Mt Richardson Iron Ore Project and Northern Yilgarn Haul Road Project

Flora and Vegetation Assessment

MINERAL RESOURCES LIMITED

JULY 2021

WOODMAN ENVIRONMENTAL

umwelt Environmental & Social Consultants

TEL. (08) 9315 4688
PO Box 50, Applecross WA 6953
www.woodmanenv.com.au
www.umwelt.com.au

Mt Richardson Iron Ore Project and Northern Yilgarn Haul Road Project

Prepared for: Mineral Resources Limited

Job Number: MRL20-38

Report Number: MRL20-38-01

Cover Photograph: Salmon Gum woodland in the southern part of the Northern Yilgarn Haul Road (photo: Woodman Environmental).

DOCUMENT REVISION AND STATUS

Revision	Status	Originator	Internal Reviewer	Internal Review Date	Client Reviewer	Client Review Date
A	Draft Report	LF/AS/DC	DC	21/07/2021	MH	22/07/2021
B	Draft Report – client comments incorp.	LF/AS/DC	DC	29/07/2021	MH	29/07/2021
0	Final report	LF/AS/DC	DC	29/07/2021		

DISCLAIMER

Woodman Environmental Consulting Pty Ltd has recently been acquired by Umwelt Australia Pty Ltd, however it will be operating under Woodman Environmental Consultancy name until full transition to the new company will be finalised.

This document is prepared in accordance with and subject to an agreement between Woodman Environmental Consulting Pty Ltd ("Woodman Environmental") and the client for whom it has been prepared ("Mineral Resources Limited" (MRL)) and is restricted to those issues that have been raised by the Client in its engagement of Woodman Environmental and prepared using the standard of skill and care ordinarily exercised by Environmental Scientists in the preparation of such Documents.

Any organisation or person that relies on or uses this document for purposes or reasons other than those agreed by Woodman Environmental and the Client without first obtaining the prior written consent of Woodman Environmental, does so entirely at their own risk and Woodman Environmental denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

TABLE OF CONTENTS

FIGURES

TABLES

PLATES

APPENDICES

Appendix M: Matrix of Vascular Plant Taxa Recorded within Each Vegetation Type Described in the Study Area

Appendix N: Results of Indicator Taxon Analysis for Vegetation Types

Appendix O: Significant Vegetation of the Study Area

EXECUTIVE SUMMARY

Mineral Resources Limited (MRL) is undertaking baseline studies of their Mt Richardson Iron Ore Project (Mt Richardson), located 130 km west of Leonora and 120 km north-west of Leinster. Additionally, MRL are conducting baseline studies of the proposed Northern Yilgarn Haul Road Project (NYHR), which links the Mt Richardson Iron Ore Project to the existing Carina Mine and associated haul road, located approximately 180 km south of Mt Richardson. To inform the environmental impact assessment (EIA) process for these projects, MRL commissioned Woodman Environmental Consulting Pty Ltd (Woodman Environmental) to undertake a flora and vegetation assessment to identify the key flora and vegetation values associated with the projects. This survey builds on previous flora and vegetation survey work conducted to inform the EIA process for the Mt Richardson Project.

A detailed flora and vegetation survey was undertaken over three visits in August and September 2020. The survey involved the assessment of 305 non-permanent flora survey quadrats measuring 20 m x 20 m. Targeted Survey for significant flora taxa was undertaken as part of the survey, specifically within the Mt Richardson area.

A total of 541 discrete vascular flora taxa (including nine introduced taxa), three known hybrids and four putative hybrids were recorded during the 2020 survey within the Study Area, representing 65 families and 216 genera. An additional 66 taxa and 13 genera were recorded during previous surveys for Mt Richardson; 607 taxa (including 11 introduced taxa), three known hybrids (as per WA Herbarium (1998-)) and 12 putative hybrids, representing 65 families and 229 genera have been recorded in the Study Area in total. A total of 37 significant flora taxa have been recorded in the Study Area including 30 Priority taxa, six potentially undescribed taxa and one taxon that is known from very few locations and is considered to be significant. No Threatened taxa have been recorded in the Study Area.

A total of 541 discrete vascular flora taxa (including nine introduced taxa), three known hybrids (as per WA Herbarium (1998-)) and four putative hybrids were recorded during the 2020 survey within the Study Area. The taxa and hybrids represent 65 families and 216 genera. Within quadrats established in 2020, the average taxon richness per quadrat was 17.28 (± 5.83), with the greatest number of taxa recorded in a single quadrat being 42 (MRD053 and MRM104) and the lowest being four (MRK063).

An additional 66 taxa and 11 genera were recorded during the 2012 survey by Woodman Environmental (Woodman Environmental 2013). The total number of discrete vascular flora taxa recorded within the Study Area (2020 survey data and 2012 survey data combined) is 607 discrete vascular flora taxa (including 11 introduced taxa), three known hybrids (as per WA Herbarium (1998-)) and 12 putative hybrids. These taxa and hybrids represent 65 families and 229 genera. The most well-represented families were Fabaceae (79 taxa, three known hybrids and six putative hybrids), Myrtaceae (70 taxa), Asteraceae (59 taxa), Poaceae (46 taxa) and Chenopodiaceae (45 taxa and one putative hybrid).

A total of 55 Vegetation Types (VTs) were defined and mapped within the Study Area. This reflects the diversity of habitats intersected over the relatively long length of the Study Area, as well as the intersection of multiple bioregions and climatic zones. Two listed significant

communities were identified and mapped in the Study Area, being the Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation) and Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation) Priority Ecological Communities (both Priority 1). A number of individual VTs are also considered to be potentially significant, as they were mapped over small areas, and occur on landforms that may be regionally restricted.

1. INTRODUCTION

1.1 Project Overview

Mineral Resources Limited (MRL) is undertaking baseline studies of their Mt Richardson Iron Ore Project (Mt Richardson), located 130 km west of Leonora and 120 km north-west of Leinster. Additionally, MRL are conducting baseline studies of the proposed Northern Yilgarn Haul Road Project (NYHR), which links the Mt Richardson Iron Ore Project to the existing Carina Mine and associated haul road, located approximately 180 km south of Mt Richardson.

To inform the environmental impact assessment (EIA) process for these projects, MRL commissioned Woodman Environmental Consulting Pty Ltd (Woodman Environmental) to undertake a flora and vegetation assessment to identify the key flora and vegetation values associated with the projects.

This survey builds on previous work conducted to inform the EIA process for the Mt Richardson Project, as detailed in Section 3.1.

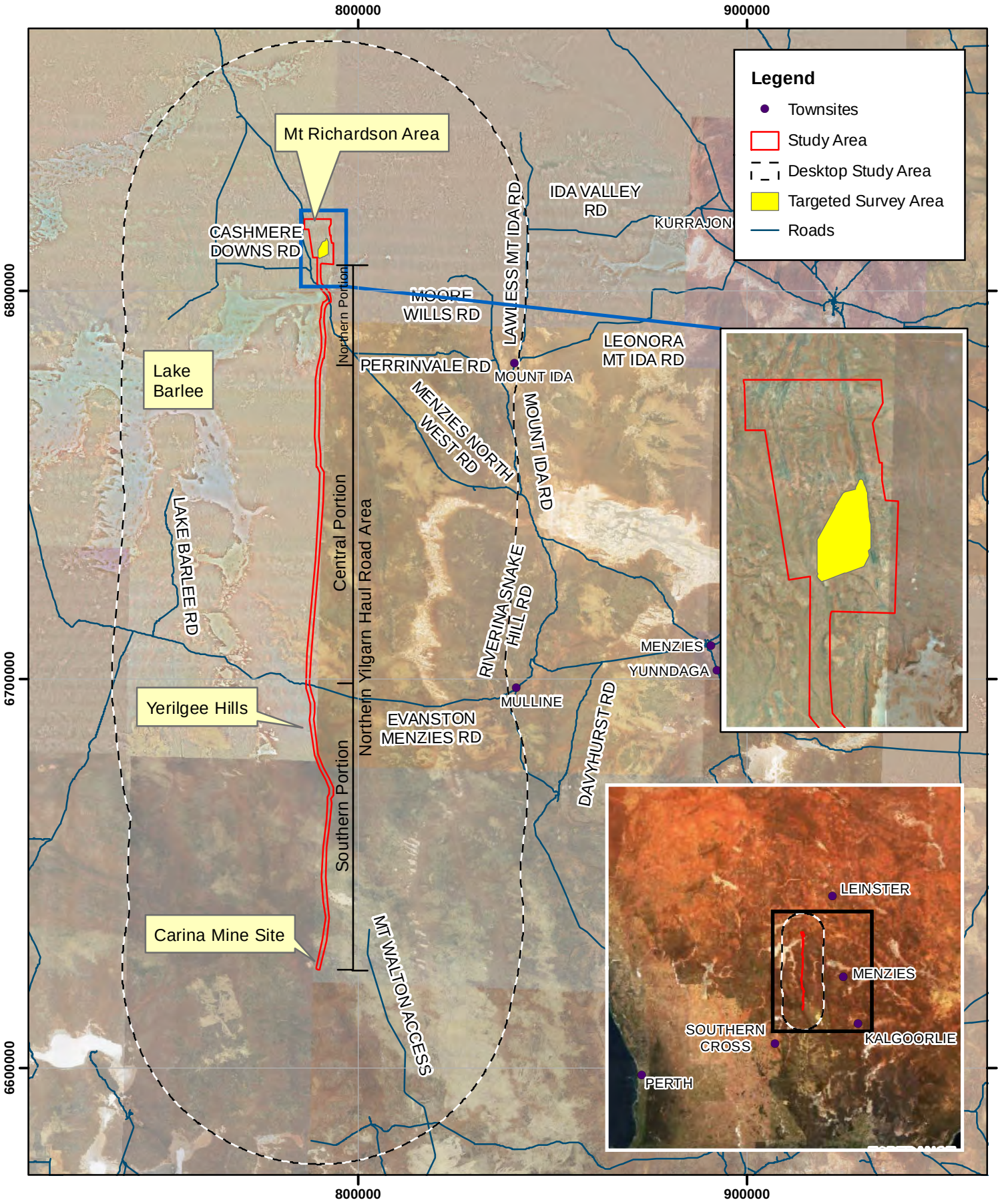
1.2 Study Area Definition

The Mt Richardson and NYHR Study Area (the Study Area) has been defined for field survey data collection and encompasses 24,986 ha (Figure 1). The majority of the Study Area consists of remnant vegetation. For the purposes of discussing the locations of particular features (e.g. significant flora, significant vegetation) in the Study Area, the Study Area has been divided into four broad areas, as presented on Figure 1 and outlined below (from north to south):

- Mt Richardson area;
- NYHR area – northern portion – between Mt Richardson area south to (and including) the edge of Lake Barlee;
- NYHR area – central portion – between the edge of Lake Barlee south to the Yerilgee Hills; and
- NYHR area – southern portion – between (and including) the Yerilgee Hills and the Carina mine site.

A Desktop Study Area was also defined for the purpose of this assessment, including interrogation of databases and searches for relevant literature. The Desktop Study Area encompasses the Study Area with a 50 km buffer, as shown on Figure 1.

A Targeted Survey Area was also defined, for the purposes of targeted significant flora survey. This area was in the Mt Richardson area, as shown on Figure **1**.



Study Area and Desktop Study Area Location	Author: David Coultas	
	WEC Ref: MRL20-38-01	
WOODMAN ENVIRONMENTAL umwelt	Filename: MRL-20-38-01-f01	**Figure**
	Scale: 1:1,300,000 (A4)	1
	Projection: GDA 1994 MGA Zone 50	
This map should only be used in conjunction with WEC report MRL20-38-01.	Revision: A - 29 July 2021	

1.3 Aim and Objectives

The primary aim of this assessment was to characterise the flora and vegetation values of the Study Area to the current regulatory standard, building upon previous survey results where appropriate.

The overall objectives of the assessment were to:

- Compile an inventory of vascular flora taxa that occur in the Study Area;
- Identify locations of vascular flora taxa occurring within the Study Area that are one of the following (hereafter referred to as significant flora taxa):
  - Listed Threatened Species under the *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act) (Commonwealth);
  - Threatened Flora (T) under the *Biodiversity Conservation Act 2016* (BC Act) (WA);
  - Priority Flora taxa as classified by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA); and
  - Other significant flora taxa as defined by the Environmental Protection Authority (EPA) (2016a; b);
- Identify locations of introduced vascular flora taxa;
- Identify, map and describe Vegetation Types (VTs) that occur within the Study Area;
- Identify, map and describe vegetation that occurs within Study Area that is one of the following (hereafter referred to as significant vegetation):
  - Listed Threatened Ecological Communities (TECs) under the EPBC Act;
  - TEC under the BC Act;
  - Priority Ecological Communities (PECs) as classified by DBCA; and
  - Other significant vegetation as defined by EPA (2016a; b).
- Map the condition of the vegetation in accordance with EPA (2016a).

The survey and reporting works comply with the following documents:

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

Other specific guidance documents used as part of this survey are detailed in the results section of this report.

1.4 Level of Assessment

The flora and vegetation survey of the Study Area involved Targeted Surveys and a Detailed Survey as defined in Sections 4.2 and 4.3 of the 'Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment' (EPA 2016a). This is considered appropriate for the Study Area, as it is likely to support a high diversity of flora and vegetation, may comprise restricted landforms or vegetation, and is likely to support significant flora or

vegetation, as outlined in Section 4.3 of the 'Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment' (EPA 2016a).

2. BACKGROUND

2.1 Climate

Because of its shape, length and orientation (more or less a linear, 180 km long north-south orientated polygon), the Study Area traverses two climatic zones. The climate of the northern third of the Study Area is described as desert (arid climate) and is characterised by 12 dry (average precipitation does not exceed evaporation) months per year and bimodal (winter and summer) rainfall distribution. The remaining two-thirds is described semi-desert (semi-arid) Mediterranean climate, with 9–11 dry months per year and a winter rainfall maximum (Beard 1990).

Due to the length of the Study Area, climate data for two locations; Bulga Downs and Southern Cross, are presented below (Figure 2; Figure 3) (Bureau of Meteorology [BoM] 2021a). Bulga Downs is located approximately 40 km north of the northern end of the Study Area and experiences desert climate; Southern Cross lies approximately 100 km south-west of the southern end of the Study Area, and experiences semi-desert Mediterranean climate. These are the nearest meteorological stations to the Study Area, where appropriate long-term data has been collected; however, temperature data has only been recorded at Bulga Downs in relatively recent years (see below).

Figure 2 presents the monthly precipitation and monthly maximum temperature statistics for 2020, as well as long-term average monthly maximum temperature (2002–2020) and average monthly precipitation (1924–2020) for Bulga Downs Station (BoM 2021a). A total of 12.0 mm of rainfall was recorded at Bulga Downs Station in the three months immediately preceding the field survey (May – July), well below the long-term average for the same period (74.4 mm). Average monthly maximum temperatures were generally higher in June and July 2020 then the long-term monthly maximum temperatures for those months, both recording temperatures more than 2°C warmer than the long-term average.

Figure 3 presents the monthly precipitation and monthly maximum temperature statistics for 2020, as well as long-term average monthly maximum temperature (1895-2007), and monthly precipitation for 2020 and the long-term average monthly precipitation (1889–2007) for Southern Cross (BoM 2021a). A total of 65.6 mm of rainfall was recorded at Southern Cross in the three months immediately preceding the field survey (May – July), well below the long-term average for the same period (114.20 mm). Average monthly maximum temperatures were generally higher from May to July 2020 then the long-term monthly maximum temperatures for these months, with June and July recording temperatures more than 2°C warmer than the long-term averages for those months.

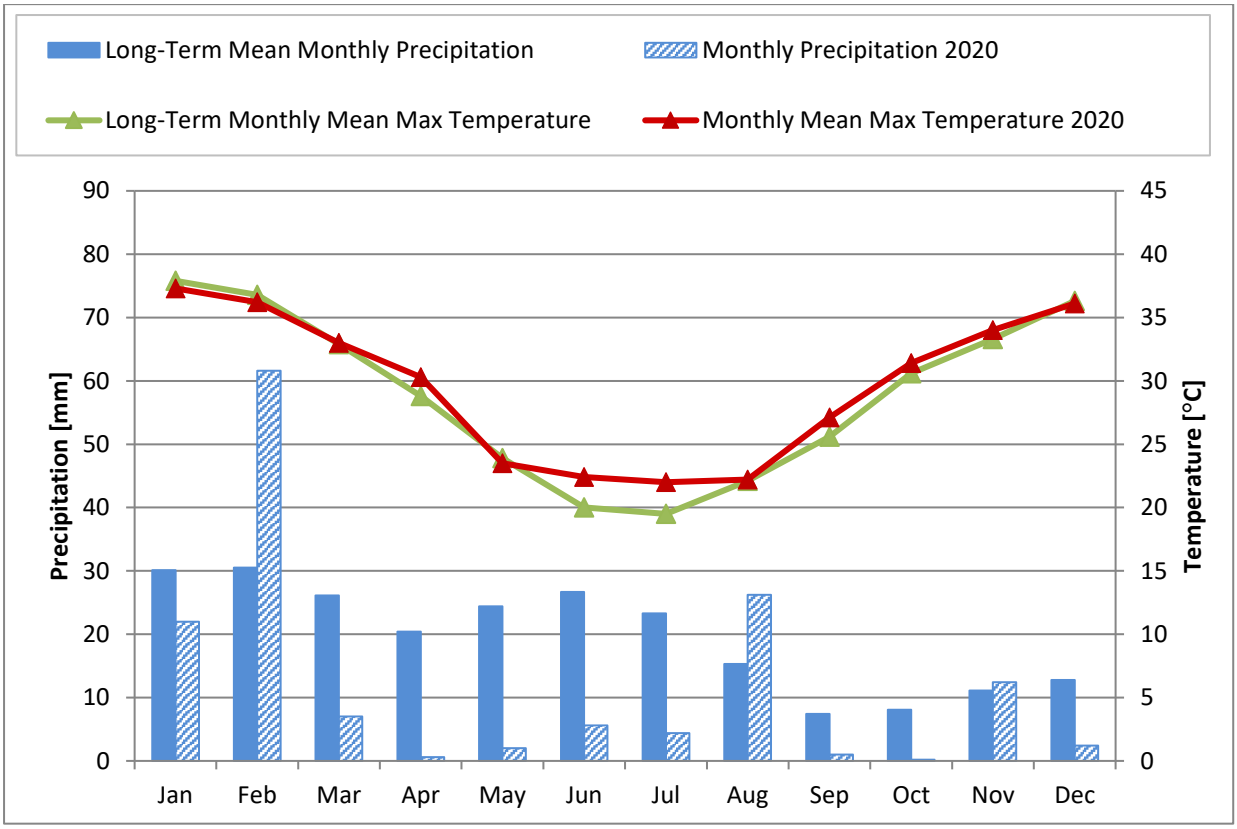


Figure 2: **Monthly Maximum Temperature 2020 and Long-Term Mean Monthly Temperature, and Monthly Precipitation 2020 and Long-Term Monthly Precipitation for Bulga Downs Station (BoM 2021a)**

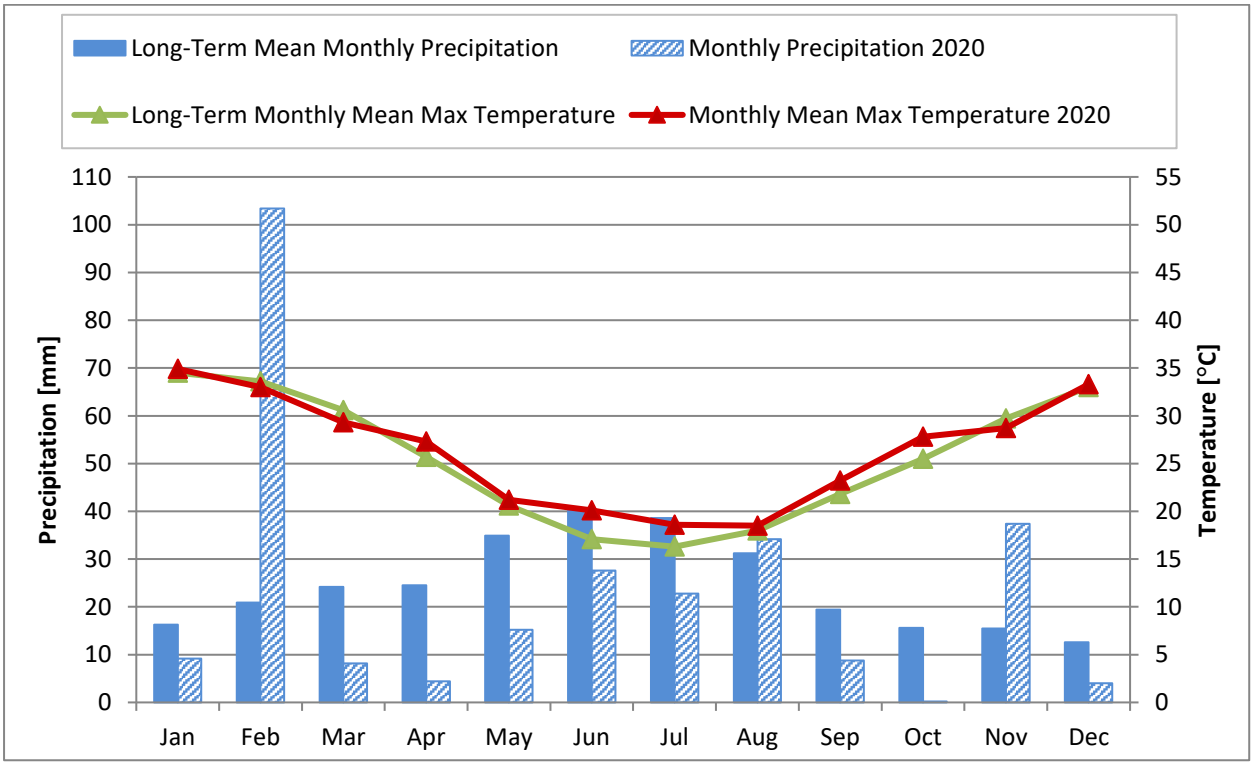


Figure 3: **Monthly Maximum Temperature 2020 and Long-Term Mean Monthly Temperature, and Monthly Precipitation 2020 and Long-Term Monthly Precipitation for Southern Cross (BoM 2021a)**

2.2 Geology, Soils and Landscape

The Study Area lies in the Southern Cross Domain of the Youanmi Terrane, a tectonic unit within the Yilgarn Craton (Cassidy *et al.* 2006). The underlying geology of the Study Area and its vicinity is dominated by Meso- to Neoarchaean metamorphosed granite and granite-like rocks. Of similar age are the greenstone belts common in this region, which consist of mafic or ultramafic volcanics and metamorphosed sediments, especially banded-iron formations and occasional quartzite or other quartz-rich rocks (Beard 1990, Geological Survey of Western Australia 2016). The greenstone belts manifest as ranges of low hills (trending generally NNW-SSE in this area) rising from the broad valleys and surrounding plain (Beard 1990). The regolithic plain is extensive, dominated by Cenozoic sandplains with occasional areas of lateritic breakaways, and Quaternary colluvial and alluvial sediments; it also features large, as well as chains of many smaller, saline playas (salt lakes), filled with Quaternary deposits and fringed by low Quaternary dunes (Raymond *et al.* 2012).

The Study Area falls within the Yilgarn Plateau Physiographic Province, crossing the boundary of two physiographic regions: In the north, it is the Murchison Plateau Region, characterised in this area by sandplains and hardpan wash plains with salt lakes, broken by ridges of metamorphic rocks and granite. In the south, it is the Southern Goldfields Plateau Region, featuring mainly undulating plains with some sandplains, ferruginous breakaways, ridges of metamorphic rocks, granitic hills and rises, and large salt lakes (Jennings & Mabbutt 1986, Pain *et al.* 2011). The most prominent features traversed by the Study Area are the ranges of Illaara Greenstone Belt (Mt Richardson-Brooking Hills) and Yerilgee Greenstone Belt, Hunt Range, Yendilberin, and Watt Hills.

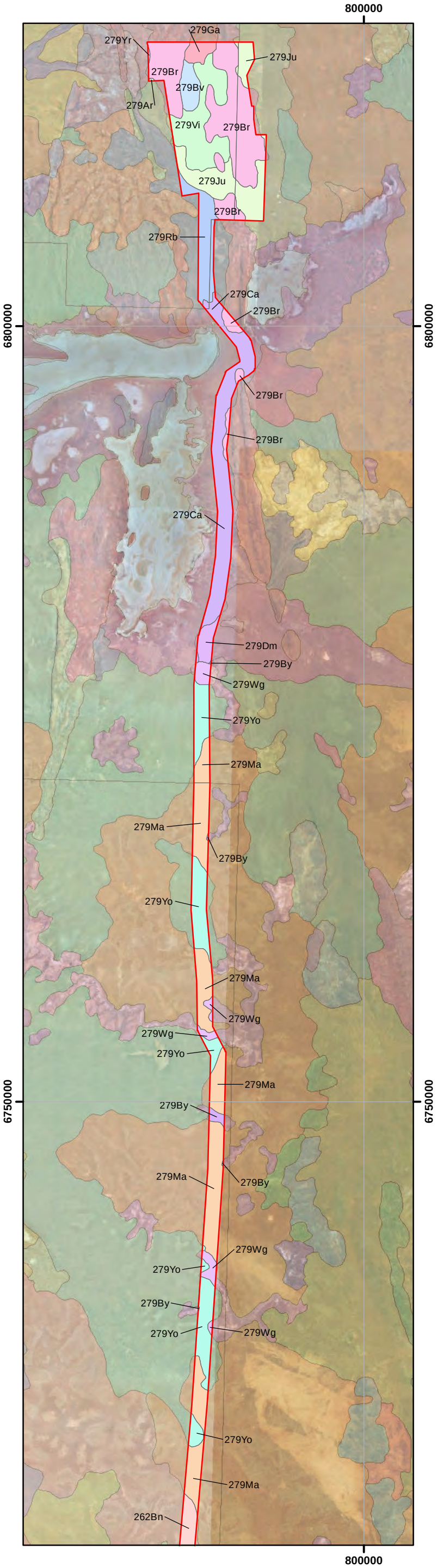
Soil-landscape mapping of the region was commissioned by the Department of Agriculture and Food, with the data on the best currently available scale of the mapping provided by the Department of Primary Industries and Regional Development (DPIRD 2020a). According to Tille (2006), the Study Area lies within the Murchison Province in the north and the Kalgoorlie Province in the south, where it traverses four soil-landscape zones, as described below:

- Salinaland Plains Zone (northern half of the Study Area) – sandplains (with hardpan wash plains and some mesas, stony plains, and salt lakes) on granitic rocks of the Yilgarn Craton with red sandy earths, red deep sands, red shallow loams (sometimes with hardpans) and red loamy earths.
- Mount Jackson Plains and Hills Zone (southern half – west) – undulating plains (with some hills and stony plains) on greenstone and granitic rocks of the Yilgarn Craton with red loamy earths, red-brown hardpan shallow loams and some red sandy earths, red shallow loams and loamy gravels.
- Norseman Zone (southern half of the Study Area – east) – undulating plains and uplands (with some sandplains and salt lakes) on granitic rocks of the Yilgarn Craton with calcareous loamy earths, yellow sandy and loamy earths, red loamy earths, red deep sands, and salt lake soils.
- Bimbijy Sandplains (middle section of the Study Area - west) – sandplains (with plains and some salt lakes and mesas) on granitic rocks of the Yilgarn Craton with red deep sands, red loamy earths and some red shallow loams, red shallow sands, salt lake soils, yellow loamy earths and yellow deep sands.

The Study Area intersects with 23 Soil-Landscape Systems as outlined in Table 1. The soil-landscape zones and the systems within them are listed in order from those that are most prevalent within the Study Area to those that are the least common for each Province / Zone.

Table 1: Soil-Landscape Systems of the Study Area

Province	Zone	System	Description
Murchison	Salinaland Plains	Marmion	Gently undulating sandplains of predominantly deep earthy red sand or deep sandy-surfaced red earth
		Brooking	Prominent ridges of banded iron formation
		Carnegie	Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks
		Yowie	Sandy plains, mainly consisting of deep red earth or deep earthy red sand, occasionally with shallow-lying hardpan
		Violet	Gently undulating gravelly plains on greenstone, laterite and hardpan, with low stony rises and minor saline plains
		Jundee	Hardpan plains with variable gravelly mantles and minor sandy banks
		Rainbow	Hardpan plains
		Waguin	Sandplains and stripped granite or laterite surfaces with low fringing breakaways and lower plains
		Bevon	Irregular low ironstone hills with stony lower slopes supporting mulga shrublands
		Deadman	Calcareous plains
		Gabanintha	Greenstone ridges, hills and footslopes supporting sparse acacia and other mainly non-halophytic shrublands
		Bandy	Gritty-surfaced plains and low outcrops of granite
		Yarrameedie	Undulating stony interfluves, drainage floors and pediment foothill plains below major ranges, supporting sparse mulga shrublands
		Ararak	Broad plains with mantles of ironstone gravel supporting mulga shrublands with wanderrie grasses
Kalgoorlie	Mount Jackson Plains and Hills	AB7	Sandy outwash plains from granites, gneisses, and allied rocks with numerous small waterways and with pediments and breakaways on ridges and slopes above the plains in a recurring pattern
		My45	Undulating terrain with small gently sloping plains and some ranges on basic schists, gneisses, and allied rocks
		Campsite	Alluvial plains
		Tealtoo	Level to gently undulating loamy plains with fine ironstone gravel mantles
		Dryandra	Ridges of banded iron formation
		Brooking	Prominent ridges of banded iron formation
		Lawrence	Low greenstone hills with ironstone ridges
	Norseman	AC1	Gently sloping to gently undulating plateau areas, or uplands, on granites, gneisses, and allied rocks, with long gentle slopes and, in places, abrupt erosional scarps
	Bimbijy Sandplains	Bannar	Level to gently undulating sandy plains

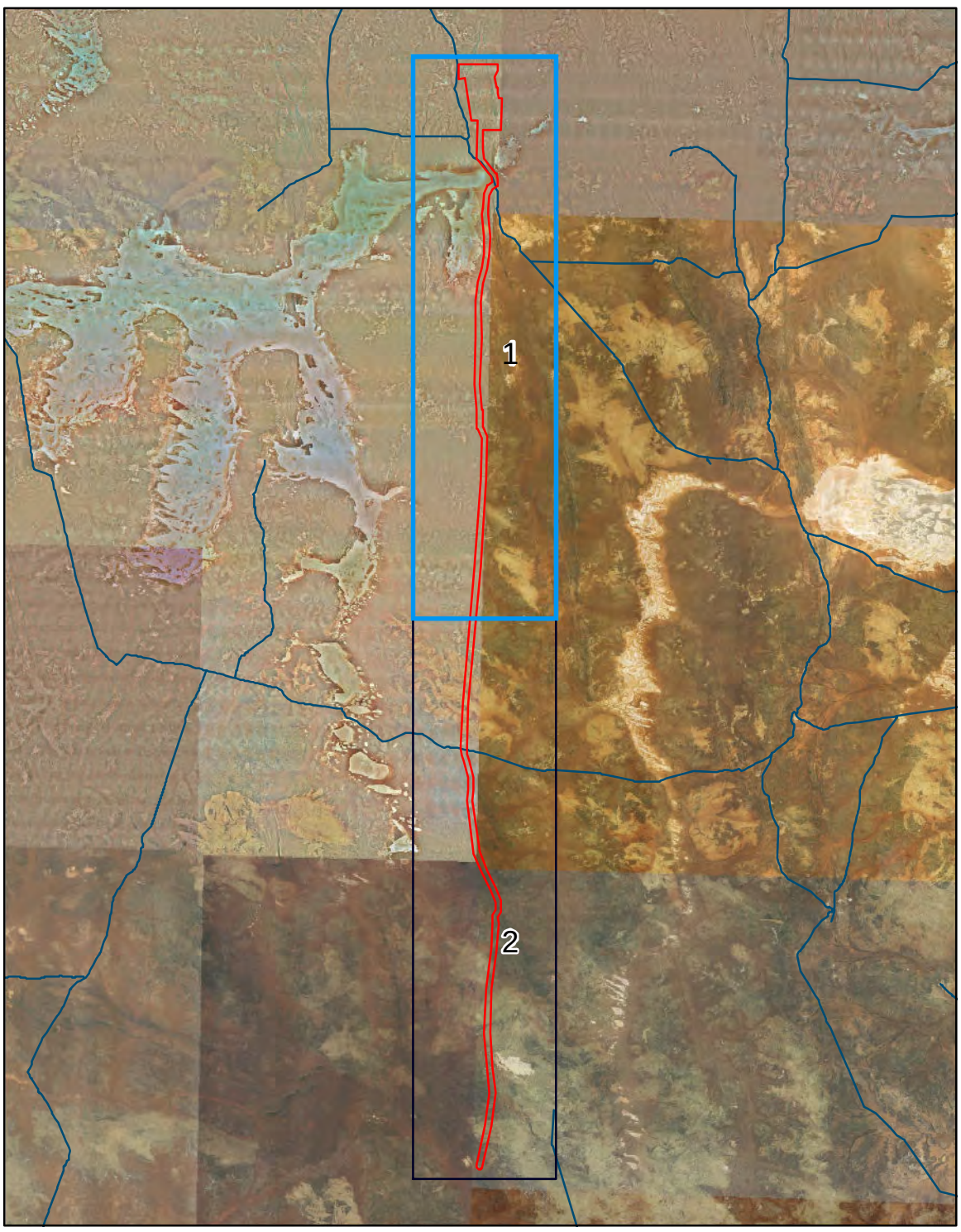


Legend

Study Area

Soil Landscape Unit

- 262Bn Bannar System
- 279Ar Ararak System
- 279Br Brooking System
- 279Bv Bevon System
- 279By Bandy System
- 279Ca Carnegie System
- 279Dm Deadman System
- 279Ga Gabanintha System
- 279Ju Jundee System
- 279Ma Marmion System
- 279Rb Rainbow System
- 279Vi Violet System
- 279Wg Waguin System
- 279Yo Yowie System
- 279Yr Yarrameedie System



WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Soil-Landscape Systems of the Study Area

Revision: A - 15 June 2021 Scale: 1:265,000

Author: Leah Firth

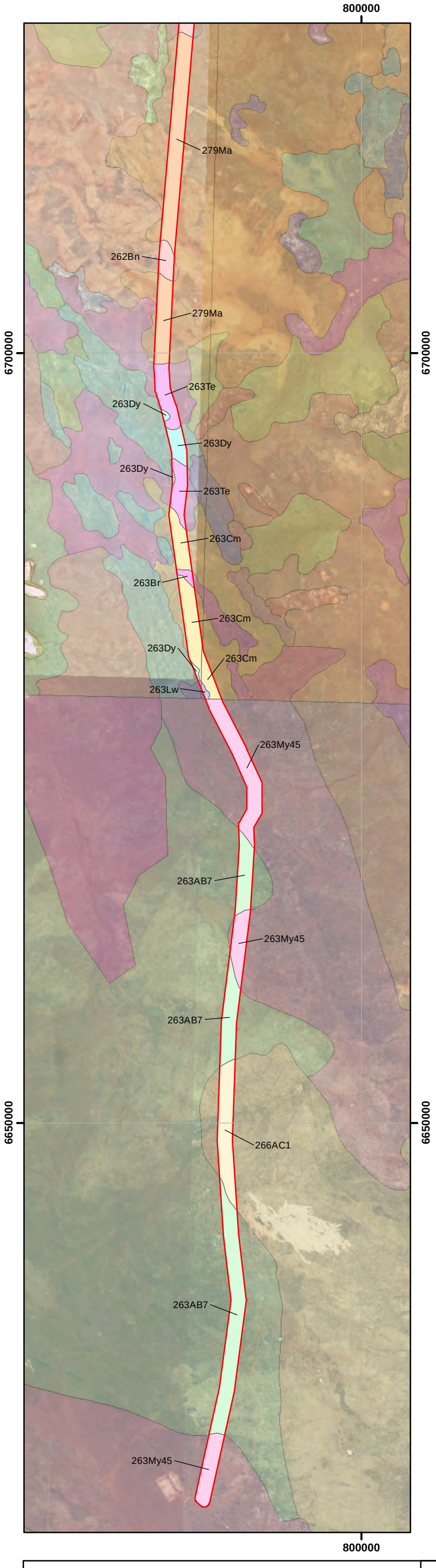
WEC Ref: MRL20-38

Filename: MRL-20-38-01-f04

Projection: GDA 1994 MGA Zone 50

Figure

4.1

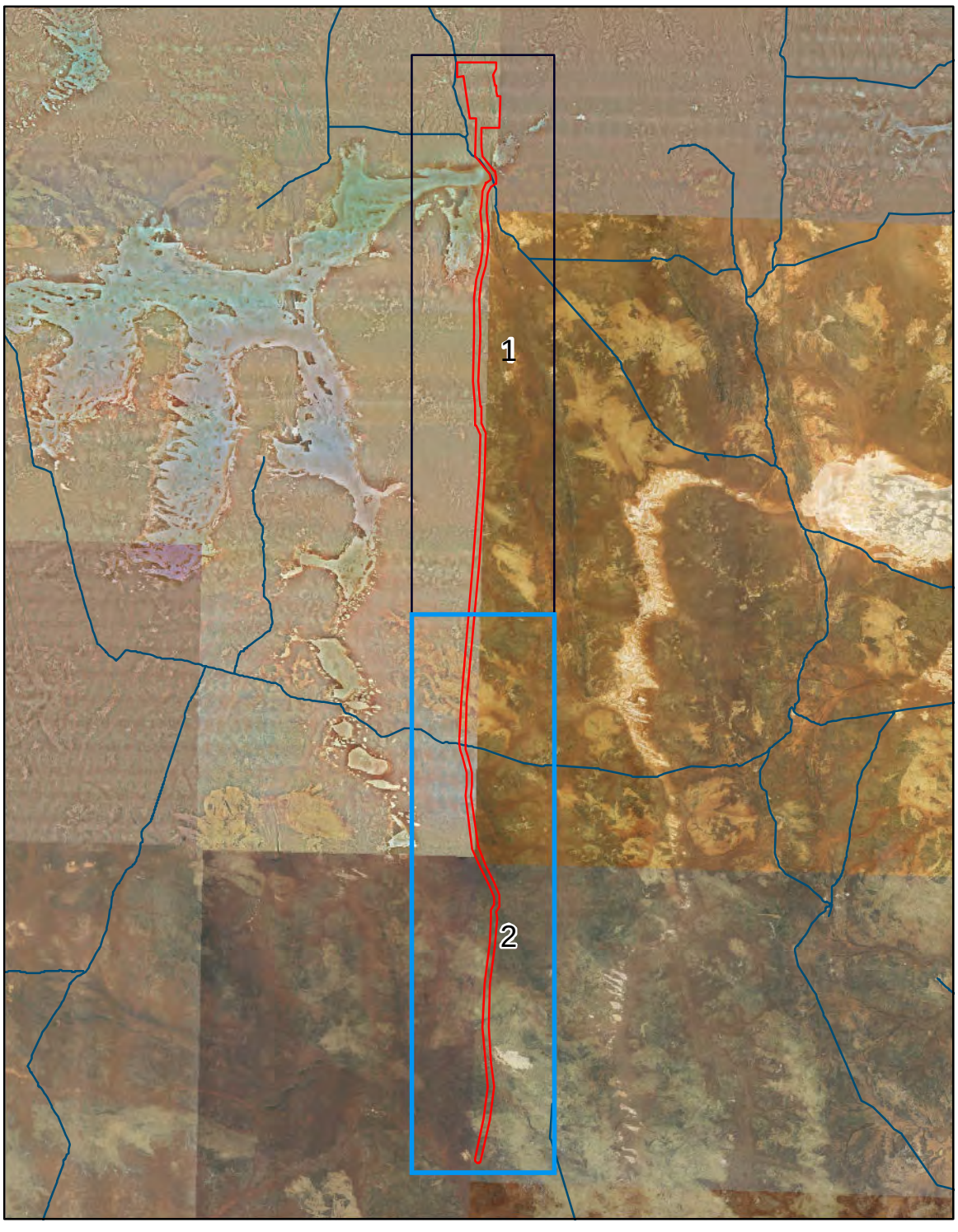


Legend

- Study Area

Soil Landscape Unit

262Bn	Bannar System
263AB7	AB7
263Br	Brooking System
263Cm	Campsite System
263Dy	Dryandra System
263Lw	Lawrence System
263My45	My45
263Te	Tealtoo System
266AC1	AC1
279Ma	Marmion System



WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Soil-Landscape Systems of the Study Area

Revision: A - 15 June 2021 Scale: 1:265,000

Author: Leah Firth

WEC Ref: MRL20-38

Filename: MRL-20-38-01-f04

Projection: GDA 1994 MGA Zone 50

Figure 4.2

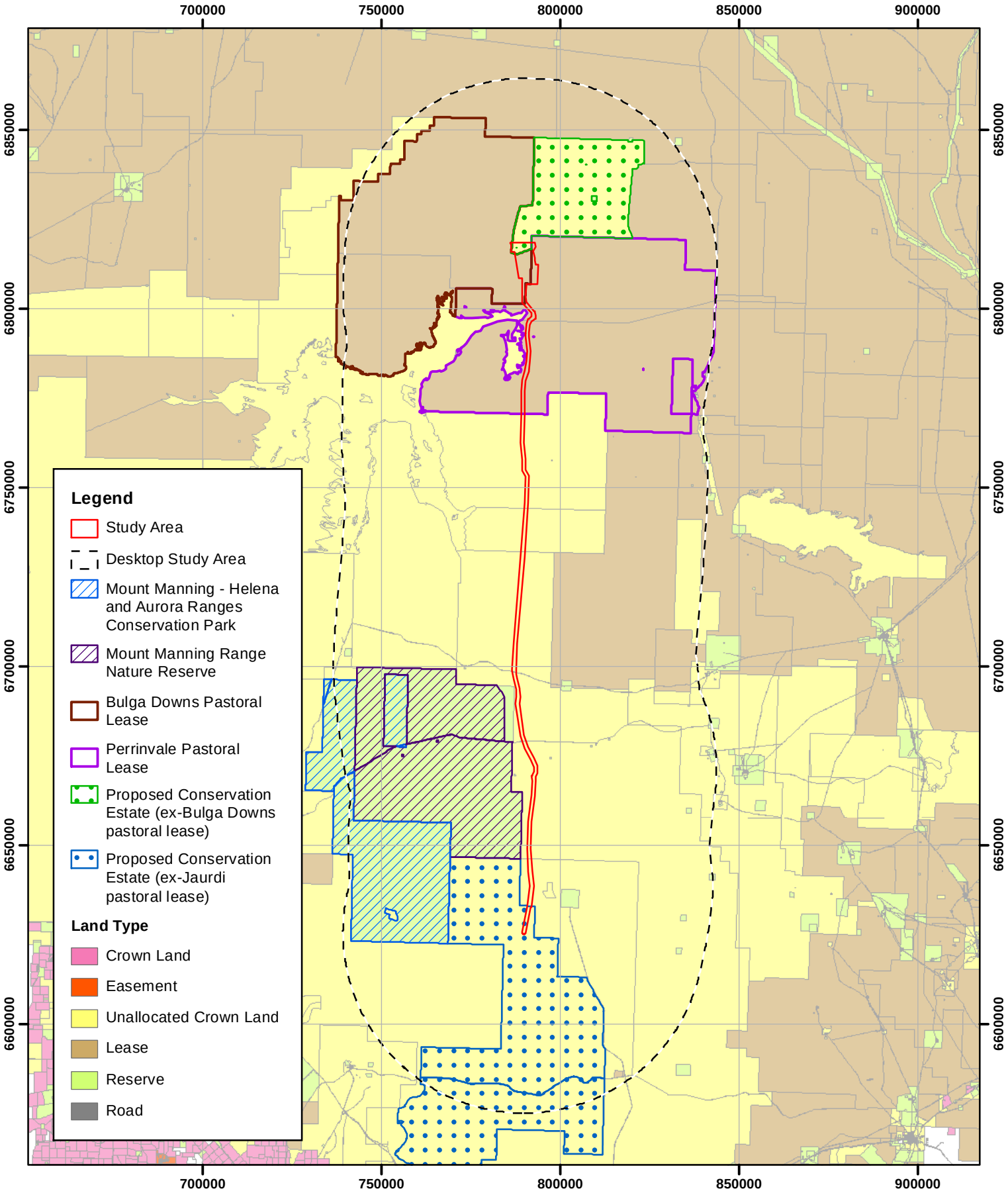
2.3 Groundwater and Surface Water Values

The Study Area is located largely in a region characterised by internal drainage (Raeside-Ponton Salt Lake Basin), with excess water draining into the numerous large and small saline playas (Cowan 2001, BoM 2021b). Most of these playas represent remnants of now occluded ancient river systems (palaeodrainage), which occasionally fill with water after very heavy rains, which then flow towards the Eucla Basin (Beard 1990, Cowan 2001, Van de Graaff *et al.* 1977). Only a small portion of the Desktop Study Area (south-eastern end) belongs to the Swan (Avon) River catchment, with the drainage flowing through a series of salt lakes (BoM 2021b).

According to the Groundwater Dependent Ecosystems (GDE) Atlas (BoM 2021b), there are numerous high and moderate potential aquatic GDEs (intermittent saline lakes) within the vicinity of the Study Area. The largest of these lakes is Lake Barlee, listed as a Nationally Important Wetland (Environment Australia 2001). Lake Barlee fills approximately every decade following major rain events, with shallow surface water persisting for approximately 6 to 9 months, providing an important breeding site for Banded stilts (*Cladorhynchus leucocephalus*) and several other water birds (DAWE 2020a). There are areas that have been mapped as having high potential to represent GDEs, such as bare areas of salt lakes, and their fringing saline plains, dunes and sandy banks, which support low halophytic shrublands and scattered tall Acacia shrublands (BoM 2021b).

2.4 Land Tenure

The majority of the Study Area is situated on Unallocated Crown Land (UCL), with smaller portions being former pastoral leasehold (ex Bulga Downs and ex Jaurdi Stations) proposed for conservation, current pastoral lease (Bulga Downs and Perrinvale Stations), and road reserves. The nearest conservation reserve is Mount Manning Range Nature Reserve, approximately 5 km to the west of the southern part of the Study Area. The Mount Manning – Helena and Aurora Ranges Conservation Park (proposed National Park) is also within the Desktop Study Area, 20 km west of the southern part Study Area (Figure 5). The Study Area is located across three local government areas; Shire of Menzies, Shire of Yilgarn and the Shire of Coolgardie.



Land Tenure of the Desktop Study Area	Author: David Coultas	N
	WEC Ref: MRL20-38-01	
WOODMAN ENVIRONMENTAL / umwelt	Filename: MRL-20-38-01-f05	**Figure**
	Scale: 1:1,400,000 (A4)	5
	Projection: GDA 1994 MGA Zone 50	
This map should only be used in conjunction with WEC report MRL20-38-01.	Revision: A - 29 July 2021	

3. METHODS

3.1 Desktop Study

Prior to commencement of the field survey, a review of all publicly available flora and vegetation data relevant to the Study Area was undertaken. This included obtaining and reviewing copies of reports of previous biological surveys carried out within the vicinity of the Study Area (where available) and interrogation of relevant databases and other sources as listed in Table 2.

Table 2: Searches Undertaken for the Desktop Study

Source	Search Attributes	Search Purpose
Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority Ecological Communities Database (DBCA 2020a)	Database interrogated using Desktop Study Area boundary	Obtain records of DBCA-classified TECs and/or DBCA-classified PECs within the Desktop Study Area
DBCA TEC and PEC lists (DBCA 2018; DBCA 2021)	Review of current DBCA TEC and PEC lists	Identify whether there are any DBCA listed TECs or PECs that could occur within the Desktop Study Area
DBCA Significant Flora Databases (WA Herbarium Specimen database and Threatened and Priority Flora (TPFL) database) (DBCA 2020b)	Database interrogated using Desktop Study Area boundary (limited to 30 km by DBCA)	Obtain records of listed significant flora within the Desktop Study Area
Department of Agriculture, Water and the Environment (DAWE) Species Profile and Threats (SPRAT) Database (interrogated using the Protected Matters Search Tool) (DAWE 2020b)	Database interrogated using approximate Desktop Study Area boundary	Identify Matters of National Environmental Significance (MNES), including Threatened flora and TECs, listed under the EPBC Act, that occur or have the potential to occur within the Desktop Study Area
DBCA *NatureMap* (WA Herbarium and TPFL records) (DBCA 2007–)	Database interrogated using approximate Desktop Study Area boundary	Obtain records of listed significant flora within the Desktop Study Area.
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Government of Western Australia 2019)	Study Area boundary	Identify extent of Vegetation System Associations within the Study Area

The interrogation of the DBCA's WA Herbarium Specimen database and TPFL database (DBCA 2020b) was limited by DBCA to a 30 km buffer around the centreline of the Study Area due to the high number of records in the area of interest. A search of the DBCA databases via *NatureMap* (DBCA 2007–) was also undertaken using the approximate boundary of the Desktop Study Area (50 km buffer around the Study Area) to check for any additional taxa outside the 30 km buffer used for the DBCA search.

Woodman Environmental have previously undertaken a flora and vegetation survey for Mt Richardson (Woodman Environmental 2013), with this survey entirely located within the Study Area. All such relevant historical data has been reviewed as part of this Desktop Study.

3.2 Personnel and Licensing

Table 3 lists the personnel involved in both fieldwork and plant identifications for the field assessment of the Study Area. The Project Manager and personnel undertaking plant identifications have had extensive previous experience (> 10 years) in conducting similar flora surveys in the Murchison and Coolgardie bioregions. All plant material was collected under the *Flora Taking (Biological Assessment) licences* and *Authorisation to Take or Disturb Threatened Species* pursuant to the *Biodiversity Conservation Act* 2016, sections 40, 274 and 275, as listed in Table 3.

Table 3: Personnel and Licensing Information

Personnel	Flora Collecting Permit (BC Act)	Role
David Coultas BSc (Environmental Biology) (Hons)	FB62000051 TFL23-1819	Project Manager Field survey Plant identifications
Marlee Starcevich BSc (Environmental Science) (Hons)	FB62000056 TFL26-1819	Field survey Plant identifications
Leah Firth BSc (Conservation Biology)	FB62000055 TFL145-2920	Field survey Plant identifications
Marco Pratissoli PostGrad. Dip. Sc. (Environmental Biology and Management)	FB62000057 TFL143-1920	Field survey
Emma Marsh BSc (Conservation and Wildlife Biology)	FB2600233-2	Field survey
Jerry Hruban MSc (Ecological and Evolutionary Biology)	FB62000251	Field survey
Kelli McCreery MSc (Environmental Management)	FB62000185b	Field survey
Emalyn Loudon BAg (Agribusiness and Farm Management) Hons)	-	Field survey
Margaret Collins MSc (Biotechnology and Molecular Biology)	-	Plant identifications

3.3 Aerial Photography Interpretation and Survey Design

Initial interpretation of ortho-rectified aerial photography at a scale of 1:10,000 was conducted to determine preliminary vegetation patterns present within the Study Area, with quadrats allocated based on these patterns. A minimum of three quadrats were allocated to each major discernible vegetation pattern where possible. For smaller patterns, fewer quadrats were allocated based on the size of the pattern.

3.4 Field Survey Methods

3.4.1 Survey Timing and Access

The Detailed and Targeted flora and vegetation surveys were undertaken over three visits:

- 3rd to 11th August
- 24th August to 2nd September
- 14th to 23rd September

The timing of the survey was selected to coincide with the most appropriate time to survey in the Murchison and Coolgardie Interim Biogeographic Regionalisation for Australia (IBRA) bioregions (within which the Study Area is located), with most of the taxa in these regions flowering at this time. This includes the majority of significant taxa that potentially occur in the Study Area.

It should be noted that the Technical Guidance for Flora and Vegetation Surveys for Environmental Impact Assessment' (EPA 2016a) stipulates that surveys should be undertaken 6-8 weeks post wet season, and then specifically notes that this period is March-June. However, it is considered incorrect that the period March-June is implied as the only appropriate time for a primary survey to be conducted. The Murchison bioregion has a bimodal rainfall pattern with rainfall peaks in both Summer and Winter (see Section 2.1); additionally, this bioregion has a desert climate with generally unreliable rainfall, and therefore may not receive significant rainfall in either Summer or Winter in any given year. It is therefore considered that the period August-September is also an appropriate time for a primary survey, as it follows one of the known rainfall peaks in the bioregion (May-July). This is reinforced by the timing chosen for all three regional banded ironstone quadrat surveys conducted by the DBCA that intersect the Study Area (August or September – see Section 5.1.3). Additionally, many ephemeral taxa in the Asteraceae family known to occur in this bioregion appear to only germinate and flower during this period and not following summer rainfall (WA Herbarium 1998-).

The Study Area was accessed by using a combination of vehicles using existing access tracks, helicopters and via foot transects. Access to the northern part of the Study Area (Mt Richardson) was achieved on foot via vehicles using existing tracks and roads. However, much of the central to southern section of the Study Area (the Northern Yilgarn Haul Road Study Area) was inaccessible to vehicles, and therefore a helicopter was utilised to access these sections.

3.4.2 Sample Sites

A total of 305 non-permanent flora survey quadrats were established and surveyed within the Study Area during the 2020 field survey. All quadrats had a total area of 400 m^2 (20 m x 20 m). The quadrat size used is the indicative size for flora and vegetation surveys in the Murchison and Coolgardie IBRA Bioregions, as outlined in Table 1 of the Technical Guidance (EPA 2016a). Quadrat locations were selected to ensure that at least three quadrats (where possible) were surveyed within each vegetation pattern initially identified from aerial photography interpretation (as per Section 3.3).

All vascular flora taxa that were visually identifiable within each quadrat were recorded. At least one reference specimen of most taxa encountered (excluding common, distinctive taxa)

was collected for verification and identification purposes. The following information was recorded at each quadrat:

- Personnel;
- Unique quadrat number;
- Date of survey;
- GPS (Global Positioning System) coordinates at start corner of quadrat;
- Site photograph, taken diagonally into quadrat from start corner;
- Compass bearing for two sides of quadrat that commence at start corner of quadrat;
- Topography (including landform type and aspect);
- Soil colour and type (including the presence of any rock outcropping and surface stones);
- Vegetation condition (EPA 2016a, scale presented in Appendix A);
- Approximate time since fire;
- Presence and type of disturbance (if any);
- Percentage foliage cover (for each vascular plant taxon, including cover within the quadrat of individuals rooted outside of the quadrat);
- Height (m) (average for each taxon, excluding climbers/aerial shrubs); and
- Additional flora taxa present immediately outside of the quadrat.

As noted in Section 3.1, Woodman Environmental have previously undertaken a flora and vegetation survey for Mt Richardson (Woodman Environmental 2013), with this survey entirely located within the Study Area. This survey involved the establishment and survey of 177 quadrats to the same standard as those established during this current survey. As this survey was undertaken relatively recently, no further quadrats were established within the Woodman Environmental (2013) study area, with the Woodman Environmental (2013) quadrat dataset incorporated into the overall results of this current flora and vegetation assessment. Prior to this incorporation, a thorough review of the quadrat dataset was undertaken, to resolve potential issues in taxon nomenclature and concepts.

Flora survey quadrats are not considered to be the most appropriate sampling method in all instances. Where areas of vegetation in relatively degraded condition are encountered, or if areas of vegetation are too narrow to allow for the establishment of quadrats (e.g. narrow road verges), the establishment and survey of relevés rather than quadrats is considered more appropriate. A single relevé was surveyed within the Study Area during this assessment; the vegetation sampled was located on a salt lake floor, appeared to be in poor condition, and had very few species present. This relevé surveyed an area approximately within a radius of 20 m around a central point. All data recorded for quadrats (as listed above) was also recorded for relevés; however, only dominant taxa were recorded, as well as taxa not previously observed elsewhere.

Quadrats, relevés and traverses in the Study Area are presented in Appendix B.

3.4.3 Vegetation Mapping Notes

Notes on vegetation pattern boundaries and distribution were also taken while traversing the Study Area, including a GPS location at the point where the notes were taken, a brief

description of the vegetation including dominant and characteristic taxa, and a photograph. These notes were used to aid in the mapping of polygons of vegetation patterns that were not allocated quadrats. Not all vegetation pattern polygons received quadrats due to time constraints; however, many polygons could be confidently allocated to a final VT using a combination of mapping notes and aerial photograph interpretation. Additional flora taxa were also recorded opportunistically in the Study Area during traverses on foot between quadrats, with GPS locations of such taxa recorded. Locations of any significant flora and introduced flora taxa encountered opportunistically while traversing between quadrats were also recorded. This process was also undertaken as part of the Woodman Environmental (2013) survey for Mt Richardson, with these notes used in the same fashion as those from this current survey. The locations of vegetation mapping note points are presented in Appendix B; note that those taken as part of the Woodman Environmental (2013) survey are not presented.

3.4.4 Targeted Significant Flora and Vegetation Survey

Targeted survey for significant flora taxa was undertaken as part of the survey, with a list of significant flora taxa likely to be encountered compiled as part of the desktop study, and all taxa on this list surveyed for. Targeted survey was undertaken on the first field trip of the survey, from the 4th – 7th of August 2020. The timing of the targeted survey was chosen to follow one of the periods when relatively significant rainfall often occurs in the Murchison region (late Autumn-early Winter), to allow for identification of all target taxa. Known locations of the majority of target flora taxa were visited prior to commencement of the targeted survey to familiarise all personnel with target flora taxa and to ensure target flora taxa were identifiable at the time of the survey. Photographs of all target taxa were obtained prior to survey to aid in identification in the field.

Targeted Survey was undertaken specifically at Mt Richardson in suitable habitat for the target taxa within the Targeted Survey Area. All such areas have been the subject of previous surveys, including relatively detailed flora and vegetation assessments that included some targeted survey (see Section 5.1.3). This allowed for identification of suitable habitat for significant flora within these areas; only suitable habitat was the subject of targeted survey for significant flora during this assessment, with no targeted survey undertaken in habitat not considered suitable for significant flora taxa. The targeted survey was undertaken via transects in a grid pattern with 30 m intervals. If populations of any significant flora taxa were identified, a representative collection of material was made, and the abundance and spatial distribution of individuals was recorded using a handheld GPS.

Further targeted survey was undertaken in the wider Study Area in the general Mt Richardson Area to provide local contextual information on abundance and distribution of those taxa identified in the Targeted Survey Area. This further survey was a combination of survey in previously unsurveyed areas of potentially suitable habitat, as well as verification of previously recorded locations of significant flora taxa, as much of the Mt Richardson area has been the subject of previous targeted significant flora survey, particularly by Woodman Environmental (2013), which also reviewed and consolidated the results of earlier surveys. The significant flora dataset from Woodman Environmental (2013) was reviewed to resolve potential issues in taxon nomenclature and concepts.

Methods of survey in previously unsurveyed areas were as for within the Targeted Survey Area; however, transects were not necessarily in a grid pattern. For the verification of previously recorded locations of significant flora taxa, with the exception of *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), all significant flora taxa recorded in the Mt Richardson area are perennial, presumably long-lived taxa. Therefore, a selection of previously recorded locations was revisited during the current survey, and notes on population distribution and abundance were taken, with these notes compared to previously recorded observations. If these observations were comparable, then the previously recorded data was considered acceptable, and such taxa were not re-censused during the current survey. For the ephemeral *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), all known locations were revisited with the aim of obtaining current data.

No targeted survey for significant flora was undertaken in any other specific areas elsewhere within the Study Area, including within the NYHR area. However, targeted survey was undertaken while traversing to quadrat and relevé locations.

Targeted survey was also undertaken for listed significant vegetation, with a list of significant vegetation likely to be encountered compiled as part of the desktop study. This was undertaken in the same areas within which targeted significant flora survey was undertaken, as well as while traversing to quadrat and relevé locations. If any occurrences of such significant vegetation were encountered, the boundary of the significant vegetation was recorded where possible, either via walking the boundary and recording the GPS track log, or by recording GPS waypoints. This allowed for the accurate calculation of the spatial areas of occurrences of significant vegetation.

All targeted significant flora and vegetation traverses in the Study Area are presented in Appendix B.

3.4.5 Introduced Flora

Locations of any introduced flora taxa encountered while traversing between quadrats, and while conducting targeted searching for significant flora taxa, were also recorded using the same method as for significant flora taxa, with particular emphasis given to Weeds of National Significance (WoNS) and Declared Pests.

3.5 Plant Collection and Identification

Specimens of any unknown taxa that were collected were pressed for later identification at the WA Herbarium. Plant identifications were undertaken by Senior Botanists with extensive previous experience in plant identifications for flora of the South-West, as listed in Table 3. The identification of all taxa (including significant taxa) used the most up to date information available. External experts of particular families or genera were consulted for any specimens considered to be difficult to identify or of taxonomic interest.

Taxon nomenclature generally follows *FloraBase* (WA Herbarium 1998-) with all names checked against the current DBCA Max database to ensure their validity. However,

nomenclature in the published literature is followed in cases where names of plant taxa have been published recently in scientific literature but have not yet been adopted on *FloraBase* due to time constraints (WA Herbarium 1998-). The conservation status of each taxon was checked against *FloraBase*, which provides the most up-to-date information regarding the conservation status of flora taxa in Western Australia.

Specimens of interest, including significant flora taxa, range extensions of taxa and potential new taxa, are sent to the WA Herbarium for consideration for vouchering as soon as practicable. However, this process is via donation, and the WA Herbarium may not voucher all specimens, in accordance with its own requirements. The specimen vouchering will be supported by completed Threatened and Priority Flora Report Forms submitted to DBCA (Species and Communities Branch) in the case of listed significant flora (e.g. Threatened and Priority flora taxa).

3.6 Floristic Analysis

A single classification analysis was performed as part of this assessment. This analysis used both quadrat data from this and previous surveys conducted within the Study Area for the Mt Richardson and NYHR Projects, as well as quadrat data from three DBCA banded ironstone surveys that located quadrats both within and immediately adjacent to the Study Area (Meissner *et al.* 2009b; Meissner and Owen 2010a; Markey and Dillon 2011b). This analysis therefore aimed to serve the dual purpose of identifying vegetation in the form of VTs at a local or project scale, as well to determine the presence of TECs or PECs that have been defined from quadrat data (specifically the banded ironstone PECs defined from quadrat data obtained by the aforementioned DBCA banded ironstone surveys). To determine presence of TECs and PECs from quadrat-derived data, the EPA (2016a) requires comparison of the study area quadrat data with that of the survey in which the TEC or PEC was originally described. Analysis methods and treatment of data by the aforementioned DBCA banded ironstone surveys were replicated in this analysis to minimise disruption to those datasets compared to the original analyses undertaken as part of these surveys, and to allow for more confident aligning of community types between surveys.

Classification analysis of floristic data was conducted using 628 quadrats established in the Study Area and surrounds from the following surveys:

- 299 quadrats established in the Study Area during this current survey;
- 177 quadrats established in the Study Area in the Mt Richardson area in 2012 by Woodman Environmental (2013);
- 51 quadrats established in the northern Yerilgee Hills in the Study Area and nearby areas (southern part of the NYHR area) in 2007 by DBCA (Markey and Dillon 2011b);
- 50 quadrats established in the Brooking Hills in the Study Area and nearby areas (northern part of the NYHR area) in 2007 by DBCA (Meissner and Owen 2010a); and
- 51 quadrats established in the Mount Forrest – Mount Richardson Range in the Study Area and nearby areas (Mt Richardson area) in 2006 by DBCA (Meissner *et al.* 2009b).

The classification analysis did not include six quadrats established by this current survey in the Study Area. Review of the data from these quadrats prior to analysis found that, following the exclusion of species as per the DBCA banded ironstone surveys (detailed below), the

species richness of these quadrats was so low (all had 5 or fewer species, with one quadrat having 0) that it was considered inappropriate to include them in such a classification analysis. These quadrats were therefore manually allocated to VTs based on their species composition – this is discussed further in Section 5.2.9.

Prior to the above analysis being conducted, a thorough review of the Woodman Environmental (2013) and DBCA banded ironstone survey quadrat datasets was undertaken, to resolve potential issues in taxon nomenclature and concepts. It is acknowledged that there are other survey-related variables that may affect analysis results when data is used from differing surveyors and years, including seasonal characteristics (particularly rainfall), surveyor experience and survey effort. However it is considered that the Woodman Environmental quadrat dataset from this current survey and the aforementioned historical datasets are compatible for the purpose of defining VTs, and determining the presence of TECs and PECs (see Section 3.9.2); the methods employed during this current survey closely replicate those used by the aforementioned historical surveys, quadrats were sampled during the same season, and the sampling by this current survey was done by relatively experienced surveyors. However, the potential effects of seasonal characteristics cannot be mitigated.

Taxa belonging to several categories removed from the data matrix prior to analysis, as listed below:

- Ephemeral or annual taxa – the presence of ephemeral or annual taxa is strongly influenced by seasonal conditions, with such taxa usually patchily-distributed in seasons with below-average rainfall. Removal of annual taxa from the data matrix is consistent with DBCA banded ironstone survey floristic classification analyses, including the three aforementioned surveys;
- Introduced taxa – introduced taxa were removed as their distributions are generally defined by the presence of disturbance (e.g. clearing, animal movement) rather than particular natural habitat types;
- Hybrids – hybrids are usually the result of random reproductive events that produce small numbers (often only one) of sterile offspring and are often not associated with particular habitat types. However, putative hybrids between Mulga (*Acacia aneura* and relatives) were included in the data matrix (see Section 5.2.8);
- Taxa where identification was unclear – taxa were removed from the analysis where identification was unclear due to poor available material in the field (see Appendix C). However, if such a taxon was known to be unique within the dataset, it was included in the analysis;
- Singletons – taxa that occur only once in the dataset were removed. This is consistent with DBCA banded ironstone survey floristic classification analyses, including the three aforementioned surveys. One such banded ironstone survey (Markey and Dillon 2008) indicated that singletons provide little information in the dataset.

Consistent with DBCA banded ironstone survey floristic classification analyses, a single-layer data matrix (i.e. presence/absence data only) was used in the classification analysis. PATN (V3.12) (Belbin and Collins 2009) was utilised to perform the classification and ordination analysis of the data matrix. The Bray-Curtis coefficient was used to generate an association matrix for the classification analysis. This association matrix consisted of pairwise coefficients of similarities between quadrats based on floristic data. Agglomerative hierarchical clustering,

using flexible Unweighted Pair Group Method with Arithmetic Mean (UPGMA) (ß = -0.1), was used to generate a quadrat classification dendrogram (Sneath and Sokal 1973).

3.7 Vegetation Type Definition, Mapping and Description

As outlined in Section 3.6, sampling of vegetation in the Study Area used quadrats (including those utilised in the classification analysis as well as those excluded from the classification analysis because of low taxon richness) and relevés. Therefore, VTs were defined using a combination of floristic composition classification (i.e. via a floristic classification analysis as outlined in Section 3.6), and structural vegetation classification, as defined in the technical guidance for flora and vegetation surveys (EPA 2016a).

The classification analysis (see Section 3.6) produced hierarchical clusters of quadrats. The resulting dendrogram and taxon group matrix were initially examined at a quadrat cluster level determined by PATN as potentially appropriate for the dataset, to determine the plausibility of quadrat clusters with regard to taxon groups, as well as field observations. This process determined a final number of clusters, which were considered to represent VTs.

Following this process, floristic and structural data recorded at relevés and quadrats which were excluded from the analysis was examined to determine whether vegetation sampled by such relevés / quadrats was analogous to any of the VTs defined by floristic composition classification. Any such vegetation that was not considered to be analogous with any of the VTs defined by floristic composition classification was considered to represent a discrete VT.

VT descriptions have been adapted from the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 6.0 (Executive Steering Committee for Australian Vegetation Information (ESCAVI) 2003), as stipulated by EPA (2016a). This model follows nationally-agreed guidelines to describe and represent VTs, so that comparable and consistent data are produced nation-wide. It should be noted that the NVIS system utilises vegetation descriptions derived from structural characteristics of the individual community units, while majority of the VTs presented in this report are defined based on the results of a floristic classification analysis, excluding any structural data. VTs therefore may include multiple structural types. Considering the effect of disturbance factors such as fire on vegetation structure, this approach is designed to provide a map of VTs that reflect taxon composition and the influences of the physical and chemical environment rather than disturbance history.

It should also be noted that this report describes VTs at the NVIS Sub-Association level, rather than the Association level as stipulated by EPA (2016a). This level is considered more appropriate for the vegetation of the Study Area, as often the vegetation possessed one or more additional strata to the traditional three-stratum classification system used at the Association level.

The locations of quadrats within each VT were used in conjunction with aerial photograph interpretation and vegetation mapping notes to develop VT mapping polygon boundaries. These boundaries were developed using aerial photography at a scale of 1:10,000, and

reflected changes in vegetation patterns visible at that scale. These VT mapping polygon boundaries were then digitised using Geographic Information System (GIS) software.

For each VT defined via floristic composition classification, indicator taxa were defined via Indicator Taxon Analysis (INDVAL). This was conducted using PC-Ord (V6.08) (McCune and Mefford 2011) via the method of Dufrene and Legendre (1997). This generates INDVAL values (a measure of taxon fidelity to a given VT), which range from 0 to 100; an INDVAL value of 100 indicates that a taxon is present in all quadrats within a particular VT, and absent from all other quadrats included in the analysis. The INDVAL values were then tested for significance of the indicator taxa using a Monte Carlo permutation test. Indicator taxa were defined as taxa with an INDVAL value > 10, and a significance Þ value of either <0.05, <0.01 or <0.001.

3.8 Vegetation Condition Mapping

Vegetation condition was described using the vegetation condition scale presented in EPA (2016a) for the South West and Interzone Botanical Province (see Appendix A). Although part of the Study Area is located in the Eremaean Botanical Province, which has been prescribed a different condition scale by EPA (2016a), it was considered necessary to use a single condition scale for consistency purposes. Notes on vegetation condition were taken during the field survey via vehicle traverses along access tracks and during foot traverses undertaken within the Study Area. Vegetation condition was also recorded at all quadrats. Vegetation condition category polygon boundaries were developed using this information and were digitised using GIS software as for VT polygon boundaries.

3.9 Significant Flora and Vegetation

3.9.1 Significant Flora

As per EPA (2016b), flora taxa may be significant for a range of reasons, including, but not limited to the following:

- Being identified as a Threatened or Priority species (formally listed significant taxa – includes taxa listed under both State and Commonwealth legislation, and classified as Priority by DBCA);
- Locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- New species or species with anomalous features that indicate a potential new species;
- Representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- Unusual species, including restricted subspecies, varieties or naturally occurring hybrids; and
- Relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Significant flora taxa recorded within the Study Area are discussed in Section 5.2.2 with reference to the above categories. Point locations, individuals and populations of significant

flora known from the Study Area are presented in this section. A population in the context of this survey is defined as a discrete group of individuals of a taxon separated by more than 500 m from the nearest discrete group of individuals (DBCA 2017); however, this definition can only be tentatively applied if intervening areas have not been surveyed.

The conservation status rankings for flora taxa in WA are presented on the DBCA Threatened species and communities website (DBCA 2019a).

3.9.2 Significant Vegetation

As per EPA (2016b), vegetation may be significant for a range of reasons, including, but not limited to the following:

- Being identified as a TEC or PEC (formally listed significant vegetation – includes vegetation listed under Commonwealth legislation, endorsed as a TEC by the Western Australian Government, or classified as a PEC by DBCA);
- Having restricted distribution;
- Degree of historical impact from threatened processes;
- A role as a refuge; and
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

3.9.2.1 Formally Listed Significant Vegetation

As the DBCA's banded ironstone surveys of the Mount Forrest – Mt Richardson Range, Brooking Hills and Northern Yerilgee Hills all overlap the Study Area, and have all formed the basis for the definition of PECs, the PECs based on these surveys are considered to occur within the Study Area (see Section 5.1). There is limited information available regarding identification of these PECs. Previous communications from DBCA have indicated that all vegetation associated with the banded ironstone ranges sampled by DBCA is considered to represent these PECs; this includes vegetation on the banded ironstone ranges themselves, as well as their outwashes, whose soils are still influenced by the banded ironstone ranges.

The classification analysis conducted as part of this current assessment (see Section 3.6) provides what is considered to be an appropriate avenue for identification of vegetation that represents the banded ironstone PECs that occur in the Study Area. It is apparent that all DBCA quadrats established as part of the above-mentioned banded ironstone surveys sampled vegetation that is now considered to be part of the PECs that occur on these ranges. As these DBCA quadrat datasets were included in the classification analysis conducted as part of this current assessment (see Section 3.6), the classification analysis was therefore used to determine relationships between DBCA quadrats and VTs defined and mapped in the Study Area. This was done by reviewing the position of DBCA quadrats within quadrat clusters that were determined as representing VTs within the Study Area. This process allowed for the designation of VTs defined and mapped by this current survey that are considered to represent one of the banded ironstone PECs known to occur in the Study Area; any VTs that were comprised in part or in full of DBCA quadrats from one of the banded ironstone surveys that overlaps the Study Area were considered to be a component of PEC associated with the banded ironstone survey.

Although the above analytical approach to identification of the aforementioned banded ironstone PECs is considered to be an appropriate identification method, it cannot be used solely to identify the banded ironstone PECs. This is primarily because the DBCA surveys that form the basis for these PECs were relatively limited in both extent and intensity. It is therefore possible that discrete communities that occur on the targeted banded ironstone ranges, which by virtue of their location on or near the target banded ironstone ranges must therefore be considered part of the associated banded ironstone PEC, were not sampled by these surveys. Therefore, any other VTs defined and mapped in the Study Area that occur on or are influenced by banded ironstone ranges were also considered to be a component of the PEC known from the banded ironstone range. Additionally, the same approach was used for VTs that occur in the Study Area that were defined using the structural vegetation classification method, as these VTs are not represented by any quadrats included in this current classification analysis.

With regard to other TECs and PECs listed in Western Australia, only broad descriptions generally are provided in the respective TEC and PEC lists published by the DBCA to allow for diagnosis. The vegetation of the Study Area was therefore manually compared to such descriptions to determine whether any vegetation may represent such a TEC or PEC. A similar process was followed for TECs listed under the EPBC Act, with the vegetation of the Study Area assessed against the appropriate listing and conservation advice for any TECs likely to occur in the Study Area.

3.9.2.2 Other Significant Vegetation Categories

The remaining significant vegetation criteria other than "being identified as a TEC and PEC" were applied to VTs mapped in the Study Area to determine whether a VT represented significant vegetation. However, determination of the significance of individual VTs in their own right is difficult because of a lack of comprehensive regional vegetation datasets from the area where the Study Area is located. The DBCA banded ironstone surveys (as detailed in Section 3.9.2.1) provide some context for the assessment of the potential significance of individual VTs in their own right. As outlined in Section 3.9.2.1, the classification analysis undertaken for this current assessment includes DBCA quadrats from three banded ironstone surveys that overlap with the Study Area. The presence of any DBCA quadrats from outside the Study Area within the quadrat clusters that comprise Study Area VTs is considered to be evidence that the VT occurs elsewhere outside the Study Area; this was therefore a consideration when determining the significance of such VTs. However, this is only relevant for VTs that occur on banded ironstone ranges and their outwashes, as the DBCA banded ironstone surveys only sampled such features. For all other VTs, significance could only be inferred based on the taxon composition of the VT and the soils and landforms that the VT occurs on.

4. ADEQUACY AND LIMITATIONS OF SURVEY

4.1 Adequacy of Survey

The Study Area covers approximately 24,986 ha, with 482 quadrats established in the Study Area specifically for the Mt Richardson and NYHR Projects (305 during this current survey; 177 during the Woodman Environmental (2013) survey). Quadrats were established in all preliminary vegetation patterns discernible by initial aerial photograph interpretation (Section 3.3), both to adequately sample variation in vegetation throughout the Study Area and to ensure adequacy of sampling for vascular plant taxa. The number of quadrats established in the Study Area is considered to be an acceptable number given the diversity of topography and soil types observed in the Study Area, as well as the size of the Study Area.

To provide an indication of the adequacy of this survey, a taxon accumulation curve was produced using PC-Ord (McCune and Mefford 2011). Taxon accumulation curves represent a theoretical model of the relationship between sampling intensity and taxon accumulation; when sampling intensity is increased, taxon accumulation is reduced, and a taxon accumulation curve becomes asymptotic.

The taxon accumulation curve for quadrat data (Woodman Environmental quadrats included in the floristic classification only) from the Study Area was generated using all native taxa (both annual and perennial) recorded within each quadrat. Taxon accumulation calculations for the Study Area were then undertaken via PC-Ord, utilising the Chao-2 estimator for species richness (Chao 1987) and compared to the actual number of taxa recorded in the Study Area. This provides an indication as to whether sufficient quadrats were surveyed to adequately sample the species richness in the Study Area. As the generation of species accumulation curves includes quadrat data only, and not opportunistically recorded taxa or taxa recorded in relevés, the indication of adequacy of survey is considered to be conservative.

Figure 6 presents the species accumulation curve generated from quadrat data from the Study Area. Using the Chao-2 estimator, the recorded number of taxa within quadrats (527 taxa) is equivalent to 81.2 % of the estimated taxon richness in the Study Area (649 estimated to occur). Sampling was therefore considered to be adequate using this estimation measure. It is of interest that the estimated number of taxa in the Study Area from quadrats only using Chao-2 was 649; when taxa from quadrats not included in the classification analysis, relevés and opportunistic records are included, 607 taxa (93.5 % of the Chao-2 estimate) were recorded in the Study Area (see Section 5.2.1), providing further indication that the Study Area was relatively well-sampled.

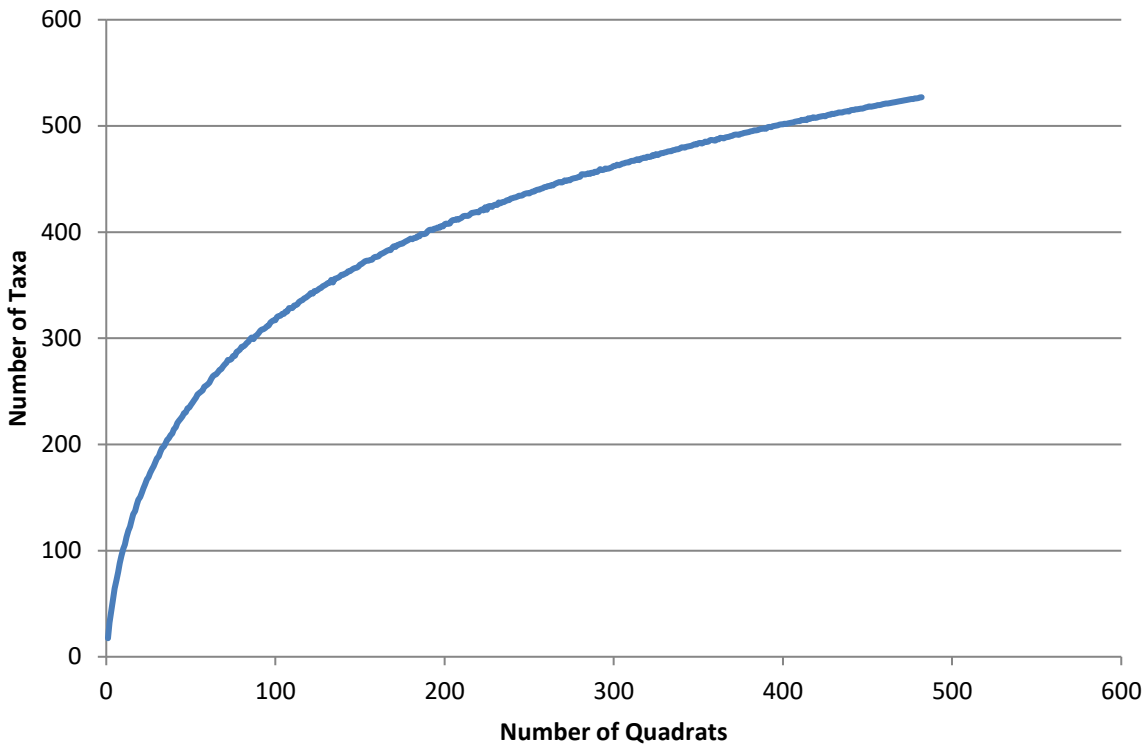


Figure 6: Study Area Quadrat Data Species Accumulation Curve

Another adequacy of survey measure is that developed by Mueller-Dombois and Ellenberg (1974), who suggest that a cut-off point might be when a 10 % increase in quadrats surveyed results in a 5 % (or less) increase in taxa recorded. This measure was also calculated using all native taxa recorded within each quadrat established by Woodman Environmental (2013; this current survey) in the Study Area. The number of quadrats established in the Study Area satisfies this adequacy measure suggested by Mueller-Dombois and Ellenberg (1974), with the final taxon increase value of 2.74 % recorded following a 10 % increase in quadrats.

4.2 Limitations of Survey

Table 4 presents the limitations of the flora and vegetation survey of the Study Area in accordance with EPA (2016a).

Table 4: Limitations of the Flora and Vegetation Survey of the Study Area

Limitation	Limitation of Survey	Comment
Effort and Extent	No	A total of 122 person days spent surveying in the Study Area during this current survey; this built on the 66 person days spent surveying in the Mt Richardson area in the Study Area in 2012 (Woodman Environmental 2013). Detailed survey was undertaken across the entire Study Area. Multiple quadrats were established in each vegetation pattern identified in the Study Area. No constraints prevented appropriate sampling techniques (quadrat establishment, foot transects) being employed. Mapping of VT boundaries was undertaken using a combination of aerial photography (scale 1:10,000) and information collected during traverses between quadrats and releves. Mapping reliability is therefore considered to be relatively high; however, field verification of vegetation boundaries post-analysis was not undertaken. Targeted survey for significant taxa was undertaken in the Targeted Survey Area, as well as surrounding areas for specific taxa, at Mt Richardson only. Targeted searching for significant flora was not undertaken across the remainder of the Study Area. Further survey for significant flora taxa may be required depending on the precise location of future development.
Competency / experience of the team carrying out the survey	No	The Project Manager has had extensive previous experience (> 10 years) in conducting similar flora surveys in the Murchison and Coolgardie bioregions. Personnel conducting plant identifications have had ~10 years' experience in plant identification in the Murchison and Coolgardie bioregions. Senior personnel provided guidance to less experienced botanists throughout the survey where necessary. Relevant experts at the WA Herbarium were consulted regarding taxonomic identifications where required.
Proportion of flora identified, recorded and/or collected.	Partial	All vascular groups that were present in the Study Area were sampled. A high proportion of perennial vascular taxa were recorded based on the intensity and method of survey, and almost all could be positively identified. However, ephemeral taxa were patchily distributed due to below average rainfall prior to the survey (see timing/weather/season/cycle below); it is possible that some taxa that would be observable in average or better rainfall seasons were not detectable during the survey. Unknown vascular taxa were collected, with specimens identified at the WA Herbarium. Adequacy of survey measures indicate that the Study Area was well sampled.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data	No	Reasonable contextual information for the Study Area was available prior to the surveys. Sources of information used included government databases (DBCA, DAWE), previous unpublished reports and data from the vicinity of the Study Area (e.g. Gibson *et al.* 1997, Outback Ecology 2005, 2007, Mattiske Consulting 2008, Polaris Metals 2010, Western Botanical 2009, 2010a, 2010b, 2011, Botanica Consulting 2013, Woodman Environmental 2013) as well as numerous general sources pertaining to the climate, geomorphology, flora and vegetation of the Murchison and Coolgardie bioregions. However, most specific flora and vegetation survey information is focussed on banded ironstone ranges in the Study Area; there is very limited survey information relevant to much of the remainder of the Study Area, including most of the NYHR area; much of this area is inaccessible by vehicle and has therefore generally not been the subject of previous surveys.

Limitation	Limitation of Survey	Comment
Timing/weather/season/cycle	Partial	Field survey was conducted within what is considered to be an appropriate time for survey in both the Murchison and Coolgardie bioregions (late winter-early spring); this period is considered to correspond with the optimum flowering period for these bioregions. However, rainfall prior to the field survey was below average for May – July for the Study Area (see Section 2.1). A large proportion of perennial plants were consequently observed to be sterile (i.e. not in flower or fruit); in general, most specimens of such taxa were still able to be confidently identified. However, there were a number of cases in which positive identification was not possible. This led to some rationalisation of floristic data for the classification analysis (see Section 5.2.8); however, it is considered that the classification analysis results were unlikely to have been significantly affected. Ephemeral taxa were patchily distributed; such taxa were generally restricted to water-gaining situations such as near salt lakes, and in cracks in ironstone or granite outcrops where there was more shade, run-off and water retention. It is therefore possible that some taxa that would be observable in average or better rainfall seasons were not detectable during the survey. In the context of significant flora in the Mt Richardson area, where targeted searching occurred, the ephemeral taxon *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), which has previously been recorded within the Mt Richardson Area, was not considered to be detectable during this survey. Searching at the historical location of this taxon failed to locate any individuals. However, all other taxa potentially occurring in the Mt Richardson area were detectable during this survey (see Section 5.2.6). In the context of significant flora in the NYHR area, most perennial taxa potentially occurring in this part of the Study Area were considered to be detectable during the survey; however, several perennial taxa whose identification is dependent on reproductive material, as well as several ephemeral taxa, may not have been detectable during the survey because of the below-average rainfall. Some rationalisation of floristic data occurred because of available material
Disturbances (e.g. fire, flood, accidental human intervention etc.), which affected results of survey	No	One very small area in the NYHR had been affected by a recent (probably Summer 2019/2020) fire; this allowed for the collection of several known short-lived, disturbance opportunist species that were not recorded elsewhere in the Study Area. This area was able to be confidently assigned to a VT based on the presence of regenerating long-lived taxa, and therefore the accuracy of the vegetation mapping in this area was not affected. A number of other areas showed evidence of fire, but it appears likely that these areas were burnt more than 10 years prior to the survey; the taxon composition therefore appeared similar to long-unburnt areas, although the vegetation structure was still clearly different. No other disturbances affected the results of the survey.
Remoteness and/or access problems	No	Access to the Study Area was generally considered adequate. The Mt Richardson part of the Study Area was easily accessed on foot and via vehicles using existing tracks and roads. The NYHR part of the Study Area was easily accessible in the north by foot and vehicle from existing roads; the majority of the central and southern part was inaccessible to vehicles and therefore helicopters were used to provide foot access. The use of helicopters overcame any potential issues related to access and remoteness in this area.

5. RESULTS AND DISCUSSION

5.1 Desktop Survey

5.1.1 Regional Flora

The interrogation of the DBCA's WA Herbarium Specimen database and TPFL database (DBCA 2020b) returned a total of 72 listed significant vascular flora taxa that have records in the search area, which was limited to a 30 km buffer around the centreline of the Study Area. This includes four Threatened taxa (as listed under the BC Act) and 68 DBCA-classified Priority flora. Of the 72 taxa returned from the search, 11 have records within the Study Area. The locations of significant flora taxa retrieved from DBCA databases are presented in Table 7 and on Figure 8.

The search of the DBCA databases via *NatureMap* (DBCA 2007–) using the approximate boundary of the Desktop Study Area (50 km buffer around the Study Area) resulted in a further 9 conservation significant flora taxa known to occur within the Desktop Study Area (Table 7). Of these, two are listed as Threatened taxa (under the BC Act), and seven are DBCA-classified Priority flora.

A search of the Department of Agriculture, Water and the Environment (DAWE) Species Profile and Threats (SPRAT) Database (DAWE 2020b) was undertaken to identify Matters of National Environmental Significance (MNES) listed under the EPBC Act that occur or have the potential to occur within the vicinity of the Desktop Study Area. The search returned eight listed Threatened flora taxa which are likely to occur, or are likely to have suitable habitat in, the Desktop Study Area, as listed below (DAWE 2020b):

- *Eremophila virens* (Endangered);
- *Eremophila viscida* (Endangered);
- *Gastrolobium graniticum* (Endangered);
- *Leucopogon spectabilis* (Critically Endangered);
- *Myriophyllum lapidicola* (Endangered);
- *Ricinocarpos brevis* (Endangered);
- *Tetratheca aphylla* (Vulnerable); and
- *Tetratheca paynterae* (Endangered).

The full results of the DAWE database search are presented in Appendix D.

A search of the WA Herbarium specimen database for records of introduced taxa within the Desktop Study Area was performed using *NatureMap*. A total of 41 introduced taxa were returned from the search. These taxa are presented in Table 8.

The search of the DAWE database also identified two significant invasive introduced flora taxa, or habitat for these taxa, which are likely to or may occur within the Desktop Study Area: *Carrichtera annua* and *Cenchrus ciliaris*.

5.1.2 Regional Vegetation

The Study Area spans two Bioregions (within which one subregion each is intersected), as defined by the IBRA mapping (Commonwealth of Australia 2012). The northern part of the Study Area is located within the Murchison Region (Eastern Murchison Subregion), while the southern part (approximately one third) belongs to the Coolgardie Region (Southern Cross Subregion). These regions largely coincide with the Natural Regions (Phytogeographical Regions), as mapped and redefined by Beard (1990): Murchison Region (Austin Botanical District) in the north, belonging to the Eremaean Province (part of Burbridge's arid Eremaean Zone of central Australia), and Southwestern Interzone (Coolgardie Botanical District), as proposed originally by Burbridge, in the south (Beard 1990).

The Eastern Murchison subregion is dominated by Mulga (*Acacia aneura*) woodlands, often rich in ephemeral understorey taxa. Other communities include hummock grasslands, and samphire and saltbush communities surrounding the salt lakes (Cowan 2001). The Southern Cross subregion features floristically diverse Eucalyptus woodlands (*Eucalyptus salmonophloia*, *E. salubris*, *E. transcontinentalis, E. longicornis*) with endemic eucalypts, mallee and scrub-heath vegetation rich in endemic *Acacia* and Myrtaceae taxa, vegetation of granite outcrops, and samphire communities of salt lakes (Cowan *et al.* 2001).

Beard *et al.* (2013) described and mapped vegetation system associations (VSA) of Western Australia, at a scale of 1:300,000. A total of 20 VSAs occur in the Desktop Study Area, as summarised in Table 5, presented in order from the most common to least common within the Study Area**.** Table 5 also presents the percentage of the pre-European mapped extent which remains uncleared, and the percentage of the current extent which is protected for conservation (in DBCA-managed land). Of the 20 vegetation systems within the Desktop Study Area 19 have undergone minimal clearing, with over 99 % of their pre-European extent remaining.

Table 5: Vegetation System Associations within the Study Area

Vegetation System Association	Description	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent Protected for Conservation (%)
BARLEE_18	Low woodland; mulga (*Acacia aneura*)	3,209,529.05	99.93	2.40
BARLEE_202	Shrublands; mulga & *Acacia quadrimarginea* scrub	176,160.17	99.96	26.21
BARLEE_485	Hummock grassland, mixed sandplain - scattered low trees over sparse dwarf shrubs with spinifex; red mallee over mixed dwarf shrubs with *Triodia* spp.	215,948.86	99.99	11.87
JACKSON_468	Medium woodland; salmon gum & goldfields blackbutt	102,024.05	100.00	24.16
JACKSON_141	Medium woodland; York gum, salmon gum & gimlet	643,140.22	99.82	47.70
BARLEE_389	Succulent steppe with open low woodland; mulga over saltbush	331,885.98	99.82	3.00
JAURDI_437	Shrublands; Mixed acacia thicket on sandplain	163,781.65	100.00	2.99

Vegetation System Association	Description	Current Extent (ha)	Pre-European Extent Remaining (%)	Current Extent Protected for Conservation (%)
BARLEE_483	Hummock grasslands, mixed sandplain - open mallee over sparse dwarf shrubs with spinifex; red mallee over mixed sparse dwarf shrubs with *Triodia* spp.	439,264.55	99.99	12.11
BARLEE_416	Low woodland; mulga mixed with cypress pine & york gum	212,513.50	99.75	6.96
JAURDI_435	Shrublands; *Acacia neurophylla, A. resinomarginea or A. beauverdiana* thicket	119,971.58	100.00	15.23
BARLEE_24	Low woodland; *Casuarina pauper*	23,491.56	99.92	15.32
BARLEE_8	Medium woodland; salmon gum & gimlet	961.99	100.00	0.00
JACKSON_24	Low woodland; *Casuarina pauper*	2,278.07	100.00	0.00
BARLEE_20	Low woodland; mulga mixed with *Casuarina pauper* & *Eucalyptus* sp.	1,172,943.21	99.78	15.61
BARLEE_19	Low woodland; mulga between sandridges	102,683.64	100.00	22.50
JACKSON_538	Shrublands; *Acacia ramulosa* scrub	100,140.21	99.24	29.66
BARLEE_128	Bare areas; rock outcrops	28,272.13	99.64	20.88
JAURDI_128	Bare areas; rock outcrops	17,509.57	100.00	7.93
BARLEE_125	Bare areas; salt lakes	482,835.87	88.78	6.86
BARLEE_468	Medium woodland; salmon gum & goldfields blackbutt	4,414.94	100.00	78.11

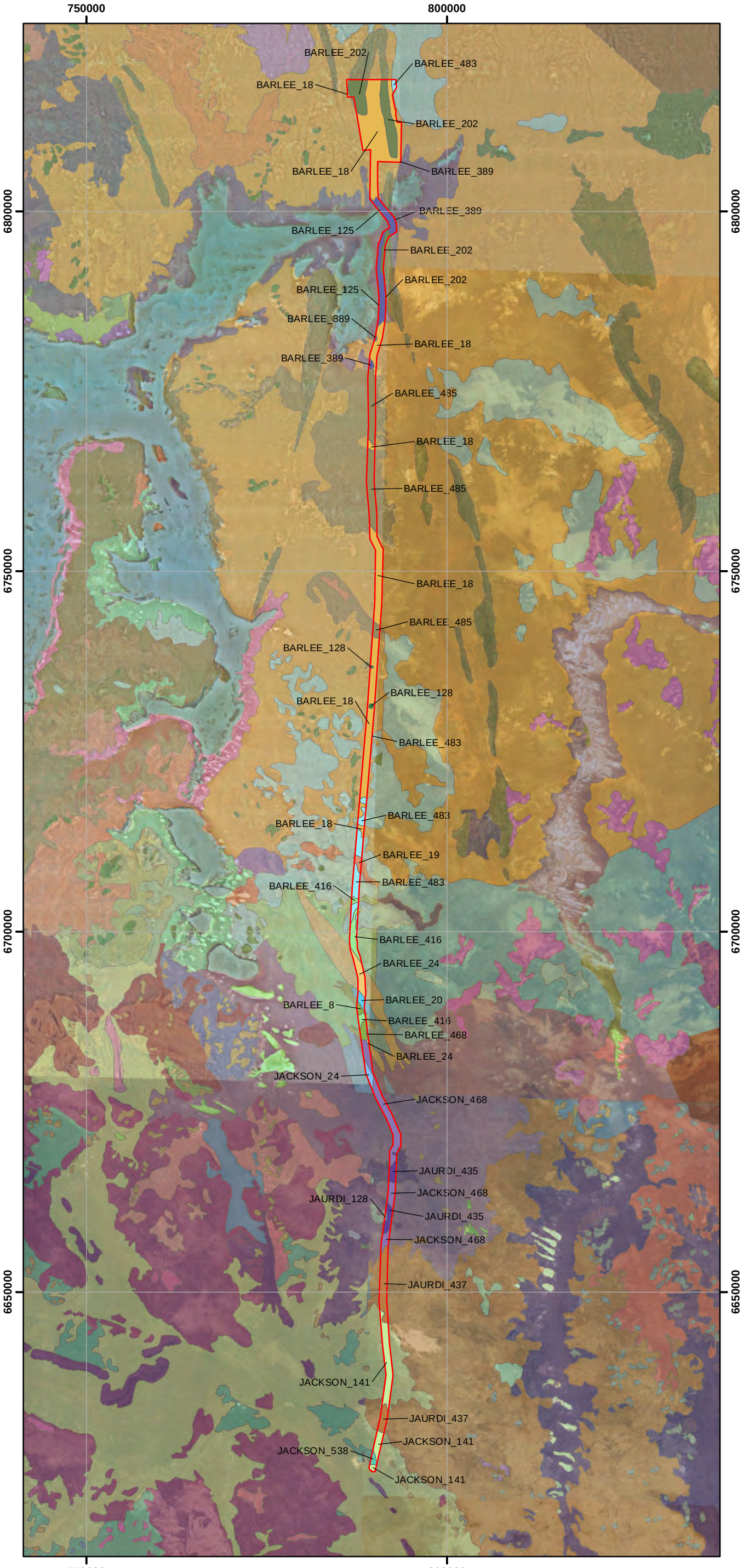
Approximately one third of the Study Area is located within the mapped extent of the Great Western Woodlands (GWW). The GWW area, comprising almost 16 million hectares, is regarded as the largest intact Mediterranean-climate woodland remaining on Earth. With the exception of established or proposed reserves, the GWW is currently not under any form of legislative protection.

The interrogation of the DBCA TEC and PEC Database (DBCA 2020a) identified 11 significant communities, or their DBCA-defined buffer zones, as occurring within the Desktop Study Area. All are PECs rated as Priority 1 (poorly known), as listed below:

- Banded Ironstone Hills with *Dryandra arborea*
- Cashmere Downs vegetation assemblages (banded ironstone formation)
- Die Hardy Range/Diemels vegetation assemblages (banded ironstone formation)
- Finnerty Range/Mt Dimer/Yendilberin Hills vegetation assemblages (banded ironstone formation)
- Helena and Aurora Range vegetation assemblages (banded ironstone formation)
- Hunt Range vegetation assemblages (banded ironstone formation)
- Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation)
- Mount Manning Range vegetation assemblages (banded ironstone formation)
- Mount Forrest - Mount Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)

- Perrinvale (Pine Well) calcrete groundwater assemblage type on Raeside palaeodrainage on Perrinvale Station
- Perrinvale/Walling vegetation assemblages (banded ironstone formation)

The search of the DAWE SPRAT database for MNES listed under the EPBC Act did not identify any TECs that occur or have the potential to occur within the Desktop Study Area (Appendix D).



Legend

Study Area

Vegetation System Associations

- BARLEE_125
- BARLEE_128
- BARLEE_18
- BARLEE_19
- BARLEE_20
- BARLEE_202
- BARLEE_24
- BARLEE_389
- BARLEE_416
- BARLEE_468
- BARLEE_483
- BARLEE_485
- BARLEE_8
- JACKSON_141
- JACKSON_24
- JACKSON_468
- JACKSON_538
- JAURDI_128
- JAURDI_435
- JAURDI_437

WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Vegetation System Associations of the Study Area

Author: Leah Firth

WEC Ref: MRL20-38

Filename: MRL-20-38-01-f07

Revision: A - 15 June 2021

Scale: 1:575,000

Projection: GDA 1994 MGA Zone 50

Figure

7

5.1.3 Local Flora and Vegetation Surveys

Flora and vegetation of the Desktop Study Area were covered by three biological survey reports, which form part of a wider series focusing on the Eastern Goldfields Region (Newbey & Hnatiuk 1985, Milewski & Dell 1992, Keighery *et al.* 1995). However, much of the significant flora and significant vegetation communities were not described or formally categorised by the time these reports were published, hence there is no summary of these within these reports. Given this fact, as well as the large scale of the surveys which covered regions far beyond the Desktop Study Area, the findings are not incorporated as part of the Desktop review.

The Department of Biodiversity Conservation and Attractions (previously known as the Conservation and Land Management (CALM) and the Department of Environment and Conservation (DEC)) commissioned a number of flora and vegetation surveys focusing on the banded ironstone formation (BIF) ranges of the Yilgarn Craton. Studies conducted within the Desktop Study Area are listed in Table 6.

In the Mt Richardson Area, several flora and vegetation surveys have been conducted by Outback Ecology (2005 and 2007), Mattiske Consulting (2008), Western Botanical (2009, 2010a, 2010b, and 2011), and Botanica Consulting (2013). As previously noted, Woodman Environmental have also undertaken flora and vegetation survey of this area in 2012 (Woodman Environmental 2013), which consolidated the findings of a number of the aforementioned previous surveys. A summary of the surveys is given in Table 6.

Macarthur Minerals Limited (MML) initiated multiple flora and vegetation surveys over their Ularring Hematite Project mining tenements, located predominantly south of the Evanston-Menzies Road and partially overlapping with the Study Area's middle section. These surveys have been carried out by several consultants and MML's own team between 2010 and 2012, as detailed in Table 6 (MML 2013).

Multiple surveys conducted by a range of consultants are listed in the public environmental review for the Carina Iron Ore Project (Polaris Metals 2010). These are located within the southern part of the Desktop Study Area, with some of them partially covering the vicinity of the very southern end of the Study Area. Details on their outcomes is provided in Table 6.

Search of the IBSA returned one relevant survey with publicly available data from the Desktop Study Area. In 2017, PGV Environmental conducted flora and vegetation survey of proposed borrow pits sites, partially overlapping with southwestern portion of the Desktop Study Area (PGV 2018).

All surveys undertaken prior to 2016 were conducted in accordance with Guidance Statement 51 (Guidance for the Assessment of Environmental Factors – Terrestrial Flora and Vegetation Surveys for Environmental Impact in Western Australia) (EPA 2004), and with reference to legislation including the *Wildlife Conservation Act 1950* (WC Act). Guidance Statement 51, and the WC Act, are now obsolete and have been superseded by the following:

- *Environmental Factor Guideline for Flora and Vegetation* (EPA 2016a);

- *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b); and
- *Biodiversity Conservation Act 2016* (BC Act) and associated *Biodiversity Conservation Regulations 2018*

Table 6: Summary of Flora and Vegetation Surveys and Desktop Assessments Previously Conducted in the Desktop Study Area

Report Title and Author	Location, Survey Type and Timing	Key Findings
DBCA (CALM/DEC) surveys of BIF ranges of the Yilgarn Craton		
Flora and vegetation of the eastern goldfields ranges, Part 1: Helena and Aurora Range Gibson *et al.* 1997	Approximately 30 km W of Study Area (southern portion) Flora and Vegetation Survey (55 quadrats) Jul & Sep 1995	• Total of 324 taxa recorded • 11 conservation significant taxa: *Acacia adinophylla* (P1), *Acacia cylindrica* (P3), *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Leucopogon spectabilis* (T), *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) 9P3), *Mirbelia ferricola* (P3), *Notisia intonsa* (P3), *Phlegmatospermum eremaeum* (P3), *Stenanthemum newbeyi* (P3), *Tetratheca aphylla* subsp. *aphylla* (T) • 21 introduced taxa • Identified 6 floristic community types
Flora and vegetation of the Eastern Goldfields ranges: Part 5. Hunt Range, Yendilberin and Watt Hills Gibson & Lyons 2001	In vicinity of Study Area (southern end) with partial overlap Flora and Vegetation Survey (53 quadrats) Sep 1995	• Total of 287 taxa recorded • 6 conservation significant taxa: *Austrostipa blackii* (P3), *Elachanthus pusillus* (P2), *Eremophila caerulea* subsp. *merrallii* (P4), *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Lissanthe scabra* (P2) • 15 introduced taxa • Identified 9 floristic community types, comprising *Eucalyptus* shrublands, and *Acacia* and *Allocasuarina* shrublands
Flora and vegetation of the Eastern Goldfields Ranges: Part 6. Mt Manning Range Gibson 2004	Approximately 30 km W of Study Area (southern portion) Flora and Vegetation Survey (54 quadrats) Nov 1995	• Total of 217 taxa recorded • 5 conservation significant taxa: *Calytrix creswellii* (P3), *Eucalyptus formanii* (P4), *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Mirbelia ferricola* (P3) • 4 introduced taxa: **Hypochaeris glabra*, **Pentameris airoides*, **Sonchus oleraceus*, **Vulpia myuros* • Identified 7 floristic community types
Flora and vegetation of banded iron formations of the Yilgarn Craton: Cashmere Downs Range Meissner *et al.* 2009a	Approximately 30 km W of Study Area (northern portion) Flora and Vegetation Survey (51 quadrats) Aug–Sep 2006	• Total of 144 taxa recorded • 2 conservation significant taxa: *Hemigenia exilis* (P4), *Phyllanthus baeckeoides* (P3) • 2 introduced taxa: **Cucumis myriocarpus* subsp. *myriocarpus*, **Pentameris airoides* • Identified 5 floristic community types

Report Title and Author	Location, Survey Type and Timing	Key Findings
Flora and vegetation of banded iron formations of the Yilgarn Craton: Mount Forrest – Mount Richardson Range Meissner *et al.* 2009b	Partial overlap with Study Area (northern end) Flora and Vegetation Survey (51 quadrats) Aug 2006	• Total of 116 taxa recorded • 2 conservation significant taxa: *Aluta teres* (P1), *Beyeria lapidicola* (P1) • One introduced taxon: **Pentameris airoides* • Identified 6 floristic community types
Flora and vegetation of banded iron formations of the Yilgarn Craton: Brooking Hills area Meissner & Owen 2010a	Partial overlap with Study Area (northern portion) Flora and Vegetation Survey (50 quadrats) Aug 2007	• Total of 104 taxa recorded • No conservation significant taxa • One introduced taxon: **Cucumis myriocarpus* subsp. *myriocarpus* • Identified 4 floristic community types
Flora and vegetation of banded iron formations of the Yilgarn Craton: Mt Ida Greenstone Belt and Mt Hope Meissner & Owen 2010b	Approximately 30 km E of Study Area (northern portion) Flora and Vegetation Survey (50 quadrats) Sep 2007	• Total of 87 taxa recorded • No conservation significant taxa • No introduced taxa • Identified 4 floristic community groups
Flora and vegetation of banded iron formations on the Yilgarn Craton: south Illaara Greenstone Belt Meissner & Wright 2010	Approximately 10 km E of Study Area (northern portion) Flora and Vegetation Survey (50 quadrats) Sep 2008	• Total of 145 taxa recorded • 2 conservation significant taxa: *Banksia arborea* (P4), *Ricinocarpos brevis* (T) • No introduced taxa • Identified 4 floristic communities
Flora and vegetation of the banded iron formations of the Yilgarn Craton: the Johnston Range, Menzies Markey & Dillon 2011a	Just outside Desktop Study Area (60 km W of the Study Area) Flora and Vegetation Survey (50 quadrats) Aug 2007	• Large *Rinzia triplex* (P3) population just outside the Desktop Study Area • Other records lie approximately 200 km SE, with the Study Area in between these populations (DBCA 2007–)

Report Title and Author	Location, Survey Type and Timing	Key Findings
Flora and vegetation of the banded iron formations of the Yilgarn Craton: the northern Yerilgee Hills, Menzies Markey & Dillon 2011b	Partial overlap with Study Area (mid- to southern portion) Flora and Vegetation Survey (51 quadrats) Sep 2007	• Total of 183 taxa recorded • 3 conservation significant taxa: *Austrostipa blackii* (P3), *Banksia arborea* (P4), *Grevillea erectiloba* (P4) • 1 introduced taxon: **Pentameris airoides* • Identified 6 floristic communities (mix of shrubland and woodland vegetation)
Flora and vegetation of the greenstone ranges of the Yilgarn Craton: Credo Station Meissner & Coppen 2013	Around eastern boundary of Desktop Study Area Flora and Vegetation Survey (50 quadrats) Aug–Sep 2011	• Vast majority of the survey area located outside the Desktop Study Area • Total of 183 taxa recorded • 3 conservation significant taxa: *Austrostipa blackii* (P3), *Menkea draboides* (P3), *Notisia intonsa* (P3) • *Menkea draboides* (P3) is widespread but poorly collected species, not known from other studies examined during the Desktop Study; population approx. 52 km E of the Study Area
Mt Richardson – Mt Forrest Area Consultant Surveys		
Flora Survey of the Paradise Bore and Cassowary Proposed Drilling Sites Outback Ecology 2005	Partial overlap with Study Area (northern end) - Cassowary Level 1 Flora and Vegetation Survey Jan 2005	• Total of 30 taxa representing 11 families • No conservation significant flora recorded • Vegetation of the Cassowary site is dominated by mixed *Acacia* low woodland over *Eremophila/Baeckea* low scrub
Vegetation and Priority Flora Surveys of the Mindax Limited tenements within the proposed Ida Valley Conservation Park Outback Ecology 2007	Partial overlap with Study Area (northern end) Flora and Vegetation Survey (32 quadrats) Jul 2005 (Vegetation Survey) & Apr 2007 (Priority Flora Survey)	• Total of 118 taxa representing 35 families • 3 conservation significant taxa: *Labichea eremaea* (P3), *Micromyrtus serrulata* (P3) and *Beyeria lapidicola* (P1) • No TECs or PECs recorded • 17 vegetation types identified, being communities of mixed *Eucalyptus* tree mallee, low *Acacia* woodlands, Chenopod shrublands, and stands of *Eucalyptus/Casuarina/Melaleuca* along creeklines
Flora and Vegetation Survey of Mt Richardson Project Mattiske 2008	Partial overlap with Study Area (northern end) Flora and Vegetation Assessment Jun–Jul 2008	• Total of 169 taxa representing 37 families • 2 conservation significant taxa: *Philotheca coateana* (P3), *Phyllanthus baeckeoides* (P3) • No introduced taxa • Total of 20 plant communities mapped within the survey area • No TECs or PECs recorded

Report Title and Author	Location, Survey Type and Timing	Key Findings
Regional Surveys for Significant Flora within Mt Richardson, Mt Alfred and Cabaret Polygons Western Botanical 2009	Partial overlap with Study Area (northern end) Regional Significant Flora Survey Nov–Dec 2008	• Total of 153 taxa recorded • 4 conservation significant taxa: *Beyeria lapidicola* (P1), *Hemigenia exilis* (P4), *Micromyrtus serrulata* (P3), *Phyllanthus baeckeoides* (P3) • One introduced taxon: **Pentameris airoides* • No TECs or PECs recorded
Flora and Vegetation Survey of Proposed RC Drilling Programs at Mt Richardson Western Botanical 2010a	Partial overlap with Study Area (northern end) Level 1 Flora and Vegetation Survey Sep and Nov 2009	• Total of 121 taxa representing 36 families • One conservation significant taxon: *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3) • 2 introduced taxa: **Cleretum papulosum* subsp. *papulosum*, **Pentameris airoides* • Total of 11 vegetation communities recorded, including 10 Mulga woodland/shrubland communities and one *Ptilotus obovatus* shrubland • No TECs or PECs recorded
Flora and Vegetation Survey of a Polygon at Brooking Hills Prospect for Future Drilling Programs Western Botanical 2010b	Overlap with Study Area (northern part of the proposed haul road) Level 1 Flora and Vegetation Survey Aug 2010	• Total of 116 taxa recorded • No conservation significant flora recorded • Conducted a search for putative new taxa belonging to *Olearia stuartii* complex, referred to by Western Botanical as *Olearia* sp. Sherwood Breakaways (A.Taylor LCH 25552) and *Olearia* sp. Yilgarn BIF (G. Cockerton *et. al. s. n.*); taxonomical status of these entities has not yet been resolved, and as such they potentially represent new, conservation significant taxa occurring within the (Desktop) Study Area • 1 introduced taxon: *Salvia verbenacea* • 13 vegetation communities recorded • No TECs or PECs recorded
Flora and Vegetation Survey of the Mt Richardson West Polygon Western Botanical 2011	Partial overlap with Study Area (northern end) Level 1 Flora and Vegetation Survey May & Jun/Jul 2011	• Total of 167 taxa recorded representing 37 families • 3 conservation significant taxa: *Beyeria lapidicola* (P1), *Calytrix creswellii* (P3), *Calytrix verruculosa* (P3), *Phyllanthus baeckeoides* (P3) • 2 introduced taxa: **Mesembryanthemum nodiflorum*, **Tribulus terrestris* • 11 vegetation communities mapped (*Acacia* shrublands, *Casuarina* low woodland)

Report Title and Author	Location, Survey Type and Timing	Key Findings
Level 2 Flora & Vegetation Survey for Mt Forrest Botanica Consulting 2013	Partial overlap with Study Area (northern end) Level 2 Flora and Vegetation Survey May & Sep 2011 (57 quadrats), Sep–Oct 2012 (119 quadrats)	• Total of 262 taxa representing 52 families • 6 conservation significant taxa: *Acacia subrigida* (P2), *Aluta teres* (P1), *Beyeria lapidicola* (P3), *Drosera eremaea* (P1), *Grevillea secunda* (P4), *Labichea eremaea* (P3) • 5 introduced taxa: **Citrullus amarus*, **Cucumis myriocarpus*, **Mesembryanthemum crystallinum*, **Solanum nigrum*, **Sonchus oleraceus* • Total of 176 survey quadrats • Identified 23 vegetation types – communities • No TECs, identified the study area lies within the *Bulga Downs/Perinvale/Walling/vegetation complexes (BIF)*, which is listed as Priority 1 Ecological Community but did not discuss further
Mount Richardson Flora and Vegetation Assessment Woodman Environmental 2013	Partial overlap with Study Area (northern end) Level 2 Flora and Vegetation Survey (177 quadrats) Aug–Sep 2012	• Total of 251 discrete taxa, 2 known hybrids, and 8 putative hybrids, in 45 families • 5 conservation significant taxa: *Beyeria lapidicola* (P1), *Hemigenia exilis* (P4), *Hibiscus krichauffianus* (P3), *Micromyrtus serrulata* (P3), *Phyllanthus baeckeoides* (P3) • 6 introduced taxa: **Citrullus amarus*, **Cucumis myriocarpus* subsp. *myriocarpus*, **Pentameris airoides*, **Portulaca oleracea*, **Sonchus oleraceus*, **Trianthema portulacastrum* • 2 collections of *Acacia* sp. which could not be identified, at least one of them potentially representing new, undescribed taxon - *Acacia* sp. nov and *Acacia* sp. (unidentified) • Identified 13 vegetation types, 9 of which are considered components of PEC
Ularring Hematite Project Consultant Surveys/Reports		
Flora and Fauna Survey for Lake Giles Project of Tenement M30/215 (2006) EcoSafe Environmental Consultants – report summary in MML (2013)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Level 2 Flora and Vegetation Survey (28 quadrats) Spring	• Total of 19 taxa (+9 identified only to family level) • No TEC or PECs identified • No conservation significant taxa • Two vegetation units described – Mulga shrubland and Allocasuarina shrubland
Vegetation Survey and Rare Flora Search of the Clark Hill North Prospect Mining Project (2008) Paul Armstrong & Associates – report summary in MML (2013)	Approx. 3 km W of Study Area (just S of Evanston-Menzies Rd) Level 2 Flora and Vegetation Survey (32 quadrats) Spring	• Total of 95 taxa recorded • One conservation significant taxon: *Grevillea erectiloba* (P4) • 10 communities identified, dominated by Acacia and Eucalypt associations • No TECs, one PEC identified: Lake Giles vegetation complex on BIF • Observed potential similarities to BIF Hills with *Dryandra arborea* PEC

Report Title and Author	Location, Survey Type and Timing	Key Findings
Revised Level 1 Flora and Vegetation Survey: Lake Giles New Exploration Areas (2010) Outback Ecology Services – report summary in MML (2013)	Potential overlap with Study Area (S of Evanston-Menzies Rd) Level 1 Flora and Vegetation Survey Spring/Summer	• Total of 105 taxa recorded • 3 conservation significant taxa: *Banksia arborea* (P4), *Grevillea georgeana* (P3), *Mirbelia ferricola* (P3) • 33 communities described • No TECs, two PECs potentially occurring in the area: Lake Giles vegetation complexes (BIF), BIF Hills with *Dryandra arborea*
Flora and Vegetation Survey; Lake Giles Central (2011) Goldfields Landcare Services – report summary in MML (2013)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Level 1 Flora and Vegetation Survey Summer	• Total of 100 taxa recorded • 3 conservation significant taxa: *Banksia arborea (P4)*, *Grevillea erectiloba* (P4), *Eucalyptus formanii* (P4) • One introduced taxon: **Pentameris airoides* • 5 floristic communities identified, dominated by Acacia and Eucalypt associations • No TECs or PECs confirmed, potential similarities to BIF Hills with *Dryandra arborea* PEC
Flora Assessment of Drill Holes in Banjo/Lost World and Moonshine Deposits; Lake Giles Survey Area (2011) Mattiske – report summary in MML (2013)	Potential overlap with Study Area (S of Evanston-Menzies Rd) Targeted – DRF and Priority Flora Summer	• No TECs recorded, One potential PEC: BIF Hills with *Dryandra arborea* • 4 conservation significant taxa: *Banksia arborea (P4)*, *Grevillea georgeana* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3), *Mirbelia ferricola* (P3).
Level 2 Flora and Vegetation Survey of the Snark Deposit, New Campsite and Explosives Storage Facility; Ularring Hematite Project Area Mattiske (2012a)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Level 2 Survey (64 quadrats) Mar/May/Sep 2011	• Total of 124 taxa representing 28 families • 2 conservation significant taxa: *Banksia arborea* (P4), *Grevillea erectiloba* (P4) • No introduced taxa recorded • No TECs or PECs recorded (unable to confirm the extent of the Lake Giles vegetation complexes (BIF) PEC due to limited information on the characteristics of the PEC)
Level 2 Flora and Vegetation Survey of the Central Deposit and Proposed Haul Road; Ularring Hematite Project Area Mattiske (2012b)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Level 2 Survey (85 quadrats) Mar/May/Sep 2011	• Total of 159 taxa representing 35 families • 5 conservation significant taxa (currently listed as Priority): *Banksia arborea (P4)*, *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3), *Mirbelia ferricola* (P3) • No introduced taxa recorded • No TECs or PECs recorded (unable to confirm the extent of the Lake Giles vegetation complexes (BIF) PEC due to limited information on the characteristics of the PEC)

Report Title and Author	Location, Survey Type and Timing	Key Findings
Level 2 Flora and Vegetation Survey of the Banjo Deposits; Ularring Hematite Project Area Mattiske (2012c)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Level 2 Survey (31 quadrats) Mar/May/Sep 2011	• Total of 89 taxa representing 23 families • 3 conservation significant taxa: *Banksia arborea (P4)*, *Grevillea georgeana* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3) • No introduced taxa recorded • No TECs or PECs recorded (unable to confirm the extent of the Lake Giles vegetation complexes (BIF) PEC due to limited information on the characteristics of the PEC)
Ularring Hematite Project. Targeted Survey of Priority Flora MML - report summary in MML (2013)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Targeted Flora Survey Apr 2012	• Targeted flora survey over MML mining tenements • Gathered information about population sizes of five conservation significant flora taxa: *Banksia arborea* (P4), *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3), *Mirbelia ferricola* (P3)
Site Inspection of New Exploration Areas for Conservation Significant Flora and Previously Unrecorded Species (2012) MML – report summary in MML (2013)	Partial overlap with Study Area (just S of Evanston-Menzies Rd) Targeted Flora Survey Nov 2012	• Targeted flora survey over MML mining tenements • Gathered information about population sizes of five conservation significant flora taxa: *Banksia arborea* (P4), *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3), *Mirbelia ferricola* (P3)
Ularring Hematite Project – Environmental Review Document – Rev6 (2013)	Consolidation of baseline survey reports that overlap or are from near to the Study Area	• Noted that the record of *Drosera eremaea* (P1) (located within the Study Area of this current survey) made by Paul Armstrong & Associates in 2008 was visited by Mattiske; a *Drosera* was collected from this location and identified as *Drosera macrantha*, a taxon that is not significant.
Carina Iron Ore Project Consultant Surveys		
• *Flora and vegetation survey of drill hole sites* (Oct 2007), *proposed access route* (Mar 2008), *and infill drill sites* (Mar 2008) *in exploration tenement E77/1115 Carina Prospect* • *Flora survey of the proposed gravel pit within exploration tenement E77/1115* (Jul 2008) • *Flora and vegetation survey of the Carina exploration lease area* (Sep 2008)	Immediately S and W of Study Area (southern end), potential small overlap Flora and Vegetation Surveys undertaken for the Carina project	• Total of 237 taxa representing 45 families • 4 conservation significant flora taxa: *Acacia crenulata* (P3), *Grevillea georgeana* (P3), other two not listed in the publicly available summary • 2 introduced taxa: *Erodium botrys*, *E. cicutarium* • Twenty-five plant communities were defined and mapped in the exploration tenement. • The vegetation communities can be broadly divided into two major groups: 1) sclerophyllous Eucalypt woodland of *Eucalyptus salmonophloia* and *Eucalyptus salubris*, together with a range of other Eucalypt species, over an understorey composed predominantly of *Acacia*, *Eremophila* and *Atriplex* species; 2) *Acacia* dominated scrub and thicket communities • No TECs or PECs recorded

Report Title and Author	Location, Survey Type and Timing	Key Findings
• *Declared rare and priority flora survey: Carina mine tenement M77/1244A* (Apr 2009) Mattiske Consulting – reports summary in Polaris Metal 2010		
Flora and vegetation survey of the proposed Carina transport route: Darrine siding (Aug 2008) and *Carina mine to Mt Walton road siding* (Oct 2009) Mattiske Consulting – reports summary in Polaris Metal 2010	Southern part of Desktop Study Area, potential small overlap with southern end of Study Area Flora and Vegetation Survey	• 9 conservation significant taxa: *Acacia adinophylla* (P1), *Acacia crenulata* (P3), *Acacia formidabilis* (P3), *Calytrix creswellii* (P3), *Grevillea georgeana* (P3), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3), *Homalocalyx grandiflorus* (P3), *Lepidosperma lyonsii* (P1), *Mirbelia ferricola* (P3), *Stylidium choreanthum* (P3) • Recorded two *Lepidosperma* species not listed on the Western Australian Herbarium database: *Lepidosperma* sp. Aurora Sandplain (R.L. Barrett 2809B) and *Lepidosperma* sp. Mt. Finnerty (S. McNee LCS 9486)
Carina iron ore project: Mt Walton siding vegetation (Feb 2010) Recon Environmental – report summary in Polaris Metal 2010	Approx. 45 km SE of Study Area (southern end) Flora and Vegetation Survey	• 5 conservation significant taxa: *Acacia formidabilis* (P3), *Calytrix creswellii* (P3), *Homalocalyx grandiflorus* (P3), *Lepidosperma lyonsii* (P1), *Mirbelia ferricola* (P3) • Recorded four species not listed on the Western Australian Herbarium database: *Lepidosperma* sp. Aurora Sandplain (R.L. Barrett 2809B), *Lepidosperma* sp. Lake King (RL Barrett 3442), *Lepidosperma* sp. (MWP12) and *Leucopogon* sp. Mt Walton (no coll. No.)
Other Surveys within the Desktop Study Area		
Sandy Ridge Project. IWDF Access Road Borrow Pit Sites Flora and Vegetation Survey PGV Environmental 2018	Partially within SE corner of Desktop Study Area Detailed Flora and Vegetation Survey Nov 2017	• Total of 107 flora taxa representing 25 families • No conservation significant taxa recorded • No introduced taxa recorded • Total of 21 different vegetation types identified in the 14 borrow pit sites • No TECs or PECs

5.1.4 Significant Flora

A list of significant flora taxa known from within the Desktop Study Area is presented in Table 7. This list has been compiled from the results of interrogations of DBCA's TPFL database and WA Herbarium Specimen database (30 km buffer around the Study Area, see section 5.1 for details), DAWE's SPRAT database and *NatureMap* search (approximate boundary of the Desktop Study Area, see Section 5.1.1), and the outcomes of the desktop review of relevant local surveys (Section 5.1.3).

A total of 88 significant taxa are known from within the Desktop Study Area, including 10 Threatened taxa, 76 DBCA-classified Priority flora, and two potentially undescribed taxa. Of these, 14 taxa have been recorded from the Study Area (highlighted in green in Table 7).

Those only returned by the DAWE search, highlighted in blue in Table 7, may not occur within the Desktop Study Area, as the database search results indicates only that the species or habitat may occur (DAWE 2020b); this is discussed further in Section 5.2.6.

Table 7: Significant Flora Taxa Known from Within the Desktop Study Area

Taxon	Status	Source	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)
Acacia adinophylla	P1	DBCA, NM, Other	Sep - Nov	Grows in rocky loam and loamy sand or clay, often over jasperlite, in open *Eucalyptus ebbanoensis* mallee shrubland.
Acacia crenulata	P3	DBCA, NM, Other	Sep - Oct	Clay, sandy clay, yellow sand. Rocky rises, granite outcrops, breakaways.
Acacia cylindrica	P3	DBCA, NM, Other	Aug - Oct	Deep yellow sand or gravelly, well-drained sand, on flat to gently undulating plains or on the sides of low hills, in open shrubland.
Acacia formidabilis	P3	DBCA, NM, Other	Aug - Sep	Grows in sand in tall open shrubland. Yellow or red/brown sand. Undulating plains, hillsides.
Acacia shapelleae	T	DBCA, NM	Aug - Sep	Brown silty sand or clay-loam on the upper slopes and ridges of low hills comprising outcropping BIF.
Acacia sp. nov	-	WEC	-	Low rises and undulating plains with mafic (?basalt) and ironstone stones
Acacia sp. Southern Cross (G. Cockerton *et al.* WB 38518)	P1	DBCA, NM	May	*Eucalyptus salubris* woodland.
Acacia sp. (unidentified)	-	WEC	-	Low rises and undulating plains with mafic (?basalt) and ironstone stones
Acacia subrigida	P2	DBCA, NM	Aug - Oct	Yellow or red sands, plains.
Aluta teres	P1	DBCA, NM, Other	Sep	Red clayey sand over hard pan on broad plain with spinifex, red sandy dunes, mid and lower slopes of ironstone range (slightly rocky) with orange sand soils.

Taxon	Status	Source	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)
Austrostipa blackii	P3	DBCA, NM, Other	Sep - Nov	Red-brown sandy clay loam or orange clay loam. BIF ranges and outcropping or basalt outcrops.
Baeckea sp. Helena and Aurora Range (G.J. Keighery 4424)	P1	DBCA, NM	Dec	Well-drained, deep yellow sand. Moderately exposed flat plains.
Banksia arborea	P4	DBCA, NM, Other	Jan - Dec	Stony loam. Ironstone hills.
Banksia lullfitzii	P3	DBCA, NM	Mar - May	Yellow sand. Sandplains.
Beyeria lapidicola	P1	DBCA, NM, WEC, Other	Jul	Rocky outcrops on banded ironstone ridges, yellow-brown soils.
Beyeria rostellata	P1	DBCA, NM	May, Jul, Sep, Oct	Skeletal red sandy to clay soils over banded ironstone substrates.
Calandrinia kalanniensis	P2	DBCA, NM	Nov - Jan	Shallow brown clay, often gritty, derived from eroded granite. Rock outcrops, herb fields.
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3	DBCA, NM, Other	Fruits in Sep - Oct	Rocky areas, usually banded ironstone or laterised ridges and outcrops, yellow-red-brown soils
Calytrix creswellii	P3	DBCA, NM, Other	Sep-Dec	Yellow sand, sometimes with lateritic gravel. Sandplains.
Calytrix hislopii	P3	DBCA, NM	Aug - Sep	Lateritic ridge, the top of a breakaway on granite.
Calytrix verruculosa	P3	Other	Aug - Oct	Sandy clay
Chamelaucium sp. Koolyanobbing (V. Clarke 644)	P1	DBCA, NM	Feb - Apr	Yellow sandplain.
Cryptandra crispula	P3	DBCA, NM	Jul - Sep	Brown sandy clay, yellow loamy sand, red soil, pebbles. Dune ridges, hills, near salt lakes.
Cyathostemon verrucosus	P3	DBCA, NM	Sep - Dec	Yellow sand plains in shrublands
Dampiera plumosa	P1	DBCA, NM	Oct	Red sandy soils.
Drosera eremaea	P1	DBCA, NM	Jul - Aug	Granite outcrop. Seasonally inundated, brown loam soil. Banded ironstone formation scree. Red orange loamy sand with extensive outcropping. Red sand, quartz grit over white quartz.
Elachanthus pusillus	P2	DBCA, NM, Other	Aug - Oct	Red loam over limestone. Drainage flat. Low plain. Ferrous and some quartz. Dry, brown, red-orange loam-clay.
Eremophila caerulea subsp. *merrallii*	P4	DBCA, NM, Other	Oct - Dec	Sand, clay or loam on undulating plains
Eremophila dendritica	P2	DBCA, NM	Sep	Clay over limestone. Winter wet depression. Orange or brown rocky loam soil.
Eremophila hamulata	P1	DBCA, NM	Aug - Oct	Brown clay loam on the margins of granite rocks. Lower slopes or ranges. On brownish red ironstone soils in creek lines.

Taxon	Status	Source	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)
Eremophila virens	T	DAWE	Aug - Oct	Red/brown sand. Granite hillsides.
Eremophila viscida	T	DAWE	Sep - Nov	Granitic soils, sandy loam. Stony gullies, sandplains.
Eucalyptus educta	P2	DBCA, NM	Mar - Apr	Slopes, declivities and at base of granite rocks but also on stony rises and ironstone low ridges.
Eucalyptus formanii	P4	DBCA, NM, Other	Dec - Apr	Die Hardy Range area. Red sand. Ironstone slopes.
Gastrolobium graniticum	T	DAWE	Aug - Sep	Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.
Goodenia jaurdiensis	P2	DBCA, NM	Sep - Oct	Red clayey loam with laterite or banded ironstone gravel or quartz pebbles. Low-lying plains and lower slopes.
Grevillea erectiloba	P4	DBCA, NM, Other	Sep - Oct	Gravelly loam. Lateritic ridges.
Grevillea georgeana	P3	DBCA, NM, Other	Jul - Oct	Stony loam/clay. Ironstone hilltops & slopes.
Grevillea sp. Yerilgee Hills (T. Laslett TL 025)	P1	DBCA	Sep	Gently inclined flat-topped ridge with fragments of banded ironstone. Very slightly rocky laterised haematite outcrop with shallow to deep red brown sandy clay loam soils.
Hemigenia exilis	P4	DBCA, NM, WEC, Other	April, Sep-Nov	Laterite, ironstone soils. Breakaways, slopes, ridges
Hemigenia tenelliflora	P2	NM	Oct	Light brown/yellow sand.
Hibbertia lepidocalyx subsp. *tuberculata*	P3	DBCA, NM	Jul	Yellow-orange loam, ironstone gravel / banded ironstone ridge.
Hibiscus krichauffianus	P3	DBCA, NM, Other	Mar or Oct	Red sandy soils.
Hibiscus sp. Perrinvale Station (J. Warden & E. Ager WB 10581)	P3	DBCA	Aug	Hilltop of a Banded Ironstone Formation ridge. Easterly aspect. Dark red silty sand.
Homalocalyx grandiflorus	P3	DBCA, NM, Other	Oct - Dec	Yellow sands, sandplains.
Hyalosperma stoveae	P2	DBCA, NM	Aug - Oct	Red brown or yellow brown sandy clay, sandy loam. Plains, flats
Hysterobaeckea ochropetala subsp. *ochropetala*	P1	DBCA, NM	Aug - Nov	Yellow sand or other sandy habitats. Sand over laterite.
Jacksonia lanicarpa	P1	DBCA, NM	Nov	Red sand
Labichea eremaea	P3	DBCA, NM	Aug-Sep	Red, yellow-orange sand. Sandplains
Lepidosperma amantiferrum	P1	NM	Expected to be Autumn. Mature seed recorded in Sep	Yellow sandy loam with banded ironstone gravel and rocks. Gentle lower slopes.
Lepidosperma bungalbin	T	DBCA, NM	Jul	Steep mid-slopes on red loam soils with banded ironstone rocks and gravel.

Taxon	Status	Source	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)
Lepidosperma ferricola	P3	NM	Expected to be Autumn. Mature seed recorded in Sep - Oct	Restricted to BIF. Rocky ledges, scree slopes, crevices and ravines on banded ironstone.
Lepidosperma lyonsii	P4	DBCA, NM, Other	Expected to be Autumn. Mature seed recorded in Sep - Oct	Pale orange skeletal sandy loam with banded ironstone gravel & rock, well-drained shallow stony loamy with quartz. Gentle hill slopes, upper slopes of large hill.
Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094)	P1	DBCA, NM	Unknown	Ridge/slope. Well-drained. Dry brown clay loam over granite. Stony (BIF) brown sandy loam adjacent to BIF ridge.
Lepidosperma sp. Pigeon Rocks (H. Pringle 30237)	P3	DBCA, NM	Sep	Midslope of granite hill. Sandy loam or red sandy clay over granite. Yellow sandy clay.
Leucopogon sp. Yellowdine (M. Hislop & F. Hort MH 3194)	P1	DBCA, NM	Aug	Yellow sand plain.
Leucopogon spectabilis	T	DAWE, NM, Other	Aug - Oct	Shallow red-brown loam, ironstone. In rock crevices on exposed ridges.
Lissanthe scabra	P2	DBCA, NM, Other	Aug	Dry white to orange-brown sand/gravel loams associated with granite breakaways.
Melichrus sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069)	P3	DBCA, NM, Other	Apr - Sep	Yellow sandy loam or white sand or orange sand. Flat. Sandplain.
Melichrus sp. Coolgardie (K.R. Newbey 8698)	P1	NM	Sep - Nov	Low hillside on dry yellow sand.
Micromyrtus serrulata	P3	DBCA, NM, Other	Jun-Nov	Brownish sandy and clayey soils over granite, red sand. Plains, granite outcrops, breakaways.
Mirbelia ferricola	P3	DBCA, NM, Other	Aug - Oct	Banded Ironstone Formation, shallow lateritic soils on lower slopes and crests of BIF massifs and laterised banded ironstone with haematite, as well as on ledges and between rock-cracks on BIF cliffs.
Myriophyllum lapidicola	T	DBCA, DAWE, NM	May, Aug - Oct	Aquatic herb. Sandy clay. Waterholes on granite outcrops.
Myriophyllum petraeum	P4	DBCA, NM	Aug - Dec	Ephemeral rock pools on granite outcrops.

Taxon	Status	Source	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)
Neurachne annularis	P3	DBCA, NM	Sep - Oct	Grows among rocks in shallow red to brown sandy to loamy soils on the tops, sides and bases of banded ironstone ranges and on brown to red or yellowish red loamy soils, often with abundant ironstone gravel or stones which are often banded ironstone fragments, on low rises and outwash plains in the close vicinity or some distance away from banded ironstone ranges.
Notisia intonsa	P3	DBCA, NM, Other	Sep	Brown stony saline loams, brown cracking clay.
Persoonia leucopogon	P1	DBCA, NM	Oct - Dec	Yellow sand or sandy clay.
Phebalium appressum	P1	DBCA, NM	Jul	Yellow sand plain
Phebalium sp. Yerilgee Sandplain (J. Jackson 223)	P2	DBCA	Aug	Orange sandy plains.
Philotheca coateana	P3	DBCA, NM, Other	Aug-Sep	Red sand. Usually sandplains, occasionally breakaways, slopes of hills
Philotheca deserti subsp. *brevifolia*	P3	DBCA, NM	Sep	Red sandy clay.
Phlegmatospermum eremaeum	P3	NM, Other	Jun, Aug - Oct.	Stony loam.
Phyllanthus baeckeoides	P3	DBCA, NM, WEC, Other	Jul-Sep	Red lateritic & sandy clay soils. Ironstone ridges, breakaways, Granite outcrops
Pterostylis virens	P3	DBCA, NM	Sep - Oct	Shallow soils on granite outcrops which dry out completely in summer but are saturated following run off in winter.
Ricinocarpos brevis	T	DBCA, DAWE, NM, Other	Jun, Jul, Nov	Shallow sandy soils on rocky banded ironstone outcrops.
Ricinocarpos digynus	P1	DBCA	Mar	Red sandy loam on sandy/stony plains. Rocky hillslope.
Sowerbaea multicaulis	P4	DBCA, NM	Oct - Jan	Yellow-brown sand.
Stenanthemum newbeyi	P3	NM, Other	Aug - Jan	Clayey sand, clay or loam over laterite or ironstone. Hillslopes.
Styphelia saxicola	P3	DBCA	Jul - Sep	Red brown loamy clay. Granite with occasional quartz. Laterite outcropping or ironstone breakaways.
Stylidium choreanthum	P3	DBCA, NM, Other	Sep - Nov	White/yellow or red sand. Plains.
Tecticornia mellarium	P1	DBCA, NM	Sep - Oct	Well drained red gypseous dunes down to the edge of lake or clay pans.
Tetratheca aphylla subsp. *aphylla*	T	NM, DAWE, Other	Jun, Sep, Oct	Red-brown loam, sandy loam, banded ironstone. Crevices in cliffs and outcrops, slopes, valleys, ridges.

Taxon	Status	Source	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)
Tetratheca paynterae subsp. *paynterae*	T	NM, DAWE	Apr, Jul	Brown clay loam, silty sandy or clayey loam, ironstone, jasperite. Mid-upper slopes, rock crevices, ridges and cliffs.
Thysanotus sp. Ennuin (N. Gibson & M. Lyons 2665)	P1	DBCA	Oct	Mid-slope of low rise, self mulching cracking clay. Flat valley, on red clay soils with laterite gravel.
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3	NM	Aug - Oct	Flat, red sandy loam over ironstone and quartz. Crest, upper slope, ridge of Ironstone.
Verticordia mitodes	P3	DBCA, NM	Oct - Dec	White to grey, yellow and red sand, sometimes over lateritic gravel and loam.
Verticordia stenopetala	P3	DBCA, NM	Oct - Jan	White to grey sand, yellow sand over loam or gravel.
Wurmbea murchisoniana	P4	DBCA, NM	Jul- Sep	Clay, sandy clay, loam. Seasonally inundated clay hollows and rock pools.

Sources:
DAWE – SPRAT database (DAWE 2020b);
DBCA – Threatened and Priority Flora and WA Herbarium database (DBCA 2020b);
NM – *NatureMap* (DBCA 2007–);
Other – studies listed in section 5.1.3
WEC – WEC 2013

650000 700000 750000 800000 850000

6850000 6800000 6750000 6700000 6650000 6600000

Legend

Desktop Study Area

Study Area

Significant Flora

- Aad *Acacia adinophylla* (P1)
- Acre *Acacia crenulata* (P3)
- Acy *Acacia cylindrica* (P3)
- Afor *Acacia formidabilis* (P3)
- Ash *Acacia shapelleae* (T)
- AsSC *Acacia* sp. Southern Cross (G. Cockerton et al. WB 38518) (P1)
- Asub *Acacia subrigida* (P2)
- Ater *Aluta teres* (P1)
- Abl *Austrostipa blackii* (P3)
- BsHA *Baeckea* sp. Helena and Aurora Range (G.J. Keighery 4424) (P1)
- Bar *Banksia arborea* (P4)
- Blu *Banksia lullfitzii* (P3)
- Bla *Beyeria lapidicola* (P1)
- Bro *Beyeria rostellata* (P1)
- Cka *Calandrinia kalanniensis* (P2)
- CspPS *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3)
- Ccr *Calytrix creswellii* (P3)
- Chi *Calytrix hislopii* (P3)
- CspK *Chamelaucium* sp. Koolyanobbing (V. Clarke 644) (P1)
- Ccri *Cryptandra crispula* (P3)
- Cyv *Cyathostemon verrucosus* (P3)
- Dpl *Dampiera plumosa* (P1)
- Der *Drosera eremaea* (P1)
- Elp *Elachanthus pusillus* (P2)
- Ecam *Eremophila caerulea* subsp. *merrallii* (P4)
- Ede *Eremophila dendritica* (P2)
- Eha *Eremophila hamulata* (P1)
- Eed *Eucalyptus educta* (P2)
- Efo *Eucalyptus formanii* (P4)
- Gja *Goodenia jaurdiensis* (P2)
- Gere *Grevillea erectiloba* (P4)
- Gge *Grevillea georgeana* (P3)
- GsYH *Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1)
- Hex *Hemigenia exilis* (P4)
- Hlet *Hibbertia lepidocalyx* subsp. *tuberculata* (P3)
- Hkr *Hibiscus krichauffianus* (P3)
- HsPS *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (P3)
- Hgr *Homalocalyx grandiflorus* (P3)
- Hsto *Hyalosperma stoveae* (P2)
- Hoco *Hysterobaeckea ochropetala* subsp. *ochropetala* (P1)
- Jla *Jacksonia lanicarpa* (P1)
- Ler *Labichea eremaea* (P3)
- Lbu *Lepidosperma bungalbin* (T)
- Lly *Lepidosperma lyonsii* (P1)
- LspPR *Lepidosperma* sp. Parker Range (N. Gibson & M. Lyons 2094) (P1)
- LsPR *Lepidosperma* sp. Pigeon Rocks (H. Pringle 30237) (P3)
- LsYd *Leucopogon* sp. Yellowdine (M. Hislop & F. Hort MH 3194) (P1)
- Lsc *Lissanthe scabra* (P2)
- MsBH *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3)
- Mse *Micromyrtus serrulata* (P3)
- Mfe *Mirbelia ferricola* (P3)
- Mla *Myriophyllum lapidicola* (T)
- Myp *Myriophyllum petraeum* (P4)
- Nan *Neurachne annularis* (P3)
- Nin *Notisia intonsa* (P3)
- Ple *Persoonia leucopogon* (P1)
- Pap *Phebalium appressum* (P1)
- PsYS *Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2)
- Pcoa *Philotheca coateana* (P3)
- Pdeb *Philotheca deserti* subsp. *brevifolia* (P3)
- Pba *Phyllanthus baeckeoides* (P3)
- Ptvi *Pterostylis virens* (P3)
- Rbr *Ricinocarpos brevis* (T)
- Rdi *Ricinocarpos digynus* (P1)
- Smu *Sowerbaea multicaulis* (P4)
- Sch *Stylidium choreanthum* (P3)
- SspB *Styphelia* sp. Bullfinch (M. Hislop 3574) (P3)
- Tmel *Tecticornia mellarium* (P1)
- TspE *Thysanotus* sp. Ennuin (N. Gibson & M. Lyons 2665) (P1)
- Vmi *Verticordia mitodes* (P3)
- Vst *Verticordia stenopetala* (P3)
- Wmu *Wurmbea murchisoniana* (P4)

WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Significant Flora of the Desktop Study Area

Revision: A - 23 July 2021 Scale: 1:800,000 (A3)

Author: David Coultas

WEC Ref: MRL20-38-01

Filename: MRL-20-38-01-f08

Projection: GDA 1994 MGA Zone 50

Figure 8

5.1.5 Introduced Flora

Table 8 presents a list of introduced flora taxa known from the Desktop Study Area, compiled from the *NatureMap* (DBCA 2007–) and DAWE's SPRAT Database (DAWE 2020b) searches (outlined in section 3.1), and the results of local flora and vegetation surveys (section 5.1.3). A total of 53 introduced taxa are known to, or likely to occur (DAWE 2020b, highlighted in yellow in Table 8) in the Desktop Study Area. Of these, three taxa are Declared Pests, highlighted in pink in Table 8, in Western Australia (DPIRD 2020b). None were identified as Weeds of National Significance (DAWE 2020). Thirteen introduced taxa have an invasiveness rating of rapid, of these, four are rated as having a high ecological impact within the DBCA Goldfields Region (DPaW 2014).

Table 8: Introduced Taxa Known from within the Desktop Study Area

Taxon	Common Name	Source*	Ecological Impact	Invasiveness
Aira caryophyllea	Silvery Hairgrass	DBCA, NM other	Unknown	Unknown
Arctotheca calendula	Cape Weed	DBCA, NM other	Low	Slow
Brassica tournefortii	Mediterranean Turnip	DBCA, NM other	Unknown	Rapid
Briza minor	Shivery Grass	DBCA, NM	-	-
Bromus diandrus	Great Brome	DBCA, NM, other	-	-
Bromus rubens	Red Brome	DBCA, NM, other	Unknown	Rapid
Carrichtera annua	Ward's Weed	DAWE, DBCA, NM	High	Rapid
Carthamus lanatus	Saffron Thistle	DBCA, NM	High	Rapid
Cenchrus ciliaris	Buffel Grass	DAWE	High	Rapid
Centaurea melitensis	Maltese Cockspur	DBCA, NM other	High	Rapid
Cerastium glomeratum	Mouse Ear Chickweed	Other	-	-
Citrullus amarus	Pie Melon	Other	Medium	Rapid
Cleretum papulosum subsp. *papulosum*	-	Other	-	-
Cucumis myriocarpus subsp. *myriocarpus*	Prickly Paddy Melon	DBCA, NM, other	Medium	Rapid
Cuscuta planiflora	-	DBCA, NM	Unknown	Rapid
Cyperus hamulosus	-	DBCA, NM	-	-
Echium plantagineum	Paterson's Curse	DBCA, NM, other	Unknown	Unknown
Ehrharta longiflora	Annual Veldt Grass	DBCA, NM	-	-
Eragrostis cilianensis	Stinkgrass	DBCA, NM	-	-
Erodium aureum	-	DBCA, NM	Unknown	Unknown
Erodium botrys	Long Storksbill	Other	Unknown	Unknown
Erodium cicutarium	Common Storksbill	DBCA, NM, other	Unknown	Unknown
Galium aparine	Goosegrass	Other	-	-
Galium murale	Small Goosegrass	DBCA, NM, other	Unknown	Slow
Galium spurium	-	DBCA	Unknown	Unknown
Hordeum glaucum	Northern Barley Grass	DBCA, NM, other	Unknown	Unknown
Hordeum leporinum	Barley Grass	Other	Unknown	Unknown
Hypochaeris glabra	Smooth Catsear	DBCA, NM, other	Unknown	Unknown
Juncus bufonius	Toad Rush	DBCA, NM	Unknown	Unknown
Lysimachia arvensis	Pimpernel	DBCA, NM, other	Unknown	Rapid
Medicago minima	Small Burr Medic	DBCA, NM	Unknown	Unknown
Medicago polymorpha	Burr Medic	DBCA, NM	Unknown	Unknown

Taxon	Common Name	Source*	Ecological Impact	Invasiveness
Medicago truncatula	Barrel Medic	DBCA, NM	Unknown	Unknown
Mesembryanthemum crystallinum	Iceplant	Other	Unknown	Unknown
Mesembryanthemum nodiflorum	Slender Iceplant	DBCA, NM, other	Unknown	Unknown
Monoculus monstrosus	Stinking Roger	DBCA, NM, other	Unknown	Unknown
Orobanche minor	Lesser Broomrape	DBCA, NM, other	Unknown	Unknown
Pentameris airoides	False Hairgrass	DBCA, NM, other	Unknown	Rapid
Portulaca oleracea	Purslane	Other	Unknown	Unknown
Pseudognaphalium luteoalbum	Jersey Cudweed	Other	-	-
Rostraria pumila	-	DBCA, NM, other	Unknown	Unknown
Rumex hypogaeus	Doublegee	DBCA, NM	-	-
Sagina apetala	Annual Pearlwort	DBCA, NM	Low	Moderate
Salvia verbenacea	Wild Sage	Other	Unknown	Unknown
Sisymbrium irio	London Rocket	DBCA, NM, other	Unknown	Unknown
Solanum nigrum	Black Berry Nightshade	other	Medium	Rapid
Sonchus oleraceus	Common Sowthistle	DBCA, NM, other	Unknown	Rapid
Trianthema portulacastrum	Giant Pigweed	Other		
Tribulus terrestris	Caltrop	Other	Low	Moderate
Ursinia anthemoides subsp. *anthemoides*	Ursinia	DBCA, NM	-	-
Vulpia bromoides	Squirrel Tail Fescue	DBCA, NM, other	Unknown	Unknown
Vulpia muralis	-	DBCA, NM, other	Unknown	Unknown
Vulpia myuros	Rat's Tail Fescue	DBCA, NM, other	Unknown	Unknown

Explanatory notes:
DAWE – SPRAT Database (DAWE 2020b);
DBCA – WA Herbarium search via *NatureMap* (DBCA 2007–);
NM – *NatureMap* (DBCA 2007–);
Other – studies listed in section 5.1.3.

5.1.6 Significant Vegetation

A list of significant vegetation with potential to occur in the Desktop Study Area is presented in Table 9. This list has been compiled from the results of searches of DBCA's TEC and PEC Database, DAWE's SPRAT database and *NatureMap* search (approximate boundary of the Desktop Study Area, see Section 5.1.1), and the outcomes of the desktop review of relevant local surveys (Section 5.1.3).. A total of 11 significant vegetation types are known from within or have the potential to occur in the Desktop Study Area. Indicative locations of these TECs/PECs (where available) are presented on Figure 9; these consist of DBCA-applied buffers surrounding known locations (as per the metadata (DBCA 2020a)). Of these, two significant vegetation type buffers intersect the Study Area (highlighted in green in Table 9).

No additional TECs or PECs were identified during the EPBA Act Protected Matters database search (DAWE 2020) or the Desktop review of the local flora and vegetation studies (section 5.1.3).

Table 9: Significant Vegetation Within the Vicinity of the Study Area

Community	Conservation Status (W.A.)	EPBC Act Ranking	Source
Banded Ironstone Hills with *Dryandra arborea*	Priority 1	-	DBCA
Cashmere Downs vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Die Hardy Range/Diemels vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Finnerty Range/Mt Dimer/Yendilberin Hills vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Helena and Aurora Range vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Hunt Range vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Mount Manning Range vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Mount Forrest - Mount Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA
Perrinvale (Pine Well) calcrete groundwater assemblage type on Raeside palaeodrainage on Perrinvale Station	Priority 1	-	DBCA
Perrinvale/Walling vegetation assemblages (banded ironstone formation)	Priority 1	-	DBCA

Explanatory notes:
DBCA – DBCA TEC and PEC Database (2020a)

Figure 9: Significant Vegetation of the Desktop Study Area

5.2 Field Survey

5.2.1 Vascular Flora

A total of 541 discrete vascular flora taxa (including nine introduced taxa), three known hybrids (as per WA Herbarium (1998-)) and four putative hybrids were recorded during the 2020 survey within the Study Area. The taxa and hybrids represent 65 families and 216 genera. Within quadrats established in 2020, the average taxon richness per quadrat was 17.28 (± 5.83), with the greatest number of taxa recorded in a single quadrat being 42 (MRD053 and MRM104) and the lowest being four (MRK063).

An additional 66 taxa and 13 genera were recorded during the 2012 survey by Woodman Environmental (Woodman Environmental 2013). The total number of discrete vascular flora taxa recorded within the Study Area (2020 survey data and 2012 survey data combined) is 607 discrete vascular flora taxa (including 11 introduced taxa), three known hybrids (as per WA Herbarium (1998-)) and 12 putative hybrids. These taxa and hybrids represent 65 families and 229 genera. The most well-represented families were Fabaceae (79 taxa, three known hybrids and six putative hybrids), Myrtaceae (70 taxa), Asteraceae (59 taxa), Poaceae (46 taxa) and Chenopodiaceae (45 taxa and one putative hybrid).

Average taxon richness per quadrat across all quadrats established by Woodman Environmental in the Study Area in 2012 and 2020 was 18.54 (± 6.41), with the greatest number of taxa recorded in a single quadrat being 46, and the lowest number being four.

A full list of taxa recorded within the Study Area is presented in Appendix E, with raw quadrat data and parameters presented in Appendix F.

Several collections could not be identified to species level because of poor material. Some are known to be distinct taxa relative to other taxa recorded by the survey – these are included in the totals presented above, and in Appendix E (e.g. *Templetonia* sp.). Other collections may represent distinct taxa relative to other taxa recorded by the survey; however, it is more likely that they represent taxa already recorded elsewhere, with the quality of the material such that this distinction cannot be made (e.g. *Goodenia* sp., *Tecticornia* sp.). Such collections are not included in the totals above, but are presented in the raw quadrat data in Appendix F.

As noted in Section 4.2, rainfall prior to the field survey was well below average. A large proportion of perennial plants were consequently observed to be sterile (i.e. not in flower or fruit); however, as noted above, most specimens of such taxa were still able to be confidently identified. Ephemeral taxa were patchily distributed, and it is considered possible that some taxa that would be observable in average or better rainfall seasons were not detectable during the survey. Although this current survey and the survey conducted by Woodman Environmental (2013) were both considered to have been undertaken at an appropriate time based on rainfall records and flowering periods of most taxa known to occur in the area, the Study Area is located in a desert environment and rainfall is inherently unreliable in both timing and amount. Ideally, the surveys would have been undertaken following significant rainfall events; however, this was not feasible given the amount of planning required for such surveys. It is worthy of note that the DBCA's banded ironstone survey of Mt Forrest and Mt Richardson was also undertaken at a time (August 2006) when rainfall prior to the survey was

well below average (approximately 9 mm recorded for May to July compared to the long-term average of 74.4 mm (BoM 2021a)).

5.2.2 Significant Flora

Table 10 presents a summary of data relating to significant flora taxa recorded in the Study Area. A total of 37 significant flora taxa have been recorded in the Study Area (Table 10; Figure 10) including 30 Priority taxa, six potentially undescribed taxa, and one taxon that is poorly known and has a restricted range, and as such is considered to be significant. The identifications of three of the 30 Priority flora taxa recorded in the Study Area are tentative at this stage; *Cryptandra* ?*crispula* (P3) lacked reproductive material, which is required to confirm its identification, while two *Lepidosperma* taxa cannot be identified with confidence because of uncertainty surrounding the taxonomy of this genus. The collection of several Priority taxa (*Eremophila perglandulosa* (P1), *Grevillea obliquistigma* subsp. *cullenii* (P3), *Neurachne lanigera* (P1), *Eutaxia rubricarina* (P3) and *Tecticornia entrichoma* (P4)) in the Study Area was not expected based on the results of a desktop review conducted prior to survey; in these instances, the collections of these taxa represent extensions to, or fill large gaps within, their known ranges. No Threatened taxa were recorded in the Study Area. Locations of significant flora taxa recorded in the Study Area are presented in table form in Appendix G, and visually in Appendix H.

Of the 37 significant taxa recorded within the Study Area, ten taxa have been recorded within the Mt Richardson Area by this survey and previous surveys, including *Beyeria lapidicola* (P1), *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), *Hibiscus krichauffianus* (P3), *Jacksonia lanicarpa* (P1), *Micromyrtus serrulata* (P3), *Philotheca coateana* (P3), *Phyllanthus baeckeoides* (P3), *Hemigenia exilis* (P4), *Acacia* sp. nov and *Acacia* sp. (unidentified). The targeted searching within the Targeted Survey Area at Mt Richardson, during which all species listed above were identifiable (except potentially *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3) – see below) and were searched for, only recorded *Micromyrtus serrulata* (P3). The historical records of three other significant flora taxa (*Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), *Philotheca coateana* (P3) and *Phyllanthus baeckeoides* (P3)) that occur within the potential future development areas assessed by this current survey were investigated; none of these taxa were observed at these locations. The records of *Philotheca coateana* (P3) in this area are considered to be erroneous and are not presented in Table 10 or Figure 10; the record of *Phyllanthus baeckeoides* (P3) is likely to have been correct, however, it is apparent that the single plant recorded previously has now senesced. *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3) is an ephemeral taxon, and was likely not detectable during this current survey because of climatic conditions. These records are discussed further in Section 5.2.3).

As outlined in Section 3.4.4, populations of previously recorded significant flora taxa in the Mt Richardson area were revisited during the current survey for verification of previously recorded data in a population distribution and abundance context. This was undertaken during the pre-survey familiarisation process, and only locations of those taxa considered most likely to occur within the areas of proposed future development were visited. Previously censused populations of *Beyeria lapidicola* (P1), *Phyllanthus baeckeoides* (P3) and *Hemigenia exilis* (P4) were visited and observed to be similar to previously recorded data; it is therefore

expected that the distribution and abundance of these species at all previously recorded populations is still similar to previously recorded data. In contrast, it was apparent from observations during this current survey that distribution and abundance data for previously censused populations of *Micromyrtus serrulata* (P3) did not reflect previously recorded data; such populations were therefore re-censused during this current survey. This is discussed further in Section 5.2.3.

The remaining 27 significant taxa listed in Table 10 were recorded within the NYHR area only; *Jacksonia lanicarpa* (P1) and *Philotheca coateana* (P3) have been recorded in both the Mt Richardson and NYHR areas, bringing the total number of significant flora taxa recorded in the NYHR to 29. In addition, one location of *Micromyrtus serrulata* (P3) located just outside the Study Area is included in Table 10; this is discussed further in Section 5.2.3.

All significant taxa previously recorded within the Study Area were recorded by this current survey except *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3). As outlined above, searching was undertaken for *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), including at a historical record location, but it was not located (this taxon is discussed further in Section 5.2.3). Several other taxa recorded by this current survey have also been recorded previously in the Study Area at further locations (Table 10).

Six taxa are considered significant as they may represent undescribed taxa; all such taxa except *Acacia* sp. (unidentified), which requires better material to be collected, have been identified in consultation with the WA Herbarium. As all of these taxa except *Olearia* aff. *pimeleoides* were sterile at the time of survey, collection of reproductive material will be required to resolve their taxonomy, and consequently their potential significance, with certainty. *Olearia* aff. *pimeleoides* is relatively easily distinguished from typical *O. pimeleoides* (which was recorded at numerous locations in the Study Area) within the Study Area itself, and it appears likely that it will prove to be distinct from typical *O. pimeleoides* as circumscribed across its entire range; however, because of the trans-continental distribution of *O. pimeleoides*, further work is required to substantiate this. One further taxon, *Eremophila glabra* subsp. Diemals (R. Davis 11349), is not currently formally listed as significant; however, as it is only known from two locations based on collections held at the WA Herbarium, it is likely that it will be listed in the near future. In the context of this current study, it is considered to be significant in line with the EPA's technical guidance for flora and vegetation surveys.

Drosera eremaea (P1) is known to occur in the Study Area, with a single WA Herbarium record from the Yerilgee Hills area in the southern half of the NYHR area. This record was made during a survey for MML in 2009 (MML 2013). However, MML (2013) notes that the location of this record was visited subsequently, with a *Drosera* species collected and subsequently identified as *Drosera macrantha* (note that in this context *Drosera macrantha* includes the recently erected phrase named taxon *Drosera* sp. Branched styles (S.C. Coffey 193)), a species not of significance that is superficially similar to *Drosera eremaea* (P1). The record location was also visited by this current survey, with no *Drosera* individuals found; this is likely because of seasonal conditions. However, collections of *Drosera macrantha* were made by this current survey in areas north and south of the aforementioned *Drosera eremaea* (P1) location. The nearest record of *Drosera eremaea* to the Study Area that has been verified by an expert in

the genus is approximately 36 km east of the Study Area (DBCA 2007-). It is therefore considered likely that *Drosera eremaea* (P1) has been erroneously identified as occurring in the Study Area at the aforementioned location, and therefore is not currently known to occur in the Study Area. It is planned that the collection from the Study Area lodged at the WA Herbarium as *Drosera eremaea* (P1) will be re-examined to confirm this in the near future, with the aim of re-determining the collection as *Drosera macrantha*. However, as noted in Section 5.2.6, it is possible that *Drosera eremaea* (P1) may occur elsewhere in the Study Area.

In addition, *Calytrix verruculosa* (P3) was previously recorded within the Study Area (within the Mt Richardson Area), with one point location (consisting of a single individual) recorded by Western Botanical (2011); however, no material was ever vouchered at the WA Herbarium. This location was unable to be confirmed by Woodman Environmental (2013). It is possible that this taxon no longer occurs at the location, or that the record was a misidentification of another *Calytrix* taxon as *Calytrix amethystina* and *Calytrix uncinata* (P3) occur in the immediate vicinity of the location. The closest known record of *Calytrix verruculosa* (P3) is over 240 km from the Study Area (DBCA 2007-). No new locations of *Calytrix verruculosa* (P3) were identified within the Study Area by Woodman Environmental (2013) or during the current survey and it is considered unlikely that this taxon occurs within the Study Area. This taxon is not discussed further in this report.

It is considered likely that the taxon recorded in the Mt Richardson area of the Study Area and referred to as *Hibiscus krichauffianus* (P3) is conspecific with *Hibiscus* sp. Perrinvale Station (J. Warden and E. Ager WB10581) (P3). This is based on gross morphology, as well as habitat preference; however, further investigation is required to conclusively confirm this, as it is not currently clear as to what characters have been used to distinguish *Hibiscus* sp. Perrinvale Station (J. Warden and E. Ager WB10581) (P3) from other taxa. The identification of this taxon may have implications in a future impact assessment context – although both *Hibiscus krichauffianus* and *Hibiscus* sp. Perrinvale Station (J. Warden and E. Ager WB10581) are both currently listed as P3, the latter is known from a single location, and therefore this rating may not be appropriate. The former is known from a wide area in W.A., although from relatively few records (WA Herbarium 1998-). The taxonomy of *Hibiscus* in Australia is currently under revision; until such time as the taxonomy of *Hibiscus* is resolved, it is considered appropriate to refer to the taxon at Mt Richardson as *Hibiscus krichauffianus* (P3).

As mentioned in Section 5.2.1, several collections could not be identified to species level because of poor material; however, no such collections are considered likely to represent significant flora taxa.

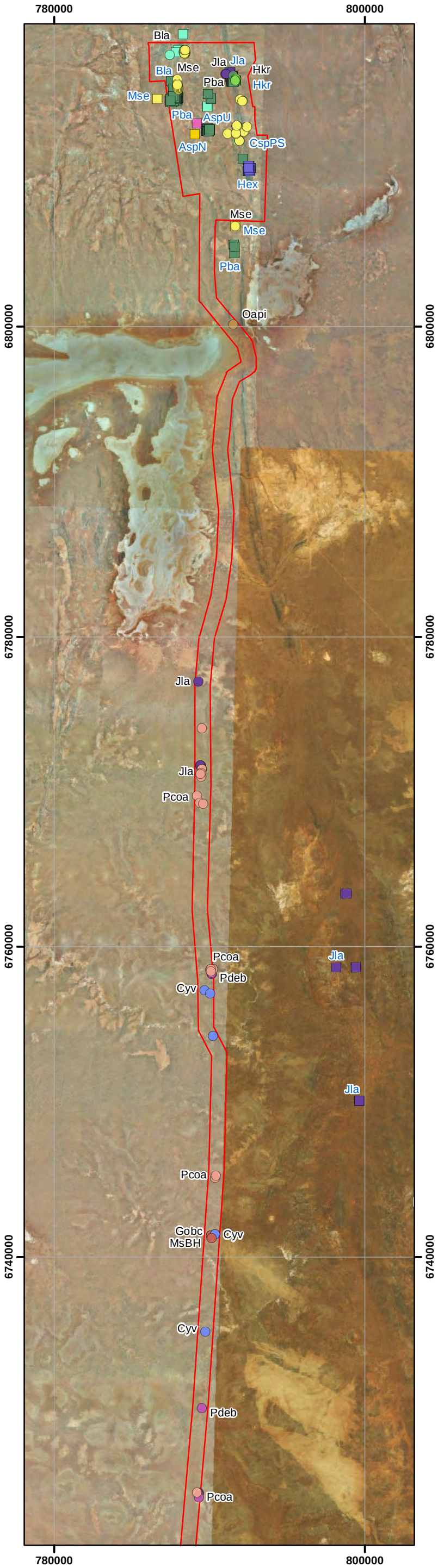
Table 10: Summary of Significant Flora Taxa Recorded within the Study Area

Taxon	Status	No. of Locations Recorded			No. of Individuals Recorded			Vegetation Types
		Study Area		Total	Study Area		Total	
		2020*	Previous Surveys**		2020*	Previous Surveys**		
Acacia crenulata	P3	5	0	5	21[#]	0	21	ElWS, EWASG
Acacia subrigida	P2	1	0	1	Not recorded	0	-	MEASSS
Acacia sp. nov	Potentially undescribed	0	1	1	0	Not recorded	Not recorded	MAcPS
Acacia sp. (unidentified)	Potentially undescribed	0	1	1	0	Not recorded	Not recorded	MEfSN
Banksia arborea	P4	1	1	2	10	Not recorded	10	ABeSG
Beyeria lapidicola	P1	1	6	7	6	36	42	AEgSB, AMESSS, CATSB, MAqSSF
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3	0	1	1	0	3	3	AEgSB
Calytrix creswellii	P3	4	0	4	Not recorded	0	-	MEASSS, MESGROS
Cryptandra ?crispula	P3	1	0	1	Not recorded	0	-	MESGROS
Cyathostemon verrucosus	P3	6	0	6	Not recorded	0	-	AeEfS, MEASNS
Eremophila caerulea subsp. *merrallii*	P4	4	0	4	Not recorded	0	-	AASYH, EsWS; but likely also EWEsS
Eremophila glabra subsp. Diemals (R. Davis 11349)	Few locations known	2	0	2	Not recorded	0	-	AMSBG, MEASSS
Eremophila perglandulosa	P1	1	0	1	Not recorded	0	-	MESGROS
Eutaxia rubricarina	P3	1	0	1	Not recorded	0	-	AASYH; but likely also EWEsS
Grevillea erectiloba	P4	14	5	19	90	18	108	AASGP, AASYH, ABeSG, MEASSS
Grevillea georgeana	P3	1	0	1	10	0	10	AASYH
Grevillea obliquistigma subsp. *cullenii*	P3	1	0	1	Not recorded	0	-	MEASNS
Grevillea sp. Yerilgee Hills (T. Laslett TL 025)	P1	2	0	2	Not recorded	0	-	AASYH, ABeSG
Hemigenia exilis	P4	1[##]	8	8	Not recorded[##]	38	38	AEpS, MAqSSF

Taxon	Status	No. of Locations Recorded			No. of Individuals Recorded			Vegetation Types
		Study Area		Total	Study Area		Total	
		2020*	Previous Surveys**		2020*	Previous Surveys**		
Hibbertia lepidocalyx subsp. *tuberculata*	P3	2	0	2	20[#]	0	20	AASGP, AASYH
Hibiscus krichauffianus	P3	7	1[##]	7	23	10[##]	23	AEpS, MAqSSF
Jacksonia lanicarpa	P1	8	1[##]	8	57	Not recorded	57	AeEfS, AEgSB, MEfSC, MEfSN
?Lamiaceae sp.	Potentially undescribed	1	0	1	Not recorded	0	-	MESGROS
Lepidosperma cf. *lyonsii*	P1	4	0	4	5[#]	0	5	AASGP, AMSBG, MEASSS
Lepidosperma cf. sp. Parker Range (N. Gibson & M. Lyons 2094)	P1	1	0	1	Not recorded	0	-	MESGROS
Melichrus sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069)	P3	13	0	13	173[#]	0	173	MEASNS, MEASSS, MESGROS
Micromyrtus serrulata	P3	79	18[##]	79	1,415	168[##]	1,415	AEgSB, AMESSS, CATSB, MAqSSF, MEfSN
Microcorys sp.	Potentially undescribed	2	0	2	Not recorded	0	-	MESGROS
Neurachne lanigera	P1	1	0	1	15	0	15	AMSBG, extending into EIWS
Olearia aff. *pimeleoides*	Potentially undescribed	1	0	1	Not recorded	0	-	AbCSSL
Persoonia leucopogon	P1	2	0	2	5	0	5	MESGROS
Phebalium sp. Yerilgee Sandplain (J. Jackson 223)	P2	5	0	5	4[#]	0	4	CWEcRS, MESGROS
Philotheca coateana	P3	19	0	19	240[#]	0	240	ABeSG, AeEfS, MEASNS, MEfSC
Philotheca deserti subsp. *brevifolia*	P3	7	0	7	30[#]	0	30	AeEfS, MEASNS
Phyllanthus baeckeoides	P3	1[#]	299	300	1[#]	8,159	8,160	AEgSB, AEpS, CATSB, MAqSSF, MEfSN
Tecticornia entrichoma	P4	1	0	1	Not recorded	0	-	TeL

Taxon	Status	No. of Locations Recorded			No. of Individuals Recorded			Vegetation Types
		Study Area		Total	Study Area		Total	
		2020*	Previous Surveys**		2020*	Previous Surveys**		
Templetonia sp.	Potentially undescribed	1	0	1	Not recorded	0	-	MESGROS

*Includes significant flora data from the Woodman Environmental 2020 survey with some locations collected directly outside the Study Area during current surveys.
**Includes significant flora data with locations in the Study Area from surveys: Woodman Environmental (2013); Western Botanical (2009, 2010a, 2011), Mattiske (2008), DBCA (DBCA 2020b).
#Number of individuals not recorded at all locations as verification of population distribution and abundance only was assessed in 2020, not a full census of population.
##Population recorded/verified in 2020 during current surveys but location/individual numbers are already included in 2020 data and are not included in totals



Legend

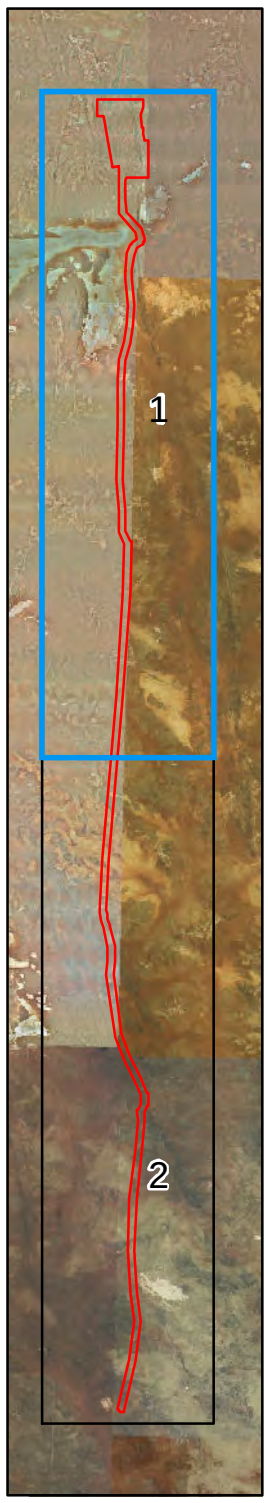
Study Area

Significant Flora (2020 Survey)

- Bla *Beyeria lapidicola* (P1)
- Cyv *Cyathostemon verrucosus* (P3)
- Gobc *Grevillea obliquistigma* subsp. *cullenii* (P3)
- Hkr *Hibiscus krichauffianus* (P3)
- Jla *Jacksonia lanicarpa* (P1)
- MsBH *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3)
- Mse *Micromyrtus serrulata* (P3)
- Oapi *Olearia* aff.*pimeleoides* (potentially undescribed)
- Pcoa *Philotheca coateana* (P3)
- Pdeb *Philotheca deserti* subsp. *brevifolia* (P3)
- Pba *Phyllanthus baeckeoides* (P3)

Significant Flora (Previous Surveys and DBCA Data)

- AspN *Acacia* sp. nov (potentially undescribed)
- AspU *Acacia* sp. (unidentified)
- Bla *Beyeria lapidicola* (P1)
- CspPS *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3)
- Hex *Hemigenia exilis* (P4)
- Hkr *Hibiscus krichauffianus* (P3)
- Jla *Jacksonia lanicarpa* (P1)
- Mse *Micromyrtus serrulata* (P3)
- Pba *Phyllanthus baeckeoides* (P3)



WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Significant Flora Locations in the Study Area

Revision: A - 29 July 2021 Scale: 1:265,000

Author: Alison Saligari

WEC Ref: MRL20-38

Filename: MRL-20-38-01-f10

Projection: GDA 1994 MGA Zone 50

Figure

10.1

780000 800000

6720000 6700000 6680000 6660000 6640000

MsBH Msp MsBH Oapi Gere Pcoa Bar Bar Gere GsYH Gere Bar Gere Bar GsYH Gge Gere GsYH Hlet Bar Gge Gge Hlet Gere MsBH Lly PsYS Egsd PsYS GsYH Ccr Eru Ecam GsYH Lly Hlet PsYS Asub Ccr PsYS Lly Tsp ?Lsp Eper Ple Ccri LspPR Ten Nla Lly Acre Ccr Gge MsBH MsBH MsBH Acre Gge Ccr

780000 800000

Legend

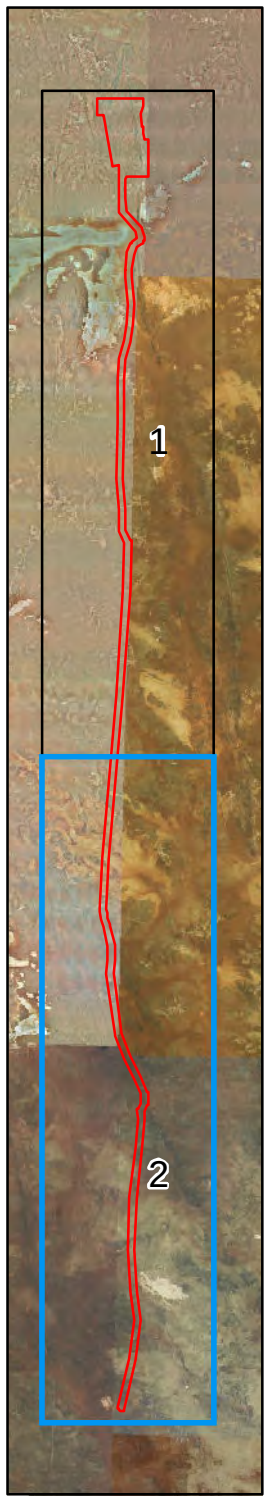
Study Area

Significant Flora (2020 Survey)

- Acre *Acacia crenulata* (P3)
- Asub *Acacia subrigida* (P2)
- Bar *Banksia arborea* (P4)
- Ccr *Calytrix creswellii* (P3)
- Ccri *Cryptandra ?crispula* (P3)
- Ecam *Eremophila caerulea* subsp. *merrallii* (P4)
- Egsd *Eremophila glabra* subsp. Diemals (R. Davis 11349) (few locations known)
- Eper *Eremophila perglandulosa* (P1)
- Eru *Eutaxia rubricarina* (P3)
- Gere *Grevillea erectiloba* (P4)
- Gge *Grevillea georgeana* (P3)
- GsYH *Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1)
- Hlet *Hibbertia lepidocalyx* subsp. *tuberculata* (P3)
- ?Lsp *?Lamiaceae* sp. (potentially undescribed)
- Lly *Lepidosperma* cf.*lyonsii* (P1)
- LspPR *Lepidosperma* cf. sp. Parker Range (N. Gibson & M. Lyons 2094) (P1)
- MsBH *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3)
- Msp *Microcorys* sp. (potentially undescribed)
- Nla *Neurachne lanigera* (P1)
- Pcoa *Philotheca coateana* (P3)
- Ple *Persoonia leucopogon* (P1)
- PsYS *Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2)
- Ten *Tecticornia entrichoma* (P4)
- Tsp *Templetonia* sp. (potentially undescribed)

Significant Flora (Previous Surveys and DBCA Data)

- Bar *Banksia arborea* (P4)
- Ccr *Calytrix creswellii* (P3)
- Gere *Grevillea erectiloba* (P4)
- Gge *Grevillea georgeana* (P3)
- GsYH *Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1)
- Hlet *Hibbertia lepidocalyx* subsp. *tuberculata* (P3)
- Lly *Lepidosperma* cf.*lyonsii* (P1)
- MsBH *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3)
- PsYS *Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2)



WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Significant Flora Locations in the Study Area

Revision: A - 29 July 2021 Scale: 1:265,000

Author: Alison Saligari

WEC Ref: MRL20-38

Filename: MRL-20-38-01-f10

Projection: GDA 1994 MGA Zone 50

Figure 10.2

5.2.3 Listed Significant Flora

***Acacia crenulata* (P3)**

Acacia crenulata (P3) is a bushy shrub or tree growing to 3 m high, and generally occurs on clay, sandy clay or yellow sand on rocky rises, granite outcrops or breakaways (WA Herbarium 1998-) (Plate 1). This taxon is endemic to Western Australia (Atlas of Living Australia (ALA) 2021), occurring over a range of approximately 250 km from near Mukinbudin in the west to Coolgardie in the east (DBCA 2007-).

There are 35 records of this taxon in DBCA's databases representing approximately 26 populations (not including the populations in the Study Area), 13 of which occur in DBCA-managed tenure; Chiddarcooping Nature Reserve, Sandford Rocks Nature Reserve, Walyahmoning Nature Reserve, Unnamed Nature Reserve (R18583) and ex-Jaurdi (former pastoral lease proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at five point locations in the Study Area during the current survey, with a total of 21 individuals recorded (individuals were not counted at all locations); all were within the southern portion of the NYHR area (south of the Yerilgee Hills). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 2 populations. The locations of this taxon occur on undulating plains and flats influenced by granite (in the form of outcropping and/or stones), within VTs ElWS and EWASG (Table 10; Figure 10).

Plate 1: Specimen of *Acacia crenulata* (P3) (collected by Woodman Environmental)

***Acacia subrigida* (P2)**

Acacia subrigida (P2) is an erect shrub growing to 3 m high, and generally occurs on yellow or red sandplains (WA Herbarium 1998-) (Plate 2). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 650 km from near Denham in the north-west to near Mukinbudin in the south (DBCA 2007-).

There are 24 records of this taxon in DBCA's databases representing approximately 14 populations (not including the population in the Study Area), 14 of which occur in DBCA-managed tenure; Wandana Nature Reserve, Walyahmoning Nature Reserve and ex-Nanga (former pastoral lease proposed for conservation) (DBCA 2007-). The location of this taxon in the Study Area is located on the very eastern edge of the known range of this taxon, and fills a large gap in its known distribution.

This taxon was recorded at one point location in the Study Area during the current survey, within the southern portion of the NYHR area (south of the Yerilgee Hills). The location in the Study Area presumably represents a new population in the context of existing data, although further survey would be required to confirm this. The total number of individuals was not recorded. The location of this taxon occurs on a gently undulating sandplain, within VT MEASSS (Table 10; Figure 10).

Plate 2: *Acacia subrigida* (P2) (Photo: Western Australian Herbarium 1998–)

***Banksia arborea* (P4)**

Banksia arborea (P4) is a tree or large shrub growing to 8 m high, and generally occurs on stony loam on ironstone hills (WA Herbarium 1998-) (Plate 3). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 175 km from near Koolyanobbing in the south to near Walling Rock pastoral lease in the north (DBCA 2007-).

There are 123 records of this taxon in DBCA's databases representing approximately 81 populations (this includes the population in the Study Area), 47 of which occur in DBCA-managed tenure; Mount Manning Range Nature Reserve, Mount Manning-Helena and Aurora Ranges Conservation Park, ex-Jaurdi, ex-Mt Jackson Station and ex-Elvire (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at one point location in the Study Area during the current survey in the Yerilgee Hills within the NYHR area, with a total of 10 individuals recorded. This location is part of the same population represented by the single previously recorded location of this taxon within the Study Area (WA Herbarium record – DBCA (2020b)). The location of this taxon occurs on the crest of a low banded ironstone hill, within VT ABeSG (Table 10; Figure 10).

Plate 3: ***Banksia arborea*** **(P4) (Photo: Woodman Environmental)**

Beyeria lapidicola **(P1)**

Beyeria lapidicola (P1) is a shrub to 2 m high (Plate 4) which generally occurs on rocky outcrops on banded ironstone ridges on yellow-brown soils WA Herbarium 1998-). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 225 km north to south and 250 km east to west, from south-west of Wiluna in the north to near Cashmere Downs in the south, and near Cue in the west (DBCA 2007-).

There are 26 records of this taxon in DBCA's databases representing approximately 10 populations (this includes the populations within the Study Area). These are distributed at three broad localities across this range; the southern-most locality corresponds to the location of the Study Area. The majority of these records occur on pastoral leases. However,

there are some records in the proposed Ida Valley conservation park (ex-Bulga Downs station) which is now DBCA-managed (DBCA 2007-).

Beyeria lapidicola (P1) has only been recorded in the Mt Richardson area in the Study Area; there are currently 3 populations known, consisting of 9 point locations and 42 individuals, although only 2 of these have been fully censused. One point location was recorded in the northern-most population during the current survey, with six individuals recorded; this location corresponds to a historical WA Herbarium record that had vague abundance data. This population has not been fully censused. The remaining two populations were censused during previous surveys; one of these was revisited in 2020 and plant numbers and distribution appeared similar to previous survey data; no new censusing of these populations was therefore undertaken in 2020. Six point locations and 36 individuals have been recorded at these populations. The locations of this taxon occur on crests, slopes, ridges and low rises with ironstone or BIF outcropping, within VTs AEgSB, AMESSS, CATSB and MAqSSF, although in all these VTs it occupied a very specific niche on large, shaded banded ironstone outcrops (Table 10; Figure 10). This species was not located in the Targeted Survey Area at Mt Richardson.

Plate 4: *Beyeria lapidicola* (P1) (Photos: Woodman Environmental)

***Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3)**

Calotis sp. Perrinvale Station (R.J. Cranfield 7096) (P3) is an annual herb to 0.1 m high occurring on rocky areas, usually on banded ironstone or laterised ridges and outcrops on yellow-red-brown soils (DBCA 2007-). This taxon has a range of approximately 530 km, from Mt Narryer Pastoral lease in the north-west to east of Lake Barlee in the south-east.

There are 24 records of this taxon in DBCA's databases representing approximately 20 populations (this includes the location within the Study Area), with approximately nine of

these locations occurring on ex Karara and ex Warriedar stations, which are now DBCA managed land. The majority of the remaining populations occur on pastoral leases (DBCA 2007-).

This species has previously been recorded in the Mt Richardson Area in the Study Area. Searching was undertaken for *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) within the Study Area by Woodman Environmental (2013) and in 2020, including revisiting the existing known location. However, this taxon could not be located, likely because it is an ephemeral taxon and was not detectable at the time of the field surveys because of climatic conditions (see Section 2.1). No new locations were identified within the Study Area in 2013 or 2020. Within the Study Area this taxon is known from the single historical record of three individuals on the Mount Richardson Range (located within the Mt Richardson Area) (Western Botanical 2010; DBCA 2020b). The location of this taxon occurs on a banded ironstone outcrop on the upper slopes of Mt Richardson, within VT AEgSB (Table 10; Figure 10). This location is within the Targeted Survey Area at Mt Richardson that was the subject of targeted searching during this current survey.

***Calytrix creswellii* (P3)**

Calytrix creswellii (P3) is a spreading shrub growing to 1 m high, and generally occurs on yellow sand, sometimes with lateritic gravel (WA Herbarium 1998-) (Plate 5). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 335 km from south of Mount Magnet in the north to north-west of Coolgardie in the south (west of Port Hedland) in the west (DBCA 2007-).

There are 36 records of this taxon in DBCA's databases representing approximately 24 populations (not including the populations in the Study Area), 14 of which occur in DBCA-managed tenure; Mount Manning Range Nature Reserve, Mount Manning-Helena and Aurora Ranges Conservation Park and Wallaroo Rock Conservation Park (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at four point locations in the Study Area during the current survey, all within the southern portion of the NYHR area (south of the Yerilgee Hills). The total number of individuals was not recorded. The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 2 populations. The locations of this taxon recorded in 2020 occur on gently undulating sandplains, within VTs MEASSS and MESGROS (Table 10; Figure 10). This taxon was previously recorded within the Mt Ricardson Area by Western Botanical (2011). However, it was confirmed by Woodman Environmental (2013) to have been erroneously identified; this taxon is therefore not considered to occur within the Mt Ricardson Area.

Plate 5: ***Calytrix creswellii*** **(P3) (Photo: Western Australian Herbarium 1998–)**

Cryptandra ?crispula **(P3)**

Cryptandra crispula (P3) is a shrub growing to 0.9 m high, and generally occurs on brown sandy clay or yellow loamy sand or red soil with pebbles on dune ridges, hills or near salt lakes (WA Herbarium 1998-) (Plate 6). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 320 km from near Koolyanobbing in the north-west to east of Norseman in the south (DBCA 2007-).

There are 11 records of this taxon in DBCA's databases representing approximately 11 populations (not including the population in the Study Area), one of which occurs in DBCA-managed tenure; ex-Jaurdi (former pastoral lease proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

A sterile collection from the Study Area has tentatively been identified as this taxon. This taxon belongs to a small group of closely related taxa known as the *Cryptandra minutifolia* complex (Rye 2007); this group is yet to be fully resolved, and floral material is required to place material within species in this complex with certainty (Rye 2007). Based on known distributions, the collection from the Study Area most likely represents *Cryptandra crispula* (P3), but it is not far removed from the ranges of *Cryptrandra aridicola* and *Cryptandra minutifolia*, both members of the same complex. In the Study Area, a single point location of the entity likely to represent *Cryptandra crispula* (P3) was recorded during the current survey in the southern portion of the NYHR area (south of the Yerilgee Hills). The total number of individuals was not recorded. The location of this taxon occurs on a gently undulating plain, within VT MESGROS (Table 10; Figure 10).

Plate 6: Specimen of *Cryptandra ?crispula* (P3) (collected by Woodman Environmental)

***Cyathostemon verrucosus* (P3)**

Cyathostemon verrucosus (P3) is a low spreading shrub growing to 0.4 m high, and generally occurs on yellow sand plains (Trudgen and Rye 2014) (Plate 7). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 210 km from near Kalgoorlie in the east to north of Koolyanobbing in the west (DBCA 2007-).

There are 27 records of this taxon in DBCA's databases representing approximately 20 populations (not including the populations in the Study Area), 13 of which occur in DBCA-managed tenure; Mount Manning-Helena and Aurora Ranges Conservation Park, Boorabbin National Park, Goldfields Woodlands Management Area and ex-Mt Jackson Station (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at six point locations in the Study Area during the survey, all within the central portion of the NYHR area (between Lake Barlee and the Yerilgee Hills). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 3 populations. The total number of individuals was not recorded.

The locations of this taxon occur on gently undulating sandplains, within VTs AeEfS and MEASNS (Table 10; Figure 10).

Plate 7: Specimen of *Cyathostemon verrucosus* (P3) (collected by Woodman Environmental)

***Eremophila caerulea* subsp. *merrallii* (P4)**

Eremophila caerulea subsp. *merrallii* (P4) is a spreading shrub growing to 0.35 m high, and generally occurs on sand, clay or loam on undulating plains (WA Herbarium 1998-) (Plate 8). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 350 km from near Kulin in the south-west to Coolgardie in the north-east (DBCA 2007-).

There are 33 records of this taxon in DBCA's databases representing approximately 20 populations (not including the populations in the Study Area), nine of which occur in DBCA-managed tenure; Mount Manning-Helena and Aurora Ranges Conservation Park, Mount Manning Nature Reserve and Jilbadji Nature Reserve (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at four point locations in the Study Area during the survey, all within the southern portion of the NYHR area (south of the Yerilgee Hills). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 2 populations. The total number of individuals was not recorded. The locations of this taxon occurred on plains in Gimlet (*Eucalyptus salubris*) or Salmon Gum (*Eucalyptus*

salmonophloia) in VT EsWS, with one location at the interface of such habitat and also VT EWEsS (Gimlet woodland) within VT AASYH; field observations indicate that it prefers Gimlet or Salmon Gum woodland as opposed to the shrubland of VT AASYH (Table 10; Figure 10).

Plate 8: *Eremophila caerulea* subsp. *merrallii* (P4) (Photo: Western Australian Herbarium 1998–)

***Eremophila perglandulosa* (P1)**

Eremophila perglandulosa (P1) is a low spreading, viscid shrub growing to 0.25 m high, and generally occurs on orange-brown sand or loam (WA Herbarium 1998-) (Plate 9). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 190 km from near Kambalda in the west to south of Queen Victoria Springs Nature Reserve in the east (DBCA 2007-).

There are 12 records of this taxon in DBCA's databases representing approximately six populations (not including the population in the Study Area), none of which occur in DBCA-managed tenure (DBCA 2007-). The population within the Study Area represents a significant range extension (approximately 150 km to the west) of the known range of this taxon. This taxon was not expected to occur in the Study Area, as no locations were identified within the Desktop Study Area as part of the Desktop Survey; it is presumed that this record represents a new population in the context of existing data.

This taxon was recorded at one point location in the Study Area during the survey within the southern portion of the NYHR area (south of the Yerilgee Hills). The total number of individuals was not recorded. The location of this taxon occurs on a gently undulating sandplain, within VT MESGROS (Table 10; Figure 10).

Plate 9: ***Eremophila perglandulosa*** **(P1) (Photo: Western Australian Herbarium 1998–)**

Eutaxia rubricarina **(P3)**

Eutaxia rubricarina (P3) is a straggling shrub growing to 0.5 m high, and generally occurs on gravelly sand, grey to pinkish-white sandy clay and red loams on flats, slopes and valley floors (WA Herbarium 1998-) (Plate 10). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 450 km from south of Northam in the west to north of Kalgoorlie in the east (DBCA 2007-).

There are 10 records of this taxon in DBCA's databases representing approximately eight populations (not including the population in the Study Area), one of which occurs in DBCA-managed tenure; ex-Goongarrie (former pastoral lease proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon; however, it was not expected to occur in the Study Area, as there are no known records within 50 km of the Study Area.

This taxon was recorded at one point location in the Study Area during the survey within the southern portion of the NYHR area (south of the Yerilgee Hills). The total number of individuals was not recorded. The location of this taxon occurs on the edge of a low rise within VT AASYH, at its interface with VT EWEsS (*Eucalyptus salubris* woodland); field observations indicate that it prefers *Eucalyptus salubris* woodland rather than the shrubland of VT AASYH (Table 10; Figure 10).

Plate 10: Specimen of *Eutaxia rubricarina* (P3) (Photo: Woodman Environmental 2020)

***Grevillea erectiloba* (P4)**

Grevillea erectiloba (P4) is an erect shrub, growing to 3 m high, and generally occurs on gravelly loam and lateritic ridges (WA Herbarium 1998-) (Plate 11). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 100 km, surrounding Mount Manning Nature Reserve, north of Koolyanobbing (DBCA 2007-). One disjunct location has also been recorded, nearly 100 km to the east.

There are 88 records of this taxon in DBCA's databases representing approximately 66 populations (including one of the populations in the Study Area), 40 of which occur in DBCA-managed tenure; Mount Manning-Helena and Aurora Ranges Conservation Park, Mount Manning Nature Reserve, ex-Jaurdi, ex-Mt Jackson Station, ex-Diemals Station and ex-Elvire (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at 14 point locations in the Study Area during the survey, with a total of 90 individuals recorded; all are within the NYHR area, primarily within the Yerilgee Hills, but also extending into the lateritic sandplains just to the north and south of these hills. These locations provisionally represent 4 populations. One of these populations is a known population (WA Herbarium and TPFL records – DBCA (2020b)); during previous surveys in the Study Area, it was recorded at five locations, with a total of 18 individuals recorded. The remaining three populations appear to be new populations; however, further survey is

required to confirm this. The locations of this taxon occur on the slopes and crests of low lateritic or banded ironstone ridges and hills and on gently undulating gravelly plains, within VTs AASGP, ABeSG, MEASSS and AASYH (Table 10; Figure 10).

Plate 11: *Grevillea erectiloba* (P4) (Photo: Western Australian Herbarium 1998–)

***Grevillea georgeana* (P3)**

Grevillea georgeana (P3) is an erect to widely spreading shrub growing to 3 m high, and generally occurs on Stoney loam or clay on ironstone hilltops and slopes (WA Herbarium 1998-) (Plate 12). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 230 km from Coolgardie in the south-east to south of Lake Barlee in the north-west (DBCA 2007-).

There are 127 records of this taxon in DBCA's databases representing approximately 85 populations (including the population in the Study Area), 73 of which occur in DBCA-managed tenure; Mount Manning-Helena and Aurora Ranges Conservation Park, Mount Manning Nature Reserve, ex-Jaurdi, ex-Credo, ex-Ennuin and ex-Diemals Station (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at one point location in the Study Area during the current survey, within the southern portion of the NYHR area in the Yerilgee Hills, with a total of 10 individuals recorded. This location is part of the same population represented by previously recorded locations of this taxon just west of the Study Area (WA Herbarium and TPFL records – DBCA (2020b)). The location of this taxon occurs on the crest of a low banded ironstone rise, within VT AASYH (Table 10; Figure 10).

Plate 12: ***Grevillea georgeana*** **(P3) (Photo: Western Australian Herbarium 1998–)**

Grevillea obliquistigma **subsp. *cullenii* (P3)**

Grevillea obliquistigma subsp. *cullenii* (P3) is a spreading shrub growing to 0.7 m high, and generally occurs on red sand (WA Herbarium 1998-) (Plate 13). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 655 km from north of Dalwallinu in the west to north-east of Laverton in the east (DBCA 2007-).

There are three records of this taxon in DBCA's databases representing three populations (not including the population in the Study Area), none of which occur in DBCA-managed tenure (DBCA 2007-). The Study Area is located within the known range of this taxon; however, it was not expected to occur in the Study Area, as there are no known records within 50 km of the Study Area.

This taxon was recorded at one point location in the Study Area during the survey within the central portion of the NYHR area (between Lake Barlee Yerilgee Hills). The total number of individuals was not recorded. The location of this taxon occurs on a gently undulating sandplain, within VT MEASNS (Table 10; Figure 10).

Plate 13: Specimen of *Grevillea obliquistigma* subsp. *cullenii* (P3) (collected by Woodman Environmental)

***Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1)**

Grevillea sp. Yerilgee Hills (T. Laslett TL 025) (P1) is an erect shrub growing to 1.5 m high, and has been recorded on red brown sandy clay loams on fragments of banded ironstone (WA Herbarium 1998-) (Plate 14). This taxon is endemic to Western Australia (WA Herbarium 1998-), occurring over a range of approximately 50 km located east of Mount Manning Range Nature Reserve (WA Herbarium 1998-).

There are five records of this taxon in DBCA's databases representing approximately five populations (including one of the populations in the Study Area), none of which occur in DBCA-managed tenure (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at two point locations in the Study Area during the survey, both within the southern portion of the NYHR area (south of the Yerilgee Hills). These locations provisionally represent 2 populations. One of these populations is a known population represented by previously recorded locations of this taxon just outside the Study Area (WA Herbarium records – DBCA (2020b)). The remaining population appears to be new; however, further survey is required to confirm this. The total number of individuals was not recorded.

The locations of this taxon occur on low banded ironstone ridges and hills, within VTs AASYH and ABeSG (Table 10; Figure 10).

Plate 14: Specimen of *Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1) (collected by Woodman Environmental)

***Hemigenia exilis* (P4)**

Hemigenia exilis (P4) is an erect, multi-stemmed shrub growing to 2 m high (Plate 15), and has been recorded on laterite breakaways and slopes (WA Herbarium 1998-). This taxon is endemic to Western Australia (WA Herbarium 1998-), occurring over a range of approximately 500 km from Weld Range in the north-west to south of Laverton in the south-east (DBCA 2007).

There are 82 records of this taxon in DBCA's databases representing approximately 30 populations (including the population in the Study Area), none of which occur in DBCA-managed tenure (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon has previously been recorded on Mt Richardson itself in the Study Area from a single population. This population was visited during this current survey for verification purposes; the distribution and abundance of this species appeared to be the same as historical observations, and therefore the historical data is considered current. Eight point locations consisting of 38 individuals of this taxon have been recorded by previous surveys in this population. The locations of this taxon occur on a steep rocky banded ironstone mid and

lower slope of Mt Richardson, primarily within VT AEpS, and in the transitional zone with this VT and MAqSSF (Table 10; Figure 10). This taxon was not located within the Targeted Survey Area at Mt Richardson.

Plate 15: *Hemigenia exilis* (P4) (Photo: Woodman Environmental)

***Hibbertia lepidocalyx* subsp. *tuberculata* (P3)**

Hibbertia lepidocalyx subsp. *tuberculata* (P3) is an erect shrub growing to 0.5 m high and occurs on rocky slopes of banded ironstone (WA Herbarium 1998-) (Plate 16). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 100 km from Koolyanobbing in the south to south of Lake Giles in the north (DBCA 2007-).

There are 29 records of this taxon in DBCA's databases representing approximately 20 populations (including the populations in the Study Area), nine of which occur in DBCA-managed tenure; Mount Manning Range Nature Reserve and Mount Manning – Helena and Aurora Ranges Conservation Park (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at two point locations in the Study Area during the current survey, within the southern portion of the NYHR area in the Yerilgee Hills, with a total of 20 individuals recorded (individuals were not counted at one location). These locations are part of the same population represented by previously recorded locations of this taxon just west of the Study Area (WA Herbarium and TPFL records – DBCA (2020b)). The locations of this taxon occur on the crests and slopes of low banded ironstone rises, within VTs AASGP and AASYH (Table 10; Figure 10).

Plate 16: *Hibbertia lepidocalyx* subsp. *tuberculata* (P3) (Photo: Woodman Environmental)

***Hibiscus krichauffianus* (P3)**

Hibiscus krichauffianus (P3) is a low or ascending shrub growing to 0.7 m high and occurs on red sandy soils (WA Herbarium 1998-) (Plate 16). This taxon is widespread throughout Australia (ALA 2021), including in WA, where it occurs over a range of approximately 950 km from west of Meekatharra in the west to the Great Victoria Desert Nature Reserve in the east (DBCA 2007-).

There are six records of this taxon in WA in DBCA's databases representing approximately six populations (including the population in the Study Area), two of which occur in DBCA-managed tenure, including Great Victoria Desert Nature Reserve and ex-Bulga Downs (former pastoral leases proposed for conservation) (the Study Area population) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at seven point locations in the Study Area during the current survey, with a total of 23 individuals recorded; all were within the Mt Richardson Area. These locations represent a single population. This population was recorded during previous surveys (Woodman Environmental 2013); however, it was opportunistically recorded at a single location, and no other data was recorded; data from this current survey therefore supersedes the previous data. The locations of this taxon occur on the mid and lower slopes of Mt Richardson, only along a small flow line, within VTs AEpS and MAqSSF (Table 10; Figure 10). This taxon was not located within the Targeted Survey Area at Mt Richardson.

As noted in Section 5.2.2, it is considered likely that *Hibiscus krichauffianus* (P3) is conspecific with *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (P3). However, as the genus *Hibiscus* is currently being revised, and it is currently unclear as to how *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) (P3) can be distinguished from other taxa,

the name *Hibiscus krichauffianus* (P3) is maintained here for the taxon that occurs at Mt Richardson.

Plate 17: Specimen of *Hibiscus krichauffianus* (P3) (collected by Woodman Environmental)

***Jacksonia lanicarpa* (P1)**

Jacksonia lanicarpa (P1) is an erect shrub growing to 2 m high, and generally occurs on sandplains (WA Herbarium 1998-) (Plate 18). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 650 km from Cue in the north-west to south of Queen Victoria spring Nature Reserve in the south-east (DBCA 2007-).

There are 15 records of this taxon in DBCA's databases representing approximately nine populations (including one of the populations in the Study Area), one of which occurs in DBCA-managed tenure; ex-Bulga Downs (former pastoral leases proposed for conservation) (one of the Study Area populations) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at eight point locations in the Study Area during the current survey, with a total of 57 individuals recorded. These locations are within both the Mt Richardson Area and the NYHR area (central portion, between Lake Barlee and the Yerilgee Hills), and provisionally represent 3 populations. The single population in the Mt Richardson Area is a known population (WA Herbarium record – DBCA (2020b)); no abundance was recorded at this location previously. The remaining 2 populations in the NYHR appear to be new populations; however, further survey is required to confirm this. The populations of this taxon in the NYHR area more or less occur in habitat considered typical for this species; one

population is on an orange sandplain in VT AeEfS, while the other population is within the interface of the sandy soils of VT AEfG and the clay soils of VT MEfSC. The population of Mt Richardson appears to be in atypical habitat; it occurs on a banded ironstone outcrop and adjacent clay flat in VTs AEgSB and MEfSN. However, there are known populations nearby in typical sandplain habitat (WA Herbarium 1998-), and therefore the Mt Richardson population may represent outlying individuals of these populations (Table 10; Figure 10). This taxon was not located within the Targeted Survey Area at Mt Richardson.

Plate 18: Specimen of *Jacksonia lanicarpa* (P1) (Collected Woodman Environmental)

***Lepidosperma* cf. *lyonsii* (P1)**

Lepidosperma lyonsii (P1) is a tufted rhizomatous, perennial sedge growing to 0.5 m high, and generally occurs on pale orange skeletal sandy loam with banded ironstone gravel and rock, sometimes with quartz on hill slopes (WA Herbarium 1998-) (Plate 19). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 620 km from near Cundeelee in the east to near Wongan Hills in the west (DBCA 2007-).

There are 57 records of this taxon in DBCA's databases representing approximately 44 populations (not including the populations in the Study Area), 20 of which occur in DBCA-managed tenure; Goldfields Woodlands National Park, Dragon Rocks Nature Reserve, Lakelands Nature Reserve, Chiddarcooping Nature Reserve, Carrabin Nature Reserve, Totadgin Conservation Park, Charles Gardner Reserve, ex-Jaurdi and ex-Cowarna Downs Station (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

As noted in Section 5.2.2, Identification of *Lepidosperma* taxa is currently difficult as the taxonomy of the genus is currently being revised, and the limits of morphological characters within taxa are unclear in many cases. Several collections from the Study Area broadly resemble *Lepidosperma lyonsii* (P1), especially in plant base, gross inflorescence and culm indumentum morphology; however, the culms are generally broader than the range given in the protologue for the species. They have therefore been tentatively placed with this species; a conclusive identification is not possible until further taxonomic investigation is undertaken.

This taxon was recorded at four point locations in the Study Area during the current survey, with a total of five individuals recorded (individuals were not counted at all locations); all within the southern portion of the NYHR area (south of the Yerilgee Hills). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 4 populations. The locations of this taxon occur generally on gently undulating gravelly sandplains (VTs AASGP and MEASSS), with one population adjacent to a granite outcrop (VT AMSBG) (Table 10; Figure 10).

Plate 19: Specimen of *Lepidosperma* cf. *lyonsii* (P1) (collected by Woodman Environmental)

***Lepidosperma* cf. sp. Parker Range (N. Gibson & M. Lyons 2094) (P1)**

Lepidosperma sp. Parker Range (N. Gibson & M. Lyons 2094) (P1) is a tufted rhizomatous, perennial sedge growing to 0.4 m high, and generally occurs on brown sandy loam on rocky hills with banded ironstone outcropping (WA Herbarium 1998-) (Plate 20). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 180 km from near Coolgardie in the east to south of Southern Cross in the west (DBCA 2007-).

There are six records of this taxon in DBCA's databases representing approximately five populations (not including the population in the Study Area), two of which occur in DBCA-managed tenure; ex-Jaurdi (former pastoral lease proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

As noted in Section 5.2.2, Identification of *Lepidosperma* taxa is currently difficult as the taxonomy of the genus is currently being revised, and the limits of morphological characters within taxa are unclear in many cases. A collection from the Study Area broadly resembles represent *Lepidosperma* cf. sp. Parker Range (N. Gibson & M. Lyons 2094) (P1), especially in plant base, gross inflorescence and culm (including indumentum morphology); however, the habitat of this collection in the Study Area (undulating orange sandplain) is atypical compared to the banded ironstone hill habitat of other collections (WA Herbarium 1998-). This collection has therefore been tentatively placed with this species; a conclusive identification is not possible until further taxonomic investigation is undertaken.

This taxon was recorded at one point location in the Study Area during the current survey within the southern portion of the NYHR area (south of the Yerilgee Hills). This population is presumably a new population in the context of existing data, although further survey would be required to confirm this. The total number of individuals was not recorded. The location of this taxon occurs on a gently undulating orange sandplain within VT MESGROS (Table 10; Figure 10).

Plate 20: Specimen of Lepidosperma cf. sp. Parker Range (N. Gibson & M. Lyons 2094) (P1) (collected by Woodman Environmental)

***Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3)**

Melichrus sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3) is a perennial shrub growing to 0.5 m high, and generally occurs yellow or orange sand (WA Herbarium 1998-) (Plate 21). This taxon appears to be endemic to Western Australia (ALA 2021), occurring over a range of approximately 300 km from near Lake Moore in the west to Mount Walton in the east (DBCA 2007-).

There are 69 records of this taxon in DBCA's databases representing approximately 41 populations (including one population in the Study Area), 21 of which occur in DBCA-managed tenure; Mount Manning Range Nature Reserve, Mount Manning – Helena and Aurora Ranges Conservation Park, Karroun Hill Nature Reserve and ex-Diemals and ex- Jaurdi (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at 13 point locations in the Study Area during the current survey, with a total of 173 individuals recorded (individuals were not counted at all locations); all were within the of the NYHR area (both the central and southern portions, between Lake Barlee and Carina mine. These locations provisionally represent 5 populations. One of these populations is a known population represented by previously recorded locations of this taxon just outside the Study Area (WA Herbarium and TPFL records – DBCA (2020b)). The remaining populations appear to be new; however, further survey is required to confirm this. The locations of this taxon occur on gently undulating orange sandplains, within VTs MEASNS, MEASSS and MESGROS (Table 10; Figure 10).

Plate 21: Specimen of *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3) (collected by Woodman Environmental)

***Micromyrtus serrulata* (P3)**

Micromyrtus serrulata (P3) is an erect or spreading shrub growing to 1.5 m high, and generally occurs on brown sandy and clayey soils over granite (WA Herbarium 1998-) (Plate 21). This taxon appears to be endemic to Western Australia (ALA 2021), occurring over a range of approximately 390 km from near Lake Barlee in the north-west to Coonana in the south-east (DBCA 2007-).

There are 26 records of this taxon in DBCA's databases representing approximately 16 populations (including three of the populations in the Study Area), two of which occur in DBCA-managed tenure; Great Victoria Desert Nature Reserve and ex-Bulga Downs (former pastoral leases proposed for conservation) (one of the Study Area populations) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at 79 point locations in the Study Area during the current survey, with a total of 1,415 individuals recorded; all were within the Mt Richardson Area. These locations provisionally represent 4 populations. Three of these populations are previously recorded populations. This taxon was known to occur within the Targeted Survey Area at Mt Richardson. However, during targeted searching in this area in 2020, it was observed that previously recorded data on distribution and abundance of this taxon did not align with observations made during this current survey. Therefore, this species was re-censused in this area during the current survey. This was repeated during verification visits to the other two known populations. The fourth new population was located during targeted searching for this species in the wider Study Area.

The locations of this taxon occur on rocky, laterised ironstone outcrops, occasionally in and near drainage lines, on the slopes of the Mt Forrest and Mt Richardson Ranges, primarily in the rocky VTs AEgSB, AMESSS and CATSB, and rarely in transitional areas with these VTs and MAqSSF and MEfSN (the latter are not considered primary habitat and plants are strictly in transitional areas). (Table 10; Figure 10).

Plate 22: ***Micromyrtus serrulata*** **(P3) (Photos: Woodman Environmental)**

Neurachne lanigera **(P1)**

Neurachne lanigera (P1) is a tufted perennial grass growing to 0.3 m high, and generally occurs on sandplains or breakaways (WA Herbarium 1998-) (Plate 23). This taxon is not endemic to Western Australia, with records also in South Australia (ALA 2021). Within WA it occurs over a range of approximately 760 km from west of Wiluna to east of the Gibson Desert Nature Reserve (DBCA 2007-).

There are 17 records of this taxon in DBCA's databases representing approximately 11 populations (not including the population in the Study Area), none of which occur in DBCA-managed tenure (DBCA 2007-). The population within the Study Area represents a significant range extension (approximately 200 km to the west) of the known range of this taxon. This taxon was not expected to occur in the Study Area, as no locations were identified within the Desktop Study Area as part of the Desktop Survey; it is presumed that this record represents a new population in the context of existing data.

This taxon was recorded at one point location in the Study Area during the current survey within the southern portion of the NYHR area (south of the Yerilgee Hills), with a total of 15 individuals recorded. The location of this taxon within the Study Area occurs on a granitic outcrop at the interface between VTs AMSBG and VT ElWS (Table 10; Figure 10).

Plate 23: Specimen of *Neurachne lanigera* (P1) (collected by Woodman Environmental)

***Persoonia leucopogon* (P1)**

Persoonia leucopogon (P1) is an erect or decumbent shrub growing to 0.6 m high, and generally occurs on yellow sandplains (WA Herbarium 1998-) (Plate 24). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 275 km from north of Mukinbudin in the west to near Lake Goongarrie in the east (DBCA 2007-).

There are 12 records of this taxon in DBCA's databases representing approximately five populations (not including the population in the Study Area), eight of which occur in DBCA-managed tenure; Mount Manning Range Nature Reserve, Mount Manning – Helena and Aurora Ranges Conservation Park and ex-Jeedamya Station (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at two point locations in the Study Area during the current survey, both within the southern portion of the NYHR area (south of the Yerilgee Hills), with a total of five individuals recorded. The locations in the Study Area provisionally represent a single population; this population is presumably a new population in the context of existing data, although further survey would be required to confirm this. The locations of this taxon occur on a gently undulating sandplain, within VT MESGROS (Table 10; Figure 10).

Plate 24: Specimen of *Persoonia leucopogon* (P1) (collected by Woodman Environmental)

***Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2)**

Phebalium sp. Yerilgee Sandplain (J. Jackson 223) (P2) is an erect perennial woody shrub growing to 0.7 m high, and occurs on sandplains (WA Herbarium 1998-) (Plate 25). This taxon is endemic to Western Australia (WA Herbarium 1998-), occurring over a range of approximately 150 km from east of Mount Manning Nature Reserve in the north to south of Great Eastern Highway to the east of Southern cross in the south (WA Herbarium 1998-).

There are 11 records of this taxon in DBCA's databases representing approximately three populations (not including populations in the Study Area), one of which occurs in Goldfields Woodlands Conservation Park (WA Herbarium 1998-). The Study Area is located within the known range of this taxon.

This taxon was recorded at five point locations in the Study Area during the current survey, within the southern portion of the NYHR area (south of the Yerilgee Hills), with a total of four individuals recorded (individuals were not counted at all locations). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 3 populations. The locations of this taxon occur on gently undulating sandplains within VTs CWEcRS and MESGROS (Table 10; Figure 10).

Plate 25: Specimen of *Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2) (collected by Woodman Environmental)

***Philotheca coateana* (P3)**

Philotheca coateana (P3) is a shrub growing to 0.5 m high, and generally occurs on sandplains (WA Herbarium 1998-) (Plate 26). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 360 km from north of Barrambie to Lake Goongarrie in the south (DBCA 2007-).

There are 17 records of this taxon in DBCA's databases representing approximately 13 populations (not including the populations in the Study Area), six of which occur in DBCA-managed tenure; ex-Mt Jackson Station, ex-Goongarrie station and ex-Diemals (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

A total of 19 point locations were recorded during the current survey, within the central portion of the NYHR area (between Lake Barlee and the Yerilgee Hills), with 240 individuals recorded (individuals were not counted at all locations). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally

represent 5 populations. The locations of this taxon occur on gently undulating sandplains, sometimes with gravel, within VTs ABeSG, AeEfS, MEASNS, and the interface of these VTs and MEfSC (Table 10; Figure 10).

Philotheca coateana (P3) has also been recorded within the Study Area by a previous survey (Mattiske 2008) within the Mt Richardson area; there are two records, both within the area of proposed future development that was the subject of targeted survey during this current survey (Figure 8). The status of this species in the Mt Richardson area has been investigated by several subsequent surveys, including in 2012 (Woodman Environmental 2013), and during this current survey, but no individuals have ever been located. It is considered likely that the identification of this species at Mt Richardson is erroneous. This species was apparently previously recorded on the banded ironstone mid slope of Mt Richardson; this habitat is atypical for this species, with almost all other known records, including all records recorded by this current survey, on sandplains. The Mattiske (2008) survey that recorded this species also surveyed areas that appear to be sandplains in the vicinity of Mt Richardson; it is also possible that this species was recorded in such areas, but erroneous coordinates were attributed to the records. In any case, this taxon is not considered to occur within the Mt Richardson Area. The records from this area are not presented in Table 10 and Figure 10.

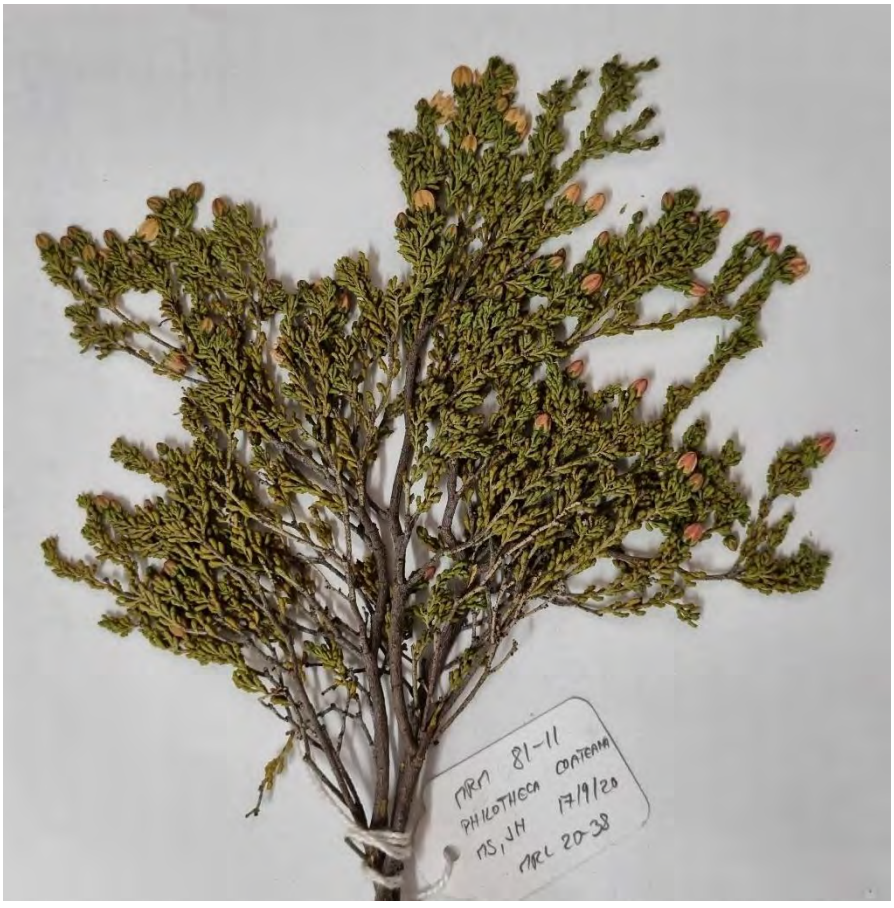


Plate 26: Specimen of *Philotheca coateana* (P3) (collected by Woodman Environmental)

***Philotheca deserti* subsp. *brevifolia* (P3)**

Philotheca deserti subsp. *brevifolia* (P3) is an erect shrub growing to 1 m high, and generally occurs on red sandy clay (WA Herbarium 1998-) (Plate 27). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 150 km from near Mount Ida in the north-east to north of Koolyanobbing in the south (DBCA 2007-).

There are 19 records of this taxon in DBCA's databases representing approximately 17 populations (not including the populations in the Study Area), 13 of which occur in DBCA-managed tenure; Mount Manning Range Nature Reserve, Mount Manning – Helena and Aurora Ranges Conservation Park and ex-Diemals and ex-Mt Elvire (former pastoral leases proposed for conservation) (DBCA 2007-). The Study Area is located within the known range of this taxon.

This taxon was recorded at seven point locations in the Study Area during the current survey, within the central portion of the NYHR area (between Lake Barlee and the Yerilgee Hills), with a total of 30 individuals recorded (individuals were not counted at all locations). The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 3 populations. The locations of this taxon occur on gently undulating sandplains, often with lateritic gravel, within VTs AeEfS and MEASNS (Table 10; Figure 10).

Plate 27: Specimen of *Philotheca deserti* subsp. *brevifolia* (P3) (collected by Woodman Environmental)

***Phyllanthus baeckeoides* (P3)**

Phyllanthus baeckeoides (P3) is a shrub measuring 0.5 - 1.5 m high (Plate 28) that occurs on banded ironstone or laterite ridges and hills (WA Herbarium 1998-). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 550 km from Mardoonganna Hill in the north-west to south-east of Laverton in the south-east (DBCA 2007-).

This taxon is known from 56 records within DBCA's databases, representing approximately 25 populations (this includes the populations in the Study Area), with the majority of these records occurring on pastoral leases (DBCA 2007-). There are no records within DBCA conservation tenure. The Study Area is located within the known range of this taxon (DBCA 2007-).

Phyllanthus baeckeoides (P3) has only been recorded in the Mt Richardson area in the Study Area; there are currently 4 populations known, consisting of 300 point locations and 8,160 individuals. All populations are now considered to have been fully censused. A single new individual was recorded during this current survey that is part of one of the populations; this individual is located downslope from the main range of the population in atypical habitat, which likely explains why it was not recorded by previous surveys. One other population of this taxon occurs within the Targeted Survey Area at Mt Richardson. However, the single point location representing this population was re-visited during targeted searching in this area in 2020 and no plants could be located. It was also not recorded elsewhere in the Targeted Survey Area; the population in this area therefore currently has no extant plants. The remaining two populations were censused during previous surveys; one of these was revisited in 2020 and plant numbers and distribution appeared similar to previous survey data; no new censusing of these populations was therefore undertaken in 2020.

The locations of this taxon occur on banded ironstone or laterised ironstone outcrops, occasionally in and near drainage lines, on the slopes of the Mount Forrest and Mount Richardson Ranges, and on low laterised ironstone hills to the west of the Mount Richardson Range, primarily within the rocky VTs AEgSB and CATSB, and rarely in VTs AEpS, MAqSSF and MEfSN; the latter two VTs are not considered primary habitat, with plants only occurring in transitional areas with these and other rocky VTs (Table 10; Figure 10).

Plate 28: *Phyllanthus baeckeoides* (P3) (Photo: Woodman Environmental)

***Tecticornia entrichoma* (P4)**

Tecticornia entrichoma (P4) is decumbent shrub growing to 0.3 m, occurring on clay and clayey sand on the margins of slightly brackish lakes. (WA Herbarium 1998-) (Plate 25). This taxon is endemic to Western Australia (ALA 2021), occurring over a range of approximately 10 km ENE of Lake King (DBCA 2007-).

There are 11 records of this taxon in DBCA's databases representing approximately four populations (not including the population in the Study Area), all of which occur in DBCA-Frank Hann National Park (DBCA 2007-). The Study Area is located over 270 km from the DBCA records of this taxon, therefore representing a significant extension to the known range of this taxon. This taxon was not expected to occur in the Study Area, as no locations were identified within the Desktop Study Area as part of the Desktop Survey; it is presumed that this record represents a new population in the context of existing data.

This taxon was recorded at one location in the Study Area during the survey, within the southern portion of the NYHR area (south of the Yerilgee Hills). The number of individuals was not recorded. The location of this taxon occurs on a seasonal, presumed fresh to slightly brackish lake floor within VT TeL (Table 10; Figure 10).

Plate 29: Specimen of *Tecticornia entrichoma* (P4) (collected by Woodman Environmental)

5.2.4 Unlisted Significant Flora Taxa

***Acacia* sp. nov**

A collection of an *Acacia* from the Mt Richardson area in the Study Area made in 2012 by Woodman Environmental (2013) could not be matched to any known *Acacia* taxon, despite the presence of some old flowering material on the collected sample. This collection was shown to *Acacia* authority Bruce Maslin at the Western Australian Herbarium, who determined that it likely represented an undescribed taxon. The collection of good flowering

and fruiting material would be needed to resolve this entity's taxonomic and conservation status.

This entity was recorded at a single location in 2012; no further locations were recorded by this current survey. The number of individuals at the location was not recorded. The location is on an open stony flat to the west of the Mt Richardson Range in VT MAcPS (Table 10; Figure 10).

Plate 30: Specimen of *Acacia* sp. nov (collected by Woodman Environmental)

***Acacia* sp. (unidentified)**

A second collection of an *Acacia* (*Acacia* sp. (unidentified)) from the Mt Richardson area in the Study Area made in 2012 by Woodman Environmental (2013) could not be identified due to the absence of appropriate material. The collection possessed similar phyllodes to the common *Acacia tetragonophylla*; however, the phyllodes were distinctly blue-coloured, and did not occur in clusters on the branches. It may represent an aberrant individual of *Acacia tetragonophylla*; however, it is also possible that it may represent an undescribed taxon. The collection of good flowering and fruiting material would be needed to resolve this entity's taxonomic and conservation status.

This entity was recorded at a single location in 2012; no further locations were recorded by this current survey. The number of individuals at the location was not recorded. The location is on an undulating stony plain to the west of the Mt Richardson Range in VT MEfSN (Table 10; Figure 10).

Plate 31: Specimen of *Acacia* sp. (unidentified) (collected by Woodman Environmental)

***Eremophila glabra* subsp. Diemals (R. Davis 11349)**

Eremophila glabra subsp. Diemals (R. Davis 11349) is a shrub growing to 0.5 m high, and generally occurs on yellow-white sand or yellow-brown clayey sand (WA Herbarium 1998-) (Plate 27). This taxon is endemic to the Western Australia (ALA 2021), occurring over a range of approximately 105 km from north of Mukinbudin in the west to near the west side Lake Barlee in the east (DBCA 2007-).

There are three records of this taxon in DBCA's databases representing two populations (not including the populations in the Study Area), none of which occur in DBCA-managed tenure. The Study Area is located outside the known range of this taxon. Although this taxon is currently not formally listed as a significant taxon, the very small number of collections held by the WA Herbarium indicates that this taxon satisfies the criteria for a Priority taxon. It is therefore considered to be a significant taxon in line with EPA (2016b).

This taxon was recorded at 2 point locations in the Study Area during the survey, within the southern portion of the NYHR area (south of the Yerilgee Hills). The total number of individuals was not recorded. The locations in the Study Area presumably represent new populations in the context of existing data, although further survey would be required to confirm this; the locations in the Study Area provisionally represent 2 populations. The location of this taxon occur on orange clayey sand to sand on gently undulating plains, within VTs AMSBG and MEASSS (Table 10; Figure 10). It is possible additional locations of this taxon would be located during targeted searching of suitable habitat within the Study Area.

Plate 32: Specimen of *Eremophila glabra* subsp. Diemals (R. Davis 11349) (collected by Woodman Environmental)

?Lamiaceae sp.

A collection from the Study Area was identified by Mike Hislop from the WA Herbarium as ?Lamiaceae sp. (Plate 33). Although sterile, this collection could not even be confidently placed at the family level. Further material is required to ascertain the taxonomic status of this entity; however, there is a reasonable possibility that it may represent an undescribed taxon (M. Hislop *pers. comm.*, 2020).

?Lamiaceae sp. is a small shrub which was recorded at one point location within the Study Area, within the southern portion of the NYHR area (south of the Yerilgee Hills). The number of individuals was not recorded. The location of this taxon occurs on a gently undulating red sandplains within VT MESGROS (Table 10; Figure 10).

Plate 33: Specimen of ?Lamiaceae sp. (collected by Woodman Environmental)

***Microcorys* sp.**

A collection of a *Microcorys* from the Study Area could not be identified by the WA Herbarium as representing any of the recognised *Microcorys* taxa (Plate 34). Vegetatively the collection appears closest to *Microcorys* sp. Mt Gibson (S. Patrick 2098), differing mainly in its very narrowly oblanceolate rather than very narrowly elliptic leaves (M. Hislop *pers. comm.* 2020). Flowering material is required to ascertain the taxonomic status of this entity (M. Hislop *pers. comm.* 2020); at this stage, it is considered to be a potentially undescribed taxon.

Microcorys sp. was recorded at one location within the Study Area, within the southern portion of the NYHR area (south of the Yerilgee Hills). The number of individuals was not recorded. The location of this taxon occurs on a gently undulating red sandplain within VT MESGROS (Table 10; Figure 10).

Plate 34: Specimen of *Microcorys* sp. (collected by Woodman Environmental)

Olearia* aff. *pimeleoides

A collection of an *Olearia* from the Study Area could not be identified by the WA Herbarium as representing any of the recognised *Olearia* taxa (Plate 35). This collection appears closest to *Olearia pimelioides*, but following an examination of a subset of material held at the WA Herbarium, was found to be distinguishable from typical *Olearia pimelioides* by its sessile inflorescences (compared to variously pedunculate in typical *Olearia pimeleoides*). This examination also revealed two additional collections held by the WA herbarium from the Sandstone area also appear to represent the same entity as that collected in the Study Area. *Olearia pimeleoides* is a variable species which has a transcontinental distribution, and therefore further research is required to confirm the distinctiveness of this entity. The Study Area collection and the two additional aforementioned collections have therefore been assigned the name *Olearia* aff. *pimeleoides* in the interim.

Olearia aff. *pimeleoides* was recorded at one location within the Study Area, within the northern portion of the NYHR area (between Mt Richardson and Lake Barlee). The number of individuals was not recorded. The location of this taxon occurs on orange-red clayey sand on an undulating saline plain adjacent to a salt lake, within VT AbCSSL (Table 10; Figure 10).

Plate 35: Specimen of *Olearia* aff. *pimeleoides* (collected by Woodman Environmental)

***Templetonia* sp.**

A collection a *Templetonia* from the Study Area could not be identified by the WA Herbarium as representing any of the recognised *Templetonia* taxa Plate 36). Although sterile, the glandular axillary processes confirm that this collection belongs to *Templetonia*, however, the combination of spinose and strongly ribbed, terete branchlets appears to rule out the *Templetonia* taxa known to occur in the area. Collection of flowering material is required to verify the taxonomic status of this entity; however, it is potentially an undescribed taxon.

Templetonia sp. was recorded at one location within the Study Area within the Northern Yilgarn Haul Road Area. The number of individuals was not recorded. The location of this taxon occurs within a low mallee woodland on gently undulating red sandplain, within VT MESGROS (Table 10; Figure 10).

Plate 36: Specimen of *Templetonia* sp. (collected by Woodman Environmental)

5.2.5 Distribution Extensions and Distributions Gaps

Table 11 presents taxa where the collections of flora taxa from the Study Area represent extensions to the known distribution of such taxa or otherwise fill gaps within the known distribution of such taxa according to *NatureMap* (DBCA 2007-). The number of such taxa in Table 11 is considered to be relatively high; however, this was expected, given the remoteness and inaccessibility of the Study Area, and consequently the lack of previous botanical surveys in the area. With respect to significant flora taxa, the collection of several Priority taxa (*Eremophila perglandulosa* (P1), *Grevillea obliquistigma* subsp. *cullenii* (P3), *Neurachne lanigera* (P1), *Eutaxia rubricarina* (P3), *Tecticornia entrichoma* (P4)) in the Study Area was not expected based on the results of a desktop review conducted prior to survey; in most of these instances, the collections of these taxa represent extensions to their known range.

Table 11: Taxa Where Collections Represent Range Extensions to the Known Ranges of these Taxa or Fill Distribution Gaps (DBCA 2007-)

Taxon	Description
Acacia jibberdingensis	Fills gap in known distribution
Acacia nigripilosa subsp. nigripilosa	Fills gap in known distribution
Aotus sp. Tortile (G.J. Keighery 3767)	Range extension
Aristida obscura	Fills gap in known distribution
Asplenium subglandulosum	Fills gap in known distribution
Atriplex amnicola	Fills gap in known distribution
Coopernookia strophiolata	Fills gap in known distribution
Cuphonotus andraeanus	Range extension

Taxon	Description
Daviesia pachyloma	Fills gap in known distribution
Eragrostis parviflora	Fills gap in known distribution
Eremophila perglandulosa (P1)	Range extension
Eutaxia rubricarina (P3)	Range extension
Gastrolobium aculeatum	Fills gap in known distribution
Grevillea beardiana	Range extension
Grevillea obliquistigma subsp. *cullenii* (P3)	Range extension
Grevillea oncogyne	Range extension
Leptochloa digitata	Fills gap in known distribution
Leptosema daviesioides	Fills gap in known distribution
Melaleuca conothamnoides	Fills gap in known distribution
Melaleuca interioris	Range extension
Neurachne lanigera (P1)	Range extension
Peplidium aithocheilum	Fills gap in known distribution
**Salvia verbeneca*	Range extension
Tecticornia doliiformis	Fills gap in known distribution
Tecticornia entrichoma (P4)	Range extension
Trianthema triquetrum	Range extension
Tricoryne sp. Mullewa (G.J. Keighery 12080)	Fills gap in known distribution
Triraphis mollis	Fills gap in known distribution

5.2.6 Likelihood of Occurrence of Further Significant Flora Locations/Taxa

5.2.6.1 Targeted Survey Area

It is considered unlikely that any additional significant flora taxa occur within the Targeted Survey Area. As noted in Section 3.4.4, all significant flora taxa likely to occur within this area except potentially *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3) (which was already known to occur in the Targeted Survey Area) were identifiable and searched for during this current survey. Consequently, potentially with the exception of *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), there are unlikely to be any further locations of the significant flora taxa recorded within the Targeted Survey Area than what was recorded during this current survey.

As noted in Section 5.2.2, *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3) could not be located during this current survey, likely because of seasonal conditions. It is possible that further locations of this taxon occur within the Targeted Survey Area; however, further survey following significant winter rainfall would be required to confirm this.

5.2.6.2 Remaining Study Area

A total of 37 significant flora taxa are known to occur in the Study Area. As the Study Area as a whole has not been the subject of targeted survey, it is therefore possible that there are further locations of all taxa present within the Study Area.

As detailed in Section 5.1.4, a total of 88 listed significant flora taxa were identified prior to the 2020 survey as occurring within or in the vicinity of the Study Area. Of these, 12 taxa (following the removal of *Drosera eremaea* (P1) and *Calytrix verruculosa* (P3) – see Section 5.2.2) were already known to occur within the Study Area (recorded by previous surveys) and 16 were recorded in the Study Area for the first time during the 2020 surveys (Table 7). Table 12 presents an assessment of the likelihood of the remaining 60 taxa occurring within the

Study Area. It is considered that there is the possibility that a further 40 Priority flora taxa could potentially occur in the Study Area, as suitable habitat may be present in the Study Area. The remaining 20 taxa are considered unlikely to occur in the Study Area, primarily because suitable habitat is not considered to be present in the Study Area.

Table 12: Likelihood of Occurrence of Significant Flora Taxa in the Study Area

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Acacia adinophylla	P1	Sep - Nov	Grows in rocky loam and loamy sand or clay, often over jasperlite, in open *Eucalyptus ebbanoensis* mallee shrubland.	25 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Acacia cylindrica	P3	Aug - Oct	Deep yellow sand or gravelly, well-drained sand, on flat to gently undulating plains or on the sides of low hills, in open shrubland.	20 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Acacia formidabilis	P3	Aug - Sep	Grows in sand in tall open shrubland. Yellow or red/brown sand. Undulating plains, hillsides.	27 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Acacia shapelleae	T	Aug - Sep	Brown silty sand or clay-loam on the upper slopes and ridges of low hills comprising outcropping BIF.	30 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Acacia sp. Southern Cross (G. Cockerton *et al.* WB 38518)	P1	May	*Eucalyptus salubris* woodland	15 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Aluta teres	P1	Sep	Red clayey sand over hard pan on broad plain with spinifex, red sandy dunes, mid and lower slopes of ironstone range (slightly rocky) with orange sand soils.	15 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Austrostipa blackii	P3	Sep - Nov	Red-brown sandy clay loam or orange clay loam. BIF ranges and outcropping or basalt outcrops.	13 km	Yes – but seasonal conditions may have prohibited flowering	**Possible** – potential habitat in Study Area, not all habitat surveyed

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Baeckea sp. Helena and Aurora Range (G.J. Keighery 4424)	P1	Dec	Well-drained, deep yellow sand. Moderately exposed flat plains.	28 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Banksia lullfitzii	P3	Mar - May	Yellow sand. Sandplains.	25 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Beyeria rostellata	P1	May, Jul, Sep, Oct	Skeletal red sandy to clay soils over banded ironstone substrates.	30 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Calandrinia kalanniensis	P2	Oct - Jan	Shallow brown clay, often gritty, derived from eroded granite. Rock outcrops, herb fields.	17 km	Possibly not	**Possible** – possibly not identifiable during survey, potential habitat in Study Area, not all habitat surveyed
Calytrix hislopii	P3	Aug - Sep	Lateritic ridge, the top of a breakaway on granite.	12 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Chamelaucium sp. Koolyanobbing (V. Clarke 644)	P1	Feb - Apr	Yellow sandplain.	20 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Dampiera plumosa	P1	Oct	Red sandy soils.	25 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Drosera eremaea	P1	July-August	Granite or banded ironstone outcrops	30 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Elachanthus pusillus	P2	Aug - Oct	Red loam over limestone. Drainage flat. Low plain. Ferrous and some quartz. Dry, brown, red-orange loam-clay.	15 km	Yes – but seasonal conditions may have prohibited flowering	**Possible** – potential habitat in Study Area, not all habitat surveyed
Eremophila dendritica	P2	Sep	Clay over limestone. Winter wet depression. Orange or brown rocky loam soil.	15 km	Yes	Unlikely – record near Study Area is unverifiable and not within accepted range of taxon
Eremophila hamulata	P1	Aug - Oct	Brown clay loam on the margins of granite rocks. Lower slopes or ranges. On brownish red ironstone soils in creek lines.	30 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Eremophila virens	T	Aug - Oct	Red/brown sand. Granite hillsides.	140 km	Yes	Unlikely – Study Area significantly outside known range of taxon
Eremophila viscida	T	Sep - Nov	Granitic soils, sandy loam. Stony gullies, sandplains.	120 km	Yes	Unlikely – Study Area significantly outside known range of taxon
Eucalyptus educta	P2	Mar - Apr	Slopes, declivities and at base of granite rocks but also on stony rises and ironstone low ridges.	15 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Eucalyptus formanii	P4	Dec - Apr	Die Hardy Range area. Red sand. Ironstone slopes.	10 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Gastrolobium graniticum	T	Aug - Sep	Sand, sandy loam, granite. Margins of rock outcrops, along drainage lines.	80 km	Yes	Unlikely – Study Area significantly outside known range of taxon

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Goodenia jaurdiensis	P2	Sep - Oct	Red clayey loam with laterite or banded ironstone gravel or quartz pebbles. Low-lying plains and lower slopes.	10 km	Yes – but seasonal conditions may have prohibited flowering	**Possible** – potential habitat in Study Area, not all habitat surveyed
Hemigenia tenelliflora	P2	Oct	Light brown/yellow sand.	45 km	Yes	Unlikely – Study Area significantly outside known range of taxon
Hibiscus sp. Perrinvale Station (J. Warden & E. Ager WB 10581)	P3	Aug	Hilltop of a Banded Ironstone Formation ridge. Easterly aspect. Dark red silty sand.	10 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed. See Section 5.2.2
Homalocalyx grandiflorus	P3	Oct - Dec	Yellow sands, sandplains.	20 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Hyalosperma stoveae	P2	Aug - Oct	Red brown or yellow brown sandy clay, sandy loam. Plains, flats	10 km	Yes – but seasonal conditions may have prohibited flowering	**Possible** – potential habitat in Study Area, not all habitat surveyed
Hysterobaeckea ochropetala subsp. *ochropetala*	P1	Aug - Nov	Yellow sand or other sandy habitats. Sand over laterite.	18 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Labichea eremaea	P3	Aug-Sep	Red, yellow-orange sand. Sandplains	17 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Lepidosperma amantiferrum	P1	Expected to be Autumn. Mature seed recorded in Sep	Yellow sandy loam with banded ironstone gravel and rocks. Gentle lower slopes.	42 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Lepidosperma bungalbin	T	Jul	Steep mid-slopes on red loam soils with banded ironstone rocks and gravel.	27 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Lepidosperma ferricola	P3	Expected to be Autumn. Mature seed recorded in Sep - Oct	Restricted to BIF. Rocky ledges, scree slopes, crevices and ravines on banded ironstone.	32 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Lepidosperma sp. Pigeon Rocks (H. Pringle 30237)	P3	Sep	Midslope of granite hill. Sandy loam or red sandy clay over granite. Yellow sandy clay.	16 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Leucopogon sp. Yellowdine (M. Hislop & F. Hort MH 3194)	P1	Aug	Yellow sand plain.	12 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Leucopogon spectabilis	T	Aug - Oct	Shallow red-brown loam, ironstone. In rock crevices on exposed ridges.	30 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Lissanthe scabra	P2	Aug	Dry white to orange-brown sand/gravel loams associated with granite breakaways.	30 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Melichrus sp. Coolgardie (K.R. Newbey 8698)	P1	Sep - Nov	Low hillside on dry yellow sand.	49 km	Yes	Unlikely – Study Area significantly outside known range of taxon
Mirbelia ferricola	P3	Aug - Oct	Banded Ironstone Formation, shallow lateritic soils on lower slopes and crests of BIF massifs and laterised banded ironstone with haematite, as well as on ledges and between rock-cracks on BIF cliffs.	1 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Myriophyllum lapidicola	T	May, Aug - Oct	Aquatic herb. Sandy clay. Pools on granite outcrops.	20 km	Yes – but seasonal conditions may have prohibited flowering	Unlikely – no potential habitat in Study Area – no outcrops considered significant enough to contain pool habitat
Myriophyllum petraeum	P4	Aug - Dec	Ephemeral rock pools on granite outcrops.	30 km	Yes – but seasonal conditions may have prohibited flowering	Unlikely – no potential habitat in Study Area – no outcrops considered significant enough to contain pool habitat
Neurachne annularis	P3	Sep - Oct	Grows among rocks in shallow red to brown sandy to loamy soils on the tops, sides and bases of banded ironstone ranges and on brown to red or yellowish red loamy soils, often with abundant ironstone gravel or stones which are often banded ironstone fragments, on low rises and outwash plains in the close vicinity or some distance away from banded ironstone ranges.	10 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Notisia intonsa	P3	Sep	Brown stony saline loams, brown cracking clay.	15 km	Yes – but seasonal conditions may have prohibited flowering	**Possible** – potential habitat in Study Area, not all habitat surveyed
Phebalium appressum	P1	Jul	Yellow sand plain	6 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Phlegmatospermum eremaeum	P3	Jun, Aug - Oct.	Stony loam.	30 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Pterostylis virens	P3	Sep - Oct	Shallow soils on granite outcrops which dry out completely in summer but are saturated following run off in winter.	30 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Ricinocarpos brevis	T	Jun, Jul, Nov	Shallow sandy soils on rocky banded ironstone outcrops.	15 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Ricinocarpos digynus	P1	Mar	Red sandy loam on sandy/stony plains. Rocky hillslopes.	30 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Sowerbaea multicaulis	P4	Oct - Jan	Yellow-brown sand.	26 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Stenanthemum newbeyi	P3	Aug - Jan	Clayey sand, clay or loam over laterite or ironstone. Hillslopes.	28 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Styphelia saxicola	P3	Jul - Sep	Red brown loamy clay. Granite with occasional quartz. Laterite outcropping or ironstone breakaways.	18 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Stylidium choreanthum	P3	Sep - Nov	White/yellow or red sand. Plains.	26 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Tecticornia mellarium	P1	Sep - Oct	Well drained red gypseous dunes down to the edge of lake or clay pans.	28 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed

Taxon	Status	Flowering Period (WA Herbarium 1998-)	Habitat (WA Herbarium 1998-)	Nearest Known Location to Study Area (DBCA 2007-)	Identifiable During Survey?	Likelihood of Occurrence in Study Area
Tetratheca aphylla subsp. *aphylla*	T	Jun, Sep, Oct	Red-brown loam, sandy loam, banded ironstone. Crevices in cliffs and outcrops, slopes, valleys, ridges.	28 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Tetratheca paynterae subsp. *paynterae*	T	Apr, Jul	Brown clay loam, silty sandy or clayey loam, ironstone, jasperite. Mid-upper slopes, rock crevices, ridges and cliffs.	60 km	Yes	Unlikely – no habitat within Study Area is present within close proximity to known records
Thysanotus sp. Ennuin (N. Gibson & M. Lyons 2665)	P1	Oct	Mid-slope of low rise, self mulching cracking clay. Flat valley, on red clay soils with laterite gravel.	29 km	Possibly not	**Possible** – possibly not identifiable during survey, potential habitat in Study Area, not all habitat surveyed
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3	Aug - Oct	Flat, red sandy loam over ironstone and quartz. Crest, upper slope, ridge of Ironstone.	35 km	Yes	Unlikely – record considered likely to be erroneous – misidentification of *Thryptomene decussata* which is known from record location
Verticordia mitodes	P3	Oct - Dec	White to grey, yellow and red sand, sometimes over lateritic gravel and loam.	28 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Verticordia stenopetala	P3	Oct - Jan	White to grey sand, yellow sand over loam or gravel.	11 km	Yes	**Possible** – potential habitat in Study Area, not all habitat surveyed
Wurmbea murchisoniana	P4	Jul- Sep	Clay, sandy clay, loam. Seasonally inundated clay hollows and rock pools.	30 km	Yes – but seasonal conditions may have prohibited flowering	**Possible** – potential habitat in Study Area, not all habitat surveyed

5.2.7 Introduced Flora

A total of nine introduced flora taxa were recorded within the Study Area during the 2020 surveys. Additionally, two further introduced taxa have previously been recorded in the Study Area (Woodman Environmental 2013). Table 13 lists location information and comments regarding the significance of these taxa, including ecological impact and invasiveness ratings for each introduced taxon under the *Invasive Plant Prioritization Process for the DBCA* for the Goldfields Region (DBCA 2014). None of these are Declared Pest under the BAM Act (DPIRD 2020b) or WoNS (Weeds Australia 2021). A figure of locations of introduced flora taxa are presented in Appendix I, with detailed GPS locations presented in Appendix G.

Table 13: Summary of Introduced Taxa Recorded within the Study Area

Taxon	Common Name	No. of Locations within the Study Area		Ecological Impact Rating	Invasiveness Rating
		2020	Previous Surveys		
Chenopodium murale	Nettle-leaf Goosefoot	1	0	Unknown	Unknown
Citrullus amarus	Pie Melon	0	1	Medium	Rapid
Cucumis myriocarpus subsp. *myriocarpus*	Prickly Paddy Melon	1	1	Medium	Rapid
Hypochaeris glabra	Flatweed	1	0	Unknown	Unknown
Pentameris airoides subsp. *airoides*	False Hairgrass	2	5	Unknown	Rapid
Salvia verbenaca	Wild Sage	1	0	Unknown	Unknown
Solanum nigrum	Black Berry Nightshade	1	0	Medium	Rapid
Sonchus oleraceus	Common Sowthistle	2	1	Unknown	Rapid
Trianthema portulacastrum	Giant Pigweed	0	1	Unknown	Unknown
Tribulus terrestris	Caltrop	1	1	Low	Moderate
Vulpia myuros forma myuros	Rat's Tail Fescue	1	0	Unknown	Unknown

5.2.8 Floristic Classification Results

The final dataset used for the classification analysis contained 330 perennial taxa. There were a number of taxa that were amalgamated for the analysis. Two such amalgamations were related to field identification and seasonal conditions during the 2020 survey. *Maireana suaedifolia* and *Maireana thesioides*, and *Triodia rigidissima* and *Triodia scariosa* are superficially very similar when sterile and require reproductive material to be reliably distinguished, and occur in similar habitats. Very few individuals of either of these species-pairs were found with reproductive material during the 2020 survey, and therefore identification with certainty was difficult. It is considered unlikely that these amalgamations have had a significant effect on the classification results.

Additionally, the majority of taxa that comprise the Mulga (*Acacia aneura*) group of taxa were amalgamated to a single taxon for the analysis. This group dominated much of the northern half of the Study Area; however confident identification of Mulga specimens was difficult,

particularly given the seasonal conditions of both this current survey and the 2012 survey (Woodman Environmental 2013). This resulted in a large number of collections being identified that were considered to be putative hybrids, or could not confidently be assigned to a particular species (see Appendix I). Because of the high level of uncertainty in the identifications, and the apparent prevalence of hybrids (which are generally omitted from analyses) within Mulga stands often being the only Mulga present within particular quadrats, it was therefore considered that for the purposes of the floristic analysis, all collections identified as being 1 of the Mulga species (or being tentatively aligned to 1 of the species), or a putative hybrid or intergrade of Mulga species, would be amalgamated into 1 taxon in the analysis. This was also undertaken in the indicator taxon analysis; this therefore meant that the Mulga species and hybrids could not be considered indicator taxa, as they were amalgamated as a single taxon.

The approach of amalgamation of the Mulga species and hybrids was supported by a review of the locations of the Mulga species and hybrids across the Study Area prior to analysis; while some patterns in the distribution of certain species were noted (i.e. a preference for stony or rocky sites in *Acacia incurvaneura*), generally the Mulga species did not exhibit any particular distributional pattern, and often several species and putative hybrids occurred together. A similar approach has also been used previously in the DEC's surveys of BIF ranges in the Yilgarn Craton, with Markey & Dillon (2008) resolving their Mulga entities into approximate morphotypes for their analysis.

Acacia craspedocarpa was the only Mulga species included as a separate taxon in the analysis. This species is easily distinguished from all other Mulga taxa, and therefore could be confidently identified in the field. Several collections that were identified as hybrids of this taxon and unknown parent were amalgamated with *Acacia craspedocarpa*.

All taxa removed from the classification analysis (excluding ephemeral or annual taxa, introduced taxa and singletons) are presented in Appendix C.

The PATN software package (Belbin and Collins 2009) initially suggested that a 26-group classification of quadrats may be appropriate for the data analysed. The resulting dendrogram (see Appendix J) and taxon group matrix (not presented because of size) were therefore initially examined at this level, to determine the plausibility of groups with regard to taxon groups and also field observations. This process identified that a number of the groups could feasibly be divided further, to reflect the complexity of habitats and vegetation patterning observed in the field. It was ultimately determined that there were 54 plausible groups which are considered to represent VTs; these groups were resolved at differing levels of similarity. The groups are indicated in the dendrogram in Appendix J. The initial 26 groups identified by PATN are also indicated on the dendrogram by the colour of each individual quadrat stem. Of these VTs, three are represented by quadrats that are all located outside the Study Area; these VTs are not considered to occur in the Study Area, and are not discussed further in this report.

The above examination also identified 56 quadrats that were considered to have been misclassified, as their position in particular quadrat groups was determined to be implausible based on a review of quadrat characteristics such as taxon composition, soil and topography

and geographic location. These quadrats were manually reassigned into what were considered to be more appropriate groups. Often this appeared to be because the quadrats were established in vegetation that was transitional, or were especially species-poor.

In particular, most quadrats considered to be mis-classified were from the relatively species-poor and closely related Mulga-dominated quadrat groups. Such quadrat groups accounted for much of the vegetation present in the Mt Richardson area, and the central and northern portions of the NYHR area. Resolving Mulga-dominated quadrat groups in the classification to define VTs was difficult given their general similarity; however, there were clear trends identified in the classification results related to the degree of influence of the banded ironstone ridges present in the aforementioned parts of the Study Area, as well as quadrat latitude. The latter trend was expected given the shift in climatic conditions from the northern part of the Study Area to the southern parts, which likely drives species turnover. These trends were followed when resolving Mulga-dominated quadrat groups to define VTs. However, because of the relative similarity of many of the Mulga-dominated quadrat groups that were ultimately resolved, misclassification of quadrats was expected. Alternative classification analysis pathways may have resulted in a more robust classification result in the context of such quadrats; however, it was considered appropriate to repeat methods utilised by the DBCA for their banded ironstone surveys, to allow for comparison between those surveys and this current survey.

It is worthy to note that a number of the final VTs are represented by only one or a few quadrats. Although EPA (2016b) notes that a minimum of three quadrats should be sampled in each vegetation unit, this relates to preliminary vegetation units identified during the survey planning process, as final vegetation units cannot be pre-empted prior to or during survey. It is acknowledged that the number of quadrats located in such VTs is currently very limited, and therefore the decision to recognise them as discrete VTs is supported by a very small sample of quadrats. This reflects the difficulties in classifying vegetation within a defined study area where some units may be poorly represented, and also the nature definition of VTs via floristic classification of quadrats, as opposed to pre- and during-survey definition of preliminary vegetation units.

5.2.9 Vegetation Types

As noted above, 51 VTs were defined and mapped within the Study Area based on the results of the floristic classification analysis and subsequent examination of quadrat data (three further VTs were defined but only occur outside the Study Area). A further four VTs were defined via structural vegetation classification, following review of quadrat data not included in the classification analysis (see Section 3.6) and relevé data, and comparison of such data with data from quadrats included in the classification analysis. A total of 55 VTs were therefore defined and mapped in the Study Area. Although the number of VTs defined is considered relatively high, VT diversity in this order was expected, given the length of the Study Area coupled with its north-south orientation, which results in the intersection of two IBRA bioregions and the crossing of climatic boundaries.

Table 14 presents a description of each of the VTs mapped in the Study Area, including location, area mapped, sampling regime, significant flora recorded, average taxon richness

and a description of variation found within the VT. The raw quadrat data is presented in Appendix F. Appendix L presents the distribution of these VTs throughout the Study Area. Appendix M presents the resulting taxon-VT matrix. Indicator taxon analysis is presented in Appendix N.

Table 14: Summary of Vegetation Types Described in the Study Area

VT	Summary	Photograph
AASGP	**Name:** *Acacia*/*Allocasuarina* Shrubland-Gravelly Plains **Description:** Tall open shrubland to shrubland dominated by *Acacia sibina*, *Allocasuarina corniculata*, *Allocasuarina acutivalvis* subsp. *acutivalvis* and occasionally *Acacia resinimarginea* over mid open shrubland of mixed species including *Aluta aspera* subsp. *aspera*, *Baeckea elderiana*, *Grevillea paradoxa, Phebalium canaliculatum* and *Prostanthera campbellii* over low sparse shrubland of mixed species including *Euryomyrtus maidenii* and *Leucopogon* sp. Clyde Hill (M.A. Burgman 1207) over low sparse tussock grassland dominated by *Amphipogon caricinus* var. *caricinus* on orange clayey sand with laterite gravel on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, predominantly southern portion (south of Yerilgee Hills), one occurrence in central portion just north of Yerilgee Hills **Area mapped (Proportion of Study Area):** 979.2 ha (3.9 %) **Sampling:** 12 quadrats - all within the Study Area (MRM099; MRM078; MRK070; MRK075; MRD095; MRK054; MRK055; MRM101; MRK068; MRD112; MRD115; MRD116) **Average Taxon Richness per Quadrat:** 12.4 (± 3.5) **Indicator Taxa:** *Acacia sibina***, *Allocasuarina corniculata*, *Baeckea elderiana*, *Grevillea paradoxa*, *Persoonia coriacea* **Significant Taxa:** *Grevillea erectiloba* (P4), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3), *Lepidosperma* cf. *lyonsii* (P1) **Variation:** none observed	 Plate 37: VT AASGP (Quadrat MRM099)

VT	Summary	Photograph
MEASSS	**Name:** Mallee Eucalypt/Acacia Shrubland-South Sandplains **Description:** Mid to low mallee woodland to open mallee woodland of mixed species including *Eucalyptus comitae-vallis* and *Eucalyptus leptopoda* subsp. *subluta* over tall open to sparse shrubland dominated by *Acacia resinimarginea* over low open shrubland of mixed species dominated by *Beyeria sulcata var. sulcata, Phebalium canaliculatum*, *Thryptomene urceolaris*, *Homalocalyx thryptomenoides* and *Aluta aspera* subsp. *aspera* on orange clayey sand to sand on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, predominantly southern portion (south of Yerilgee Hills), one occurrence in central portion just north of Yerilgee Hills **Area mapped (Proportion of Study Area):** 1605.6 ha (6.4 %) **Sampling:** 16 quadrats – all within the Study Area (MRD073, MRD094, MRD104, MRD105, MRD114, MRD117, MRK039, MRK060, MRK061, MRM076, MRM077, MRM090, MRM091, MRM094, MRM095, MRM100) **Average Taxon Richness per Quadrat:** 16.1 (± 5.3) **Indicator Taxa:** *Leptospermum fastigiatum*, *Phebalium canaliculatum*, *Thryptomene urceolaris* **Significant Taxa:** *Acacia subrigida* (P2), *Calytrix creswellii* (P3), *Eremophila glabra* subsp. Diemals (R. Davis 11349), *Grevillea erectiloba* (P4), *Lepidosperma* cf. *lyonsii* (P1), *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3) **Variation:** In several occurrences a low sparse hummock grassland to hummock grassland of *Triodia rigidissima* or *T. scariosa* was present; such areas may represent transitional vegetation between this and VT MESGROS	 Plate 38: VT MEASSS (Quadrat MRM100)  Plate 39: VT MEASSS Variation with presence of hummock grassland (Quadrat MRM076)

VT	Summary	Photograph
MEASNS	**Name:** Mallee Eucalypt/Acacia Shrubland-North Sandplains **Description:** Occasional mid open mallee woodland of *Eucalyptus leptopoda* subsp. *subluta* over tall sparse shrubland dominated by *Acacia effusifolia* over low sparse shrubland of mixed species dominated by *Aluta aspera* subsp. *aspera, Phebalium canaliculatum*, *Euryomyrtus maidenii*, *Homalocalyx thryptomenoides* and *Thryptomene urceolaris* over low sparse tussock and hummock grassland of *Amphipogon caricinus* subsp. *caricinus* and *Triodia rigidissima* on yellow-brown to orange clayey sand to sandy loam, rarely with laterite gravel, on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 1177.7 ha (4.7 %) **Sampling:** 13 quadrats – all within the Study Area (MRD067, MRD070, MRD072, MRK036, MRK037, MRM043, MRM049, MRM050, MRM052, MRM056, MRM061, MRM062, MRM067) **Average Taxon Richness per Quadrat:** 13.2 (± 3.9) **Indicator Taxa:** *Aluta aspera* subsp. *aspera*, *Eucalyptus leptopoda* subsp. *subluta*, *Homalocalyx thryptomenoides* **Significant Taxa:** *Cyathostemon verrucosus* (P3), *Grevillea obliquistigma* subsp. *cullenii* (P3), *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3), *Philotheca coateana* (P3), *Philotheca deserti* subsp. *brevifolia* (P3) **Variation:** no major variation observed	 Plate 40: VT MEASNS (Quadrat MRM043)

VT	Summary	Photograph
AeEfS	**Name:** *Acacia effusifolia/Eremophila forrestii* Shrubland **Description:** Mid open mallee woodland of *Eucalyptus leptopoda* subsp. *subluta* or *E. rigidula* over tall sparse shrubland dominated by *Acacia effusifolia* and *A. caesaneura* over mid sparse shrubland dominated by *Eremophila forrestii* subsp. *forrestii* over low sparse shrubland of mixed species dominated by *Euryomyrtus maidenii*, *Phebalium canaliculatum*, *Prostanthera prostantheroides* and *Philotheca coateana* on yellow-brown to orange sandy clay loam to sandy loam with occasional granite or quartz gravel on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 1503.5 ha (6.0 %) **Sampling:** 19 quadrats – all within the Study Area (MRD035, MRD036, MRD046, MRD047, MRD048, MRD055, MRM039, MRM040, MRM041, MRM042, MRM044, MRM045, MRM046, MRM053, MRM055, MRM057, MRM063, MRM064, MRM072) **Average Taxon Richness per Quadrat:** 11.8 (± 3.7) **Indicator Taxa:** *Acacia effusifolia* **Significant Taxa:** *Cyathostemon verrucosus* (P3), *Jacksonia lanicarpa* (P1), *Philotheca coateana* (P3), *Philotheca deserti* subsp. *brevifolia* (P3) **Variation:** no major variation observed	 Plate 41: VT AeEfS (Quadrat MRM045)

VT	Summary	Photograph
ABeSG	**Name:** *Acacia/Baeckea elderiana* Shrubland-Gravel Slopes **Description:** Tall open shrubland of mixed species dominated by *Acacia caesaneura*, *A. ramulosa* var. *ramulosa, A. effusifolia* and *Allocasuarina eriochlamys* subsp. *eriochlamys* over low open shrubland of mixed species dominated by *Leucopogon* sp. Clyde Hill (M.A.Burgman1207), *Baeckea elderiana*, *Eremophila latrobei* subsp. *latrobei*, *Philotheca brucei* subsp. *brucei* and *Olearia humilis* on orange clay to sandy clay loam with quartz and/or ironstone gravel on gently undulating plains and slopes of low hills. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills), with several occurrences in Yerilgee Hills **Area mapped (Proportion of Study Area):** 501.8 ha (2.0 %) **Sampling:** 10 quadrats within the Study Area (GILE14, MRD059, MRD077, MRD080, MRD081, MRD083, MRK043, MRM073, MRM074, MRM081); 5 quadrats outside the Study Area (GILE10, GILE13, GILE32, GILE39, GILE49) **Average Taxon Richness per Quadrat:** 19.1 (± 3.2) **Indicator Taxa:** *Allocasuarina eriochlamys* subsp. *eriochlamys, Leucopogon* sp. Clyde Hill (M.A. Burgman 1207), *Olearia humilis, Prostanthera magnifica, Thysanotus manglesianus* **Significant Taxa:** *Banksia arborea* (P4), *Grevillea erectiloba* (P4), *Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1), *Philotheca coateana* (P3) **Variation:** In several occurrences a mid to low open mallee woodland of *Eucalyptus* species including *Eucalyptus ebbanoensis* subsp. *ebbanoensis*, *Eucalyptus ewartiana* or *Eucalyptus loxophleba* subsp. *lissophloia* was present.	 Plate 42: VT ABeSG (Quadrat MRD080)  Plate 43: VT ABeSG Variation with presence of Eucalyptus loxophleba subsp. lissophloia woodland (Quadrat MRM073)

VT	Summary	Photograph
MESGROS	**Name:** Mallee/Spinifex–Red/Orange Sand **Description:** Mid mallee woodland to open mallee woodland dominated by *Eucalyptus horistes* and *E. rigidula* over tall to mid sparse shrubland of mixed species including *A. hemiteles, A. eremophila* var. *eremophila* and *A. colletioides* over low sparse shrubland of mixed species including *Beyeria sulcata*, *Westringia rigida* and *Westringia cephalantha* var. *cephalantha* over low open hummock grassland of *Triodia scariosa* or *T. rigidissima* on red or orange sand to sandy clay loam on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) and southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 745.8 ha (3.0 %) **Sampling:** 10 quadrats– all within the Study Area (MRD065, MRD075, MRD076, MRD099, MRD103, MRD107, MRD108, MRD113, MRM097, MRM098) **Average Taxon Richness per Quadrat:** 13.9 (± 3.4) **Indicator Taxa:** *Acacia eremophila* var. *eremophila, Beyeria sulcata* var. *sulcata, Eucalyptus horistes, Melaleuca vinnula, Olearia incana, Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2), *Westringia rigida* **Significant Taxa:** *Calytrix creswellii* (P3), *Cryptandra* ?*crispula* (P3), *Eremophila perglandulosa* (P1), ?Lamiaceae sp., *Lepidosperma* cf. sp. Parker Range (N. Gibson & M. Lyons 2094) (P1), *Melichrus* sp. Bungalbin Hill (F.H. & M.P. Mollemans 3069) (P3), *Microcorys* sp., *Persoonia leucopogon* (P1), *Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2), *Templetonia* sp. **Variation:** no major variation observed	 Plate 44: VT MESGROS (Quadrat MRD076)

VT	Summary	Photograph
ElArG	**Name:** *Eucalyptus leptopoda/Acacia resinimarginea*-Granite **Description:** Low open mallee woodland of *Eucalyptus leptopoda* subsp. *subluta* over mid shrubland dominated by *Acacia resinimarginea* and *Acacia prainii* on orange-brown sandy clay loam with granite, laterite and quartz gravel on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 34.9 ha (0.1 %) **Sampling:** 1 quadrat –within the Study Area (MRM108) **Average Taxon Richness per Quadrat:** 9.0 **Indicator Taxa:** N/A (single quadrat) **Significant Taxa: -** **Variation:** no major variation observed	 Plate 45: VT ElArG (Quadrat MRM108)

VT	Summary	Photograph
CEWSP	**Name:** *Callitris/Eucalyptus* Woodland/Spinifex-Plains **Description:** Low open mallee woodland/woodland of *Callitris columellaris* and *Eucalyptus rigidula* over tall open to sparse shrubland dominated by *Acacia effusifolia* and *A. burkittii* over mid to low sparse shrubland of mixed species including *Phebalium canaliculatum* and *Scaevola spinescens* over low open to sparse hummock grassland of *Triodia rigidissima* on orange to red sandy clay loam on gently undulating plains. **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 624.9 ha (2.5 %) **Sampling:** 9 quadrats – all within the Study Area (MRD068, MRD069, MRD071, MRD074, MRK035, MRM047, MRM051, MRM071, MRM075) **Average Taxon Richness per Quadrat:** 17.4 (± 5.4) **Indicator Taxa:** none defined **Significant Taxa: -** **Variation:** no major variation observed	 Plate 46: VT CEWSP (Quadrat MRM047)

VT	Summary	Photograph
CWEcRS	**Name:** *Callitris* Woodland/*Eremophila caperata*-Red Sand **Description:** Mid open mallee woodland/woodland of mixed species dominated by *Callitris columellaris* and *Eucalyptus concinna* over tall open shrubland dominated by *Acacia burkittii* and *A. ramulosa* var. *ramulosa* over mid sparse shrubland dominated by *Eremophila caperata* and *Acacia colletioides* over low open shrubland of mixed species including *Scaevola spinescens* and *Olearia muelleri* on red or orange-brown sand or sandy clay loam on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) and southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 804.9 ha (3.2 %) **Sampling:** 9 quadrats – all within the Study Area **(**MRD054, MRD066, MRK053, MRK059, MRM058, MRM065, MRM068, MRM069, MRM079) **Average Taxon Richness per Quadrat:** 16.3 (± 5.4) **Indicator Taxa:** *Eremophila caperata, Eucalyptus concinna, Eremophila decipiens* subsp. *decipiens* **Significant Taxa:** *Phebalium* sp. Yerilgee Sandplain (J. Jackson 223) (P2) **Variation:** In several occurrences a low sparse hummock grassland to hummock grassland of *Triodia scariosa* or *T. rigidissima* was present.	 Plate 47: VT CWEcRS (Quadrat MRM069)  Plate 48: VT CWEcRS Variation with presence of hummock grassland (Quadrat MRM079)

VT	Summary	Photograph
ElWS	**Name:** *Eucalyptus loxophleba* Woodland-South **Description:** Mid to low mallee woodland dominated by *Eucalyptus loxophleba* subsp. *lissophloia* over tall open shrubland of *Acacia burkittii* over mid to low open shrubland of mixed species dominated by *Acacia colletioides*, *Alyxia buxifolia, Eremophila decipiens* subsp. *decipiens*, *Exocarpos aphyllus* and *Senna artemisioides* subsp. *filifolia* on red or brown clay loam or sandy clay on gently undulating plains and flats. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 340.6 ha (1.4 %) **Sampling:** 7 quadrats – all within the Study Area (MRD100, MRD110, MRD111, MRK065, MRM092, MRM103, MRM107) **Average Taxon Richness per Quadrat:** 21.1 (± 6.9) **Indicator Taxa:** *Eremophila decipiens* subsp. *decipiens* **Significant Taxa:** *Acacia crenulata* (P3), *Neurachne lanigera* (P1) **Variation:** no major variation observed	 Plate 49: VT ElWS (Quadrat MRM107)

VT	Summary	Photograph
EsWS	**Name:** *Eucalyptus salmonophloia* Woodland-South **Description:** Mid woodland of *Eucalyptus salmonophloia* and/or *E. transcontinentalis* over mid open shrubland dominated by *Eremophila ionantha* and *E. scoparia* over low open to sparse shrubland of mixed species including *Grevillea acuaria*, *Olearia muelleri* and *Scaevola spinescens* on red clay loam or sandy clay loam on gently undulating plains and flats. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 888.6 ha (3.6 %) **Sampling:** 11 quadrats– all within the Study Area **(**MRD098, MRD101, MRD106, MRD118, MRD120, MRK064, MRK066, MRK072, MRM093, MRM096, MRM102) **Average Taxon Richness per Quadrat:** 18.0 (± 2.3) **Indicator Taxa:** *Eremophila ionantha***,** *Eucalyptus salmonophloia, Grevillea acuaria* **Significant Taxa:** *Eremophila caerulea* subsp. *merrallii* (P4) **Variation:** In several occurrences there were woodlands of *Eucalyptus loxophleba* subsp. *lissophloia, E. griffithsii* and *E. salubris* present.	 Plate 50: VT 8 (Quadrat MRD106)  Plate 51: VT EsWS Variation with presence of E. salubris woodland (Quadrat MRD096)

VT	Summary	Photograph
EWEsS	**Name:** *Eucalyptus* Woodland/*Eremophila scoparia* Shrubland **Description:** Mid woodland of a combination of *Eucalyptus ravida* or *E. salmonophloia* and/or *E. salubris* over tall open shrubland dominated by *Eremophila scoparia* over low sparse shrubland dominated by *Atriplex vesicaria* and *A. nummularia* subsp. *spathulata* on red-brown or red sandy clay loam or clay loam on gently undulating plains and flats. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (Yerilgee Hills, south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 325.1 ha (1.3 %) **Sampling**: 8 quadrats within the Study Area (GILE51, MRD085, MRK046, MRK049, MRK057, MRM083, MRM086, MRM088); 1 quadrat outside the Study Area (GILE34) **Average Taxon Richness per Quadrat:** 21.0 (± 3.7) **Indicator Taxa**: *Atriplex nummularia* subsp. *spathulata, Atriplex vesicaria, Eremophila scoparia, Frankenia desertorum, Maireana tomentosa* subsp. *tomentosa, Maireana trichoptera, Ptilotus exaltatus* **Significant Taxa: -** **Variation:** There was one occurrence of a *E. longissima* woodland and one occurrence of *Casuarina pauper* woodland on a quartz rise.	 Plate 52: VT EWEsS (Quadrat MRK046)  Plate 53: VT EWEsS Variation with presence of Casuarina pauper woodland (Quadrat MRD085)

VT	Summary	Photograph
EWASG	**Name:** Eucalypt Woodland/*Acacia* Shrubland-Granite **Description:** Low mallee woodland of *Eucalyptus kochii* subsp. *amaryssia* and *Eucalyptus griffithsii* over tall shrubland to open shrubland dominated by *Acacia burkittii*, *A. crenulata*, *A. ramulosa* var. *ramulosa*, *A. tetragonophylla* and *Allocasuarina acutivalvis* subsp. *acutivalvis* over mid to low sparse shrubland of mixed species including *Senna artemisioides* subsp. *filifolia*, *Dodonaea adenophora* and *Philotheca brucei* subsp. *brucei* on orange or pinkish brown clay loam with granite, laterite and quartz stones and occasional granite outcropping on gently undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 59.9 ha (0.2 %) **Sampling:** 2 quadrats – both within the Study Area (MRM105, MRM106) **Average Taxon Richness per Quadrat:** 22.5 (± 4.9) **Indicator Taxa:** *Acacia colletioides, Acacia crenulata* (P3), *Allocasuarina acutivalvis* subsp. *acutivalvis, Dodonaea adenophora, Eucalyptus kochii* subsp. *amaryssia, Hakea francisiana, Sclerolaena fusiformis* **Significant Taxa:** *Acacia crenulata* (P3) **Variation:** At one location the mallee woodland stratum was absent.	 Plate 54: VT EWASG (Quadrat MRM105)  Plate 55: VT EWASG Variation with the absence of the mallee woodland (Quadrat MRM106)

VT	Summary	Photograph
EoEcW	**Name:** *Eucalyptus oleosa/corrugata* Woodland **Description:** Low woodland/mallee woodland dominated by *Eucalyptus corrugata* and *E. oleosa* subsp. *oleosa* over mid sparse shrubland of mixed species including *Atriplex nummularia* subsp. *spathulata, Eremophila pustulata* and *Senna artemisioides* subsp. *filifolia* on red-brown or brown sandy clay loam or clay loam on undulating plains. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 361.4 ha (1.5 %) **Sampling:** 6 quadrats – all within the Study Area (MRD087, MRD089, MRD091, MRK051, MRK074, MRM089) **Average Taxon Richness per Quadrat:** 17.2 (± 2.9) **Indicator Taxa:** *Acacia erinacea, Austrostipa platychaeta, Eremophila pustulata, Eremophila* sp. Mt Jackson (G.J. Keighery 4372), *Eucalyptus oleosa* subsp. *oleosa, Exocarpos aphyllus* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 56: VT EoEcW (Quadrat MRK074)

VT	Summary	Photograph
CpEW	**Name:** *Casuarina pauper*/Eucalypt Woodland **Description:** Mid to low mallee woodland/woodland of a combination of *Casuarina pauper*, *Eucalyptus loxophleba* subsp. *lissophloia* and *E. salubris* over tall open to sparse shrubland of mixed species dominated by *Acacia burkittii*, *A. duriuscula*, *Eremophila oldfieldii* subsp. *angustifolia* and *E. oppositifolia* subsp. *angustifolia* over low sparse shrubland dominated by *Rhagodia drummondii* and *Scaevola spinescens* over low sparse chenopod shrubland of mixed species including *Maireana trichoptera*, *M. georgei* and *Sclerolaena diacantha* on pink-brown, cream or red clay loam or light clay on gently undulating plains, flats and low rises. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills), southern portion (Yerilgee Hills) **Area mapped (Proportion of Study Area):** 614.2 ha (2.5 %) **Sampling:** 10 quadrats within the Study Area (MRD052, MRD057, MRD061, MRD064, MRD078, MRD088, MRD090, MRK042, MRK047, MRM082); 11 outside the Study Area (GILE02, GILE15, GILE17, GILE20, GILE21, GILE29, GILE35, GILE40, GILE42, GILE45, GILE48) **Average Taxon Richness per Quadrat:** 20.4 (± 3.4) **Indicator Taxa:** *Casuarina pauper* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 57: VT CpEW (Quadrat MRK042)

VT	Summary	Photograph
EWLSB	**Name:** Eucalypt Woodland/Lignum Shrubland-Basins **Description:** Low mallee woodland of *Eucalyptus loxophleba* subsp. *lissophloia* and *E. yilgarnensis* over low sparse shrubland of *Duma florulenta* on orange-brown or brown-cream sandy loam or sandy clay loam on basin margins. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 22.3 ha (0.1 %) **Sampling:** 2 quadrats – both within the Study Area (MRD102, MRK062) **Average Taxon Richness per Quadrat:** 8.0 (± 4.2) **Indicator Taxa:** *Atriplex stipitata, Duma florulenta, Eucalyptus loxophleba* subsp. *lissophloia, Eucalyptus vittata, Eucalyptus yilgarnensis, Ptilotus holosericeus, Sclerolaena diacantha* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 58: VT EWLSB (Quadrat MRK062)

VT	Summary	Photograph
MFC	**Name:** Mulga/Forbs-Clay Pan **Description:** Tall open shrubland of *Acacia aptaneura*, *A. burkittii* and *Eremophila longifolia* over low sparse shrubland dominated by *Enchylaena tomentosa* var. *tomentosa* and *Ptilotus obovatus* over low sparse forbland of mixed species including *Calandrinia pumila*, *Portulaca oleracea, Dysphania melanocarpa* forma *melanocarpa* and *Alternanthera nodiflora* on red-brown clay loam in clay pans. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 17.0 ha (0.1 %) **Sampling:** 1 quadrat –within the Study Area (MRM025) **Average Taxon Richness per Quadrat:** 26.0 **Indicator Taxa:** N/A **Significant Taxa:** - **Variation:** no major variation observed	 Plate 59: VT MFC (Quadrat MRM025)

VT	Summary	Photograph
EmEsC	**Name:** *Eremophila maculata/Eragrostis setifolia*-Clay Pan **Description:** Tall sparse shrubland dominated by *Acacia burkittii* over low sparse shrubland dominated by *Eremophila maculata* subsp. *brevifolia* over low sparse tussock grassland dominated by *Eragrostis setifolia* over low sparse chenopod shrubland of mixed species including *Rhagodia drummondii*, *Maireana tomentosa* subsp. *tomentosa* and *Sclerolaena diacantha* over low sparse forbland of mixed species including *Convolvulus clementii*, *Ptilotus holosericeus*, *Cullen cinereum*, *Rhodanthe floribunda* and *Streptoglossa liatroides* on red cracking clay in clay pans. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 12.1 ha (0.1 %) **Sampling:** 1 quadrat – within the Study Area (MRD086) **Average Taxon Richness per Quadrat:** 26.0 **Indicator Taxa:** N/A **Significant Taxa: -** **Variation:** no major variation observed	 Plate 60: VT EmEsC (Quadrat MRD086)

VT	Summary	Photograph
LAaSB	**Name:** Lignum/*Atriplex amnicola* Shrubland-Basins **Description:** Mid isolated shrubs of mixed species including *Hakea preissii*, *Acacia burkittii* and *A. tetragonophylla* over mid to low sparse shrubland dominated by *Duma florulenta* and *Atriplex amnicola* on red to orange clay in basins. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 11.4 ha (0.1 %) **Sampling:** 4 quadrats – all within the Study Area (MRD016, MRD024, MRD040, MRD045) **Average Taxon Richness per Quadrat:** 22.0 (± 6.2) **Indicator Taxa:** *Atriplex amnicola, Bergia perennis* subsp. *exigua, Sida fibulifera* **Significant Taxa: -** **Variation:** occasionally *Duma florulenta* was absent from the low shrubland stratum.	 Plate 61: VT LAaSB (Quadrat MRD016)

VT	Summary	Photograph
AbCSSL	**Name:** *Acacia burkittii*/Chenopod Shrublands-Salt Lake **Description:** Tall sparse shrubland dominated by *Acacia burkittii*, *Eremophila longifolia*, *E. miniata* and *Hakea preissii* over low sparse shrubland of mixed species including *Atriplex vesicaria*, *Maireana pyramidata* and *Ptilotus obovatus* over low sparse hummock grassland of *Triodia basedowii* on orange or red clayey sand or sand on undulating plains adjacent to salt lakes. **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 347.0 ha (1.4 %) **Sampling:** 4 quadrats – all within the Study Area (MRD015, MRD018, MRD032, MRD039) **Average Taxon Richness per Quadrat:** 21.0 (± 2.2) **Indicator Taxa**: *Eremophila miniata, Maireana pyramidata, Rhagodia drummondii, Solanum nummularium* **Significant Taxa:** *Olearia* aff. *pimeleoides* **Variation:** There was one occurrence of an *Acacia aptaneura* and *A. caesaneura* tall sparse shrubland, with *Acacia burkittii* absent at this location.	 Plate 62: VT AbCSSL (Quadrat MRD032)  Plate 63: VT AbCSSL Variation with the presence of Acacia aptaneura and A. caesaneura shrubland (Quadrat MRD018)

VT	Summary	Photograph
CCSSL	**Name:** Chenopod/*Cratystylis* Shrubland-Salt Lake **Description:** Tall sparse shrubland dominated by *Acacia masliniana* and *A. burkittii* over mid sparse shrubland dominated by *Cratystylis subspinescens, Maireana pyramidata* and *Atriplex vesicaria* over low sparse shrubland dominated by *Gunniopsis quadrifida* and *Maireana georgei* on red or red-brown sandy clay loam or light clay on gently undulating plains and flats adjacent to salt lakes. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 995.6 ha (4.0 %) **Sampling:** 8 quadrats – all within the Study Area (MRD014, MRD020, MRD021, MRD025, MRD027, MRM029, MRM030, MRM033) **Average Taxon Richness per Quadrat:** 19.1 (± 5.0) **Indicator Taxa:** *Cratystylis subspinescens, Gunniopsis quadrifida, Maireana atkinsiana, Maireana georgei* **Significant Taxa: -** **Variation:** There was an absence of the *Acacia masliniana* and *A. burkittii* sparse shrubland at some locations.	 Plate 64: VT CCSSL (Quadrat MRM033)  Plate 65: VT CCSSL Variation with the absence of the Acacia masliniana and A. burkittii shrubland (Quadrat MRM029)

VT	Summary	Photograph
EPCS	**Name:** *Eremophila pantonii*/Chenopod Shrubland **Description:** Mid open to sparse shrubland dominated by *Eremophila pantonii*, *Hakea preissii*, *Scaevola spinescens* and *Senna artemisioides* subsp. x *sturtii* over chenopod shrubland of mixed species including *Maireana georgei*, *M. tomentosa* subsp. *tomentosa*, *Sclerolaena diacantha* and *S. eriacantha* on red or light brown light clay or clay loam with ironstone, quartz, granite and laterite stones on flats. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 48.6 ha (0.2 %) **Sampling:** 4 quadrats – all within the Study Area (MRM005, MRM008, MRM010, MRM011) **Average Taxon Richness per Quadrat:** 10.8 (± 1.5) **Indicator Taxa:** *Hakea preissii, Sclerolaena eriacantha* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 66: VT EPCS (Quadrat MRM008)

VT	Summary	Photograph
EvWCS	**Name:** *Eucalyptus vittata* Woodland/Chenopod Shrubland **Description:** Mid open woodland of *Eucalyptus vittata* over low sparse shrubland of *Acacia merrallii*, *Atriplex stipitata* and *Eremophila scoparia* over low sparse chenopod shrubland of *Maireana pentatropis*, *M. thesioides*, *M. trichoptera* and *Sclerolaena diacantha* on white to cream clay loam with stony colluvium in outwashes and flow lines below breakaways. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 6.4 ha (0.03 %) **Sampling:** 1 quadrat – within the Study Area (MRK076) **Average Taxon Richness per Quadrat:** 18.0 **Indicator Taxa:** N/A **Significant Taxa: -** **Variation:** no major variation observed	 Plate 67: VT EvWCS (Quadrat MRK076)

VT	Summary	Photograph
EcWC	**Name:** *Eucalyptus clelandiorum* Woodland-Calcrete **Description:** Low woodland of *Eucalyptus clelandiorum* over low sparse shrubland mixed species dominated by *Ptilotus obovatus*, *Maireana pentatropis* and *Sclerolaena diacantha* on brown clay loam with calcrete stones on low rises. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 6.7 ha (0.03 %) **Sampling:** 1 quadrat – within the Study Area (MRD002) **Average Taxon Richness per Quadrat:** 9.0 **Indicator Taxa:** N/A **Significant Taxa:** - **Variation:** no major variation observed	 Plate 68: VT EcWC (Quadrat MRD002)

VT	Summary	Photograph
AMSBG	**Name:** *Acacia*/*Malleostemon* Shrubland/*Borya*-Granite **Description:** Tall sparse shrubland dominated by *Acacia burkittii* and *A. ramulosa* var. *ramulosa* over mid open to sparse shrubland dominated by *Malleostemon tuberculatus, Mirbelia microphylla* and *Prostanthera campbellii* over low sparse tussock grassland dominated by *Aristida contorta*, *Austrostipa tenuifolia* and *Tripogonella loliiformis* over low sparse forbland dominated by *Borya constricta, Cheilanthes sieberi* subsp. *sieberi* and *Goodenia havilandii* on orange-brown sandy clay or clay loam on granite outcrops. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 71.9 ha (0.3 %) **Sampling:** 4 quadrats – all within the Study Area (MRD109, MRK071, MRM104, MRM109) **Average Taxon Richness per Quadrat:** 26.8 (± 5.7) **Indicator Taxa:** *Austrostipa tenuifolia, Borya constricta, Eriachne ovata, Malleostemon tuberculatus, Prostanthera campbellii, Stylidium dielsianum* **Significant Taxa:** *Lepidosperma* cf. *lyonsii* (P1) **Variation:** no major variation observed	 Plate 69: VT AMSBG (Quadrat MRM104)

VT	Summary	Photograph
ASSDB	**Name:** *Acacia* Shrubland-Southern Duricrust Breakaways **Description:** Tall sparse shrubland of *Acacia caesaneura* and *A. quadrimarginea* over mid sparse shrubland dominated by *Dodonaea rigida*, *Eremophila latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *brucei* over low sparse shrubland dominated by *Calytrix amethystina* and *Verticordia interioris* on pink-brown clay or clay loam with lateritic duricrust gravel and outcropping on low breakaways. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 31.6 ha (0.1 %) **Sampling:** 3 quadrats – all within the Study Area (MRD056, MRD062, MRD079) **Average Taxon Richness per Quadrat:** 17.7 (± 1.5) **Indicator Taxa:** *Calytrix amethystina, Eriachne mucronata, Tripogonella loliiformis, Verticordia interioris* **Significant Taxa:** - **Variation:** no major variation observed	 Plate 70: VT ASSDB (Quadrat MRD079)

VT	Summary	Photograph
AEfG	**Name:** *Acacia/Eremophila forrestii* Shrubland-Granite **Description:** Tall sparse shrubland of *Acacia quadrimarginea* and *A. ramulosa* var. *ramulosa* over mid sparse shrubland dominated by *Eremophila forrestii* subsp. *forrestii* over low open to sparse tussock grassland dominated by *Aristida contorta* and *Tripogonella loliiformis* over low sparse forbland of mixed species including *Calandrinia ptychosperma*, *Cheilanthes sieberi* subsp. *sieberi* and *Erodium cygnorum* on orange light clay or clayey sand on low rises and plains with granite outcropping. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 74.2 ha (0.3 %) **Sampling:** 5 quadrats – all within the Study Area (MRD031, MRD034, MRD053, MRM054, MRM070) **Average Taxon Richness per Quadrat:** 20.4 (± 13.1) **Indicator Taxa:** none defined **Significant Taxa: -** **Variation:** no major variation observed	 Plate 71: VT AEfG (Quadrat MRD031)

VT	Summary	Photograph
AEpCS	**Name:** *Acacia/Eremophila pantonii/*Chenopod Shrubland **Description:** Tall open to sparse shrubland dominated by *Acacia burkittii*, *A. incurvaneura* and *A. kalgoorliensis* over mid sparse shrubland dominated by *Eremophila pantonii* over low open to sparse shrubland dominated by *Ptilotus obovatus* and *Sclerolaena fusiformis* red clay loam with calcrete, ironstone and quartz stones and occasionally calcrete outcropping on undulating plains and flats. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 119.0 ha (0.5 %) **Sampling:** 9 quadrats – all within the Study Area (CNR-011, CNR-014, CNR-028, CNR-029, CNR-080, CNR-105, CNR-126, CNR-160, CNR-180) **Average Taxon Richness per Quadrat:** 16.4 (± 6.5) **Indicator Taxa:** *Austrostipa trichophylla* **Significant Taxa:** - **Variation:** no major variation observed	 Plate 72: VT AEpCS (Quadrat CNR-011)

VT	Summary	Photograph
AEoCS	**Name:** *Acacia/Eremophila oldfieldii/*Chenopod Shrubland **Description:** Tall open to sparse shrubland dominated by *Acacia kalgoorliensis, A. burkittii* and *Eremophila oldfieldii* subsp. *angustifolia* over mid sparse shrubland dominated by *Dodonaea adenophora, D. lobulata*, *E. pantonii* and *Senna artemisioides* subsp. *filifolia* over low sparse shrubland dominated by *Ptilotus obovatus, Scaevola spinescens* and *Sclerolaena fusiformis* on red-brown or red clay loam with ironstone, calcrete and quartz stones and occasionally calcrete or ironstone outcropping on low rises and ridges. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 50.4 ha (0.2 %) **Sampling:** 7 quadrats – all within the Study Area (CNR-017, CNR-046, CNR-077, CNR-151, CNR-156, CNR-158, MRK018) **Average Taxon Richness per Quadrat:** 17.4 (± 3.8) **Indicator Taxa:** *Acacia kalgoorliensis, Eucalyptus clelandiorum, Olearia calcarea* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 73: VT AEoCS (Quadrat CNR-156)

VT	Summary	Photograph
EcW	**Name:** *Eucalyptus carnei* Woodland **Description:** Low open woodland of *Eucalyptus carnei* over mid open shrubland of *Dodonaea lobulata* and *Eremophila pantonii* over low sparse shrubland dominated by *Ptilotus obovatus* on orange-brown clay loam on stony mid to lower slopes. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 20.8 ha (0.1 %) **Sampling**: 2 quadrats within the Study Area (BULG33, MRD008); 4 quadrats outside the Study Area (BULG30, BULG34, BULG35, BULG36) **Average Taxon Richness per Quadrat:** 12.5 (± 4.8) **Indicator Taxa:** *Dodonaea lobulata, Eremophila pantonii, Eucalyptus carnei* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 74: VT EcW (Quadrat MRD008)

VT	Summary	Photograph
MAcPS	**Name:** Mulga/*Acacia cockertoniana/Ptilotus* Shrubland **Description:** Tall open to sparse shrubland of mixed *Acacia* species dominated by *Acacia incurvaneura* and *A. cockertoniana* over mid sparse shrubland of mixed species dominated by *Eremophila oldfieldii* subsp. *angustifolia, Dodonaea adenophora, A. exocarpoides* and *Scaevola spinescens* over low sparse shrubland dominated by *Ptilotus obovatus* on red or red-brown clay-loams with ironstone, quartz and basalt stones and occasionally ironstone outcropping on low rises, undulating plains and flats. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 313.8 ha (1.3 %) **Sampling:** 18 quadrats – all within the Study Area (BULG19, BULG20, CNR-016, CNR-018, CNR-023, CNR-027, CNR-037, CNR-039, CNR-053, CNR-061, CNR-063, CNR-066, CNR-113, CNR-119, CNR-159, CNR-166, MRK021, MRK028) **Average Taxon Richness per Quadrat:** 21.3 (± 5.5) **Indicator Taxa**: none defined **Significant Taxa:** *Acacia* sp. nov **Variation:** no major variation observed	 Plate 75: VT MAcPS (Quadrat CNR-023)

VT	Summary	Photograph
APbSYH	**Name:** Acacia/*Philotheca brucei* Shrubland-Yerilgee Hills **Description:** Tall shrubland to open shrubland dominated by *Acacia burkittii*, *A. ramulosa* var. *ramulosa* and *A. tetragonophylla* over mid sparse shrubland of mixed species dominated *Philotheca brucei* subsp. *brucei*, *Eremophila latrobei* subsp. *latrobei* and *Scaevola spinescens* on red clay loam with ironstone stones on lower slopes and plains. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (Yerilgee Hills) **Area mapped (Proportion of Study Area):** 454.5 ha (1.8 %) **Sampling:** 2 quadrats within the Study Area (MRD084, MRM080); 13 quadrats outside the Study Area (GILE03, GILE05, GILE07, GILE12, GILE18, GILE19, GILE24, GILE26, GILE27, GILE28, GILE37, GILE38, GILE46) **Average Taxon Richness per Quadrat:** 21.4 (± 2.6) **Indicator Taxa:** *Allocasuarina dielsiana* **Significant Taxa:** - **Variation:** no major variation observed	 Plate 76: VT APbSYH (Quadrat MRD084)

VT	Summary	Photograph
CMEfS	**Name:** *Callitris*/Mulga/*Eremophila forrestii* Shrubland **Description:** Low woodland to open woodland of *Callitris columellaris* and occasionally *Eucalyptus ebbanoensis* subsp. *ebbanoensis* and *E. longissima* over tall open to sparse shrubland dominated by *Acacia incurvaneura*, *A. caesaneura*, *A. mulganeura A. burkittii* and *A. ramulosa* var. *ramulosa* over mid sparse shrubland dominated by *Eremophila latrobei* subsp. *latrobei*, *E. forrestii* subsp. *forrestii* and *Scaevola spinescens* on orange to red clay loam on plains, flats and lower slopes. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills), southern portion (Yerilgee Hills) **Area mapped (Proportion of Study Area):** 1754.3 ha (7.0 %) **Sampling:** 13 quadrats within the Study Area (GILE50, MRD044, MRD049, MRD058, MRD060, MRD063, MRD082, MRK038, MRK040, MRK041, MRK045, MRM066, MRM087); 10 quadrats outside the Study Area (GILE04, GILE08, GILE09, GILE11, GILE16, GILE23, GILE25, GILE30, GILE33, GILE47 **Average Taxon Richness per Quadrat:** 21.0 (± 5.7) **Indicator Taxa:** none defined **Significant Taxa: -** **Variation:** no major variation observed	 Plate 77: VT CMEfS (Quadrat MRD063)

VT	Summary	Photograph
AASYH	**Name:** *Acacia/Allocasuarina* Shrubland-Yerilgee Hills **Description:** Low woodland to open woodland dominated by a combination of *Casuarina pauper, Eucalyptus longissima* and *E. corrugata* over tall open to sparse shrubland dominated by *Acacia burkittii, A. duriuscula, A. ramulosa* var. *ramulosa* and *Allocasuarina acutivalvis* subsp. *acutivalvis* over mid sparse shrubland of mixed species dominated by *Eremophila latrobei* subsp. *latrobei, Philotheca brucei* subsp. *brucei* and *Scaevola spinescens* over low sparse shrubland dominated by *Hibbertia pungens* and *Olearia muelleri* on red clay loam with ironstone, laterised ironstone and quartz stones and occasionally ironstone outcropping on the slopes and crests of low ridges. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (Yerilgee Hills) **Area mapped (Proportion of Study Area):** 829.2 ha (3.3 %) **Sampling:** 10 quadrats within the Study Area (MRD092, MRD093, MRD097, MRK044, MRK048, MRK050, MRK052, MRK056, MRM084, MRM085); 1 quadrat outside the Study Area (GILE43) **Average Taxon Richness per Quadrat:** 20.7 (± 3.4) **Indicator Taxa:** *Acacia duriuscula, Hibbertia pungens* **Significant Taxa:** *Eremophila caerulea* subsp. *merrallii* (P4), *Eutaxia rubricarina* (P3), *Grevillea erectiloba* (P4), *Grevillea georgeana* (P3), *Grevillea* sp. Yerilgee Hills (T. Laslett TL 025) (P1), *Hibbertia lepidocalyx* subsp. *tuberculata* (P3) **Variation:** There was an absence of the *Casuarina pauper* / *Eucalyptus* woodland at a number of locations.	 Plate 78: VT AASYH (Quadrat MRD097)  Plate 79: VT AASYH Variation with absence of *Casuarina pauper* / *Eucalyptus* woodland (Quadrat MRK044)

VT	Summary	Photograph
MEfSN	**Name:** Mulga/*Eremophila forrestii* Shrubland-Northern **Description:** Tall shrubland to sparse shrubland of mixed species dominated by *Acacia incurvaneura, A. caesaneura A. aptaneura, A. ramulosa* var. *ramulosa* and *A. tetragonophylla* over mid sparse shrubland dominated by *Eremophila forrestii* subsp. *forrestii* over low sparse shrubland of mixed species including *Ptilotus obovatus*, *Abutilon cryptopetalum, Sida ectogama, Solanum lasiophyllum* and *Sida* sp. dark green fruits (S. van Leeuwen 2260) over low sparse grassland and forbland of mixed species including *Monachather paradoxus, Eragrostis eriopoda, Austrostipa scabra* and *Cheilanthes sieberi* subsp. *sieberi* on red or red-brown sandy or clay-loam, frequently with some ironstone, quartz and laterised ironstone stones on flats, undulating plains, lower slopes and in minor drainage lines. **Definition method:** floristic composition classification **Location:** Mt Richardson area; NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 2768.7 ha (11.1 %) **Sampling:** 71 quadrats – all within the Study Area (CNR-010, CNR-012, CNR-019, CNR-020, CNR-025, CNR-026, CNR-030, CNR-034, CNR-035, CNR-038, CNR-044, CNR-048, CNR-049, CNR-056, CNR-060, CNR-062, CNR-064, CNR-067, CNR-068, CNR-069, CNR-070, CNR-071, CNR-073, CNR-074, CNR-075, CNR-076, CNR-079, CNR-083, CNR-085, CNR-091, CNR-095, CNR-096, CNR-098, CNR-100, CNR-101, CNR-102, CNR-103, CNR-104, CNR-109, CNR-110, CNR-112, CNR-123, CNR-125, CNR-128, CNR-131, CNR-133, CNR-142, CNR-143,CNR-144, CNR-145, CNR-150, CNR-157, CNR-164, CNR-174, CNR-175, CNR-176, CNR-177, CNR-181, CNR-194, MRD009, MRK001, MRK002, MRK003, MRK004, MRK007, MRK009, MRK019, MRK022, MRM013, MRM019, MRM022) **Average Taxon Richness per Quadrat:** 22.9 (± 6.4) **Indicator Taxa:** *Solanum ferocissimum* **Significant Taxa:** *Acacia* sp. (unidentified), *Jacksonia lanicarpa* (P1), *Micromyrtus serrulata* (P3), *Phyllanthus baeckeoides* (P3) **Variation:** no major variation observed	 Plate 80: VT MEfSN (Quadrat MRK019)

VT	Summary	Photograph
MAqSSF	**Name:** Mulga/*Acacia quadrimarginea* Shrubland-Slopes/Flats **Description:** Tall open to sparse shrubland dominated by *Acacia incurvaneura*, *A. caesaneura, A. quadrimarginea* and *A. ramulosa* var. *ramulosa* over mid open to sparse shrubland dominated by *Eremophila forrestii* subsp. *forrestii* over low sparse shrubland of mixed species including *E. jucunda* subsp. *jucunda, Sida* sp. Golden calyces glabrous (H.N. Foote 32) and *S.* sp. dark green fruits (S. van Leeuwen 2260) over low sparse grassland and forbland of mixed species including *Cheilanthes sieberi* subsp. *sieberi, Eragrostis eriopoda* and *Monachather paradoxus* on orange, red or red-brown clay-loam with ironstone and quartz stones on flats, lower slopes, undulating plains and occasionally ridges. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 1230.7 ha (4.9 %) **Sampling:** 37 quadrats within the Study Area (BULG01, BULG02, CNR-013, CNR-021, CNR-022, CNR-024, CNR-033, CNR-040, CNR-042, CNR-045, CNR-047, CNR-057, CNR-058, CNR-065, CNR-078, CNR-081, CNR-082, CNR-084, CNR-086, CNR-092, CNR-099, CNR-121, CNR-124, CNR-129, CNR-134, CNR-162, CNR-184, CNR-190, MRD010, MRD012, MRK011, MRK012, MRK020, MRM001, MRM003, MRM004, MRM006); 2 quadrats outside the Study Area (BULG48, BULG51) **Average Taxon Richness per Quadrat:** 14.7 (± 4.7) **Indicator Taxa:** none defined **Significant Taxa:** *Beyeria lapidicola* (P1), *Hemigenia exilis* (P4), *Hibiscus krichauffianus* (P3), *Micromyrtus serrulata* (P3), *Phyllanthus baeckeoides* (P3) **Variation:** no major variation observed	 Plate 81: VT MAqSSF (Quadrat CNR-190)

VT	Summary	Photograph
MEfSC	**Name:** Mulga/*Eremophila forrestii* Shrubland-Central **Description:** Tall open to sparse shrubland of dominated by *Acacia caesaneura, A. incurvaneura, A. aptaneura, A. ramulosa* var. *ramulosa* and *A. tetragonophylla* over mid sparse shrubland dominated by *Eremophila forrestii* subsp. *forrestii* over sparse shrubland of mixed species including *Rhagodia drummondii*, *Sida ectogama*, *Atriplex vesicaria*, *Enchylaena tomentosa* var. *tomentosa* and *Maireana georgei* on red sandy clay loam on plains. **Definition method:** floristic composition classification **Location:** NYHR, central portion (Lake Barlee area, between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 2592.2 ha (10.4 %) **Sampling:** 22 quadrats – all within the Study Area (MRD019, MRD023, MRD026, MRD028, MRD029, MRD030, MRD033, MRD037, MRD042, MRD050, MRM026, MRM027, MRM028, MRM031, MRM032, MRM034, MRM035, MRM037, MRM038, MRM048, MRM059, MRM060) **Average Taxon Richness per Quadrat:** 12.5 (± 3.9) **Indicator Taxa:** none defined **Significant Taxa:** *Jacksonia lanicarpa* (P1), *Philotheca coateana* (P3) **Variation:** no major variation observed	 Plate 82: VT MEfSC (Quadrat MRD029)

VT	Summary	Photograph
MECS	**Name:** Mulga/*Eremophila*/Chenopod Shrubland **Description:** Tall open shrubland to shrubland dominated by *Acacia caesaneura, A. incurvaneura*, *A. ramulosa* var. *ramulosa* and *A. tetragonophylla* over mid open to sparse shrubland dominated by *Eremophila. forrestii* subsp. *forrestii* and *Eremophila latrobei* subsp. *latrobei* over low sparse shrubland of mixed species including *Ptilotus obovatus, Teucrium teucriiflorum*, *Rhagodia drummondii* and *Enchylaena tomentosa* var. *tomentosa* on red sandy clay with ironstone, laterised ironstone and quartz stones on plains **Definition method:** floristic composition classification **Location:** Mt Richardson area; NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 978.2 ha (3.9 %) **Sampling:** 10 quadrats – all within the Study Area (MRM002, MRM007, MRM009, MRM014, MRM016, MRM017, MRM018, MRM020, MRM023, MRM024) **Average Taxon Richness per Quadrat:** 16.9 (± 3.0) **Indicator Taxa:** *Acacia craspedocarpa, Psydrax suaveolens* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 83: VT MECS (Quadrat MRM017)

VT	Summary	Photograph
AEgSB	**Name:** *Acacia/Eremophila glutinosa* Shrubland-BIF **Description:** Tall shrubland to open shrubland dominated by *Acacia cockertoniana, A. incurvaneura* and *A. quadrimarginea* over mid open to sparse shrubland of mixed species dominated by *Eremophila glutinosa, Dodonaea adenophora, Hysterobaeckea occlusal, Thryptomene decussata* and *Eremophila latrobei* subsp. *latrobei,* over low sparse shrubland of mixed species including *Prostanthera althoferi* subsp. *althoferi* and *Sida* sp. Golden calyces glabrous (H.N. Foote 32) over low sparse tussock grassland and forbland of mixed species including *Monachather paradoxus, Tripogon loliiformis* and *Cheilanthes sieberi* subsp. *sieberi* on red or brown clay-loam with ironstone and laterised ironstone stones, frequently over laterised ironstone or BIF outcropping, on crests and slopes of ridges and low rises. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 786.0 ha (3.2 %) **Sampling:** 55 quadrats within the Study Area (BULG08, BULG09, BULG10, BULG17, BULG18, BULG24, BULG26, BULG32, CNR-001, CNR-002, CNR-004, CNR-005, CNR-007, CNR-009, CNR-015, CNR-032, CNR-036, CNR-050 CNR-051, CNR-055, CNR-059, CNR-087, CNR-090, CNR-093, CNR-097, CNR-114, CNR-127, CNR-130, CNR-132, CNR-138, CNR-139, CNR-140, CNR-153, CNR-155, CNR-161, CNR-163, CNR-165, CNR-170, CNR-171, CNR-173, CNR-178, CNR-193, MRD004, MRD006, MRD011, MRK005, MRK006, MRK008, MRK014, MRK015, MRK016, MRK017, MRK025, MRK026, MRK034); 5 quadrats outside the Study Area (BULG29, BULG31 BULG42, BULG45, BULG49) **Average Taxon Richness per Quadrat:** 13.7 (± 4.7) **Indicator Taxa:** *Acacia cockertoniana* **Significant Taxa:** *Beyeria lapidicola* (P1), *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3), *Jacksonia lanicarpa* (P1), *Micromyrtus serrulata* (P3), *Phyllanthus baeckeoides* (P3) **Variation:** no major variation observed	 Plate 84: VT AEgSB (Quadrat CNR-001)

VT	Summary	Photograph
AHPS	**Name:** *Acacia/Hysterobaeckea/Prostanthera* Shrubland **Description:** Tall open to sparse shrubland dominated by *Acacia cockertoniana, A. incurvaneura* and *A. quadrimarginea* over mid to tall sparse shrubland dominated by *Hysterobaeckea occlusa, Thryptomene decussata, Eremophila glutinosa* and *Drummondita microphylla* over low sparse shrubland dominated by *Prostanthera prostantheroides* on brown or orange clay loam, often with laterised ironstone, BIF or duricrust outcropping on upper slopes and ridges. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 96.6 ha (0.4 %) **Sampling:** 6 quadrats within the Study Area (BULG06, CNR-137, CNR-168, MRD003, MRD007, MRK030); 1 quadrat outside the Study Area (BULG28) **Average Taxon Richness per Quadrat:** 14.1 (± 2.9) **Indicator Taxa:** *Dodonaea petiolaris, Drummondita microphylla, Hysterobaeckea occlusa, Prostanthera prostantheroides, Thryptomene decussata* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 85: VT AHPS (Quadrat CNR-137)

VT	Summary	Photograph
CATSB	**Name:** *Callitris/Acacia/Thryptomene* Shrubland-BIF **Description:** Tall shrubland to open shrubland dominated by *Callitris columellaris, Acacia incurvaneura* and *A. quadrimarginea* over mid open to sparse shrubland dominated by *Thryptomene decussata, Eremophila glutinosa, Drummondita microphylla* and *Eremophila latrobei* subsp. *latrobei* over low open to sparse shrubland dominated by *Dodonaea petiolaris*, *Ptilotus obovatus,* and *Sida* sp. Golden calyces glabrous (H.N. Foote 32) over low sparse forbland dominated by *Cheilanthes sieberi* subsp. *sieberi* on red or brown clay-loam, usually over BIF outcropping, on ridge crests and slopes. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 287.9 ha (1.2 %) **Sampling:** 32 quadrats within the Study Area (BULG03, BULG04, BULG05, BULG11, BULG12, BULG13, BULG15, BULG16, BULG21, BULG22, BULG25, CNR-003, CNR-006, CNR-008, CNR-041, CNR-043, CNR-088, CNR-089, CNR-094, CNR-111, CNR-115, CNR-117, CNR-118, CNR-120, CNR-154, CNR-183, CNR-191, CNR-192, MRK013, MRK023, MRK029, MRK031); 8 quadrats outside the Study Area (BULG27, BULG37, BULG38, BULG39, BULG40, BULG46, BULG47, BULG50 **Average Taxon Richness per Quadrat:** 14.1 (± 3.8) **Indicator Taxa:** *Eremophila glutinosa* **Significant Taxa:** *Beyeria lapidicola* (P1), *Micromyrtus serrulata* (P3), *Phyllanthus baeckeoides* (P3) **Variation:** no major variation observed	 Plate 86: VT CATSB (Quadrat CNR-089)

VT	Summary	Photograph
AMESSS	**Name:** Acacia/mixed *Eremophila* Shrubland-Stony Slopes **Description:** Tall open to sparse shrubland dominated by *Acacia incurvaneura* and *A. quadrimarginea* over mid to low sparse shrubland of mixed species dominated by *Dodonaea adenophora, Drummondita microphylla*, *Eremophila conglomerata*, *E. georgei* and *E. latrobei* subsp. *latrobei* over low sparse tussock grassland and forbland dominated by *Monachather paradoxus* and *Cheilanthes sieberi* subsp. *sieberi* on red or brown clay loam with ironstone, quartz and laterised ironstone stones on mid to lower slopes and undulating stony plains. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 190.3 ha (0.8 %) **Sampling:** 11 quadrats -all within the Study Area (BULG07, BULG14, BULG23, CNR-052, CNR-116, CNR-135, CNR-141, CNR-169, CNR-172, MRD005, MRK032) **Average Taxon Richness per Quadrat:** 15.4 (± 5.1) **Indicator Taxa:** *Eremophila conglomerata* **Significant Taxa:** *Beyeria lapidicola* (P1), *Micromyrtus serrulata* (P3) **Variation:** no major variation observed	 Plate 87: VT AMESSS (Quadrat CNR-169)

VT	Summary	Photograph
AEgSBR	**Name:** Acacia/*Eremophila georgei* Shrubland-BIF Ridges **Description:** Tall sparse shrubland dominated by *Acacia incurvaneura*, *A. cockertoniana* and *A. quadrimarginea* over mid sparse shrubland of mixed species dominated by *Dodonaea petiolaris, Eremophila georgei, E. latrobei* subsp. *latrobei* and *Philotheca brucei* subsp. *brucei* over low sparse shrubland dominated by *Ptilotus obovatus* and *Sida* sp. Golden calyces glabrous (H.N. Foote 32) on red-brown clay loam, usually over BIF outcropping, on crests and slopes of ridges. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 3.6 ha (0.01 %) **Sampling:** 1 quadrat within the Study Area (MRD013); 22 quadrats outside the Study Area (BRKG05, BRKG09, BRKG14, BRKG15, BRKG18, BRKG20, BRKG21, BRKG22, BRKG23, BRKG24, BRKG26, BRKG27, BRKG30, BRKG32, BRKG33, BRKG35, BRKG42, BRKG43, BRKG45, BRKG46, BRKG48, BRKG49 **Average Taxon Richness per Quadrat:** 12.1 (± 2.9) **Indicator Taxa:** *Sida* sp. Golden calyces glabrous (H.N. Foote 32) **Significant Taxa:** - **Variation:** no major variation observed	 Plate 88: VT AEgSBR (Quadrat MRD013)

VT	Summary	Photograph
AEpS	**Name:** *Acacia/Eremophila platycalyx* Shrubland **Description:** Tall open to sparse shrubland dominated by *A. incurvaneura*, *A. quadrimarginea* and *Eremophila platycalyx* subsp. *platycalyx* over mid sparse shrubland of mixed species including *Dodonaea petiolaris*, *D. rigida* and *Eremophila latrobei* subsp. *latrobei* over low open to sparse shrubland dominated by *Ptilotus obovatus* over low sparse tussock grassland and forbland of mixed species including *Aristida contorta*, *Cheilanthes sieberi* subsp. *sieberi* and *Enneapogon caerulescens* on red or red-brown clay loam with ironstone, granite and quartz stones, sometimes with ironstone outcropping, on slopes of ridges and plains. **Definition method:** floristic composition classification **Location:** Mt Richardson area; NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 82.4 ha (0.3 %) **Sampling:** 8 quadrats within the Study Area (CNR-107, CNR-122, CNR-167, CNR-182, MRK024, MRK027, MRK033, MRM012); 14 quadrats outside the Study Area (BRKG01, BRKG02, BRKG03, BRKG04, BRKG06, BRKG07, BRKG08, BRKG11, BRKG12, BRKG13, BRKG17, BRKG29, BRKG38, BRKG50) **Average Taxon Richness per Quadrat:** 14.1 (± 4.0) **Indicator Taxa:** *Eremophila platycalyx* subsp. *platycalyx* **Significant Taxa:** *Hemigenia exilis* (P4), *Hibiscus krichauffianus* (P3), *Phyllanthus baeckeoides* (P3) **Variation:** no major variation observed	 Plate 89: VT AEpS (Quadrat MRM012)

VT	Summary	Photograph
MEfHB	**Name:** Mulga/*Eriachne flaccida*/Forbs-Clay Pan **Description:** Tall open shrubland of *Acacia caesaneura*, *A. craspedocarpa*, *A. tetragonophylla* and *Eremophila longifolia* over low sparse tussock grassland dominated by *Eriachne flaccida* over low sparse forbland and sedgeland of mixed species including *Centipeda thespidioides*, *Cyperus iria, Goodenia havilandii* and *Dysphania glomulifera* on light brown clay in clay pans. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 1.1 ha (0.004 %) **Sampling:** 1 quadrat - within the Study Area (MRD001) **Average Taxon Richness per Quadrat:** 20.0 **Indicator Taxa:** N/A **Significant Taxa: -** **Variation:** no major variation observed	 Plate 90: VT MEfHB (Quadrat MRD001)

VT	Summary	Photograph
CpSLD	**Name:** *Casuarina pauper* Woodland-Salt Lake Dune **Description:** Low woodland of *Casuarina pauper* over mid sparse shrubland of mixed species including *Senna artemisioides* subsp. *filifolia*, *Acacia tetragonophylla*, *Exocarpos aphyllus* and *Templetonia incrassata* over low sparse shrubland of mixed species including *Maireana pyramidata*, *Atriplex vesicaria* and *Ptilotus obovatus* on red sand on low dunes adjacent to salt lakes. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 4.5 ha (0.02 %) **Sampling:** 1 quadrat -within the Study Area (MRD022) **Average Taxon Richness per Quadrat:** 9.0 **Indicator Taxa:** N/A **Significant Taxa:** - **Variation:** no major variation observed	 Plate 91: VT CpSLD (Quadrat MRD022)

VT	Summary	Photograph
MAqSG	**Name:** Mulga/*Acacia quadrimarginea* Shrubland–Granite **Description:** Tall shrubland dominated by *Acacia caesaneura* and *Acacia quadrimarginea* over mid sparse shrubland dominated by *Acacia tetragonophylla* and *Eremophila platycalyx* subsp. *platycalyx* over low sparse shrubland of mixed species including *Eremophila latrobei* subsp. *latrobei*, *Sida ectogama*, *Ptilotus obovatus* and *Cratystylis subspinescens* on orange clayey sand with granite and quartz stones over occasional granite outcropping on plains. **Definition method:** floristic composition classification **Location:** NYHR, northern portion (north of Lake Barlee area) **Area mapped (Proportion of Study Area):** 17.1 ha (0.1 %) **Sampling:** 1 quadrat – within the Study Area (MRM021) **Average Taxon Richness per Quadrat:** 20.0 **Indicator Taxa:** N/A **Significant Taxa: -** **Variation:** no major variation observed	 Plate 92: VT MAqSG (Quadrat MRM021)
ElWMsC	**Name:** *Eucalyptus lucasii* Woodland/Mulga Shrubland-Creek **Description:** Low mallee woodland of *Eucalyptus lucasii* over tall open shrubland dominated by *Acacia aptaneura* and *Acacia craspedocarpa* over mid sparse shrubland of mixed species including *Senna artemisioides* subsp. *x artemisioides*, *Senna artemisioides* subsp. *filifolia*, *Eremophila pantonii* and *Dodonaea lobulata* on red-brown sandy loam with ironstone and quartz stones in major drainage lines. **Definition method:** floristic composition classification **Location:** Mt Richardson area **Area mapped (Proportion of Study Area):** 8.6 ha (0.03 %) **Sampling:** 1 quadrat – within the Study Area (MRK010) **Average Taxon Richness per Quadrat:** 24.0 **Indicator Taxa:** N/A	

VT	Summary	Photograph
	Significant Taxa: - **Variation:** no major variation observed	Plate 93: VT ElWMsC (Quadrat MRK010)
MEfVS	**Name:** Mulga/*Eremophila forrestii*/*Verticordia* Shrubland **Description:** Tall sparse shrubland dominated by *Acacia caesaneura* and *A. incurvaneura* over mid sparse shrubland dominated by *Eremophila forrestii* subsp. *forrestii* over low open to sparse shrubland dominated by *Euryomyrtus maidenii, Mirbelia microphylla* and *Verticordia interioris* on orange sandy loam with granite stones and occasional granite outcropping on plains and flats. **Definition method:** floristic composition classification **Location:** NYHR, central portion (between Lake Barlee and Yerilgee Hills) **Area mapped (Proportion of Study Area):** 24.0 ha (0.10 %) **Sampling:** 4 quadrats – all within the Study Area (MRD041, MRD043, MRD051, MRM036) **Average Taxon Richness per Quadrat:** 19.3 (± 5.4) **Indicator Taxa:** *Mirbelia microphylla, Monachather paradoxus* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 94: VT MEfVS (Quadrat MRD041)

VT	Summary	Photograph
APgS	**Name:** *Acacia/Prostanthera grylloana* Shrubland **Description:** Tall sparse shrubland dominated by *Acacia burkittii, A. ramulosa* var. *ramulosa, A. resinimarginea* and *Allocasuarina acutivalvis* subsp. *acutivalvis* over mid sparse shrubland of mixed species dominated by *Alyxia buxifolia* and *Grevillea zygoloba* over low sparse shrubland dominated by *Prostanthera grylloana, Euryomyrtus maidenii, Dampiera tenuicaulis* var. *curvula* and *Leucopogon* sp. Clyde Hill (M.A. Burgman 1207) over low sparse tussock and hummock grassland dominated by *Amphipogon caricinus* var. *caricinus* and *Triodia scariosa* on red sandy clay with ironstone and quartz stones on undulating plains and low rises. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 30.6 ha (0.1 %) **Sampling:** 2 quadrats – both within the Study Area (MRK067, MRK069) **Average Taxon Richness per Quadrat:** 21.5 (± 6.4) **Indicator Taxa:** *Acacia resinimarginea, Comesperma integerrimum, Dampiera tenuicaulis* var. *curvula, Eucalyptus ewartiana, Euryomyrtus maidenii, Grevillea haplantha* subsp. *haplantha, Grevillea zygoloba, Leucopogon* sp. Clyde Hill (M.A. Burgman 1207), *Olearia pimeleoides*, *Seringia velutina, Triodia scariosa* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 95: VT APgS (Quadrat MRK067)

VT	Summary	Photograph
EWASSR	**Name:** Eucalypt Woodland/*Acacia* Shrubland-Stony Rises **Description:** Low mallee woodland to open mallee woodland of *Eucalyptus corrugata* or *E. loxophleba* subsp. *lissophloia* over tall open shrubland dominated by *Acacia burkittii*, *A. effusifolia*, *A. resinimarginea* and *A. tetragonophylla* over mid open to sparse shrubland of mixed species dominated by *Alyxia buxifolia*, *Eremophila oppositifolia* subsp. *angustifolia* and *Phebalium canaliculatum* over low sparse shrubland of mixed species dominated by *Hybanthus floribundus* subsp. *curvifolius* and *Prostanthera grylloana* on red or red-brown clay loam with ironstone, quartz or duricrust stones on undulating plains and rises. **Definition method:** floristic composition classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 69.2 ha (0.3 %) **Sampling:** 2 quadrats – both within the Study Area (MRD119, MRK073) **Average Taxon Richness per Quadrat:** 18.5 (± 0.7) **Indicator Taxa:** *Hybanthus floribundus* subsp. *curvifolius, Olearia pimeleoides, Prostanthera grylloana, Westringia cephalantha* **Significant Taxa: -** **Variation:** no major variation observed	 Plate 96: VT EWASSR (Quadrat MRK073)

VT	Summary	Photograph
TeL	**Name:** *Tecticornia entrichoma* shrubland-Lake Floor **Description:** Tall sparse tussock grassland of *Leptochloa digitata* over low sparse samphire shrubland of *Tecticornia entrichoma* on cream-brown sandy clay with mixed colluvial pebbles on seasonal, fresh to slightly brackish lake floors **Definition method:** structural vegetation classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 6.7 ha (0.03 %) **Sampling:** 1 quadrat – within the Study Area (MRK063) **Average Taxon Richness per Quadrat:** 3.0 **Indicator Taxa:** N/A **Significant Taxa:** *Tecticornia entrichoma* (P4) **Variation:** no major variation observed	 Plate 97: VT TeL (Quadrat MRK063)

VT	Summary	Photograph
MSLSB	**Name:** *Melaleuca* Shrubland/Lignum Shrubland-Basins **Description:** Low open woodland of *Eucalyptus loxophleba* subsp. *lissophloia* and *E. yilgarnensis* over mid shrubland of *Melaleuca halmaturorum* over low sparse shrubland of *Duma florulenta* on red sandy clay loam with mixed colluvial pebbles in seasonal, fresh to slightly brackish basins. **Definition method:** structural vegetation classification **Location:** NYHR, southern portion (south of Yerilgee Hills) **Area mapped (Proportion of Study Area):** 2.7 ha (0.01 %) **Sampling:** 1 quadrat – within the Study Area (MRK058) **Average Taxon Richness per Quadrat:** 5.0 **Indicator Taxa:** N/A **Significant Taxa: -** **Variation:** no major variation observed	 Plate 98: VT MSLSB (Quadrat MRK058)

VT	Summary	Photograph
SSSLM	**Name:** Samphire Shrubland-Salt Lake Margins **Description:** Low open samphire shrubland of mixed species including *Tecticornia indica* subsp. *bidens*, *Tecticornia doliiformis* and *Tecticornia* sp. Dennys Crossing (K.A. Shepherd & J. English KS 552) on red or orange sandy clay or sandy loam on salt lake margins. **Definition method:** structural vegetation classification **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 7.0 ha (0.03 %) **Sampling:** 2 quadrats – both within the Study Area (MRD017, MRD038) **Average Taxon Richness per Quadrat:** 9.0 **Indicator Taxa:** N/A **Significant Taxa:** - **Variation:** no major variation observed	 Plate 99: VT SSSLM (Quadrat MRD017)

VT	Summary	Photograph
SSSLF	**Name:** Samphire Shrubland-Salt Lake Floors **Description:** Low open samphire shrubland dominated by *Tecticornia* sp. (unidentified) and *Tecticornia doliiformis* on red sandy clay on salt lake floors **Definition method:** structural vegetation classification **Location:** NYHR, northern portion (Lake Barlee area) **Area mapped (Proportion of Study Area):** 4.8 ha (0.02 %) **Sampling:** 1 relevé – within the Study Area (MRDR01) **Average Taxon Richness per Relevé:** 2.0 **Indicator Taxa:** N/A **Significant Taxa: -** **Variation:** no major variation observed	 Plate 100: VT SSSLF (Relevé MRDR01)

5.2.10 Other Areas Described

Areas where natural vegetation has been completely and apparently permanently removed, with no native taxa remaining, have been mapped as 'Cleared' (C) which consisted primarily of existing roads and major tracks. A total of 37.1 ha of Cleared areas were mapped within the Study Area. In addition, there were two areas mapped as Unvegetated Clay Pan (UC); these areas were observed to be filled with surface water at the time of survey, and had no vegetation present. It is unclear as to whether herbs would be present in these areas when the water recedes. A total of 1.1 ha of UC was mapped within the Study Area (Appendix K).

5.2.11 Significant Vegetation

A total of 23 significant or potentially communities have been identified by this assessment as occurring within the Study Area, as listed in Table 15. The significant communities are represented by one or more VTs defined and mapped within the Study Area (Table 15). The significant communities include two PECs, and 21 Study Area VTs that may be regionally rare and restricted are considered to be potentially significant as per EPA (2016a, b), but are not considered to be equivalent to any formally recognised significant communities ('Unlisted Vegetation'). Each significant community is discussed further below (the Study Area VTs considered to represent potentially significant vegetation are discussed collectively). The locations of significant communities are presented in Figure 11 and Appendix O. In Table 15, an occurrence in the context of the Study Area (i.e. not considering vegetation outside the Study Area) is defined as a discrete area of vegetation separated from other areas by differing vegetation; this does not include minor roads or tracks which may split areas of vegetation. The number of occurrences is therefore considered approximate, as many may be linked by the same vegetation outside the Study Area.

Table 15: Significant and Potentially Significant Vegetation Occurring within the Study Area

Community	Conservation Status (W.A.)	Conservation Status (Commonwealth)	VTs	No. of Occurrences	Total Area Mapped (ha)^	Condition (ha)
Listed TECs and PECs						
Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)	P1	-	AEgSB, AEgSBR, AEoCS, AEpCS, AEpS, AHPS, AMESSS, CATSB, EcW, ElWMsC, EPCS`, MAcPS, MAqSSF	44	3238.7	E – 3238.7

Community	Conservation Status (W.A.)	Conservation Status (Commonwealth)	VTs	No. of Occurrences	Total Area Mapped (ha)^	Condition (ha)
Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation)	P1	-	AASYH, ABeSG, APbSYH, CpEW	53	2399.6	E – 2399.6
Unlisted Vegetation – Potentially Significant						
Study Area VT AEoCS	-	-	NA	5	50.4	E – 50.4
Study Area VT AEpCS	-	-	NA	11	119.0	E – 119.0
Study Area VT AEpS	-	-	NA	9	82.4	E – 82.4
Study Area VT AHPS	-	-	NA	3	96.6	E – 96.6
Study Area VT EcW	-	-	NA	5	20.8	E – 20.8
Study Area VT ElWMsC	-	-	NA	1	8.6	E – 8.6
Study Area VT EPCS	-	-	NA	8	48.6	E – 48.6
Study Area VT APgS	-	-	NA	1	30.6	E – 30.6
Study Area VT ASSDB	-	-	NA	10	31.6	E – 31.6
Study Area VT CpSLD	-	-	NA	4	4.5	E – 4.5
Study Area VT ElArG	-	-	NA	4	34.9	E – 34.9
Study Area VT EmEsC	-	-	NA	4	12.1	E – 12.1
Study Area VT EvWCS	-	-	NA	1	6.4	E – 6.4
Study Area VT EWASG	-	-	NA	1	59.9	E – 59.9
Study Area VT EWLSB	-	-	NA	3	22.3	E – 22.3
Study Area VT LAaSB	-	-	NA	13	11.4	E – 2.3 VG – 9.1
Study Area VT MEfHB	-	-	NA	1	1.1	G – 1.1
Study Area VT MEfVS	-	-	NA	9	24.0	E – 24.0
Study Area VT MFC	-	-	NA	37	16.9	E – 16.9
Study Area VT MSLSB	-	-	NA	1	2.7	E – 2.7
Study Area VT TeL	-	-	NA	1	6.7	E – 6.7

As presented on Figure 9, buffer polygons of the Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation) and Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation) PECs intersect the Study Area. As detailed in Table 15, both are considered to occur in the Study Area. None of the other significant vegetation types known to occur or potentially occur within the Desktop Study Area (as presented in Figure 9) are considered to occur in the Study Area.

Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)

The PEC 'Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)' (P1 – W.A.) (not listed under the EPBC Act) was listed following DBCA's

banded ironstone surveys of the Mount Forrest – Mount Richardson Range and Brooking Hills area (Meissner *et al.* 2009; Meissner and Owen 2010), and encompasses floristic community types on banded ironstone ranges that were described by these surveys. This PEC is considered to occur on the Mount Forrest Range, the Mount Richardson Range, and the Brooking Hills, all of which intersect the Study Area (Mt Richardson area and northern portion of the NYHR area); the known range of this PEC is believed to be indicated by the buffer polygons presented in Figure 9. Mapping of this PEC has been undertaken by the DBCA; however, it is believed that no ground truthing of this mapping has been undertaken. It is believed that all quadrats established during these surveys are considered to be confirmed occurrences of this PEC. There are no known patch size or condition thresholds for occurrences of this TEC.

As outlined in Section 3.9.2, all vegetation associated with the above-mentioned banded ironstone ranges sampled by DBCA is considered to represent this PEC; this includes vegetation on the banded ironstone ranges themselves, as well as their outwashes, whose soils are still influenced by the banded ironstone ranges. The classification analysis conducted as part of this current assessment (see Section 5.2.8) was used in conjunction with a review of geological and topographical data for the quadrats established by this and previous surveys in the Study Area to identify VTs that are considered to represent this PEC. A total of 13 VTs mapped in the Study Area are considered to represent this PEC; two additional VTs that were defined by the classification analysis (see Section 5.2.8) but do not occur in the Study Area are also considered to represent this PEC. These 15 VTs contain all quadrats established by the aforementioned DBCA banded ironstone surveys; however, a number of these VTs do not contain any such quadrats, but are influenced by the banded ironstone ranges to some degree, and hence are considered to represent the PEC.

This PEC has been mapped widely in the Mt Richardson area of the Study Area, with two small polygons mapped in the northern part of the NYHR in the Lake Barlee Area (Figure 11; Appendix O). Almost all of the mapped area occurs within the DBCA buffer polygons presented in Figure 9. Approximately 44 occurrences are considered to occur in the Study Area, with 3238.7 ha mapped. All of the vegetation mapped as the PEC is considered to be in Excellent condition.

Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation)
The PEC 'Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation)' (P1 – W.A.) (not listed under the EPBC Act) was listed following DBCA's banded ironstone surveys of the northern Yerilgee Hills (Markey and Dillon 2011), and encompasses floristic community types on banded ironstone ranges that were described by these surveys. This PEC is considered to occur on the Yerilgee Hills, which intersect the Study Area (southern portion of NYHR area); the known range of this PEC is believed to be indicated by the buffer polygon presented in Figure 9. Mapping of this PEC has been undertaken by the DBCA; however, it is believed that no ground truthing of this mapping has been undertaken. It is believed that all quadrats established during these surveys are currently considered to be confirmed occurrences of this PEC. There are no known patch size or condition thresholds for occurrences of this TEC.

As for the Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation) PEC above, the classification analysis conducted as part of this current assessment (see Section 5.2.8) was used in conjunction with a review of geological and topographical data for the quadrats established by this and previous surveys in the Study Area to identify VTs that are considered to represent this PEC. A total of 4 VTs mapped in the Study Area are considered to represent this PEC; one additional VT that was defined by the classification analysis (see Section 5.2.8) but does not occur in the Study Area is also considered to represent this PEC. These 5 VTs contain the majority of quadrats established by the aforementioned DBCA banded ironstone surveys; all such VTs contain at least one DBCA quadrat.

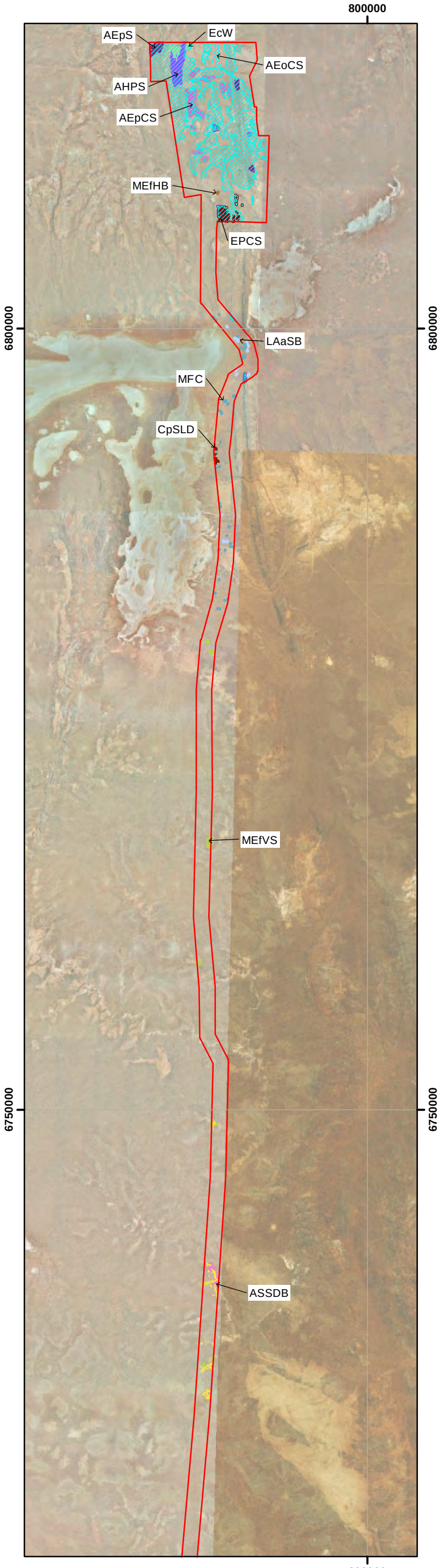
Thirteen DBCA quadrats occur in two additional VTs that were described and mapped by this current survey in the Study Area, being VTs EWEsS and CMEfS. Both VTs almost always occur on flats and plains; CMEfS occurs widely on plains and flats north of the Yerilgee Hills, and also occurs on the extreme lower slopes of very low banded ironstone hills in the Study Area. VT EWEsS occurs on flats and plains in the general vicinity of the Yerilgee Hills; one occurrence is also on a quartz rise. There was rarely any evidence of banded ironstone recorded in occurrences of these VTs in the form of gravel or stones. The taxon composition of these VTs also reflects the limited influence of the banded ironstone hills; in particular, EWEsS is generally dominated by large Eucalypts such as *E. salubris*, *E. ravida* or *E. salmonophloia*, which rarely if ever occur in association with banded ironstone (Woodman Environmental field observations). Additionally, all the DBCA quadrats except one that are included as part of VTs CMEfS and EWEsS represent floristic community types 5 (EWEsS) and 6 (CMEfS) as described by Markey and Dillon (2011). This report noted that these floristic community types were located in the lowest topographical positions sampled on deep soils with some colluvial deposits of banded ironstone, including wide, lowland valleys between ridges (5) and the lower slopes and plains adjacent to ridges (6).

Although it is apparent that all DBCA quadrats established across the northern Yerilgee Hills are considered by DBCA to represent occurrences of the 'Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation)' PEC, and consequentially, VTs EWEsS and CMEfS could therefore be considered to represent this PEC, based on the results of the floristic classification and review of geological and topographical information for quadrats in this current survey, as well as DBCA's survey of the northern Yerilgee Hills (Markey and Dillon 2011), it is considered that these VTs should not be considered part of this PEC. The description of the PEC stipulates that vegetation complexes on banded ironstone formation constitute the PEC. It is considered that the nearby banded ironstone ranges have little to no influence on the areas where VTs EWEsS and CMEfS have been mapped. A similar situation is evident in the Mt Richardson area, where VT MEfSN has been mapped widely on the plains and extreme lower slopes of banded ironstone ranges, but is not considered to constitute the 'Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)' PEC. Banded ironstone gravel and stones was present in many areas of this VT; however, the taxon composition did not reflect this, with many of the taxa present on the adjacent banded ironstone ridges absent from this VT. This VT was not sampled by the DBCA survey of the Mount Forrest and Mt Richardson ranges (Meissner *et al.* 2009), providing some indication that areas mapped as this VT were not viewed as being influenced by banded ironstone.

This PEC has been mapped widely in the Yerilgee Hills in the NYHR area (Figure 11; Appendix O) within the DBCA buffer polygon presented in Figure 9. Additionally, there are a number of other small occurrences of vegetation considered to be this PEC that have been mapped north of the Yerilgee Hills in the central portion of the NYHR area, outside the DBCA buffer polygon for this PEC (Figure 11; Appendix O). These areas coincide with low rises and ridges that are of similar relief to those in the Yerilgee Hills, and appear (based on field observations) to be geologically similar; this likely explains their floristic similarity to areas in the Yerilgee Hills themselves. Approximately 53 occurrences are considered to occur in the Study Area, with 2399.6 ha mapped. All of the vegetation mapped as the PEC is considered to be in Excellent condition.

Unlisted Significant Vegetation

Thirteen VTs mapped in the Study Area that are not formally listed significant vegetation in their own right (some are considered to be components of the 'Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation)' PEC) are considered to represent potentially significant vegetation (Figure 11; Appendix O). All have been mapped over very small areas, and may be relatively restricted in a regional context, as they occur on landforms that may be uncommon in the region; further investigation in the wider region is required to confirm this. This includes a number of VTs that occur in wetland areas. Several VTs that occur on banded ironstone ridges (see Table 14 for landform descriptions) are also considered to be potentially significant in their own right, in addition to being a component of one of the banded ironstone PECs mapped in the Study Area; such banded ironstone VTs are those that appear to be restricted or near-restricted to the Study Area, in addition to being mapped over small areas. There are a number of VTs that occur on banded ironstone that are also considered components of one of the banded ironstone PECs, but are not considered significant in their own right; these were mapped widely in the Study Area, and usually, were also considered to be represented outside the Study Area by DBCA banded ironstone survey quadrats. One VT (MEfHB) may also be under threat from grazing by stock, as it occurs on pastoral lease and was observed to be in poorer condition relative to surrounding vegetation (Table 15).



Legend

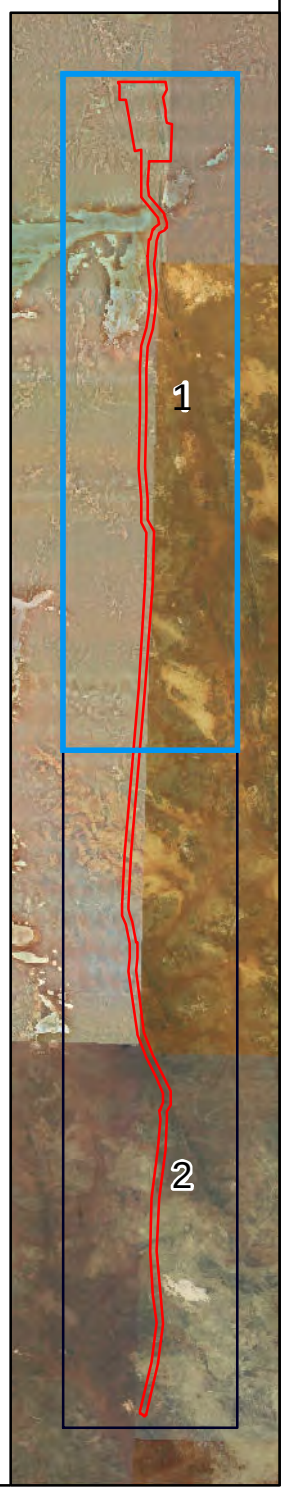
Study Area

Listed Significant Vegetation

- Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation) (P1)
- Mount Forrest - Mt Richardson (Bulga Downs) vegetation assemblages (banded ironstone formation) (P1)

Unlisted Potentially Significant Vegetation

- AEoCS (Very small local area, potentially restricted)
- AEpCS (Very small local area, potentially restricted)
- AEpS (Very small local area, potentially restricted)
- AHPS (Very small local area, potentially restricted)
- ASSDB (Very small local area, potentially restricted)
- CpSLD (Very small local area, potentially restricted)
- EPCS (Very small local area, potentially restricted)
- EcW (Very small local area, potentially restricted)
- LAaSB (Very small local area, potentially restricted)
- MEfHB (Very small local area, potentially restricted, possibly threatened by grazing by stock)
- MEfVS (Very small local area, potentially restricted)
- MFC (Very small local area, potentially restricted)



WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Overview of Significant Vegetation of the Study Area

Revision: A - 23 July 2021

Scale: 1:265,000

Author: Alison Saligari

WEC Ref: MRL20-38

Filename: MRL-20-38-01-f11

Projection: GDA 1994 MGA Zone 50

Figure

11.1

Legend

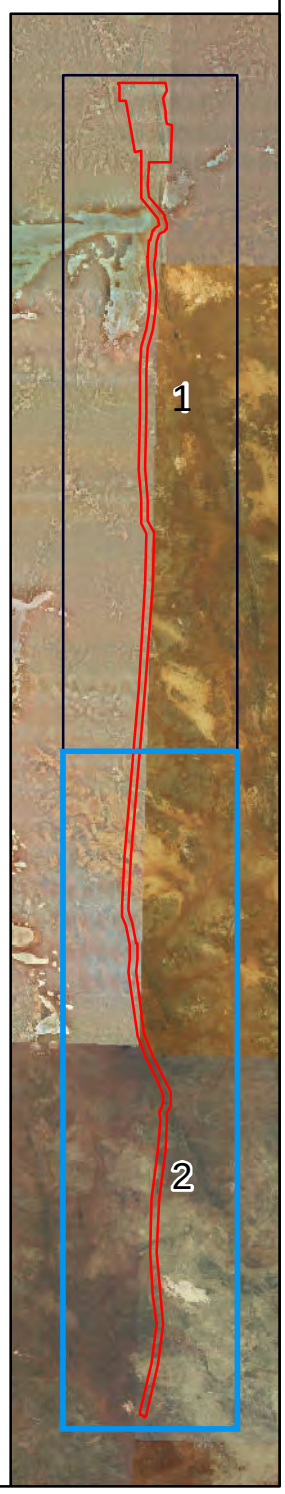
Study Area

Listed Significant Vegetation

Lake Giles (northern Yerilgee Hills) vegetation assemblages (banded ironstone formation) (P1)

Unlisted Potentially Significant Vegetation

- APgS (Very small local area, potentially restricted)
- ASSDB (Very small local area, potentially restricted)
- EWASG (Very small local area, potentially restricted)
- EWLSB (Very small local area, potentially restricted)
- EmEsC (Very small local area, potentially restricted)
- EvWCS (Very small local area, potentially restricted)
- MSLSB (Very small local area, potentially restricted)
- TeL (Very small local area, potentially restricted)



WOODMAN ENVIRONMENTAL

umwelt

N

This map should only be used in conjunction with WEC report MRL20-38-01.

Overview of Significant Vegetation of the Study Area

Revision: A - 23 July 2021

Scale: 1:265,000

Author: Alison Saligari

WEC Ref: MRL20-38

Filename: MRL-20-38-01-f11

Projection: GDA 1994 MGA Zone 50

Figure

11.2

5.2.12 Wetlands, Groundwater and Surface Water Dependent Vegetation

Ten VTs mapped in the Study Area are considered to occur in wetland areas, as outlined below:

- VT ElWMsC: mapped in a relatively major creek in the Mt Richardson area.
- VTs EmEsC, MEfHB, MFC: mapped in flat, ephemeral clay pans that are likely to be periodically inundated.
- VTs EWLSB, LAaSB, MSLSB: mapped in relatively deep, ephemeral basins that are likely to be periodically inundated.
- VTs SSSLF, SSSLM, TeL: mapped on either saline (SSSLF, SSSLM) or presumed brackish (TEL) lake floors and edges.

Additionally, the area mapped as UC (Unvegetated Claypan), is also considered to be a wetland, albeit one without terrestrial vegetation at the time of survey.

All of the above areas are likely to be dependent on surface water flows.

No other VTs mapped within the Study Area are considered to be wetlands.

No data is currently available regarding depth to groundwater across the Study Area. However, based on the taxa recorded in wetland, it appears unlikely that any of the wetland VTs, or any other VTs mapped in the Study Area, are groundwater dependent. Although there appears to be very little information published on groundwater usage by vegetation in the Murchison or Coolgardie bioregions, in general, phreatophytic taxa in the Eremaean area of WA are large trees from either the genus *Eucalyptus* or *Melaleuca* (Department of Water 2010). Although examples of these genera were recorded in wetland areas (e.g. *Eucalyptus lucasii* in ElWMsC, *Melaleuca xerophila* in ElWMsC, *Melaleuca halmaturorum* in MSLSB), they are considered unlikely to be phreatophytes; *Eucalyptus lucasii* does not generally occur in wetland situations, while both *Melaleuca* taxa are widespread in arid and semi-arid clay pans and clay salt lakes; this likely indicates they are dependent on water stored in the vadose zone of the clay soil profile in these areas, rather than the groundwater table. However, further information on groundwater depths in the areas where these taxa were recorded would be required to conclusively confirm this.

5.2.13 Vegetation Condition

The majority (99.9 %) of the vegetation in the Study Area was rated as 'Excellent' (EPA 2016a; Appendix A) as there was no or little evidence of impact to vegetation composition as a result of human activities. Table 16 presents the area (ha) of each VT and corresponding condition rating mapped in the Study Area.

The vegetation within VTs AbCSSL, EcWC, LAaSB and MEfHB recorded areas of vegetation rated as 'Very Good' or 'Good'. These areas generally displayed obvious signs of impacts to structure and species composition, primarily as a result of cattle trampling and grazing. In addition, VT SSSLF and part of VT MEfSN were rated as 'Poor'. It is unclear as to the reasons why VT SSSLF appears to be in stressed condition; the vast majority of samphire individuals in this VT were dead or very unhealthy. It is possible that a combination of salinity and drought

may have contributed to its condition. The area of VT MEfSN occurs around a cattle yard and has consequently been significantly affected by cattle activity.

Areas mapped as Cleared were not assigned a condition rating.

Detailed vegetation condition mapping is presented in Appendix I.

Table 16: Vegetation Condition Types Mapped in the Study Area

VT	Area (ha)	Vegetation Condition (EPA 2016a)					
		Excellent (E)	Very Good (VG)	Good (G)	Poor (P)	Degraded (D)	Completely Degraded (CD)
AASGP	979.19	979.19	-	-	-	-	-
AASYH	829.20	829.20	-	-	-	-	-
AbCSSL	346.97	346.97	-	-	-	-	-
ABeSG	501.82	501.82	-	-	-	-	-
AeEfS	1503.49	1503.49	-	-	-	-	-
AEfG	74.18	74.18	-	-	-	-	-
AEgSB	786.05	786.05	-	-	-	-	-
AEgSBR	3.56	3.56	-	-	-	-	-
AEoCS	50.36	50.36	-	-	-	-	-
AEpCS	119.02	119.02	-	-	-	-	-
AEpS	82.44	82.44	-	-	-	-	-
AHPS	96.62	96.62	-	-	-	-	-
AMESSS	190.26	190.26	-	-	-	-	-
AMSBG	71.92	71.92	-	-	-	-	-
APbSYH	454.45	454.45	-	-	-	-	-
APgS	30.64	30.64	-	-	-	-	-
ASSDB	31.57	31.57	-	-	-	-	-
CATSB	287.86	287.86	-	-	-	-	-
CCSSL	995.61	995.61	-	-	-	-	-
CEWSP	624.94	624.94	-	-	-	-	-
CMEfS	1754.29	1754.29	-	-	-	-	-
CpEW	614.15	614.14	-	-	-	-	-
CpSLD	4.47	4.47	-	-	-	-	-
CWEcRS	804.88	804.88	-	-	-	-	-
EcW	20.81	20.81	-	-	-	-	-
EcWC	6.68	-	6.68	-	-	-	-
ElArG	34.95	34.95	-	-	-	-	-
ElWMsC	8.58	8.58	-	-	-	-	-
ElWS	340.61	340.61	-	-	-	-	-
EmEsC	12.14	12.14	-	-	-	-	-
EoEcW	361.37	361.37	-	-	-	-	-
EPCS	48.60	48.60	-	-	-	-	-
EsWS	888.64	888.64	-	-	-	-	-
EvWCS	6.43	6.43	-	-	-	-	-
EWASG	59.85	59.85	-	-	-	-	-
EWASSR	69.24	69.24	-	-	-	-	-
EWEsS	325.13	325.13	-	-	-	-	-
EWLSB	22.30	22.30	-	-	-	-	-

VT	Area (ha)	Vegetation Condition (EPA 2016a)					
		Excellent (E)	Very Good (VG)	Good (G)	Poor (P)	Degraded (D)	Completely Degraded (CD)
LAaSB	11.40	2.32	9.10	-	-	-	-
MAcPS	313.85	313.85	-	-	-	-	-
MAqSG	17.12	17.12	-	-	-	-	-
MAqSSF	1230.67	1230.67	-	-	-	-	-
MEASNS	1177.71	1177.71	-	-	-	-	-
MEASSS	1605.56	1605.56	-	-	-	-	-
MECS	978.23	978.23	-	-	-	-	-
MEfHB	1.11	-	-	1.11	-	-	-
MEfSC	2592.17	2592.17	-	-	-	-	-
MEfSN	2768.69	2768.01	-	-	0.69	-	-
MEfVS	24.04	24.04	-	-	-	-	-
MESGROS	745.79	745.79	-	-	-	-	-
MFC	16.98	16.98	-	-	-	-	-
MSLSB	2.74	2.74	-	-	-	-	-
SSSLF	4.77	-	-	-	4.77	-	-
SSSLM	7.00	7.00	-	-	-	-	-
TeL	6.72	6.72	-	-	-	-	-
UC	1.10	1.10	-	-	-	-	-
C	37.14	-	-	-	-	-	-
TOTAL	**24,986**	**24,926.6**	**15.8**	**1.1**	**5.5**	**0.0**	**0.0**

6. REFERENCES

Atlas of Living Australia (ALA) 2021
Atlas of Living Australia website. Available: https://bie.ala.org.au, accessed March 2021.

Beard, J.S. (1990)
Plant Life of Western Australia. Kangaroo Press, Perth.

Beard, J. S., Beeston, G.R., Harvey, J.M., Hopkins, A. J. M. and Shepherd, D. P. (2013)
The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition. *Conservation Science Western Australia 9: 1-152.*

Belbin, L. and Collins, A. (2009)
PATN. Version 3.12, Blatant Fabrications Pty Ltd.

Botanica Consulting (2013)
Level 2 Flora & Vegetation Survey for Mt Forrest (Tenements: L29/104, M29/257, M29/314, M29/258, M29/348, M29/349, M29/350, M29/351). Consultant Report to Mindax Limited, 2012/58.

Bureau of Meteorology (2021a)
Climate Statistics for Australian Locations.
URL: http://www.bom.gov.au/climate/data/ [accessed January 2021]

Bureau of Meteorology (2021b)
Groundwater Dependent Ecosystems Atlas.
URL: http://www.bom.gov.au/water/groundwater/gde/ [accessed January 2021]

Cassidy, K.F., Champion, D.C., Krapež, B., Barley, M.E., Brown, S.J.A., Blewett, R.S., Groenewald, P.B. and Tyler, I.M. (2006)
A revised geological framework for the Yilgarn Craton, Western Australia. Geological Survey of Western Australia – Record 2006/8, 8p.

Chao, A. (1987)
Estimating the population size for capture-recapture data with unequal catchability. *Biometrics* 43:783-791.

Commonwealth of Australia (2012)
Interim Biogeographic Regionalisation for Australia, Version 7.
Department of Sustainability, Environment, Water, Population and Communities.
URL: http://www.environment.gov.au/land/nrs/science/ibra

Commonwealth of Australia (2013)
Matters of National Environmental Significance. Significant Impact Guidelines. EPBC Act Policy Statement 1.1.

Cowan, M. (2001)
Murchison 1 (MUR1 – East Murchison subregion). In *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, The Department of Conservation and Land Management. P. 466–479.

Cowan, M., Graham, G. and McKenzie, N. (2001)
Coolgardie 2 (COO1 – Southern Cross subregion). In *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, The Department of Conservation and Land Management. P. 143–155.

Department of Agriculture, Water and the Environment (DAWE) (2020a)
Directory of Important Wetlands in Australia — Information Sheet: Lake Barlee. Directory search URL: https://www.environment.gov.au/cgi-bin/wetlands/report.pl# [queried 23/06/2020]

Department of Agriculture, Water and the Environment (DAWE) (2020b)
Interrogation of Species Profile and Threats (SPRAT) Database using *Protected Matters Search Tool*. [queried 12/06/2020]
URL: https://www.environment.gov.au/epbc/protected-matters-search-tool

Department of Biodiversity, Conservation and Attractions (DBCA) (2007–)
NatureMap: Mapping Western Australia's Biodiversity.
URL: https://naturemap.dpaw.wa.gov.au/ [accessed June 2020]

Department of Biodiversity, Conservation and Attractions (DBCA) (as Department of Parks and Wildlife, DPaW) (2013)
Definitions, Categories and Criteria for Threatened and Priority Ecological Communities. Current January 2013. URL: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf

Department of Biodiversity, Conservation and Attractions (DBCA) (2018)
List of Threatened Ecological Communities (TECs) Endorsed by the Western Australian Minister for Environment. Department of Biodiversity, Conservation and Attractions, 28th June 2018

Department of Biodiversity, Conservation and Attractions (DBCA) (2019a)
Conservation Codes for Western Australian Flora and Fauna. Current 3rd January 2019. URL: https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation%20code%20definitions.pdf

Department of Biodiversity, Conservation and Attractions (DBCA) (2020a)
Interrogation of the DBCA Threatened Ecological Communities and Priority Ecological Communities database, performed 03/07/2020. Reference: 06-0720EC.

Department of Biodiversity, Conservation and Attractions (DBCA) (2020b)

Interrogation of the DBCA Western Australian Herbarium specimen database, Threatened and Priority Flora database, performed 22/06/2020. Reference: 18-0620FL.

Department of Biodiversity, Conservation and Attractions (DBCA) (2021)
Priority Ecological Communities for Western Australia, Version 28. Species and Communities Program, Department of Biodiversity, Conservation and Attractions, 10th January 2019

Department of Biodiversity, Conservation and Attractions (DBCA) (as Department of Parks and Wildlife) (2014)
Ecological Impact and Invasiveness Ratings from the Department of Parks and Wildlife Goldfields Region Species Prioritisation Process 2014.
Retrieved from: https://www.dpaw.wa.gov.au/images/documents/plants-animals/plants/weeds/goldfields_region_-_impact_and_invasiveness_ratings.xlsx

Department of Primary Industries and Regional Development (DPIRD) (2020a)
Soil-landscape mapping covering Western Australia at the best available scale (Version April 2018). URL: https://maps.agric.wa.gov.au/nrm-info/ [accessed June 2020]

Department of Primary Industries and Regional Development (DPIRD) (2020b)
Declared Organism Search – online portal.
URL: https://www.agric.wa.gov.au/organisms [accessed June 2020]

Department of Water (2010)
Lower De Grey River: ecological values and issues. Environmental Water Report series. Report no. 12. Government of Western Australia. Department of Water. January 2010.

Dufrene, M. and Legendre, P. (1997)
Species Assemblages and Indicator Species: The need for a flexible asymmetrical approach. In: *Ecological Monographs* 67: 345-366.

Environment Australia (2001)
A Directory of Important Wetlands in Australia. Third edition. Environment Australia, Canberra.

Environmental Protection Authority (EPA) (2004)
Guidance for the assessment of environmental factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. No. 51. Environmental Protection Authority, Perth, Western Australia.

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

Environmental Protection Authority (EPA) (2016b)

Environmental Factor Guideline – Flora and Vegetation. Published 13th December 2016 (www.epa.wa.gov.au/).

Executive Steering Committee for Australian Vegetation Information (ESCAVI) (2003)
Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0. Department of the Environment and Heritage, Canberra.

Geological Survey of Western Australia (2016)
1:500 000 State interpreted bedrock geology of Western Australia, 2016. Digital data layer available via *GeoView* interactive mapping system [accessed June 2020]
URL: http://www.dmp.wa.gov.au/GeoView-WA-Interactive-1467.aspx

Gibson, N. (2004)
Flora and vegetation of the Eastern Goldfields Ranges: Part 6. Mt Manning Range. *Journal of the Royal Society of Western Australia*, 87: 35–47.

Gibson, N. and Lyons, M.N. (2001)
Flora and vegetation of the Eastern Goldfields Ranges: Part 5. Hunt Range, Yendilberin and Watt Hills. *Journal of the Royal Society of Western Australia*, 84: 129–142.

Gibson, N., Lyons, M.N. and Lepschi, B.J. (1997)
Flora and vegetation of the Eastern Goldfields Ranges, Part 1: Helena and Aurora Range. *CALMScience* 2: 231–246.

Government of Western Australia (2019)
2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). WA Department of Biodiversity, Conservation and Attractions. Current as of June 2020.
URL: https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Jennings, J.N. and Mabbutt, J.A. (1986)
Physiographic outlines and regions. In *'Australia, a geography. Volume 1. The natural environment*.' (*Ed*. D.N. Jeans) (Sydney University Press: Sydney)

Keighery, G.J., Milewski, A.V. and Hall, N.J. (1995)
Vegetation and flora In: The biological survey of the eastern goldfields of Western Australia. Part 12. The Barlee-Menzies study area. *Records of the Western Australian Museum Supplement* 49: 183–207.

Macarthur Minerals Limited (MML) (2013)
Ularring Hematite Project. Environmental Review Document – Rev6. Unpublished report, June 2013.

Markey, A. S. and Dillon, S. J. (2008)

Flora and Vegetation of the Banded Ironstone Formations of the Yilgarn Craton: The Central Tallering Land System. *Conservation Science Western Australia* 7 (1): 121–149.

Markey, A.S. and Dillon, S.J. (2011a)
Flora and vegetation of banded iron formations of the Yilgarn Craton: the Johnston Range, Menzies. *Conservation Science Western Australia* 8 (1): 137–161.

Markey, A.S. and Dillon, S.J. (2011b)
Flora and vegetation of banded iron formations of the Yilgarn Craton: the northern Yerilgee Hills, Menzies. *Conservation Science Western Australia* 8 (1): 163–186.

Mattiske Consulting Pty Ltd (2008)
Flora and Vegetation Survey of Mt Richardson Project (E29/571). Consultant Report to Iron Mountain Limited, IML0801/063/08.

Mattiske Consulting Pty Ltd (2011)
Flora Assessment of Drill Holes in Banjo/Lost World and Moonshine Deposits, Lake Giles Survey Area. Consultant report to Macarthur Minerals Limited.

Mattiske Consulting Pty Ltd (2012a)
Level 2 Flora and Vegetation Survey of the Snark Deposit, New Campsite and Explosives Storage Facility, Ularring Hematite Project Area. Consultant report to Macarthur Minerals Limited.

Mattiske Consulting Pty Ltd (2012b)
Level 2 Flora and Vegetation Survey of the Central Deposit and Proposed Haul Road, Ularring Hematite Project Area. Consultant report to Macarthur Minerals Limited.

Mattiske Consulting Pty Ltd (2012c)
Level 2 Flora and Vegetation Survey of the Banjo Deposit, Ularring Hematite Project Area. Consultant report to Macarthur Minerals Limited.

McCune, B. and Mefford, M.J. (2011)
PC-Ord. Multivariate Analysis of Ecological Data, Version 6.08. MjM Software, Gleneden Beach, Oregon U.S.A.

Meissner, R. and Coppen, R. (2013)
Flora and vegetation of the greenstone ranges of the Yilgarn Craton: Credo Station. *Conservation Science Western Australia* 8 (3): 333–343.

Meissner, R. and Owen, G. (2010a)
Flora and vegetation of banded iron formations of the Yilgarn Craton: Brooking Hills area. *Conservation Science Western Australia* 7 (3): 571–581.

Meissner, R. and Owen, G. (2010b)
Flora and vegetation of banded iron formations of the Yilgarn Craton: Mt Ida Greenstone Belt and Mt Hope. *Conservation Science Western Australia* 7 (3): 583–592.

Meissner, R., Owen, G. and Bayliss, B. (2009a)
Flora and vegetation of banded iron formations of the Yilgarn Craton: Cashmere Downs Range. *Conservation Science Western Australia* 7 (2): 349–361.

Meissner, R., Owen, G. and Bayliss, B. (2009b)
Flora and vegetation of banded iron formations of the Yilgarn Craton – Mount Forrest – Mount Richardson Range, *Conservation Science Western Australia* 7 (2): 377–389.

Meissner, R. and Wright, J. (2010)
Flora and vegetation of banded iron formations of the Yilgarn Craton: south Illaara Greenstone Belt. *Conservation Science Western Australia* 7 (3): 605–616.

Milewski, A.V. and Dell, J. (1992)
Vegetation and Flora In: The biological survey of the Eastern Goldfields of Western Australia. Part 6. Youanmi-Leonora study area. *Records of the Western Australian Museum Supplement* 40: 11–19.

Mueller-Dombois, D. and Ellenberg, H. (1974)
Aims and Methods of Vegetation Ecology. Wiley and Sons, Canada.

Newbey, K.R. and Hnatiuk, R.J. (1985)
Vegetation and Flora In: The biological survey of the Eastern Goldfields of Western Australia. Part 3 Jackson-Kalgoorlie study area. *Records of the Western Australian Museum Supplement* 23: 11–38.

Outback Ecology Services (Outback Ecology) (2005)
Flora Survey of the Paradise Bore and Cassowary Proposed Drilling Sites. Consultant report to Mindax Limited.

Outback Ecology Services (Outback Ecology) (2007)
Vegetation and Priority Flora Surveys of the Mindax Limited tenements within the proposed Ida Valley Conservation Park. Consultant report to Mindax Limited.

Pain, C., Gregory, L., Wilson, P. and McKenzie, N. (2011)
The physiographic regions of Australia – Explanatory notes 2011. Australian Collaborative Land Evaluation Program and National Committee on Soil and Terrain.

PGV Environmental (2018)
Sandy Ridge Project. IWDF Access Road Borrow Pit Sites Flora and Vegetation Survey. Consultant Report to Tallus Holdings Pty Ltd, Report No. 2017-359.

Polaris Metals NL (2010)

Public Environmental Review. Carina Iron Ore Mine: Yilgarn Region WA. Polaris Metals NL, February 2010.
Retrieved from: http://www.epa.wa.gov.au/sites/default/files/PER_documentation/A1756_R1368_Carina%20Iron%20Ore_PER%20draft%203_1_Possibly%20final.pdf

Raymond, O.L., Liu, S., Gallagher, R., Zhang, W., Highet, L.M. (2012)
Surface Geology of Australia 1:1 million scale dataset 2012 edition. Geoscience Australia, Canberra. URL: http://pid.geoscience.gov.au/dataset/ga/74619
Viewed via interactive map provided by Commonwealth of Australia (Geoscience Australia) 2020, Canberra. [accessed June 2020]
URL: http://maps.ga.gov.au/interactive-maps/#/theme/minerals/map/geology

Rye, B.L. (2007)
New species and keys for *Cryptandra* and *Stenanthemum* (Rhamnaceae) in Western Australia. *Nuytsia* 16 (2): 325-382.

Sneath, P.H.A, and Sokal, R.R. (1973)
Numerical Taxonomy: The Principles and Practice of Numerical Classification. Published by Freeman, San Francisco.

Tille, P.J. (2006)
Soil-landscapes of Western Australia's rangelands and arid interior. Department of Agriculture and Food, Western Australia, Perth. Report 313.

Trudgen M.E. & Rye B.L. (2014)
An update to the taxonomy of some Western Australian genera of Myrtaceae tribe Chamelaucieae. 2. Cyathostemon. Nuytsia 24: 7-16

Van de Graaff, W.J.E., Crowe, R.W.A., Bunting, J.A. and Jackson, M.J. (1977)
Relict Early Cainozoic Drainages in arid Western Australia. *Zeitschrift für Geomorphologie N. F. Bd*. 21: 379–400.

Weeds Australia (2021)
Weeds of National Significance (WONS). URL: https://weeds.org.au/weeds-profiles/ [accessed January 2021]

Western Australian Herbarium (1998–)
FloraBase—the Western Australian Flora. Department of Biodiversity, Conservation and Attractions. URL: https://florabase.dpaw.wa.gov.au/

Western Botanical (2009)
Regional Surveys for Significant Flora within Mt Richardson, Mt Alfred & Cabaret polygons, Consultant report to Portman Iron Ore Pty Ltd, Ref: WB558.

Western Botanical (2010a)
Flora and Vegetation Survey of Proposed RC Drilling Programs at Mt Richardson. Consultant report to Cliffs Asia Pacific Iron Ore Pty Ltd, Ref: WB623.

Western Botanical (2010b)

Flora and Vegetation Survey of a Polygon at Brooking Hills Prospect for Future Drilling Programs. Consultant report to Cliffs Asia Pacific Iron Ore Pty Ltd, Ref: WB668.

Western Botanical (2011)

Flora and Vegetation Survey of the Mt Richardson West Polygon May / July 2011. Consultant report to Cliffs Asia Pacific Iron Ore Pty Ltd, Ref: WB715.

Woodman Environmental Consulting Pty Ltd (2013)

Mount Richardson Flora and Vegetation Assessment. Consultant report to Cliffs Asia Pacific Iron Ore Pty Ltd, WEC Reference: CNR12-14-01.