Report No. J021158

Detailed flora and vegetation Survey of the Great Northern Highway intersection – Lamb Creek Project

Prepared for: Mineral Resources Limited
Date: 29 October 2021

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Revision	Date	Prepared	Reviewed	Approved
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Executive Summary

Mineral Resources Limited (MRL) commissioned Rapallo Environmental (Rapallo) to conduct a single-phase detailed vegetation and flora survey of the Great Northern Highway Intersection area associated with the Lamb Creek Project.

The Great Northern Highway intersection survey area (the survey area) comprised 254 hectares, beginning at the Great Northern Highway and extending north-westwards.

The objectives of the survey were to complete a desktop study and single-phase detailed flora and vegetation survey to map vegetation types, describe floristic diversity, verify desktop information, and assess whether the habitats of the survey area contain conservation significant flora and vegetation. Conservation significant flora taxa are presented in a separate targeted report (Rapallo 2021).

Methods

The single-phase flora and vegetation survey was completed by a team of three botanists over a period of six days. The work was completed in conjunction with a targeted conservation significant flora survey, which is reported on separately (Rapallo 2021).

A total of nineteen flora quadrats (50 by 50 meters) and one relevé were sampled. Additional flora taxa were recorded opportunistically while traversing between quadrats, and during the targeted survey. Preliminary vegetation boundaries were mapped in the field using aerial photographs and GPS waypoints with associated vegetation notes.

Desktop results

The desktop study returned 800 vouchered vascular plant taxa (species and subspecies) within 40 kilometres of the survey area, representing 252 genera and 79 families.

The desktop study found 86 conservation significant vascular flora taxa from within 60 kilometres of the Lamb Creek project area. A likelihood assessment was based on proximity of records and availability of habitat in the survey area. The assessment identified eleven taxa that were either confirmed, likely to occur, or may potentially occur in the survey area. Five of these were recorded during the survey.

The desktop study identified forty-eight introduced taxa (weeds). Nine of these taxa were recorded during the field survey.

The desktop returned one Priority Ecological Community (PEC) within 5 km of the survey area. This was subtype 2 of the Coolibah-Lignum Flats vegetation community, which is listed Priority 1. Results from previous surveys of the Lamb Creek project (Rapallo 2012) and the current field survey confirmed that the PEC does not occur in the survey area.

Field survey results

The survey recorded 187 flora taxa from 35 different families. These included 178 native taxa and nine introduced taxa (weeds: section 4.2.3). The most well-represented families were Poaceae (40 taxa), Fabaceae (37 taxa), and Malvaceae (16 taxa).

Of the 187 flora taxa recorded, 26 taxa (14%) were annuals, 18 (10%) were annual or short-lived perennial, 131 (70%) were perennials. Twelve taxa (6%) did not have life cycle information available.

Five conservation significant flora taxa were recorded from the survey area, as listed below. These are described and mapped in Rapallo (2021):

- *Aristida lazaridis*: Priority 2
- *Rhagodia* sp. Hamersley (M. Trudgen 17794): Priority 3
- *Goodenia nuda*: Priority 4
- *Seringia exastia*: Critically Endangered
- *Euphorbia* aff. ferdinandi: Potentially undescribed

The most commonly recorded taxon was *Aristida lazaridis*, which occurred throughout the survey area, within vegetation types A, B, C and D. *Seringia exastia*, although currently listed Critically Endangered, is listed as a result of a taxonomic revision and is likely to be de-listed in the future (DBCA communication received 24/08/2021)

Vegetation of the survey area

The vegetation across the survey area generally comprised low open woodland to isolated trees dominated by mulga (*Acacia aptaneura*) or other acacia species, over an understorey of either spinifex, tussock grasses, or a combination thereof, on a flat to gently sloping clay-loam plain. The dominant spinifex species was *Triodia pungens*, however patches dominated by *Triodia wiseana* occurred throughout the survey area, with some patches large enough to be mapped.

The vegetation of the survey area has been affected by fire, as visible on the ground during the survey, and supported by NAFI data which maps the entire survey area as having been burnt in 2015 (NAFI 2021). Disturbance notes taken during the survey indicated that fire killed between 5% and 90% of (tall) shrubs and trees in the area.

Vegetation condition across the survey area varied from Very Good to Degraded, with most of the quadrats ranked as Good (EPA 2016a: Table 2). The main reason for this ranking was fire.

Vegetation types

Vegetation types were identified and described through a combination of manual classification and statistical analysis using PATN software. Results of PATN matched well with manual classification.

Six vegetation types were mapped and described across the survey area:

- Vegetation type A – Low open *Eucalyptus gamophylla* woodland over *Triodia melvillei* and *T. pungens* on stony plain (39 ha)
- Vegetation type B – Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover (49 ha)
- Vegetation type C – Mulga and acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover (84 ha)
- Vegetation type D – Mulga, Hakea lorea, and *Eucalyptus xerothermica* low open woodland over closed tussock grassland on gently sloping clay-loam plain (no rocks) (51 ha)
- Vegetation type E – Low mulga woodland over sparse understorey on stony plain (9 ha)
- Vegetation type F – *Triodia wiseana* hummock grassland with emergent shrubs and low trees on gently sloping stony plain (4 ha)

Twenty hectares of the survey area was cleared, disturbed, contained roads, or contained regrowth or revegetation with native species. These areas did not represent a vegetation type.

Site selection and vegetation mapping was limited by the absence of a recent aerial photograph showing the current state of the vegetation within the survey area. The most recent aerials available were dated 2009 and 2013, which pre-dated the 2015 fire.

Not all vegetation types were represented adequately with quadrats, with vegetation types A and E only represented by a single quadrat, while vegetation type F was only sampled with a relevé. Additional quadrats are likely to improve vegetation community definition and mapping.

Of the six vegetation types identified in the survey area, four (A, B, C and D) were identified as being of moderate local significance due to the presence of *Aristida lazaridis* which is listed Priority 2.

1 Introduction

1.1 Project overview

The Lamb Creek Iron Ore Project comprises a proposed mining area and an associated haul road, located approximately 130 kilometres (km) north-west of Newman in the Pilbara region of Western Australia. The project occurs within retention licence R47/19 and miscellaneous licence 47/736.

Mineral Resources Limited (MRL) commissioned Rapallo Environmental (Rapallo) to conduct a single phase detailed vegetation and flora survey of the Great Northern Highway Intersection area associated with the Lamb Creek Project. The location and extent of the survey area is described in section 1.2.

The detailed vegetation and flora survey, in conjunction with a targeted survey, was completed by a team of three botanists over a period of six days, from 12th to 17th May 2021.

The targeted survey for conservation significant species is presented in (Rapallo 2021).

1.2 Survey Area

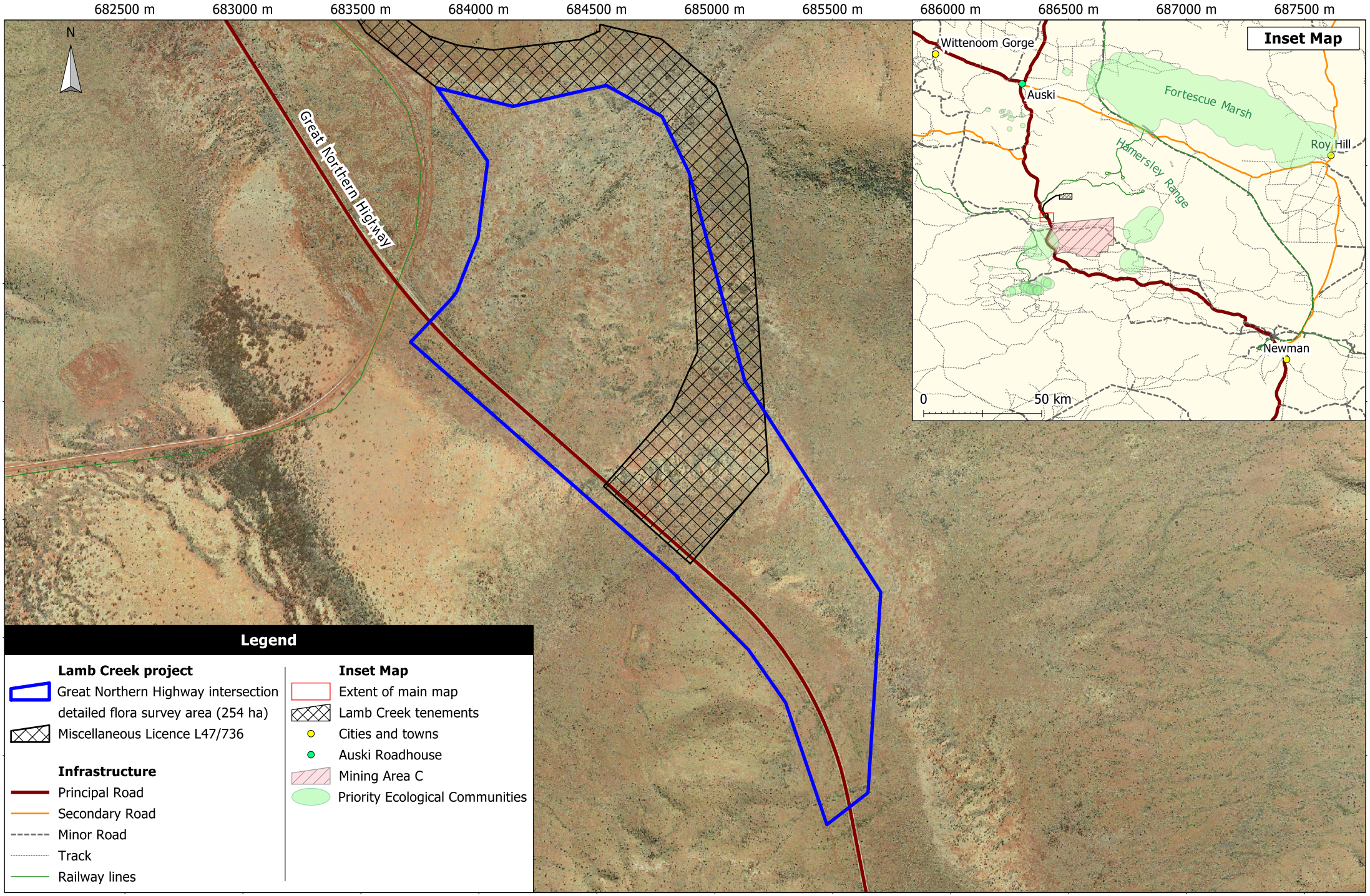
The Great Northern Highway intersection survey area comprised 254 hectares, beginning at the Great Northern Highway and extending north-westwards (Figure 1.1). Hereafter, this area will be referred to as the GNHI survey area, or simply the survey area.

The survey area enveloped various intersection options investigated for a proposed haul road connecting the Lamb Creek resource area with the highway. It was not bounded by a registered tenement at the time of survey, but enclosed the southern end of miscellaneous licence L47/736.

1.3 Scope and objectives

The objectives of the detailed flora and vegetation survey were to:

- Complete a desktop study to identify conservation significant flora and ecological communities that may occur in the survey area.
- Conduct a single-phase detailed flora and vegetation survey of the GNHI survey area, to map broad-scale vegetation types, describe floristic diversity, verify desktop information, and assess whether the habitats of the survey area contain conservation significant flora and vegetation.



Rapallo environmental

Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Great Northern Highway intersection
detailed flora survey (May 2021)

Original Size: A4 Scale: 1:20,000
Datum: MGA94 Zone 50
0 800 m

Figure 1.1

Location of the Lamb Creek project and delineation of the survey area

2 Regional context

2.1 Climate and weather

The Lamb Creek project is situated in the Hamersley subregion (PIL03) of the Pilbara IBRA region, which is part of the Eremaean province (Beard 1990). The climate of the Hamersley IBRA subregion (PIL03) is described as semi-desert tropical. The average rainfall is 300 mm per year, usually in summer cyclonic or thunderstorm events. Winter rain is not uncommon (Kendrick 2001). Cyclones develop off the north-west coast and often cross the coastline between Karratha and Port Hedland and move inland over the Fortescue Valley system towards Newman (Beard 1990).

The closest Bureau of Meteorology (BOM) weather station to the survey area is at Newman Airport (station number 007176), located 130 kilometres south-east of the survey area. This weather station has been recording rainfall data since 1971 and temperature data since 1996.

Data recorded at Newman Airport (BoM 2021) (Figure 2.1) shows a mean annual rainfall of 324.3 millimetres. Mean monthly rainfall is highest in February at 70.2 millimetres, and lowest in September at 3.7 millimetres. The hottest month is December with a mean maximum temperature of 39.3°C and a mean minimum temperature of 24.1°C. The annual wind records from 9am and 3pm show a dominant easterly throughout the day, with the strongest winds recorded in the morning of up to 30 kilometres/hour.

Evaporation rates are not recorded at the Newman Airport Weather Station. However, evaporation in the Central Pilbara Region is estimated to be between 2000 millimetres and 3500 millimetres per annum, which is approximately ten times greater than annual rainfall (Gardiner 2003). This disparity maintains a typically arid landscape, except for areas located in proximity to river systems and shallow groundwater resources.

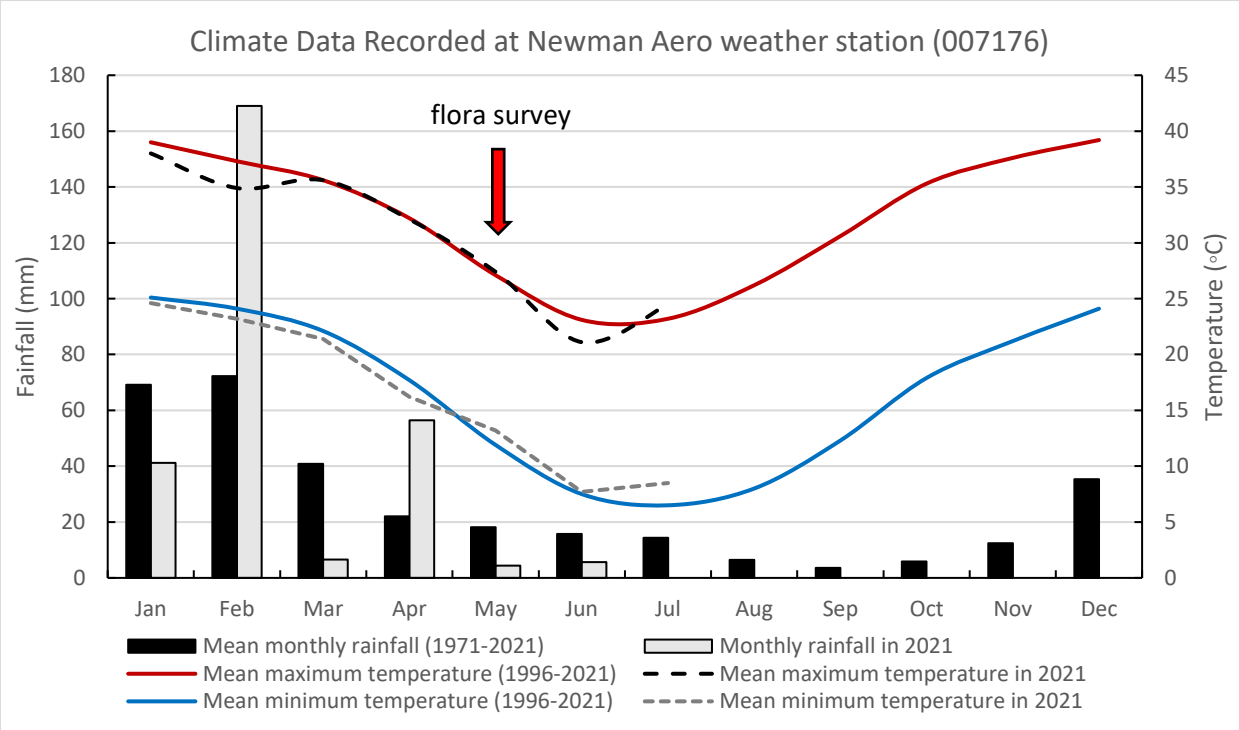


Figure 2.1 Long-term average monthly rainfall and maximum temperature, and 2021 monthly rainfall and maximum temperatures recorded at Newman Aero weather station

Rainfall over the three months preceding the survey was above average with substantial rainfall recorded in February 2021 (169 millimetres) and April (56.4 millimetres). Mean maximum and minimum temperatures during the survey (May 2021) were in line with the average, at respectively 27.4 °C during the day, and 13.2 °C at night.

2.2 Biogeography

2.2.1 IBRA bioregions

The bioregions of Australia are described in the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway & Cresswell 1995). Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions and 419 subregions (Department of the Environment and Energy (DotEE) 2012).

The Lamb Creek project is located in the Hamersley (PIL3) subregion of the Pilbara bioregion. The Hamersley subregion comprises the southern section of the Pilbara Craton. It is a mountainous area of Proterozoic sedimentary ranges and plateaux, dissected by gorges (basalt, shale and dolerite). Geographically it is synonymous with the Hamersley vegetation system as described by Beard (1990). The dominant vegetation is mulga low woodland over bunch grasses on fine textured soils in valley floors, and *Eucalyptus leucophloia* (snappy gum) over *Triodia brizoides* on skeletal soils of the ranges. Regional vegetation is further described in section 2.3. Drainage runs into either the Fortescue River to the north, the Ashburton river to the south, or the Robe river to the west (Kendrick 2001).

2.2.2 Land System

The land systems of the Pilbara region are classified according to similarities in landform, soil, vegetation, geology and geomorphology, following van Vreeswyk *et al.* (2004). Three land systems occur on the survey area, as listed and summarised in Table 2.1.

The majority of the survey area falls within the Boolgeeda land system, comprising stony slopes, plains, hills, and drainage floors with spinifex followed by the Wannamunna land system; characterised by hardpan plains and internal drainage tracts supporting mulga shrublands and woodlands (and occasionally eucalypt woodlands). A small portion of the Newman land system, comprising rugged mountains, ridges, and plateaux, intersects the southern edge of the survey area .

Table 2.1 Land systems of the survey area

Name	Land type	Description	Extent in survey area
Boolgeeda Land System	Stony plains with spinifex grasslands	Stony lower slopes, stony plains below hills, and narrow sub-parallel drainage floors. Supports hard and soft spinifex grasslands or mulga shrublands. Often occurs below hill systems such as Newman and Rocklea	182 ha
Wannamunna Land System	Wash plains on hardpan with mulga shrublands	Hardpan plains and internal drainage tracts supporting mulga shrubland and woodlands, and occasionally eucalypt woodlands. Depositional surfaces, level hardpan wash plains subject to overland sheet flow. Broad internal drainage flats receiving run-on from	69 ha

Name	Land type	Description	Extent in survey area
		adjacent hardpan surfaces; rare channelled tracts but mostly not organised through drainage. Relief up to 5 m.	
Newman Land System	Hills and ranges with spinifex grasslands	Rugged high mountains, ridges and plateaux with near vertical escarpments of jaspilite, chert and shale, supporting hard spinifex grasslands. Relief up to 400 m.	3 ha

2.2.3 Geology

The survey area is located in the south-west corner of the Roy Hill 1:250,000 Geological Survey Sheet (SF50-12: Thorne & Tyler 1997). The geology of the survey area is generally defined by the assemblage of prehnite, pumpellyite, epidote, actinolite. Basement rocks comprise the early Proterozoic Brockman Iron Formation and Weeli Wolli Formation. The Brockman Iron Formation consists of banded iron formation (BIF) and shale, while the Weeli Wolli formation consists of BIF separated by shale and siltstone bands, with younger dolerite sills that intersect the sedimentary sequence.

Regionally, the fresh basement rocks are typically overlain by weathered basement rocks which occur as lateritic and basal gravel and/or conglomerate deposits. These weathered deposits underlie early Tertiary Channel Iron Deposits (CID), which are the dominant economic-grade iron deposits in the region. The CID is typically overlain by younger alluvial and colluvial gravels and sediments (Thorne & Tyler 1997).

The survey area overlies the following geological units (Stewart *et al.* 2008), as described below.

- Quaternary Colluvium (Qrc): Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.
- Brockman Iron Formation (Lchk): Banded iron-formation, chert, mudstone and siltstone of Palaeozoic age

2.2.4 Soils

The survey area is located within the Fortescue botanical district of the Pilbara region (Beard 1990). This region is mountainous, with soils ranging from shallow, stony sandy loams along slopes, to cracking clays, stripped hardpans and calcareous loams along active waterways (Beard 1990).

The landforms of the survey area are typical of the eastern Pilbara with rocky hills, small gorges, mostly seasonal watercourses and gravelly loam valleys. The soils are typified by hard red alkaline soils on plains, pediments and alluvial areas, while shallow, skeletal soils are common on ranges that rise to 1,250 metres (Beard 1990). The southern part of eastern Pilbara region is characterised by earthy loams underlain by red-brown hardpan (Beard 1975, 1990).

The survey area has two distinct soil and landform assemblages. The greater majority of the survey area is characterised as soil unit Fb3, while the southern tip of the survey area falls within soil unit Fa13. These are defined as follows (CSIRO Australia 2018):

- Fb3 – High-level valley plains set in extensive areas of unit Fa13. There are extensive areas of pisolitic limonite deposits: principal soils are deep earthy loams (Um5.52) along with small areas of (Gn2.12) soils.

- Fa13 – Ranges of banded jaspilite and chert along with shales, dolomites, and iron ore formations with some areas of ferruginous duricrust as well as occasional narrow winding valley plains and steeply dissected pediments. This unit is largely associated with the Hamersley and Ophthalmia Ranges. The soils are frequently stony and shallow and there are extensive areas without soil cover: chief soils are shallow stony earthy loams (Um5.51) along with some (Uc5.11) soils on the steeper slopes. Associated are (Dr2.33, Dr2.32) soils on the limited areas of dissected pediments, while (Um5.52) and (Uf6.71) soils occur on the valley plains.

2.2.5 Hydrology

Within the Hamersley (PIL3) subregion drainage runs into either the Fortescue River to the north, the Ashburton river to the south, or the Robe river to the west (Kendrick 2001). The Great Northern Highway intersection survey area falls within the Ashburton River Catchment. One mapped intermittent creek line enters the survey area from the north-east, with the much of the survey area characterised by non-incised drainage plain, receiving run-on from adjacent hills.

2.2.6 Topography

The survey area occurs within the central Hamersley Ranges which dominate the sub-region (Thorne & Tyler 1997). The topography of the region is highly mountainous comprising three smaller ranges: Packsaddle Range in the centre, Jirrpalpur Range in the south and the Hancock Range to the north. The survey area skirts the western edge of the Hancock Range, with the survey area predominantly characterised by plain and valley floor.

2.3 Regional vegetation

2.3.1 Botanical district

The survey area is located in the Fortescue botanical district of the Pilbara region (Beard 1990), which forms part of the Eremaean Botanical Province. The Pilbara region receives a slightly higher than average rainfall than most of the Eremaean Province, due to the prevalence of cyclones off the coast, but this is not enough to modify the essentially desert appearance of the plant cover (Beard 1990).

The Fortescue district consists predominantly of tree and shrub steppe communities with *Eucalyptus* trees, *Acacia* shrubs and spinifex grasses including *Triodia pungens* and *T. wiseana* (Beard, (1975). Mulga (species of the *Acacia aneura* complex) occurs in valleys and short-grass plains may be present on alluvial soils (Beard 1990).

2.3.2 Vegetation system association

Digital maps (shapefiles) of pre-European vegetation communities, based on state-wide mapping by J.S. Beard at 1:250,000 scale, are published by the Department of Primary Industries and Regional Development (Beard 2018).

Vegetation of the Hamersley (PIL3) IBRA subregion is generally low Mulga woodland over bunch grasses on fine textured soils in the valleys with snappy gums (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001). The mountain tops and gorges of the Hamersley subregion provide refugia for humidophile and/or fire intolerant flora, and support a diversity of range-restricted species (Kendrick 2001).

(Beard, (1975) mapped the vegetation system-associations of the survey area as Hamersley 18: Low woodland of Acacia aneura, and Hamersley 82: Hummock-grass (*Triodia wiseana*) steppe with irregularly scattered *Eucalyptus brevifolia* trees; and Hamersley 18: Low woodland of *Acacia aneura* (Table 2.2).

Table 2.2 Pre-European vegetation within the survey area

Beard Vegetation System and Association	Extent in survey area	Total current extent in Australia (1)	Pre-European extent remaining (1)
Hamersley 18	209 ha	575 852 ha	99.96
Hamersley 82	46 ha	2 157 841 ha	99.99

Footnotes: 1) Numbers from 2018 Statewide Vegetation Statistics (DBCA 2019)

Vegetation that is not a Threatened or Priority Ecological Community may still be considered significant if it has a restricted distribution, or has experienced a degree of historical impact from threatening processes (EPA 2016b). Vegetation types retaining less than 30% of their pre-European extent generally experience accelerated species loss at an ecosystem level (EPA 2000) and are regarded as being 'vulnerable', while vegetation types retaining less than 10% of their original extent are regarded as being 'endangered' (EPA 2000, Shepherd *et al.* 2002, DER 2014a, 2016b).

As presented in Table 2.2, the Hamersley 18 and Hamersley 82 vegetation system-associations intersected by the survey area still have close to 100% of their original extent remaining, and would be considered 'least concern' (DER 2014a).

2.4 Reserves and environmentally sensitive areas

Environmentally sensitive areas (ESAs) are protected under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and are selected for their environmental values at state or national levels. The survey area does not occur within an ESA, nor are there any ESAs within five kilometres of the survey area, as shown by the Department of Environment Regulation (DER) Native Vegetation Map Viewer (DER 2014b).

Karijini National Park is located to the west of the survey area, approximately 18 kilometres west of the intersection of the proposed haul road and the Great Northern Highway. Mungaroona Range Nature Reserve is approximately 100 kilometres northwest of the survey area. The nearest Nationally Important Wetland is the Fortescue Marsh located 52 km north of the survey area (AWE 2021).

Threatened Ecological Communities and Priority Ecological Communities are addressed in section 3.1.

3 Methods

3.1 Desktop study

The desktop study comprised a search of paid and free databases, and a review of available literature relevant to the survey area. The desktop served to compile a list of conservation significant flora taxa and vegetation communities with the potential to occur within the survey area. Database search parameters are outlined in Table 3.1 below. Conservation codes for Australian flora are detailed Appendix I.

Table 3.1 Flora database search parameters

Source of information	Search area
DBCA (2021a) Threatened and Priority Flora Database (including WA Herbarium database records)	60 km radius centred on the Lamb Creek project area
DBCA (2021b) Threatened and Priority Ecological Communities (TEC-PEC) database	50 km radius centred on the Lamb Creek project area
DBCA (2021c) NatureMap online database	40 km radius centred on the Lamb Creek project area
Department of Agriculture Water and the Environment (AWE) (2021) Protected Matters search tool	50 km radius centred on the Lamb Creek project area

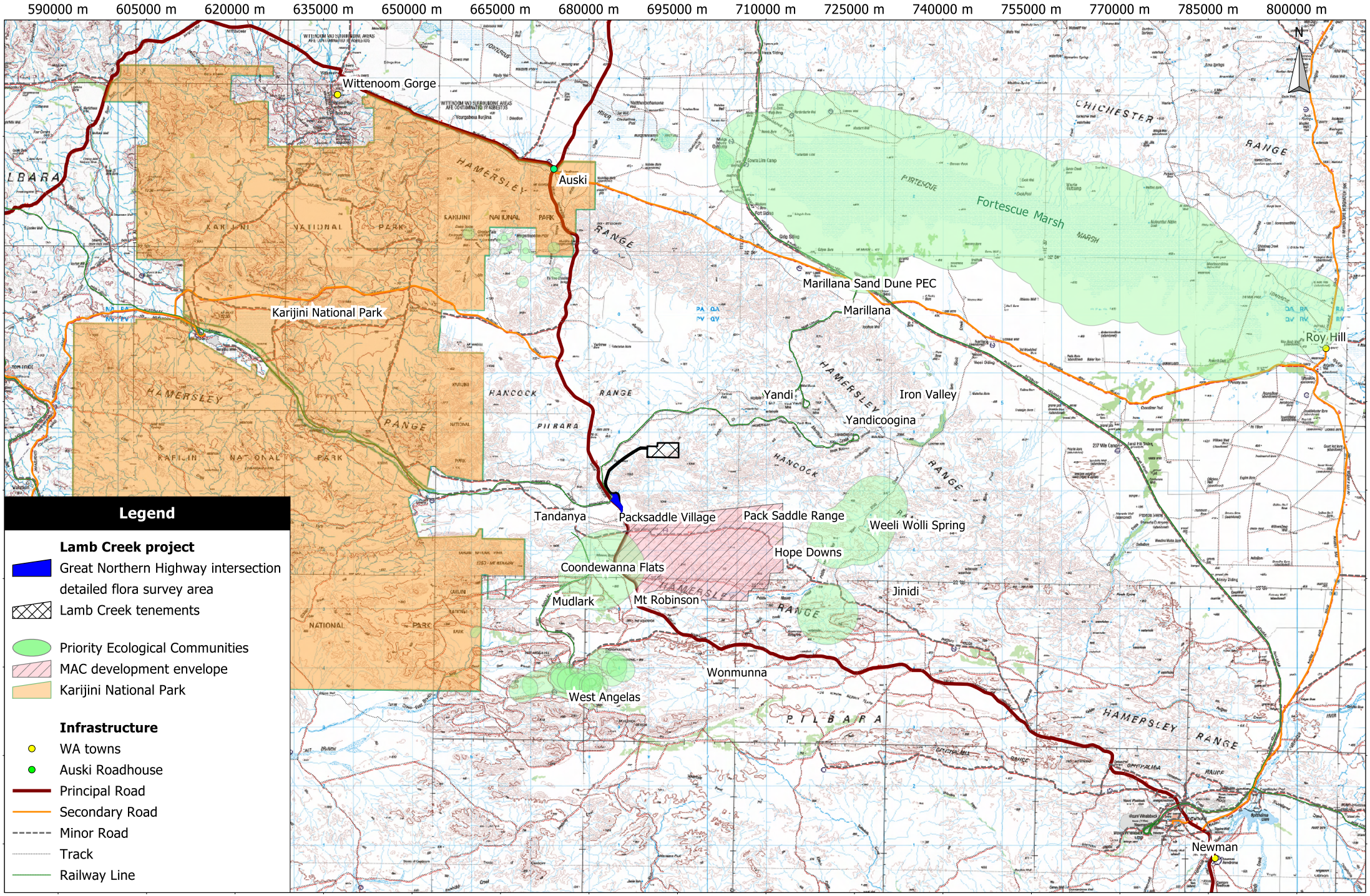
The region has had considerable flora survey effort over the last 20 years predominantly due to flora and vegetation surveys completed within, or partly within, the boundary of the Mining Area C (MAC) Development Envelope between 1997 and 2014. The MAC Development Envelope is approximately 1.3 kilometres south of the survey area (Figure 1.1: Inset Map). The surveys used as part of the literature review are listed in Appendix II and generally occurred within 50 kilometres of the survey area. Figure 3.1 provides regional context.

The conservation significant taxa identified in the desktop were reviewed for likelihood of occurrence within the GNHI survey area, based on the likelihood categories outlined in Table 3.2. Desktop results and likelihood assessment are presented in Appendix II.

Table 3.2 Likelihood assessment criteria

Rank	Criteria
Confirmed	1. The species was recorded on the survey area; or 2. The species was recorded directly adjacent (within 500 m) of the survey area from habitat continuing into the survey area.
Likely to occur	1. There are existing records of the species in close proximity to the survey area (within 20 km); and • the species is strongly linked to a specific habitat, which is present in the survey area; or • the species has more general habitat preferences, and suitable habitat is present.
May potentially occur	1. There are existing records of the species from the region (within 30 km), however: • the species is strongly linked to a specific habitat, of which only a small amount is present in the survey area; or • the species has more general habitat preferences, but only some suitable habitat is present. 2. There is suitable habitat in the survey area, but there are very few or only very old (1999 or before) records from the region.

Rank	Criteria
Unlikely to occur	1. The species is linked to a specific habitat, which is absent from the survey area; or 2. Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or 3. There is some suitable habitat in the survey area, however the species is very infrequently recorded in the locality.
Highly unlikely to occur	1. The species is strongly linked to a specific habitat, which is absent from the survey area; and/or 2. The species' range is very restricted and would not include the survey area.



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Lamb Creek Project

Lamb Creek Iron Ore Project
Great Northern Highway intersection
detailed flora survey (May 2021)

Original Size: A4 Scale: 1:800,000
Datum: MGA94 Zone 50

0 25 km

Figure 3.1

Regional localities

3.2 Field survey

A single-phase detailed flora and vegetation survey was completed by a team of three botanists over a period of six days, from 12 to 17 May 2021. The survey was completed in conjunction with a targeted conservation significant flora survey, as reported in Rapallo (2021). The survey area was accessed by four-wheel drive vehicle using existing tracks and surveyed on foot.

The survey was carried out in a manner consistent with the following documents developed by the Western Australian Environmental Protection Authority (EPA):

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

3.2.1 Quadrats

Nineteen 50 by 50 metre quadrats were sampled, as mapped in Figure 3.2. Quadrats were selected within all vegetation types discernible through aerial photography interpretation, topography, and pre-European vegetation and landform mapping, in combination with on-ground observations. It was noted while in the field that the aerial photograph available was dated, and no longer representative of the vegetation seen on the ground.

The following information was recorded at each quadrat:

- Site name, date, photographs, central GPS coordinate
- Landform, aspect, slope
- Soil type, soil colour
- Rock type, rock cover, rock size
- Vegetation condition rating (as per Table 2 in EPA 2016a)
- Disturbances noted in the area including estimated fire history
- Vascular plant species – including height and approximate foliage cover

3.2.2 Relevés

A single relevé (R01) was sampled within the only patch of *Triodia wiseana* that was large enough to sample (Figure 3.2). Patches dominated by this spinifex species were found throughout the survey area, but were generally too small to sample. Information recorded at the relevé was the same as that recorded for quadrats, but for an unbounded area.

3.2.3 Opportunistic records and field notes

Additional flora taxa were recorded opportunistically while traversing between quadrats, and during the targeted survey. The targeted component of the survey (as reported in Rapallo 2021) involved walking transects across approximately two-thirds of the detailed survey area, which enabled many additional flora records of both conservation significant and common flora taxa.

Preliminary vegetation boundaries were mapped in the field using aerial photographs and GPS waypoints with associated vegetation notes.

3.2.4 Specimen collection and identification

Flora specimens were collected and pressed and as per Western Australian Herbarium (2008) guidelines. Each specimen was assigned a unique field name and field number and was marked with a plant tag containing specimen and location information. All specimens were pressed and dried on the day of collection. Fragile material such as flowers, seed capsules, or very small specimens were sealed in paper bags which were marked as per the plant tags.

Taxonomic identification of flora specimens was completed by Sharnya Thomson-Yates (Table 3.3) with the use of the WA Herbarium reference collection, latest flora identification keys, and recent scientific publications. As per section 7.2 of EPA (2016a) and under flora licence conditions, suitable voucher specimens will be lodged with the Western Australian Herbarium.

3.2.5 Vegetation classification and mapping

Vegetation types of the survey area were classified and mapped using a combination of statistical analysis, manual classification, and field-based observations.

Quadrats were initially grouped into interim vegetation types based on quadrat data collected on species composition, vegetation structure, fire history, landform, soil, rock cover, and site photographs. Next, PATN software was used to group the quadrats based on a statistical measure of similarity of species presence and density. Finally, the grouping of quadrats produced by the PATN analysis was augmented by the interim vegetation types, quadrat data as listed above, and interpretation of aerial photography, in order to derive the final vegetation types.

3.2.5.1 PATN analysis procedure

Statistical analysis to support classification of vegetation types was carried out using PATN software (Belbin 2013). The analysis was completed using data from all 19 survey quadrats. Taxa that were alien were removed from the dataset, and the analysis was conducted using the 149 remaining taxa. The analysis was undertaken using the density code values from the quadrat occurrence records. A two-step association measure was used to classify flora taxa into 13 groups.

A further analysis was done using these groups, which were then refined by removing taxa with Kruskall Wallis values (KW values) lower than 1.0. This resulted in 14 taxa being removed from the analysis. The final association of sites used the Agglomerative Hierarchical Fusion classification strategy, the Flexible UPGMA classification technique and the Bray and Curtis association measure, with beta of -0.1, producing 6 groups of sites. PATN results are presented in section 4.2.5.1 and Figure 4.1.

3.2.5.2 Personnel and licensing

The personnel involved in the field survey, data entry and analysis, and the preparation of this report are listed in Table 3.3. The field survey was conducted under was conducted under Flora Taking (Biological Assessment) Licences FB62000183, FB6200067-3, and FB62000331 pursuant to Regulation 62 of the *Biodiversity Conservation Regulations 2018.* As part of the license conditions, a list of flora and fauna species recorded in the survey will be forwarded to the DBCA.

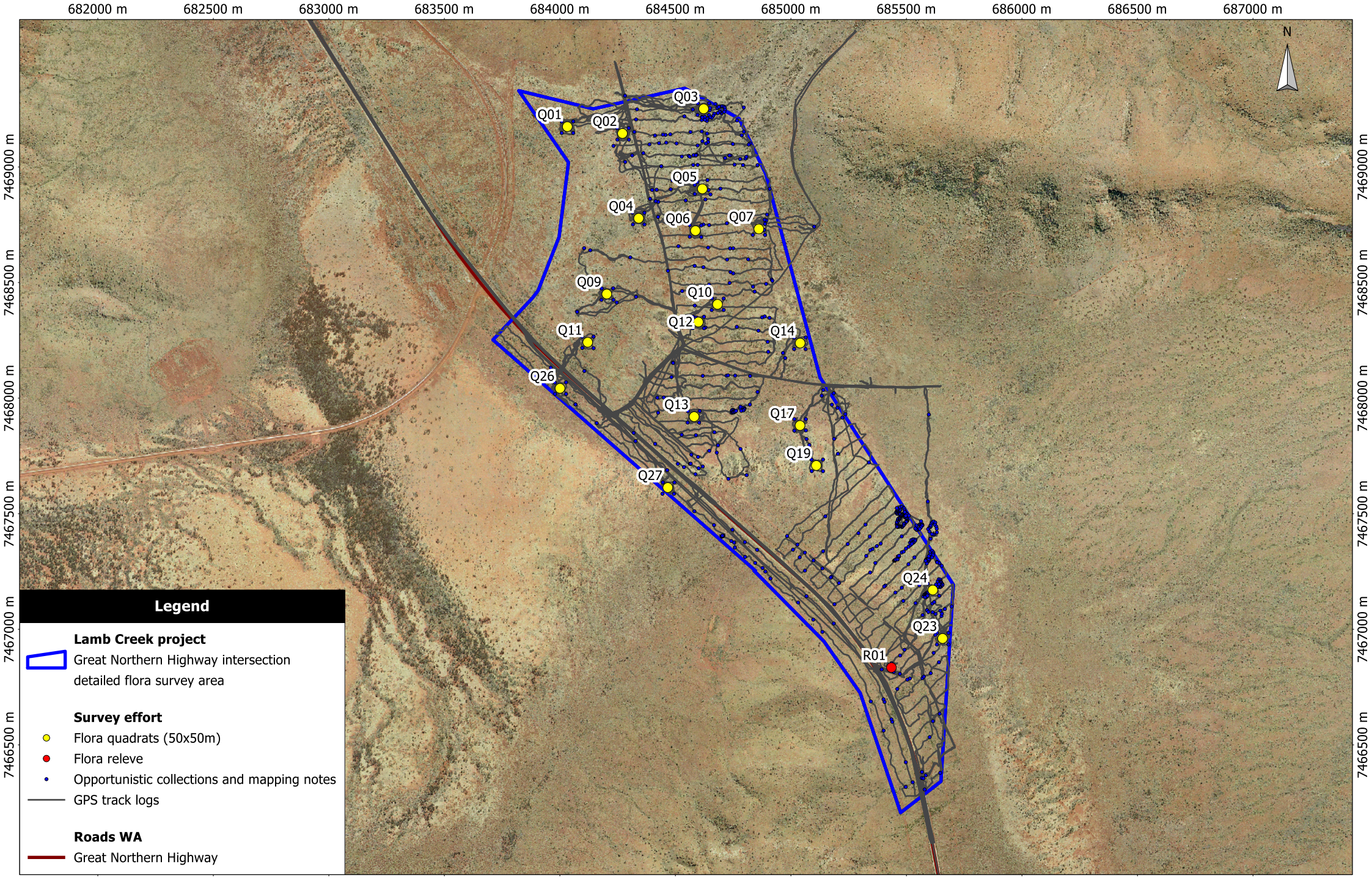
Table 3.3 Personnel

Name	Position	Field work	Taxonomy	Analysis	Reporting
Kate George	Principal Environmental Scientist				•
Marieke Weerheim	Senior Environmental Scientist			•	•
Sharnya Thomson-Yates[1]	Senior Botanist Botanical Taxonomist	•	•		
Linda Dalgliesh[2]	Senior Botanist	•			
Joshua Gilovitz[3]	Senior Botanist Senior Data Analyst	•		•	

Footnotes: 1 = License number FB62000183; 2 = License number FB6200067-3; 3 = License number FB62000331.

3.2.6 Nomenclature and conservation listing

Flora taxonomy and nomenclature follows FloraBase (Western Australian Herbarium 1998). FloraBase was also accessed to verify conservation codes, distribution records, habitat requirements, and flowering times. Conservation codes cited in this report are as per detailed Appendix I. Note that the conservation codes on FloraBase are the most up to date, whereas the DBCA Threatened (Declared Rare) and Priority Flora List (DBCA 2018) was last updated on 5 December 2018.



Rapallo environmental

Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Great Northern Highway intersection
detailed flora survey (May 2021)

Original Size: A4 Scale: 1:20,000
Datum: MGA94 Zone 50
0 800 m

Figure 3.2

Survey effort

4 Results and Discussion

4.1 Desktop results

The desktop study returned 800 vouchered vascular plant taxa (species and sub species) within 40 kilometres of the survey area, representing 252 genera and 79 families. Conservation significant flora, weeds, and conservation significant vegetation are discussed in sections 4.1.1, 4.1.2, and 4.1.3.

4.1.1 Conservation significant flora

The desktop study found 86 significant vascular flora taxa from within 60 kilometres of the Lamb Creek project area. An assessment was completed to estimate the likelihood of occurrence within the Great Northern Highway intersection area for each of these conservation taxa. Desktop results are summarised in Table 4.1 and complete search results and likelihood ranking presented in Appendix II.

Note that the likelihood scores presented in this report are different from those presented in the targeted report (Rapallo 2021), because the latter considered the Lamb Creek project as a whole, while the GNHI survey area covered a small subset of this area containing far fewer habitats. This led to a down-grading of likelihood scores for all taxa for which the GNHI survey area did not contain habitat.

Table 4.1 Summary of Lamb Creek desktop results for conservation significant taxa

Likelihood ranking	Status[1]						Total taxa
	VU[2]	CR[3]	P1	P2	P3	P4	
Confirmed	1			1	2	1	**5**
Likely to occur			1	1	3		**5**
May potentially occur				1			**1**
Unlikely to occur		1	7	11	32	6	**57**
Highly unlikely to occur			5	4	9		**18**
Grand Total	**1**	**1**	**13**	**18**	**46**	**7**	**86**

Footnotes:
1. P = Priority (administered by DBCA; Biodiversity Conservation Act 2016 (BC Act)), VU = Vulnerable, CR = Critically Endangered.
2. Listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and BC Act,
3. Listed BC Act only. Refer to Appendix I for detailed explanation of conservation codes.

Two species listed as vulnerable and critically endangered were returned via the threatened and priority flora database search (DBCA 2021a) and the protected matters search (AWE 2021).

- *Thryptomene wittweri* listed as vulnerable under the BC Act and EPBC Act was assessed as unlikely to occur due to habitat requirements and distance of records from the survey area (>20 kilometres). This species is not discussed further in this report.
- *Seringia exastia* listed as critically endangered under the BC Act is. However, this taxon is only listed as a result of a taxonomic revision and is likely to be delisted (section 4.2.2.

Most records were DBCA listed priority flora taxa and the greater majority (87%) were ranked as unlikely to highly unlikely to occur within the survey area (Appendix II). These taxa are not discussed further in this report. Five conservation significant taxa were confirmed to occur within the Great Northern Highway intersection area during the targeted flora survey (section 4.2.2). Conservation significant taxa recorded

in the Lamb Creek project area are discussed in detail in the targeted survey report (Rapallo 2021), with the discussion not repeated in this report.

4.1.2 Introduced flora (weeds)

4.1.2.1 Weed classification in Western Australia

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) categorises the weeds of Western Australia into four main classifications:

- Declared Pests (under Section 22 of the Act);
- Permitted (under Section 11 of the Act);
- Prohibited (under Section 12 of the Act); and
- Permitted requiring a permit (Section 73, BAM Regulations 2013).

Under the BAM Act all declared plant pests are placed in one of three categories:

- C1 (Exclusion) — Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State;
- C2 (Eradication) — Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still feasible; and
- C3 (Management) — Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size.

Fifteen introduced taxa have been identified by DBCA as 'Priority Alerts' for the Pilbara region, including **Azadirachta indica, *Calotropis procera, *Chloris gayana, *Clitoria ternatea, *Cryptostegia grandiflora, *Cylindropuntia spp., *Euphorbia tirucalli, *Jatropha gossypifolia, *Lantana camara, *Moringa oleifera, *Ricinus communis, *Schinus molle var. areira, *Vachellia nilotica, *Washingtonia robusta and *Xanthium strumarium* (DPaW 2014). None of these taxa were recorded during the survey.

4.1.2.2 Weeds identified in the desktop study

The desktop study identified forty-nine introduced taxa from the vicinity of the survey area, as presented in Appendix III. The greater majority of weeds recorded in the desktop were listed as Permitted – s11, with one weed (**Argemone mexicana*) listed as Declared Pest (Prohibited) – s12 category C2 (Eradication) under the *Biosecurity and Agriculture Management Act 2007* (DAFWA 2021).

No Weeds of National Significance (WONS) were returned from the desktop search (Centre for Invasive Species Solutions 2021).

4.1.3 Conservation significant vegetation

The survey area is not located within a known TEC or PEC. The nearest known PEC is subtype 2 of the Coolibah-Lignum Flats vegetation community, with the edge of the buffer zone located less than five kilometres south of the survey area (DBCA 2021b) as shown in Figure 3.1.

The Coolibah-Lignum Flats vegetation complex is described as: Woodland or forest of *Eucalyptus victrix* (coolibah) over thicket of *Duma florulenta* (lignum) on red clays in run-on zones. Associated species include *Eriachne benthamii*, *Themeda triandra*, *Aristida latifolia*, *Eulalia aurea* and *Acacia aneura* (DBCA 2021d).

Three sub-types have been identified, of which sub-type 2 occurs near the project with the edge of the buffer zone less than five kilometres from the southern edge of the survey area (Figure 3.1).

1. Coolibah and mulga (*Acacia aneura*) woodland over lignum and tussock grasses on clay plains (Coondewanna Flats and Wanna Munna Flats) – Priority 3
2. Coolibah woodlands over lignum (*Duma florulenta*) over swamp wandiree (Lake Robinson is the only known occurrence) – Priority 1
3. Coolibah woodland over lignum and silky browntop (*Eulalia aurea*); two occurrences known on Mt Bruce Flats – Priority 1

A detailed flora and vegetation survey of the Lamb Creek project completed in 2012 (Rapallo 2012) concluded that the Coolibah-Lignum Flats PEC is unlikely to occur in the survey area because neither Coolibah (*E. victrix*) nor lignum species were recorded.

Onshore (2013b) reviewed vegetation mapping within Coodewanna Flats and Lake Robinson and confirmed fine-scale mapping for the two sub-types of the Coolibah-lignum Flats. Onshore (2013b) concluded that the Priority 1 sub-type 2 lies at the lowest point of the Coondewanna Flats associated with Lake Robinson, and the Priority 3(i) sub-type 1 occurs on alluvial flats (Coondewanna Flats) around Lake Robinson, to the south and found that the Great Northern Highway divides the PEC to the west from the MAC Development Envelope MAC. Based on the Onshore (2013b) mapping, the PEC occurs ca. 12 kilometres to the south of the survey area.

4.2 Field survey results

4.2.1 Flora taxa recorded during the survey

The survey recorded 187 flora taxa from 35 different families, as presented in Appendix IV. These included 178 native taxa and nine introduced taxa (weeds: section 4.2.3). The most well-represented families were Poaceae (40 taxa), Fabaceae (37 taxa), and Malvaceae (16 taxa).

Of the 187 flora taxa recorded, 26 taxa (14%) were annuals, 18 (10%) were annual or short-lived perennial, 131 (70%) were perennials. Twelve taxa (6%) did not have life cycle information available. The full list of taxa is presented in Appendix IV.

Five conservation significant flora taxa were recorded from the Great Northern Highway intersection area during the targeted. These are discussed in detail in Rapallo (2021) and briefly described in section 4.2.2.

A list of quadrat locations is presented in Appendix V and quadrat data is provided in Appendix VI.

4.2.2 Conservation significant flora

Five conservation significant flora taxa were recorded from the Great Northern Highway intersection area during both the detailed and targeted survey, as listed in Table 4.2. Conservation significant flora are described and mapped in detail in the targeted flora survey report (Rapallo 2021).

The desktop study identified eleven conservation significant flora taxa that were considered likely or highly likely to occur in the survey area, based on proximity of records and availability of habitats in the survey area (section 4.1.1, Appendix II).

The vegetation types of the survey area (section 4.2.5) all comprised varieties of acacia and/or mulga (*Acacia aptaneura*) woodland over either spinifex (*Triodia* spp.), mixed tussock grasses, or a combination thereof, located on a flat or gently sloping plain. The limited habitat information provided for the conservation significant taxa identified in the desktop did not allow a distinction in likelihood scores between the vegetation types recorded within the GNHI survey area. Hence, the likelihood assessment presented in Appendix II refers to the survey area as a whole.

Table 4.2 Conservation significant flora taxa recorded during the survey

Taxon	Conservation status	Locations recorded per vegetation type							
		A	B	C	D	E	F	X	O
Aristida lazaridis	Priority 2	9	28	38	196			1	31
Rhagodia sp. Hamersley (M. Trudgen 17794)	Priority 3		4	11					
Goodenia nuda	Priority 4				1				
Seringia exastia	Critically Endangered							2	
Euphorbia aff. *ferdinandi*	Potentially undescribed			3	1				

The most commonly recorded conservation significant taxon was *Aristida lazaridis* (Priority 2) which is species of grass recorded throughout vegetation types A and D. Numbers in Table 4.2 above refer to the number of locations this grass was recorded in 2021, not the total number of plants.

Seringia exastia is only listed as a results of a taxonomic revision, which merged a common and a restricted species. DBCA communications (24/08/2021) confirmed that the species is "considered common and widespread" and likely to be delisted in the future.

4.2.3 Introduced flora taxa (weeds)

Nine introduced flora taxa (weeds) were recorded during the survey, these are listed in Table 4.3 below. The weeds were recorded in five of the six vegetation types identified during the survey, as well as from disturbed areas and outside of the survey area. The greater majority of weed records were from vegetation type B which occurred on a gently sloping drainage plain intersected by minor creek lines.

Table 4.3 Weeds recorded during the survey

Taxon	WAOL status	Locations recorded per vegetation type							
		A	B	C	D	E	F	X	O
**Aerva javanica*	Permitted - s11		1						
**Bidens bipinnata*	Permitted - s11	1	6	2	6			1	
**Stylosanthes hamata*	Permitted - s11				1				
**Malvastrum americanum*	Permitted - s11		11	2				2	
**Cenchrus ciliaris*	Permitted - s11	1	25	1		1		1	1
**Cenchrus setiger*	Permitted - s11		10	1					1
**Melinis repens*	Permitted - s11	1							
**Portulaca oleracea*	Permitted - s11	1	2	5	1				
**Solanum lasiophyllum*	Permitted - s11	1	3	2					

The most frequently recorded weed was **Cenchrus ciliaris* (buffel grass) which was recorded from three quadrats as well as opportunistically across the survey area from four different vegetation types. Vegetation types A, B, and C were the most heavily affected, especially type B which supported seven different weed species recorded from a total of 58 locations.

4.2.4 Flora of other significance

Flora species, subspecies, varieties, hybrids, and ecotypes may be considered significant for reasons other than listing as a Threatened or Priority flora taxon. This may include, but is not limited to, range extensions, keystone species, relic status, local endemism and anomalous features (EPA 2004). Based on these features, *Euphorbia* aff. *ferdinandi* recorded during the survey may be considered flora of "other" significance, as it represents a potentially undescribed species with unknown and potentially restricted distribution range. This taxon is discussed in Rapallo (2021).

4.2.5 Vegetation of the survey area

The vegetation across the survey area generally comprised low open woodland to isolated trees dominated by mulga (*Acacia aptaneura*) or other acacia species, over an understorey of either spinifex, tussock grasses, or a combination thereof, on a flat to gently sloping clay-loam plain. The dominant spinifex species was *Triodia pungens*, however patches dominated by *Triodia wiseana* occurred throughout the southern part of the survey area, with some patches large enough to be mapped.

The vegetation of the survey area has been affected by fire, as visible on the ground during the survey, and supported by NAFI data which maps the entire survey area as having been burnt in 2015 (NAFI 2021). Disturbance notes taken during the survey indicated that fire killed between 5% and 90% of (tall) shrubs and trees in the area. Comparison of vegetation data recorded in 2012 over a subset of the current survey area , as well as direct field observations noting many burnt trees and shrubs, strongly indicate that the 2015 fire has altered vegetation structure and composition of the survey area. This was further supported by comparison of vegetation structure and boundaries visible on the ground, with those shown on the available aerial photographs of the survey aera, which were taken pre-fire (2009 and 2013).

The absence of a recent aerial photograph presented a limitation with respect to both survey planning and vegetation mapping, as the vegetation visible on the aerials no longer reflected the actual vegetation on the ground. Vegetation mapping therefore relied heavily on field notes, photographs, and associated GPS coordinates.

Vegetation condition across the survey area varied from Very Good to Degraded (EPA 2016a: Table 2), with the greater majority of the quadrats ranked as Good (Appendix VI).

4.2.5.1 PATN classification of quadrats

The PATN analysis results in six quadrat groups, as presented in Figure 4.1. The grouping derived by PATN aligned well with manual classification of the sites, as outlined in Table 4.4. PATN groups 5 and 6 were manually combined into vegetation type D, based on floristic composition, land form, and site photos.

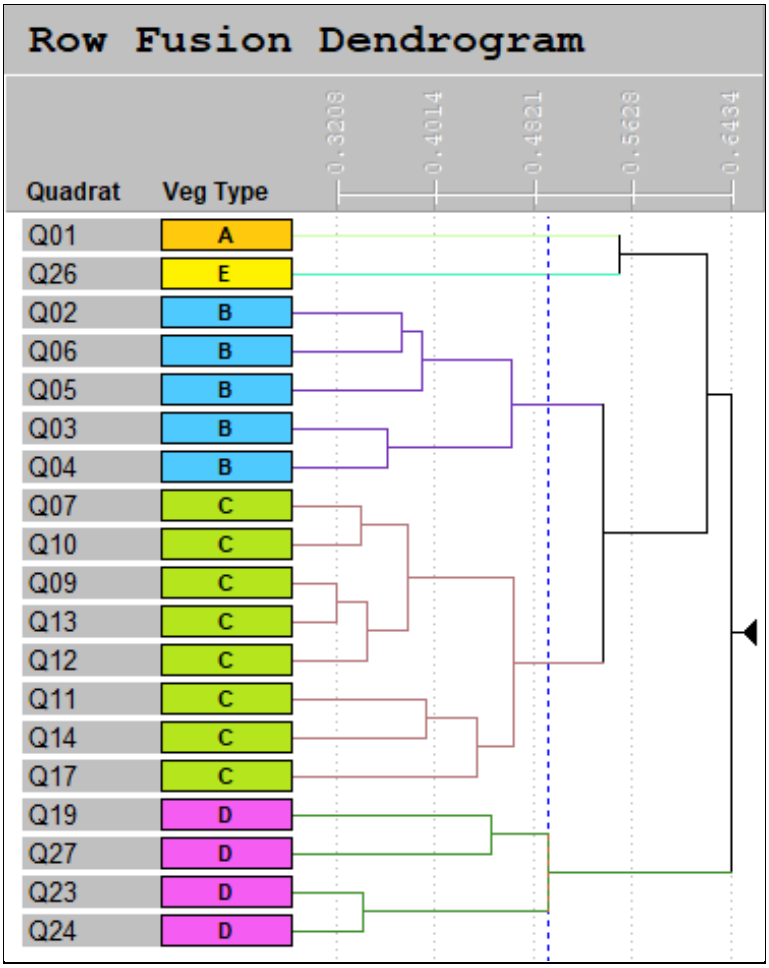


Figure 4.1 PATN dendrogram

Table 4.4 Comparison of PATN results with manual classification of vegetation types

PATN group	Vegetation types	Sites
1	Vegetation type A	Q01
2	Vegetation type E	Q26
3	Vegetation type B	Q02, Q03, Q04, Q05, Q06
4	Vegetation type C	Q07, Q09, Q10, Q11, Q12, Q13, Q14, Q17
5	Vegetation type D	Q19, Q27
6	Vegetation type D	Q23, Q24
n/a	Vegetation type F	R01

4.2.5.2 Vegetation types

Six vegetation types were mapped and described across the survey area, as summarised in Table 4.5 and mapped in Figure 4.2. The vegetation types of the survey area are described in detail in Table 4.6.

The vegetation types across the survey area were assessed as having moderate significance, based on criteria outlined in Appendix VII. This ranking was primarily due to the Priority 2 listed grass *Aristida lazaridis*, which was recorded in high numbers across the survey area, especially in vegetation type D, and also in types C, B, and A. Refer to Rapallo (Rapallo 2021) for further details on *Aristida lazaridis* populations within the survey area.

Table 4.5 Summary of vegetation types

Code	Vegetation type	Landform	Area (ha)
A	Low open *Eucalyptus gamophylla* woodland over *Triodia melvillei and T. pungens* on stony plain	Stony plain	39 ha
B	Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	Gently sloping clay-loam plain with minor drainage channels and surface drainage	49 ha
C	Mulga and acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	Clay-loam plain	84 ha
D	Mulga, *Hakea lorea*, and *Eucalyptus xerothermica* low open woodland over closed tussock grassland on gently sloping clay-loam plain (no rocks)	Gently sloping clay-loam plain without rocks	51 ha
E	Low mulga woodland over sparse understorey on stony plain	Flat stony plain	9 ha
F	*Triodia wiseana* hummock grassland with emergent shrubs and low trees on gently sloping stony plain	Gently sloping stony plain	4 ha
X	(not a vegetation type)	Disturbed / cleared / road	20 ha

Table 4.6 Vegetation types of the survey area

Type	Vegetation description	Photo
A	**Low open *Eucalyptus gamophylla* woodland over *Triodia melvillei* and *T. pungens* on stony plain** Description: *Eucalyptus gamophylla* (mallee) and *Corymbia deserticola* subsp. *deserticola* low open woodland; over *Acacia pruinocarpa*, *A. ancistrocarpa*, *A. atkinsiana* sparse shrubland; over isolated low shrubs; over isolated dwarf shrubs; over *Ptilotus calostachyus*, *Ptilotus obovatus*, *Trichodesma zeylanicum* var. *zeylanicum* sparse forbland; over *Triodia melvillei* and *Triodia pungens* sparse hummock grassland. Extent and landform: This vegetation type covers 38 hectares (15%) of the survey area. It occurs in the north-western part of the survey area, and along the Great Northern Highway. Vegetation type A falls primarily within the Boolgeeda land system. It occurs on a flat stony plain over a red-brown clay-loam plain. Rock cover is high, at approximately 90%. Quadrats: Q05 Vegetation condition: Good Disturbances: Tracks, clearing, recent fire, weeds Conservation significant flora: *Aristida lazaridis* (P2) Weeds: **Bidens bipinnata*, **Cenchrus ciliaris*, **Melinis repens*, **Portulaca oleracea*, **Solanum lasiophyllum* Significance: Local, Moderate	 **Site Q01** (Condition: Good)

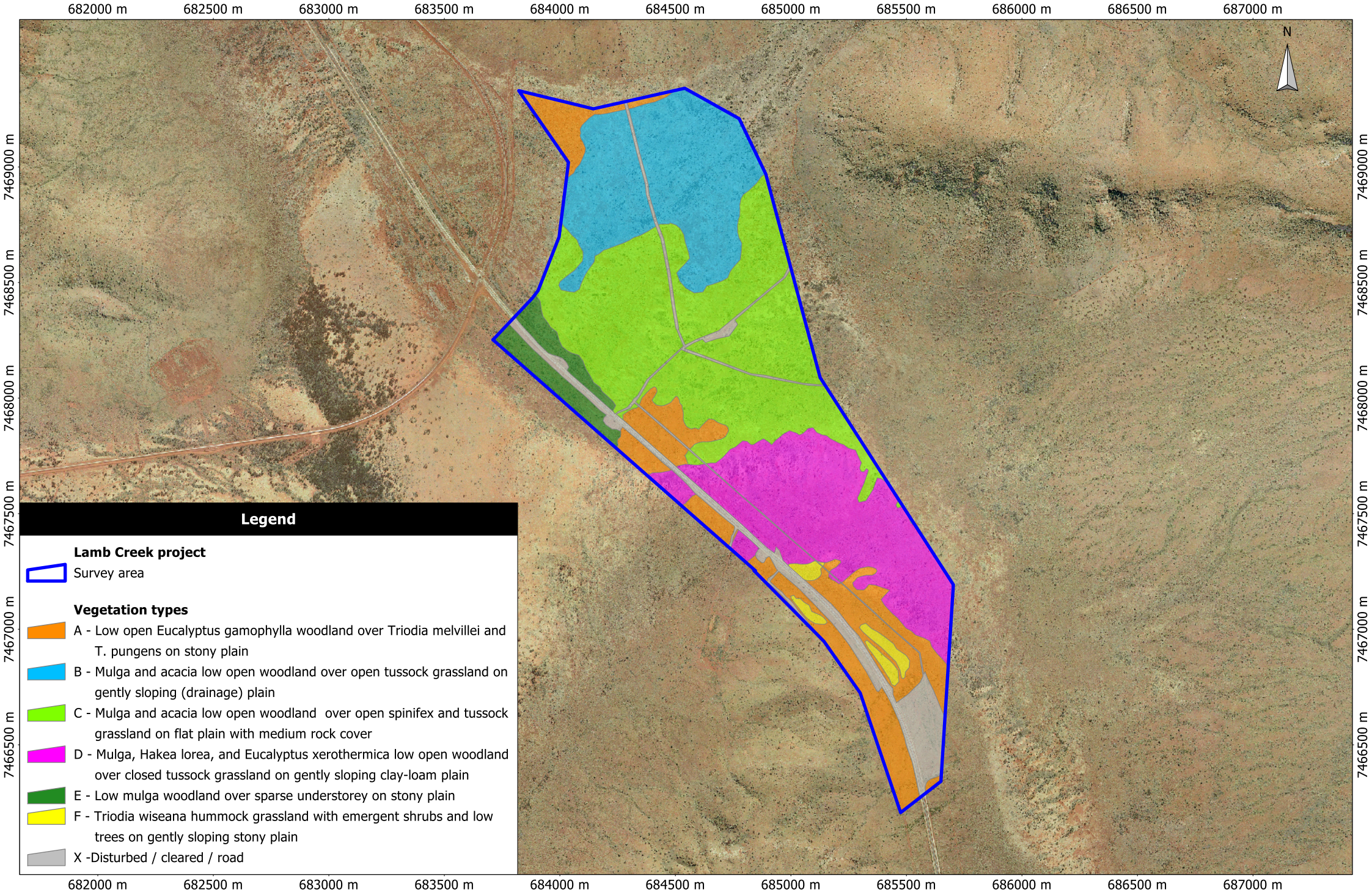
Type	Vegetation description	Photo
B	**Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover** Description: *Acacia aptaneura* and *A. pruinocarpa* low open woodland; over sparse tall shrubland including *Eremophila longifolia* and *Santalum lanceolatum*; over mixed isolated shrubs to sparse shrubland; over isolated forbs to open forbland dominated by *Pterocaulon sphacelatum*, *Ptilotus obovatus*, and *Arivela viscosa*; over sparse to medium-dense tussock grassland dominated by *Aristida inaequiglumis*, *A. contorta* and *Themeda triandra*. Extent and landform: Covers 49 hectares (19%) of the survey area. It occurs in the north of the survey area, on flat to gently sloping drainage plain, within the Boolgeeda land system. It is intersected by minor drainage lines, with mulga vegetation becoming denser along drainage lines. Soils are red-brown clay loam with generally low rock cover (2-10%) but with some areas of very high rock cover (90%). Quadrats: Q02, Q03, Q04, Q05, Q06 Vegetation condition: Good to Degraded Disturbances: Fire has killed on average 50% of trees and tall shrubs. Weeds. Conservation significant flora: *Aristida lazaridis* (P2), *Rhagodia* sp. Hamersley (P3) Weeds: **Aerva javanica*, **Bidens bipinnata*, **Malvastrum americanum*, **Cenchrus ciliaris*, **Cenchrus setiger*, **Portulaca oleracea*, **Solanum lasiophyllum*. Significance: Local, Moderate	 **Site Q04** (Condition: Good)  **Site Q05** (Condition: Good)

Type	Vegetation description	Photo
C	**Mulga and acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover** Description: *Acacia aptaneura*, *A. pruinocarpa* low open woodland with occasional *Corymbia deserticola*; over isolated tall shrubs to sparse tall shrubland dominated by *Hakea lorea* subsp. *lorea*, *Acacia elachantha*, *A. aptaneura*, *A. pruinocarpa*, *Santalum lanceolatum*; over isolated medium to dwarf shrubs; over sparse forbland dominated by *Pterocaulon sphacelatum*, *Arivela viscosa*, *Ptilotus obovatus*; over *Triodia pungens* and *T. melvillei* open hummock grassland, with *Themeda triandra*, *Aristida inaequiglumis*, and *A. contorta* open tussock grassland. Extent and landform: The most common vegetation type, covering 84 hectares (33%) of the survey area. Flat clay-loam plain with medium (10-60%) rock cover. This vegetation type occurs primarily in the Boolgeeda land system, with a minor extent in the Wannamunna land system. Quadrats: Q07, Q09, Q10, Q11, Q12, Q13, Q14, Q17 Vegetation condition: Good (one quadrat rated Very Good) Disturbances: Fire has killed 10-50% of tall shrubs and trees. Conservation significant flora: *Aristida lazaridis* (P2), *Rhagodia* sp. Hamersley (P3) *Euphorbia* aff. *ferdinandi* (potentially undescribed) Weeds: **Bidens bipinnata*, **Malvastrum americanum*, **Cenchrus ciliaris*, **Cenchrus setiger*, **Portulaca oleracea*, **Solanum lasiophyllum* Significance: Local, Moderate	 **Site Q07** (Condition: Good)  **Site Q17** (Condition: Good)

Type	Vegetation description	Photo
D	**Mulga, *Hakea lorea*, and *Eucalyptus xerothermica* low open woodland over closed tussock grassland on gently sloping clay-loam plain (no rocks)** Description: Low open woodland of *Acacia aptaneura*, *Hakea lorea* subsp. *lorea*, and *Eucalyptus xerothermica*; over isolated tall to dwarf shrubs; over sparse forbland to isolated forbs dominated by *Pterocaulon sphacelatum*; over closed tussock grassland dominated by *Themeda triandra*, with *Aristida inaequiglumis* and *A. contorta*. Extent and landform: Covers 51 hectares (20%) of the survey area, occurring only within the Wannamunna land system, with vegetation boundaries closely matching the land system boundaries. Flat clay-loam plain without rocks. Quadrats: Q19, Q23, Q24, Q27 Vegetation condition: Good Disturbances: Fire has killed on average 50% of trees and tall shrubs. Conservation significant flora: *Aristida lazaridis* (P2), *Goodenia nuda* (P4), *Euphorbia* aff. *ferdinandi* (potentially undescribed. Weeds: **Bidens bipinnata*, **Portulaca oleracea*, **Stylosanthes hamata* Significance: Local, Moderate	 **Site Q19** (Condition: Good)  **Site Q23** (Condition: Good)

Type	Vegetation description	Photo
E	**Low mulga woodland over sparse understorey on stony plain** Description: *Acacia aptaneura* low mulga woodland; over *Acacia pachyacra* and *A. ?sibirica* sparse shrubland; over isolated dwarf shrubs; over isolated forbs and ferns; over *Digitaria ammophila*, *Chrysopogon fallax*, *Aristida inaequiglumis* sparse tussock grassland. Extent and landform: Covers 9 hectares (4% of the survey area). Flat stony plain with high (90%) rock cover on red-brown clay loam. Occurs in the western part of the survey area, along the Great Northern Highway, within the Boolgeeda land system. Quadrats: Q26 Vegetation condition: Good Disturbances: Fire, some evidence of clearing Conservation significant flora: None Weeds: **Cenchrus ciliaris* Significance: Negligible	 **Site Q26** (Condition: Good)
F	***Triodia wiseana* hummock grassland with emergent shrubs and low trees on gently sloping stony plain** Description: *Corymbia hamersleyana* and *Corymbia deserticola* subsp. *deserticola* isolated low trees; over isolated tall shrubs; over *Acacia ancistrocarpa* and mixed *Acacia* spp. sparse shrubland; over isolated dwarf shrubs; over isolated forbs; over *Triodia wiseana* hummock grassland. Extent and landform: Occurs across in patches throughout the survey area on a gentle sloping stony plain with high (80%) rock cover. Patches large enough to map cover a combined area of 4 hectares (1%) of the survey area, but the actual extent is greater than this. Quadrats: None. Represented only by relevé R01. Vegetation condition: Good Disturbances: Fire, berms, rubbish from highway, intersected by cleared areas. Conservation significant flora: None (patches too small) Weeds: None (patches too small) GDV indicator species: None Significance: Negligible	 **Site R01** (Condition: Good)

Type	Vegetation description	Photo
X	**Disturbed / cleared / road** Description: this is not a vegetation type. It includes roads, completely cleared or heavily disturbed areas, and areas with regrowth or revegetation of native species. It covers 20 hectares (8%) of the survey area. Conservation significant flora: *Seringia exastia* (CR), *Aristida lazaridis* (P2) Weeds: **Bidens bipinnata*, **Malvastrum americanum*, **Cenchrus ciliaris*	(no photo)
Vegetation Types were ranked for significance (High, Moderate, Low or Very Low) according to the criteria in Appendix VII		



Rapallo environmental

Mineral Resources Limited
Lamb Creek Project

Lamb Creek Iron Ore Project
Great Northern Highway intersection
detailed flora survey (May 2021)

Original Size: A4 Scale: 1:20,000
Datum: MGA94 Zone 50
0 800 m

Figure 4.2

Vegetation types recorded in the survey area

4.2.6 Listed conservation significant vegetation

None of the vegetation types listed Table 4.5 and described in Table 4.6 aligned with listed PEC for the Pilbara region (DBCA 2021d). Neither Coolibah nor species of lignum were recorded in the survey area, supporting supports conclusions from (Rapallo 2012) and the desktop (section 4.1.3) that the Coolibah-Lignum flats PEC does not intersect the survey area.

4.2.7 Locally significant vegetation

Vegetation may be of significance for reasons other than a listing as a TEC or a PEC. This may include, although is not limited to, scarcity, combination of species, role as a refuge, restricted distribution and vegetation extent being below a threshold level (EPA 2004).

Local significance can be determined where a vegetation type is confined to a specialised habitat and/or landform that is not common in the local area or the vegetation types are supporting conservation significant species or groundwater dependent species.

Vegetation types retaining less than 30% of their pre-European extent generally experience accelerated species loss at an ecosystem level (EPA 2000) and are regarded as being 'vulnerable', while vegetation types retaining less than 10% of their original extent are regarded as being 'endangered' (EPA 2000, 2016b, Shepherd *et al.* 2002, DER 2014a).

The Hamersley 18 and Hamersley 82 vegetation system-associations intersected by the survey still have close to 100% of their original extent remaining, and would be considered 'least concern' (DER 2014a).

No vegetation considered to provide refugia for flora taxa (for example, vegetation associated with gorges or seepage areas), or otherwise providing an important function required to maintain ecological integrity of a significant ecosystem (as defined by EPA 2016a) was recorded in the survey area.

4.2.7.1 Mulga Vegetation on Floodplains

Mulga (species in the *Acacia aneura* complex) is widespread across arid and semi-arid regions of Western Australia, covering approximately 37 percent of the surface area of Western Australia (Fox 1980). Grove-intergrove Mulga communities of the eastern Hamersley range are considered as "ecosystems at risk" by (Kendrick 2001) because it is thought that sensitivity to disturbance is greatest at the northern limit mulga's distribution (Fox 1980), related to the dominant summer rainfall pattern of the Pilbara (Fox 1980, Kendrick 2001, Maslin & Reid 2012).

Kendrick (2001) lists a number of 'ecosystems at risk' including grove/inter-grove mulga of the eastern Hamersley range, and 'valley floor mulga' within the Hamersley IBRA subregion. Given the lack of detail provided by Kendrick, it is not possible to determine if the mulga vegetation at Lamb Creek match the mulga ecosystems at risk. However, vegetation types B, C, D and E (Table 4.6) do contain *Acacia aptaneura* as dominant upper storey on stony or clay plains and floodplains, which matches the broad description of 'valley floor mulga'.

Regionally, (Biota 2014) consider "valley floor mulga" to extend over a range of approximately 350 kilometres through the southern half of the Pilbara (Biota, unpublished data, cited in Biota 2014) and Onshore (2017) conclude that mulga vegetation of *Acacia catenulata* subsp. *occidentalis* and *Acacia aptaneura* that aligns with valley floor mulga' on the MAC Development Envelope is common on plains between Newman and Roy Hill (approximate range 150 kilometres).

Onshore (2017) concluded that seven other vegetation associations within BHP Billiton Iron Ore's consolidated vegetation mapping database support *Acacia catenulata* subsp. o*ccidentalis* and *Acacia aptaneura* as dominant upper storey components, and are considered to be closely affiliated with the mulga communities recorded on the lower stony plains of the MAC development area. As such Onshore (2017) does not considered the mulga communities within the MAC Development Area to be locally endemic or unique.

Neither the vegetation association nor related ecosystem of "valley floor mulga" has been nominated as a PEC by DBCA since identified as an ecosystem at risk by Kendrick (2001b) suggesting a low level of perceived conservation significance.

4.2.7.2 Vegetation supporting conservation significant species

Irrespective of whether the vegetation types of the survey area align with mulga vegetation as identified by (Kendrick (2001b) (section 4.2.7.1), vegetation types A, B, C and D are considered locally significant due to supporting the Priority 2 listed grass *Aristida lazaridis*, as well as other conservation significant species. For further information on conservation listed species refer to Rapallo (Rapallo 2021). Vegetation types A, B, C, and D are regarded as moderate significance, and types E and F as negligible significance, based on the criteria presented in Appendix VII,

4.2.8 Watercourses and groundwater dependent vegetation

No groundwater dependent taxa were recorded during the survey.

4.3 Survey adequacy and limitations

4.3.1 Level of assessment and survey timing

The flora survey was conducted in accordance with EPA (2016a) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, and conformed to requirements for a single-season detailed flora survey.

Survey level and timing were as per client request. Survey timing was primarily aimed to intercept the flowering period of several conservation significant taxa identified in the desktop and recorded during previous surveys of the Lamb Creek project. The survey period of May 2021 aligned with the recommended timing for vegetation surveys in the Eremaean Botanical Province, and fell within the primary survey period (EPA 2016a).

4.3.2 Survey completeness

To provide an indication of survey completeness of the detailed flora survey, the software program EstimateS (Version 9.1.0) (Colwell 2013) was used to generate species accumulation curves and to calculate predicted species richness. Species accumulation curves represent a theoretical model of the relationship between survey effort and species accumulation: as the number of quadrats increases, the accumulation of flora taxa decreases until the curve reaches an asymptote (Gotelli & Colwell 2011).

Since models can only be generated from data collected through systematic methods, the species accumulation curve and predicted species richness could only be calculated from quadrat data. Analyses were conducted on presence-absence data from the quadrats (152 taxa from 19 quadrats), using the default settings, with the following exceptions:

- Accumulations (runs) were randomised 1,000 times without replacement.
- Upper abundance limit for rare or infrequent species was set to 5.

The species accumulation curve is presented in Figure 4.3, plotting number of flora taxa (y-axis) against the number of quadrats surveyed (x-axis). Observed species richness is presented as a sample-based rarefaction curve, computing the mean expected number of flora taxa (S(est)) over all possible combinations of 1, 2, and up to 19 quadrats (Colwell *et al.* 2012). Predicted species richness was calculated by taking the average of the estimators ICE, Chao 2, Jackknife 1, and Jackknife 2.

Predicted species richness was 185 taxa, which indicates that 82% of the (estimated) total flora taxa present in the survey area were recorded in the quadrats. This is reflected in the species accumulation curve, which after 19 quadrats is approaching an asymptote (Figure 4.3).

Opportunistic collections and relevé data yielded an additional 35 taxa not recorded in quadrats, hence the actual number of taxa recorded (187 taxa) exceeds the predicted total. Since predicted species richness calculated by EstimateS is based on quadrat data, and cannot take into account opportunistic and relevé records, the predicted number of 185 taxa appeared to be a slight underestimation of the actual species richness in the survey area.

The fact that 19% of the taxa recorded during the survey were from opportunistic collections rather than quadrats supports the observation that not all vegetation types of the survey area were adequately sampled (see Table 4.4, and section 4.3.3 and 4.3.4), with types A and E only represented by a single quadrat, and type F only sampled by a single relevé.

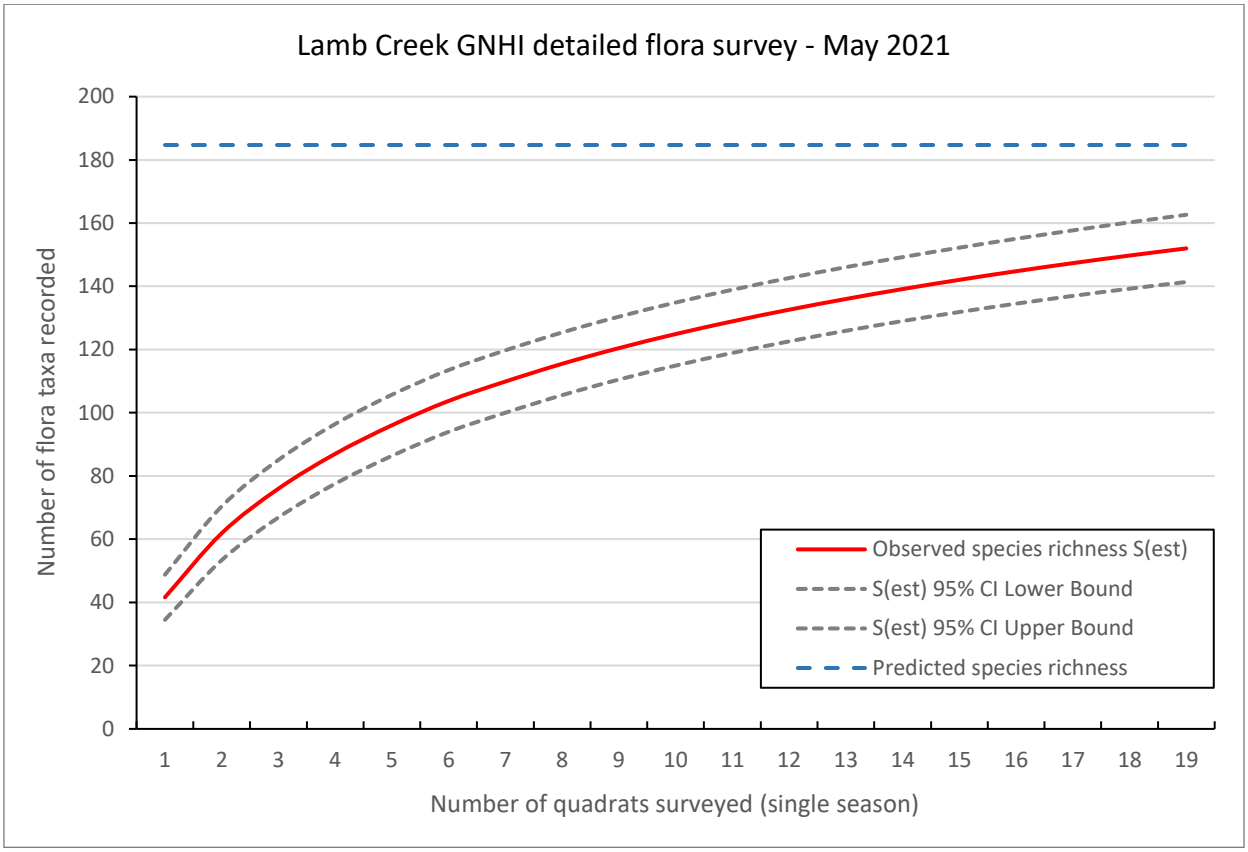


Figure 4.3 Species accumulation curve based on presence-absence quadrat data

In summary, although the survey effort appeared to have been adequate to sample the flora species richness present in the survey area at the time of survey, additional quadrats are expected to improve vegetation type classification and mapping.

4.3.3 Assessment against EPA technical guidance

The detailed flora and vegetation survey was conducted in accordance with Environmental Protection Authority (EPA) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* and aligned with criteria for a detailed flora survey (EPA 2016a). An assessment of the survey against EPA criteria for detailed flora and vegetation surveys, and for quadrat sampling, is provided in Table 4.7.

Table 4.7 Assessment of the survey against EPA technical guidance

EPA (2016a) criteria for detailed flora surveys	Survey met EPA criterion	Details
Surveys should be conducted during optimal survey timing for the botanical province.	Yes	The survey was completed in May 2021 which in the Pilbara is the post-wet season and is the primary survey season for the Eremaean botanical province.
Adequate survey may necessitate multiple sampling events in the same season or in different seasons.	No	The survey was completed during a single season. Additional surveys during the supplementary survey period (after winter rainfall) are likely to yield additional taxa.
Where desktop results indicate that there is insufficient local and regional	Yes	Sufficient local and regional information is available.

EPA (2016a) criteria for detailed flora surveys	Survey met EPA criterion	Details
information, the survey must extend beyond the proposal area.		
Interpretation of vegetation boundaries and selection of sampling sites should be conducted with the use of aerial photography at 1:10,000 – 1:40,000 scale.	No	The aerial photograph available was of 1:80,000 scale and not recent enough to enable accurate interpretation of vegetation boundaries.
Quadrats should be placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression, and soil type, as well vegetation structure, composition, and condition.	Yes	Quadrats were positioned at representative locations within preliminary vegetation types identified at the time of survey.
Quadrats should be positioned to avoid the boundary or transition zone between vegetation units and to minimise the influence of edge effects.	Yes	Quadrats were positioned away from vegetation boundaries.
Where possible, quadrats should be located in intact mature vegetation and in areas of best condition.	Yes	The entire survey area was affected by fire, and it was not possible to avoid these areas. Quadrats were positioned in the best quality representative areas within.
Survey design should consider disturbance events (such as fire)	Yes	Disturbances were present throughout the survey area and could not be avoided.
Quadrat size should be appropriate for the bioregion.	Yes	Quadrats were 50 by 50 metres, as is appropriate for the Pilbara.
The survey effort should be adequate to characterise the flora and vegetation within the survey area.	Partial	The species accumulation curve indicates that survey effort was adequate to sample the floristic diversity of the survey area, however additional quadrats are required to adequately describe and map vegetation types.
A minimum of three quadrats should be sampled in each vegetation unit. Quadrats within a widespread vegetation unit should be located to sample throughout its geographic range.	No	Six vegetation types were identified within the survey area. Of these, only three were sampled with three or more quadrats. Vegetation types A and E were sampled with a single quadrat only, while type F was only represented by a relevé. This occurred due to the quality and age of aerial photograph available to plan the survey.
Opportunistic collections, systematic transects and targeted inspections of potential habitat are required to verify that the survey area has been well characterised and important values identified.	Yes	Extensive opportunistic collections and mapping notes were taken during the detailed survey as well as the targeted survey.
Survey effort should be intensified in areas with unusual habitat or potential to provide habitat for conservation significant flora and or vegetation.	Yes	A targeted survey was completed to supplement the detailed survey results.

4.3.4 *Survey limitations table*

Table 4.8 Limitations of the targeted flora survey

Aspect	Limitation	Discussion
Availability of contextual information at a regional and local scale	No	Sufficient flora and vegetation information was available for the Hamersley subregion (of the Pilbara Bioregion) to place the survey area in a regional context. At a local scale, sufficient (publicly available) flora and vegetation surveys have been completed in the vicinity of the survey area. There has been a significant body of work completed at Mining Area C which is in close proximity to the Lamb Creek project.
Competency/experience of the team carrying out the survey, including experience in bioregion surveyed	No	The survey was completed by a team of senior botanists, each with between 10-20 years' experience completing flora and vegetation surveys throughout Western Australia. Sharnya Thomson-Yates is also an experienced botanical taxonomist.
Proportion of flora recorded and/or collected, any identification issues	No	There were no identification issues.
Was the appropriate area fully surveyed (effort and extent)	Partial	The entirety of the survey area was visited by the team. However, results of PATN analysis indicates that not all vegetation types were adequately sampled with at least three quadrats. The absence of a representative aerial photograph made it difficult to determine whether all vegetation types were adequately covered, and also limited vegetation mapping post-survey.
Access restrictions within the survey area	No	The entirety of the survey area was readily accessible by vehicle and on foot. There were no survey limitations due to access restrictions.
Survey timing, rainfall, season of survey	No	The field survey was completed in May 2021, which falls within the primary recommended timing for surveys in the Eremaean botanical province (EPA 2016a). The survey area experienced good rainfall over the months preceding both surveys, and this was reflected in the relatively high number of annuals and short-lived perennials present in the dataset, making up 23% of the dataset. Overall, survey timing was deemed to be appropriate for the survey area and the region.
Disturbances that may have affected the results of the survey (e.g. fire, flooding, clearing)	Yes	The survey area has been affected by a fire which burnt across the entirety of the survey area in 2015. No recent aerial photographs are available that show the current state of the survey area, and this limited both site selection before and during the field survey, and also the detail with which the vegetation boundaries could be mapped. Vegetation mapping relied heavily on mapping notes which did not always match vegetation boundaries visible on the aerial photographs which were taken in 2009 and 2013, pre-fire. The fire history of the survey area appears to have altered vegetation structure and composition of the vegetation types, which is supported by site photos and notes indicating between 5-90% of trees and tall shrubs had been killed by fire. The survey area was also affected by weeds, especially vegetation type B.

5 Conclusion

A single-season detailed flora and vegetation survey was completed across the Great Northern Highway intersection area of the Lamb Creek project over a period of six days, from 12 to 17 May 2021. The survey was completed in conjunction with a targeted conservation significant flora survey (Rapallo 2021). All preliminary vegetation types present in the survey area were visited and sampled through a total of 19 quadrats, one relevé, opportunistic collections, and mapping notes.

The detailed flora survey recorded 187 vascular flora taxa from 35 families, including 178 native species and nine introduced taxa. One Threatened flora taxon was recorded, *Seringia exastia*. This taxon is currently listed as Critically Endangered, but this ranking is due to a taxonomic revision. The DBCA (communications received 24/08/2021) considers the taxon common and widespread and likely to be delisted. Three Priority flora taxa were recorded, these were *Aristida lazaridis* (Priority 2), *Rhagodia* sp. Hamersley (Priority 3) and *Goodenia nuda* (Priority 4). One other taxon, *Euphorbia* aff. *ferdinandi*, is considered significant because it represents a potentially undescribed taxon.

The survey recorded nine weeds, none of which were Declared Pests. No Threatened or Priority Ecological Communities (TEC-PEC) were recorded from the survey area. None of the taxa recorded during the survey were indicative of groundwater dependent vegetation.

Six broad vegetation types were identified and mapped across the survey area. Vegetation types A, B, C and D were considered moderately significant because they supported populations of *Aristida lazaridis*. This further discussed in the Targeted report (Rapallo 2021).

The survey area was affected by a fire which burnt across the entire survey area in 2015. Vegetation condition ranged from Very Good to Degraded, with most quadrats ranked as Good. The main reason for this ranking was fire.

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7 Appendices

Number	Title
Appendix I	Conservation codes for Australian flora
Appendix II	Flora desktop results: Conservation significant flora and likelihood assessment
Appendix III	Flora desktop results: Introduced taxa (weeds)
Appendix IV	Taxa per vegetation type collected from the survey area
Appendix V	List of quadrat locations
Appendix VI	Quadrat Data
Appendix VII	Significance Assessment Criteria (Vegetation)

Appendix I Conservation codes for Australian flora

Threatened species under the Commonwealth EPBC Act

Threatened fauna and flora may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in any one of the following categories:

EX Extinct

EW Extinct in the wild

CR Critically endangered

EN Endangered

VU Vulnerable

CD Conservation dependent

Conservation codes for Western Australian flora under the Western Australian *Biodiversity Conservation Act 2016*

Threatened, Extinct and Specially Protected fauna or flora are species 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:

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 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 (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 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 (Rare Flora) Notice 2018* for vulnerable flora.

Priority species

Priority species are possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the 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. In this report, priority species are given the codes P1, P2, P3 and P4.

P1 Priority 1: Poorly-known species

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

P2 Priority 2: Poorly-known species

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

P3 Priority 3: Poorly-known species

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

P4 Priority 4: Rare, Near Threatened and other species in need of monitoring

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

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

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

Appendix II Flora desktop results: Conservation significant flora and likelihood assessment

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at in GNHI survey area?	Distance to survey area	Likelihood ranking
Acacia bromilowiana	P4	Tree or shrub to 12 m high	WAH and TPFL : High in landscape, Slope, cliff, gully, crest, summit , very steep	Red skeletal stony loam, orange-brown pebbly,gravel loam, laterite, banded ironstone, basalt. Rocky hills, breakaways, scree slopes, gorges, creek beds.	May, July, August	No	Within 20 km	Unlikely to occur
Acacia daweana	P3	Shrub from 0.3- 2m.	WAH: Gentle slopes, Along diffuse drainage area where it leaves low rocky hills. Low shrubland with Triodia basedowii, Acacia bivenosa, A. validinervia and A. maitlandii.	Stony red loamy soils. Low rocky rises, along drainage lines	July-October	Yes	Not within 20km	Unlikely to occur
Acacia effusa	P3	Low, dense, spreading, somewhat viscid shrub, 0.3-1 m high.	WAH: Scree, gentle slope, footslope, creeklines, low iron stone hill, stony plain base of hills , skeletal soils, red brown, Red brown clay loam.	Stony red loam. Scree slopes of low ranges.	May-August	No	Within 20 km	Unlikely to occur
Acacia subtiliformis	P3	Spindly, slender, erect shrub, to 3.5 m	WAH: Calcrete slope, rise, plain	On rocky calcrete plateau.	April-June	No	Within 20 km	Unlikely to occur
Adiantum capillus-veneris	P2	Perennial small herb from 0.1-0.2m. Frond 1-2 pinnate	WAH: In wet rocky crevices, associated with gorges or springs.	Moist sheleted sites in gorges and on cliff walls.	March, September	No	Not within 20km	Unlikely to occur
Amaranthus centralis	P3	Annual Herb	WAH: Tussock grassland of Themeda triandra, Eulalia aurea and Aristida inaequiglumis with open woodland of Eucalyptus victrix and Corymbia aspera over low open woodland of Corymbia aspera and Hakea lorea subsp. lorea over high open shrubland of Gossypium robi. Low in the landscape, alluvial flats, River banks, Mulga woodland[3]	no info	No info	Yes	Not within 20km	Unlikely to occur
Ampelopteris prolifera	P3	Perennial herb/fern to 4m	no info	Near water or in wet ground.	No info	No	Not within 20km	Unlikely to occur
Aristida jerichoensis var. subspinulifera	P3	Compactly tufted perennial, grass-like or herb, 0.3-0.8 m high	WAH: Plain or Flat, clay/loam. Often mulga woodlands or acacia shrublands over spinifex and/or tussock grassland.	Hardpan plains	May, July, September	Yes	Recorded elsewhere in Lamb Creek project	Likely to occur
Aristida lazaridis	P2	Tufted perennial, grass-like or herb, 0.4-1.5 m high.	WAH: Plain, clay /loam, drainage, slope; often mulga low open woodland with or without Eucalypts, over variety of shrubs and herbs, often over tussock grassland but sometimes with Triodia hummock grassland.	Sand or loam	April, May	Yes	Confirmed	Confirmed
Arthropodium vanleeuwenii	P2	Perennial herb 0.3 to nearly 1m.	WAH. Moderately steep facing slopes including banded and Brockman ironstone formations on red-brown, orange-brown loams and sandy loams. Low open woodland of Eucalyptus leucophloia subsp and Corymbia hamersleyana over hummock grassland of Triodia brizoides. Other tussock grassland species include Themeda triandra. Known from two small populations growing above 900 m on south-facing hillslopes of Brockman Iron Formation in the Pilbara bioregion of Western Australia. Associated vegetation includes Eucalyptus leucophloia subsp. leucophloia, Corymbia hamersleyana, Indigofera fractiflexa, Triodia spp. and Themeda triandra. Often found growing under the Triodia and occasionally under the Themeda, very rarely growing in the open. Flowering from mid- to late September. Fruiting from late September to mid-October[4]	No info	October	Yes but off footprint	Not within 20km	Unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at in GNHI survey area?	Distance to survey area	Likelihood ranking
Atriplex flabelliformis	P3	Monoecious, erect, rounded perennial, herb, to 0.35 m high.	WAH: Saline areas. Often salt tolerant shrublands, over low open heath.	Clay loam, loam. Saline flats or marshes.	No info	No	Not within 20km	Highly unlikely to occur
Barbula ehrenbergii	P1	Moss	Moss. Shaded moist environment on rock face 1.A species of hydric environments [2]	No info	No info	No	Not within 20km	Highly unlikely to occur
Calotis squamigera	P1	Procumbent annual, herb, to 0.21 m high.	WAH: Flat. Red brown loam clay, Stony plain with sandy loam soil. Low woodland of Acacia aptaneura, over open tussock grassland of Aristida contorta and Chrysopogon fallax with high open shrubland of Acacia synchronicia and Psydrax latifolia.	Pebbly loam	July	Yes	Not within 20km	Unlikely to occur
Cladium procerum	P2	Densely tufted perennial, grass-like or herb (sedge), 2 m high.	WAH: Major creeklines , Eucalyptus camaldulensis and Melaleuca argentea open woodland	Perennial pools	July, October, November	No	Not within 20km	Highly unlikely to occur
Dampiera anonyma	P3	Multi-stemmed perennial herb, 0.5 - 1m. Blue purple flower	WAH: Hillside; rocky red ironstone.	Skeletal red-brown gravelly soil over banded ironstone, basalt, shale and Jaspilite. Hills, summits and upper slopes (>1000m)	June, July, September	No	Not within 20km	Unlikely to occur
Dampiera metallorum	P3	Rounded, multi-stemmed perennial, herb, to 0.5 m high.	WAH: Summit of hill, high in landscape, steep slope, skeletal red gritty soil over massive banded ironstone.	Skeletal red-brown gravelly soil over banded ironstone. Steep slopes, summits of hills.	April-October	No	Not within 20km	Unlikely to occur
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	no info	WAH: Cracking clay	Spreading annual herb to 10 cm tall, with blue flowers in March; occurs on cracking clay on flat to gently undulating plains with large surface rock	March, May, July	No	Within 20 km	Unlikely to occur
Dysphania congestiflora	P3	no info	WAH: Saline floodplain. Recorded from the western side of Fortescue Marsh from flats on the margin and towards the centre of seasonally inundated flood plains and lake beds, on saline, deep, light-medium to heavy clay soils. A single collection has also been recorded from the Lyndon River in close proximity to Lake Macleod [5]	No info	June, July	No	Not within 20km	Highly unlikely to occur
Eleocharis papillosa	P3	Annual, herb.	WAH: Claypan low dune/berm on eastern edge of wetland.	Red clay over granite, open clay flats. Claypans.	November	No	Not within 20km	Unlikely to occur
Eragrostis crateriformis	P3	Annual, grass-like or herb, 0.17-0.42 m high	WAH: Drainage area / floodplain.	Clayey loam or clay. Creek banks, depressions.	January-July	Yes	Not within 20km	Unlikely to occur
Eragrostis sp. Erect spikelets (P.K. Latz 2122)	P3	Erect perennial grass-like or herb to 0.3 m high	WAH: Near samphire flat. Associated species: Goodenia omeriana, G. forrestii, Cullen cinereum, Scaevola spinescens, Acacia tetragonophylla, A. victoriae. Associated species: Halosarcia spp., Eragrostis falcata (mostly as first year plants), Nicotiana sp., Swainsona sp., Angianthus sp. Low calcrete platforms/rises [12]	No info	No	No	Not within 20km	Highly unlikely to occur

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Eragrostis sp. Mt Robinson (S. van Leeuwen 4109)	P1	Tussock-forming perennial, grass-like or herb, to 0.3 m high	WAH and TPFL: Open mallee shrubland; Summit of hill, steep western slopes. Skeletal gritty soil. Massive banded Brockman Iron Formation.	Red-brown skeletal soils, ironstone. Steep slopes, summits.	September	No	Not within 20km	Unlikely to occur
Eremophila magnifica subsp. magnifica	P4	Shrub, 0.5-1.5 m high.	WAH: High in landscape, steep slopes, summits, gullies, skeletal red gritty soil over massive banded ironstone of the Brockman Iron Formation.	Skeletal soils over ironstone. Rocky screes.	June-November	No	Within 20 km	Unlikely to occur
Eremophila magnifica subsp. velutina	P3	Shrub, 0.5-1.5 m high.	WAH: Summit of steep hill, high in landscape, steep slopes, rock screes and cliff faces, skeletal red stony soil over massive ironstone of the Brockman Iron Formation.	Skeletal soils over ironstone. Summits.	July-October	No	Not within 20km	Highly unlikely to occur
Eremophila pusilliflora	P2	Shrub to 0.5m	WAH: Low lying associated with drainage lines on red/brown clay loams and ironstone. Low open woodlands scattered with Corymbia hamersleyana and with Acacia aneura, A. inaequlatera, A. pyrifolia over hummock grasslands of T. wiseana, T. pungens and T. brizoides. TPFL: Low lying in valleys, gibber plains above drainage line with Goodenia over red clay loams. Open woodlands of Acacia aneura with Ptilotus exaltatus and Ptilotus helipteroides. Found on seasonally inundated alluvial plains between Turee Creek, Pingandy Creek and drainage systems leading into the Ashburton River, growing in red-brown sandy loam soils in open low shrubland with Acacia aneura, Ptilotus nobilis, Goodenia and Triodia species[6]	No info	April-September and after rainfall	Yes	Within 20 km	May potentially occur
Eremophila sp. Hamersley Range (K. Walker KW 136)	P3	no info	WAH: Rocky gullies and gorges. Steep rocky hill slopes and summits, high in the landscape	No info	June, August, September	No	Recorded elsewhere in Lamb Creek project	Unlikely to occur
Eremophila sp. West Angelas (S. van Leeuwen 4068)	P1	no info	WAH: TPFL Summits and slopes of hills, high in the landscape.	No info	August, September	Yes but off footprint, infrequently recorded ain locality	Not within 20km	Unlikely to occur
Eremophila spongiocarpa	P3	Compact, succulent-leaved shrub, to 1 m high.	WAH and TPFL: Saline , Alluvial margin of marsh. Edge of marsh, saline flats, broad plain, floodplain, claypan, Slope of linear dune.	Weakly saline alluvial plain on margins of marsh.	May, August, September	No	Not within 20km	Unlikely to occur
Eremophila youngii subsp. lepidota	P4	Dense, spreading shrub, (0.2-)1-3 m high.	WAH: Mulga woodland or acacia shrublands. Can grow near salt marshes in combination with Atriplex and other chenopods.	Stony red sandy loam. Flats plains, floodplains, sometimes semi-saline, clay flats.	January-March or August, September	Yes	Not within 20km	Unlikely to occur
Euphorbia australis var. glabra	P3	Prostrate herb, 10cm	WAH: Vegetation dominated by Acacia aptaneura. Acacia aff. aneura (long, flat, recurved; F. .MR 35.3), (Eucalyptus xerothermica) low woodland over *Malvastrum americanum, Sida aff. fibulifera low open shrubland over Sporobolus australasicus scattered bunch grasses. Associated Species: Acacia tetragonophylla. Broad, flat plain; calcrete platform to west and major creekline to east. Flat, red brown loam.	Prostrate annual herb. Typically occurs on cracking clay and clay plains	No	Yes	Not within 20km	Unlikely to occur
Euphorbia clementii	P3	Erect herb to 0.6m	TPFL; Sparse low woodland over Senna spp. moderately dense low shrubland over Triodia spp. and other grasses. Rock (Laterite) and red sand. Occasional Eucalyptus leucophloia. TPFL Taxon has been recorded on plains and outwash slopes, and in minor drainage lines or areas of sheet flow. This taxon is typically a fire-responder (and relatively short-lived) and can be observed in large numbers in recently burnt areas. [7]	Gravelly hillsides, stony grounds	May-July	Yes, would be obvious but as is a big post fire coloniser	Not within 20km	Unlikely to occur

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Euphorbia inappendiculata var. inappendiculata	P2	small prostrate, much branched annual herb	Acacia aptaneura dominated vegetation. Flat, red brown loam. Recorded in cracking claypans of red sandy clay at Miralga Creek [7]	No info	No info	Yes, infrequently recorded	Not within 20km	Unlikely to occur
Euphorbia inappendiculata var. queenslandica	P2	prostrate annual herb	WAH: Tussock grassland of Astrebla elymoides, Chrysopogon fallax and Urochloa occidentalis var. occidentalis with open herbs of Polymeria longifolia, with high open shrubland of Acacia synchronicia. Cracking clay soil, Gilgai plain.	No info	No info	No	Not within 20km	Unlikely to occur
Euphorbia stevenii	P3	Succulent perennial herb from 0.1-0.5	Gently sloping area to gently undulating. Soils include: Red-brown cracking clay with scattered pebbles and cobbles on the surface. Occurs with many grasses including Astrebla sp, Themeda sp and Aristida sp.	Clay, sandy soils	June	Yes, infrequently recorded in locality	Not within 20km	Unlikely to occur
Fimbristylis sieberiana	P3	Shortly rhizomatous, tufted perennial, grass-like or herb (sedge), 0.25-0.6 m high.	WAH: Major drainage, edge of watercourse. With Eleocharis sp. Eucalyptus camaldulensis and Melaleuca argentea open woodland over Acacia pyrifolia var. pyrifolia; Acacia tumida var. pilbarensis and Clerodendrum tomentosum mid sparse shrubland over Cladium procerum and Cyperus vaginatus sedges and Cenchrus ciliaris. Woodland to forest of Eucalyptus camaldulensis and/or Melaleuca leucadendra and Acacia coriacea subsp. pendens over high shrubland.	Mud, skeletal soil pockets. Pool edges, sandstone cliffs.	May-August	No	Not within 20km	Unlikely to occur
Geijera salicifolia	P3	Tree from 1.5m-6m	WAH: Growing in flood area at base of gorge wall. Stony.	Skeletal soils, stony soils; Massive rock scree and gorges	September	No	Not within 20km	Unlikely to occur
Glycine falcata	P3	Mat-forming perennial, herb, to 0.2 m high	WAH: Sump, low in landscape. With Cullen and Vittadinia sp., Goodenia pascua and Bulbine pendula. Often low grassland or herbland with Acacia shrublands and hummock grassland, sometimes Eucalypts. Clay soils, cracking clays	Black clayey sand. Along drainage depressions in crabhole plains on river floodplains.		No	No	Within 20 km
Gompholobium karijini	P2	Low shrub growing to 70 cm tall, with coarsely fibrous, grey bark.	Eucalyptus leucophloia subsp. leucophloia over Triodia sp. Triodia hummock grassland with scattered shrubs and trees on ironstone gravel 9 Breakaway habitats and associated rocky slopes, the top edge of mesas, broadly rocky and rugged upland habitats, and incised gullies/ rocky gullies of the upland areas' and 'mesa top habitat consisting of hill top, mesa top, and broad rolling hill habitats. [10]	Typically occurs on rocky crests and slopes of hill	January, August-September	No	Not within 20km	Unlikely to occur
Goodenia lyrata	P3	Prostrate herb with lyrate leaves. Ephemeral	Broad drainage tract in hardpan plain. Mulga woodland. Mulga woodland or acacia shrublands, sometimes with E. victrix, over open shrubland, herbs.	Red sandy loam. Near claypan	May, August, October	No	Within 20 km	Unlikely to occur
Goodenia nuda	P4	Erect to ascending herb, to 0.5 m high.	WAH and TPFL : Variety of habitats	No info	March-August	Yes	Confirmed	Confirmed
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3	Open, erect annual or biennial, herb, to 0.2 m high.	WAH and TPFL : Variety of habitats with calcrete , Grassland on crabhole clay flats.	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains.	March-May and after rainfall	No	Within 20 km	Unlikely to occur
Grevillea saxicola	P3	Tall shrub or tree	WAH: High in landscape, steep and undulating terrain, skeletal red-brown gritty soil over massive banded ironstone of the Brockman Iron Formation. Mulga woodlands over shrublands with Eremophilas and other species, over Scaevola. No mention of Triodia. Skeletal red-brown sandy loam on steep slopes, rocky hills and ridges, usually growing with Mulga 10	No info	February, March	No	Not within 20km	Unlikely to occur
Gymnanthera cunninghamii	P3	Erect shrub, 1-2 m high.	WAH: South facing ironstone scree slope adjacent to Weeli Wolli Creek.	Sandy soils on islands in river and creek channels	Year-round	No, very scattered distribution.	Not within 20km	Unlikely to occur

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Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	P2	Shrub to 3m.	Gorges and Gullies associated with ironstone (inc: Brockman ironstone) outcroppings and boulders. Soils include Red-brown loams amongst boulders. Rocky ground high in the landscape. Gullies and gorges. [10]	No info	No info	No	Not within 20km	Highly unlikely to occur
Indigofera gilesii	P3	Shrub, to 1.5 m high.	WAH: Near summit of hill, high in landscape, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation, Gorge / gully. Red brown skeletal. Continuous ironstone pebbles, Breakaway. Red dry soil.	Pebbly loam. Amongst boulders & outcrops, hills.	May, June, August	No	Within 20 km	Unlikely to occur
Indigofera ixocarpa	P2	Shrub to 1m	WAH: Dry creekline. Ironstone rocks and loamy soil	Skeletal red soils over massive ironstone	May, June, August	No	Not within 20km	Highly unlikely to occur
Iotasperma sessilifolium	P3	Erect herb	WAH: Sump, low in landscape, flat terrain, cracking red clay-loam.	Cracking clay, black loam. Edges of waterholes, plains.	September	No	Not within 20km	Highly unlikely to occur
Ipomoea racemigera	P2	Creeping annual, herb or climber.	WAH: Medium drainage line, fringing vegetation. Open forest of Eucalyptus camaldulensis and Melaleuca argentea	No info	June	No	Not within 20km	Unlikely to occur
Isotropis parviflora	P2	Shrub, 0.1 m high.	WAH: Stony plain, lower slopes, Hillcrest/upper slope.	Valley slope of ironstone plateaus, hill slopes and stony plains.	March-August	Yes	Within 20 km	Likely to occur
Kohautia australiensis	P2	Erect sparsely or much-branched annual, herb, 0.1-0.5 m high..	WAH: Calcrete plains, hills and rises	No info	March-May	No	Not within 20km	Unlikely to occur
Lepidium catapycnon	P4	Open, woody perennial, herb or shrub, 0.2-0.3 m high, stems zigzag.	Variety of vegetation types, typically with E. leucophloia over Acacias over Triodia. Strong habitat preference for steep upper breakaway slopes of mesa hills where it grows in skeletal light brown loam or sandy loam soils with a large proportion of loose rocks at the surface (50-100 percent) comprising a mixture of banded iron formation (BIF), banded chert and siltstone [11]	Skeletal soils. Hillsides.	May, June, August-November	No	Not within 20km	Unlikely to occur
Lindernia sp. Pilbara (M.N. Lyons & L. Lewis FV 1069)	P1	Annual or perennial herb, to 0.6 cm high	WAH: Claypan, low dune, edge of wetland.	No info	No info	No	Not within 20km	Unlikely to occur
Myriocephalus scalpellus	P1	Semi-erect herb, 0.03-0.08 m high.	WAH: At edge of claypan, In fringing vegetation.	Claypan	June	No	Not within 20km	Unlikely to occur
Nicotiana umbratica	P3	Erect, short-lived annual or perennial, herb, 0.3-0.7 m high. Fl. white, Apr to Jun. Shallow soils. Rocky outcrops.	no info	Shallow soils. Rocky outcrops.	April-June	No	Within 20km	Unlikely to occur
Olearia mucronata	P3	Densely branched, unpleasantly aromatic shrub (0.6-1m)	WAH: Steep upper slope, Soil: Red-brown scree boulders (ironstone), stones, base of south facing ironstone cliff, bordering a large scree slope.	Schistose hills along drainage channels	July-January	No	Not within 20km	Highly unlikely to occur
Oxalis sp. Pilbara (M.E. Trudgen 12725)	P2	Small annual herb to 10 cm tall. Leaves green above, purple below	WAH: Gorge, gully, cliff	No info	May, July	No	Not within 20km	Highly unlikely to occur

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Pentalepis trichodesmoides subsp. Hispida	P2	Compact shrub to 1m	WAH: Summit of ridge, high in landscape, steep terrain, skeletal brown gritty soil over metabasaltic pillow lava, breccia; metatuff and minor cherts of the Bunjinah Formation, altitude ca. = 1020 m.	No info	August, September	No	Not within 20km	Unlikely to occur
Pilbara trudgenii	P3	Gnarled, aromatic shrub, to 1 m high.	WAH: Skeletal soil Summit, slopes, screes and cliffs. Brockman Iron Formation. With Eucalyptus leucophloia, E. gamophylla.	Skeletal, red stony soil over ironstone. Hill summits, steep slopes, screes, cliff faces.	July, September	No	Not within 20km	Highly unlikely to occur
Ptilotus mollis	P4	Compact, perennial shrub, to 0.5 m high, soft grey foliage.	WAH: Steep, rocky scree slope, laterite.	Stony hills and screes.	May, July, September	No	Not within 20km	Unlikely to occur
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	A spindly shrub growing to 2 m tall;	WAH: Mulga over mixed grassland. Emergent eucalypts and Triodia grassland. Very open mulga woodland over patchy mixed grasses. Floodplains, hardpan plains.	Red sandy clay loam plains and floodplains growing in association with Mulga (Acacia aneura)	March, May, September	Yes	Confirmed	Confirmed
Rhodanthe ascendens	P1	Ascending annual herb to 0.1m	WAH: Flat terrain, low in landscape, stony gibber with red cracking clay soils. Acacia aneura over Open Tussock Grass of Aristida spp.	Clay, roadside verge	August, September	Yes, infrequently collected	Not within 20km	Unlikely to occur
Rhynchosia bungarensis	P4	Compact, prostrate shrub, to 0.5 m high.	WAH: Creekline in a gorge	Pebbly, shingly coarse sand amongst boulders. Banks of flow line in the mouth of a gully in a valley wall.	November	No	Not within 20km	Unlikely to occur
Rostellularia adscendens var. latifolia	P3	Herb or shrub, 0.1-0.3 m high.	Acacia shrubland, sometimes with Eucalypts and Corymbias, over shrublands and herblands, over tussock grassland, or Triodia pungens hummock grassland.	Ironstone soils. Near creeks, rocky hills.	April, June, August	Yes	Confirmed	Confirmed
Samolus sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	P1	Erect perennial herb, 0.3-1.0 m high	Margins of semi-permanent/permanent freshwater pools and the margins of samphire shrublands where creeks discharge freshwater following periods of high rainfall. [13]	No info	September	No	Not within 20km	Highly unlikely to occur
Scaevola sp. Hamersley Range basalts (S. van Leeuwen 3675)	P2	Shrub, to 1 m high	Steep slopes and screes. Growing in Regenerating Open Shrub Mallee of Eucalyptus kingsmillii and E. gamophylla over Dwarf Scrub C/D of Triumfetta sp, Corchorus sp, Hibiscus sp. and Acacia bivenosa over Open Hummock Grass of Triodia sp.	Skeletal, brown gritty soil over basalt. Summits of hills, steep hils.	July-August	No	Not within 20km	Unlikely to occur
Seringia exastia	CR	Shrub	Variety of mulga woodlands, sometimes with Eucalypts, over Acacia shrublands over Trioda pungens hummock grassland. Gully - washout. Red sand/laterite over sandstone.	No info	Year-round	Yes	Confirmed	Confirmed
Sida sp. Barlee Range (S. van Leeuwen 1642)	P3	Spreading shrub, to 0.5 m high.	WAH: Cliff line and scree slopes, gorge and steep gully	Skeletal red soils pockets. Steep slope.	August	No	Not within 20km	Highly unlikely to occur
Sida sp. Hammersley Range basalts (K. Newbey 10692)	P3	Herb or shrub to 0.15m	Plants growing amongst rocks along the south side of a small ironstone breakaway. Low open woodland over hummock grassland of Triodia sp.	No info	May, August, October	Possible, very little info, infrequently recorded at locality	Not within 20km	Unlikely to occur
Solanum kentrocaule	P3	Perennial shrub to 2.5m	WAH: Near summit of hill, high in landscape, skeletal red-brown stony soil over massive ironstone of the Brockman Iron Formation, steep slopes, steep gullies	No info	May, July, August	No	Not within 20km	Unlikely to occur
Stackhousia clementii	P3	Dense broom-like perennial, herb, to 0.45 m high.	Acacia shrubland, sometimes with E. victrix, over Acacia sclerosperma. WAH: Clay loam plains, drainage plains	Skeletal soils. Sandstone hills.	April, September		Not within 20km	Unlikely to occur

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Streptoglossa sp. Cracking clays (S. van Leeuwen et a. PBS 7353)	P3	Multi stemmed annual herb	Cracking clay, Acacia aneura var. longicarpa high open shrubland over Rhagodia eremaea scattered shrubs over Aristida latifolia and Astrebla elymoides scattered tussock grasses. Acacia aneura var. longicarpa 3-5 m < 1-5%; Rhagodia eremaea 0.4-1.2 m < 1%; Aristida latifolia.	No info	June	No	Not within 20km	Unlikely to occur
Stylidium weeliwolli	P3	Annual, herb, 0.1-0.25 m high, throat appendages 4, rod-shaped.	WAH: In damp soil in rock clefts of river bed, permanent pools.	Damp soil in rock clefts of river bed, permanent pools, edge of water courses	July-October	No	Not within 20km	Unlikely to occur
Swainsona thompsoniana	P3	Prostrate annual herb to 10 cm high	WAH: Gently sloping area to gently undulating. Soil: Red-brown cracking clay with scattered pebbles and cobbles on the surface. Includes a flowline. Varies to areas of orange-brown cracking clay. Colluvial and alluvial gravels in fan or floodplain	No info	April, June, August	No	Not within 20km	Unlikely to occur
Synostemon hamersleyensis	P1	no info	WAH: Steep scree slope below banded iron formation cliff line with brown sandy loam soil. Steep hillslope, narrow gorge	No info	No info	No	Not within 20km	Highly unlikely to occur
Tecticornia globulifera	P1	no info	WAH: Saline flats and marsh with light medium clay soil.	No info	No info	No	Not within 20km	Highly unlikely to occur
Tecticornia medusa	P3	no info	WAH: Growing on the lake bed a few 100 metres from the shoreline. Red clayey sand., Claypan	No info	November	No	Not within 20km	Highly unlikely to occur
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	P1	no info	Samphire flats.	No info	No info	No	Not within 20km	Highly unlikely to occur
Tetratheca fordiana	P2	Dwarf shrub; 0.3-0.4m	WAH: Vertical cliff faces amongst ironstone. Breakaways on Skeletal soils. Scattered low trees of Eucalyptus leucophloia, E. kingsmillii over scattered shrubs of Acacia hamersleyensis over open hummock grassland of Triodia epactia, Triodia wiseana and Triodia sp. Mt Ella (M.E. Trudgen 12739) with scattered tussock grasses of Eriachne mucronata.	Shale pocket amongst ironstone	April, May	No	Not within 20km	Unlikely to occur
Teucrium pilbaranum	P2	Upright shrub, 0.2 m high	WAH: High shrubland of Acacia sclerosperma, Acacia synchronicia, Eremophila longifolia and Acacia citrinoviridis over open herbs of Malvastrum americanum, Corchorus tridens and Cleome viscosa with low open woodland of Acacia citrinoviridis and Acacia aptaneura. Plain with brown clay loam soil.	Crab hole plain in a river floodplain, margin of calcrete table.	May, September	No	Not within 20km	Unlikely to occur
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	Tussocky perennial, grass-like or herb, 0.9-1.8 m high.	Variety of habitats including Mulga woodlands and mixed shrublands. Cracking clays, Red clay. Clay pan, grass plain.	Red clay. Clay pan, grass plain.	July-September	Yes	Within 20 km	Likely to occur
Thryptomene wittweri	VU	Spreading or rounded shrub from 0.5 - 1.5(2.1m)	WAH: Growing on tops of cliffs, ledges along cliff, in rock crevices and on boulder screes in shades southerly situations. Skeletal red stony soil. Ironstone. High in landscape, rocks on edge of cliff face and growing on face itself, S aspect, skeletal red-brown soil over massive banded ironstone of the Brockman Iron Formation, lots of rock and large sheets of ironstone on surface.	Skeletal red stony soils. Breakaways, stony creek beds.	April-August	No	Not within 20km	Unlikely to occur
Triodia basitricha	P3	no info	WAH Rehabilitation adjacent to Coondewanna airstrip, Mining Area C: Isolated Eucalyptus victrix and Corymbia hamersleyana, OR isolated Corymbia opaca trees over open to sparse Acacia aptaneura, A. bivenosa, A. pruinocarpa, and other shrubs, sometimes over Triodia, sometimes over low shrubs.	No info	No info	No	Within 20 km	Unlikely to occur

Taxon	Status	Growth Form	Habitat from DBCA database records	Habitat from FloraBase	Flowering period	Habitat present at in GNHI survey area?	Distance to survey area	Likelihood ranking
Triodia sp. Karijini (S. van Leeuwen 4111)	P1	no info	WAH: Triodia hummock grassland, variety of species including T. pungens, T. wiseana, often with emergent eucalypts and Corymbias, with Acacia shrublands. Very steep hillslope of grey silty loam.	No info	September	No	Within 20 km	Unlikely to occur
Triodia sp. Mt Ella (M.E. Trudgen 12739)	P3	Perennial, grass-like or herb, 0.4 m high.	WAH: Rocky creeklines, often grows together with Triodia pungens. With E. leucophloia and C. hamersleyana.	Light orange-brown, pebbly loam. Amongst rocks & outcrops, gully slopes.	February, March, September	Yes	Within 20 km	Likely to occur
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1	Annual daisy	WAH: Woodland to open forest of variety of mulga species and other acacias, OR shrubland of acacias and other species, sometimes with Eucalypts, over diverse shrubland, often over open Triodia grassland (T. pungens, T. melvillei). Plain, floodplain, drainage, sandy-clay loam,	No info	May, July, September	Yes	Within 20 km	Likely to occur
Xerochrysum boreale	P3	no info	WAH: Mulga, stony plain	No info	No info	Yes but rarely collected in locality	Not within 20km	Unlikely to occur

Appendix III Flora desktop results: Introduced taxa (weeds)

Family	Taxon	WAOL status	Total records
Amaranthaceae	**Aerva javanica*	Permitted s11	9
Apiaceae	**Cyclospermum leptophyllum*	Permitted s11	1
Arecaceae	**Phoenix dactylifera*	Permitted s11	1
Asteraceae	**Bidens bipinnata*	Permitted s11	34
Asteraceae	**Bidens subalternans var. simulans*	Not listed	1
Asteraceae	**Centaurea melitensis*	Permitted s11	1
Asteraceae	**Conyza bonariensis*	Permitted s11	2
Asteraceae	**Flaveria trinervia*	Permitted s11	12
Asteraceae	**Lactuca saligna*	Permitted s11	1
Asteraceae	**Lactuca serriola*	Permitted s11	2
Asteraceae	**Lactuca serriola forma serriola*	Permitted s11	2
Asteraceae	**Sonchus asper*	Permitted s11	1
Asteraceae	**Sonchus oleraceus*	Permitted s11	9
Asteraceae	**Symphyotrichum squamatum*	Permitted s11	1
Asteraceae	**Taraxacum khatoonae*	Permitted s11	1
Asteraceae	**Tridax procumbens*	Permitted s11	1
Brassicaceae	**Brassica rapa*	Permitted s11	1
Cucurbitaceae	**Citrullus amarus*	Permitted s11	1
Cucurbitaceae	**Citrullus colocynthis*	Permitted s11	3
Cucurbitaceae	**Citrullus lanatus*	Permitted s11	1
Cucurbitaceae	**Cucumis melo*	Permitted s11	4
Cucurbitaceae	**Cucumis myriocarpus*	Permitted s11	2
Cucurbitaceae	**Cucumis myriocarpus subsp. myriocarpus*	Permitted s11	1
Fabaceae	**Stylosanthes hamata*	Permitted s11	2
Fabaceae	**Vachellia farnesiana*	Permitted s11	14
Malvaceae	**Malvastrum americanum*	Permitted s11	26
Oxalidaceae	**Oxalis corniculata*	Permitted s11	1
Papaveraceae	**Argemone mexicana*	Declared Pest, Prohibited - s12 (C1 Prohibited)	1
Papaveraceae	**Argemone ochroleuca*	Permitted s11	6
Papaveraceae	**Argemone ochroleuca subsp. ochroleuca*	Permitted s11	3
Poaceae	**Cenchrus ciliaris*	Permitted s11	25
Poaceae	**Cenchrus echinatus*	Permitted s11	2
Poaceae	**Cenchrus setiger*	Permitted s11	5
Poaceae	**Chloris barbata*	Permitted s11	2

Family	Taxon	WAOL status	Total records
Poaceae	**Chloris virgata*	Permitted s11	22
Poaceae	**Cynodon dactylon*	Permitted s11	5
Poaceae	**Digitaria ciliaris*	Permitted s11	1
Poaceae	**Echinochloa colona*	Permitted s11	1
Poaceae	**Polypogon monspeliensis*	Permitted s11	1
Poaceae	**Rostraria cristata*	Permitted s11	1
Poaceae	**Setaria verticillata*	Permitted s11	18
Poaceae	**Sigesbeckia orientalis*	Permitted s11	12
Polygonaceae	**Rumex vesicarius*	Permitted s11	8
Portulacaceae	**Portulaca pilosa*	Permitted s11	3
Primulaceae	**Lysimachia arvensis*	Permitted s11	1
Solanaceae	**Datura leichhardtii*	Permitted s11	5
Solanaceae	**Datura leichhardtii subsp. leichhardtii*	Permitted s11	3
Solanaceae	**Solanum nigrum*	Permitted s11	3
Zygophyllaceae	**Tribulus terrestris*	Permitted s11	1

Appendix IV Taxa per vegetation type collected from the survey area

Family	Taxon name	Status	Vegetation type [1]						Other [2]	
			A	B	C	D	E	F	X	O
Amaranthaceae	**Aerva javanica*	Weed		X						
Amaranthaceae	*Alternanthera nana*			X	X	X	X			
Amaranthaceae	*Amaranthus cuspidifolius*			X						
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*			X	X					
Amaranthaceae	*Ptilotus calostachyus*		X		X			X		
Amaranthaceae	*Ptilotus clementii*					X				
Amaranthaceae	*Ptilotus exaltatus*		X	X	X	X				
Amaranthaceae	*Ptilotus fusiformis*		X							
Amaranthaceae	*Ptilotus gaudichaudii*				X	X				
Amaranthaceae	*Ptilotus helipteroides*		X	X	X	X	X			
Amaranthaceae	*Ptilotus obovatus*		X	X	X	X	X			
Amaranthaceae	*Ptilotus rotundifolius*				X					
Asteraceae	**Bidens bipinnata*	Weed	X	X	X	X			X	
Asteraceae	*Chrysocephalum apiculatum* subsp. *pilbarense*				X					
Asteraceae	*Chrysocephalum gilesii*					X				
Asteraceae	*Peripleura virgata*				X					
Asteraceae	*Peripleura obovata*			X	X	X				X
Asteraceae	*Pterocaulon sphacelatum*			X	X	X				
Asteraceae	*Roebuckiella similis*		X							
Boraginaceae	*Capparis lasiantha*				X					
Boraginaceae	*Stenopetalum nutans*					X				
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*		X	X	X	X				
Brassicaceae	*Lepidium echinatum*				X					
Campanulaceae	*Wahlenbergia tumidifructa*		X							
Caryophyllaceae	*Polycarpaea corymbosa*		X	X	X					
Caryophyllaceae	*Polycarpaea holtzei*		X							
Celastraceae	*Stackhousia* sp. swollen gynophore (W.R. Barker 2041)							X		
Chenopodiaceae	*Dysphania kalpari*				X	X				
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *inflata*			X	X	X				
Chenopodiaceae	*Maireana villosa*		X	X	X	X	X			
Chenopodiaceae	*Rhagodia eremaea*			X						

Family	Taxon name	Status	Vegetation type [1]						Other [2]	
			A	B	C	D	E	F	X	O
Chenopodiaceae	*Rhagodia* sp. Hamersley (M. Trudgen 17794)	Priority 3		X	X					
Chenopodiaceae	*Salsola australis*			X	X					
Chenopodiaceae	*Sclerolaena cornishiana*			X	X					
Cleomaceae	*Arivela viscosa*			X	X	X				
Convolvulaceae	*Convolvulus clementii*			X						
Convolvulaceae	*Duperreya commixta*		X	X	X	X	X			
Convolvulaceae	*Dysphania glomulifera* subsp. *eremaea*					X				
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*		X	X	X	X	X			
Cucurbitaceae	*Cucumis variabilis*			X	X	X				
Cyperaceae	*Bulbostylis barbata*					X				
Euphorbiaceae	*Euphorbia* aff. *ferdinandi*	Potentially undescribed			X	X				
Euphorbiaceae	*Euphorbia australis* var. *hispidula*		X							
Euphorbiaceae	*Euphorbia australis* var. *subtomentosa*			X	X					
Euphorbiaceae	*Euphorbia biconvexa*				X	X				
Euphorbiaceae	*Euphorbia coghlanii*			X						
Euphorbiaceae	*Euphorbia tannensis* subsp. *erem ophila*			X						
Fabaceae	**Stylosanthes hamata*	Weed			X	X				
Fabaceae	*Acacia ? aneura*							X		
Fabaceae	*Acacia ? sibirica*		X				X			
Fabaceae	*Acacia acradenia*				X					
Fabaceae	*Acacia adoxa* var. *adoxa*								X	
Fabaceae	*Acacia adsurgens*					X				
Fabaceae	*Acacia ancistrocarpa*		X					X		
Fabaceae	*Acacia aptaneura*		X	X	X	X	X			
Fabaceae	*Acacia atkinsiana*		X					X		
Fabaceae	*Acacia bivenosa*		X	X	X					
Fabaceae	*Acacia dictyophleba*		X		X	X		X		
Fabaceae	*Acacia elachantha*				X	X				
Fabaceae	*Acacia maitlandii*								X	
Fabaceae	*Acacia marramamba*							X		
Fabaceae	*Acacia minyura*									X
Fabaceae	*Acacia monticola*								X	

Family	Taxon name	Status	Vegetation type [1]						Other [2]	
			A	B	C	D	E	F	X	O
Fabaceae	*Acacia pachyacra*		X		X	X	X			X
Fabaceae	*Acacia pruinocarpa*		X	X	X	X				
Fabaceae	*Acacia pyrifolia* var. *pyrifolia*							X		
Fabaceae	*Acacia tenuissima*		X		X	X				
Fabaceae	*Acacia pachyacra*				X					
Fabaceae	*Acacia* sp.			X	X					
Fabaceae	*Cajanus marmoratus*			X						
Fabaceae	*Glycine canescens*				X					
Fabaceae	*Glycine* sp.			X	X					
Fabaceae	*Gompholobium oreophilum*		X							
Fabaceae	*Indigofera monophylla*								X	
Fabaceae	*Indigofera georgei*		X	X	X	X	X			
Fabaceae	*Isotropis iophyta*				X					X
Fabaceae	*Rhynchosia minima*			X						
Fabaceae	*Senna artemisioides* subsp. *x artemisioides*				X	X				
Fabaceae	*Senna artemisioides* subsp. *helmsii*			X	X					
Fabaceae	*Senna artemisioides* subsp. *oligophylla*		X	X	X					
Fabaceae	*Senna glutinosa* subsp. *glutinosa*		X							
Fabaceae	*Senna glutinosa* subsp. *X luerssenii*								X	
Fabaceae	*Senna notabilis*				X	X				X
Fabaceae	*Tephrosia* sp.				X				X	
Goodeniaceae	*Goodenia microptera*		X		X					
Goodeniaceae	*Goodenia nuda*	Priority 4				X				
Goodeniaceae	*Goodenia prostrata*			X	X	X				
Goodeniaceae	*Goodenia stellata*			X	X					
Goodeniaceae	*Scaevola parvifolia* subsp. *parvifolia*		X		X					
Gyrostemonaceae	*Codonocarpus* sp.					X				
Lamiaceae	*Clerodendrum floribundum* var. *angustifolium*					X				
Lamiaceae	*Teucrium teucriiflorum*					X				
Loranthaceae	*Lysiana murrayi*				X	X		X		
Malvaceae	**Malvastrum americanum*	Weed		X	X				X	
Malvaceae	*Abutilon fraseri*			X	X	X				

Family	Taxon name	Status	Vegetation type [1]						Other [2]	
			A	B	C	D	E	F	X	O
Malvaceae	*Abutilon lepidum*			X						
Malvaceae	*Abutilon macrum*			X	X					
Malvaceae	*Abutilon otocarpum*		X	X	X	X	X			
Malvaceae	*Androcalva luteiflora*			X						
Malvaceae	*Corchorus lasiocarpus* subsp. *parvus*								X	
Malvaceae	*Gossypium australe*		X							
Malvaceae	*Gossypium robinsonii*			X						
Malvaceae	*Melhania oblongifolia*			X						
Malvaceae	*Seringia exastia*	Critically Endangered							X	
Malvaceae	*Seringia velutina*							X		
Malvaceae	*Sida ? echinocarpa*			X						
Malvaceae	*Sida platycalyx*			X	X	X				
Malvaceae	*Sida* sp. *? L (A.M. Ashby 4202)*		X	X	X	X	X			
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)			X	X					
Montiaceae	*Calandrinia pumila*					X				
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*		X		X			X		
Myrtaceae	*Corymbia hamersleyana*							X	X	
Myrtaceae	*Eucalyptus gamophylla*		X		X					
Myrtaceae	*Eucalyptus leucophloia* subsp. *leucophloia*		X							
Myrtaceae	*Eucalyptus xerothermica*					X				
Nyctaginaceae	*Boerhavia coccinea*			X	X	X				
Nyctaginaceae	*Boerhavia schomburgkiana*				X					
Oleaceae	*Jasminum didymum* subsp. *lineare*					X				
Phyllanthaceae	*Phyllanthus erwinii*				X					
Plantaginaceae	*Stemodia grossa*			X		X				
Poaceae	**Cenchrus ciliaris*	Weed	X	X	X		X		X	X
Poaceae	**Cenchrus setiger*	Weed		X	X					X
Poaceae	**Melinis repens*	Weed	X							
Poaceae	*Aristida contorta*		X	X	X	X	X			
Poaceae	*Aristida holathera* var. *holathera*		X		X	X				
Poaceae	*Aristida inaequiglumis*		X	X	X	X	X			
Poaceae	*Aristida lazaridis*	Priority 2	X	X	X	X			X	X

Family	Taxon name	Status	Vegetation type [1]						Other [2]	
			A	B	C	D	E	F	X	O
Poaceae	*Aristida obscura*						X			
Poaceae	*Aristida lazaridis*				X					
Poaceae	*Bothriochloa ewartiana*					X				
Poaceae	*Chrysopogon fallax*			X	X	X	X			
Poaceae	*Cymbopogon ambiguus*		X	X						
Poaceae	*Cymbopogon obtectus*		X		X	X				
Poaceae	*Dactyloctenium radulans*			X						
Poaceae	*Dichanthium sericeum* subsp. *humilius*		X			X				
Poaceae	*Digitaria ammophila*			X		X	X			
Poaceae	*Digitaria brownii*				X		X			
Poaceae	*Digitaria ctenantha*			X						
Poaceae	*Enneapogon caerulescens*		X	X	X		X			
Poaceae	*Enneapogon polyphyllus*		X	X	X	X	X			
Poaceae	*Enneapogon robustissimus*			X	X					
Poaceae	*Enneapogon lindleyanus*				X		X			
Poaceae	*Eragrostis cumingii*		X				X			
Poaceae	*Eragrostis eriopoda*		X	X						
Poaceae	*Eragrostis pergracilis*					X				
Poaceae	*Eriachne mucronata*			X	X					
Poaceae	*Eriachne pulchella* subsp. *pulchella*		X	X	X		X			
Poaceae	*Eulalia aurea*			X	X	X				
Poaceae	*Iseilema macratherum*					X	X			
Poaceae	*Panicum decompositum*		X	X	X	X	X			
Poaceae	*Paraneurachne muelleri*		X	X	X		X			
Poaceae	*Paspalidium rarum*				X	X				
Poaceae	*Perotis rara*			X	X	X	X			
Poaceae	*Schizachyrium fragile*		X	X	X		X			
Poaceae	*Sporobolus australasicus*			X	X		X			
Poaceae	*Themeda triandra*			X	X	X				
Poaceae	*Tragus australianus*			X						
Poaceae	*Triodia melvillei*		X		X	X	X			
Poaceae	*Triodia pungens*		X	X	X					
Poaceae	*Triodia wiseana*							X		
Polygalaceae	*Polygala glaucifolia*				X		X			

Family	Taxon name	Status	Vegetation type [1]						Other [2]	
			A	B	C	D	E	F	X	O
Portulacaceae	**Portulaca oleracea*	Weed	X	X	X	X				
Proteaceae	*Grevillea wickhamii* subsp. *hispidula*								X	
Proteaceae	*Hakea chordophylla*		X		X			X		
Proteaceae	*Hakea lorea* subsp. *lorea*			X	X	X				
Proteaceae	*Heliotropium inexplicitum*		X							
Proteaceae	*Hibiscus burtonii*		X	X	X	X	X			
Proteaceae	*Hibiscus coatesii*		X		X	X				
Proteaceae	*Hibiscus sturtii* var. *platychlamys*			X	X					
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*				X	X	X			
Rubiaceae	*Psydrax latifolia*			X	X					
Rubiaceae	*Psydrax rigidula*				X					
Rubiaceae	*Psydrax suaveolens*					X				
Rubiaceae	*Spermacoce brachystema*					X				
Santalaceae	*Anthobolus leptomerioides*		X		X					
Santalaceae	*Santalum lanceolatum*			X	X	X				
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*		X	X	X					
Scrophulariaceae	*Eremophila fraseri* subsp. *fraseri*		X							
Scrophulariaceae	*Eremophila lanceolata*					X				
Scrophulariaceae	*Eremophila latrobei* subsp. *filiformis*			X	X					
Scrophulariaceae	*Eremophila longifolia*			X	X	X				
Solanaceae	**Solanum lasiophyllum*	Weed	X	X	X					
Solanaceae	*Solanum ? horridum*				X					
Solanaceae	*Solanum ferocissimum*				X					
Zygophyllaceae	*Tribulus astrocarpus*						X			
Zygophyllaceae	*Tribulus macrocarpus*		X	X	X					
Zygophyllaceae	*Tribulus suberosus*								X	

Footnotes:
1: Vegetation types A to F.
2: X = Disturbed / cleared / revegetated areas; O = taxa recorded just outside the survey area boundaries

Appendix V List of quadrat locations

Site name	Site type	Vegetation type	Coordinates (MGA94 zone 50)	
			Easting	Northing
Q01	Quadrat (50x50m)	A	684032	7469174
Q02	Quadrat (50x50m)	B	684271	7469145
Q03	Quadrat (50x50m)	B	684622	7469252
Q04	Quadrat (50x50m)	B	684341	7468778
Q05	Quadrat (50x50m)	B	684617	7468905
Q06	Quadrat (50x50m)	B	684587	7468724
Q07	Quadrat (50x50m)	C	684861	7468732
Q09	Quadrat (50x50m)	C	684203	7468450
Q10	Quadrat (50x50m)	C	684682	7468406
Q11	Quadrat (50x50m)	C	684121	7468241
Q12	Quadrat (50x50m)	C	684599	7468329
Q13	Quadrat (50x50m)	C	684581	7467920
Q14	Quadrat (50x50m)	C	685040	7468238
Q17	Quadrat (50x50m)	C	685039	7467882
Q19	Quadrat (50x50m)	D	685110	7467709
Q23	Quadrat (50x50m)	D	685657	7466960
Q24	Quadrat (50x50m)	D	685614	7467170
Q26	Quadrat (50x50m)	E	684001	7468042
Q27	Quadrat (50x50m)	D	684467	7467613
R01	Relevé	F	685435	7466834

Appendix VI Quadrat Data

Site	Q01	Site photo
Date	14/05/21	 Flora_Quadrat/PhotoP5140012
Vegetation type	A - Low open Eucalyptus gamophylla woodland over Triodia melvillei and T. pungens on stony plain	
Landform	Plain	
Slope	Negligible	
Soil	Clay, Dark red/brown	
Rock type	Shale, Quartzite, Laterite	
Rock size	Up to 8cm	
Rock cover	90%	
Vegetation cover	10%	
Condition	Good	
Disturbances	Fire killed off 50% of shrubs >2m, Acacias, e.g. A. pruinocarpa	
Easting (MGA94 Zone 51)	684008	
Northing (MGA94 Zone 51)	7469197	
Vegetation description	*Eucalyptus gamophylla* (mallee) and *Corymbia deserticola* subsp. *deserticola* low open woodland; over *Acacia pruinocarpa*, *A. ancistrocarpa*, A. atkinsiana sparse shrubland; over isolated low shrubs; over isolated dwarf shrubs; over *Ptilotus calostachyus*, *Ptilotus obovatus*, *Trichodesma zeylanicum* var. zeylanicum sparse forbland; over *Triodia melvillei* and *Triodia* pungens sparse hummock grassland	

Taxon name	Growth form	Height (m)	Cover%
**Cenchrus ciliaris*	grass	0.3	0.1
**Portulaca oleracea*	herb	0.1	0.1
**Solanum lasiophyllum*	shrub	0.5	0.1
Abutilon otocarpum	shrub	0.3	0.1
Acacia ancistrocarpa	shrub	1.5	0.1
Acacia aptaneura	shrub	0.5	0.1
Acacia atkinsiana	shrub	1.5	0.1
Acacia dictyophleba	shrub	1.5	0.1
Acacia pruinocarpa	shrub	2	1
Acacia tenuissima	shrub	0.5	0.1
Anthobolus leptomerioides	shrub	0.8	0.1
Aristida contorta	grass	0.3	0.1
Aristida holathera var. holathera	grass	0.4	0.1
Aristida inaequiglumis	grass	0.5	0.1
Corymbia deserticola subsp. Deserticola	tree	7	0.1
Cymbopogon ambiguus	grass	0.4	0.1
Cymbopogon obtectus	grass	0.4	0.1
Duperreya commixta	creeper	n/a	0.1
Enneapogon caerulescens	grass	0.2	0.1
Enneapogon polyphyllus	grass	0.2	0.1
Eragrostis eriopoda	grass	0.4	0.1
Eremophila forrestii subsp. forrestii	shrub	1.2	0.1
Eremophila fraseri subsp. fraseri	shrub	0.5	0.1
Eriachne pulchella subsp. pulchella	grass	0.2	0.1
Eucalyptus gamophylla	mallee	4.5	1

Euphorbia australis var. hispidula	herb	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Goodenia microptera	herb	0.1	0.1
Heliotropium inexplicitum	herb	0.2	0.1
Hibiscus burtonii	shrub	0.3	0.1
Hibiscus coatesii	shrub	0.3	0.1
Indigofera georgei	shrub	0.4	0.1
Maireana villosa	shrub	0.2	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.2	0.1
Polycarpaea corymbosa	herb	0.1	0.1
Ptilotus calostachyus	herb	0.8	0.1
Ptilotus exaltatus	herb	0.5	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	0.4	0.1
Schizachyrium fragile	grass	0.1	0.1
Senna artemisioides subsp. oligophylla	shrub	0.3	0.1
Senna glutinosa subsp. glutinosa	shrub	0.5	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Tribulus macrocarpus	herb	0.1	0.1
Trichodesma zeylanicum var. zeylanicum	herb	0.4	0.1
Triodia melvillei	grass	0.5	2
Triodia pungens	grass	0.4	1

Site	Q02	Site photo
Date	14/5/21	 Flora_Quadrat/PhotoP5140012
Vegetation type	B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	
Landform	Open woodland of Acacias over grasses + shrubs (Eremophila)	
Slope	Plain	
Soil	Negligible	
Rock type	Clay, Red brown	
Rock size	Quartzite, Laterite	
Rock cover	Up to 5cm	
Vegetation cover	5%	
Condition	Good	
Disturbances	Fire has killed 10% of shrubs >2m	
Easting (MGA94 Zone 51)	684249	
Northing (MGA94 Zone 51)	7469197	
Vegetation description	*Acacia aptaneura* (mulga) and *A. pruinocarpa* low open woodland; over *Eremophila longifolia*, *E. forrestii* subsp. *forrestii*, and *Acacia aptaneura* sparse tall shrubland; over *Eremophila latrobei* subsp. *filiformis* and *Santalum lanceolatum* sparse shrubland; over isolated low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum* and *Ptilotus obovatus* sparse forbland; over *Aristida inaequiglumis*, *Aristida contorta*, and *Themeda triandra* open tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
Abutilon fraseri	shrub	0.3	0.1
Abutilon lepidum	herb	0.2	0.1
Abutilon otocarpum	shrub	0.3	0.1
Acacia aptaneura	tree	8	2
Acacia aptaneura	shrub	2.5	0.1
Acacia pruinocarpa	tree	4	1
Aristida contorta	grass	0.3	3
Aristida inaequiglumis	grass	0.4	4
Arivela viscosa	herb	0.8	0.1
Boerhavia coccinea	herb	0.1	0.1
Chrysopogon fallax	grass	0.6	0.1
Cucumis variabilis	creeper	n/a	0.1
Cymbopogon ambiguus	grass	0.8	0.1
Dactyloctenium radulans	grass	0.1	0.1
Digitaria ctenantha	grass	0.2	0.1
Duperreya commixta	creeper	n/a	0.1
Dysphania rhadinostachya subsp. inflata	herb	0.1	0.1
Enneapogon caerulescens	grass	0.2	0.1
Enneapogon polyphyllus	grass	0.2	0.1
Enneapogon robustissimus	grass	0.2	0.1
Eremophila forrestii subsp. forrestii	shrub	2.2	1
Eremophila latrobei subsp. filiformis	shrub	1.5	1
Eremophila longifolia	shrub	2.5	3
Eriachne mucronata	grass	0.3	0.1

Eulalia aurea	grass	0.1	0.1
Euphorbia coghlanii	herb	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.1	0.1
Gomphrena canescens subsp. Canescens	herb	0.2	0.1
Hibiscus burtonii	shrub	0.6	0.1
Maireana villosa	shrub	0.1	0.1
Perotis rara	grass	0.1	0.1
Pterocaulon sphacelatum	herb	1	1
Ptilotus exaltatus	herb	0.2	0.1
Ptilotus helipteroides	herb	0.1	0.1
Ptilotus obovatus	herb	1	1
Rhynchosia minima	herb	0.3	0.1
Salsola australis	shrub	0.3	0.1
Santalum lanceolatum	shrub	2	0.1
Sclerolaena cornishiana	herb	0.2	0.1
Senna artemisioides subsp. helmsii	shrub	0.6	0.1
Senna artemisioides subsp. helmsii	shrub	0.6	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.1	0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	shrub	0.9	0.1
Themeda triandra	grass	0.2	3
Tragus australianus	grass	0.1	0.1
Triodia pungens	grass	0.4	0.1

Site	Q03	Site photo
Date	14/05/21	 Flora_Quadrat/PhotoP5140010
Vegetation type	B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	
Landform	Plain	
Slope	Negligible	
Soil	Clay, Red brown	
Rock type	Quartzite, laterite	
Rock size	<10cm	
Rock cover	2%	
Vegetation cover	80%	
Condition	Good	
Disturbances	Fire has killed 90% of shrubs over 3m (Old burnt stage to 6m)	
Easting (MGA94 Zone 51)	684598	
Northing (MGA94 Zone 51)	7469275	
Vegetation description	*Acacia pruinocarpa* low open woodland; over *Eremophila longifolia* and *Santalum lanceolatum* sparse tall shrubland; over *Acacia aptaneura* and *Acacia* spp. sparse shrubland; over isolated low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, *Ptilotus obovatus*, *Arivela viscosa* open forbland; over *Aristida inaequiglumis*, *Themeda triandra*, *Aristida lazaridis* open tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Cenchrus setiger*	grass	0.5	0.1
**Malvastrum americanum*	herb	0.4	0.1
**Solanum lasiophyllum*	shrub	0.5	0.1
Abutilon macrum	shrub	0.3	0.1
Abutilon otocarpum	shrub	0.3	0.1
Acacia aptaneura	shrub	2	0.1
Acacia bivenosa	shrub	2	0.1
Acacia pruinocarpa	tree	5	1
Acacia sp.	shrub	2	1
Alternanthera nana	herb	0.2	0.1
Androcalva luteiflora	shrub	1.3	0.1
Aristida contorta	grass	0.3	0.1
Aristida inaequiglumis	grass	0.6	5
Aristida lazaridis	grass	0.8	0.1
Arivela viscosa	herb	0.5	0.1
Boerhavia coccinea	herb	0.1	0.1
Cajanus marmoratus	herb	0.1	0.1
Chrysopogon fallax	grass	0.5	0.1
Convolvulus clementii	creeper	n/a	0.1
Cucumis variabilis	creeper	n/a	0.1
Dactyloctenium radulans	grass	0.1	0.1
Duperreya commixta	creeper	n/a	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Enneapogon robustissimus	grass	0.5	0.1

Eremophila longifolia	shrub	4	2
Euphorbia australis var. subtomentosa	herb	0.1	0.1
Euphorbia coghlanii	herb	0.2	0.1
Euphorbia tannensis subsp. eremophila	herb	0.2	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Glycine sp.	herb	0.4	0.1
Goodenia stellata	herb	0.1	0.1
Hibiscus sturtii var. platychlamys	shrub	0.3	0.1
Indigofera georgei	shrub	0.5	0.1
Maireana villosa	shrub	0.3	0.1
Melhania oblongifolia	shrub	0.4	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.2	0.1
Perotis rara	grass	0.1	0.1
Pterocaulon sphacelatum	herb	0.7	20
Ptilotus exaltatus	herb	0.4	0.1
Ptilotus helipteroides	herb	0.4	0.1
Ptilotus obovatus	herb	0.6	0.1
Rhynchosia minima	creeper	n/a	0.1
Salsola australis	shrub	1.1	0.1
Santalum lanceolatum	shrub	2	0.1
Senna artemisioides subsp. oligophylla	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.3	0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	shrub	1	0.1
Themeda triandra	grass	0.4	4
Tribulus macrocarpus	herb	0.1	0.1
Trichodesma zeylanicum var. zeylanicum	herb	1.2	0.1

Site	Q04	Site photo
Date	14/05/21	 Flora_Quadrat/PhotoP5140022
Vegetation type	B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	
Landform	Plain	
Slope	Very Slight	
Soil	Clay, Red brown	
Rock type	Quartzite, Shale	
Rock size	To 5cm	
Rock cover	10%	
Vegetation cover	85%	
Condition	Good	
Disturbances	Fire deaths 50% of shrubs >3m	
Easting (MGA94 Zone 51)	684314	
Northing (MGA94 Zone 51)	7468803	
Vegetation description	*Acacia aptaneura* isolated low trees; over *Acacia pruinocarpa*, *Santalum lanceolatum*, *Gossypium robinsonii* sparse tall shrubland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, *Arivela viscosa*; *Trichodesma zeylanicum* var. *zeylanicum* open forbland; over *Aristida inaequiglumis* and *Aristida contorta* tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Bidens bipinnata*	herb	0.4	0.1
**Malvastrum americanum*	herb	0.6	0.1
Abutilon fraseri	shrub	0.5	0.1
Abutilon otocarpum	shrub	0.4	0.1
Acacia aptaneura	tree	8	0.1
Acacia pruinocarpa	shrub	3	2
Alternanthera nana	herb	0.2	0.1
Amaranthus cuspidifolius	herb	0.2	0.1
Aristida contorta	grass	0.3	5
Aristida inaequiglumis	grass	0.5	60
Arivela viscosa	herb	1	0.1
Chrysopogon fallax	grass	0.7	0.1
Cucumis variabilis	creeper	n/a	0.1
Dactyloctenium radulans	grass	0.1	0.1
Duperreya commixta	creeper	n/a	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Eragrostis eriopoda	grass	0.3	0.1
Glycine sp.	creeper	n/a	0.1
Gossypium robinsonii	shrub	4	0.1
Maireana villosa	shrub	0.4	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.5	0.1
Perotis rara	grass	0.1	0.1
Psydrax latifolia	shrub	1	0.1
Pterocaulon sphacelatum	herb	0.9	15

Ptilotus exaltatus	grass	0.8	0.1
Ptilotus helipteroides	herb	0.1	0.1
Rhynchosia minima	creeper	n/a	0.1
Salsola australis	shrub	0.5	0.1
Santalum lanceolatum	tree	2	0.1
Senna artemisioides subsp. helmsii	shrub	1	0.1
Sida platycalyx	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.1	0.1
Themeda triandra	grass	0.6	0.1
Tribulus macrocarpus	herb	0.1	0.1
Trichodesma zeylanicum var. zeylanicum	herb	1.5	0.1

Site	Q05	Site photo
Date	14/05/21	 Flora_Quadrat/PhotoP5140017
Vegetation type	B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	
Landform	Drainage line on Plain	
Slope	Drains to south (200°)	
Soil	Clay	
Rock type	Quartzite, laterite	
Rock size	To 8cm	
Rock cover	2%	
Vegetation cover	60%	
Condition	Degraded	
Disturbances	Weeds, fire has killed some large trees, as well as shrubs >2m (5%)	
Easting (MGA94 Zone 51)	684684	
Northing (MGA94 Zone 51)	7468922	
Vegetation description	Acacia aptaneura low mulga woodland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over Pterocaulon sphacelatum, *Bidens bipinnata, *Malvastrum americanum open forbland; over Cenchrus ciliaris, Aristida contorta, A. inaequiglumis, Themeda triandra (56.2%) tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Bidens bipinnata*	herb	0.2	2
**Cenchrus ciliaris*	grass	1	40
**Malvastrum americanum*	herb	0.3	2
**Portulaca oleracea*	herb	0.1	0.1
**Solanum lasiophyllum*	shrub	0.3	0.1
Abutilon macrum	shrub	0.2	0.1
Abutilon otocarpum	shrub	0.3	0.1
Acacia aptaneura	tree	9	20
Alternanthera nana	herb	0.2	0.1
Aristida contorta	grass	0.3	8
Aristida inaequiglumis	grass	0.6	5
Arivela viscosa	herb	1	0.1
Boerhavia coccinea	herb	0.1	0.1
Chrysopogon fallax	grass	0.7	0.1
Cucumis variabilis	creeper	n/a	0.1
Digitaria ammophila	grass	0.2	0.1
Digitaria ctenantha	grass	0.1	0.1
Duperreya commixta	creeper	n/a	0.1
Dysphania rhadinostachya subsp. inflata	herb	0.1	0.1
Enneapogon caerulescens	grass	0.2	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Eragrostis eriopoda	grass	0.2	0.1
Eremophila latrobei subsp. filiformis	shrub	1.5	0.1
Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Euphorbia australis var. subtomentosa	herb	0.1	0.1

Evolvulus alsinoides var. villosicalyx	herb	0.1	0.1
Glycine sp.	Creeper	n/a	0.1
Goodenia prostrata	herb	0.01	0.1
Gossypium robinsonii	shrub	n/a	0.1
Maireana villosa	shrub	0.2	0.1
Melhania oblongifolia	shrub	0.3	0.1
Paraneurachne muelleri	grass	0.1	0.1
Perotis rara	grass	0.1	0.1
Polycarpaea corymbosa	herb	0.1	0.1
Pterocaulon sphacelatum	herb	0.5	5
Ptilotus exaltatus	grass	0.7	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	0.5	0.1
Rhagodia eremaea	shrub	1	0.1
Rhagodia sp. Hamersley (M. Trudgen 17794)	shrub	2	0.1
Rhynchosia minima	creeper	0.3	0.1
Salsola australis	shrub	1	0.1
Schizachyrium fragile	grass	0.1	0.1
Senna artemisioides subsp. helmsii	shrub	0.6	0.1
Senna artemisioides subsp. oligophylla	shrub	0.4	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Sporobolus australasicus	herb	0.15	0.1
Stemodia grossa	herb	0.4	0.1
Themeda triandra	grass	0.9	2
Tragus australianus	grass	0.1	0.1
Tribulus macrocarpus	herb	0.1	0.1
Trichodesma zeylanicum var. zeylanicum	herb	1.5	0.1
Triodia pungens	grass	0.3	0.1

Site	Q06	Site photo
Date	14/05/21	 Flora_Quadrat/PhotoP5140020
Vegetation type	B - Mulga and acacia low open woodland over open tussock grassland on gently sloping (drainage) plain with variable rock cover	
Landform	Plain	
Slope	Negligible	
Soil	Clay, Red brown	
Rock type	Shale, quartzite, laterite	
Rock size	To 10cm	
Rock cover	95%	
Vegetation cover	6%	
Condition	Good	
Disturbances	Fire deaths of 50% of shrubs >2m	
Easting (MGA94 Zone 51)	684562	
Northing (MGA94 Zone 51)	7468748	
Vegetation description	*Acacia pruinocarpa* and *A. aptaneura* low open woodland; over *Hakea lorea* subsp. *lorea*, *Eremophila forrestii* subsp. *forrestii*, **Solanum lasiophyllum* isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over isolated forbs; over *Aristida contorta*, *A. inaequiglumis*, *Themeda triandra* sparse tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Portulaca oleracea*	herb	0.1	0.1
**Solanum lasiophyllum*	shrub	1	0.1
Abutilon otocarpum	shrub	0.2	0.1
Acacia aptaneura	tree	4	1
Acacia pruinocarpa	tree	9	1
Aristida contorta	grass	0.2	6
Aristida inaequiglumis	grass	0.5	0.1
Boerhavia coccinea	herb	0.1	0.1
Cucumis variabilis	Creeper	n/a	0.1
Cymbopogon ambiguus	grass	1	0.1
Duperreya commixta	Creeper	1.2	0.1
Dysphania rhadinostachya subsp. inflata	herb	0.1	0.1
Enneapogon caerulescens	grass	0.2	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Enneapogon robustissimus	grass	0.2	0.1
Eremophila forrestii subsp. forrestii	shrub	1.2	0.1
Goodenia prostrata	herb	0.01	0.1
Hakea lorea subsp. lorea	shrub	1.5	0.1
Hibiscus burtonii	shrub	0.3	0.1
Maireana villosa	shrub	0.5	0.1
Paraneurachne muelleri	grass	0.4	0.1
Perotis rara	grass	0.1	0.1
Pterocaulon sphacelatum	herb	1	0.1
Ptilotus exaltatus	grass	1	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	0.9	0.1

Rhagodia eremaea	shrub	0.6	0.1
Salsola australis	shrub	1	0.1
Senna artemisioides subsp. helmsii	shrub	0.5	0.1
Sida ? echinocarpa	shrub	0.5	0.1
Stemodia grossa	herb	0.2	0.1
Themeda triandra	grass	0.7	0.1
Tribulus macrocarpus	herb	0.1	0.1
Triodia pungens	grass	0.6	0.1

Site	Q07	Site photo
Date	12/05/21	 Flora_Quadrat/PhotoP5120003
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	N/A	
Soil	Clay, Dark red/black	
Rock type	Laterite	
Rock size	<10cm	
Rock cover	50%	
Vegetation cover	40%	
Condition	Very Good	
Disturbances	Fire >10 y.b.p	
Easting (MGA94 Zone 51)	684837	
Northing (MGA94 Zone 51)	7468759	
Vegetation description	Acacia pruinocarpa and Eucalyptus gamophylla low open woodland; over Acacia aptaneura, A. elachantha, and Santalum lanceolatum sparse tall shrubland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over Ptilotus obovatus, Pterocaulon sphacelatum, Arivela viscosa sparse forbland; over Aristida inaequiglumis, Themeda triandra, Triodia pungens, T. melvillei open grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Portulaca oleracea*	herb	0.1	0.1
Abutilon otocarpum	shrub	0.4	0.1
Acacia aptaneura	shrub	4	2
Acacia dictyophleba	shrub	1.2	0.1
Acacia elachantha	shrub	4	0.1
Acacia pruinocarpa	tree	5	4
Acacia sp.	shrub	2	0.1
Alternanthera nana	herb	0.2	0.1
Aristida contorta	grass	0.1	0.1
Aristida inaequiglumis	grass	0.8	10
Arivela viscosa	herb	0.4	0.1
Boerhavia schomburgkiana	herb	0.2	0.1
Capparis lasiantha	shrub	1	0.1
Chrysopogon fallax	grass	0.3	0.1
Cucumis variabilis	Creeper	n/a	0.1
Duperreya commixta	Creeper	n/a	0.1
Enneapogon polyphyllus	grass	0.2	0.1
Enneapogon robustissimus	grass	0.5	0.1
Eremophila forrestii subsp. forrestii	shrub	2	0.1
Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Eucalyptus gamophylla	tree	3	1
Evolvulus alsinoides var. villosicalyx	herb	0.1	0.1
Goodenia microptera	herb	0.1	0.1
Hakea chordophylla	shrub	2	0.1
Hibiscus burtonii	shrub	0.3	0.1

Hibiscus coatesii	shrub	0.3	0.1
Hibiscus sturtii var. platychlamys	shrub	0.2	0.1
Maireana villosa	shrub	0.2	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.2	0.1
Perotis rara	grass	0.1	0.1
Polycarpaea corymbosa	herb	0.1	0.1
Psydrax latifolia	shrub	1.2	0.1
Pterocaulon sphacelatum	herb	0.7	0.1
Ptilotus exaltatus	herb	0.2	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	1	1
Rhagodia sp. Hamersley (M. Trudgen 17794)	shrub	1.1	0.1
Salsola australis	shrub	0.1	0.1
Santalum lanceolatum	tree	3	0.1
Senna artemisioides subsp. helmsii	shrub	0.5	0.1
Sida platycalyx	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.1	0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	herb	0.8	0.1
Themeda triandra	grass	0.8	10
Trichodesma zeylanicum var. zeylanicum	herb	1.1	0.1
Triodia pungens	grass	0.5	5

Site	Q09	Site photo
Date	17/05/21	 Flora_Quadrat/PhotoP5170080
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	-	
Soil	Clay, Red brown	
Rock type	Quartzite + laterite fines	
Rock size	<10cm	
Rock cover	10%	
Vegetation cover	50%	
Condition	Good	
Disturbances	Fire deaths 20% of shrubs/trees >2m	
Easting (MGA94 Zone 51)	684181	
Northing (MGA94 Zone 51)	7468474	
Vegetation description	*Acacia aptaneura*, *A. pruinocarpa*, and *Corymbia deserticola* isolated low trees; over *Acacia dictyophleba* and *Santalum lanceolatum* isolated tall shrubs; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, **Malvastrum americanum*, *Arivela viscosa* sparse forbland; *Triodia pungens*, *Aristida inaequiglumis* and *Themeda triandra* open grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Malvastrum americanum*	herb	0.8	0.1
**Portulaca oleracea*	herb	0.1	0.1
**Stylosanthes hamata*	herb	0.3	0.1
Abutilon otocarpum	shrub	0.3	0.1
Acacia acradenia	shrub	1.5	0.1
Acacia aptaneura	tree	8	0.1
Acacia bivenosa	shrub	2	0.1
Acacia dictyophleba	shrub	2.5	0.1
Acacia elachantha	shrub	1.1	0.1
Acacia pachyacra	shrub	1.2	0.1
Acacia pruinocarpa	tree	6	0.1
Alternanthera nana	herb	0.2	0.1
Aristida contorta	grass	0.3	0.1
Aristida holathera var. holathera	grass	0.4	0.1
Aristida inaequiglumis	grass	0.4	3
Arivela viscosa	herb	0.7	0.1
Boerhavia coccinea	herb	0.2	0.1
Chrysopogon fallax	grass	0.5	0.1
Corymbia deserticola subsp. Deserticola	tree	3.2	0.1
Cucumis variabilis	Creeper	n/a	0.1
Cymbopogon obtectus	grass	1	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania kalpari	herb	0.1	0.1
Enneapogon polyphyllus	grass	0.4	0.1
Enneapogon robustissimus	grass	0.5	0.1

Eremophila forrestii subsp. forrestii	shrub	1.2	0.1
Eremophila latrobei subsp. filiformis	shrub	1	0.1
Eremophila longifolia	shrub	1.2	0.1
Eulalia aurea	grass	0.7	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Goodenia microptera	herb	0.3	0.1
Hibiscus sturtii var. platychlamys	shrub	0.5	0.1
Maireana villosa	shrub	0.5	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.5	0.1
Perotis rara	grass	0.1	0.1
Phyllanthus erwinii	shrub	0.1	0.1
Pterocaulon sphacelatum	herb	1	0.1
Ptilotus exaltatus	grass	0.6	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	0.6	0.1
Santalum lanceolatum	tree	2	0.1
Senna notabilis	shrub	0.4	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Themeda triandra	grass	0.6	2
Trichodesma zeylanicum var. zeylanicum	herb	1.2	0.1
Triodia melvillei	grass	0.5	0.1
Triodia pungens	grass	0.5	4

Site	Q10	Site photo
Date	17/05/21	 Flora_Quadrat/PhotoP5170078
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	-	
Soil	Clay, Red brown	
Rock type	Clay + Laterite fines	
Rock size	<8cm	
Rock cover	40%	
Vegetation cover	45%	
Condition	Good	
Disturbances	Fire killed 20% shrubs >2m	
Easting (MGA94 Zone 51)	684659	
Northing (MGA94 Zone 51)	7468432	
Vegetation description	*Acacia pruinocarpa*, *A. aptaneura*, *Corymbia deserticola* subsp. *deserticola* low open woodland; over isolated tall shrubs; over isolated shrubs; over sparse dwarf shrubs; over *Arivela viscosa*, *Pterocaulon sphacelatum*, *Ptilotus obovatus* isolated forbs; over *Triodia pungens*, *Aristida inaequiglumis*, *Themeda triandra* grassland.	

Taxon name	Growth form	Height (m)	Cover%
*Cenchrus ciliaris	grass	0.6	0.1
Abutilon otocarpum	shrub	0.2	0.1
Acacia aptaneura	tree	5	2
Acacia dictyophleba	shrub	2.5	0.1
Acacia pruinocarpa	tree	6	4
Aristida contorta	grass	0.3	0.1
Aristida holathera var. holathera	grass	0.3	0.1
Aristida inaequiglumis	grass	0.4	2
Arivela viscosa	herb	0.8	0.1
Chrysopogon fallax	grass	0.5	0.1
Corymbia deserticola subsp. Deserticola	tree	4	0.1
Cucumis variabilis	Creeper	n/a	0.1
Duperreya commixta	Creeper	n/a	0.1
Enneapogon caerulescens	grass	0.2	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Eremophila forrestii subsp. forrestii	shrub	2	0.1
Eremophila latrobei subsp. filiformis	shrub	0.5	0.1
Eremophila longifolia	shrub	2.5	0.1
Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Eulalia aurea	grass	1	0.1
Euphorbia australis var. subtomentosa	herb	0.2	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.3	0.1
Hibiscus sturtii var. platychlamys	shrub	0.2	0.1
Maireana villosa	shrub	0.4	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.4	0.1

Perotis rara	grass	0.1	0.1
Polycarpaea corymbosa	herb	0.2	0.1
Pterocaulon sphacelatum	herb	0.8	0.1
Ptilotus exaltatus	grass	0.3	0.1
Ptilotus obovatus	herb	0.4	0.1
Salsola australis	shrub	0.3	0.1
Schizachyrium fragile	grass	0.2	0.1
Sclerolaena cornishiana	herb	0.1	0.1
Senna artemisioides subsp. oligophylla	shrub	0.1	0.1
Sida platycalyx	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.4	0.1
Themeda triandra	grass	0.5	2
Tribulus macrocarpus	herb	0.2	0.1
Triodia pungens	grass	0.5	40

Site	Q11	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160044
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	Negligible	
Soil	Clay, Red brown	
Rock type	Quartzite	
Rock size	Up to 8cm	
Rock cover	20%	
Vegetation cover	20%	
Condition	Good	
Disturbances	Fire deaths Acacia >2m 50%	
Easting (MGA94 Zone 51)	684096	
Northing (MGA94 Zone 51)	7468226	
Vegetation description	*Acacia aptaneura* low open woodland; over *Acacia pruinocarpa* and *A. elachantha* isolated tall shrubs; over *Acacia dictyophleba*, *A. pachyacra*, *Psydrax latifolia* isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Ptilotus calostachyus*, *Ptilotus obovatus*, *Evolvulus alsinoides* var. *villosicalyx* sparse forbland; over *Triodia melvillei*, *Aristida contorta*, *Themeda triandra* open grassland.	

Taxon name	Growth form	Height (m)	Cover%
Abutilon otocarpum	shrub	0.6	0.1
Acacia aptaneura	tree	7	5
Acacia dictyophleba	shrub	2	0.1
Acacia elachantha	shrub	2.5	0.1
Acacia pruinocarpa	shrub	2.5	0.1
Acacia pachyacra	shrub	1.2	0.1
Aristida contorta	grass	0.4	5
Aristida holathera var. holathera	grass	0.4	0.1
Arivela viscosa	herb	0.2	0.1
Cheilanthes sieberi subsp. sieberi	fern	0.2	0.1
Chrysopogon fallax	grass	0.5	0.1
Cucumis variabilis	Creeper	n/a	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania kalpari	herb	0.1	0.1
Enneapogon polyphyllus	grass	0.2	0.1
Enneapogon robustissimus	grass	0.6	0.1
Eulalia aurea	grass	0.6	0.1
Euphorbia aff. ferdinandi	herb	0.1	0.1
Euphorbia biconvexa	herb	0.2	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.3	0.1
Goodenia microptera	herb	0.2	0.1
Goodenia stellata	herb	0.1	0.1
Hibiscus burtonii	shrub	0.5	0.1
Hibiscus sturtii var. platychlamys	shrub	0.5	0.1
Indigofera georgei	shrub	0.8	0.1

Maireana villosa	shrub	0.3	0.1
Panicum decompositum	grass	0.3	0.1
Paraneurachne muelleri	grass	0.4	1
Paspalidium rarum	grass	0.2	0.1
Perotis rara	grass	0.1	0.1
Psydrax latifolia	shrub	1.8	0.1
Pterocaulon sphacelatum	herb	1.2	0.1
Ptilotus calostachyus	herb	0.8	0.1
Ptilotus exaltatus	grass	0.4	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	0.5	0.1
Scaevola parvifolia subsp. parvifolia	shrub	0.4	0.1
Sclerolaena cornishiana	herb	0.1	0.1
Senna artemisioides subsp. oligophylla	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	shrub	1.2	0.1
Themeda triandra	grass	0.8	2
Triodia melvillei	grass	0.7	10

Site	Q12	Site photo
Date	17/05/21	 Flora_Quadrat/PhotoP5170076
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	-	
Soil	Clay, Red brown	
Rock type	Quartzite	
Rock size	<5cm	
Rock cover	25%	
Vegetation cover	55%	
Condition	Good	
Disturbances	Fire deaths 10% Shrubs >2m	
Easting (MGA94 Zone 51)	684574	
Northing (MGA94 Zone 51)	7468353	
Vegetation description	*Acacia pruinocarpa*, *Eremophila longifolia*, *Hakea lorea* subsp. *lorea* open (5.2%) woodland; over *Acacia aptaneura* (0.1%) isolated tall shrubs; over *Acacia dictyophleba*, *Anthobolus leptomerioides*, *Salsola australis* (0.3%) shrubs; over *Abutilon macrum*, *Abutilon otocarpum*, *Hibiscus burtonii* (0.4%) low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, *Arivela viscosa*, *Ptilotus calostachyus* sparse forbland; over *Themeda triandra*, *Eulalia aurea*, *Triodia pungens* and *T. melvillei* open grassland.	

Taxon name	Growth form	Height (m)	Cover%
Abutilon macrum	shrub	0.5	0.1
Abutilon otocarpum	shrub	0.6	0.1
Acacia aptaneura	shrub	3	0.1
Acacia dictyophleba	shrub	1.5	0.1
Acacia pruinocarpa	tree	7	5
Alternanthera nana	herb	0.4	0.1
Anthobolus leptomerioides	shrub	1	0.1
Aristida contorta	grass	0.3	1
Aristida holathera var. holathera	grass	0.5	0.1
Aristida inaequiglumis	grass	0.6	0.1
Aristida lazaridis	grass	0.3	0.1
Arivela viscosa	herb	1	0.1
Boerhavia coccinea	herb	0.1	0.1
Cheilanthes sieberi subsp. sieberi	fern	0.2	0.1
Chrysocephalum apiculatum subsp. pilbarense	grass	0.25	0.1
Chrysopogon fallax	grass	0.7	0.1
Cucumis variabilis	Creeper	n/a	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania kalpari	herb	0.1	0.1
Enneapogon polyphyllus	grass	0.4	0.1
Enneapogon robustissimus	grass	0.5	0.1
Enneapogon lindleyanus	grass	0.3	0.1
Eremophila longifolia	shrub	6	0.1
Eulalia aurea	grass	0.5	10

Euphorbia australis var. subtomentosa	herb	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Glycine sp.	Creeper	n/a	0.1
Hakea lorea subsp. lorea	tree	5	0.1
Hibiscus burtonii	shrub	0.5	0.1
Maireana villosa	shrub	0.4	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.5	0.1
Peripleura virgata	herb	0.3	0.1
Perotis rara	grass	0.1	0.1
Pterocaulon sphacelatum	herb	0.5	5
Ptilotus calostachyus	herb	0.8	0.1
Ptilotus exaltatus	grass	0.7	0.1
Ptilotus helipteroides	herb	0.2	0.1
Ptilotus obovatus	herb	1	0.1
Salsola australis	shrub	1	0.1
Senna notabilis	shrub	0.3	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	shrub	0.6	0.1
Themeda triandra	grass	0.5	20
Triodia pungens	grass	0.5	5

Site	Q13	Site photo
Date	17/05/21	 Flora_Quadrat/PhotoP5170082
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	<2°	
Soil	Clay, Red brown	
Rock type	Quartzite + laterite fines	
Rock size	<10cm	
Rock cover	60%	
Vegetation cover	40%	
Condition	Good	
Disturbances	Fire deaths 50% trees + Shrubs >2m	
Easting (MGA94 Zone 51)	684555	
Northing (MGA94 Zone 51)	7467944	
Vegetation description	*Acacia aptaneura* low open mulga woodland; over *Acacia pruinocarpa*, *Hakea lorea* subsp. *lorea*, *Acacia elachantha* sparse tall shrubland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, *Arivela viscosa*, *Ptilotus obovatus* sparse forbland; over *Eulalia aurea*, *Aristida inaequiglumis*, and *Themeda triandra* tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Bidens bipinnata*	herb	0.2	0.1
**Cenchrus setiger*	grass	0.2	0.1
**Portulaca oleracea*	herb	0.1	0.1
**Solanum lasiophyllum*	shrub	0.2	0.1
Abutilon otocarpum	shrub	0.2	0.1
Acacia aptaneura	shrub	4	2
Acacia dictyophleba	shrub	1.5	0.1
Acacia elachantha	shrub	3	0.1
Acacia pachyacra	shrub	2	0.1
Acacia pruinocarpa	shrub	2.2	1
Alternanthera nana	herb	0.3	0.1
Aristida contorta	grass	0.3	1
Aristida inaequiglumis	grass	0.5	10
Aristida lazaridis	grass	0.5	0.1
Arivela viscosa	herb	0.6	0.1
Boerhavia coccinea	herb	0.2	0.1
Chrysopogon fallax	grass	0.3	0.1
Cucumis variabilis	Creeper	n/a	0.1
Digitaria brownii	grass	0.6	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania rhadinostachya subsp. Inflata	herb	0.2	0.1
Enneapogon polyphyllus	grass	0.4	1
Enneapogon robustissimus	grass	0.5	0.1
Eremophila latrobei subsp. filiformis	shrub	1.1	0.1
Eremophila longifolia	shrub	1.2	0.1

Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Eulalia aurea	grass	0.7	15
Euphorbia aff. ferdinandi	herb	0.1	0.1
Euphorbia biconvexa	shrub	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.1	0.1
Hakea lorea subsp. lorea	tree	2	1
Hibiscus burtonii	shrub	0.8	0.1
Indigofera georgei	shrub	1.1	0.1
Maireana villosa	shrub	0.4	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.1	0.1
Peripleura virgata	herb	0.3	0.1
Peripleura obovata	herb	0.3	0.1
Perotis rara	grass	0.1	0.1
Psydrax latifolia	shrub	0.7	0.1
Pterocaulon sphacelatum	herb	1	4
Ptilotus exaltatus	grass	0.5	0.1
Ptilotus helipteroides	herb	0.3	0.1
Ptilotus obovatus	herb	0.5	0.1
Senna artemisioides subsp. x artemisioides	shrub	1	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Solanum ? horridum	shrub	0.5	0.1
Sporobolus australasicus	herb	0.1	0.1
Themeda triandra	grass	0.6	5
Triodia melvillei	grass	0.6	1
Triodia pungens	grass	0.6	2

Site	Q14	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160058
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	-	
Soil	Clay, Red brown	
Rock type	Quartzite, Shale	
Rock size	Up to 10cm	
Rock cover	45%	
Vegetation cover	25%	
Condition	Good	
Disturbances	Fire deaths 10% of shrubs >2m	
Easting (MGA94 Zone 51)	685014	
Northing (MGA94 Zone 51)	7468361	
Vegetation description	*Acacia acradenia* and *Acacia aptaneura* low open woodland; over *Acacia pruinocarpa*, *A. dictyophleba*, *Hakea lorea* subsp. *lorea* sparse tall shrubland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, *Goodenia microptera*, *Ptilotus exaltatus* sparse forbland; over *Triodia melvillei* open hummock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Bidens bipinnata*	herb	0.1	0.1
**Portulaca oleracea*	herb	0.1	0.1
**Solanum lasiophyllum*	shrub	0.5	0.1
Abutilon fraseri	shrub	0.3	0.1
Abutilon otocarpum	shrub	0.3	0.1
Acacia acradenia	tree	8	2
Acacia aptaneura	tree	6	2
Acacia dictyophleba	shrub	3	2
Acacia pruinocarpa	shrub	4	2
Alternanthera nana	herb	0.1	0.1
Anthobolus leptomerioides	shrub	1	0.1
Aristida contorta	grass	0.4	0.1
Aristida inaequiglumis	grass	0.5	0.1
Arivela viscosa	herb	0.1	0.1
Boerhavia coccinea	herb	0.1	0.1
Chrysopogon fallax	grass	0.6	0.1
Digitaria brownii	grass	0.5	0.1
Duperreya commixta	Creeper	n/a	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Eriachne mucronata	grass	0.1	0.1
Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Eulalia aurea	grass	0.9	0.1
Euphorbia aff. ferdinandi	herb	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Goodenia microptera	herb	0.3	0.1

Goodenia prostrata	herb	0.01	0.1
Hakea lorea subsp. lorea	tree	2.1	0.1
Hibiscus burtonii	shrub	0.5	0.1
Hibiscus sturtii var. platychlamys	shrub	0.5	0.1
Panicum decompositum	grass	0.5	0.1
Paraneurachne muelleri	grass	0.5	0.1
Polycarpaea corymbosa	herb	0.1	0.1
Polygala glaucifolia	herb	0.1	0.1
Psydrax latifolia	shrub	1	0.1
Psydrax rigidula	shrub	1	0.1
Pterocaulon sphacelatum	herb	0.3	0.1
Ptilotus exaltatus	herb	0.3	0.1
Ptilotus helipteroides	herb	0.3	0.1
Ptilotus obovatus	grass	0.4	0.1
Scaevola parvifolia subsp. parvifolia	shrub	0.3	0.1
Schizachyrium fragile	grass	0.2	0.1
Senna notabilis	shrub	0.1	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.3	0.1
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)	shrub	1	0.1
Tephrosia sp.	shrub	0.4	0.1
Themeda triandra	grass	0.5	0.1
Triodia melvillei	grass	1	10

Site	Q17	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160051
Vegetation type	C - Mulga and Acacia low open woodland over open spinifex and tussock grassland on flat plain with medium rock cover	
Landform	Plain	
Slope	-	
Soil	Clay, Red brown	
Rock type	Quartzite + laterite fines	
Rock size	<5cm	
Rock cover	5%	
Vegetation cover	22%	
Condition	Good	
Disturbances	Fire death 5% of shrubs/trees over 2m	
Easting (MGA94 Zone 51)	685015	
Northing (MGA94 Zone 51)	7467909	
Vegetation description	*Acacia aptaneura* low open (mulga) woodland; over *Hakea lorea* subsp. *lorea*, *Acacia pachyacra* and *A. tenuissima* sparse tall shrubland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Ptilotus helipteroides*, *Pterocaulon sphacelatum*, *Ptilotus exaltatus* sparse forbland; over *Triodia melvillei*, *Aristida contorta, A. inaequiglumis* open grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Portulaca oleracea*	herb	0.1	0.1
Abutilon otocarpum	shrub	0.2	0.1
Acacia aptaneura	tree	6	5
Acacia pachyacra	shrub	2.5	0.1
Acacia tenuissima	shrub	2.5	0.1
Anthobolus leptomerioides	shrub	1	0.1
Aristida contorta	grass	0.2	2
Aristida holathera var. holathera	grass	0.3	0.1
Aristida inaequiglumis	grass	0.5	2
Boerhavia coccinea	herb	0.1	0.1
Chrysopogon fallax	grass	0.6	0.1
Cymbopogon obtectus	grass	0.3	0.1
Digitaria brownii	grass	0.5	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania kalpari	herb	0.1	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Enneapogon robustissimus	grass	0.5	0.1
Eremophila latrobei subsp. filiformis	shrub	1.5	0.1
Eremophila longifolia	shrub	1.2	0.1
Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Eulalia aurea	grass	0.6	0.1
Euphorbia biconvexa	shrub	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Gomphrena canescens subsp. Canescens	herb	0.2	0.1
Goodenia prostrata	herb	0.01	0.1

Hakea lorea subsp. lorea	tree	2	2
Hibiscus burtonii	shrub	1	0.1
Lysiana murrayi	Mistletoe	n/a	0.1
Maireana villosa	shrub	0.1	0.1
Perotis rara	grass	0.1	0.1
Polycarpaea corymbosa	herb	0.1	0.1
Pterocaulon sphacelatum	herb	0.8	0.1
Ptilotus exaltatus	herb	0.1	0.1
Ptilotus gaudichaudii	herb	0.2	0.1
Ptilotus helipteroides	herb	0.2	1
Ptilotus obovatus	grass	0.4	0.1
Rhagodia sp. Hamersley (M. Trudgen 17794)	shrub	1	0.1
Schizachyrium fragile	grass	0.1	0.1
Senna notabilis	shrub	0.1	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.5	0.1
Solanum ferocissimum	herb	0.2	0.1
Themeda triandra	grass	0.5	0.1
Triodia melvillei	grass	0.5	10

Site	Q19	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160053
Vegetation type	D – Mulga, Hakea lorea, and Eucalyptus xerothermica low open woodland over closed tussock grassland on flat clay plain (no rocks)	
Landform	Plain	
Slope	-	
Soil	Clay, Red brown	
Rock type	-	
Rock size	-	
Rock cover	-	
Vegetation cover	80%	
Condition	Good	
Disturbances	Fire deaths of shrubs <1m about 20%	
Easting (MGA94 Zone 51)	685089	
Northing (MGA94 Zone 51)	7467734	
Vegetation description	*Acacia aptaneura*, *Hakea lorea* subsp. *lorea* low open woodland; over *Hakea lorea* subsp. *lorea* sparse tall shrubland; over isolated shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, **Bidens bipinnata*, *Euphorbia biconvexa* sparse forbland; over *Aristida inaequiglumis*, *Themeda triandra*, *Aristida contorta* tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Bidens bipinnata*	herb	0.3	0.1
Acacia aptaneura	tree	10	3
Acacia pachyacra	shrub	1.2	0.1
Alternanthera nana	herb	0.1	0.1
Aristida contorta	grass	0.2	2
Aristida holathera var. holathera	grass	0.2	0.1
Aristida inaequiglumis	grass	0.4	32
Boerhavia coccinea	herb	0.2	0.1
Cheilanthes sieberi subsp. sieberi	fern	0.2	0.1
Chrysopogon fallax	grass	0.5	0.1
Cucumis variabilis	Creeper	n/a	0.1
Digitaria ammophila	grass	0.2	0.1
Dysphania rhadinostachya subsp. Inflata	herb	0.1	0.1
Enneapogon polyphyllus	grass	0.4	0.1
Eremophila longifolia	shrub	1.2	0.1
Eulalia aurea	grass	0.4	0.1
Euphorbia biconvexa	herb	0.2	0.1
Goodenia prostrata	herb	0.01	0.1
Hakea lorea subsp. lorea	tree	3	2
Indigofera georgei	shrub	0.3	0.1
Lysiana murrayi	Mistletoe	n/a	0.1
Maireana villosa	shrub	0.3	0.1
Panicum decompositum	grass	0.5	0.1
Panicum decompositum	grass	0.1	0.1
Perotis rara	grass	0.1	0.1
Pterocaulon sphacelatum	herb	0.5	2

Ptilotus clementii	grass	0.3	0.1
Ptilotus obovatus	grass	0.5	0.1
Sida platycalyx	shrub	0.4	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.4	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.2	0.1
Teucrium teucriiflorum	shrub	0.4	0.1
Themeda triandra	grass	0.5	32
Themeda triandra	grass	0.5	0.1

Site	Q23	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160048
Vegetation type	D – Mulga, Hakea lorea, and Eucalyptus xerothermica low open woodland over closed tussock grassland on flat clay plain (no rocks)	
Landform	Almost indiscernible	
Slope	Clay, Red brown	
Soil	-	
Rock type	-	
Rock size	-	
Rock cover	95%	
Vegetation cover	Good	
Condition	Fire deaths of 25% of shrubs >2m	
Disturbances	685632	
Easting (MGA94 Zone 51)	7466984	
Northing (MGA94 Zone 51)	Plain	
Vegetation description	*Acacia aptaneura*, *Hakea lora* subsp. *lorea*, *Eucalyptus xerothermica* low open woodland; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over *Trichodesma zeylanicum* var. *zeylanicum*, *Arivela viscosa*, *Pterocaulon sphacelatum* isolated forbs; over *Themeda triandra*, *Aristida inaequiglumis*, *Aristida contorta* closed tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
Abutilon otocarpum	shrub	0.5	0.1
Acacia aptaneura	tree	7	6
Acacia tenuissima	shrub	1.2	0.1
Alternanthera nana	herb	0.2	0.1
Aristida contorta	grass	0.4	2
Aristida inaequiglumis	grass	0.6	5
Aristida lazaridis	grass	0.5	0.1
Arivela viscosa	herb	1	0.1
Chrysocephalum gilesii	herb	0.3	0.1
Chrysopogon fallax	grass	0.7	0.1
Cucumis variabilis	creeper	n/a	0.1
Digitaria ammophila	grass	0.5	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania kalpari	herb	0.2	0.1
Eremophila lanceolata	shrub	0.5	0.1
Eucalyptus xerothermica	tree	8	1
Eulalia aurea	grass	0.9	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.1	0.1
Hakea lorea subsp. lorea	tree	4	2
Panicum decompositum	grass	0.6	0.1
Pterocaulon sphacelatum	herb	0.4	0.1
Ptilotus obovatus	grass	0.5	0.1
Sida platycalyx	shrub	0.5	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.3	0.1
Stemodia grossa	herb	0.2	0.1

Themeda triandra	grass	0.6	85
Trichodesma zeylanicum var. zeylanicum	herb	1.5	0.1
Triodia melvillei	grass	0.5	0.1

Site	Q24	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160049
Vegetation type	D – Mulga, Hakea lorea, and Eucalyptus xerothermica low open woodland over closed tussock grassland on flat clay plain (no rocks)	
Landform	Plain	
Slope	Almost indiscernible	
Soil	Clay, Red brown	
Rock type	-	
Rock size	-	
Rock cover	-	
Vegetation cover	98%	
Condition	Good	
Disturbances	Fire deaths of 90% of shrubs _ trees >2m, Acacia regrowth <2m	
Easting (MGA94 Zone 51)	685593	
Northing (MGA94 Zone 51)	7467197	
Vegetation description	*Eucalyptus xerothermica* isolated low trees; over *Acacia dictyophleba*, *A. pachyacra*, *Clerodendrum floribundum* isolated tall shrubs; over isolated shrubs; over isolated low shrubs; over isolated dwarf shrubs; over isolated forbs; over *Themeda triandra* and *Aristida inaequiglumis* closed tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
Abutilon fraseri	shrub	0.4	0.1
Abutilon otocarpum	shrub	0.1	0.1
Acacia dictyophleba	shrub	2.5	0.1
Acacia elachantha	shrub	1.5	0.1
Acacia pachyacra	shrub	2.5	0.1
Acacia pruinocarpa	shrub	0.4	0.1
Alternanthera nana	creeper	n/a	0.1
Aristida contorta	grass	0.2	0.1
Aristida inaequiglumis	grass	0.5	15
Aristida lazaridis	grass	0.3	0.1
Arivela viscosa	herb	0.8	0.1
Chrysopogon fallax	grass	0.8	0.1
Clerodendrum floribundum var. angustifolium	shrub	2.3	0.1
Cucumis variabilis	creeper	2	0.1
Digitaria ammophila	grass	0.2	0.1
Duperreya commixta	creeper	n/a	0.1
Enneapogon polyphyllus	grass	0.5	0.1
Eremophila longifolia	shrub	2	0.1
Eucalyptus xerothermica	tree/mallee	9	0.1
Eulalia aurea	grass	0.7	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Hibiscus burtonii	shrub	0.6	0.1
Jasminum didymum subsp. lineare	Creeper	n/a	0.1
Pterocaulon sphacelatum	herb	1.1	0.1
Ptilotus obovatus	grass	0.5	0.1

Sida sp. ? L (A.M. Ashby 4202)	shrub	1	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.4	0.1
Themeda triandra	grass	0.6	80
Themeda triandra	grass	0.6	0.1
Trichodesma zeylanicum var. zeylanicum	herb	1.2	0.1

Site	Q26	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160042
Vegetation type	E - Low mulga woodland over sparse understorey on stony plain	
Landform	Plain	
Slope	Negligible	
Soil	Clay, Red brown	
Rock type	Quartzite	
Rock size	Up to 8cm	
Rock cover	90%	
Vegetation cover	25%	
Condition	Good	
Disturbances	Some? Fire deaths (Logs on ground).	
Easting (MGA94 Zone 51)	683979	
Northing (MGA94 Zone 51)	7468067	
Vegetation description	*Acacia aptaneura* low mulga woodland; over *Acacia pachyacra* and *A. ?sibirica* sparse shrubland; over isolated dwarf shrubs; over isolated ferns; over isolated forbs; over *Digitaria ammophila*, *Chrysopogon fallax*, *Aristida inaequiglumis* sparse tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
Abutilon otocarpum	shrub	0.3	0.1
Acacia ? sibirica	shrub	1.2	2
Acacia aptaneura	tree	4	20
Acacia pachyacra	shrub	1.2	5
Alternanthera nana	herb	0.2	0.1
Aristida contorta	grass	0.1	0.1
Aristida inaequiglumis	grass	0.3	0.1
Aristida obscura	grass	0.1	0.1
Cheilanthes sieberi subsp. sieberi	fern	0.2	0.1
Chrysopogon fallax	grass	0.4	0.1
Digitaria ammophila	grass	0.5	0.1
Digitaria brownii	grass	0.3	0.1
Duperreya commixta	Creeper	n/a	0.1
Enneapogon caerulescens	grass	0.3	0.1
Enneapogon polyphyllus	grass	0.3	0.1
Enneapogon lindleyanus	grass	0.2	0.1
Eragrostis cumingii	grass	0.1	0.1
Eriachne pulchella subsp. pulchella	grass	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Hibiscus burtonii	shrub	0.3	0.1
Indigofera georgei	shrub	0.3	0.1
Iseilema macratherum	grass	0.2	0.1
Iseilema macratherum	grass	0.1	0.1
Maireana villosa	shrub	0.2	0.1
Panicum decompositum	grass	0.2	0.1
Paraneurachne muelleri	grass	0.2	0.1
Perotis rara	grass	0.1	0.1

Polygala glaucifolia	herb	0.1	0.1
Polygala glaucifolia	herb	0.1	0.1
Ptilotus helipteroides	herb	0.3	0.1
Ptilotus obovatus	herb	0.2	0.1
Schizachyrium fragile	grass	0.1	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.3	0.1
Sporobolus australasicus	herb	1.3	0.1
Tribulus astrocarpus	herb	0.1	0.1
Triodia melvillei	grass	0.3	0.1

Site	Q27	Site photo
Date	16/05/21	 Flora_Quadrat/PhotoP5160040
Vegetation type	D – Mulga, Hakea lorea, and Eucalyptus xerothermica low open woodland over closed tussock grassland on flat clay plain (no rocks)	
Landform	Plain, next to GNH	
Slope	Negligible	
Soil	Clay, Red brown	
Rock type	-	
Rock size	-	
Rock cover	-	
Vegetation cover	80%	
Condition	Good	
Disturbances	Fire has killed 50% of trees/shrubs >2m Fence through quadrat	
Easting (MGA94 Zone 51)	684446	
Northing (MGA94 Zone 51)	7467636	
Vegetation description	*Hakea lorea* subsp. *lorea* low open woodland; over isolated shrubs; over isolated dwarf shrubs; over *Pterocaulon sphacelatum*, *Abutilon otocarpum*, *Ptilotus obovatus* sparse forbland; over *Themeda triandra*, *Aristida contorta*, *Aristida inaequiglumis*, *Enneapogon polyphyllus* closed tussock grassland.	

Taxon name	Growth form	Height (m)	Cover%
**Bidens bipinnata*	herb	0.1	0.1
**Portulaca oleracea*	herb	0.1	0.1
**Stylosanthes hamata*	herb	0.2	0.1
Abutilon otocarpum	herb	0.4	0.1
Acacia aptaneura	shrub	2	0.1
Alternanthera nana	herb	0.3	0.1
Aristida contorta	grass	0.2	20
Aristida inaequiglumis	grass	0.4	10
Arivela viscosa	herb	0.5	0.1
Bulbostylis barbata	sedge	0.05	0.1
Cheilanthes sieberi subsp. sieberi	fern	0.3	0.1
Chrysopogon fallax	grass	0.3	0.1
Cucumis variabilis	Creeper	n/a	0.1
Dichanthium sericeum subsp. Humilius	grass	0.2	0.1
Duperreya commixta	Creeper	n/a	0.1
Dysphania glomulifera subsp. eremaea	herb	0.1	0.1
Enneapogon polyphyllus	grass	0.4	10
Eragrostis pergracilis	grass	0.1	0.1
Euphorbia aff. ferdinandi	herb	0.1	0.1
Euphorbia biconvexa	herb	0.1	0.1
Evolvulus alsinoides var. villosicalyx	herb	0.2	0.1
Goodenia nuda	herb	0.3	0.1
Goodenia prostrata	herb	0.01	0.1
Hakea lorea subsp. lorea	tree	5	2
Hibiscus coatesii	shrub	0.2	0.1

Iseilema macratherum	grass	0.3	0.1
Panicum decompositum	grass	0.1	0.1
Paspalidium rarum	grass	0.2	0.1
Perotis rara	grass	0.1	0.1
Pterocaulon sphacelatum	herb	0.5	0.1
Ptilotus exaltatus	herb	0.5	0.1
Ptilotus gaudichaudii	herb	0.4	0.1
Ptilotus helipteroides	herb	0.4	0.1
Ptilotus obovatus	herb	0.4	0.1
Senna notabilis	shrub	0.1	0.1
Sida sp. ? L (A.M. Ashby 4202)	shrub	0.3	0.1
Spermacoce brachystema	herb	0.2	0.1
Stenopetalum nutans	herb	0.3	0.1
Themeda triandra	grass	0.3	40

Site	R01	Site photo
Date	17/05/21	
Vegetation type	F - Triodia wiseana hummock grassland with emergent shrubs and low trees on gently sloping stony plain	
Landform	Gentle slope, foothills	
Slope	2°	
Soil	Clay, Red brown	
Rock type	Quartzite	
Rock size	<5cm	
Rock cover	80%	
Vegetation cover	40%	
Condition	Good	
Disturbances	Droppers, berms, rubbish from Hwy.	
Easting (MGA94 Zone 51)	685435	
Northing (MGA94 Zone 51)	7466834	
Vegetation description	*Corymbia hamersleyana* and *Corymbia deserticola* subsp. *deserticola* isolated low trees; over isolated tall shrubs; over *Acacia ancistrocarpa* and mixed *Acacia* spp. sparse shrubland; over isolated dwarf shrubs; over isolated forbs; over *Triodia wiseana* hummock grassland	

Taxon name	Growth form	Height (m)	Cover%
Acacia ? aneura	shrub	1.5	0.1
Acacia ancistrocarpa	shrub	2	2
Acacia atkinsiana	shrub	1.5	1
Acacia dictyophleba	shrub	1.3	0.1
Acacia marramamba	shrub	2	0.1
Acacia pyrifolia var. pyrifolia	shrub	2	0.1
Corymbia deserticola subsp. Deserticola	tree	3	0.1
Corymbia hamersleyana	tree	6	0.1
Hakea chordophylla	shrub	2.2	0.1
Ptilotus calostachyus	herb	1	0.1
Seringia velutina	shrub	0.2	0.1
Stackhousia sp. swollen gynophore (W.R. Barker 2041)	herb	0.2	0.1
Triodia wiseana	grass	0.5	40

Appendix VII Significance Assessment Criteria (Vegetation)

Score	Criteria
High	Supports threatened flora species/ threatened ecological community listed under the EPBC Act and/ or BC Act or supports a: unique or regionally significant population of Priority 1 or Priority 2 species; a unique or regionally significant priority ecological community or occurs in association with a major river or creek system.
Moderate	Supports a population of priority 1, priority 2 flora species or an unlisted species that is restricted and warrants listing/ priority ecological community or occurs in association with a major river or creek system or supports a unique/ unusual floral assemblage not recognised by DBCA as a PEC.
Low	Supports a population of priority 3 or priority 4 species / priority ecological community or occurs in association with a medium ephemeral river or creek system with sensitive obligate phreatophytic vegetation or supports a unique/ unusual floral assemblage or disturbance sensitive communities such as mulga on sheet flow, or occurs in association with a unique/ unusual landform or refugia such as gorges, high ranges, outcrops or seepage areas not common in the IBRA subregion
Very Low	Vegetation and landform is widespread/common and does not solely support priority 3 or priority 4 flora species. May contain, presumed facultative phreatophytic vegetation species not in association with a river or creek system typically in association with un-incised drainage lines and flood plains.
Negligible	Vegetation and landform is widespread/common and does not support priority flora species. May contain presumed facultative phreatophytic vegetation.