
Condition: Excellent; possibly some historic mining impact – old clearing – overgrown		
Disturbance: Low; historic mining impacts downslope; current impacts from pastoral/ feral grazers		
NVIS VI: U1+^ *Acacia caesaneura, Brachychiton gregorii, Acacia quadrimarginea\Acacia\^shrub, tree\4\c; M1^ Eremophila latrobei subsp. latrobei\ Eremophila\^shrub\3\r; M2 ^ Senna cardiosperma, Ptilotus obovatus, Acacia caesaneura, Solanum lasiophyllum\Senna\^shrub\2\r; G1^ Cheilanthes lasiophylla\Cheilanthes\^fern\1\i*		

Height (m)	Crown cover %	Habit	Species
4 – 5	30 – 40	Shrub, tree	*Acacia caesaneura, Brachychiton gregorii, Acacia quadrimarginea tall shrubland*
1 – 2	2 – 10	Shrub	*Eremophila latrobei subsp. latrobei sparse shrubland*
0.2 – 0.7	2 – 10	Shrub	*Senna cardiosperma, Ptilotus obovatus, Acacia caesaneura, Solanum lasiophyllum low sparse shrubland*
< 0.2	10 – 15	Fern	*Cheilanthes lasiophylla low open fernland*
	< 1	Aerial	*Amyema benthamii mistletoe in Brachychiton gregorii*

Other species: *Casuarina pauper* (downslope); metamorphosed rocks; ultramafics, ?quartzite

Vegetation: *Acacia caesaneura, Brachychiton gregorii, Acacia quadrimarginea tall shrubland over Eremophila latrobei subsp. latrobei sparse shrubland over Senna cardiosperma, Ptilotus obovatus, Acacia caesaneura, Solanum lasiophyllum low sparse shrubland over Cheilanthes lasiophylla low open fernland*

R6	R7
Acacia caesaneura *Acacia quadrimarginea* *Amyema benthamii* *Brachychiton gregorii* *Cheilanthes lasiophylla* *Eremophila latrobei subsp. latrobei* *Ptilotus obovatus* *Senna cardiosperma* *Solanum lasiophyllum*	*Acacia caesaneura* *A. quadrimarginea* *A. ramulosa var. ramulosa* *Brachychiton gregorii* *Casuarina pauper* *Dodonaea lobulata* *Dodonaea rigida* *Eremophila latrobei* subsp. *latrobei* *Ptilotus obovatus* *Solanum lasiophyllum*

R7: 263507 E/ 6707415 N

Upper midslope 4B

Casuarina pauper open woodland to isolated trees over *Acacia caesaneura, A. quadrimarginea, A. ramulosa var. ramulosa, Eremophila latrobei* subsp. *latrobei, Brachychiton gregorii* tall open shrubland over *Dodonaea lobulata, Casuarina pauper, Dodonaea rigida, Eremophila latrobei* subsp. *latrobei* open shrubland over *Ptilotus obovatus, Solanum lasiophyllum* low isolated shrubs

	
View to north west (263463 E/ 6707357 N)	R7; isolated C. pauper low trees over tall open shrubland

Riverina Relevé R8

Date: 12/01/21 VT 8

GPS: 263739 E/ 6707881 N	Location: North west of mining area	Landform: Valley between greenstone hills
Land surface: Yellowish red clay loam; surface rock (dolerite, quartz) 40 – 50 %; litter 30 – 40 %; fallen timber 20 – 30 %		
Condition: Very good; some drought impacts		
Disturbance: Moderate level of historic pastoral and mining impacts – old tracks, clearing – overgrown; current impact from donkeys, cattle		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\6\bi; M1+^ Acacia burkittii, Allocasuarina eriochlamys subsp. eriochlamys, Pittosporum angustifolium\Acacia\^shrub\4\c; Allocasuarina eriochlamys subsp. eriochlamys, Acacia burkittii, Eremophila decipiens subsp. decipiens, Senna artemisioides subsp. filifolia, Dodonaea lobulata\Allocasuarina\^shrub\3\i; Ptilotus obovatus, Acacia tetragonophylla\Ptilotus\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
5 – 8	< 2	Tree	*Casuarina pauper*
2 – 4	30 – 40	Shrub	*Acacia burkittii, Allocasuarina eriochlamys subsp. eriochlamys, Pittosporum angustifolium tall shrubland*
1 – 2	10 – 20	Shrub	*Allocasuarina eriochlamys subsp. eriochlamys, Acacia burkittii, Eremophila decipiens subsp. decipiens, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia tetragonophylla open shrubland*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus, Acacia tetragonophylla low sparse shrubland*

Vegetation: *Casuarina pauper low isolated trees over Acacia burkittii, Allocasuarina eriochlamys subsp. eriochlamys, Pittosporum angustifolium tall shrubland over Allocasuarina eriochlamys subsp. eriochlamys, Acacia burkittii, Eremophila decipiens subsp. decipiens, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia tetragonophylla open shrubland Ptilotus obovatus, Acacia tetragonophylla low sparse shrubland*

Species list
Acacia burkittii *Acacia tetragonophylla* *Allocasuarina eriochlamys subsp. eriochlamys* *Casuarina pauper* *Dodonaea lobulata* *Eremophila decipiens subsp. decipiens* *Pittosporum angustifolium* *Senna artemisioides subsp. filifolia* *Ptilotus obovatus*

Riverina Relevé R9

Date: 13/01/21 VT 3A

GPS: 264024 E/ 6708124 N	Location: North of mining area	Landform: Broad regional drainage line; valley
Land surface: Yellowish red gritty clay loam; surface rock (dolerite, quartz, calcrete rounded washed pebbles) 20 – 30 %; litter 50- 60 % ^ 20cm; fallen timber 15 – 20 %		
Condition: Very good		
Disturbance: Cattle		
NVIS V1: U1+^ *Eucalyptus oleosa subsp. oleosa\Eucalyptus\^mallee\7\c; M1^ Acacia burkittii, A. assimilis subsp. assimilis, Senna artemisioides subsp. filifolia, Eucalyptus oleosa subsp. oleosa\Acacia\ ^shrub, mallee\4\i; M2^ Senna artemisioides subsp. filifolia, Dodonaea lobulata\Senna\^shrub\3\i; Ptilotus obovatus, Senna artemisioides subsp. filifolia, Sclerolaena diacantha\Ptilotus\^shrub, forb\1\i*		

Height (m)	Crown cover %	Habit	Species
12 – 15	40 – 50	Mallee	*Eucalyptus oleosa subsp. oleosa tall open mallee forest*
2 – 5	20 – 30	Shrub	*Acacia burkittii, A. assimilis subsp. assimilis, Senna artemisioides subsp. filifolia, Eucalyptus oleosa subsp. oleosa tall open shrubland*
1 – 2	20 – 30	Shrub	*Senna artemisioides subsp. filifolia, Dodonaea lobulata open shrubland*
< 0.7	10 – 20	Shrub	*Ptilotus obovatus, Senna artemisioides subsp. filifolia, Sclerolaena diacantha low open shrubland*

Other species: *Eremophila decipiens* subsp. *decipiens, Acacia tetragonophylla, Alectryon oleifolius* subsp*. oleifolius*

Vegetation: *Eucalyptus oleosa* subsp*. oleosa* tall open mallee forest over *Acacia burkittii, A. assimilis subsp. assimilis, Senna artemisioides* subsp*. filifolia, Eucalyptus oleosa subsp. oleosa* tall open shrubland over *Senna artemisioides* subsp. *filifolia, Dodonaea lobulata* open shrubland over *Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Sclerolaena diacantha* low open shrubland

Species list
Acacia assimilis subsp. assimilis
Acacia burkittii
Acacia tetragonophylla
Alectryon oleifolius subsp. *oleifolius*
Dodonaea lobulata
Eremophila decipiens subsp. *decipiens*
Eucalyptus oleosa subsp. oleosa
Ptilotus obovatus
Sclerolaena diacantha
Senna artemisioides subsp. filifolia

Riverina Relevé R10

Date: 13/01/21 (Jeremy Riv13-1) VT 3A

GPS: 264003 E/ 6708154 N	Location: North of mining area	Landform: Creek channel; incised
Land surface: Rocky		
Condition: Very good to excellent; water holes (dry); Euro sighted		
Disturbance: Cattle; signs of old floods – large debris dams along edges and in vegetation; grasses absent		
NVIS VI: U1+^ *Eucalyptus griffithsii, E. oleosa subsp. oleosa\Eucalyptus\^tree, mallee\7\c; M1 ^ Acacia burkittii, Myoporum sp., Brachychiton gregorii, Santalum spicatum\Acacia\^shrub, tree\4\i; M2 Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia burkittii, Eremophila interstans subsp. interstans, E. decipiens subsp. decipiens\Senna\^shrub\3\i\; G1 ^ Maireana georgei, Solanum lasiophyllum, Senna artemisioides subsp. filifolia\Maireana\^shrub\2\i*		

Height (m)	Crown cover %	Habit	Species
10 – 15	40 – 50	Tree, mallee	*Eucalyptus griffithsii, E. oleosa subsp. oleosa woodland*
2 – 4	10 – 20	Shrub, tree	*Acacia burkittii, Myoporum sp. (tentative), Brachychiton gregorii, Santalum spicatum tall open shrubland*
1 – 2	20 – 30	Shrub	*Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia burkittii, Eremophila interstans subsp. interstans, E. decipiens subsp. decipiens open shrubland*
< 1	10 – 20	Shrub	*Maireana georgei, Solanum lasiophyllum, Senna artemisioides subsp. filifolia low open shrubland*
Aerial	< 1	Mistletoe	*Amyema fitzgeraldii on Acacia burkittii*

Vegetation: *Eucalyptus griffithsii, E. oleosa* subsp*. oleosa* woodland over *Acacia burkittii, Myoporum sp., Brachychiton gregorii, Santalum spicatum* tall open shrubland over *Senna artemisioides* subsp. *filifolia, Dodonaea lobulata, Acacia burkittii, Eremophila interstans* subsp. *interstans, E. decipiens subsp. decipiens* open shrubland over *Maireana georgei, Solanum lasiophyllum, Senna artemisioides subsp. filifolia* low open shrubland

Species list
Acacia burkittii
Amyema fitzgeraldii
Brachychiton gregorii
Dodonaea lobulata
E. decipiens subsp. decipiens
Eremophila interstans subsp. interstans
E. oleosa subsp. oleosa
Eucalyptus griffithsii
Maireana georgei
Myoporum montanum
Santalum spicatum
Senna artemisioides subsp. filifolia
Solanum lasiophyllum

Riverina Relevé R11

Date: 13/01/21 VT 6B (area too small to map)

GPS: 263529 E/ 6708343 N	Location: North of mining area; near Q6	Landform: Greenstone hills; summit – broad ridge; aspect NW
Land surface: Reddish brown clay loam; surface rock (greenstone/ dolerite) 20 – 30 %; litter 40 – 50 %; fallen timber 1 – 2 %		
Condition: Very good; some drought impacts		
Disturbance: Grazing impacts – cattle (cow pats in area), donkeys		
NVIS VI: U1+^*Eucalyptus corrugata, Casuarina pauper**Eucalyptus*\^*tree**6**i; M1^Senna artemisioides subsp. filifolia, Casuarina pauper, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia**Senna*\^*shrub**3**i; G1^ Ptilotus obovatus, Senna artemisioides subsp. filifolia, Casuarina pauper, Dodonaea lobulata**Ptilotus*\^*shrub**2**r*		

Height (m)	Crown cover %	Habit	Species
6 – 8	10 – 20	Tree	*Eucalyptus corrugata, Casuarina pauper open woodland*
1 – 2	10 – 20	Shrub	*Senna artemisioides subsp. filifolia, Casuarina pauper, Acacia quadrimarginea, Eremophila oldfieldii subsp. angustifolia open shrubland*
< 0.7	2 – 10	Shrub	*Ptilotus obovatus, Senna artemisioides subsp. filifolia, Casuarina pauper (grazed), Dodonaea lobulata low sparse shrubland*

Vegetation: *Eucalyptus corrugata, Casuarina pauper* open woodland over *Senna artemisioides* subsp. *filifolia, Casuarina pauper, Acacia quadrimarginea, Eremophila oldfieldii* subsp. *angustifolia* open shrubland over *Ptilotus obovatus, Senna artemisioides subsp. filifolia, Casuarina pauper, Dodonaea lobulata* low sparse shrubland

Species list
Acacia quadrimarginea *Casuarina pauper* *Dodonaea lobulata* *Eucalyptus corrugata* *Eremophila oldfieldii subsp. angustifolia* *Ptilotus obovatus* *Senna artemisioides subsp. filifolia* *es subsp. filifolia*

Riverina Relevé R12

Date: 13/01/21 VT 4B

GPS: 0263496 E/ 6708369 N	Location: North of mining area; west of R11 and Q6	Landform: Greenstone hills; upper slope; western aspect; (eastern side of valley)
Land surface: Reddish brown clay loam; surface rock (greenstone/ dolerite, quartz) 20 – 40 %; litter 20 – 30 %; fallen timber 2 – 3 %		
Condition: Excellent; some drought impacts, senescing shrubs – particularly Olearia.		
Disturbance: Likely to be some grazing impact from cattle although no recent signs observed at this site		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\6\r; M1+^ Acacia quadrimarginea, Eremophila latrobei subsp. latrobei, Acacia burkittii, Brachychiton gregorii\ Acacia\^shrub, tree\4\i; M2^ Philotheca brucei subsp. brucei, Eremophila latrobei subsp. latrobei, Casuarina pauper\ Philotheca\^shrub\3\i; G1^ Olearia humilis, Ptilotus obovatus, Acacia burkittii\Olearia\^shrub\1\bi*		

12A

Height (m)	Crown cover %	Habit	Species
4 – 6	2 – 10	Tree	*Casuarina pauper low open woodland to isolated trees*
2 – 4	10 – 20	Shrub, tree	*Acacia quadrimarginea, Eremophila latrobei subsp. latrobei, Acacia burkittii, Brachychiton gregorii tall open shrubland*
0.7 – 1.5	10 – 20	Shrub	*Philotheca brucei subsp. brucei, Eremophila latrobei subsp. latrobei, Casuarina pauper open shrubland*
< 0.4	1 – 2	Shrub	*Olearia humilis, Ptilotus obovatus, Acacia burkittii low sparse shrubland*

12A

12B

12A: *Casuarina pauper* low open woodland to isolated trees over *Acacia quadrimarginea, Eremophila latrobei* subsp. *latrobei, Acacia burkittii, Brachychiton gregorii* tall open shrubland over *Philotheca brucei* subsp. *brucei, Eremophila latrobei* subsp. *latrobei, Casuarina pauper* open

shrubland over *Olearia humilis, Ptilotus obovatus, Acacia burkittii* low sparse shrubland to isolated low shrubs

Other species: *Senna artemisioides* subsp. *filifolia, Acacia tetragonophylla, Senna cardiosperma*

12B (263420 E/ 6708390 N): Aspect west; quartz and dolerite **VT 4B grading to 4A**

Casuarina pauper low open woodland over *Acacia quadrimarginea, Eremophila latrobei* subsp. *latrobei* open shrubland over *Senna cardiosperma, Acacia tetragonophylla, Olearia humilis, Eremophila latrobei* subsp. *latrobei, Ptilotus obovatus* low open shrubland

Riverina Relevé R13

Date: 13/01/21 13A VT 9B; 13B VT 9A

GPS: 263337 E/ 6708388 N 10.24 am	**Location: north of mining area, north of creek; east of Q7**	**Landform: Greenstone hills; valley, midslope; broad creek banks; aspect south**
Land surface: reddish brown fine sandy clay loam; surface rock (greenstone, dolerite, calcrete) 5 – 20 %; litter 20 – 30 (mostly under Acacia shrubs); fallen timber 1 – 2 %; cryptogams (lichen) 10 – 20 %; surface dry, moist at depth		
Condition: Good		
Disturbance: Grazing, soil disturbance – cattle – recent signs in area; lack of understorey; erosion active – sheet, rills		
NVIS V: U1^ *Casuarina pauper\Casuarina\^tree\6\bi; M1+^ Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla\Acacia\^shrub\4\c*		

13A Creek banks – broad gently sloping, east of drainage line

Height (m)	**Crown cover %**	**Habit**	**Species**
4 – 6	< 2	Tree	*Casuarina pauper isolated low trees*
2 – 4	30 – 40	Shrub	*Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall shrubland*

Vegetation: *Casuarina pauper isolated low trees over Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall shrubland*

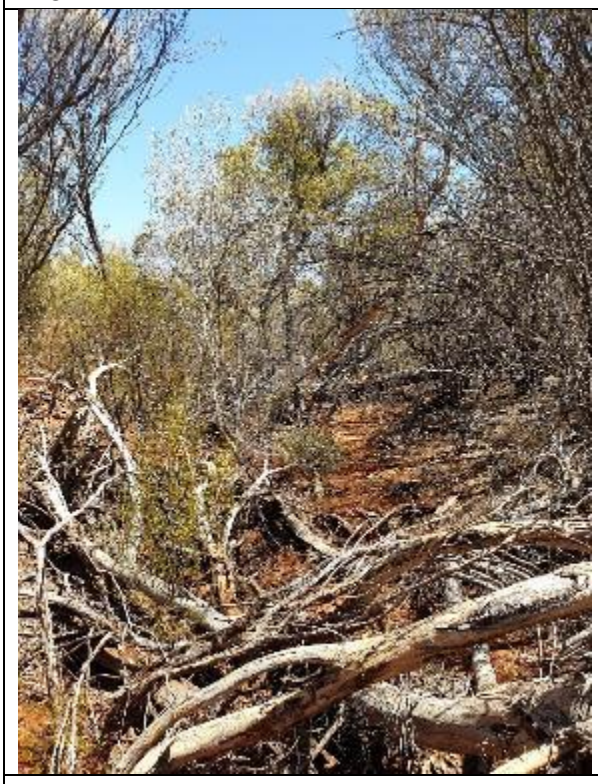
13B Drainage line (VT 9A); incised; reddish brown clay loam; surface rock < 2 %; litter 40 – 50%; fallen timber 30 – 40 %

Condition: very good; some active erosion; fewer pastoral impacts; high amount of fallen timber creating debris dams

Height (m)	**Crown cover %**	**Habit**	**Species**
3 – 6	30 – 40	Mallee, tree, shrub	*Eucalyptus leptopoda subsp. subluta, Brachychiton gregorii, Acacia burkittii low mallee woodland/ tall shrubland*
1 – 2	20 – 30	shrub	*Senna cardiosperma, Dodonaea rigida, D. lobulata, Eucalyptus leptopoda subsp. subluta open shrubland*
< 1	2 – 10	Shrub	*Dodonaea rigida, D. lobulata, Ptilotus obovatus, Senna cardiosperma low sparse shrubland*

R13A

R14B



13B

14B

Species list 13A	**Species list 13B**
Acacia burkittii	*Acacia burkittii*
Acacia ramulosa var. ramulosa	*Brachychiton gregorii*
Acacia tetragonophylla	*Dodonaea lobulata*
Casuarina pauper	*Dodonaea rigida*
	Eucalyptus leptopoda subsp. *subluta*
	Ptilotus obovatus
	Senna cardiosperma

Riverina Relevé R14

Date: 13/01/21 **14A** VT 9A

GPS: 263347 E/ 6708269 N	**Location: North west of PDA; north of North creek; east of Q7**	**Landform: Valley – gently sloping lower outwash slope, west of tributary creekline**
Land surface: Red clay loam; surface rock (quartz, dolerite, fine gravel) < 2 %; litter 5 – 10 % (under shrubs); fallen timber 10 – 15 %; cryptogams (lichen) < 10%; surface dry, moist at depth		
Condition: Good; lacking groundcover; very low recruitment		
Disturbance: Historic and current pastoral/ feral grazing – very recent signs of cattle in area; active erosion – sheet wash, rills and gullying; historic mining/ recreation – rubbish, old camp sites		
NVIS V: U1+^ *Eucalyptus leptopoda subsp. subluta, E. oleosa subsp. oleosa, Acacia burkittii, Casuarina pauper\Eucalyptus\^mallee, tree\6\r; M1^ Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall open\Acacia\^shrub\4\i; M2^ Acacia assimilis subsp. assimilis, A. burkittii, A. ramulosa var. ramulosa\Acacia\3\r; Ptilotus obovatus\Ptilotus\^shrub\1\bi*		

Height (m)	**Crown cover %**	**Habit**	**Species**
5 – 8	8 – 10	Mallee, tree, shrub	*Eucalyptus leptopoda subsp. subluta, E. oleosa subsp. oleosa, Acacia burkittii, Casuarina pauper open mallee woodland*
3 – 5	10 – 20	Shrub	*Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall open shrubland*
1 – 2	2 – 10	Shrub	*Acacia assimilis subsp. assimilis, A. burkittii, A. ramulosa var. ramulosa sparse shrubland*
< 0.5	< 2	Shrub	*Ptilotus obovatus low isolated shrubs*

Vegetation: *Eucalyptus leptopoda subsp. subluta, E. oleosa subsp. oleosa, Acacia burkittii, Casuarina pauper open mallee woodland over Acacia burkittii, A. ramulosa var. ramulosa, A. tetragonophylla tall open shrubland over Acacia assimilis subsp. assimilis, A. burkittii, A. ramulosa var. ramulosa sparse shrubland over Ptilotus obovatus low isolated shrubs*

14B: 263366 E/ 6708207 N: patches of *Acacia ramulosa* var. *ramulosa* tall shrubland

Species list	
Acacia assimilis subsp. assimilis *Acacia burkittii* *A. ramulosa var. ramulosa* *A. tetragonophylla* *Casuarina pauper*	*Eucalyptus leptopoda subsp. subluta* *Eucalyptus oleosa subsp. oleosa* *Ptilotus obovatus*

Riverina Relevé R15

Date: 13/01/21 VT 4A

GPS: 263422 E/ 6708114 N	Location: North of PDA; SE of Q7	Landform: Greenstone hill; lower slope; scree; southerly aspect
Land surface: Reddish brown clay loam; surface rock (dolerite) 25 – 40 %; litter 50 – 60 %; fallen timber < 10 %		
Condition: Very good		
Disturbance: Pastoral/ feral impacts – grazing obvious on *Casuarina*; cow pats and tracks in area		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\7\bi; U2+^ Casuarina pauper\Casuarina\^tree\6\i; M1^ Acacia burkittii, A. quadrimarginea, A. tetragonophylla, Casuarina pauper\Acacia\^shrub\4\i; M2^ Senna artemisioides subsp. filifolia, Acacia tetragonophylla, Casuarina pauper\Senna\^shrub \3\r; G1^ Casuarina pauper, Ptilotus obovatus, Solanum lasiophyllum\Casuarina\^shrub\1\i*		

Height (m)	Crown cover %	Habit	Species
15 – 16	< 2	Tree	*Casuarina pauper emergent trees*
8 – 10	10 – 20	Tree	*Casuarina pauper low woodland*
2 – 5	20 – 30	Shrub	*Acacia burkittii, A. quadrimarginea, A. tetragonophylla, Casuarina pauper tall open shrubland*
1 – 2	8 – 10	Shrub	*Senna artemisioides subsp. filifolia, Acacia tetragonophylla, Casuarina pauper sparse shrubland*
< 0.7	10 – 20	Shrub	*Casuarina pauper, Ptilotus obovatus, Solanum lasiophyllum low open shrubland*

Vegetation: *Casuarina pauper* emergent trees over *Casuarina pauper* low woodland over *Acacia burkittii, A. quadrimarginea, A. tetragonophylla, Casuarina pauper* tall open shrubland over *Senna artemisioides* subsp. *filifolia, Acacia tetragonophylla, Casuarina pauper* sparse shrubland over *Casuarina pauper, Ptilotus obovatus, Solanum lasiophyllum* low open shrubland

Species list
Acacia burkittii *Acacia quadrimarginea* *Acacia tetragonophylla* *Casuarina pauper* *Ptilotus obovatus* *Solanum lasiophyllum* *Senna artemisioides* subsp. *filifolia*

Riverina Relevé R16

Date: 13/01/21 VT 1B

GPS: 263415 E/ 6708080 N	Location: North of mining area; north bank of main drainage line	Landform: Valley; alluvial plain; lower catchment
Land surface: Yellowish red clay loam; surface rock < 2%; litter 40 – 60 %; fallen timber 2 – 3 %		
Condition: Very good; some areas of regrowth present		
Disturbance: Pastoral – cattle, donkeys		
NVIS V: U1+^ *Eucalyptus oleosa subsp. oleosa\Eucalyptus\^mallee\6\i; M1^ Acacia burkittii, A. caesaneura\Acacia\^shrub, tree\4\i; M2^ Acacia burkittii, Senna artemisioides subsp. filifolia, Eremophila decipiens subsp. decipiens, Hybanthus floribundus subsp. curvifolius\Acacia\^shrub\3\r*		

Height (m)	Crown cover %	Habit	Species
6 – 10	20 – 30	Mallee	*Eucalyptus oleosa subsp. oleosa mallee woodland*
3 – 6	10 – 20	Shrub, tree	*Acacia burkittii, A. caesaneura tall open shrubland*
0.7 – 1.5	2 – 10	Shrub	*Acacia burkittii, Senna artemisioides subsp. filifolia, Eremophila decipiens subsp. decipiens, Hybanthus floribundus subsp. curvifolius sparse shrubland*

Vegetation: *Eucalyptus oleosa* subsp. *oleosa* mallee woodland over *Acacia burkittii, A. caesaneura* tall open shrubland over *Acacia burkittii, Senna artemisioides* subsp. *filifolia, Eremophila decipiens* subsp*. decipiens, Hybanthus floribundus* subsp. *curvifolius* sparse shrubland

Species list
Acacia burkittii *Acacia caesaneura* *Eremophila decipiens* subsp. *decipiens* *Eucalyptus oleosa* subsp. *oleosa* *Hybanthus floribundus* subsp. *curvifolius* *Senna artemisioides* subsp. *filifolia*

Riverina Relevé R17

Date: 13/01/21 VT 4B grading to 4E downslope

GPS: 263675 E/ 6705535 N	Location: West of mining area; central west area of range	Landform: Greenstone hills; valley; midslope; aspect south
Land surface: Red clay loam; surface rock (dolerite, quartz, chert) 30 – 40 %; litter 40 – 50 % ^ 10 cm;		
Condition: Very good; moderate levels of crown death – dry conditions		
Disturbance: Historic mining and pastoral; unsealed road on south side; termite mounds		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\6\bi; M1+^ Acacia burkittii, Casuarina pauper, Brachychiton gregorii\Acacia\^shrub, tree\4\c; M2^ Acacia burkittii, Eremophila latrobei subsp. latrobei, Brachychiton gregorii, Acacia tetragonophylla\Acacia\^shrub\3\r; M3^ Eremophila latrobei subsp. latrobei, E. sp. Mt Jackson, Casuarina pauper\Eremophila\^shrub\2\r; G1^ Ptilotus obovatus\Ptilotus\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
8 – 12	< 2	Tree	*Casuarina pauper*
3 – 6	30 – 40	Shrub, tree	*Acacia burkittii, Casuarina pauper, Brachychiton gregorii*
1 – 2	2 – 10	Shrub	*Acacia burkittii, Eremophila latrobei subsp. latrobei, Brachychiton gregorii, Acacia tetragonophylla*
0.5 – 1	2 – 10	Shrub	*Eremophila latrobei subsp. latrobei, E. sp. Mt Jackson, Casuarina pauper*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus*

Vegetation: *Casuarina pauper low isolated trees over Acacia burkittii, Casuarina pauper, Brachychiton gregorii tall shrubland over Acacia burkittii, Eremophila latrobei subsp. latrobei, Brachychiton gregorii, Acacia tetragonophylla sparse shrubland over Ptilotus obovatus low sparse shrubland*

Species list
Acacia burkittii *Acacia quadrimarginea (upslope)* *Acacia tetragonophylla* *Brachychiton gregorii* *Casuarina pauper* *Eremophila latrobei subsp. latrobei* *Eremophila sp. Mt Jackson* *Ptilotus obovatus*

Riverina Relevé R18

Date: 13/01/21 VT 4A

GPS: 263527 E/ 6705595 N 12.54 pm	Location: West of mining area; central area, north of unsealed road to dam	Landform: Greenstone hills; upper slope; aspect south
Land surface: red clay loam; surface rock (BIF/ iron ore)		
Condition: Very good		
Disturbance: Cattle, historic mining – clearing, timber cutting, digging		

Height (m)	Crown cover %	Habit	Species
> 9	< 2	Tree	*Casuarina pauper isolated trees over*
4 – 8	15 – 20 (30)	Tree	*Casuarina pauper low woodland*
1 – 2	20 – 30	Shrub	*Senna artemisioides subsp. filifolia, Scaevola spinescens, Dodonaea lobulata, Eremophila oldfieldii subsp. angustifolia, Casuarina pauper mixed open shrubland*
< 0.5	30 – 40	Shrub	*Ptilotus obovatus*

18A Vegetation: *Casuarina pauper low woodland over Senna artemisioides subsp. filifolia, Scaevola spinescens, Dodonaea lobulata, Eremophila oldfieldii subsp. angustifolia, Casuarina pauper mixed open shrubland over Ptilotus obovatus low shrubland*

18B GPS: 263527 E/ 6705595 N; brown (pale whitish/pink) loam – lot of calcrete; likely high level of historic mining activity in area

Height (m)	Crown cover %	Habit	Species
4 – 5	30 – 35	Tree	*Casuarina pauper low woodland*
1 – 2	20 – 30	Shrub	*Casuarina pauper, Eremophila sp. Mt Jackson, Dodonaea lobulata, Senna artemisioides subsp. filifolia open shrubland*
< 0.7	10 – 30	Shrub	*Ptilotus obovatus, Eremophila oldfieldii subsp. angustifolia, Eremophila sp. Mt Jackson low open shrubland*

Species list
Brachychiton gregorii *Casuarina pauper* *Dodonaea lobulata* *Eremophila oldfieldii subsp. angustifolia* *Eremophila* sp. Mt Jackson *Ptilotus obovatus* *Scaevola spinescens,* *Senna artemisioides subsp. filifolia*

Riverina Relevé R19

Date: 13/01/21 VT 4 – minor patch of *Acacia* shrubland within VT4A

GPS: 263441 E/ 6705590 N	**Location: Central area of range; western side**	**Landform: Greenstone range; upper slope; crest of ridge; east/ west drainage**
Land surface: Red clay loam; rock outcrop (schist, metabasalt, BIF, quartz) > 80 %; dolerite scree lower slopes		
Condition: Very good/ excellent		
Disturbance: historic mining in area; old overgrown tracks; cattle heard		
NVIS VI: M1+^ *Acacia tetragonophylla, Dodonaea lobulata, Acacia assimilis subsp. assimilis, Senna artemisioides subsp. filifolia, Eremophila oldfieldii subsp. angustifolia\Acacia\^shrub\3\c; M2^ Scaevola spinescens, Eremophila oldfieldii subsp. angustifolia, Ptilotus obovatus, Dodonaea lobulata\ Scaevola\^shrub\1\r*		

Height (m)	**Crown cover %**	**Habit**	**Species**
1 – 1.7	30 – 40	Shrub	*Acacia tetragonophylla, Dodonaea lobulata, Acacia assimilis subsp. assimilis, Senna artemisioides subsp. filifolia, Eremophila oldfieldii subsp. angustifolia shrubland*
< 0.7	2 – 10	Shrub	*Scaevola spinescens, Eremophila oldfieldii subsp. angustifolia, Ptilotus obovatus, Dodonaea lobulata low sparse shrubland*

Vegetation: *Acacia tetragonophylla, Dodonaea lobulata, Acacia assimilis subsp. assimilis, Senna artemisioides subsp. filifolia, Eremophila oldfieldii subsp. angustifolia shrubland over Scaevola spinescens, Eremophila oldfieldii subsp. angustifolia, Ptilotus obovatus, Dodonaea lobulata low sparse shrubland*

Other species: *Casuarina pauper, Acacia quadrimarginea, Senna cardiosperma, Dodonaea lobulata* – creekline with *Santalum spicatum* 263389 E/ 6705573 N (2 in area)

Species list	
Acacia assimilis subsp. *assimilis* *Acacia tetragonophylla* *Dodonaea lobulata* *Eremophila oldfieldii* subsp. *angustifolia* *Ptilotus obovatus* *Scaevola spinescens* *Senna artemisioides* subsp. *filifolia* *Acacia quadrimarginea* (outside) *Casuarina pauper* (outside)	

Riverina Relevé R20

Date: 13/01/21 VT 4B

GPS: 263390 E/ 6705386 N	Location: West of PDA; central area; near western boundary	Landform: Greenstone hills; midslope; south aspect
Land surface: Red clay loam; surface rock (dolerite, metabasalt/ schist, quartz) > 80 %		
Condition: Very good; drought impacted		
Disturbance: Historical and current pastoral impacts; cattle in area; old erosion rills; debris dams		
NVIS VI: U1^ *Casuarina pauper, Brachychiton gregorii\ Casuarina\^tree\6\r; M1+^ Acacia quadrimarginea, A. ramulosa var. ramulosa\Acacia\^shrub\4\i; M2^ Acacia quadrimarginea, Casuarina pauper, Eremophila latrobei subsp. latrobei, Senna cardiosperma, Acacia ramulosa var. ramulosa\Acacia\^shrub\3\r; G1^ Ptilotus obovatus\Ptilotus\^shrub\1\bi*		

Height (m)	Crown cover %	Habit	Species
6 – 10	2 – 10	Tree	*Casuarina pauper, Brachychiton gregorii low open woodland*
2 – 4	10 – 20	Shrub	*Acacia quadrimarginea, A. ramulosa var. ramulosa tall open shrubland*
1 – 2	2 – 10	Shrub	*Acacia quadrimarginea, Casuarina pauper, Eremophila latrobei subsp. latrobei, Senna cardiosperma, Acacia ramulosa var. ramulosa sparse shrubland*
< 0.5	< 2	Shrub	*Ptilotus obovatus low isolated shrubs*

Vegetation: *Casuarina pauper, Brachychiton gregorii* low open woodland over *Acacia quadrimarginea, A. ramulosa* var. *ramulosa* tall open shrubland over *Acacia quadrimarginea, Casuarina pauper, Eremophila latrobei* subsp. *latrobei, Senna cardiosperma, Acacia ramulosa* var. *ramulosa* sparse shrubland over *Ptilotus obovatus* low isolated shrubs

Species list
Acacia ramulosa var. *ramulosa* *Acacia quadrimarginea* *Brachychiton gregorii* *Casuarina pauper* *Eremophila latrobei* subsp. *latrobei* *Ptilotus obovatus* *Senna cardiosperma*

Riverina Relevé R21

Date: 13/01/21 VT 4E

GPS: 263423 E/ 6705351 N 1.29 pm	Location: Western central survey area	Landform: Greenstone hills; valley, drainage line; eastern aspect
Land surface: Red clay loam; litter 50 – 60 %, fallen timber 2 – 3 %		
Condition: Very good		
Disturbance: Adjacent to unsealed track to Mulline dam; pipeline alongside road; cattle in area; some erosion along creek banks		
NVIS V: U1+^ *Acacia incurvaneura\Acacia\^shrub\6\c; M1^ Senna cardiosperma, Prostanthera campbellii, Eremophila latrobei subsp. latrobei, Casuarina pauper\Senna\^shrub\3\i*		

Height (m)	Crown cover %	Habit	Species
8 – 9	40 – 50	Shrub	*Acacia incurvaneura tall shrubland*
1 – 1.5	20 – 30	Shrub	*Senna cardiosperma, Prostanthera campbellii, Eremophila latrobei subsp. latrobei, Casuarina pauper open shrubland*

Acacia incurvaneura tall shrubland over *Senna cardiosperma, Prostanthera campbellii, Eremophila latrobei subsp. latrobei, Casuarina pauper open shrubland*

Species list
Acacia incurvaneura *Casuarina pauper* *Eremophila latrobei subsp. latrobei* *Senna cardiosperma* *Prostanthera campbellii*

Riverina Relevé R22

Date: 13/01/21 VT 6A

GPS: 263882 E/ 6705910 N	Location: Eastern side of western survey area; south of track	Landform: Greenstone hills; broad valley; lower slope
Land surface: Red clay loam; surface rock (dolerite, chert) 20 – 30 %; litter > 90 % - dense under trees; fallen timber		
Condition: Very good		
Disturbance: Historical and current pastoral impacts		
NVIS VI: U1+^ *Eucalyptus corrugata\Eucalyptus\^mallee\6\c; M1^ Eremophila oldfieldii subsp. angustifolia, Casuarina pauper, Senna artemisioides subsp. filifolia, Acacia tetragonophylla, Dodonaea lobulata\Eremophila\^shrub\3\i; G1^ Ptilotus obovatus, Casuarina pauper, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Olearia muelleri\Ptilotus\^shrub\1\i*		

Height (m)	Crown cover %	Habit	Species
9 – 10	40 – 50	Mallee	*Eucalyptus corrugata woodland patch*
1 – 1.5	10 – 20	Shrub	*Eremophila oldfieldii subsp. angustifolia, Casuarina pauper, Senna artemisioides subsp. filifolia, Acacia tetragonophylla, Dodonaea lobulata, Eremophila decipiens subsp. decipiens sparse shrubland to open shrubland*
< 0.7	10 – 15		*Ptilotus obovatus, Casuarina pauper, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Olearia muelleri low open shrubland*

Species list
Acacia tetragonophylla *Casuarina pauper* *Dodonaea lobulata* *Eremophila decipiens* subsp. *decipiens* *Eremophila oldfieldii* subsp. *angustifolia* *Eucalyptus corrugata* *Ptilotus obovatus* *Olearia muelleri* *Senna artemisioides* subsp. *filifolia*

Vegetation: *Eucalyptus corrugata* mallee woodland patches within open shrubland of *Eremophila* and *Acacia* spp.

Riverina Relevé R23

Date: 13/01/21 VT 1A

GPS: 266093 E/ 6706853 N	Location: South of airstrip; east of PDA	Landform: Stony plain
Land surface: Red clay loam; surface rock (fine ironstone gravel, quartz; rock from drilling program) 20 – 40 %		
Condition: mostly degraded		
Disturbance: Pastoral, timber cutting, drilling, donkeys; mining – old drill tracks, drill sites		

Height (m)	Crown cover %	Habit	Species
8 – 14	< 2	Tree	*Casuarina pauper, Acacia fuscaneura, A. caesaneura, ?Myoporum platycarpum isolated low trees*
1 – 2	1 – 2 (5)	Shrub	*Acacia tetragonophylla, Senna artemisioides subsp. filifolia, Acacia murrayana, A. caesaneura, Eremophila scoparia, A. ligulata isolated shrubs to patches of shrubs*
< 0.5	< 2	Shrub	*Maireana sedifolia, Senna artemisioides subsp. filifolia isolated low shrubs*

Species list
Acacia caesaneura *Acacia fuscaneura* *Acacia ligulata* *Acacia murrayana* *Acacia tetragonophylla* *Casuarina pauper* *Eremophila scoparia* *Maireana sedifolia,* *Myoporum platycarpum* *Senna artemisioides subsp. filifolia*

Riverina Relevé R24

Date: 13/01/21 VT 2

GPS: 266188 E/ 6707103 Fauna site: RIV 18	Location: South of airstrip; east of TSF	Landform: Stony plain
Land surface: red clay loam; surface rock (fine ironstone gravel) 50 – 60 %		
Condition: Poor to good; regrowth in most areas		
Disturbance: Historic and current pastoral/ feral grazing; timber cutting		

Height (m)	Crown cover %	Habit	Species
8 – 10	< 2	Tree	*Casuarina pauper isolated trees over*
1 – 2	2 – 10	Shrub	*Senna artemisioides subsp. filifolia, Casuarina pauper, Senna artemisioides subsp. x artemisioides, Acacia burkittii, Maireana sedifolia, Eremophila scoparia sparse shrubland*
< 0.5	< 2	Shrub	*Senna artemisioides subsp. filifolia, Maireana sedifolia low isolated shrubs*

Species list
Acacia burkittii *Acacia aptaneura* *Acacia hemiteles* *Acacia murrayana,* *Casuarina pauper* *Eremophila decipiens* subsp. *decipiens* *Eremophila scoparia* *Exocarpos aphyllus* *Maireana sedifolia* *Ptilotus obovatus* *Rhagodia drummondii* *Santalum spicatum* *Senna artemisioides* subsp. *filifolia* *Senna artemisioides* subsp. *x artemisioides*

24A: 266208 E/ 6707088 N

Acacia aptaneura, Santalum spicatum tall sparse shrubland over *Acacia hemiteles, A. murrayana*, *Eremophila decipiens* subsp. *decipiens, Exocarpos aphyllus, Senna artemisioides subsp. filifolia, Eremophila scoparia open shrubland over Maireana sedifolia, Ptilotus obovatus, Rhagodia drummondii, Eremophila decipiens subsp. decipiens grazed low isolated shrubs;* High levels of grazing

Riverina Relevé R25

Date: 14/01/21 VT 3E

GPS: 265843 E/ 6708241 N	Location: South of airstrip	Landform: Alluvial plain
Land surface: Yellowish red silty clay loam; surface rock (washed gravel) < 5 %; litter 20 – 30 %; fallen timber 4 – 6 %		
Condition: Good		
Disturbance: Cattle activity; historic and current pastoral activities – grazed grass tussocks; more open patches used by cattle		
NVIS V: U1+^ *Acacia burkittii, Acacia aptaneura, A. murrayana, Santalum spicatum\Acacia\^shrub \4\c; M1 ^ Senna artemisioides subsp. x artemisioides, Senna artemisioides subsp. filifolia, Acacia murrayana, Senna pleurocarpa var. pleurocarpa, Pimelea microcephala\Senna\^shrub\3\c; G1 ^ Senna artemisioides subsp. filifolia, Ptilotus obovatus\Senna\^shrub\1\i*		

Height (m)	Crown cover %	Habit	Species
2 – 5	30 – 40	Shrub	*Acacia burkittii, Acacia aptaneura, A. murrayana, Santalum spicatum tall shrubland*
1 – 2	30 – 40	Shrub	*Senna artemisioides subsp. x artemisioides, Senna artemisioides subsp. filifolia, Acacia murrayana, Senna pleurocarpa var. pleurocarpa, Pimelea microcephala shrubland*
< 0.6	10 – 15	Shrub	*Senna artemisioides subsp. filifolia, Ptilotus obovatus low open to sparse shrubland*
	< 1	Aerial	*Amyema fitzgeraldii on Acacia burkittii*

Vegetation: *Acacia burkittii, Acacia aptaneura, A. murrayana, Santalum spicatum tall shrubland over Senna artemisioides subsp. x artemisioides, Senna artemisioides subsp. filifolia, Acacia murrayana, Senna pleurocarpa var. pleurocarpa, Pimelea microcephala shrubland over Senna artemisioides subsp. filifolia, Ptilotus obovatus low open to sparse shrubland*

Species list
Acacia aptaneura *Acacia burkittii* *Acacia murrayana* *Acacia tetragonophylla* *Amyema fitzgeraldii* *Eremophila oldfieldii* subsp. *angustifolia* *Maireana tomentosa* *Pimelea microcephala* *Ptilotus obovatus* *Santalum spicatum* *Senna artemisioides* subsp. *filifolia* *Senna artemisioides* subsp. x *artemisioides*

Riverina Relevé R26

Date: 14/01/21 VT 3E

GPS: 265799 E/ 6707905 N	Location: South of airstrip	Landform: Alluvial plain; low rise
Land surface: Yellowish red (5YR 5/8) fine sandy clay loam; surface rock (gravel) 20 – 30 %		
Condition:		
Disturbance: Active erosion – scouring, sheet erosion, pedestalling, hummocking – wind erosion; historic and current pastoral/ feral grazing activities		
NVIS VI: U1+^ *Acacia burkittii, A. tetragonophylla, Dodonaea lobulata\Acacia\^shrub\4\c; M1^ Senna artemisioides subsp. x artemisioides, Dodonaea lobulata, Senna artemisioides subsp. filifolia\ Senna\^shrub\3\i; G1 ^ Ptilotus obovatus, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia burkittii\Ptilotus\ ^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
2 – 5	30 – 40	Shrub	*Acacia burkittii, A. tetragonophylla, Dodonaea lobulata tall shrubland*
1 – 2	10 – 20	Shrub	*Senna artemisioides subsp. x artemisioides, Dodonaea lobulata, Senna artemisioides subsp. filifolia open shrubland*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus, Senna artemisioides subsp. filifolia, Dodonaea lobulata, Acacia burkittii low sparse shrubland*
		Aerial	*Amyema fitzgeraldii in Acacia burkittii*

Species list
Acacia burkittii *Acacia tetragonophylla* *Amyema fitzgeraldii* *Casuarina pauper* *Dodonaea lobulata* *Ptilotus obovatus* *Senna artemisioides* subsp*. filifolia* *Senna artemisioides* subsp. x *artemisioides*

Other species: low rise with more rock – *Casuarina pauper*

Riverina Relevé R27

Date: 14/01/21 VT 2

GPS: 265744 E/ 6707712 N	Location: South of airstrip, between Q8 and Q9	Landform: Alluvial plain; low stony rise
Land surface: Yellowish red (5YR 5/8) fine sandy clay loam; surface rock (ironstone gravel, quartz 40 – 50 %); fallen timber ~ 10 %; cryptogams (lichen) 20- 30 %		
Condition: Very good		
Disturbance: Old erosion; timber clearing		
NVIS VI: U1^ *Casuarina pauper\Casuarina\^tree\7\bi; M1 +^Acacia ramulosa var. ramulosa, A. burkittii, A. tetragonophylla\Acacia\^shrub\4\i; M2^ Acacia tetragonophylla, Senna artemisioides subsp. x artemisioides, Scaevola spinescens, Acacia ramulosa var. ramulosa, Dodonaea lobulata, Casuarina pauper\Acacia\^shrub\3\i; G1^ Ptilotus obovatus, Acacia tetragonophylla\Ptilotus\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
9 – 12	< 2	Tree	*Casuarina pauper isolated trees*
2 – 5	10 – 20	Shrub	*Acacia ramulosa var. ramulosa, A. burkittii, A. tetragonophylla*
1 – 2	10 – 20	Shrub	*Acacia tetragonophylla, Senna artemisioides subsp. x artemisioides, Scaevola spinescens, Acacia ramulosa var. ramulosa, Dodonaea lobulata, Casuarina pauper*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus, Acacia tetragonophylla*

Species list
Acacia burkittii
Acacia ramulosa var. ramulosa
Acacia tetragonophylla
Casuarina pauper
Dodonaea lobulata
Ptilotus obovatus
Scaevola spinescens
Senna artemisioides subsp. x artemisioides

Vegetation: *Casuarina pauper* isolated emergent trees over *Acacia ramulosa var. ramulosa, A. burkittii, A. tetragonophylla* tall open shrubland over *Acacia tetragonophylla, Senna artemisioides subsp. x artemisioides, Scaevola spinescens, Acacia ramulosa var. ramulosa, Dodonaea lobulata, Casuarina pauper* open shrubland over *Ptilotus obovatus, Acacia tetragonophylla* low sparse shrubland

Riverina Relevé R28

Date: 14/01/21 VT2

GPS: 265952 E/ 6707504 N	Location: NE of WD/ TSF; near Q10	Landform: Stony plain
Land surface: Stony plain (ironstone gravel, calcrete, dolerite, quartz) > 80%		
Condition:		
Disturbance: Old timber cutting		

Q10 surrounding area: Stands of *Eucalyptus corrugata* and *Casuarina pauper* trees surrounded by *Acacia burkittii, A. caesaneura, Dodonaea lobulata, A. tetragonophylla, Senna artemisioides* subsp. *filifolia* open shrubland over *Ptilotus obovatus, Senna artemisioides* subsp. *filifolia; Marsdenia australis* vines; + *Olearia muelleri*

Patch of *Casuarina pauper* over *Senna* and *Olearia*; ground cover sparse – *Maireana tomentosa, M. thesioides, M. triptera, P. obovatus, M. sedifolia* (1.1 m)

28A: 266230 E/ 6707499 N (East of R28) Stony plain

Casuarina pauper low open woodland over *Acacia, Senna, Eremophila decipiens* subsp. *decipiens, Maireana sedifolia*; isolated *Santalum spicatum*

Species list	
Acacia burkittii	*Maireana sedifolia*
Acacia caesaneura	*Maireana thesioides*
Acacia tetragonophylla	*Maireana tomentosa*
Casuarina pauper	*Maireana triptera*
Dodonaea lobulata	*Olearia muelleri*
Eucalyptus corrugata	*Ptilotus obovatus*
Eremophila decipiens subsp. *decipiens*	*Santalum spicatum*
Marsdenia australis vines	*Senna artemisioides* subsp. *filifolia*

Riverina Relevé R29

Date: 14/01/21 VT

GPS: 266246 E/ 6707682 N	Location: NE of mining area	Landform: Floodplain/ alluvial plain
Land surface: Yellowish red clay loam, surface cracking; surface rock < 1%;		
Condition: Poor		
Disturbance: Historic and current pastoral impacts; recent cattle and donkey tracks; sheet erosion; slight pedestalling		
NVIS VI:		

Height (m)	Crown cover %	Habit	Species
2 – 4	8 – 10	Shrub, tree	*Acacia burkittii, A. murrayana, Pittosporum angustifolium, Casuarina pauper tall sparse shrubland over*
1 – 2	10 – 20	Shrub	*Senna artemisioides subsp. x artemisioides, Maireana pyramidata, Eremophila decipiens subsp. decipiens, Acacia murrayana open shrubland*
< 0.7	8 – 10	Shrub	*Ptilotus obovatus, Senna artemisioides subsp. x artemisioides, Atriplex vesicaria, Maireana pyramidata, Salsola australis low sparse shrubland*

Other species: patches of *Acacia aptaneura* tall shrubland or isolated shrubs

29A: *Acacia aptaneura* shrublands and open patches over *Ptilotus obovatus* low sparse shrubland; small rocky patches of ultramafic rock; bark stripping noted on *Acacia aptaneura*
Other species: *Acacia caesaneura, Santalum spicatum*

Species list	
Acacia burkittii	*Eremophila decipiens subsp. decipiens*
Acacia aptaneura	*Maireana pyramidata*
Acacia caesaneura	*Pittosporum angustifolium*
Acacia murrayana	*Ptilotus obovatus*
Atriplex vesicaria	Santalum spicatum
Casuarina pauper	*Senna artemisioides subsp. x artemisioides*

Riverina Airstrip – Relevé A1

Date: 13/01/21 VT 3C

GPS: 265454 E/ 6708437	Location: Airstrip north side; north of mining area	Landform: Alluvial plain
Land surface: Red fine sandy clay loam; surface rock < 2 %		
Condition: Good to very good – improves further away from airstrip		
Disturbance: Clearing with regrowth; pastoral activities – grazing, cattle, donkeys		

Height (m)	Crown cover %	Habit	Species
5 – 10	2 – 10	Tree	*Casuarina pauper open woodland*
1 – 2	10 – 30	Shrub	*Acacia murrayana, A. ligulata, Senna artemisioides subsp. filifolia, S. pleurocarpa open shrubland*

Grasses – *Aristida contorta, Austrostipa* sp.*, Eragrostis setifolia* (tentative, dried, sterile), *Ptilotus obovatus* along fenceline and inside airstrip boundary

	
West end of survey area: *Acacia aptaneura, A. burkittii, Brachychiton gregorii* tall open shrubland over *Senna artemisioides, Acacia murrayana, A. burkittii* shrubland (VT3D)	A1: *Casuarina pauper* open woodland over *Senna* and *Acacia* spp. Grasses, *Senna, Ptilotus obovatus* inside airstrip fence

Species list	
Acacia aptaneura	*Brachychiton gregorii*
Acacia burkittii	*Casuarina pauper*
Acacia ligulata	*Eragrostis setifolia*
Acacia murrayana	*Ptilotus obovatus*
Aristida contorta	*Senna artemisioides subsp. filifolia*
Austrostipa sp	*Senna pleurocarpa var. pleurocarpa*

Riverina Airstrip Relevé A2

Date: 13/01/21 VT 3A; 3C

GPS: 266059 E/ 6708448 N	Location: Airstrip, north side	Landform: Alluvial plain
Land surface: Red clay loam; surface rock < 1 %; litter 20 – 40 % (mostly under trees)		
Condition: Very good		
Disturbance: Historic and current pastoral/ feral grazing; clearing		

Height (m)	Crown cover %	Habit	Species
10 – 14	20 – 30 (40)	Tree, mallee	*Eucalyptus oleosa subsp. oleosa, E. corrugata woodland*
2 – 5	2 – 10	Shrub, tree	*Acacia burkittii, A. murrayana, Casuarina pauper tall sparse shrubland*
1 – 2	10 – 30	Shrub	*Senna artemisioides subsp. filifolia, Acacia burkittii, Acacia tetragonophylla, Senna artemisioides subsp. x artemisioides, Dodonaea lobulata*
< 0.7	10 – 20	Shrub, tussock grass	*Ptilotus obovatus, Senna artemisioides subsp. filifolia, Scaevola spinescens, Dodonaea lobulata, Austrostipa elegantissima*

Species list	
Acacia burkittii	*Eucalyptus oleosa subsp. oleosa*
Acacia hemiteles	*Maireana sedifolia*
Acacia murrayana	*Olearia muelleri*
Acacia tetragonophylla	*Pimelea microcephala*
Austrostipa elegantissima	*Ptilotus obovatus*
Casuarina pauper	*Rhagodia drummondii*
Eremophila decipiens subsp. decipiens	*Scaevola spinescens*
Eremophila oldfieldii	*Senna artemisioides subsp. filifolia*
Eucalyptus corrugata	*Senna artemisioides subsp. x artemisioides*

Riverina Relevé A3

Date: 12/01/21 VT 3E

GPS: 266796 E/ 6708350 N	Location: Airstrip south side	Landform: Alluvial plain
Land surface:		
Condition: Poor to good; mostly regrowth		
Disturbance: Historic clearing – pastoral activities; current impacts from stock grazing		

Height (m)	Crown cover %	Habit	Species
2 – 4	10 – 30	Shrub	*Acacia ligulata, A. burkittii tall open shrubland*
1 – 2	30 – 40	Shrub	*Acacia murrayana, Senna artemisioides subsp. filifolia, S. pleurocarpa var. pleurocarpa, Acacia burkittii, Eremophila decipiens subsp. decipiens, Scaevola spinescens shrubland*

Riverina Relevé A4

Date: 12/01/21 VT 3E

GPS: 267017 E/ 6708418 N	Location: Airstrip east	Landform: Alluvial plain
Land surface: Red clay loam		
Condition: Degraded		
Disturbance: High impacts from cattle		

Height (m)	Crown cover %	Habit	Species
4 – 8	< 2	Tree	*Casuarina pauper, Acacia aptaneura isolated low trees*
1 – 2	2 – 10	Shrub	*Acacia murrayana, A. tetragonophylla, Senna artemisioides subsp. filifolia, S. pleurocarpa var. pleurocarpa, Maireana sedifolia sparse shrubland*
< 0.5	2 – 10	Shrub	*Ptilotus obovatus, Maireana sedifolia low sparse shrubland*

GPS: 267132 E/ 6708440 N: Open *Acacia* shrubland over *Senna artemisioides subsp. filifolia, S. pleurocarpa* var. *pleurocarpa, Maireana sedifolia, Ptilotus obovatus*

Riverina Relevé A5

Date: 12/01/21 VT 2

GPS: 267196 E/ 6708501 N	Location: Airstrip east	Landform: Alluvial plain
Land surface: red clay loam; surface rock (fine ironstone gravel) 20 – 40 %		
Condition: Poor		
Disturbance: Historic and current pastoral activities; feral grazing		
NVIS VI: U1+^ *Casuarina pauper, Eucalyptus oleosa subsp. oleosa, Alectryon oleifolius subsp. canescens\Casuarina\^tree\6\bi; U2 ^Eremophila oldfieldii, Santalum spicatum, Acacia burkittii\ Eremophila\^^tree, shrub\6\r; M1^ Rhagodia drummondii, Acacia tetragonophylla\Rhagodia\ ^shrub\3\bi*		

Height (m)	Crown cover %	Habit	Species
4 – 8	< 2	Tree	*Casuarina pauper, Eucalyptus oleosa subsp. oleosa, Alectryon oleifolius subsp. canescens low isolated trees*
2 – 4	2 – 10	Tree, shrub	*Eremophila oldfieldii, Santalum spicatum, Acacia burkittii tall sparse shrubland/ low open woodland*
0.7 – 1.5	< 2	Shrub	*Rhagodia drummondii, Acacia tetragonophylla isolated shrubs*

A5

A5-2

A5-2 GPS 267253 E/ 6708537 N: *Eucalyptus oleosa* woodland patch over *Maireana sedifolia*, *Senna artemisioides subsp. filifolia, Ptilotus obovatus, Eremophila decipiens subsp. decipiens open shrubland*

Other species: Eremophila interstans subsp. *interstans, Acacia hemiteles, Pimelea microcephala, Acacia tetragonophylla, Santalum spicatum*

Southern Diversion Road (SDR) Area B1 – B11

Riverina Relevé B1

Date:14/01/21 VT 1

GPS: 266281 E/ 6706273 N	**Location: South of SDR east end**	**Landform: Lateritic Plain**
Land surface: red clay loam; surface rock (fine ironstone gravel) 40 – 50 %; litter < 10 %; fallen timber < 1 %; bare ground > 40 %		
Condition: Good; significant areas poor or degraded		
Disturbance: Historical and current pastoral activities/ feral grazing		
NVIS V: U1+^ *Casuarina pauper, Eucalyptus corrugata\Casuarina\^tree\7\bi; M1 Senna artemisioides subsp. filifolia, Maireana sedifolia, Eremophila decipiens subsp. decipiens\Senna\^shrub\3\r*		

Height (m)	**Crown cover %**	**Habit**	**Species**
8 – 12	< 2	Tree	*Casuarina pauper, Eucalyptus corrugata isolated trees*
2 – 3	< 2	Shrub	*Acacia synchronicia (tentative, sterile) isolated tall shrubs*
0.7 – 1.5	2 – 10	shrub	*Senna artemisioides subsp. filifolia, Maireana sedifolia, Eremophila decipiens subsp. decipiens, Maireana pyramidata sparse shrubland*
< 0.2	< 2	Forb	*Sclerolaena fusiformis low isolated forbs*

Vegetation: *Casuarina pauper, Eucalyptus corrugata isolated trees over Acacia synchronicia (tentative, sterile) isolated tall shrubs over Senna artemisioides subsp. filifolia, Maireana sedifolia, Eremophila decipiens subsp. decipiens, Maireana pyramidata sparse shrubland over Sclerolaena fusiformis low isolated forbs*

Riverina Relevé B2

Date: 14/01/2021 VT 3D

GPS: 266260 E/ 6705916 N Fauna site RIV 23	Location: South of SDR; eastern area	Landform: Alluvial plain
Land surface: Red clay loam; surface rock (gravel) 30 – 40 %		
Condition: good; on southern edge of survey area		
Disturbance: historic and current pastoral impacts/ feral grazers; significant cleared areas		

Height (m)	Crown cover %	Habit	Species
4 – 6	30 – 40	Tree	*Acacia aptaneura low woodland*
1 – 2	10 – 20	Shrub	*Acacia aptaneura open shrubland*

Vegetation: *Acacia aptaneura* low woodland over *A. aptaneura* open shrubland

	
B2A *Acacia aptaneura* tall shrubland	B2B – north of B2A

B2B (266233 E/ 6705877 N): changes to *Acacia burkittii* tall open shrubland – VT1A

Casuarina pauper isolated trees over *Acacia burkittii, A. tetragonophylla* tall open shrubland over *Senna artemisioides* subsp. *filifolia, Eremophila decipiens* subsp. *decipiens, Acacia tetragonophylla, Scaevola spinescens* open shrubland over *Ptilotus obovatus* low isolated shrubs

Other species: *Acacia caesaneura, A. murrayana*

Riverina Relevé B3

Date: 14/01/2021 VT 3B

GPS: 265987 E/ 6705732 N	Location: South of SDR	Landform: Broad drainage line/ depression
Land surface: Red fine sandy clay loam		
Condition: Very good		
Disturbance: Historic and current pastoral/ feral grazing		

Height (m)	Crown cover %	Habit	Species
10 – 16	10 – 30	Tree	*Eucalyptus corrugata, E. griffithsii woodland patch*
3 – 8	10 – 30	Tree	*Casuarina pauper, Acacia synchronicia?, Eucalyptus corrugata low open woodland*
1 – 2	30 – 40	Shrub	*Acacia murrayana, A. tetragonophylla, Casuarina pauper, Senna artemisioides subsp. filifolia shrubland*
< 1	10 – 30	Shrub	*Senna artemisioides subsp. filifolia, Maireana sedifolia, Casuarina pauper, Eremophila decipiens subsp. decipiens low open shrubland*

Other species: *Myoporum sp., Acacia burkittii, A. aptaneura*

Vegetation: *Eucalyptus corrugata, E. griffithsii woodland patch over Casuarina pauper, Acacia synchronicia, Eucalyptus corrugata low open woodland over Acacia murrayana, A. tetragonophylla, Casuarina pauper, Senna artemisioides subsp. filifolia shrubland over Senna artemisioides subsp. filifolia, Maireana sedifolia, Casuarina pauper, Eremophila decipiens subsp. decipiens low open shrubland*

Riverina Relevé B4

Date:14/01/21 VT

GPS: 265835 E/ 6705726 N	Location: South of SDR	Landform: Alluvial plain
Land surface: Red clay loam; surface rock (fine ironstone gravel) 40 – 50 %		
Condition: Poor		
Disturbance: Historic and current pastoral/ feral grazing; old tracks, erosion – sheet and pedestalling		
NVIS V: U1+^ *Eucalyptus oleosa subsp. oleosa\Eucalyptus\^tree\7\r; M1 ^ Senna artemisioides subsp. filifolia, Maireana sedifolia, Acacia tetragonophylla\Senna\^shrub\3\bi; M2^ Maireana sedifolia, Senna artemisioides subsp. filifolia\Maireana\^shrub\1\bi*		

Height (m)	Crown cover %	Habit	Species
14 – 16	< 10	Tree	*Eucalyptus oleosa subsp. oleosa isolated trees*
1 -2	1 – 2	Shrub	*Senna artemisioides subsp. filifolia, Maireana sedifolia, Acacia tetragonophylla isolated shrubs*
<0.5	1 – 2	Shrub	*Maireana sedifolia, Senna artemisioides subsp. filifolia low sparse shrubland to isolated shrubs*

Vegetation: *Eucalyptus oleosa subsp. oleosa isolated trees over Senna artemisioides subsp. filifolia, Maireana sedifolia, Acacia tetragonophylla isolated shrubs over Maireana sedifolia, Senna artemisioides subsp. filifolia low sparse shrubland to isolated shrubs*

Riverina Relevé B5

Date: 14/01/21 VT 1A

GPS: 265896 E/ 6706030 N	Location: South of bypass road	Landform: Alluvial plain
Land surface: Red silty clay loam; surface rock (ironstone gravel, calcrete) > 70 %; litter < 2 %		
Condition: Good; with some highly degraded areas		
Disturbance: Historic and current pastoral/ feral grazing impacts		

Height (m)	Crown cover %	Habit	Species
10 – 14	variable	Tree	*Eucalyptus corrugata, E. griffithsii isolated trees*
1 – 2	variable	shrub	*Senna artemisioides subsp. filifolia, Maireana sedifolia, M. triptera, Atriplex vesicaria patches of shrubland*

Other species: *Acacia aptaneura patches; A. murrayana, Casuarina pauper*

Vegetation: patches of *Eucalyptus* woodland or isolated trees over sparse shrublands; dense shrublands of *Senna artemisioides* subsp. *filifolia* with occasional *Maireana sedifolia, M. triptera* and *Atriplex vesicaria*; significant areas of bare ground

Riverina Relevé B6

Date: 14/01/21 VT 6 Woodland patch 20 m x 20 m

GPS: 264695 E/ 6704996 N	**Location: South of SDR; western end**	**Landform: Low hill; south end of greenstone range**
Land surface: red clay loam; surface rock (calcrete, dolerite, quartz, ironstone gravel) 40 – 50 %; litter 50 – 60 %; fallen timber 5 – 10 %		
Condition: Good patch within highly disturbed area		
Disturbance: Historic mining impacts – clearing, land disturbances; historic and current pastoral/ feral grazing impacts		
NVIS VI: U1+^ *Eucalyptus clelandiorum\Eucalyptus\^tree\6\i; M1 ^Senna artemisioides* subsp. *filifolia*		

Height (m)	**Crown cover %**	**Habit**	**Species**
8 – 10	20 – 30	Tree	*Eucalyptus clelandiorum woodland (4)*
1 – 2	< 2	Shrub	*Senna artemisioides* subsp. *filifolia (2)*
0.5 – 1	< 2	Shrub	*Senna artemisioides* subsp. *filifolia (4), Casuarina pauper (1), Maireana tomentosa (1)*
< 0.5	5 – 10	Shrub	*Ptilotus obovatus (18), Maireana tomentosa (10), Casuarina pauper (1)*

Other species: *Eremophila* sp. Mt Jackson, *Senna artemisioides* subsp. x *artemisioides, Allocasuarina acutivalvis* (outside patch)

Vegetation: *Eucalyptus clelandiorum woodland over Senna artemisioides* subsp. *filifolia, Eremophila* sp. Mt Jackson *isolated shrubs over Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Maireana tomentosa, Casuarina pauper low sparse shrubland*

Species list	
Allocasuarina acutivalvis *Casuarina pauper* *Eucalyptus clelandiorum* *Eremophila* sp. Mt Jackson *Ptilotus obovatus* *Maireana tomentosa* *Senna artemisioides* subsp. *filifolia* *Senna artemisioides* subsp. x *artemisioides*	

A. 264621 E/ 6704973 N (west of B6) *Acacia tetragonophylla* shrubland on ironstone gravel/ low rise

Riverina Relevé B7

Date: VT 6

GPS: 265114 E/ 6704994 N	Location: south of SDR; western end	Landform: Broad low ridge; aspect east to north east
Land surface: Calcrete rocks; high level of disturbance – mining		
Condition: Poor		
Disturbance: Historic mining impacts – clearing, land disturbances; historic and current pastoral/ feral grazing impacts		

Height (m)	Crown cover %	Habit	Species
< 10	10 – 20	Tree	*Eucalyptus clelandiorum, Casuarina pauper*
2 – 3	2 – 4	Shrub	*Acacia burkittii, A. aptaneura tall sparse shrubland*
1 – 2	< 2	Shrub	*Dodonaea lobulata, Acacia burkittii sparse isolated shrubs*
< 0.5	< 2		*Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Dodonaea lobulata low isolated shrubs*

Other species: *Acacia tetragonophylla*

Vegetation: *Eucalyptus clelandiorum, Casuarina pauper low open woodland patch over Acacia burkittii, A. aptaneura tall sparse shrubland over Dodonaea lobulata, Acacia burkittii sparse isolated shrubs over Ptilotus obovatus, Senna artemisioides* subsp. *filifolia, Dodonaea lobulata low isolated shrubs*

(B7A) *Eucalyptus oleosa* subsp. *oleosa* (north) 265077 E/ 6705231 N; 264996 E/ 6705146 N

Riverina Relevé B8

Date: VT 6

GPS: 265274 E/ 6705032 N	Location: south of SDR; western end	Landform: Change to plain
Land surface: reddish brown clay loam; surface rock (calcrete, fine ironstone gravel, quartz)		
Condition: Degraded		
Disturbance: Historic mining impacts – clearing, land disturbances; historic and current pastoral/ feral grazing impacts; erosion active		

Height (m)	Crown cover %	Habit	Species
8 – 10	< 2	Tree	*Eucalyptus griffithsii, E. corrugata, Casuarina pauper isolated trees to patches of trees*
0.5 – 1	10 – 15	Shrub	*Maireana sedifolia, Senna artemisioides* subsp*. filifolia open shrubland (regrowth)*
	< 2	Shrub	*Ptilotus obovatus, Maireana sedifolia, Senna artemisioides subsp. filifolia low isolated shrubs*

Vegetation: Isolated trees or patches of trees within extensive areas of *Maireana sedifolia, Senna artemisioides* subsp*. filifolia open shrubland over Ptilotus obovatus, Maireana sedifolia, Senna artemisioides subsp. filifolia low isolated shrubs*

Riverina Relevé B9

Date: 14/01/21 VT 6 20 m x 20 m area

GPS: 265465 E/ 6705121 N	Location: south of SDR; central western area	Landform: Plain
Land surface: reddish brown clay loam; surface rock (calcrete) 30 – 40 %		
Condition: Good		
Disturbance: Historic mining impacts – clearing, timber cutting, land disturbances; historic and current pastoral/ feral grazing impacts		
NVIS V: U1+^ *Eucalyptus salubris\Eucalyptus\^tree\6\i; M1^ Maireana sedifolia\Maireana \^chenopod shrub\2\r; G1 ^ Maireana sedifolia, Ptilotus obovatus, Maireana tomentosa, Solanum lasiophyllum\Maireana\^chenopod shrub, shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
8 – 10	20 – 25	Tree	*Eucalyptus salubris (2)*
0.5 – 1	2 – 10	Shrub	*Maireana sedifolia (16)*
< 0.5	2 – 10	Shrub	*Maireana sedifolia (24), Ptilotus obovatus (7), Maireana tomentosa (9), Solanum lasiophyllum (3)*

Other species: *Exocarpos aphyllus*, *Eucalyptus corrugata* (north)

Vegetation: *Eucalyptus salubris low woodland over Maireana sedifolia low sparse shrubland over Maireana sedifolia, Ptilotus obovatus, Maireana tomentosa, Solanum lasiophyllum low sparse shrubland*

Riverina Relevé B10

Date: 14/01/21 VT

GPS: 265357 E/ 6705227 N	Location: south of SDR road	Landform: Minor drainage line; plain
Land surface: Red clay loam		
Condition: Good		
Disturbance: historic and current pastoral/ feral grazing impacts		

Height (m)	Crown cover %	Habit	Species
6 – 9	> 40	Shrub, tree	*Acacia aptaneura, Brachychiton gregorii tall shrubland*
0.7 – 1.5	<2	Shrub	*Scaevola spinescens, Acacia tetragonophylla, Senna artemisioides subsp. filifolia isolated shrubs*

Other species: Eremophila decipiens subsp. decipiens

Vegetation: *Acacia aptaneura* tall shrubland follows creekline; open tall shrubland away from creek

Brachychiton gregorii low tree (9m) with isolated shrubs under canopy; *Acacia aptaneura* tall shrubland in background

Riverina Relevé B11

Date: 14/01/21 VT

GPS: 264614 E/ 6704620 N	Location: South of bypass road; east of Riverina ? road	Landform: Low hill; southern end of greenstone range
Land surface: red clay loam; surface rock (ironstone gravel, quartz) 70 – 80 %		
Condition: variable; very good in drainage line to south; more disturbance on rise – good		
Disturbance: Historic mining impacts – clearing, timber cutting, land disturbances; historic and current pastoral/ feral grazing impacts		
NVIS VI:		

Vegetation: 1) *Acacia burkittii, Eremophila oldfieldii* subsp. *angustifolia, Casuarina pauper, Acacia fuscaneura* tall open shrubland over *Senna artemisioides* subsp. *filifolia, Dodonaea lobulata, Acacia tetragonophylla* open shrubland over *Senna artemisioides* subsp. f*ilifolia, Ptilotus obovatus, Scaevola spinescens* low sparse shrubland

Open to sparse shrubland areas between patches of tall open shrubland

2) *Eucalyptus clelandiorum* open woodland to east

3) Drainage line (south): *Eucalyptus oleosa* subsp. *oleosa, E. corrugata* woodland with occasional *E. griffithsii*

Riverina Camp Area: C1 – C2

Riverina Relevé C1

Date: 13/01/21 VT 6A

GPS: 264099 E/ 6704576 N	Location: Riverina Camp area	Landform: Greenstone range, southern end; low hill; western aspect
Land surface:		
Condition: Good		
Disturbance: Historic and current mining and pastoral (grazing, clearing); mining camp located to west		
NVIS VI: U1+^ *Eucalyptus clelandiorum\7\i; M1^Eremophila sp. Mt Jackson\Eremophila\^shrub\4\r; G1^ Olearia muelleri, Acacia erinacea\Olearia\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
10 – 14	20 – 30	Tree	*Eucalyptus clelandiorum woodland*
2 – 3	2 – 10	Shrub	*Eremophila sp. Mt Jackson sparse shrubland*
< 0.5	2 – 10	Shrub	*Olearia muelleri, Acacia erinacea low sparse shrubland*

Other species: *Acacia quadrimarginea, A. tetragonophylla, Dodonaea lobulata* – just to north west

Vegetation:

Species list
Acacia erinacea *Eremophila sp. Mt Jackson* *Eucalyptus clelandiorum* *Olearia muelleri*

Riverina Relevé C2

Date: 13/01/21 VT 4B changing to 4A on north side

GPS: 263929 E/ 6704661 N	Location: Riverina Camp area	Landform: Greenstone hills; low hill
Land surface: Red clay loam; surface rock (dolerite, calcrete) 40 – 50 %; litter 20 – 30 %; fallen timber 2 – 5 %		
Condition: Very good		
Disturbance: historic pastoral and mining activities; old clearing; adjacent to new camp		
NVIS V: U1^ *Casuarina pauper\Casuarina\^tree\6\r; M1+^ Acacia quadrimarginea, A. tetragonophylla\Acacia\^shrub\4\i; M2^ Senna artemisioides subsp. filifolia, Acacia tetragonophylla, Eremophila oldfieldii subsp. angustifolia\Senna\^shrub\3\i; G1^ Ptilotus obovatus, Senna artemisioides subsp. filifolia\Ptilotus\^shrub\1\r*		

Height (m)	Crown cover %	Habit	Species
4 – 8	2 – 10	Tree	*Casuarina pauper low open woodland*
2.5 – 4	10 – 20	Shrub	*Acacia quadrimarginea, A. tetragonophylla tall open to sparse shrubland*
1 – 1.5	10 – 20	Shrub	*Senna artemisioides subsp. filifolia, Acacia tetragonophylla, Eremophila oldfieldii subsp. angustifolia, Casuarina pauper, Acacia quadrimarginea, Scaevola spinescens open to sparse shrubland*
< 0.7	2 – 10	Shrub	*Ptilotus obovatus, Senna artemisioides subsp. filifolia low sparse shrubland*

Species list broader area
Acacia assimilis subsp. *assimilis* *Acacia quadrimarginea* *Acacia tetragonophylla* *Brachychiton gregorii* *Casuarina pauper* *Dodonaea lobulata* *Eremophila oldfieldii subsp. angustifolia* *Ptilotus obovatus* *Scaevola spinescens* *Senna artemisioides subsp. filifolia*

Creekline (263873 E/ 6704643 N): *Casuarina pauper* low woodland – *Casuarina* denser along creeks

Main drainage line near road (264320 E/ 6705004 N): *Eucalyptus corrugata* woodland

Appendix 5: Conservation codes (DBCA 2019)

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

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

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

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

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

CR **Critically endangered species**

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

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

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.

1 **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.

2 **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.

3 **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.

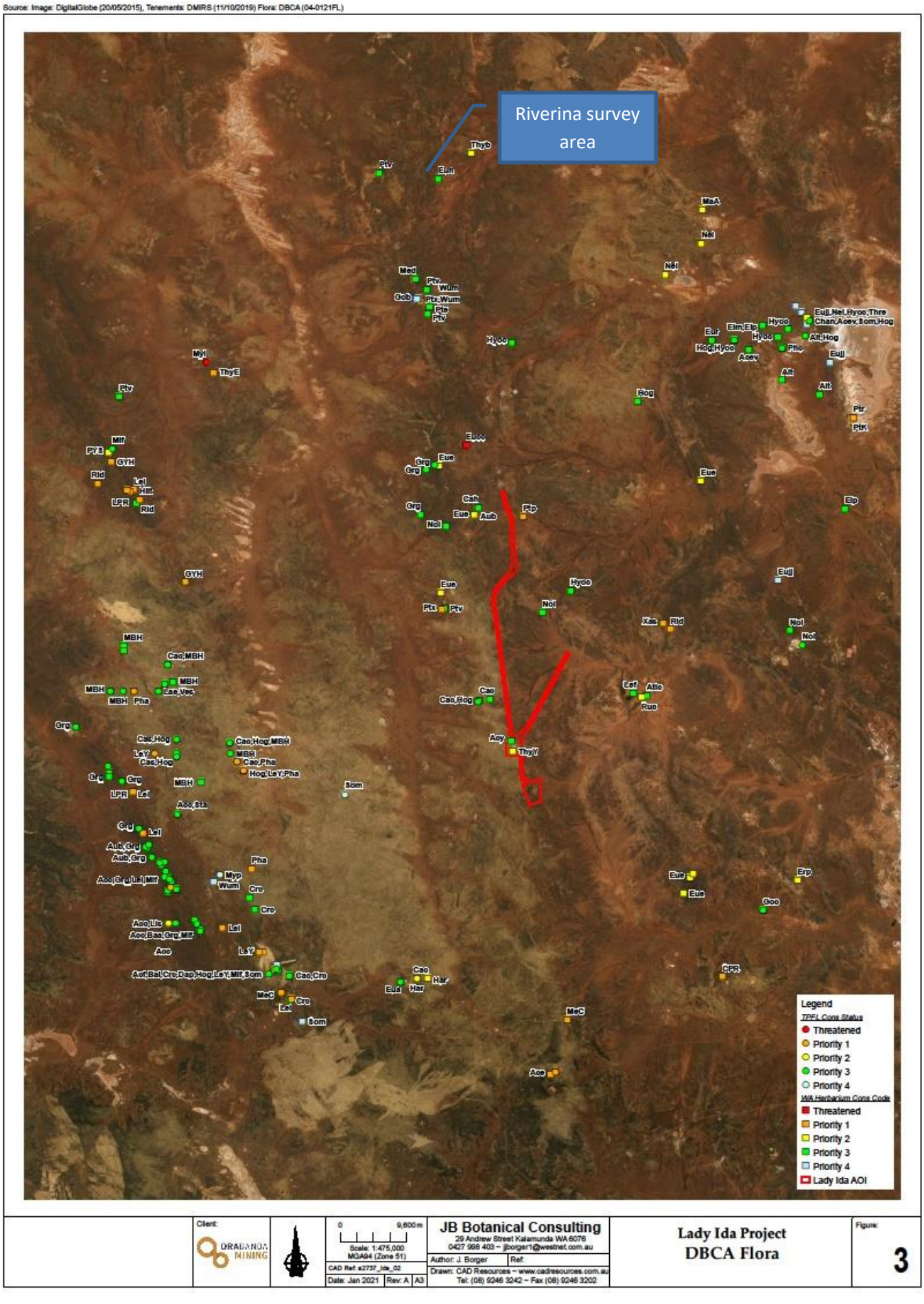
4 **Priority 4: Rare, Near Threatened and other species in need of monitoring**

(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.

[1] The definition of flora includes algae, fungi and lichens
[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

Last updated 3 January 2019

Appendix 6: DBCA Database Search Mapped Locations – codes are on the following page



Appendix 6 codes

Abbrev	Taxon
Acc	Acacia crenulata (3)
Ace	Acacia epedunculata (1)
Acev	Acacia eremophila var. variabilis (3)
Acf	Acacia formidabilis (3)
Acy	Acacia cylindrica (3)
Alt	Alyxia tetanifolia (3)
Atlc	Atriplex lindleyi subsp. conduplicata (3)
Aub	Austrostipa blackii (3)
Baa	Banksia arborea (4)
Bal	Banksia lullfitzii (3)
Cac	Calytrix creswellii (3)
Cah	Calytrix hislopii (3)
Chan	Chrysocephalum apiculatum subsp. norsemanense (3)
CPR	Chamelaucium sp. Parker Range (B.H. Smith 1255) (1)
Crc	Cryptandra crispula (3)
Dap	Dampiera prasiolitica (1)
Elm	Elatine macrocalyx (3)
Elp	Eleocharis papillosa (3)
Erp	Eremophila praecox (2)
Eua	Eutaxia actinophylla (3)
Eucc	Eucalyptus crucis subsp. crucis (T)
Eue	Eucalyptus educta (2)
Eujj	Eucalyptus jutsonii subsp. jutsonii (4)
Eun	Eutaxia nanophylla (3)
Eur	Eutaxia rubricarina (3)
Gob	Goodenia berringbinensis (4)
Goc	Gompholobium cinereum (3)
Grg	Grevillea georgeana (3)
GYH	Grevillea sp. Yerilgee Hills (T. Laslett TL 025) (1)
Har	Hakea rigida (2)
Hilt	Hibbertia lepidocalyx subsp. tuberculata (3)
Hog	Homalocalyx grandiflorus (3)
Hyoc	Hysterobaeckea ochropetala subsp. cometes (3)
Lae	Labichea eremaea (3)
Lef	Lepidium fasciculatum (3)
Lel	Lepidosperma lyonsii (1)
LeY	Leucopogon sp. Yellowdine (M. Hislop & F. Hort MH 3194) (1)
Lis	Lissanthe scabra (2)
LPR	Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094) (1)
MaA	Malleostemon sp. Adelong (G.J. Keighery 11825) (2)
MBH	Melichrus sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (3)
MeC	Melichrus sp. Coolgardie (K.R. Newbey 8698) (1)
Med	Menkea draboides (3)
Mif	Mirbelia ferricola (3)
Myl	Myriophyllum lapidicola (T)
Myp	Myriophyllum petraeum (4)
Nei	Newcastelia insignis (2)
Noi	Notisia intonsa (3)
Pha	Phebalium appressum (1)
Phc	Philotheca coateana (3)
Pte	Pterostylis elegantissima (1)
PtK	Ptilotus sp. Kalgoorlie (J. Jackson & B. Moyle 260) (1)
Ptp	Ptilotus procumbens (1)
Ptr	Ptilotus rigidus (1)
Ptv	Pterostylis virens (3)
Ptx	Pterostylis xerampelina (1)
PYS	Phebalium sp. Yerilgee Sandplain (J. Jackson 223) (2)
Rid	Ricinocarpos digynus (1)
Ruc	Rumex crystallinus (2)
Som	Sowerbaea multicaulis (4)
Sta	Styphelia saxicola (3)
Thre	Thryptomene eremaea (2)
Thyb	Thysanotus brachyantherus (2)
ThyE	Thysanotus sp. Ennuin (N. Gibson & M. Lyons 2665) (1)
ThyY	Thysanotus sp. Yellowdine (A.S. George 6040) (2)
Ves	Verticordia stenopetala (3)
Wum	Wurmbea murchisoniana (4)
Xas	Xanthoparmelia subbarbatica (1)