

**Western Range
Desktop Flora and Vegetation Study
August 2018**

Prepared for
Rio Tinto Iron Ore



This page has been left blank intentionally.

Western Range Desktop Flora and Vegetation Study

Prepared for
Rio Tinto Iron Ore




Job Number: 14298-18

Reference: 14298-18-BISR-Rev0_181018

Revision Status

Rev	Date	Description	Author(s)	Reviewer
A	14/08/2018	Draft Issued for Client Review	K. McMaster	J. Atkinson
B	10/10/2018	Revised Draft Issued for Client Review	K. McMaster	J. Atkinson
0	18/10/2018	Final Issued for Information	K. McMaster	J. Atkinson

Approval

Rev	Date	Issued to	Authorised by	
			Name	Signature
A	14/08/2018	J. McShane	S. Pearse	
B	10/10/2018	J. McShane	S. Pearse	
0	18/10/2018	J. McShane	S. Pearse	



© Copyright 2018 Astron Environmental Services Pty Ltd. All rights reserved.

This document and information contained in it has been prepared by Astron Environmental Services under the terms and conditions of its contract with its client. The report is for the clients use only and may not be used, exploited, copied, duplicated or reproduced in any form or medium whatsoever without the prior written permission of Astron Environmental Services or its client.

Abbreviations

Abbreviation	Definition
Astron	Astron Environmental Services
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i> (State)
DBCA	Department of Biodiversity, Conservation and Attractions
DRF	Declared Rare Flora
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth)
ESA	Environmentally Sensitive Areas
GDA94	Geocentric Datum of Australia 1994
GDE	Groundwater Dependent Ecosystem
IBRA	Interim Biogeographic Regionalisation for Australia
MNES	Matters of National Environmental Significance (under the EPBC Act)
MGA	Map Grid of Australia
NVCP	Native Vegetation Clearing Permit
P	Priority
PEC	Priority ecological community
Rio Tinto	Rio Tinto Iron Ore Pty Ltd
sp.	Species (singular)
spp.	Species (plural)
subsp.	Subspecies
T	Threatened
The ‘study area’	Western Range Development Envelope (approximately 6,265 ha)
TEC	Threatened ecological community
TPFL	Threatened and Priority Flora Database (administered by DBCA)
TP List	Threatened and Priority Flora List (administered by DBCA)
WA Herb	Western Australian Herbarium database
WC Act	<i>Wildlife Conservation Act 1950</i> (State)
WoNS	Weeds of National Significance

Executive Summary

Rio Tinto is currently evaluating the potential development of the Western Range iron ore deposit, located to the west of the existing Greater Paraburdoo operations in the Pilbara region of Western Australia. Rio Tinto commissioned Astron to undertake a desktop flora and vegetation study within the Western Range Development Envelope (approximately 6,265 ha). The purpose of this desktop study is to gather contextual information from existing surveys, literature, database searches and spatial information and collate it into one comprehensive dataset.

There have been 291 confirmed vascular flora taxa from 47 families and 131 genera recorded in the study area. The most represented families were Fabaceae, Poaceae and Malvaceae. Analysis of a species accumulation curve indicates sampling has been adequate to provide a comprehensive flora species list for the study area.

Six conservation significant flora species have been previously recorded within the study area: *Aluta quadrata* T, *Goodenia* sp. East Pilbara P3, *Grevillea saxicola* P3, *Nicotiana umbratica* P3, *Sida* sp. Barlee Range P3 and *Ptilotus trichocephalus* P4. One species, *Hibiscus campanulatus* P1, is considered likely to occur, but has not been previously recorded.

Aluta quadrata T, is only known to occur within the Channar, Paraburdoo and Western Range areas. Over 74% of the *Aluta quadrata* T known population occurs within the study area.

There were 21 vegetation units described within the current study area, none of which represent a threatened ecological community or priority ecological community. Floristic analysis of sites within the study area and in comparison to sites across the local region indicates that the scale of mapping based on visual interpretation was appropriate for the floristic diversity of the study area. Most vegetation units are considered to be well represented beyond the study area, however, three vegetation units, H6, H7 and P3, may be restricted to the local area.

A further seven vegetation types are considered to be of conservation value. One vegetation unit, D8, is considered a potential groundwater dependent ecosystem. Vegetation unit D8, together with D1 and D3, is also considered to represent an 'ecosystem at risk'. One vegetation unit, D6, is considered to represent a potential refuge from fire and along with vegetation units H1, H2 and H3, is known to provide habitat for the Threatened species *Aluta quadrata*.

Vegetation was generally in excellent to very good condition, with just some areas within drainage lines and the floodplains of large creeks subject to degradation by grazing and weed invasion.

Nine introduced species have been previously recorded within the study area, and a further 25 introduced species are known to occur in the vicinity of the study area. None of these 34 species are listed as Weeds of National Significance or as declared pests.

Table of Contents

1	Introduction.....	1
1.1	Project Background	1
1.2	Scope and Objectives	1
2	Environmental Context.....	3
2.1	Physical Environment.....	3
2.1.1	Climate	3
2.1.2	Geology and Soils.....	3
2.1.3	Surface Water and Hydrology	4
2.2	Biological Environment	4
2.2.1	Interim Biogeographic Regionalisation of Australia	4
2.2.2	Land Systems.....	5
2.2.3	Pre-European Vegetation.....	6
2.3	State and Commonwealth Conservation Categories and Management	8
2.4	Introduced Flora.....	8
2.5	Land Use and Tenure.....	8
3	Methods	9
3.1	Database Searches	9
3.2	Literature Review	10
3.3	Likelihood of Occurrence Assessment	11
3.4	Vegetation Mapping.....	12
3.5	Flora Taxonomy and Nomenclature.....	12
3.6	Floristic Analysis	13
3.7	Limitations.....	13
4	Results	15
4.1	Database Search Results	15
4.2	Literature Review	17
4.2.1	Previous Level 2 (detailed) surveys.....	20
4.2.2	Previous Level 1(reconnaissance) surveys	21
4.2.3	Previous targeted flora searches	22
4.3	Flora.....	22

4.3.1	Conservation Significant Flora	23
4.3.2	Introduced Flora.....	24
4.4	Floristic Analysis	27
4.5	Vegetation	28
4.5.1	Conservation Significant Vegetation.....	44
4.5.2	Vegetation Condition	46
5	Contextual Analysis	47
5.1	Overview of the Study Area	47
5.2	Flora.....	47
5.3	Vegetation	50
6	Conclusions.....	52
7	References.....	53

List of Figures

Figure 1: Study area location.	2
Figure 2: Climate data for Paraburdoo (Station 007185).	3
Figure 3: Species accumulation curve for vegetation sampling sites within the Western Range Development Envelope study area.....	27

List of Plates

Plate 1: Vegetation unit H1 – AanAprAteTe	30
Plate 2: Vegetation unit H2 – AprGbERsppTe.....	31
Plate 3: Vegetation unit H3 – DpERcrTe	32
Plate 4: Vegetation unit H4 – AteAsyERcTe	33
Plate 5: Vegetation unit H5 – AteERfTw	33
Plate 6: Vegetation unit H7 – AanAteERfTeTw	34
Plate 7: Vegetation unit P1 – AanAxAteERcSpp	35
Plate 8: Vegetation unit P2 – AanAteSpp.....	36

Plate 9: Vegetation unit P4 – AanAxAteERcT.....	37
Plate 10: Vegetation unit P4 – AanAxAteERcTa.....	38
Plate 11: Vegetation unit P9 – CEsp.....	38
Plate 12: Vegetation unit D1 – AanAwTe.....	39
Plate 13: Vegetation unit D3 – AciAanAwTe.....	40
Plate 14: Vegetation unit D5 –AciCEspTe	41
Plate 15: Vegetation unit D6 – CfAciAanTe.....	41
Plate 16: Vegetation unit D8 – EvAcMgCEsp.....	42
Plate 17: Vegetation unit D10 – AanAxTe.....	42

List of Tables

Table 1: Summary of survey scope.	1
Table 2: Geological units of the study area	4
Table 3: Distribution of land systems within the study area.	6
Table 4: Extent of pre-European vegetation in the study area (Department of Parks and Wildlife 2016a).	7
Table 5: Database searches undertaken.....	9
Table 6: Criteria used to assess the likely presence of conservation significant flora in the study area.	12
Table 7: Threatened and priority flora listed in database search results.	16
Table 8: Summary of relevant vegetation and flora surveys in the vicinity of the current survey area.	18
Table 9: Families and genera most represented in the study area.	23
Table 10: Conservation significant flora recorded in the study area.....	24
Table 11: Rankings of introduced flora recorded in the study area, nearby previous surveys and NatureMap search.	25

Table 12: Floristic groups within the Western Range study area defined by a single sampling site....	27
Table 13: Floristic groups from local region analysis that occur only within the Western Range study area.	28
Table 14: Vegetation units described for the survey area.....	30
Table 15: Summary of sampling for each vegetation unit within and outside the project area.	44
Table 16: Conservation significant flora recorded in the study area.....	48
Table 17: Potentially restricted or endemic vegetation units and their area in the Western Range Development Envelope study area.....	51
Table 18: Vegetation units of elevated conservation value and their area in the Western Range Development Envelope study area.....	51

List of Appendices

Appendix A: Geology, Land Systems and Pre-European Vegetation of the Survey Area

Appendix B: Conservation Categories for Flora and Ecological Communities and Categories for Introduced Flora

Appendix C: Previous Survey Area Locations

Appendix D: Database Searches

Appendix E: Compiled Species List

Appendix F: Flora and Vegetation Sampling Site Locations

Appendix G: Conservation Significant Flora Locations and Descriptions

Appendix H: Threatened and Priority Flora Species Likelihood of Occurrence within the Survey Area

Appendix I: Introduced Flora Species (Weed) Locations and Descriptions

Appendix J: Floristic Analysis

Appendix K: Vegetation Mapping

This page has been left blank intentionally.

1 Introduction

1.1 Project Background

Rio Tinto is currently evaluating the potential development of the Western Range iron ore deposit, located to the west of the existing Greater Paraburdoo operations in the Pilbara region of Western Australia. A provisional Western Range Development Envelope (WRDE) (approximately 6,265 ha) intended to encompass any potential future mine and infrastructure associated with the Proposal has been prepared (Figure 1).

Rio Tinto commissioned Astron to undertake a desktop flora and vegetation study within the WRDE. The purpose of this desktop study is to gather contextual information on the WRDE from existing surveys, literature, database searches and spatial information and collate it into one comprehensive dataset. This work will inform the Rio Tinto environmental impact assessment for the Western Range Project.

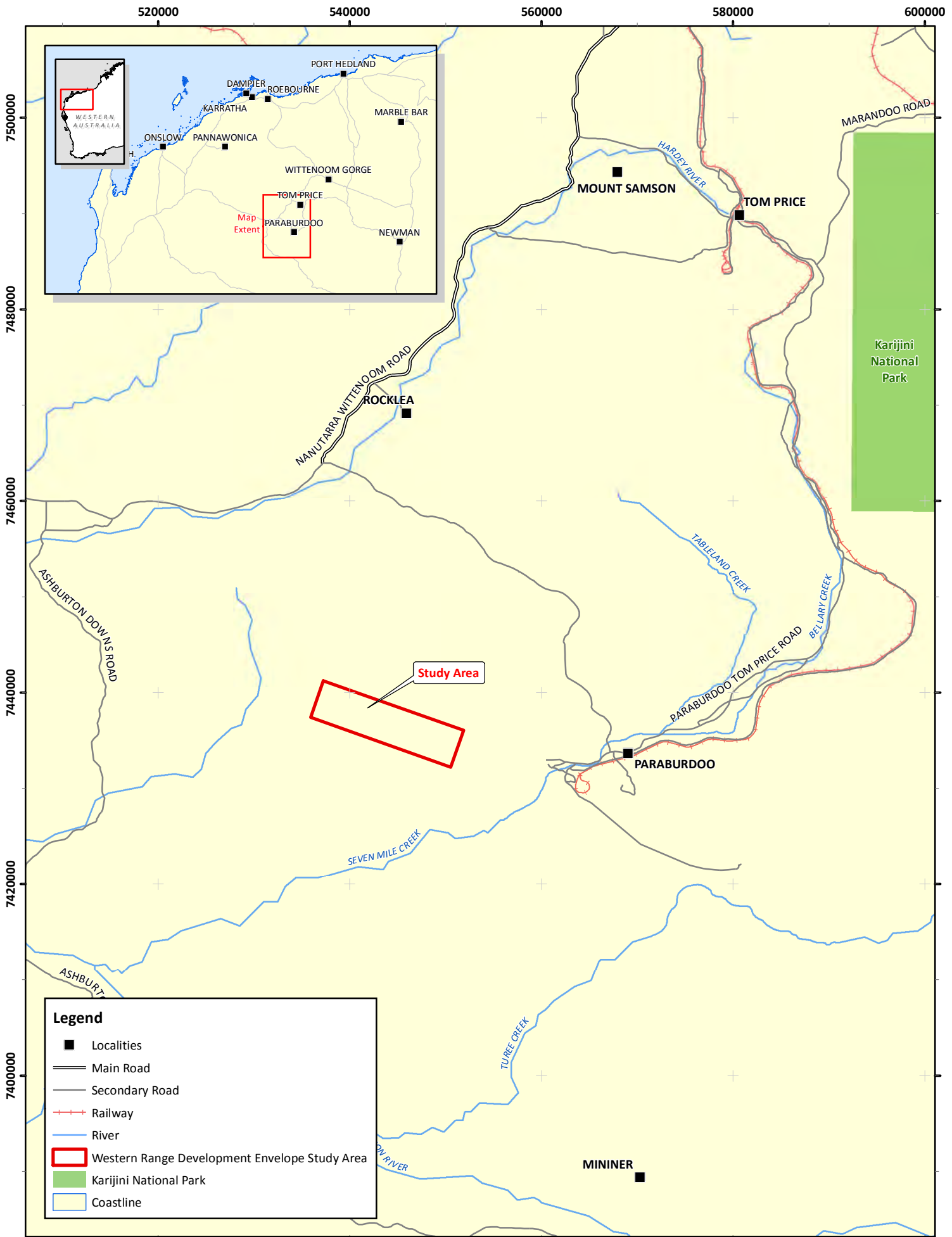
1.2 Scope and Objectives

The objective of this study is to review available relevant data in order to understand the biological context of the WRDE study area and inform the likelihood of occurrence assessments for conservation significant flora and vegetation. This includes:

- desktop assessment, including database searches and literature review of available contextual and project related resources
- contextual analysis involving comparison of systematic flora/vegetation data from within the Greater Paraburdoo area
- consolidation and updating of flora species lists and vegetation mapping across the study area, including floristic analysis
- assessment of the likelihood of conservation significant flora or vegetation occurring within the study area
- preparation of a report summarising the above findings.

Table 1: Summary of survey scope.

Level of survey	Survey area	Survey timing	Relevant regulatory guidance documents	Key survey limitations
Desktop Assessment	6,265 ha	N/A	Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority, 2016)	N/A



Legend

- Localities
- Main Road
- Secondary Road
- +— Railway
- River
- ▭ Western Range Development Envelope Study Area
- ▭ Karijini National Park
- ▭ Coastline

Rio Tinto Iron Ore
 Western Range – Desktop Flora and Vegetation Study, August 2018



Figure 1: Study area location

Author: K. McMaster	Date: 08-10-2018	Datum: GDA 1994 - Projection: MGA Zone 50 	
Drawn: C. Dyde	Figure Ref: 14298-18-BIDR-1RevB_181008_Fig01_Locn		

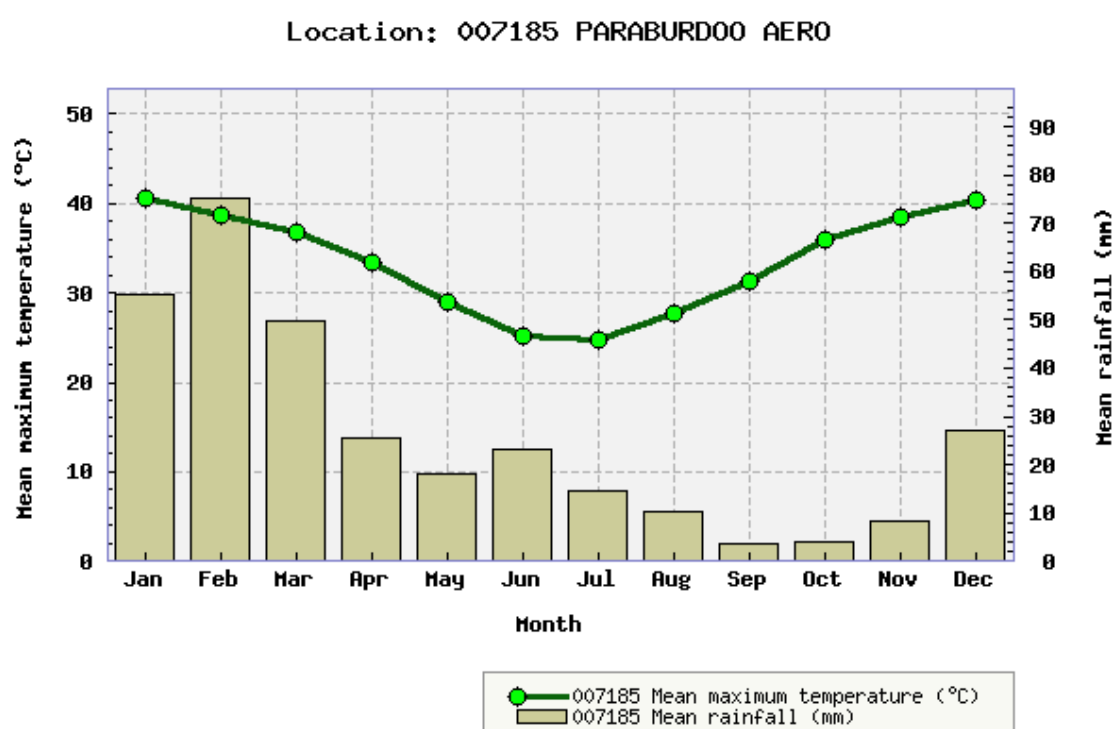
2 Environmental Context

2.1 Physical Environment

2.1.1 Climate

The climate of the Pilbara region of Western Australia is classified as arid tropical with two distinct seasons: a hot, wet summer (October – April) and a mild, dry winter (May – September) (Bureau of Meteorology 2018).

Based on long-term climatic data from the nearest Bureau of Meteorology weather station at Paraburdoo Aero (Station 007185) (approximately 10 km north-east of the study area) the mean annual rainfall since 1974 is 315 mm. The mean maximum daily temperatures range between 24.8°C and 40.6°C, and range above 30°C for much of the year (Bureau of Meteorology 2018) (Figure 2).



Australian Government
Bureau of Meteorology

Created on Fri 27 Apr 2018 13:33 PM AEST

Figure 2: Climate data for Paraburdoo (Station 007185). Mean annual rainfall data has been calculated from 1974 – 2018 and mean maximum temperature has been calculated from 1966 – 2018 (Bureau of Meteorology 2018).

2.1.2 Geology and Soils

The surface geology of the study area is comprised of six units (Stewart et al. 2008), with the Hamersley Group the most dominant (Table 2). Geological mapping of the study area and surrounds is presented in Figure A.1 (Appendix A).

Table 2: Geological units of the study area (Stewart et al. 2008).

Geological name	Label	Area within study area (ha)
Boongal Formation: basalt with some pillow lava development	Abfo	76.6
Calcrete 38497: pisolitic, nodular or massive calcrete; ferruginous inclusions; calcareous cementing of bedrock and transported materials; locally with intercalated chalcedony; as low mounds, in playa lakes, or as valley calcrete; locally dissected and karstified.	Czk	1,207.7
Colluvium 38491: colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite.	Qrc	172.8
Fortescue Group: metadolerite, dolerite, gabbro; medium to coarse grained, massive grey-green rock, usually foliated.	Adf	623.0
Hamersley Group: undivided chert, banded iron-formation, jaspilite, dolomite, mudstone, siltstone.	Lch	2,649.1
Jeerinah Formation: shale, sandstone, siltstone, mudstone, dolomite, local microbanded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows.	Awfj	1,536.2

2.1.3 Surface Water and Hydrology

No Wetlands of International Importance (i.e. Ramsar wetlands) or Nationally Important Wetlands occur within the study area (Department of the Environment and Energy 2017b, 2017a). The nearest Nationally Important Wetland is Mount Bruce coolibah-lignum flats located 95 km north-east of the study area.

Drainage within the study area runs off the hills mostly to the south, and eventually joins into the Minilya River south branch, to the south of the study area.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy 2016a). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The study area occurs in the Pilbara and Gascoyne Bioregions, of which 5% to 10% is represented in the national reserve system (Department of the Environment and Energy 2016b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land Management 2002b). The study area occurs within the Hamersley subregion (4,043 ha) of the Pilbara region and the Ashburton subregion (2,222 ha) of the Gascoyne region. These subregions are described in the audit as:

- Hamersley PIL3 – dissected bold plateaux and ranges of flat lying, moderately folded sandstone and quartzite with vegetation described as Mulga low woodland over tussock

grasses occurring on fine textured soils in valley floors, with scattered snappy gum (*Eucalyptus leucophloia*) over *Triodia brizoides* on skeletal soils of the ranges (Kendrick 2001b).

- Ashburton GAS1 - mountainous range country divided by broad flat valleys of shales, sandstones and conglomerates with vegetation described as mulga or snakewood low woodlands over hardpans, with low mixed shrublands on hills and areas supporting large areas of *Triodia* (Kendrick 2001a).

2.2.2 Land Systems

Land systems of the Western Australian rangelands have been mapped and described by the Department of Agriculture and Food outlining the distributions and providing comprehensive descriptions of biophysical resources, including soil and vegetation condition. A total of 102 land systems occur in the Pilbara bioregion covering 181,723 km² and a total of 172 land systems occur in the Gascoyne bioregion covering 183,784 km². Six land systems occur in the study area; each of which is associated with both the Pilbara and Gascoyne bioregions (Table 3). The layout of these land systems within the study area is shown in Figure A.2 (Appendix A).

Table 3: Distribution of land systems within the study area.

Land system	Total area within bioregion (ha)	Total area within study area (ha)	Proportion within study area (%)
Pilbara bioregion			
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	961,847	74.6	<0.1
Ethel - cobble plains with sparse mulga and other acacia shrublands.	2,886	10.1	0.3
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	1,994,339	2,934.0	0.1
Paraburdoo - basalt derived stony gilgai plains and stony plains supporting snakewood and mulga shrublands with spinifex, chenopods and tussock grasses.	130,774	2.7	<0.1
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	2,880,288	1,021.5	<0.1
Table - low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.	20,653	0.3	<0.1
Gascoyne bioregion			
Boolgeeda - stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands and mulga shrublands.	37,022	60.1	0.2
Ethel - cobble plains with sparse mulga and other acacia shrublands.	113,657	198.7	0.2
Newman - rugged jaspilite plateaux, ridges and mountains with hard spinifex.	6,021	731.5	12.1
Paraburdoo - basalt derived stony gilgai plains and stony plains supporting snakewood and mulga shrublands with spinifex, chenopods and tussock grasses.	14,076	143.0	1.0
Rocklea - basalt hills, plateaux, lower slopes and minor stony plains supporting hard spinifex and occasionally soft spinifex grasslands with scattered shrubs.	7,110	23.1	0.3
Table - low calcrete plateaux, mesas and lower plains supporting mulga and cassia shrublands and minor spinifex grasslands.	138,971	1,065.8	0.8

2.2.3 Pre-European Vegetation

Beard (1975a) completed broad-scale (1:1,000,000) pre-European vegetation mapping at an association level.

Four pre-European vegetation units, 82, 163, 181 and 567 (Shepherd, Beeston, and Hopkins 2002), are associated with the study area (Figure A.3, Appendix A). Table 4 summarises the current and pre-European extent of these four vegetation units in the Pilbara bioregion, Gascoyne bioregion and the study area.

Table 4: Extent of pre-European vegetation in the study area (Department of Parks and Wildlife 2016a).

Vegetation unit	Mapping unit (Beard 1975b)	Description	Extent in study area (ha)	Pre-European extent (ha)	Current extent in bioregion (ha)	Proportion of pre-European extent remaining (%)	Pre-European extent with formal protection (%)
Pilbara bioregion							
82	e16Lr t3Hi	Hummock grasslands, low tree steppe; snappy gum over <i>Triodia wiseana</i>	2,427.8	2,563,583	2,550,899	99.5	10.6
163	ecZi	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub	68.8	235.64	231.2	98.1	0
181	a1,11Si	Shrublands; mulga and snakewood scrub	184.4	65,090.4	63,204.5	97.1	4.8
567	a1,2Sr t1,2Hi	Hummock grasslands, shrub steppe; mulga and kanji over soft spinifex and <i>Triodia basedowii</i>	1,362.2	776,824.0	774,213.0	99.7	22.3
Gascoyne bioregion							
163	ecZi	Shrublands; <i>Eremophila</i> and <i>Cassia</i> dwarf scrub	535.9	640,581.3	640,515.8	99.99	0
181	a1,11Si	Shrublands; mulga and snakewood scrub	1,656.9	1,632,078.4	1,631,913.8	99.99	2.2
567	a1,2Sr t1,2Hi	Hummock grasslands, shrub steppe; mulga and kanji over soft spinifex and <i>Triodia basedowii</i>	29.4	682.9	682.9	100	0

2.3 State and Commonwealth Conservation Categories and Management

Commonwealth and State regulatory authorities maintain databases of the locations and conservation status of significant flora, fauna and ecological communities in Western Australia.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage Matters of National Environmental Significance (MNES) including listed flora, fauna and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables B.1 and B.2 (Appendix B).

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as threatened ecological communities (TECs) and are listed at both Commonwealth level under the EPBC Act and State level by the Western Australian Minister for Environment (Table B.3, Appendix B). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a list of priority ecological communities (PECs), which may also be under threat and are assigned one of four Priority rankings according to the criteria outlined in Table B.4 (Appendix B).

Under Western Australian legislation, all native flora is protected and it is an offence to ‘take’ protected flora. The *Wildlife Conservation Act 1950* (WC Act) also provides for native plant species to be specially protected when they are under identifiable threat of extinction, are rare, or otherwise in need of special protection (Department of Biodiversity, Conservation, and Attractions 2017a). Such specially protected flora is considered under the WC Act to be ‘declared rare’ (Threatened). In addition, due to the diversity of Western Australia’s flora, many species are known from only a few collections or locations, but have not been adequately surveyed. Such flora may be rare or threatened, but cannot be considered for declaration as threatened flora until adequate surveys have been undertaken. These flora species are included on a supplementary conservation list managed by DBCA called the *Priority Flora List* (Table B.5, Appendix B).

In addition to these protections, Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment under Section 51B of the *Environmental Protection Act 1986* to prevent incremental degradation of important environmental values such as declared rare flora (DRF), TECs or significant wetlands.

2.4 Introduced Flora

Significant weed species are identified at both the state and national level. The Australian Weeds Strategy (Australian Weeds Committee 2012a) identifies Weeds of National Significance (WoNS) which have the potential to impact primary industry and/or environmental and social values. The management of weeds in Western Australia is primarily regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Species listed under this act are allocated one of three declared pest categories which define the required level of management (Department of Agriculture and Food Western Australia 2016). Declared pest categories and listed weed species’ priority ratings are presented in Table B.6 (Appendix B).

2.5 Land Use and Tenure

The study area is located within the Shire of Ashburton. The majority of the study area is on the Mininer and Rocklea Station pastoral lease. The local area is used for pastoralism, mineral exploration and mining activity.

Karijini National Park is the nearest conservation reserve to the study area, located approximately 46 km to the north-east (Figure 1).

3 Methods

3.1 Database Searches

Database searches were conducted to identify listed conservation significant flora and ecological communities within, or in close proximity to, the study area. Database search details are summarised in Table 5. Conservation categories for ecological communities and flora are presented in Appendix B. Introduced flora species were compared to the Department of Primary Industries and Regional Development list, to determine if any have been listed as declared pests (Department of Primary Industries and Regional Development 2018), and the WoNS list (Australian Weeds Committee 2012b). Introduced flora categories are presented in Table B.6 (Appendix B).

Table 5: Database searches undertaken.

Database	Date search results received	Search focus	Search area
<i>NatureMap</i> (Department of Biodiversity, Conservation, and Attractions 2018b)	11/07/2018	Flora of conservation significance	40 km circular buffer around the coordinates: 23°10'28" S, 117°25'21" E
Threatened and Priority Ecological Communities Database (Department of Biodiversity, Conservation, and Attractions 2018c)	12/07/2018	Listed threatened and priority ecological communities	40 km radius from the study area boundary
Threatened and Priority Flora Database (TPFL) (Department of Biodiversity, Conservation, and Attractions 2018d)	09/07/2018	Listed threatened and priority flora	40 km radius from the study area boundary
Threatened and Priority Flora List (TP List) (Department of Biodiversity, Conservation, and Attractions 2018e)			
Western Australian Herbarium Flora Database (Department of Biodiversity, Conservation, and Attractions 2018f)			
Protected Matters Search Tool (Department of the Environment and Energy 2018b)	11/07/2018	MNES – flora	40 km circular buffer around the coordinates: - 23.17436, 117.42261 (MGA50, GDA94)
Rio Tinto Iron Ore 'Priority Flora Database Records' Digital Dataset (Rio Tinto Iron Ore 2018)	09/07/2018	Flora of conservation significance	The study area.

Database	Date search results received	Search focus	Search area
Western Australian government datasets (Department of the Environment and Energy 2017a, 2017b; Department of the Environment and Energy 2018a) and the Register of the National Estate dataset (Department of the Environment and Energy 2008)	28/06/2018	Environmentally Sensitive Areas (ESAs)	100 km radius from the study area boundary.

3.2 Literature Review

Flora and vegetation surveys have previously been commissioned by Rio Tinto within the vicinity of the study area and supplied to Astron for the desktop assessment. The previous survey areas in relation to the current study area are shown in Figure C.1 (Appendix C). The Biota (2007) survey did not have a defined survey area and could not be included in Figure C.1. Five previous surveys occur within the study area:

- Western Ranges Level 1 Vegetation, Flora and Fauna Survey (Astron Environmental Services 2013)
- Western Range Additional Area Vegetation and Flora Report (Biota Environmental Sciences 2012a)
- Western Range Phase 2 Vegetation and Flora Report (Biota Environmental Sciences 2012b)
- Regional Survey for *Ptilotus* sp. Brockman, *Aluta quadrata* and *Geijera* aff. *salicifolia* (Biota Environmental Sciences 2007)
- 66 West (Western Ranges) Rare Flora Survey (Biota Environmental Sciences 2003).

The reports from an additional two surveys conducted immediately adjacent to the study area were also reviewed:

- Greater Paraburdoo Detailed Flora and Vegetation Survey (Astron Environmental Services 2018b). Which also reviewed:
 - Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo (Mattiske Consulting 1998)
 - Report for Turee Syncline Project. Vegetation, Flora and Fauna Baseline Surveys (GHD Pty Ltd 2009)
 - Eastern Ranges Life of Mine Flora and Vegetation Report NVCP (Rio Tinto Iron Ore 2010)
 - Paraburdoo Mine Area Botanical And Vertebrate Fauna Survey (ecologia Environment 2011)
 - Flora and Vegetation Survey of the Turee Syncline Area (Mattiske Consulting 2011)
 - Flora and Vegetation Survey for the Paraburdoo Magazine and the Tom Price Powerline Infrastructure Areas (Pilbara Flora 2011)
 - Flora and Vegetation Assessment of the Turee Creek Water Pipeline Upgrade and Paraburdoo Town Feeder One Line Replacement (Rio Tinto Iron Ore 2012)

- Flora and Vegetation Assessment of the Eastern Ranges Study Area (Rio Tinto Iron Ore 2014)
- Joe’s Crossing Minor Tributary Biological Assessment (Astron Environmental Services 2015a)
- Paraburdoo Haul Road Biological Assessment (Astron Environmental Services 2015b)
- Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016)
- Channar Reconnaissance Flora and Vegetation Survey (Astron Environmental Services 2018a). Which also reviewed:
 - Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo (Mattiske Consulting 1998)
 - Eastern Ranges Life of Mine Flora and Vegetation Report NVCP (Rio Tinto Iron Ore 2010)
 - Paraburdoo Mine Area Botanical and Vertebrate Fauna Survey (ecologia Environment 2011)
 - Flora and Vegetation Assessment of the Turee Creek Water Pipeline Upgrade and Paraburdoo Town Feeder One Line Replacement (Rio Tinto Iron Ore 2012) (Rio Tinto Iron Ore 2012)
 - Flora and Vegetation Assessment of the Eastern Ranges Study Area (Rio Tinto Iron Ore 2014)
 - Paraburdoo Haul Road Biological Assessment (Astron Environmental Services 2015b)
 - Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment (Eco Logical Australia 2016)
 - Flora and Vegetation Survey of the Turee Syncline Area (Mattiske Consulting Pty Ltd 2011) (Mattiske Consulting 2011)
 - Flora and Vegetation Survey for the Paraburdoo Magazine and the Tom Price Powerline Infrastructure Areas (Pilbara Flora 2011)
 - Joe’s Crossing Minor Tributary Biological Assessment (Astron Environmental Services 2015a).

3.3 Likelihood of Occurrence Assessment

Previous vegetation mapping, flora and vegetation survey results and aerial imagery was interpreted to identify potential habitat types. The conservation significant flora species returned from the database searches were then categorised according to the criteria in Table 6 for potential occurrence within the study area.

Table 6: Criteria used to assess the likely presence of conservation significant flora in the study area.

Likelihood of occurrence	Criteria
Recorded	Species previously recorded within the study area and likely to still occur (records from literature review or recent database records, in areas where no clearing has been undertaken)
Likely	Species previously recorded within the study area (older records from database searches) or within 10 km of the study area and suitable habitat appears to be present in the study area
Potential	Species previously recorded within 10 km to 20 km of the study area and/or suitable habitat appears to be present in the study area
Unlikely	No suitable habitat appears to be present in the study area

3.4 Vegetation Mapping

A large proportion (83%) of the study area has been previously mapped. The vegetation mapping from Biota (2012b, 2012a) and Astron (2013) was amalgamated, and the vegetation unit descriptions from each was reconciled in line with vegetation mapping undertaken in the adjacent Greater Paraburdoo survey area (Astron Environmental Services 2018b). The codes, descriptions and nomenclature used for the vegetation units have been standardised across the study area. All vegetation descriptions and codes have been updated to reflect current nomenclature and to maintain consistency with the style of description used by Astron Environmental Services (2018b). In all mapping units, all members of the *Acacia aneura* complex are referred to as *Acacia aneura* sens. lat. for consistency (see Section 3.5 for details).

For parts of the study area that had not previously been mapped (17%), colour signatures of aerial imagery were compared with adjacent mapped vegetation units to extrapolate probable vegetation units. This does not substitute for a thorough on-ground assessment of the vegetation, but provides some indication of the likely variability and extent of vegetation units across the area.

3.5 Flora Taxonomy and Nomenclature

A compiled species list for the study area was created from previous surveys and included all data from the Astron (2013) and Biota (2003) surveys, plus data from quadrats and relevés that fall within the current study area from Biota (2012b, 2012a). More species may have been observed by Biota (2012a, 2012b) as opportunistic observations, but as the study areas for these surveys are larger than the current study area, and there are no locations given for each opportunistic observation, it cannot be determined if these would occur within or outside the current study area.

The taxa from each project were reconciled and brought up to date with current Western Australian Herbarium nomenclature. All members of the *Acacia aneura* complex have been referred to as *Acacia aneura* sens. lat. for consistency, including references to: *Acacia aneura*, *Acacia aneura* var. *longicarpa*, *Acacia aneura* var. *intermedia*, *Acacia aneura* var. *?aneura*, *Acacia aneura* var. *?aneura/intermedia*, *Acacia aneura* (flat curved; MET 15 548), *Acacia aneura* (grey flat recurved tips; MET 15 828), *Acacia aneura* (long, flat, recurved; FMR 35-3), *Acacia* aff. *aneura* (long, flat, recurved; FMR 35-3), *Acacia* aff. *aneura* (long, flat, recurved; FMR35-3) x *A.* aff. *aneura* (narrow, fine veined; site 1259), *Acacia aneura* (narrow fine veined; site 1259), *Acacia* aff. *aneura* (narrow fine veined; site 1259), *Acacia* aff. *aneura* (subterete long; site 1245), *Acacia aneura* (form not determined), *Acacia aptaneura*, *Acacia fuscaneura*, *Acacia* aff. *fuscaneura* and *Acacia pteraneura*.

3.6 Floristic Analysis

A species accumulation curve and cluster analyses were completed by Astron Senior Scientist Dr Aaron Gove. A species accumulation curve was created in order to examine the adequacy of survey effort, while cluster analyses were completed to examine the relationship between:

- floristic groups and vegetation units within the current study area
- floristic groups of study area quadrats and relevés and their association with quadrats and relevés surveyed at a local scale.

Sampling effort was assessed using a species accumulation curve and modelled estimates of the total species pool. Four different species estimators were compared: Chao 2, Jackknife 1, Jackknife 2, and Bootstrap (Colwell and Coddington 1994). Surveys included in the analysis were: Astron (2013), and Biota (2012b, 2012a). All analysis was performed in R 3.2.1 (R Development Core Team 2015) using the package “Vegan”.

Similarity amongst vegetation quadrats was assessed using dendrograms which were based on Sorensen’s index of Similarity (equivalent to Bray-Curtis similarity with presence-absence data). The dendrograms were constructed using the Unweighted Pair Group Method with Arithmetic Mean method, within the software Primer. Significant clusters of samples were identified using the Simprof test (Clarke, Somerfield, and Gorley 2008). Following normal convention, statistically significant clusters were those distinguished by a P-value <0.05.

The species lists from all projects used in the analyses were reconciled to provide consistency in nomenclature. Any taxa not confirmed to species level were removed from the analyses. Analysis of floristic groups and vegetation units within only the current WRDE study area were performed on presence-absence data of all species from 61 sites (Astron Environmental Services 2013; Biota Environmental Sciences 2012b, 2012a). For the larger local analysis, annual species were removed prior to analysis in order to minimise temporal variation between surveys undertaken during different seasons and across different years. This local analysis was undertaken for 463 sites from eight surveys (Astron Environmental Services 2013, 2018b; Biota Environmental Sciences 2012b, 2012a; ecologia Environment 2011; GHD Pty Ltd 2009; Mattiske Consulting 2011; Rio Tinto Iron Ore 2014).

3.7 Limitations

Following completion of the desktop assessment, a review of any limitations that may have affected a complete assessment of the study area was conducted. The limitations discussed below are based on those suggested as considerations in EPA (2016).

Previous biological surveys have been conducted in the broader area, and broad-scale information is available from Beard (1975a) and Payne et al. (1980). Many previous biological reports near to the study area were available for review (see Section 3.2). Previous vegetation mapping has been undertaken over 83% of the study area (Biota Environmental Sciences 2012a, 2012b; Astron Environmental Services 2013). Therefore, contextual information at a very broad regional scale and at a smaller locality scale is not a limiting factor for this survey.

However, it should be noted that the most recent flora and vegetation survey of the study area was undertaken in 2013, and thus the information being relied upon for this desktop assessment is generally over five years old. There may have been changes to vegetation condition in that time, and other temporal changes to vegetation structure due to fire, grazing or succession.

With regard to the completeness of the study, a significant portion of the study area (1,040 ha or 17%) has not been subjected to a flora and vegetation survey. These areas are generally lower hills and plains to the north-west and south-west of Western Range. Conclusions here regarding representation of vegetation units and the presence of conservation significant flora in these areas are informed only from analysis of similar aerial imagery and extrapolation of vegetation mapping units, and may not be accurate.

Furthermore, some vegetation units described by previous reports do not have sufficient vegetation sampling sites (neither in the current study area, nor outside of it) to accurately delineate the vegetation unit using multivariate statistics, and do not meet the minimum requirements for sampling as outlined in the Technical Guidance (Environmental Protection Authority 2016). These are discussed in more detail in Section 4.5.

4 Results

4.1 Database Search Results

The Protected Matters Search Tool was utilised to generate an EPBC Act Protected Matters Report for an area within a 40 km buffer surrounding a central point within the study area. The full results are detailed in Appendix D. No Federally listed threatened flora species or their habitat were listed in the search results (Department of the Environment and Energy 2018b). There was one listed occurrence of Commonwealth land, however it was unnamed and unspecified (Department of the Environment and Energy 2018b). The only invasive flora species identified as likely to occur in the area was **Cenchrus ciliaris* (buffel grass) (Department of the Environment and Energy 2018b).

Available government databases were searched for the occurrence of any ESAs within 100 km of the edge of the study area. Searches found no RAMSAR sites and no World Heritage areas within 100 km of the study area (Department of the Environment and Energy 2017a; Department of the Environment and Energy 2018a). One important wetland, the Mount Bruce coolibah-lignum flats wetland occurs approximately 95 km from the study area (Department of the Environment and Energy 2017b). Two ESAs listed under the Register of the National Estate occur within the search area. These are: the Woongarra Gorge Area, approximately 37 km from the study area; and the Hamersley Range National Park (1977 boundary, now Karijini National Park), approximately 47 km from the study area (Department of the Environment and Energy 2008).

A search for threatened and priority ecological communities was undertaken by DBCA for an area within 40 km of the study area (Appendix D). No threatened or priority ecological communities were listed in the search area (Department of Biodiversity, Conservation, and Attractions 2018c).

A search for threatened and priority flora species was undertaken by DBCA using the Threatened and Priority Flora Database (TPFL), the Western Australian Herbarium database (WAHerb) and the Threatened and Priority Flora Species List (TP List) for an area within 40 km of the study area (full results in Appendix D). The TP List is searched based on place names/descriptions rather than a specific geodetic location and thus, can return results from further than the requested 40 km buffer.

Database searches recorded 39 conservation significant flora species within the vicinity of the study area, including: one threatened species, nine P1 species, six P2 species, 17 P3 species and six P4 species (Table 7). These are discussed further in Section 4.3.1.

Table 7: Threatened and priority flora listed in database search results.

Species	TP List ¹	WAHerb ²	NatureMap ³	Rio Tinto Iron Ore supplied ⁴
Threatened				
<i>Aluta quadrata</i> T	✓	✓	✓	✓
Priority 1				
<i>Dicrasyllis mitchellii</i> P1	✓			
<i>Eremophila</i> sp. Hamersley Ranges (K. Walker KW 136) P1		✓	✓	✓
<i>Goodenia pedicellata</i> P1		✓		
<i>Helichrysum oligochaetum</i> P1	✓	✓	✓	
<i>Hibiscus campanulatus</i> P1	✓	✓	✓	✓
<i>Hibiscus</i> sp. Mt Brockman (E. Thoma ET 1354) P1		✓		
<i>Sida</i> sp. Hamersley Range (K. Newbey 10692) P1		✓	✓	✓
<i>Indigofera roseola</i> P1	✓			
<i>Uvedalia clementii</i> P1	✓			
Priority 2				
<i>Hibiscus</i> sp. Gurinbiddy Range (M.E. Trudgen MET 15708) P2		✓		✓
<i>Eremophila pusilliflora</i> P2	✓			
<i>Oxalis</i> sp. Pilbara (M. E. Trudgen 12725) P2				✓
<i>Rhodanthe frenchii</i> P2		✓		
<i>Scaevola</i> sp. Hamersley Range basalts (S. van Leeuwen 3675) P2		✓	✓	
<i>Solanum octonum</i> P2		✓	✓	✓
Priority 3				
<i>Dampiera anonyma</i> P3		✓		
<i>Eremophila coacta</i> P3	✓	✓	✓	✓
<i>Eremophila magnifica</i> subsp. <i>velutina</i> P3		✓		
<i>Eremophila rigens</i> P3	✓	✓		
<i>Eremophila shonae</i> subsp. <i>diffusa</i> P3	✓			
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3		✓	✓	✓
<i>Grevillea saxicola</i> P3	✓	✓	✓	✓
<i>Gunniopsis propinqua</i> P3		✓		
<i>Nicotiana umbratica</i> P3		✓	✓	✓
<i>Olearia mucronata</i> P3	✓	✓		
<i>Pilbara trudgenii</i> P3		✓	✓	✓
<i>Ptilotus subspinescens</i> P3	✓	✓		
<i>Rostellularia adscendens</i> var. <i>latifolia</i> P3, <i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3		✓		
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	✓		✓	✓
<i>Solanum kentrocaule</i> P3		✓		✓

Species	TP List ¹	WAHerb ²	NatureMap ³	Rio Tinto Iron Ore supplied ⁴
<i>Swainsona thompsoniana</i> P3		✓	✓	
<i>Themeda</i> sp. Hamersley Station (M.E. Trudgen 11431) P3		✓	✓	
Priority 4				
<i>Bulbostylis burbidgeae</i> P4				✓
<i>Eremophila magnifica</i> subsp. <i>magnifica</i> P4		✓	✓	
<i>Eremophila youngii</i> subsp. <i>lepidota</i> P4	✓	✓		
<i>Ptilotus mollis</i> P4		✓		✓
<i>Ptilotus trichocephalus</i> P4	✓	✓	✓	✓
<i>Rhynchosia bungarensis</i> P4	✓			

¹- TP List (Department of Biodiversity, Conservation, and Attractions 2018e)

²- WAHerb (Department of Biodiversity, Conservation, and Attractions 2018c, 2018e)

³- NatureMap (Department of Biodiversity, Conservation, and Attractions 2018b)

⁴- Rio Tinto Iron Ore supplied 'Priority Flora Database Records' (Rio Tinto Iron Ore 2018)

4.2 Literature Review

Seven surveys undertaken within, or adjacent to the study area, are considered relevant for contextual information. A summary of the key findings from these reports is provided in Table 8. The location of these surveys in relation to the study area is presented in Figure C.1 (Appendix C), except for Biota (2007) which did not have a defined survey area. Further detail on the results of the surveys is provided under the subheadings below.

Table 8: Summary of relevant vegetation and flora surveys in the vicinity of the current survey area.

Survey parameter	Astron (2013) Western Range Level 1 Vegetation, Flora and Fauna Survey	Biota (2012a) Western Range Additional Area: Vegetation and Flora Report	Biota (2012b)Western Range Phase 2: Vegetation and Flora Report	Biota (2007) Regional Survey for <i>Ptilotus</i> sp. Brockman, <i>Aluta</i> <i>quadrata</i> and <i>Geijera</i> aff. <i>salicifolia</i>	Biota (2003) 66 West (Western Range) rare flora survey	Astron (2018b) Greater Paraburdoo Detailed Flora and Vegetation Survey	Astron (2018a) Channar Reconnaissance Flora Survey
Survey area size (ha)	487.5	4, 423	3,281	50 km radius of known populations	N/A	11,203	7,305
Survey focus	Level 1	Level 1	Level 2 – two phase	Systematic rare flora searches	Systematic rare flora searches	Level 2 – two phase	Reconnaissance
Survey timing	August 2013	September 2011	June and September and October 2009 May 2011	October 2006	August and September 2002	July and 25 August 2017 April 2018	April 2018
Seasonal conditions	Optimal	Average	Optimal (2009) Average (2011)	N/A	Dry	Average to below average	Below average
Survey effort (quadrats/relevés)	18 relevés	49 quadrats	38 quadrats	N/A	50 – 100 m transects	41 quadrats / 3 relevés	16 relevés
Total vegetation associations mapped	14	22	22	N/A	N/A	21	35
TEC/PECs recorded	0	0	0	N/A	N/A	0	0
Total species recorded	188	326	311	1	3	300	114
Conservation significant flora species recorded (currently listed)	2	2 (1 potential)	6	1	3	7 (1 potential)	3
<i>Aluta quadrata</i> T			✓	✓	✓	✓	

Survey parameter	Astron (2013) Western Range Level 1 Vegetation, Flora and Fauna Survey	Biota (2012a) Western Range Additional Area: Vegetation and Flora Report	Biota (2012b) Western Range Phase 2: Vegetation and Flora Report	Biota (2007) Regional Survey for <i>Ptilotus</i> sp. Brockman, <i>Aluta quadrata</i> and <i>Geijera</i> aff. <i>salicifolia</i>	Biota (2003) 66 West (Western Range) rare flora survey	Astron (2018b) Greater Paraburdoo Detailed Flora and Vegetation Survey	Astron (2018a) Channar Reconnaissance Flora Survey
<i>Eremophila</i> sp. Hamersley Range (K. Walker KW 136) P1						✓	
<i>Hibiscus campanulatus</i> P1			✓			✓	✓
<i>Eremophila coacta</i> P3							✓
<i>Goodenia</i> sp. East Pilbara P3	✓	✓	✓		✓	✓	
<i>Grevillea saxicola</i> P3						✓	✓
<i>Nicotiana umbratica</i> P3	✓		✓			✓	
<i>Sida</i> sp. Barlee Range P3			✓		✓	✓	
<i>Ptilotus trichocephalus</i> P4		✓	✓				
<i>Eriachne</i> sp. Western Range		✓					
<i>Solanum</i> sp. (indet.)/ <i>Solanum octonum</i> P2						✓	

Note: Author names are abbreviated.

4.2.1 Previous Level 2 (detailed) surveys

One Phase 2 vegetation and flora survey has been conducted over 3,281 ha (52.4%) of the study area (Biota Environmental Sciences 2012b). Approximately half of the Biota (2012b) survey area also extends into the Greater Paraburdoo survey area (Astron Environmental Services 2018b). The Biota (2012b) report should be read in conjunction with the Western Range Additional Area: Vegetation and Flora Report (Biota Environmental Sciences 2012a), which expands upon the previous area of the two phase survey, with a single season Level 2 survey of additional areas. Together, these two previous surveys encompass 78.2% (4,895.5 ha) of the current study area.

Environmental conditions during the two phase survey were considered optimal for recording annual and cryptic flora species and floristic diversity was considered comprehensive (Biota Environmental Sciences 2012b). Twenty-two vegetation units were mapped across the survey area. Floristic analysis was undertaken for all the sites within the survey area, and supported the level of vegetation mapping undertaken (Biota Environmental Sciences 2012b), however no local or regional analysis was undertaken. Vegetation units D7 and D8 of the major creek systems were considered to be of Moderate conservation significance (Biota Environmental Sciences 2012b). These units represent ‘ecosystems at risk’ within the “springs” and “major ephemeral watercourses/wetland systems” categories, which should ascribe them a High conservation value, but they were noted to be degraded through weed invasion (Biota Environmental Sciences 2012b). Sections of vegetation supporting the then P1 and now threatened species *A. quadrata* T, within vegetation types H1, H2 and H3, were considered to be of Moderate conservation significance, as they provide habitat for this restricted species (Biota Environmental Sciences 2012b).

Five priority flora species were recorded: *A. quadrata* T; *Goodenia*. sp. East Pilbara (A.A. Mitchell PRP 727) P3, *Nicotiana umbratica* P3, *Sida* sp. Barlee Range (S. van Leeuwen 1642) P3 and *Ptilotus trichocephalus* P4. One species of interest, *Hibiscus* sp. Canga, which has since been renamed *H. campanulatus* P1 (Biota Environmental Sciences 2012b) was also recorded. A total of 311 native taxa and 15 introduced species were recorded (Biota Environmental Sciences 2012b).

A single season Level 2 survey of additional areas was undertaken following below average rainfall (Biota Environmental Sciences 2012a). The 22 vegetation units described and mapped in the Western Range survey area (Biota Environmental Sciences 2012b) were extended into the additional areas (Biota Environmental Sciences 2012a). Vegetation types D7 and D8 of the major creek systems were again considered to be of Moderate conservation significance (Biota Environmental Sciences 2012a). Gullies and gorges within the survey area, denoted by vegetation unit D6, were also noted as areas of Moderate conservation significance due to their value as refugia for fire sensitive species and other species that prefer rocky, mesic habitats (Biota Environmental Sciences 2012a).

Two conservation significant flora species were identified, *G.* sp. East Pilbara P3 and *P. trichocephalus* P4 (Biota Environmental Sciences 2012a). A single specimen of an *Eriachne* was also noted as of interest, as it may represent a previously undescribed and poorly known entity, referred to with the provisional name of *Eriachne* sp. Western Range (Biota Environmental Sciences 2012a). A total of 326 native taxa and 17 introduced species were recorded within the Western Range Additional Area (Biota Environmental Sciences 2012a).

The Greater Paraburdoo Development Envelope is immediately east of the study area. This area was recently surveyed by Astron (2018b) including a review of previous work in the area and a detailed (two phase) flora and vegetation assessment. The seasonal conditions for the post-wet season second phase survey were considered average to below average (Astron Environmental Services 2018b). Twenty-one vegetation units, aligned to the previous Biota (2012b) vegetation mapping

units, were identified over the area (Astron Environmental Services 2018b). A floristic analysis of the plots within the survey area concluded that the scale of mapping was conservative and appropriate for the floristic diversity of the area (Astron Environmental Services 2018b). One vegetation unit, D7 was considered to potentially represent a groundwater dependent ecosystem (GDE) (Astron Environmental Services 2018b).

Seven conservation significant flora species were identified in the Greater Paraburdoo Development Envelope; *A. quadrata* T, *Eremophila* sp. Hamersley Range (K. Walker KW 136) P1, *H. campanulatus* P1, *G.* sp. East Pilbara (A.A. Mitchell PRP 727) P3, *G. saxicola* P3, *N. umbratica* P3, *S.* sp. Barlee Range (S. van Leeuwen 1642) P3 (Astron Environmental Services 2018b). Additionally, one unconfirmed species of conservation significance, *Solanum* sp. (indet.) was recorded. *Solanum octonum* P2 was recorded in previous surveys of the area, but it is possible those records may represent the unconfirmed *Solanum* sp. (indet.) (Astron Environmental Services 2018b). *Ptilotus trichocephalus* P4 was considered likely to occur but was not recorded during the below average seasonal conditions (Astron Environmental Services 2018b). A total of 278 confirmed native taxa and 22 introduced species were recorded (Astron Environmental Services 2018b). The weed **Ruellia simplex* (Mexican petunia) was identified as the first record within Western Australia (Astron Environmental Services 2018b).

4.2.2 Previous Level 1(reconnaissance) surveys

A Level one survey of an area overlapping some of the Biota (2012a, 2012b) areas, and extending over the rocky hills further to the west, was undertaken by Astron (2013). This area lies entirely within the current WRDE study area and accounts for 7.8% (487.5 ha). The survey was undertaken during optimal seasonal conditions (Astron Environmental Services 2013). Fourteen vegetation types, as aligned to the previous Biota (2012b) vegetation mapping units, were identified over the area (Astron Environmental Services 2013). Two vegetation types (D1 and D3) were identified to correspond with the Ashburton subregion ‘ecosystem at risk’ “Mulga creekline community, alluvial plains of Ashburton” (Astron Environmental Services 2013). One of the three Pre-European vegetation associations broadly mapped over the area (Beard 1975a) was considered to accurately represent and describe the vegetation present in the area (Astron Environmental Services 2013). This vegetation association, 181, was identified as high reservation priority in the Ashburton subregion (Kendrick 2001a), and medium reservation priority in the Hamersley subregion (Kendrick 2001b). Two conservation significant flora species, *N. umbratica* P3 and *G.* sp. East Pilbara P3 were recorded (Astron Environmental Services 2013). A total of 183 native taxa and five introduced species were recorded (Astron Environmental Services 2013).

The Channar Development Envelope is adjacent to the eastern end of the Greater Paraburdoo survey area. This survey was limited by dry seasonal conditions and a lack of access to large portions of the survey area (Astron Environmental Services 2018a). Three priority flora species were identified during the survey: *H. campanulatus* P1, *Eremophila coacta* P3 and *G. saxicola* P3 (Astron Environmental Services 2018a). Eleven conservation significant flora that were recorded by previous targeted surveys of the area, were considered likely to occur: *A. quadrata* T, *E.* sp. Hamersley Range (K. Walker KW 136) P1, *Sida* sp. Hamersley Range (K. Newbey 10692) P1, *S. octonum* P2, *G.* sp. East Pilbara (A.A. Mitchell PRP 727) P3, *N. umbratica* P3, *S.* sp. Barlee Range (S. van Leeuwen 1642) P3, *Solanum kentrocaule* P3, *Bulbostylis burbridgeae* P4, *Ptilotus mollis* P4 and *P. trichocephalus* P4 (Astron Environmental Services 2018a).

A large proportion of the Channar Development Envelope (93%) had been previously mapped by Mattiske and Associates (1986). Areas that had not been previously mapped were assigned mapping units consistent with those from the adjacent Greater Paraburdoo survey area (Astron Environmental Services 2018b). Thirty-five vegetation units and 13 mosaics were mapped over the

Channar survey area (Astron Environmental Services 2018a). The vegetation units used in the Greater Paraburdoo survey (and the previous Biota surveys (2012b, 2012a)) tend to be broader associations than those defined by Mattiske and Associates (1986), however, the two data sets could not be easily amalgamated into one without undertaking a more detailed field investigation (Astron Environmental Services 2018a). The mapping that was preserved from Mattiske and Associates (1986) appeared to be reliable and accurate in the areas where it was able to be ground-truthed (Astron Environmental Services 2018a).

4.2.3 Previous targeted flora searches

In 2002, Hamersley Iron commissioned Biota Environmental Sciences to undertake systematic rare flora searches in the 66 West area, which is part of the current WRDE study area. Previous work near Howie's Hole in Channar had identified the then P1 (now T) species *A. quadrata* T and, given its high conservation significance, this species was one of the main targets for the 66 West rare flora survey (Biota Environmental Sciences 2003). The timing of the survey was not optimal for the collection of ephemeral flora species, as it followed a prolonged dry period (Biota Environmental Sciences 2003). In excess of 6,500 *Aluta quadrata* T were recorded from eight relatively discrete gorge/creek systems (Biota Environmental Sciences 2003). *Goodenia omearana* P1 (now known as *G. sp.* East Pilbara P3) was recorded from four locations on calcareous plains in the south-west of the study area (Biota Environmental Sciences 2003). One species of interest, at the time identified as *Sida aff. cardiophylla*, now identified as *S. sp.* Barlee Range P3, was found in rocky gorge habitats (Biota Environmental Sciences 2003).

In 2007, Pilbara Iron commissioned Biota Environmental Sciences to undertake a regional survey for three conservation significant flora species (Biota Environmental Sciences 2007). One of these was *A. quadrata* T, which was searched for at previously recorded locations, and in target areas of narrow, sheltered gullies determined from GoogleEarth, within a 50 km radius of known populations (Biota Environmental Sciences 2007). *Aluta quadrata* T was difficult to see from the air, and no new populations were identified, although at least 14 locations were searched, and some appeared to have suitable habitat (Biota Environmental Sciences 2007).

One previous location of *A. quadrata* T, recorded by Malcolm Trudgen, and currently mapped on FloraBase approximately 30 km south of Paraburdoo (Biota Environmental Sciences 2007), is within the study area. The co-ordinates currently listed on FloraBase for this record are: 23° 21' 30.0" S, 117° 26' 30.0" E. However, following discussion with Malcolm Trudgen, it was determined that these co-ordinates should be corrected to 23° 11' 18.02" S and 117° 28' 23.00" E (Biota Environmental Sciences 2007). The correct location falls within the current WRDE study area, somewhat east of the eastern most population of *A. quadrata* T currently recorded by Rio Tinto within the area. The single previous record of *A. quadrata* T, from the Ashburton region (recorded as 6 km west of Mount Boggola) was determined to be an incorrect record and no *A. quadrata* T were able to be found at this location (Biota Environmental Sciences 2007). As such, the species is only known from three locations; Channar, Piraburdoo Creek and Western Range.

4.3 Flora

A compiled species list for the study area was created from previous surveys and is presented in Appendix E. This includes all data from the Astron (2013) and Biota (2003) surveys, plus data from quadrats and relevés that fall within the current study area from Biota (2012b, 2012a). All flora and vegetation sampling sites from previous surveys that occur within the study area are mapped in Figure F.1 (Appendix F).

There have been 291 confirmed vascular flora taxa from 47 families and 131 genera recorded in the study area. Some specimens could not be identified to species level, and may represent additional species (*Asteraceae* sp., *Aristida* sp., *Boerhavia* sp., *Corchorus* sp., *Cymbopogon* sp., *Dysphania* sp., *Eremophila* sp., *Eriachne* sp., *Euphorbia* sp., *Ficus* sp., *Goodenia* sp., *Hibiscus* sp., *Lepidium* sp., *Pterocaulon* sp., *Rhodanthe* sp., *Sclerolaena* sp., *Sida* sp., *Solanum* sp. and *Stenopetalum* sp.).

The dominant plant families were Fabaceae and Poaceae, with 42 and 34 confirmed species represented, respectively. *Eremophila* and *Acacia* were the most diverse genera, with 22 and 20 taxa respectively (Table 9).

Table 9: Families and genera most represented in the study area.

Family	Number of taxa
Fabaceae	42
Poaceae	34
Malvaceae	27
Genus	Number of taxa
<i>Eremophila</i>	22
<i>Acacia</i>	20
<i>Ptilotus</i>	13

4.3.1 Conservation Significant Flora

Conservation significant species recorded in the WRDE study area to date include:

- *Aluta quadrata* T
- *Goodenia* sp. East Pilbara P3
- *Grevillea saxicola* P3
- *Nicotiana umbratica* P3
- *Sida* sp. Barlee Range P3
- *Ptilotus trichocephalus* P4.

Table 10 provides details of vegetation units, habitat type, number of individuals and number of records for each of these priority flora species. Locations of conservation significant flora and species descriptions are provided in Appendix G.

Thirty-nine priority flora species have been identified within the literature and database searches as occurring within the vicinity of the WRDE study area. Of these, six have been previously recorded within the study area (Section 4.2), one species is considered likely to occur, and 15 species are considered to have the potential to occur (Appendix H). The remaining 17 species identified are considered unlikely to occur, due to lack of suitable habitat within the study area.

Hibiscus campanulatus P1 is considered likely to occur within the study area. It was identified in the Biota (2012b) survey, however the recorded locations occur just to the east of the current study area, within the Greater Paraburdoo Development Envelope. The vegetation types that this species was recorded from in Greater Paraburdoo area are also present in the WRDE study area, and there is therefore high potential that this species may occur.

Other priority species with potential to occur in the study area include:

- three P1 species; *E. sp.* Hamersley Range (K. Walker KW 136) P1, *Helichrysum oligochaetum* P1 and *S. sp.* Hamersley Range (K. Newbey 10692) P1
- three P2 species; *Hibiscus sp.* Gurinbiddy Range (M.E. Trudgen MET 15708) P2, *Scaevola sp.* Hamersley Range basalts (S. van Leeuwen 3675) P2 and *S. octonum* P2
- six P3 species; *E. coacta* P3, *Olearia mucronata* P3, *Pilbara trudgenii* P3, *Solanum kentrocaule* P3, *Swainsona thompsoniana* P3 and *Themeda sp.* Hamersley Station (M.E. Trudgen 11431) P3
- three P4 species; *Eremophila magnifica* subsp. *magnifica* P4, *Eremophila youngii* subsp. *lepidota* P4 and *P. mollis* P4.

Table 10: Conservation significant flora recorded in the study area.

Species	Estimated abundance (# of records) within the current study area ¹	Habitat	Vegetation unit/s
<i>Aluta quadrata</i> T	31,617 (2,960)	Edge of creek beds, base of cliffs, rocky crevices, near crest of ridge.	H1, H2, H3, P1, P3, D3, D6 and D10
<i>Goodenia sp.</i> East Pilbara (A.A. Mitchell PRP 727) P3	107 (19)	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains, stony plains, hill slopes.	H2, H3, H6, P1 and P4
<i>Grevillea saxicola</i> P3	5 (5)	Low rocky hill, red-brown sandy loam with ironstone pebble cover, steep scree slopes.	H1 and H2
<i>Nicotiana umbratica</i> P3	116 (4)	Shallow soils. Rocky outcrops.	H1, H2 and H3
<i>Sida sp.</i> Barlee Range (S. van Leeuwen 1642) P3	62 (13)	Skeletal red soils pockets. Steep slope.	H1, H2, H3 and H4
<i>Ptilotus trichocephalus</i> P4	985 (164)	Sandy soils, colluvial plains.	P1, P4 and D3

¹ –Population counts from records in the Western Range Development Envelope study area as provided by RTIO database (Rio Tinto Iron Ore 2018)

4.3.2 Introduced Flora

A search for weeds within the Rio Tinto database listed nine introduced species from previous surveys in the study area (Rio Tinto Iron Ore 2018). Table 11 details the number of individuals and records for each introduced species previously recorded within and surrounding the study area; along with their rankings in the Pilbara according to the Weed Prioritisation Process (Department of Parks and Wildlife 2016b; Rio Tinto Iron Ore 2018). Previously recorded introduced flora locations and descriptions are presented in Appendix H. None of the introduced species, either known from the current study area or from any of the surrounding surveys and database searches, are listed as WoNS (Australian Weeds Committee 2012b), or listed as declared pest plants in Western Australia under the BAM Act (Department of Primary Industries and Regional Development 2018).

Table 11: Rankings of introduced flora recorded in the study area, nearby previous surveys and NatureMap search.

Species	Ecological impact ¹	Invasiveness ¹	Priority ranking ¹	No. individuals (no populations) in study area	Biota 2012a	Biota 2012b	Astron 2013	Astron 2018a	Astron 2018b	DBCAs 2018b
* <i>Aerva javanica</i> (kapok bush)	High	Rapid	Low	3 (3)	x	x		x	x	x
* <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i> (Mexican poppy)	Unknown	Rapid	Low		x	x			x	x
* <i>Asphodelus fistulosus</i> (onion weed)	Unknown	Rapid	Low							x
* <i>Bidens bipinnata</i> (bipinnate beggartick)	Unknown	Rapid	Low	42 (14)		x			x	
* <i>Cenchrus ciliaris</i> (buffel grass)	High	Rapid	Low	4004 (297)	x	x	x	x	x	x
* <i>Cenchrus setiger</i> (birdwood grass)	High	Rapid	Low	932 (42)	x	x	x		x	x
* <i>Chloris barbata</i> (purpletop chloris)	High	Rapid	High		x				x	
* <i>Chloris virgata</i> (feathertop Rhodes grass)	High	Rapid	High							x
* <i>Citrullus colocynthis</i> (colocynth)	Unknown	Moderate	-		x	x			x	x
* <i>Citrullus lanatus</i> (pie melon)	Unknown	Moderate	-			x			x	
* <i>Cynodon dactylon</i> (couch)	High	Rapid	Low			x			x	
* <i>Cyperus involucratus</i>	Unknown	Moderate	-							x
* <i>Datura leichhardtii</i> (native thornapple)	Unknown	Unknown	Low	1 (1)		x				x
* <i>Digitaria ciliaris</i> (summer grass)	Low	Slow	Negligible							x
* <i>Echinochloa colona</i> (awnless barnyard grass)	High	Rapid	Low		x	x			x	
* <i>Euphorbia hirta</i> (asthma plant)	Low	Slow	Negligible						x	x
* <i>Flaveria trinervia</i> (speedy weed)	Unknown	Unknown	-	2 (1)	x	x			x	x
* <i>Lactuca serriola</i> (prickly lettuce)	Low	Rapid	-						x	
* <i>Malvastrum americanum</i> (spiked malvastrum)	High	Rapid	Low	25 (7)	x	x	x		x	x
* <i>Melochia pyramidata</i>	Low	Unknown	-						x	
* <i>Passiflora foetida</i> var. <i>hispida</i> (stinking passion flower)	High	Rapid	Low		x				x	

Species	Ecological impact ¹	Invasiveness ¹	Priority ranking ¹	No. individuals (no populations) in study area	Biota 2012a	Biota 2012b	Astron 2013	Astron 2018a	Astron 2018b	DBCA 2018b
* <i>Phoenix dactylifera</i> (date palm)	High	Rapid	Medium						x	
* <i>Ricinus communis</i> (castor oil plant)	Unknown	Moderate	-						x	
* <i>Ruellia simplex</i> (Mexican petunia)	Unlisted	Unlisted	Unlisted						x	
* <i>Rumex vesicarius</i> (ruby dock)	High	Rapid	Medium	2169 (25)	x	x	x		x	x
* <i>Setaria verticillata</i> (whorled pigeon grass)	High	Rapid	Low	1 (1)	x				x	
* <i>Sisymbrium orientale</i> (Indian hedge mustard)	Low	Unknown	Low		x				x	x
* <i>Solanum nigrum</i> (black berry nightshade)	Low	Rapid	Low		x				x	x
* <i>Sonchus oleraceus</i> (common sowthistle)	Low	Rapid	Negligible		x	x			x	x
* <i>Taraxacum khatoonae</i> (dandelion)	Unlisted	Unlisted	Unlisted							x
* <i>Trianthema portulacastrum</i> (giant pigweed)	Unlisted	Unlisted	Unlisted						x	
* <i>Tribulus terrestris</i> (caltrop)	Unknown	Moderate	Low						x	
* <i>Vachellia farnesiana</i> (mimosa bush)	High	Rapid	Low		x				x	x
* <i>Washingtonia filifera</i> (cotton palm)	Low	Slow	Very High						x	

¹As rated by the Weed Prioritisation Process (Department of Parks and Wildlife 2016b). An 'Unknown' rating indicates that not enough information was known about the impacts or invasiveness of a species in a region and further research is required before a rating can be allocated. 'Unlisted' indicates this species was not included in the Weed Prioritisation Process.

²Population counts from records in the Western Range Development Envelope study area as provided by Rio Tinto database (Rio Tinto Iron Ore 2018).

4.4 Floristic Analysis

The species accumulation curve (Figure 3) indicates that between 64% and 87% of the potential total species pool available at the time of the surveys was recorded. The species accumulation curve indicates that the total number of species has been near exhaustive; the final 10% increase in sampling effort only resulted in a 3% increase in species recorded (Appendix J).

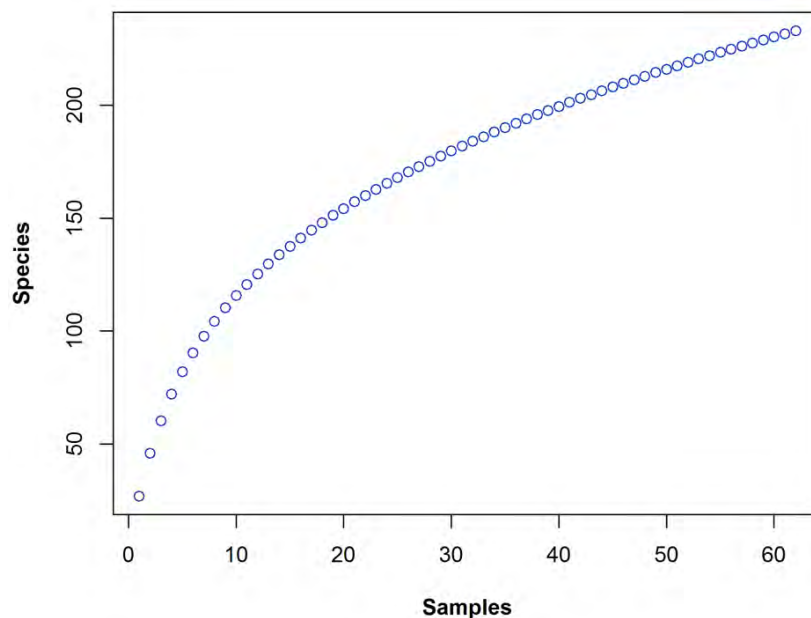


Figure 3: Species accumulation curve for vegetation sampling sites within the Western Range Development Envelope study area.

A floristic analysis of the available quadrat and relevé sites (61 sites) within the current WRDE study area (Astron Environmental Services 2013; Biota Environmental Sciences 2012b, 2012a) identified 18 statistically significant floristic groups (details of analysis and dendrogram provided in Appendix J). Six of these floristic groups are defined by only a single sampling site (listed in Table 12), indicating that either that particular type of flora assemblage is under-sampled in the study area, or that it is a restricted floristic type. There is some clustering of drainage line vegetation sites and hills and ridges vegetation sites, but the floristic analysis does not clearly show the same patterns as defined by the structural vegetation mapping (Appendix J).

Table 12: Floristic groups within the Western Range study area defined by a single sampling site.

Floristic groups with a single sampling site	Corresponding vegetation unit
WRA14	D3: AciAanAwTe
WRCP-04	D5: AciCEsppTe
WRR21	H1: AanAprAteTe
WRA09	H2: AprGbERsppTe
WRCP-10	D1: AanAwTe
WRR04	P1: AanAxAteERCspp

A local region analysis of all available quadrat and relevé data (463 sites) from eight surveys within the local region, including sites from Western Range, Paraburdoo, Eastern Range and Turee Syncline (Astron Environmental Services 2013, 2018b; Biota Environmental Sciences 2012b, 2012a; ecologia Environment 2011; GHD Pty Ltd 2009; Mattiske Consulting 2011; Rio Tinto Iron Ore 2014) identified

69 statistically significant floristic groups (Appendix J). Sites from the study area fell into 19 of these floristic groups. This is generally supportive of the results of Western Range only floristic analysis and the number of structural vegetation units mapped across the WRDE study area, with at least 19 significantly clustered floristic groups compared to 21 structural vegetation units (see Section 4.5).

Four of the floristic groups identified in the local region analysis are represented only by sites from Western Range, which may indicate that these floristic groups, and perhaps their associated vegetation units, may be restricted to the WRDE study area, or may not be represented elsewhere in the local region (Table 13).

Table 13: Floristic groups from local region analysis that occur only within the Western Range study area.

Western Range floristic group sites	Corresponding vegetation units
WRR21, WRR33 and WRR37	H1: AanAprAteTe, and H3: DpERcrTe
WRCP-10	D1: AanAwTe
WRA07, WRA08, WRA13, WRA16 and WRA24	H6: AanAteSsppTw, D1: AanAwTe and H7: AanAteERfTeTw
WRCP-02, WRA04, WRA27 and WRR13	P2: AanAteSspp, and P3: AanAteTe

4.5 Vegetation

Approximately 5,225 ha (83%) of the study area has been mapped previously and presented in the following reports:

- Western Range Phase 2 Vegetation and Flora Report (Biota Environmental Sciences 2012b)
- Western Range Additional Area: Vegetation and Flora Report (Biota Environmental Sciences 2012a)
- Western Ranges Level 1 Vegetation, Flora and Fauna Survey (Astron Environmental Services 2013).

Approximately 1,040 ha (17%) of the study area has not previously had vegetation mapped. To indicate what vegetation is likely to occur in the un-surveyed areas, adjacent vegetation mapping units have been extrapolated. The vegetation units presented in the extrapolated areas should be taken as indicative only, until they can be ground-truthed and mapped by experienced botanists.

Following amalgamation and reconciliation, 21 vegetation units were described within the study area. Vegetation unit descriptions and representative photos (where available) are presented in Table 14. Areas where vegetation had been removed for roads and tracks are mapped as 'cleared'. Vegetation mapping is presented in Figure K.1 (Appendix K) and all previous vegetation sampling site locations are presented in Figure F.1 (Appendix F).

Twenty of these vegetation units have been described by previous reports. One new vegetation unit, P9: CEsp, was described for a previously unmapped area in the south-west of the study area, as vegetation on plain landforms in this area did not match any of the other aerial photography signatures. Astron Zoologists had completed a fauna habitat description in the area and the photographs captured were used to support the new description.


Table 14 details which reports have described these vegetation units previously and the vegetation sampling sites which occur within each particular vegetation unit. The number of quadrats and relevés sampled in each vegetation unit is summarised in Table 15. Most of the amalgamated vegetation units have been adequately sampled within the study area (Environmental Protection


Authority 2016). Three vegetation units, H5: AteERfTw, P4: AanAxAteERcTa, and D10: AanAxTe, have been described only from sites which occur outside of the study area. Two vegetation units have less than the current expectation of three replicate sites (Environmental Protection Authority 2016); H5: AteERfTw is described by 2 quadrats and D5: AciCEsppTe is described by one quadrat and one relevé. Three vegetation units, P9: CEsp, D2: AanAxTa and D4: AciAanAwTw, have been described with no formal sites (no quadrats or relevés) sampled.


Vegetation unit P1: AanAxAteERcSpp, was the most widely distributed, covering approximately 18% of the study area. Vegetation units H2: AprGbERsppTe, H1: AanAprAteTe and P2: AanAteSpp, accounted for approximately 17%, 14% and 13% respectively.

Vegetation unit D2: AanAxTa, covered less than 0.1% of the study area, and similarly the drainage vegetation units D4: AciAanAwTw and D10: AanAxTe, each cover less than 0.5%.

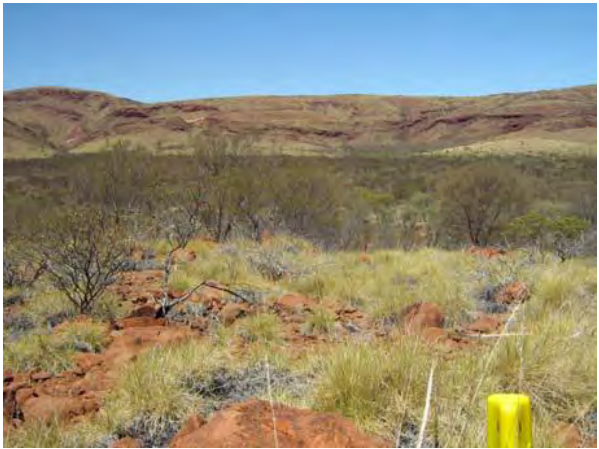
Table 14: Vegetation units described for the survey area.


Vegetation unit code and description	Sites	Representative photograph
Vegetation of Hills and Ridges		
<p>H1 – AanAprAteTe <i>Acacia aneura</i> sens. lat., <i>A. pruinocarpa</i> tall open shrubland over <i>A. tetragonophylla</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 859.5 (13.7)</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. kempeana</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>Dodonaea pachyneura</i>, <i>D. petiolaris</i>, <i>Eremophila canaliculata</i>, <i>E. cryptothrix</i>, <i>E. cuneifolia</i>, <i>E. fraseri</i> subsp. <i>fraseri</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Eriachne mucronata</i>, <i>E. pulchella</i>, <i>Gomphrena cunninghamii</i>, <i>Grevillea berryana</i>, <i>Maireana georgei</i>, <i>M. melanocoma</i>, <i>Polycarpaea longiflora</i>, <i>Psyrax suaveolens</i>, <i>Ptilotus obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Senna glutinosa</i> subsp. <i>glutinosa</i>, <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRR15, WRR21, WRR40, WRCP01, WRCP07, WRmn-03, WRmn-04, WRmn-06, WRmn-08, WRA03, WRA06</p> <p>(sites outside the current study area: GP04, GP20, WRR38, WRR41, WRR45, WRA41, MNBE01, MNBE02, MNBE06, MNBE17)</p>	 <p>Plate 1: Vegetation unit H1 – AanAprAteTe (Astron Environmental Services 2018b).</p>


Vegetation unit code and description	Sites	Representative photograph
<p>H2 – AprGbERsppTe <i>Acacia pruinocarpa</i>, <i>Grevillea berryana</i> tall open shrubland over <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, <i>E. canaliculata</i>, <i>E. cuneifolia</i> scattered low shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 1,055.5 (16.8)</p> <p>Associated species: <i>Abutilon lepidum</i>, <i>Acacia aneura</i> sens. lat., <i>A. synchronica</i>, <i>A. tetragonophylla</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>Cymbopogon ambiguous</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Eremophila cryptothrix</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. reticulata</i>, <i>Eriachne mucronata</i>, <i>E. pulchella</i>, <i>Euphorbia boophthona</i>, <i>Grevillea berryana</i>, <i>Maireana georgei</i>, <i>Paspalidium clementii</i>, <i>Ptilotus obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Scaevola acacioides</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>luerssenii</i>, <i>S. glutinosa</i> subsp. <i>pruinosa</i>, <i>S. glutinosa</i> subsp. <i>glutinosa</i>, <i>S. stricta</i>, <i>Solanum lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Trachymene oleracea</i> subsp. <i>oleracea</i>, <i>Tribulus suberosus</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRR14, WRR17, WRR18, WRR20, WRR30, WRF-ME, WRA09, WRCP-08, WRCP-09, WRmn-05 (sites outside the current study area: GP42, GP45, WRR36, MNBE23)</p>	 <p>Plate 2: Vegetation unit H2 – AprGbERsppTe (Astron Environmental Services 2018b).</p>


Vegetation unit code and description	Sites	Representative photograph
<p>H3 – DpERcrTe <i>Dodonaea pachyneura</i>, <i>Eremophila cryptothrix</i> tall shrubland over <i>Triodia epactia</i> hummock grassland</p> <p>Condition: Very Good – Excellent</p> <p>Area (ha) and proportion (%): 191.9 (3.1)</p> <p>Associated species: <i>Abutilon</i> sp. <i>Dioicum</i>, <i>Acacia aptaneura</i>, <i>A. pruinocarpa</i>, <i>A. tetragonophylla</i>, <i>Aluta quadrata</i> T, <i>Bulbostylis barbata</i>, <i>Cheilanthes brownii</i>, <i>Cleome viscosa</i>, <i>Cymbopogon ambiguus</i>, <i>Cyperus cunninghamii</i>, <i>Dodonaea petiolaris</i>, <i>Duperreya commixta</i>, <i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon polyphyllus</i>, <i>Eremophila cuneifolia</i>, <i>E. fraseri</i> subsp. <i>fraseri</i>, <i>E. latrobei</i> (various subspecies), <i>Eriachne mucronata</i>, <i>E. pulchella</i> subsp. <i>pulchella</i>, <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>, <i>Grevillea berryana</i>, <i>Lobelia heterophylla</i>, <i>Maireana georgei</i>, <i>Marsdenia australis</i>, <i>Nicotiana benthamiana</i>, <i>Paspalidium clementii</i>, <i>P. constrictum</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus incanus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>P. obovatus</i>, <i>Sida fibulifera</i>, <i>S. sp. Excedentifolia</i> (J.L. Egan 1925), <i>Senna glutinosa</i> subsp. <i>glutinosa</i>, <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p> <p>Previously described by: Biota (2012b) and Astron (2018b).</p>	<p>WRR33, WRR37, WRF-MF (sites outside the current study area: GP01, GP02)</p>	 <p>Plate 3: Vegetation unit H3 – DpERcrTe (Astron Environmental Services 2018b).</p>



Vegetation unit code and description	Sites	Representative photograph
<p>H4 – AteAsyERcTe <i>Acacia tetragonophylla</i>, <i>A. synchronicia</i> scattered tall shrubs over <i>Eremophila cuneifolia</i> scattered shrubs over <i>Triodia epactia</i> hummock grassland</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 319.7 (5.1)</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>Acacia pruinocarpa</i>, <i>Bonamia media</i>, <i>Bulbostylis barbata</i>, <i>Cleome viscosa</i>, <i>Corchorus crozophorifolius</i>, <i>Corymbia hamersleyana</i>, <i>Cucumis variabilis</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila cryptothrix</i>, <i>E. fraseri</i> subsp. <i>fraseri</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne mucronata</i>, <i>Gomphrena cunninghamii</i>, <i>Indigofera monophylla</i>, <i>Paraneurachne muelleri</i>, <i>Paspalidium clementii</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>glutinosa</i>, <i>S. stricta</i>, <i>Sida echinocarpa</i>, <i>Solanum cleistogamum</i>, <i>S. lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i>, <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>, <i>Triodia wiseana</i>, <i>Triumfetta clementii</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRR11, WRR12, WRCP-05 (sites outside the current study area: e029-AR, e030-AR, GP12, GP16, WRR43, WRF-MB, WRA33, WRA36, WRA38, WRA42, WRA43, WRA45, MNBE08, MNBE09, MNBE20)</p>	 <p>Plate 4: Vegetation unit H4 – AteAsyERcTe (Astron Environmental Services 2018b).</p>
<p>H5 – AteERfTw <i>Acacia tetragonophylla</i> scattered tall shrubs over <i>Eremophila fraseri</i> subsp. <i>fraseri</i> scattered shrubs over <i>Triodia wiseana</i> hummock grassland</p> <p>Condition: Good – Excellent</p> <p>Area (ha) and proportion (%): 31.1 (5.1)</p> <p>Associated species: <i>Acacia aneura</i> sens. lat., <i>A. pyrifolia</i>, <i>A. rhodophloia</i>, <i>A. sibirica</i>, <i>*Aerva javanica</i>, <i>*Bidens bipinnata</i>, <i>Cleome viscosa</i>, <i>Corchorus crozophorifolius</i>, <i>Cymbopogon ambiguus</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila cuneifolia</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>, <i>Gomphrena cunninghamii</i>, <i>Indigofera monophylla</i>, <i>Iseilema dolichotrichum</i>, <i>Notoleptopus decaisnei</i>, <i>Oldenlandia crouchiana</i>, <i>Paspalidium clementii</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus nobilis</i>, <i>P. obovatus</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. stricta</i>, <i>Solanum lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Swainsona canescens</i>, <i>Tribulus suberosus</i>, <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a) and Astron (2018b).</p>	<p>No sites recorded in current study area (sites outside the current study area: GP28, GP30, MNBE12, MNBE14)</p>	 <p>Plate 5: Vegetation unit H5 – AteERfTw (Astron Environmental Services 2018b).</p>


Vegetation unit code and description	Sites	Representative photograph
<p>H6- AanAteSppTw <i>Acacia aneura</i> sens. lat. low open woodland over <i>A. tetragonophylla</i> tall open shrubland over <i>Senna</i> spp. scattered shrubs over <i>Triodia wiseana</i> open hummock to hummock grassland.</p> <p>Condition: Very Good – Excellent</p> <p>Area (ha) and proportion (%): 182.1 (2.6)</p> <p>Associated species: <i>Aristida contorta</i>, <i>Eremophila jucunda</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Maireana planifolia</i>, <i>Ptilotus obovatus</i> var. <i>obovatus</i> and <i>Sporobolus australasicus</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a) and Astron (2013).</p>	<p>WRR16, WRA07, WRA08, WRA13</p>	<p>No photograph available</p>
<p>H7- AanAteERfTeTw <i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i> tall open shrubland over <i>Eremophila fraseri</i> subsp. <i>fraseri</i> scattered shrubs over <i>Triodia epactia</i>, <i>T. wiseana</i> open hummock grassland.</p> <p>Condition: Very Good – Excellent</p> <p>Area (ha) and proportion (%): 372.3 (5.9)</p> <p>Associated species: <i>Acacia citrinoviridis</i>, <i>A. kempeana</i>, <i>Aristida contorta</i>, <i>Eremophila cuneifolia</i>, <i>E. forrestii</i> subsp. <i>forrestii</i>, <i>Scaevola spinescens</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>pruinosa</i>.</p> <p>Previously described by: Biota (2012b) and Biota (2012a)</p>	<p>WRR08, WRA24, WRA26, WRA28, WRA29 (sites outside the current study area: WRR09, WRF-MD)</p>	 <p>Plate 6: Vegetation unit H7 – AanAteERfTeTw (Biota Environmental Sciences 2012a)</p>


Vegetation unit code and description	Sites	Representative photograph
Vegetation of Stony Plains		
<p>P1 – AanAxAteERcSspp <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i> open shrubland over <i>Eremophila cuneifolia</i>, <i>Senna</i> spp. scattered low shrubs</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 1,145.6 (18.3)</p> <p>Associated species: <i>Acacia synchronicia</i>, <i>A. wanyu</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>*Cenchrus ciliaris</i>, <i>Corchorus crozophorifolius</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caeruleus</i>, <i>E. polyphyllus</i>, <i>Eremophila forrestii</i> subsp. <i>forrestii</i>, <i>E. fraseri</i>, <i>E. latrobei</i> subsp. <i>filiformis</i>, <i>Eriachne pulchella</i>, <i>Frankenia magnifica</i>, <i>Gomphrena kanisii</i>, <i>Goodenia tenuiloba</i>, <i>Hybanthus aurantiacus</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Lepidium platypetalum</i>, <i>L. pedicellosum</i>, <i>Maireana melanocoma</i>, <i>M. planifolia</i>, <i>M. thesioides</i>, <i>Paraneurachne muelleri</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus aervoides</i>, <i>P. nobilis</i> subsp. <i>nobilis</i>, <i>P. obovatus</i>, <i>Scaevola spinescens</i>, <i>Sclerolaena costata</i>, <i>S. densiflora</i>, <i>S. eriacantha</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>S. sp.</i> Meekatharra, <i>S. stricta</i>, <i>Sporobolus australasicus</i>, <i>Trianthema glossostigmum</i>, <i>Tribulus suberosus</i>, <i>Triodia epactia</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRR04, WRR10, WRR19, WRR23, WRR31, WRR35, WRR42, WRA17, WRA18, WRCP-06 (sites outside the current study area: WRR02, WRR06, WRR07, WRR32, WRR34, WRF-MA, WRF-MC, WRA22, WRA31, WRA37, WRA39-AR, WRA46, WRA47, WRA49, WRA53)</p>	 <p>Plate 7: Vegetation unit P1 – AanAxAteERcSspp (Astron Environmental Services 2018b).</p>



Vegetation unit code and description	Sites	Representative photograph
<p>P2 – AanAteSpp <i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i> tall open shrubland over <i>Senna</i> spp. scattered low shrubs</p> <p>Condition: Good – Excellent</p> <p>Area (ha) and proportion (%): 813.6 (13.0)</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. rhodophloia</i>, <i>A. sibirica</i>, <i>A. wanyu</i>, <i>A. xiphophylla</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>, <i>E. cuneifolia</i>, <i>E. latrobei</i> subsp. <i>filiformis</i>, <i>E. platycalyx</i>, <i>Eriachne mucronata</i>, <i>E. pulchella</i>, <i>Gomphrena canescens</i> subsp. <i>canescens</i>, <i>G. kanisii</i>, <i>Goodenia tenuiloba</i>, <i>Grevillea berryana</i>, <i>Heliotropium heteranthum</i>, <i>Maireana melanocoma</i>, <i>Portulaca oleracea</i>, <i>Ptilotus helipteroides</i>, <i>P. nobilis</i> subsp. <i>nobilis</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Sclerolaena densiflora</i>, <i>Senna artemisioides</i> subsp. <i>helmsii</i>, <i>S. artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>glutinosa</i>, <i>S. stricta</i>, <i>Solanum cleistogamum</i>, <i>S. lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Trianthema glossostigma</i>, <i>Tribulus suberosus</i>, <i>Trigastrotheca molluginea</i>, <i>Triodia epactia</i>, <i>Triodia wiseana</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRR13, WRA27, WRCP-02, WRmn-02 (sites outside the current study area: GP22, GP34, GP36, MNBE18)</p>	 <p>Plate 8: Vegetation unit P2 – AanAteSpp (Astron Environmental Services 2018b).</p>



Vegetation unit code and description	Sites	Representative photograph
<p>P3- AanAteTe <i>Acacia aneura</i> sens. lat., <i>A. tetragonophylla</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland.</p> <p>Condition: Very Good – Excellent</p> <p>Area (ha) and proportion (%): 406.4 (13.0)</p> <p>Associated Species: <i>Acacia kempeana</i>, <i>A. synchronicia</i>, <i>Aristida contorta</i>, <i>Boerhavia coccinea</i>, <i>Bonamia media</i>, <i>Bulbostylis barbata</i>, <i>Corchorus crozophorifolius</i>, <i>Enneapogon caeruleus</i>, <i>E. polyphyllus</i>, <i>Eremophila cuneifolia</i>, <i>E. fraseri</i>, <i>E. latrobei</i> subsp. <i>filiformis</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne pulchella</i>, <i>Gomphrena cunninghamii</i>, <i>G. kanisii</i>, <i>Goodenia tenuiloba</i>, <i>Hibiscus burtonii</i>, <i>Indigofera monophylla</i>, <i>Iseilema dolichotrichum</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Maireana melanocoma</i>, <i>M. planifolia</i>, <i>Paspalidium clementii</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>P. schwartzii</i>, <i>Scaevola spinescens</i>, <i>Sclerolaena densiflora</i>, <i>S. eriacantha</i>, <i>Senna artemisioides</i> subsp. <i>helmsii</i>, <i>S. artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>pruinosa</i>, <i>S. stricta</i>, <i>Sida echinocarpa</i>, <i>Solanum horridum</i>, <i>S. lasiophyllum</i>, <i>Trianthema glossostigma</i>, <i>Tribulus suberosus</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a) and Astron (2013).</p>	<p>WRA04, WRA10, WRA11, WRmn-07</p>	 <p>Plate 9: Vegetation unit P4 – AanAxAteERcT (Astron Environmental Services 2013).</p>

Vegetation unit code and description	Sites	Representative photograph
<p>P4 – AanAxAteERcTa <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open shrubland over <i>A. tetragonophylla</i>, <i>Eremophila cuneifolia</i> shrubland over <i>Triodia angusta</i> hummock grassland</p> <p>Condition: Good – Excellent</p> <p>Area (ha) and proportion (%): 40.4 (0.6)</p> <p>Associated species: <i>Acacia aptaneura</i>, <i>A. synchronica</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caeruleus</i>, <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Goodenia forrestii</i>, <i>G. pascua</i>, <i>Lawrencia densiflora</i>, <i>Lepidium pedicellose</i>, <i>Maireana georgei</i>, <i>Paspalidium clementii</i>, <i>Ptilotus clementii</i>, <i>P. obovatus</i>, <i>P. schwartzii</i> var. <i>schwartzii</i>, <i>Scaevola acacioides</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>Sida echinocarpa</i>, <i>Solanum horridum</i>, <i>S. lasiophyllum</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i>, <i>Trigastrotheca molluginea</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>No sites recorded in current study area (sites outside the current study area: GP24, GP32, GP37, MNBE16)</p>	 <p>Plate 10: Vegetation unit P4 – AanAxAteERcTa (Astron Environmental Services 2018b).</p>
<p>P9- CEsp Mixed <i>Acacia</i> spp. scattered tall shrubs over <i>*Cenchrus ciliaris</i> and <i>*Cenchrus setiger</i> hummock grassland</p> <p>Condition: Poor</p> <p>Area (ha) and proportion (%): 30.5 (0.5)</p> <p>Associated Species: <i>Acacia aptaneura</i>, <i>Acacia citrinoviridis</i>, <i>Acacia tetragonophylla</i>, <i>Acacia xiphophylla</i>, <i>Grevillea berryana</i>.</p> <p>Not previously described.</p>	<p>No sites recorded in this vegetation unit.</p>	 <p>Plate 11: Vegetation unit P9 – CEsp</p>

Vegetation unit code and description	Sites	Representative photograph
Vegetation of Drainage Lines		
<p>D1 – AanAwTe <i>Acacia aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 164.4 (2.6)</p> <p>Associated species: <i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618), <i>Acacia aptaneura</i>, <i>A. synchronica</i>, <i>A. tetragonophylla</i>, <i>A. xiphophylla</i>, <i>Aristida contorta</i>, <i>Bulbostylis barbata</i>, <i>*Cenchrus ciliaris</i>, <i>Corchorus crozophorifolius</i>, <i>Crotalaria medicaginea</i> var. <i>neglecta</i>, <i>Cymbopogon ambiguus</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Eremophila cuneifolia</i>, <i>Eremophila forrestii</i> subsp. <i>forrestii</i>, <i>E. jucunda</i> subsp. <i>pulcherrima</i>, <i>E. latrobei</i>, <i>E. phyllopoda</i> subsp. <i>obliqua</i>, <i>Eriachne mucronata</i>, <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>, <i>Hybanthus aurantiacus</i>, <i>Hibiscus campanulatus</i> (P1), <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Maireana georgei</i>, <i>Paspalidium clementii</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Santalum lanceolatum</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>luerssenii</i>, <i>Solanum lasiophyllum</i>, <i>Tribulus suberosus</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRA05, WRA16, WRCP-10 (sites outside the current study area: GP15, GP33, GPR44)</p>	 <p>Plate 12: Vegetation unit D1 – AanAwTe (Astron Environmental Services 2018b).</p>
<p>D2 – AanAxTa <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall open scrub over <i>Triodia angusta</i> open hummock grassland.</p> <p>Condition: Excellent</p> <p>Area (ha) and proportion (%): 3.0 (<0.1)</p> <p>Associated species: <i>Acacia tetragonophylla</i>, <i>Eremophila cuneifolia</i>, <i>Ptilotus obovatus</i> var. <i>obovatus</i>, <i>Senna stricta</i>, <i>Sporobolus australasicus</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a) and Astron (2013).</p>	<p>No sites recorded in this vegetation unit. Mapping notes only (Biota Environmental Sciences 2012a)</p>	<p>No photograph available</p>

Vegetation unit code and description	Sites	Representative photograph
<p>D3 – AciAanAwTe <i>Acacia citrinoviridis</i>, <i>A. aneura</i> sens. lat., <i>A. wanyu</i> tall shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Condition: Degraded –Excellent</p> <p>Area (ha) and proportion (%): 218.7 (3.5)</p> <p>Associated species: <i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618), <i>Acacia pyrifolia</i>, <i>A. tetragonophylla</i>, <i>A. wanyu</i>, *<i>Aerva javanica</i>, *<i>Cenchrus ciliaris</i>, <i>Corchorus crozophorifolius</i>, <i>Crotalaria medicaginea</i> var. <i>neglecta</i>, <i>Cucumis variabilis</i>, <i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Eriachne tenuiculmis</i>, <i>Grevillea berryana</i>, <i>Hybanthus aurantiacus</i>, <i>Indigofera monophylla</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Notoleptopus decaisnei</i> var. <i>orbicularis</i>, <i>Polycarpaea longiflora</i>, <i>Ptilotus obovatus</i>, <i>Rhynchosia minima</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90), <i>Sporobolus australasicus</i>, <i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606), <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRR39, WRA12, WRA14, WRA15, WRmn-01 (sites outside the current study area: WRA23, WRA35, GP03, GP38, GP41)</p>	 <p>Plate 13: Vegetation unit D3 – AciAanAwTe (Astron Environmental Services 2018b).</p>
<p>D4 – AciAanAwTw <i>Acacia citrinoviridis</i>, <i>A. aneura</i> sens. lat. low open woodland to low woodland over <i>A. wanyu</i> tall open shrubland over <i>Triodia wiseana</i> very open hummock grassland</p> <p>Condition: Good – Very Good</p> <p>Area (ha) and proportion (%): 13.8 (0.2)</p> <p>Associated species: <i>Acacia pyrifolia</i> var. <i>pyrifolia</i>, <i>A. tetragonophylla</i>, <i>Corchorus crozophorifolius</i>, <i>Dodonaea pachyneura</i>, <i>Eremophila cryptothrix</i>, <i>E. cuneifolia</i>, <i>E. forrestii</i> subsp. <i>forrestii</i>, <i>Grevillea berryana</i>, <i>Ptilotus obovatus</i> var. <i>obovatus</i>, <i>Triodia epactia</i>.</p> <p>Previously described by: Biota (2012b) and Biota (2012a).</p>	<p>No sites recorded in this vegetation unit. Mapping notes only (Biota Environmental Sciences 2012a).</p>	<p>No photograph available</p>

Vegetation unit code and description	Sites	Representative photograph
<p>D5- AciCEsppTe <i>Acacia citrinoviridis</i> low woodland over *<i>Cenchrus</i> spp. open tussock to closed tussock grassland with <i>Triodia epactia</i> scattered to very open hummock grassland.</p> <p>Condition: Degraded – Very Poor</p> <p>Area (ha) and proportion (%): 164.4 (2.6)</p> <p>Associated Species: <i>Acacia pyrifolia</i>, <i>A. sclerophylla</i> var. <i>sclerophylla</i>, <i>A. tetragonophylla</i>, <i>Calotis hispidula</i>, <i>C. plumulifera</i>, *<i>Cenchrus ciliaris</i>, <i>Convolvulus clementii</i>, <i>Cucumis maderaspatanus</i>, <i>Grevillea berryana</i>, <i>Jasminum didymium</i> subsp. <i>lineare</i>, *<i>Malvastrum americanum</i>, <i>Ptilotus aurantiacus</i>, <i>Wahlenbergia tumidifructa</i>, <i>Zygophyllum retivalve</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a) and Astron (2013).</p>	<p>WRCP-04 (sites outside the current study area: WRA20)</p>	 <p>Plate 14: Vegetation unit D5 – AciCEsppTe (Astron Environmental Services 2013)</p>
<p>D6 – CfAciAanTe <i>Corymbia ferriticola</i> scattered low trees over <i>Acacia citrinoviridis</i>, <i>A. aneura</i> sens. lat. tall shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Condition: Poor – Excellent</p> <p>Area (ha) and proportion (%): 46.1 (0.7)</p> <p>Associated species: <i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618), <i>Acacia pruinocarpa</i>, <i>A. pyrifolia</i>, <i>A. rhodophloia</i>, <i>A. tetragonophylla</i>, *<i>Cenchrus ciliaris</i>, <i>Cleome viscosa</i>, <i>Clerodendrum floribundum</i>, <i>Corchorus crozophorifolius</i>, <i>Cymbopogon ambiguus</i>, <i>Dodonaea pachyneura</i>, <i>Duperreya commixta</i>, <i>Eremophila fraseri</i> subsp. <i>fraseri</i>, <i>E. latrobei</i> subsp. <i>glabra</i>, <i>Eriachne mucronata</i>, <i>Gomphrena cunninghamii</i>, <i>Grevillea berryana</i>, <i>Hibiscus campanulatus</i> (P1), <i>Indigofera monophylla</i>, <i>Jasminum didymium</i> subsp. <i>lineare</i>, <i>Paspalidium clementii</i>, <i>Pluchea dentex</i>, <i>Ptilotus obovatus</i>, *<i>Rumex vesicarius</i>, <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>, <i>Triodia wiseana</i>.</p> <p>Previously described by: Biota (2012b), Biota (2012a) and Astron (2018b).</p>	<p>WRF MG (sites outside the current study area: GP05, GP29, GPR19, GPR25, MNBE15, MNLV02)</p>	 <p>Plate 15: Vegetation unit D6 – CfAciAanTe (Astron Environmental Services 2018b).</p>

Vegetation unit code and description	Sites	Representative photograph
<p>D8 – EvAcMgCEspp <i>Eucalyptus victrix</i> woodland over <i>Acacia coriacea</i> subsp. <i>pendens</i>, <i>Melaleuca glomerata</i> tall shrubland over *<i>Cenchrus</i> spp. open tussock grassland</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 61.2 (1.0)</p> <p>Associated species: <i>Acacia ampliceps</i>, <i>A. citrinoviridis</i>, <i>A. coriacea</i> subsp. <i>pendens</i>, <i>A. pyrifolia</i>, *<i>Aerva javanica</i>, <i>Amaranthus undulatus</i>, <i>Boerhavia coccinea</i>, <i>Capparis spinosa</i>, <i>Cleome viscosa</i>, *<i>Cenchrus ciliaris</i>, *<i>C. setiger</i>, <i>Cleome viscosa</i>, <i>Corchorus crozophorifolius</i>, <i>Cucumis variabilis</i>, <i>Cyperus vaginatus</i>, <i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>, <i>Hybanthus aurantiacus</i>, <i>Indigofera monophylla</i>, <i>Jasminum didymum</i> subsp. <i>lineare</i>, <i>Notoleptopus decaisnei</i> var. <i>orbicularis</i>, <i>Petalostylis labicheoides</i>, <i>Phyllanthus maderaspatensis</i>, <i>Pluchea rubelliflora</i>, <i>Rhynchosia minima</i>, <i>Stemodia grossa</i>, <i>Tephrosia rosea</i> var. <i>Fortescue</i> creeks (M.I.H. Brooker 2186)</p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>WRA25, WRCP-03 (sites outside the current study area: GP13, WRA01-AR, WRA21-AR, WRR44)</p>	 <p>Plate 16: Vegetation unit D8 – EvAcMgCEspp (Astron Environmental Services 2018b).</p>
<p>D10 – AanAxTe <i>Acacia aneura</i> sens. lat., <i>A. xiphophylla</i> tall shrubland over mixed open shrubland over <i>Triodia epactia</i> open hummock grassland</p> <p>Condition: Degraded – Excellent</p> <p>Area (ha) and proportion (%): 26.5 (0.4)</p> <p>Associated species: <i>Acacia citrinoviridis</i>, <i>A. synchronicia</i>, <i>A. tetragonophylla</i>, <i>A. wanyu</i>, *<i>Cenchrus ciliaris</i>, *<i>C. setiger</i>, <i>Cynodon prostratus</i>, <i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>, <i>Duperreya commixta</i>, <i>Enchylaena tomentosa</i> var. <i>tomentosa</i>, <i>Enneapogon caerulescens</i>, <i>Eremophila cuneifolia</i>, <i>E. forrestii</i> subsp. <i>forrestii</i>, <i>Eriachne mucronata</i>, <i>Frankenia</i> aff. <i>hispidula</i>, <i>Lepidium pedicellosum</i>, <i>L. platypetalum</i>, <i>Maireana georgei</i>, <i>M. thesioides</i>, <i>M. tomentosa</i> subsp. <i>tomentosa</i>, <i>Pterocaulon sphacelatum</i>, <i>Ptilotus obovatus</i>, <i>Scaevola spinescens</i>, <i>Sclerolaena eriacantha</i>, <i>Senna artemisioides</i> subsp. <i>oligophylla</i>, <i>S. glutinosa</i> subsp. <i>x luerssenii</i>, <i>S. stricta</i>, <i>Sporobolus australasicus</i>, <i>Tribulus suberosus</i></p> <p>Previously described by: Biota (2012b), Biota (2012a), Astron (2013) and Astron (2018b).</p>	<p>No sites recorded in current study area (sites outside the current study area: e073-AR, GP43, WRA23-AR)</p>	 <p>Plate 17: Vegetation unit D10 – AanAxTe (Astron Environmental Services 2018b).</p>

Vegetation unit code and description	Sites	Representative photograph
Cleared Condition: Completely Degraded Area (ha) and proportion (%): 118.7 (1.9)	N/A	N/A

Table 15: Summary of sampling for each vegetation unit within and outside the project area.

Vegetation Unit	Number of quadrats sampled inside project area (outside)	Number of relevés sampled inside project area (outside)	Mapping notes recorded	Adequately surveyed (≥3 quadrats)
H1: AanAprAteTe	5 (6)	6 (0)	Yes	Yes
H2: AprGbERsppTe	6 (3)	4 (0)	Yes	Yes
H3: DpERcrTe	2 (2)	1 (0)	No	Yes
H4: AteAsyERcTe	2 (11)	1 (1)	Yes	Yes
H5: AteERfTw	0 (2)	0 (0)	Yes	No
H6: AanAteSppTw	4 (0)	0 (0)	No	Yes
H7: AanAteERfTeTw	5 (1)	0 (1)	No	Yes
P1: AanAxAteERcCAssp	9 (13)	1 (2)	No	Yes
P2: AanAteCAssp	2 (3)	1 (0)	Yes	Yes
P3: AanAteTe	3 (0)	0 (0)	Yes	Yes
P4: AanAxAteERcTa	0 (3)	0 (0)	Yes	Yes
P9: CEssp	0 (0)	0 (0)	No	No
D1: AanAwTe	2 (3)	1 (0)	No	Yes
D2: AanAxTa	0 (0)	0 (0)	Yes	No
D3: AciAanAwTe	4 (5)	0 (0)	Yes	Yes
D4: AciAanAwTw	0 (0)	0 (0)	Yes	No
D5: AciCEsspTe	0 (1)	1 (0)	No	No
D6: CfAciAanTe	0 (4)	1 (0)	Yes	Yes
D8: EvAcMgCEssp	1 (4)	1 (0)	No	Yes
D10: AanAxTe	0 (3)	0 (0)	No	Yes

4.5.1 Conservation Significant Vegetation

None of the vegetation units mapped in the study area represent TECs listed either under the Commonwealth EPBC Act or the State WC Act. None of the vegetation units represent PECs listed by the DBCA.

A single TEC based on botanical values is listed for the Pilbara bioregion, comprising the Hamersley Station *Themeda* grasslands community (Department of Biodiversity, Conservation, and Attractions 2018a). This TEC is associated with broad cracking clay flats, and does not occur in the Paraburdoo locality. No flora-related TECs are currently listed for the Gascoyne bioregion (Department of Biodiversity, Conservation, and Attractions 2018a). A number of PECs are listed for the Pilbara bioregion, including vegetation communities associated with cracking clays and permanent springs (Department of Biodiversity, Conservation, and Attractions 2017b). None of these listed PECs occur in the vicinity of Paraburdoo. No PECs are currently identified for the Gascoyne bioregion (Department of Biodiversity, Conservation, and Attractions 2017b).

The DBCA also recognises some communities within each subregion as “ecosystems at risk” (Department of Conservation and Land Management 2002a), some of which may be of relevance to the WRDE study area. In the Hamersley subregion, these include the following:

- “Lower-slope mulga”, which is understood to mean Mulga (*Acacia aneura* sens. lat.) tall shrublands and woodlands occurring over a significant cover of spinifex, as the latter makes the community vulnerable to frequent fires (preventing regeneration of the Mulga component) (Kendrick 2001b)
- Wetland communities of various springs, including Weeli Wolli Spring near Newman and Palm Spring west of Tom Price; these communities are under threat from grazing and trampling by cattle and other feral herbivores, as well as invasion by weeds (principally buffel grass) (Kendrick 2001b)
- “All major ephemeral watercourses”, which are under threat from the same processes described for the springs communities (Kendrick 2001b).

In the Ashburton subregion, ecosystems at risk include:

- Wetland systems of the Ashburton and Lyons drainage (including permanent and semi-permanent pools and springs); these are threatened by grazing and trampling from cattle and feral herbivores, and invasion by buffel grass (Kendrick 2001a)
- The Mulga creekline community occurring on alluvial plains of the Ashburton River Catchment (type MUCR in Payne, Mitchell, and Holman 1988). The MUCR vegetation type is described as occurring in drainage floors and channels in four of the land systems mapped within the current study area (Ethel, Paraburdoo, Rocklea and Table; see Payne, Mitchell, and Holman 1988). This creekline community is under threat from grazing and trampling by cattle and introduced herbivores (Kendrick 2001a).

Vegetation within the major creek systems (D8) was previously considered to be of ‘Moderate’ conservation significance (Biota Environmental Sciences 2012b, 2012a), as this unit potentially represents an ‘ecosystem at risk’ within the “springs” and “major ephemeral watercourses/wetland systems” categories. This should ascribe this vegetation unit a ‘High’ conservation value, but it was noted to be degraded through weed invasion (Biota Environmental Sciences 2012b, 2012a).

Additionally this vegetation unit (D8), which represents the larger drainage lines within the study area, is defined by a woodland of the facultative phreatophytic species *Eucalyptus victrix*, and has another facultative phreatophyte, *Eucalyptus camaldulensis* as an associated species. This vegetation unit may be considered to potentially represent a GDE. Therefore, vegetation unit D8: EvAcMgCEspp, should be ascribed at least a ‘Moderate’ conservation value. Even though it is degraded through weed invasion, it may represent an ‘ecosystem at risk’ and a potential GDE.

Two vegetation types representing smaller drainage systems on the plains (D1 and D3) were previously identified to correspond with the Ashburton subregion ‘ecosystem at risk’ “Mulga creekline community, alluvial plains of Ashburton” (Astron Environmental Services 2013), and thus should be ascribed a ‘High’ conservation value.

Gullies and gorges within the study area are generally denoted by vegetation unit D6: CfAciAanTe. These areas are likely to be refugia for fire sensitive species and other species that prefer rocky, mesic habitats. Therefore, this vegetation unit was previously noted as an area of ‘Moderate’ conservation significance (Biota Environmental Sciences 2012a).

Sections of vegetation supporting the then P1 and now threatened species *A. quadrata* T were previously considered to be of ‘Moderate’ conservation value, as they provide habitat for this restricted species (Biota Environmental Sciences 2012b). *Aluta quadrata* T is currently mapped over the entire study area in eight vegetation units (H1, H2, H3, P1, P3, D3, D6 and D10). It is suggested that vegetation units considered core habitat for *A. quadrata* T are of higher conservation value. The

vegetation units that represent hilltops/slopes and gorge/gully vegetation are most definitive of the core habitat for this species and include; H1, H2, H3 and D6.

4.5.2 Vegetation Condition

The vegetation of the WRDE study area was generally in Excellent to Very Good condition (Biota Environmental Sciences 2012b, 2012a). Beyond the obvious signs of disturbance from clearing for drill lines, weed invasion and grazing by cattle comprised the main disturbance factors. The arid hill habitats of the Western Range and its surrounding stony plains are not particularly favourable for either weed invasion or grazing, and hence a scarce number of weeds were recorded in these habitats (Biota Environmental Sciences 2012b, 2012a). Introduced flora species (principally **Cenchrus ciliaris*) dominated the floodplains of the large creeks, with introduced flora species accounting for up to 60% of the understory. The vegetation condition of the drainage lines was rates from Excellent to Degraded (Astron Environmental Services 2013). This is similar to observations in the adjacent Greater Paraburdoo Development Area, that describes the vegetation in drainage lines and associated floodplains to be generally of a low quality due to grazing pressure and the presence of introduced flora, while the hills and slopes were generally in better condition (Astron Environmental Services 2018b).

5 Contextual Analysis

5.1 Overview of the Study Area

The main conservation reserve in the locality, and also the closest to the WRDE study area, is the A-Class Karijini National Park. The south-western corner of this reserve is approximately 46 km to the east of the survey area. With the exception of the Ethel land system, all of the land systems mapped within the WRDE study area are represented in the Karijini National Park. Three of the four Beard Pilbara vegetation associations within the study area, Hamersley 82, Hamersley 567 and Hamersley 181, are dominant in Karijini National Park. However, the three Ashburton Valley mapping units are not well represented within conservation reserves in the Gascoyne region, and the mapping unit 163 appears to have no formal protection in either the Pilbara or Gascoyne regions. This suggests that the finer-scale vegetation types identified on the Western Range itself are likely to be present within at least Karijini National Park, however, the stony plains surrounding the Western Range may not be well represented within conservation reserves (Astron Environmental Services 2013).

The study area encompasses a significant portion (12.1%) of the Newman land system from within the Gascoyne bioregion. Approximately 730 ha of the 6,021 ha of the Newman land system mapped in the Gascoyne bioregion occurs within the study area. Parts of the study area that represent both the Beard mapping unit 163 and the Newman land system within the Gascoyne bioregion should be considered to be poorly represented within the Gascoyne region and with no formal protection regionally.

Over the years that Rio Tinto has been developing projects in the locality, especially at Paraburdoo and Channar, there has been considerable flora and vegetation survey effort, particularly searching for conservation significant flora species within the Channar, Paraburdoo, Eastern and Western Range areas. This provides a significant base of knowledge for assessing the extent and significance of conservation significant flora populations. However, as is true for much of the Eremaean regions of Western Australia, vegetation surveys outside of these proposed impact areas and vegetation mapping of a comparable scale (NVIS level V association) for the region, is lacking, thus making broad scale contextual analysis of the significance of the vegetation in the proposed impact area difficult. The large amount of work conducted in the local region by Rio Tinto has enabled a locality scale analysis to be undertaken for this study, however interpretation across the broader regional scale is limited.

5.2 Flora

The floristic diversity apparent in the WRDE study area from the combined species list presented in this study (291 confirmed taxa, Appendix E), appears to be consistent with that observed in the nearby Greater Paraburdoo Development Area survey (278 taxa) and the previous overlapping surveys of the Western Range Phase 2 and Western Range Additional Areas (311, and 326 taxa respectively) (Astron Environmental Services 2013; Biota Environmental Sciences 2012b, 2012a). This appears to be within the expected range of floristic diversity values for the region. Analysis of the species accumulation curve for the 61 sites within the current study area suggests that the area has been adequately sampled to provide a relatively complete species list for the study area.

Six conservation significant flora species have been previously recorded within the study area and one species is considered likely to occur. Table 16 details the estimated abundance and the number of records of each of these species within the study area and the adjoining Greater Paraburdoo and Channar development areas. These amounts can then be compared to the estimated total known abundance of each of the species from Rio Tinto's database across the Pilbara (Rio Tinto Iron Ore 2018).

Table 16: Conservation significant flora recorded in the study area.

Species	Estimated abundance within the study area ¹	Estimated abundance within Greater Paraburdoo Development Envelope ²	Estimated abundance within the Channar Development Envelope ³	Estimated total known abundance ⁴	Habitat	Vegetation unit/s
<i>Aluta quadrata</i> T	31,617 (2,960)	1,098 (13)	9,978 (1,336)	42,693 (4,309)	Edge of creek beds, base of cliffs, rocky crevices, near crest of ridge.	H1, H2, H3, P1, P3, D3, D6 and D10
<i>Hibiscus campanulatus</i> P1	0 (0)*	4,432 (309)	9,290 (944)	13,952 (1,271)	Hill slopes, base of slopes, rocky gully and drainage areas, often on Canga detritals.	D1, D3, D6, D7, D8, D9, D10, D13, H1 H2, H4, H12, P1, P8 *
<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3	107 (19)	110 (4)	349 (24)	73,395 (1,581)	Red-brown clay soil, calcrete pebbles. Low undulating plain, swampy plains, stony plains, hill slopes.	H2, H3, H6, P1 and P4
<i>Grevillea saxicola</i> P3	5 (5)	327 (102)	900 (301)	2,089 (610)	Low rocky hill, red-brown sandy loam with ironstone pebble cover, steep scree slopes.	H1 and H2
<i>Nicotiana umbratica</i> P3	116 (4)	4 (4)	3(1)	145 (16)	Shallow soils. Rocky outcrops.	H1, H2 and H3
<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	62 (13)	392 (105)	910 (130)	11,865 (1,713)	Skeletal red soils pockets. Steep slope.	H1, H2, H3 and H4
<i>Ptilotus trichocephalus</i> P4	985 (164)	671 (74)	20 (1)	4,535 (383)	Sandy soils, colluvial plains.	P1, P4 and D3

¹ –Population counts from records (number of records in brackets) in the Western Range Development Envelope study area as provided by RTIO database.

² –Population counts from records (number of records in brackets) in the Greater Paraburdoo Development area as provided by RTIO database.

³ –Population counts from records (number of records in brackets) in the Channar Development Envelope area as provided by RTIO database.

⁴ –Population counts from records (number of records in brackets) for each species that occur on the RTIO database for the Pilbara region.

* No *Hibiscus campanulatus* P1 are known from the current Western Range study area, but the species is considered likely to occur in the area. Vegetation units are those recorded in the Greater Paraburdoo area (Astron Environmental Services 2018b)

Some of the recorded species appear to be relatively widespread, such as *G. sp.* East Pilbara (A.A. Mitchell PRP 727) P3, *S. sp.* Barlee Range (S. van Leeuwen 1642) P3 and *P. trichocephalus* P4.

Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) P3 has over 99% of its known populations and close to 97% of its total number of records represented outside of the study area, Greater Paraburdoo and Channar development areas (Rio Tinto Iron Ore 2018). *Sida sp.* Barlee Range (S. van Leeuwen 1642) P3 has over 88% of its known population and over 85% of its total number of records known to occur outside of the two adjacent Rio Tinto development areas (Rio Tinto Iron Ore 2018). The distribution of both of these species, as presented on FloraBase, appear to encompass most of the Hamersley Ranges (Western Australian Herbarium 1998-2018). It is unlikely that development within the WRDE or within the adjoining Greater Paraburdoo or Channar development areas, will significantly impact upon the populations or distributions of these two species.

Ptilotus trichocephalus P4 has an estimated 63% of its known population occurring outside of the three adjacent Rio Tinto development areas, but has over 62% of its known number of records occurring within the areas, and the majority of these (43%) occur within the WRDE study area (Rio Tinto Iron Ore 2018). This species distribution extends south of the Pilbara and into the Gascoyne bioregion (Western Australian Herbarium 1998-2018). *Ptilotus trichocephalus* P4 may be over-represented in the Paraburdoo area, due to concentrated survey efforts in this area, in comparison to other parts of the species range which are likely to be less intensively surveyed. It is also likely that this species may be under collected in general across its range, due to its seasonal nature and a requirement for the presence of flowering material to obtain a positive identification. It is unlikely that development within the WRDE or within the adjoining Greater Paraburdoo or Channar development areas, will significantly impact upon the population and distribution of *P. trichocephalus* P4.

Nicotiana umbratica P3 has an estimated 85% of its known population and 56% of its known number of records occurring within the three adjacent Rio Tinto development areas (Rio Tinto Iron Ore 2018). However, this may be an artefact of where Rio Tinto has undertaken survey work and been able to obtain records for the species. This species occurs across some of the Hamersley Ranges, and then extends to the north-east across the Chichester Ranges and further north towards Eighty Mile Beach (Western Australian Herbarium 1998-2018). It may be that the WRDE, Greater Paraburdoo and Channar development areas represent a strong population centre for this species. However, it appears unlikely that development within these areas would significantly impact upon the overall distribution of this species.

Grevillea saxicola P3 has an estimated 59% of its known population and 67% of its known number of records occurring within the three adjacent Rio Tinto development areas (Rio Tinto Iron Ore 2018). However, only five individual plants from five individual locations are known from the WRDE study area, with the majority of the known population for this species occurring within the Channar Development Envelope (Rio Tinto Iron Ore 2018). It is worth noting that this species distribution appears to be relatively restricted to the southern portion of the Hamersley Range (Western Australian Herbarium 1998-2018), and that cumulative impacts across all three of these adjacent Rio Tinto development areas could have an impact upon this species' known population and distribution. However, development within the WRDE study area alone is unlikely to significantly impact upon the population or distribution of *G. saxicola* P3.

Hibiscus campanulatus P1 has not been recorded within the WRDE study area. However, there are records in close proximity, and vegetation units it is known to occur in are mapped within the study area. Therefore, it is considered likely that *H. campanulatus* P1 may occur in the WRDE study area. Over 98% of the known population and records for this species occur within the Greater Paraburdoo and Channar development areas (Rio Tinto Iron Ore 2018). The distribution of this species appears

to be relatively restricted to the Paraburdoo locality, with 13 out of the 22 records for the species on FloraBase occurring within either the Greater Paraburdoo or Channar development areas. Nine further records occur outside of this area, with some known from near to Newman and some from areas towards the western end of the Hamersley Ranges (Western Australian Herbarium 1998-2018). This P1 species may require further survey in these areas to determine its full population and distribution. Cumulative impacts across all three adjacent Rio Tinto development areas may have a significant impact upon the population and distribution of *H. campanulatus* P1.

Rio Tinto's records for the threatened species *A. quadrata* T, indicate that 100% of its known population and all of its known records occur within the three adjacent Rio Tinto development areas addressed here (Rio Tinto Iron Ore 2018). This species is known to be restricted in its range and attempts to locate it in other parts of the Pilbara have been unsuccessful. Over 74% of the known population and over 68% of the known number of records for *A. quadrata* T occur within the WRDE study area (Rio Tinto Iron Ore 2018).

Aluta quadrata T has a total of 18 records on Florabase (Western Australian Herbarium 1998-2018). Of these, 16 occur in either the Channar or Western Range project areas; 11 records occur within the Channar project area, near to Howie's Hole, and five occur in the current WRDE study area. Of the two remaining records, one location, recorded by Malcolm Trudgen, and described as approximately 15 km from Paraburdoo actually falls within the Western Range project area (Biota Environmental Sciences 2007). The correct location falls within the current WRDE study area, somewhat east of the eastern most population of *A. quadrata* T currently recorded by Rio Tinto within the area.

The only record of *A. quadrata* T, that is thought to fall outside of the Channar, Paraburdoo and Western Range areas, is a record from 1992, from a location recorded as "6 km west of Mount Boggola". Investigation into this record and its location by Biota (2007) failed to find any *A. quadrata* T at the listed location. It is suggested that perhaps the rocky slopes of Mount Boggola itself might provide suitable habitat for the species, but searches were not conducted there (Biota Environmental Sciences 2007). Thus, there are no confirmed records of *A. quadrata* T currently known outside of the Channar, Paraburdoo and Western Range areas.

5.3 Vegetation

Thirteen of the vegetation units identified in the study area are also present in the Greater Paraburdoo Development Envelope, and five vegetation units are not known to be represented elsewhere (D2, D4, H6, P3 and P9).

Of the vegetation units that are exclusive to the Western Range, four have no sample sites at all (D2, D4, D5, P9) and thus do not correspond to any sites within the floristic analyses. Three have only been described from sites outside of the current study area and thus are also not represented in the study area floristic analysis (H5, P4 and D10).

Fifteen of the 19 floristic groups that are represented in the WRDE study area are also represented by other sites within the local region. Four floristic groups are represented exclusively by sites from the study area. However, of the vegetation types represented by the sites within those four floristic groups, only H6, H7 and P3 are mapped exclusively within the WRDE study area. This indicates that of the 21 vegetation units represented in the study area, H6, H7 and P3 are not likely to be found elsewhere in the local region and may be considered to be locally restricted or endemic. The proportion of the study area each of these vegetation units occupy is detailed in Table 17.

Table 17: Potentially restricted or endemic vegetation units and their area in the Western Range Development Envelope study area.

Potential endemic vegetation unit	Area (ha) within the study area (%)
H6: AanAteSspTw	182.1 (2.9%)
H7: AanAteERfTeTw	372.3 (5.9%)
P3: AanAteTe	406.4 (6.5%)

None of the recorded vegetation units represents a listed TEC or PEC. However, seven vegetation units are recognised as either potential ‘ecosystems at risk’, or provide other conservation values, and are thus considered to be of either ‘High’ or ‘Moderate’ conservation value. None of these seven vegetation units correspond to the three potentially endemic vegetation units of the WRDE study area. A further three vegetation units are associated with habitat for *A. quadrata* T. The area and ecological value of each of these vegetation units within the study area is detailed in Table 18.

Table 18: Vegetation units of elevated conservation value and their area in the Western Range Development Envelope study area.

Vegetation unit	Area (ha) within the study area (%)	Rating (Kendrick 2001b, 2001a)	Significance of the vegetation unit
D1: AanAwTe	164.4 (2.6%)	High	Ecosystem at risk
D3: AciAanAwTe	218.7 (3.5%)	High	Ecosystem at risk
D6: CfAciAanTe	46.1 (0.7%)	Moderate	Fire refugia and habitat for a threatened species
D8: EvAcMgCEspp	61.2 (1%)	Moderate	Ecosystem at risk and potential GDE, but degraded by weed invasion
H1: AanAprAteTe	859.5 (13.7%)	N/A	Habitat for a threatened species
H2: AprGbERsppTe	1055.5 (16.8%)	N/A	Habitat for a threatened species
H3: DpERcrTe	191.9 (3.1%)	N/A	Habitat for a threatened species
H6: AanAteSspTw	182.1 (2.9%)	N/A	Potential endemic vegetation unit
H7: AanAteERfTeTw	372.3 (5.9%)	N/A	Potential endemic vegetation unit
P3: AanAteTe	406.4 (6.5%)	N/A	Potential endemic vegetation unit

Approximately 1,040 ha (17%) of the study area has never been surveyed for flora and vegetation. The vegetation mapping in these areas has therefore been extrapolated. This extrapolation does not substitute for a ground-truthed survey by experienced botanists, and as such the mapping must be treated as of low confidence and should not be used for management decisions.

6 Conclusions

The study area has been adequately surveyed to provide a relatively complete flora species list. However, there remain areas that have not been surveyed at all for flora and vegetation and some vegetation units that do not have adequate sample sites to define them.

Six conservation significant flora species have been previously recorded within the study area. One of these is the threatened species *A. quadrata* T, which is only known to occur within the Channar, Paraburdoo and Western Range areas. Over 74% of the *A. quadrata* T known population occurs within the current WRDE study area. *Hibiscus campanulatus* P1 is considered likely to occur in the study area, and also has a relatively restricted distribution.

No TECs or PECs have been recorded within the study area. However, three recorded vegetation units: H6, H7 and P3 are likely to be restricted in their distribution and are potentially endemic to the area. Furthermore, three vegetation units: D1, D3 and D8 may represent an ‘ecosystem at risk’. Vegetation unit D8 may also represent a potential GDE. Four vegetation units: H1, H2, H3 and D6 are habitat for *A. quadrata* T. Vegetation unit D6 is also likely to represent a refugia for fire sensitive species and other habitat-restricted species that prefer rocky, mesic habitats.

7 References

- Astron Environmental Services 2013, *Western Ranges Level 1 Vegetation, Flora and Fauna Survey*, unpublished report to Rio Tinto Iron Ore.
- Astron Environmental Services 2015a, *Joe's Crossing Minor Tributary Biological Assessment*, unpublished report to Rio Tinto Iron Ore.
- Astron Environmental Services 2015b, *Paraburdoo Haul Road Biological Assessment, Revision 1*, unpublished report to Rio Tinto Iron Ore.
- Astron Environmental Services 2018a, *Channar Reconnaissance Flora and Vegetation Survey (in preparation)*, unpublished report to Rio Tinto Iron Ore.
- Astron Environmental Services 2018b, *Greater Paraburdoo Detailed Flora and Vegetation Survey, April 2018*, Unpublished report prepared for Rio Tinto, Perth.
- Australian Weeds Committee 2012a, *Weeds of National Significance*, Canberra.
- Australian Weeds Committee 2012b, *Weeds of National Significance 2012*, Dept. of Agriculture, Fisheries and Forestry, Canberra, ACT.
- Beard, JS 1975a, 'The Vegetation of the Pilbara Area 1:1 000 000 Vegetation Series', University of Western Australia Press, Nedlands, Western Australia.
- Beard, JS 1975b, *Vegetation Survey of Western Australia, Pilbara. 1:1 000 000 Vegetation Series. Explanatory Notes to Sheet 5*, University of Western Australia Press, Nedlands, Western Australia.
- Biota Environmental Sciences 2003, *66 West (Western Ranges) Rare Flora Survey*, unpublished report to Hamersley Iron Pty Ltd.
- Biota Environmental Sciences 2007, *Regional Survey for *Ptilotus* sp. Brockman, *Aluta quadrata* and *Geijera* aff. *salicifolia**, unpublished report to Pilbara Iron Pty Ltd.
- Biota Environmental Sciences 2012a, *Western Range Additional Area: Vegetation and Flora Report*, unpublished report to Rio Tinto Iron Ore.
- Biota Environmental Sciences 2012b, *Western Range Phase 2: Vegetation and Flora Report*, unpublished report to Rio Tinto Iron Ore.
- Bureau of Meteorology 2018, *Climate Data Online: Monthly climatic statistics for Paraburdoo Aero (Station #007185)*, <http://www.bom.gov.au/climate/averages/tables/cw_007185.shtml>.
- Clarke, KR, Somerfield, PJ & Gorley, RN 2008, 'Testing of null hypotheses in exploratory community analyses: similarity profiles and biota-environment linkage', *Journal of Experimental Marine Biology and Ecology*, vol. 366, no. 1–2, pp. 56-69.
- Colwell, RK & Coddington, JA 1994, 'Estimating terrestrial biodiversity through extrapolation', *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, vol. 345, no. 1311, pp. 101-18.
- Department of Agriculture and Food Western Australia 2016, *Western Australian Organisms List*, <<https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>>.
- Department of Biodiversity, Conservation & Attractions 2017a, *Conservation Codes for Western Australia flora and fauna* Government of Western Australia, Perth
- Department of Biodiversity, Conservation & Attractions 2017b, *Priority Ecological Communities for Western Australia, Version 27*, Species and Communities Branch, Department of Biodiversity, Conservation and Attractions.

Department of Biodiversity, Conservation & Attractions 2018a, *List of threatened ecological communities endorsed by the Western Australian Minister for Environment*.

Department of Biodiversity, Conservation & Attractions 2018b, 'NatureMap Database Search 2018', Perth, Western Australia.

Department of Biodiversity, Conservation & Attractions 2018c, 'Threatened and Priority Ecological Communities Database', Dept. of Biodiversity, Conservation & Attractions, Perth WA.

Department of Biodiversity, Conservation & Attractions 2018d, 'Threatened and Priority Flora Database', Dept. of Biodiversity, Conservation & Attractions, Perth WA.

Department of Biodiversity, Conservation & Attractions 2018e, 'Threatened and Priority Flora List', Dept. of Biodiversity, Conservation & Attractions, Perth WA.

Department of Biodiversity, Conservation & Attractions 2018f, 'Western Australian Herbarium database', Department of Biodiversity, Conservation & Attractions, Perth WA.

Department of Conservation and Land Management 2002a, *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, Department of Conservation and Land Management, Perth.

Department of Conservation and Land Management 2002b, *Bioregional Summary of the 2002 Biodiversity Audit for Western Australia*, Department of Conservation and Land Management, Perth.

Department of Parks and Wildlife 2016a, *2016 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report)*, Dept. of Parks and Wildlife, Perth, WA.

Department of Parks and Wildlife 2016b, *Weed Prioritisation Process for DPaW (formerly DEC) – “An Integrated Approach to Weed Management on DPaW Managed Lands in WA”*, Department of Parks and Wildlife, Perth.

Department of Primary Industries & Regional Development 2018, *Western Australian Organisms List*, Dept. Primary Industries and Regional Development, Perth, WA, <<https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>>.

Department of the Environment & Energy 2018a, *Australia's World Heritage Areas*, Dept. of the Environment and Energy, Canberra, ACT, <<http://www.environment.gov.au/heritage/about/world-heritage>>.

Department of the Environment and Energy 2008, 'Register of the National Estate - Spatial Database (RNESDB)'

Department of the Environment and Energy 2016a, *Interim Biogeographic Regionalisation for Australia (IBRA), Version 7*, Department of the Environment, viewed 2016, <<http://www.environment.gov.au/land/nrs/science/ibra>>.

Department of the Environment and Energy 2016b, *National Reserve System*, <<http://www.environment.gov.au/topics/land/national-reserve-system>>.

Department of the Environment and Energy 2017a, 'Australian Wetlands Database: Ramsar Wetlands', Dept. of the Environment and Energy, Canberra ACT.

Department of the Environment and Energy 2017b, 'Directory of Important Wetlands in Australia', Commonwealth of Australia.

Department of the Environment and Energy 2018b, *Protected Matters Search Tool*, <www.environment.gov.au/epbc/pmst/index.html>.

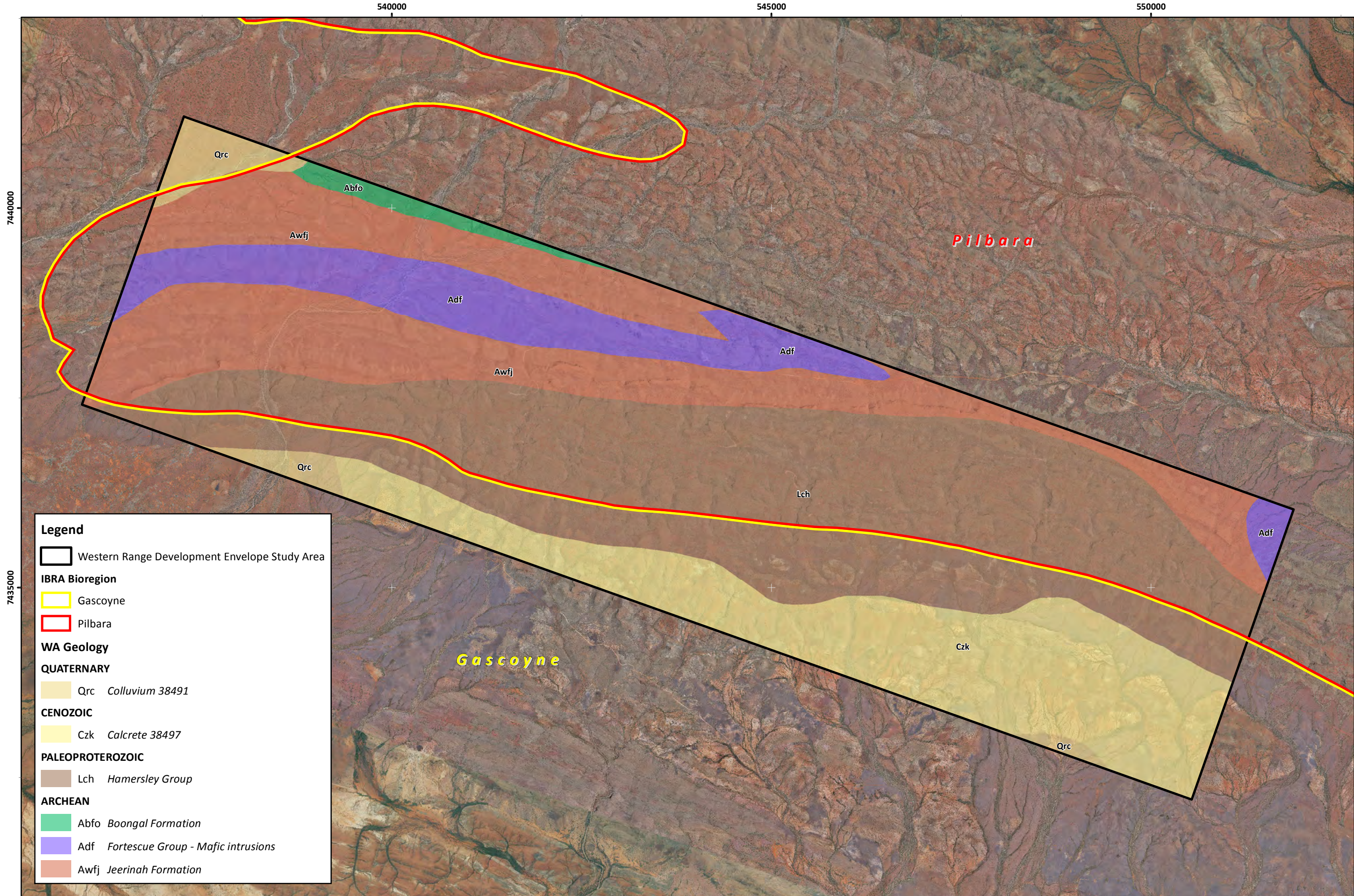
- Eco Logical Australia 2016, *Doggers Gorge Flora, Vegetation and Fauna Habitat Assessment*, unpublished report to Rio Tinto Iron Ore.
- ecologia Environment 2011, *Paraburdoo Mine Area Botanical and Vertebrate Fauna Survey*, unpublished report to Rio Tinto Iron Ore.
- Environmental Protection Authority 2016, *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*, Environmental Protection Authority, Perth.
- GHD Pty Ltd 2009, *Report for Turee Syncline Project. Vegetation, Flora and Fauna Baseline Surveys*, unpublished report to Rio Tinto.
- Kendrick, P 2001a, *Gascoyne 1 (GAS1 - Ashburton Subregion)*, (M. Cowan, chairman), *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, Department of Conservation and Land Management, Perth.
- Kendrick, P 2001b, *Pilbara 3 (PIL3 - Hamersley Subregion)*, (M. Cowan, chairman), *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*, Department of Conservation and Land Management, Perth.
- Mattiske and Associates 1986, *Flora and Vegetation Survey of the Channar Mining Area and Surrounds, Hamersley Range, Western Australia*, unpublished report to Hamersley Iron Pty. Ltd.
- Mattiske Consulting 1998, *Flora, Vegetation and Vertebrate Fauna on 23E/42E Paraburdoo*, unpublished report for Hamersley Iron.
- Mattiske Consulting 2011, *Flora and Vegetation Survey of the Turee Syncline Area*, prepared for Rio Tinto Iron Ore.
- Payne, AL, Curry, PJ & Spencer, GF 1980, *An inventory and condition survey of rangelands in the Carnarvon Basin, Western Australia. Technical Bulletin No. 73*, Department of Agriculture, Perth.
- Payne, AL, Mitchell, AA & Holman, WF 1988, *An inventory and condition survey of rangelands in the Ashburton River catchment, Western Australia. Technical Bulletin No. 62*, Department of Agriculture, Perth.
- Pilbara Flora 2011, *Flora and Vegetation Surveys for the Paraburdoo Magazine and the Tom Price Powerline Infrastructure Areas*, prepared for Rio Tinto Iron Ore
- R Development Core Team 2015, 'R: A language and environment for statistical computing', R Foundation for Statistical Computing, Vienna.
- Rio Tinto Iron Ore 2010, *Eastern Ranges Life of Mine Flora and Vegetation Report*, Rio Tinto Iron Ore, Perth.
- Rio Tinto Iron Ore 2012, *Flora and Vegetation Assessment of the Turee Creek Water Pipeline Upgrade and Paraburdoo Town Feeder One Line Replacement*, Rio Tinto, Perth
- Rio Tinto Iron Ore 2014, *Flora and Vegetation Assessment of the Eastern Ranges Study Area*, Rio Tinto Iron Ore, Perth.
- Rio Tinto Iron Ore 2018, 'Flora Database Records', Digital dataset supplied by Rio Tinto.
- Shepherd, DP, Beeston, GR & Hopkins, AJM 2002, 'Native Vegetation in Western Australia: Extent, Type and Status', *Resource Management Technical Report 249*, Department of Agriculture, Western Australia.
- Stewart, AJ, Sweet, IP, Needham, RS, Raymond, OL, Whitaker, AJ, Liu, SF, Phillips, D, Retter, AJ, Connolly, DP & Stewart, GR 2008, 'Surface Geology of Australia 1: 1 000 000 Scale, Western

Australia [Digital Dataset]', The Commonwealth of Australia, Geoscience Australia (<http://www.ga.gov.au>), Canberra.

Western Australian Herbarium 1998-2018, 'FloraBase – the Western Australian Flora', Department of Parks and Wildlife. <http://florabase.dpaw.wa.gov.au>.

Appendix A: Geology, Land Systems and Pre-European Vegetation of the Survey Area

This page has been left blank intentionally.



Rio Tinto Iron Ore
 Western Range – Desktop Flora and Vegetation Study, August 2018

Figure A.1: Geological units of the study area

Author: K. McMaster

Drawn: C. Dyde

Date: 08-10-2018

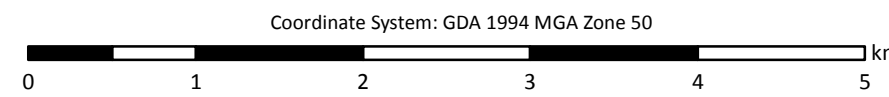
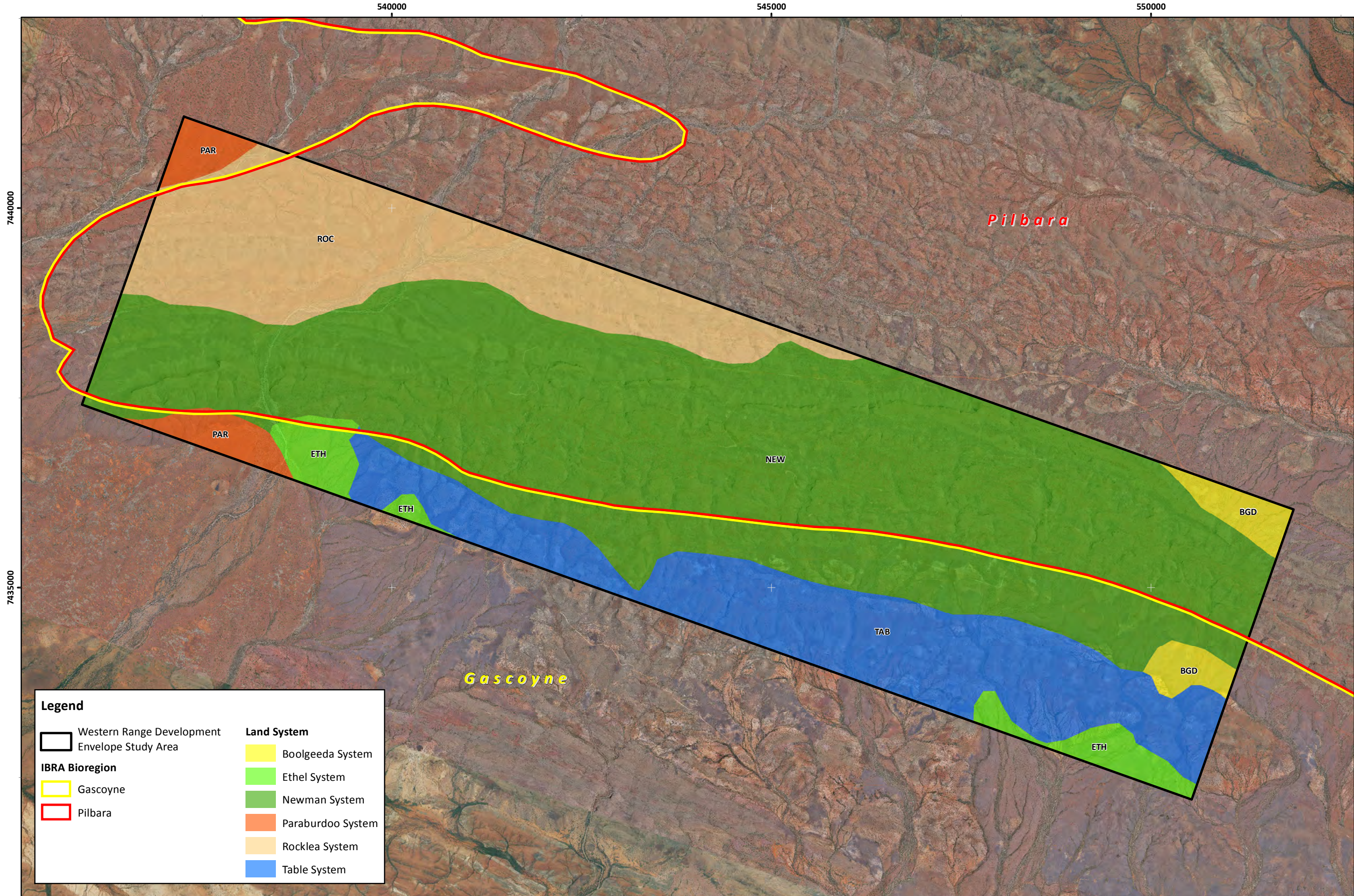


Figure Ref: 14298-18-BIDR-1RevB_181008_FigA1_Geo



Legend

Western Range Development Envelope Study Area	Land System
Gascoyne	Boolgeeda System
Pilbara	Ethel System
	Newman System
	Paraburdoo System
	Rocklea System
	Table System

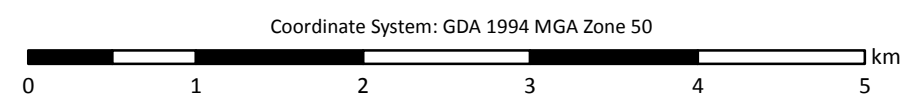
Rio Tinto Iron Ore
 Western Range – Desktop Flora and Vegetation Study, August 2018

Figure A.2: Land systems of the study area

Author: K. McMaster

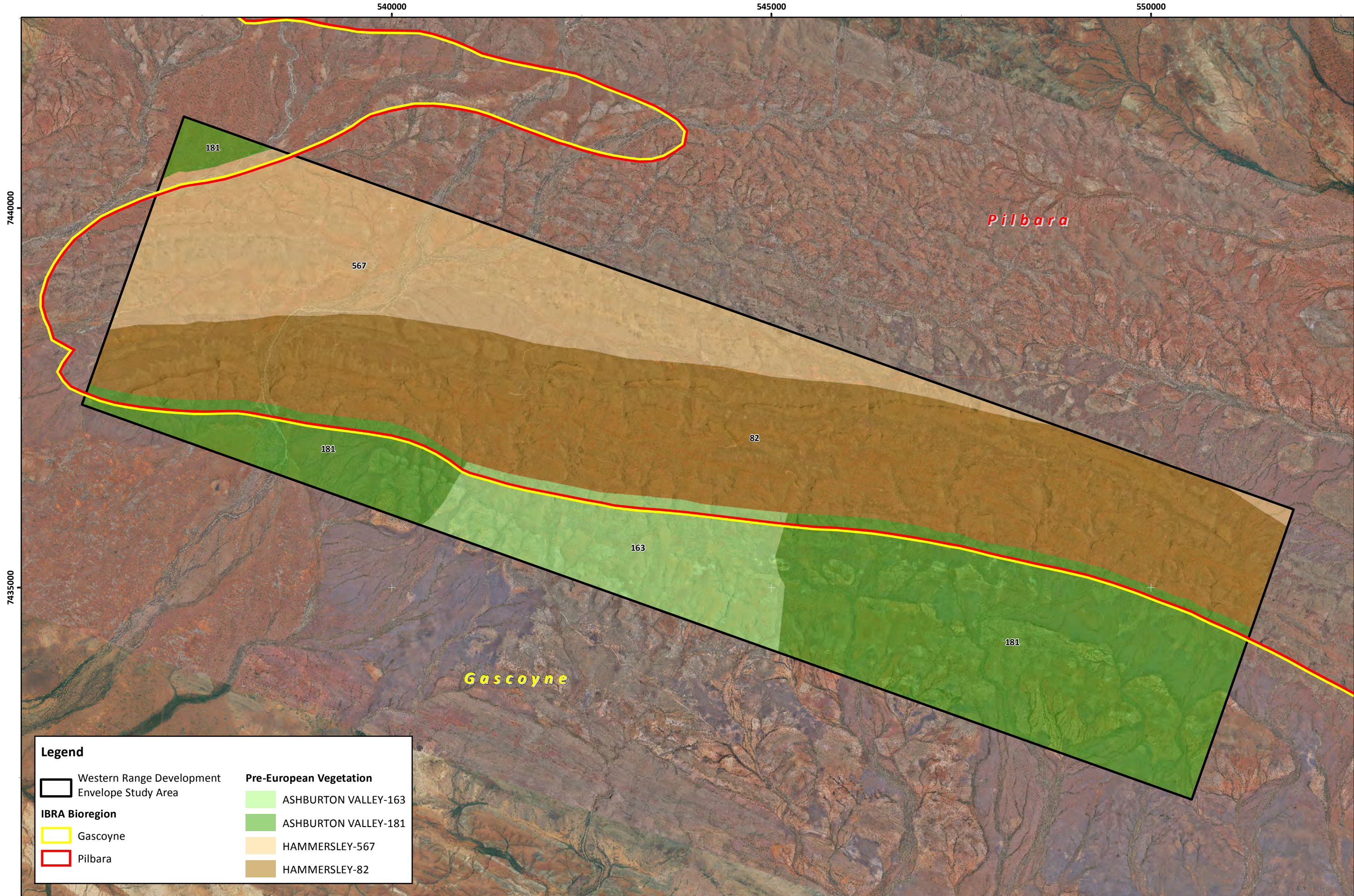
Drawn: C. Dyde

Date: 08-10-2018



astron
 delivering environmental intelligence™

Figure Ref: 14298-18-BIDR-1RevB_181008_FigA2_LSys

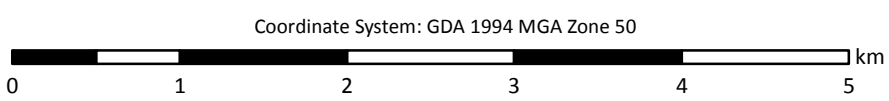


Rio Tinto Iron Ore
 Western Range – Desktop Flora and Vegetation Study, August 2018

Figure A.3: Pre-European vegetation of the study area

Author: K. McMaster

Drawn: C. Dyde



Date: 08-10-2018

Figure Ref: 14298-18-BIDR-1RevB_181008_FigA3_PreEuroVeg

This page has been left blank intentionally.

Appendix B: Conservation Categories for Flora and Ecological Communities and Categories for Introduced Flora

This page has been left blank intentionally.

Table B.1: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999*.

Conservation category	Definition
Presumed extinct (EX)	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent fauna (CD)	<p>Fauna taxa which are the focus of a specific conservation program, the cessation of which would result in the species becoming threatened; or the following subparagraphs are satisfied:</p> <ul style="list-style-type: none"> • the taxa is a species of fish; • the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximized; • the management plan is in force under a law of the Commonwealth or of a State or Territory; • cessation of the management plan would adversely affect the conservation status of the taxa • fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Table B.2: Definitions and criteria for threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999* (Department of Biodiversity Conservation and Attractions 2017a).

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table B.3: Categories of Threatened Ecological Communities (Department of Biodiversity Conservation and Attractions 2017a).

PD: Presumed Totally Destroyed
<p>An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.</p> <p>An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B):</p> <p>A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or</p> <p>B) All occurrences recorded within the last 50 years have since been destroyed.</p>
CR : Critically Endangered
<p>An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated.</p> <p>An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C):</p> <p>A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii):</p> <p>i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years);</p> <p>ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated.</p> <p>B) Current distribution is limited, and one or more of the following apply (i, ii or iii):</p> <p>i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years);</p> <p>ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes;</p> <p>iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.</p> <p>C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).</p>

En: Endangered

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU: Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (Table B.4).

Table B.4: Definitions and criteria for priority ecological communities (Department of Biodiversity Conservation and Attractions 2017a).

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring.

Table B.5: Priority species under Western Australian Wildlife Conservation Act 1950 (Department of Biodiversity Conservation and Attractions 2017a)

P1: Priority One – Poorly known taxa
Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2: Priority Two – Poorly known taxa
Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly known taxa
Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. (b) Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

The management of introduced flora species in Western Australia is now regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). A list of declared pests, including ‘pest’ plants is provided under the BAM Act, which has been updated to incorporate a number of other Acts that are administered by the Department of Agriculture and Food Western Australia. Declared pests can fall into two categories: one that relates to the prevention of introducing the species or eradicating it; and the other relates to managing the species and whether it can be kept (i.e. for scientific purposes, education or other purpose).

The threat and risk posed to site-specific biodiversity values, influences to rehabilitation success, primary production, infrastructure assets or human health will differ depending on the unique characteristics of each site and the associated land management practice or operation. Therefore site or project specific weed assessments and priorities should be reviewed for each project.

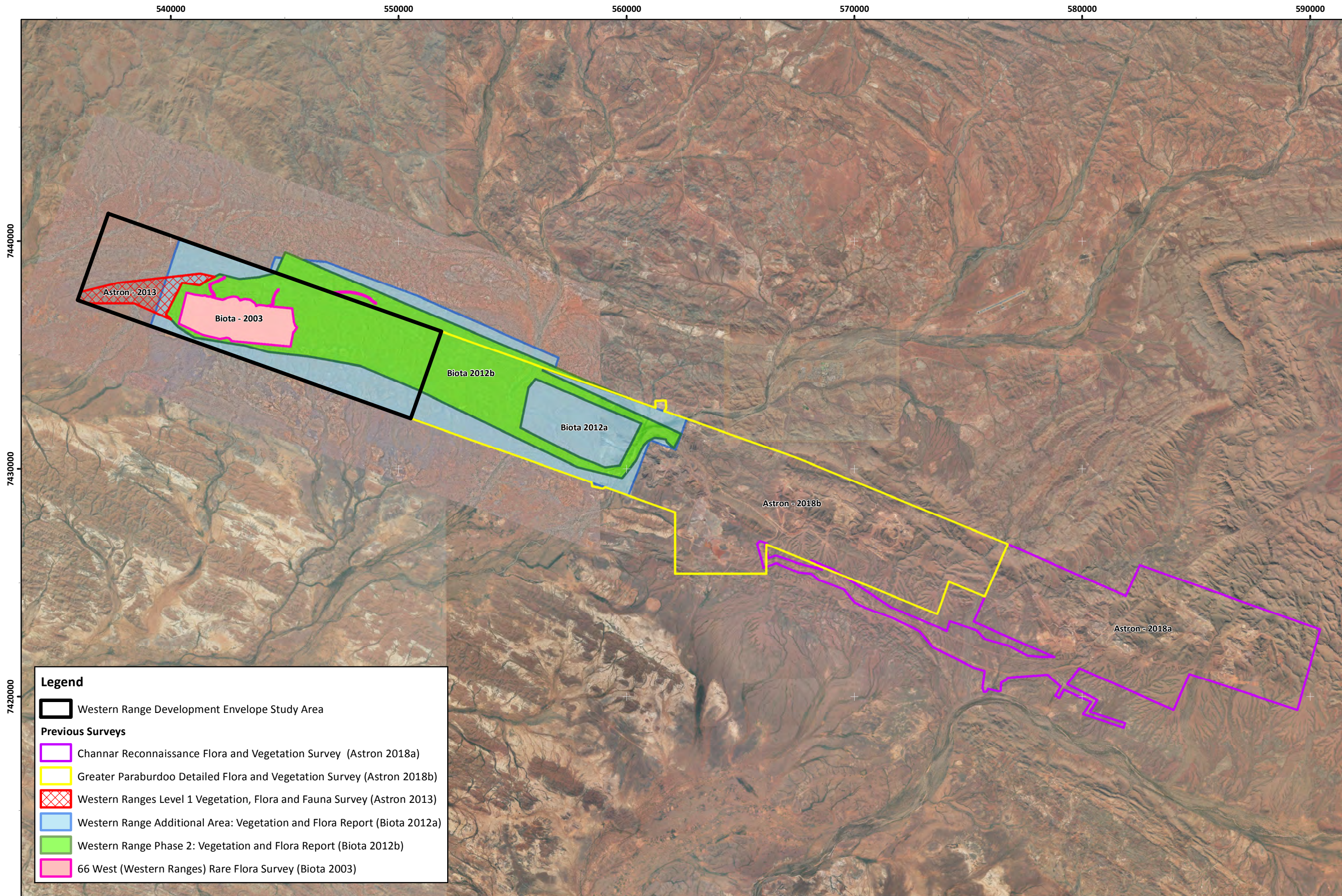
As per introduced flora species, the BAM Act seeks to establish a modern biosecurity regulatory scheme to prevent serious animal pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State. Declared animal pests fall into three categories as Gazetted under the *Biosecurity and Agriculture Management Regulations 2013*. These categories are outlined in Table B.6.

Table B.6: Declared pests control categories as gazetted under the *Biosecurity and Agriculture Management Regulations 2013*.

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

Appendix C: Previous Survey Area Locations

This page has been left blank intentionally.



Legend

- Western Range Development Envelope Study Area
- Previous Surveys**
- Channar Reconnaissance Flora and Vegetation Survey (Astron 2018a)
- Greater Paraburdoo Detailed Flora and Vegetation Survey (Astron 2018b)
- Western Ranges Level 1 Vegetation, Flora and Fauna Survey (Astron 2013)
- Western Range Additional Area: Vegetation and Flora Report (Biota 2012a)
- Western Range Phase 2: Vegetation and Flora Report (Biota 2012b)
- 66 West (Western Ranges) Rare Flora Survey (Biota 2003)

Rio Tinto Iron Ore
 Western Range – Desktop Flora and Vegetation Study, August 2018

Figure C.1: Previous survey area locations

Author: K. McMaster

Drawn: C. Dyde

Date: 08-10-2018

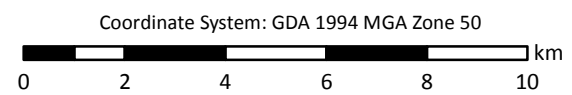


Figure Ref: 14298-18-BIDR-1RevB_181008_FigC1_PrevSurveys

This page has been left blank intentionally.

Appendix D: Database Searches

This page has been left blank intentionally.



Astron Environmental Services

129 Royal Street
East Perth WA 6004

Attention: Lucy Dadour

Dear Lucy Dadour,

REQUEST FOR THREATENED AND PRIORITY FLORA INFORMATION

I refer to your request of 26 June 2018 for Threatened (Declared Rare) and Priority Flora information in the Paraburdoo area. The search was conducted within the area of the shapefile you submitted with an additional 50km buffer.

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) and Priority Flora* database (for results, see "TPFL" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for Threatened and Priority flora species opportunistically collected in the area of interest (for results, see "WAHERB"- coordinates are GDA94 – see condition number 4 in the attached 'Conditions in Respect of Supply') and **(3)**, the Department's *Threatened and Priority Flora List* [this list is searched using 'place names'. This list, which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "TP List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the ninth point, which refers to the requirement to undertake field investigations for the accurate determination of Threatened and Priority flora occurrence at a site. *The information supplied should be regarded as an indication only of the Threatened and Priority flora that may be present and may be used as a target list in any surveys undertaken.*

The information provided does not preclude you from obtaining and complying with, where necessary, land clearing approvals from other agencies.

An invoice for \$ 300 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of Threatened and Priority flora you encounter in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss Threatened and Priority flora management, please contact Dr Ken Atkins, Manager, Species and Communities Branch, on (08) 9219 9511.

Yours faithfully

Steve Martin

.....
THREATENED FLORA DATABASE OFFICER
for the Director General

9 July 2018



THREATENED AND PRIORITY FLORA INFORMATION

Conditions with Respect to the Supply of Information

- The data supplied may not be provided to any other organisations, nor be used for any purpose other than for the project for which it has been originally provided for; without the prior consent of the Executive Director, Department of Biodiversity, Conservation and Attractions.
- Specific locality information for threatened flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for threatened flora may not be used in reports without the written permission of the Executive Director, Department of Biodiversity, Conservation and Attractions. Reports may only show generalised locations at a low resolution or, where necessary, show specific locations without identifying species. Species and Communities Branch is to be contacted for guidance on the presentation of threatened flora information.
- The Department of Biodiversity, Conservation and Attractions respects the privacy of private landowners who may have threatened and priority flora on their property. Threatened and priority flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners must only be made through the Department of Biodiversity, Conservation and Attractions.
- The development of the Perth Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being data based. It is only in recent times that collections have been submitted with GPS coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.
- Acknowledgment of the Department Biodiversity, Conservation and Attractions as the source of data is to be made in any published material and cited as Biodiversity, Conservation and Attractions (2018) Threatened and Priority Flora Database Search for [search area] accessed on the [date of search]. Prepared by the Species and Communities Branch for [Requesters name and company] for [purpose of search].
- Copies of all such publications are to be forwarded to the Department of Biodiversity, Conservation and Attractions, Attention; the Manager, Species and Communities Branch.

Disclaimers with Respect to the Supply of Information

- Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data, they may be present. The Department of Biodiversity, Conservation and Attractions accepts no responsibility for this.
- Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
- It should be noted that the supplied data does not necessarily represent a comprehensive listing of the threatened flora of the area in question. Its comprehensiveness is dependent on the amount of surveys carried out within a specified area. The receiving organisation should consider engaging a botanist, if required, to undertake a survey of the area under consideration.



ABBREVIATIONS USED IN THREATENED AND PRIORITY FLORA DATABASE

VESTING

AAP	Aboriginal Planning Authority
AGR	Chief Executive, Dep. of Agriculture
ALT	Aboriginal Land Trust
APB	Agricultural Protection Board of WA
BGP	Botanical Gardens & Parks Authority
BSA	Boy Scouts Association
CC	Conservation Commission – NPNCA - LFC
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
CRW	Crown
DAG	Dep. of Agriculture
DOW	Dep. of Water
DPI	Dep. of Planning
EXD	Exec Direc CALM
FES	Fire and Emergency Services Aust.
HOW	Dep. of Housing/State Housing Commission
ILD	Industrial Lands Develop. Auth
LAC	LandCorp
LGA	Shire/LGA
MAG	Minister for Agriculture
MCB	Metropolitan Cemeteries Board
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
PLB	Pastoral Lands Board
PRI	Private/Freehold
RAI	Public Transport Authority
REL	Religious Organisation
SPC	State Planning Commission
SYN	Synergy (ex Western Power)

SWA	State of Western Australia
TEL	Telstra
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
ACC	Access Track
AER	Aerodrome
AIR	Airport
ARS	Agricultural Research Station
BAP	Baptist Union of WA
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CMN	Communications
COM	Common
CON	Conservation Park
CPK	Car Park
CRM	Conservation & Resource Management
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes
UWA	
ENE	Enjoyment of Natural Environ.
EPL	Ex-pastoral Lease (Sect 33(2) CALM Act)
EPS	Explosives
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
FP	Foreshore Purposes
GE	General Lease
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes

HER	Heritage trail
HOS	Hospital
KEN	Kennels
LGA	LGA/Shire Requirements
LPR	Landscape Protection
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PCR	Proposed for Conservation
PFF	Protection of Flora & Fauna
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
PMC	Protection of Meteorite Crater
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUR	Purchase Lease
PUT	Public Utility
QUA	Quarry
RAC	Racecourse
RAD	Radio Station
REC	Recreation
REH	Rehabilitation/Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAL	Saleyards
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHO	Showgrounds
SNN	Sanitary
SOI	Soil Conservation
STO	Stopping place
STK	Stock Route
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
UCL	Unallocated Crown Land
UNK	Unknown
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WLS	Wildlife Sanctuary
WOO	Firewood



ABBREVIATIONS USED IN THE WESTERN AUSTRALIAN HERBARIUM DATABASE

Geocode Method - The method that was used to record the latitude and longitude.

Auto - Indicates that the coordinate data in the record was created automatically (i.e. by software), usually by creating a coordinate from information provided in the Nearest Named Place or Locality textual description fields.

GAP - Acronym for "Generalised Arbitrary Point" as used in HISPID. GAP indicates that the coordinate data was obtained manually from the Nearest Named Place or Locality textual description fields.

GPS - Acronym for "Global Positioning System". GPS indicates that the coordinate data in the record was obtained from a GPS unit by the collector of the specimen.

MAN - Shorthand for manual. MAN indicates that the coordinate data was created by hand using some method not allowed for by one of the other manual Geocode Method values, in particular, TOPO, GAP, or GPS.

TOPO - Shorthand for topographic map. TOPO indicates that the coordinate data was obtained by plotting textual locality details against a topographic map.

None - Indicates that no coordinate data has been supplied by the collector.

Unknown - Indicates that there is no known method for determining the coordinate data. Should be used if the collector provided no indication of how they sampled the specimen's coordinate data.

PREC (Precision) - precision ratings for coordinates.

Precision 1: Absolutely precise (to nearest 100m or nearest second) and must be GPS determined. For example 35°26'42"S 123°40'26"E

Precision 2: Falling within a diameter of 3km (ca 2 minutes) or if no GPS mentioned in collecting notes. (The location must be able to be pinpointed on a 1:250 000 map, a spot locality. For example 35°26'42"S 123°40'26"E

Precision 3: Falling within a diameter of 10km (ca 7 minutes) or for degrees and minutes, where seconds have not been given. For example 35°26'_"S 123°40'_"E

Precision 4: Falling within a diameter of ca 50km (30 minutes). For example 35°26'_"S 123°40'_"E

Precision 5: Where a location is a prescribed large geographical area within a state or only the state is given. Diameter is greater than 50km. For example 35°_'_"S 123°_'_"E

Precision 6: used when localities are New Holland, Eastern Australia or Not given. Fields will be left blank.



CONSERVATION CODES

For Western Australian Flora and Fauna

T Threatened species

Listed as Specially Protected under the *Wildlife Conservation Act 1950*, published under Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

- Fauna that is rare or likely to become extinct are declared to be fauna that is in need of special protection
- Flora that are extant and considered likely to become extinct, or rare and therefore in need of special protection, are declared to be rare flora

Species* which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

The assessment of the conservation status of these species is based on their national extent.

X Presumed extinct species

Listed as Specially Protected under the *Wildlife Conservation Act 1950*, published under Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora (which may also be referred to as Declared Rare Flora).

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such.

IA Migratory birds protected under an international agreement

Listed as Specially Protected under the *Wildlife Conservation Act 1950*, listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), relating to the protection of migratory birds.

S Other specially protected fauna

Listed as Specially Protected under the *Wildlife Conservation Act 1950*. Fauna declared to be in need of special protection, otherwise than for the reasons mentioned for Schedules 1, 2 or 3, are published under Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Threatened Fauna and Flora are ranked according to their level of threat using IUCN Red List categories and criteria. *For example:* Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is listed as 'Specially Protected' under the *Wildlife Conservation Act 1950*, published under Schedule 1, and referred to as a 'Threatened' species with a ranking of 'Endangered'.

CR Critically Endangered - considered to be facing an extremely high risk of extinction in the wild.

EN Endangered - considered to be facing a very high risk of extinction in the wild.

VU Vulnerable - considered to be facing a high risk of extinction in the wild.

A list of the current rankings can be downloaded from the Parks and Wildlife Threatened Species and Communities webpage at <http://dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/>



P Priority species

Species that maybe threatened or near threatened but are data deficient, have not yet been adequately surveyed to be listed under the Schedules of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Conservation dependent species that are subject to a specific conservation program are placed in Priority 5.

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

1: Priority One: Poorly-known species

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

2: Priority Two: Poorly-known species

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

3: Priority Three: Poorly-known species

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

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

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

(b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

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

5: Priority Five: Conservation Dependent species

Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies, variety or forma).



**Department of Biodiversity,
Conservation and Attractions**

Science and Conservation Service

DEPARTMENT OF BIODIVERSITY, CONSERVATION AND ATTRACTIONS

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data are to be made in writing to the Department of Biodiversity, Conservation and Attractions. Attention: Species and Communities Branch
2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the data custodian (Val English), Species and Communities Branch.
3. Specific locality information for threatened ecological communities (TECs/PECs) is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for TECs/PECs may not be used in public reports without the written permission of the data custodian (Val English). Acknowledgment of the Department of Biodiversity, Conservation and Attractions as source of the data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Biodiversity, Conservation and Attractions, Attention: Manager, Species and Communities Branch.
4. Note that the Department of Biodiversity, Conservation and Attractions respects the privacy of private landowners who may have threatened and priority ecological communities on their property. Locations of TECs/PECs identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Biodiversity, Conservation and Attractions.
5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Biodiversity, Conservation and Attractions accepts no responsibility for this.
6. Receiving organisations must also recognise that the Threatened and Priority Ecological Communities database is subject to continual updating and amendment, and such considerations should be taken into account by the user.
7. It should be noted that the supplied data do not necessarily represent a comprehensive listing of the threatened or priority ecological communities of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. Private property has been relatively little surveyed. The receiving organisation should employ a consultant, if there is any likelihood of the presence of any threatened or priority ecological community, to undertake a survey of the area under consideration.

NatureMap Species Report

Created By Guest user on 11/07/2018

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 117° 25' 21" E, 23° 10' 28" S
Buffer 40km
Group By Family

Family	Species	Records
Acanthaceae	3	7
Aizoaceae	4	8
Amaranthaceae	24	56
Apocynaceae	3	3
Araliaceae	2	4
Asphodelaceae	1	2
Asteraceae	26	44
Boraginaceae	9	14
Brassicaceae	8	11
Campanulaceae	3	7
Capparaceae	1	3
Caryophyllaceae	2	4
Chenopodiaceae	32	49
Cleomaceae	2	3
Convolvulaceae	9	20
Cucurbitaceae	2	4
Cyperaceae	8	14
Euphorbiaceae	14	22
Fabaceae	73	204
Frankeniaceae	2	5
Gentianaceae	1	1
Geraniaceae	1	1
Goodeniaceae	13	31
Lamiaceae	3	5
Loranthaceae	5	8
Lythraceae	2	2
Malvaceae	46	101
Marsileaceae	1	1
Molluginaceae	1	2
Montiaceae	4	9
Moraceae	1	1
Myrtaceae	17	54
Nyctaginaceae	3	3
Oleaceae	2	4
Papaveraceae	1	2
Phrymaceae	1	1
Phyllanthaceae	4	9
Plantaginaceae	1	1
Poaceae	42	65
Polygonaceae	1	1
Portulacaceae	2	5
Potamogetonaceae	2	2
Primulaceae	1	1
Proteaceae	7	18
Pteridaceae	2	3
Rhamnaceae	1	1
Rubiaceae	4	6
Santalaceae	1	6
Sapindaceae	5	10
Scrophulariaceae	24	82
Solanaceae	13	23
Surianaceae	1	4
Thymelaeaceae	2	2
Typhaceae	1	1
Violaceae	1	5
Zygophyllaceae	6	10
TOTAL	451	965

Name ID Species Name Naturalised Conservation Code ¹Endemic To Query Area

Acanthaceae

- 7164 *Dicladantha forrestii*
- 11320 *Dipteracanthus australasicus subsp. australasicus*
- 17326 *Hamieria kempeana*

Aizoaceae

- 44241 *Trianthema glossostigma*

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
5.	44305 <i>Trianthema pilosum</i>			
6.	44362 <i>Trianthema triquetrum</i>			
7.	29095 <i>Zaleya galericulata</i> subsp. <i>galericulata</i>			
Amaranthaceae				
8.	2646 <i>Aerva javanica</i> (Kapok Bush)	Y		
9.	2660 <i>Amaranthus cuspidifolius</i>			
10.	2666 <i>Amaranthus mitchellii</i> (Boggabri Weed)			
11.	20018 <i>Amaranthus undulatus</i>			
12.	18361 <i>Gomphrena affinis</i> subsp. <i>pilbarensis</i>			
13.	2676 <i>Gomphrena canescens</i> (Batchelors Buttons)			
14.	18363 <i>Gomphrena canescens</i> subsp. <i>canescens</i>			
15.	2680 <i>Gomphrena cunninghamii</i>			
16.	18367 <i>Gomphrena kanisii</i>			
17.	2690 <i>Ptilotus aervoides</i>			
18.	2696 <i>Ptilotus astrolasius</i>			
19.	2698 <i>Ptilotus auriculifolius</i>			
20.	2704 <i>Ptilotus calostachyus</i> (Weeping Mulla Mulla)			
21.	2706 <i>Ptilotus carinatus</i>			
22.	2711 <i>Ptilotus clementii</i> (Tassel Top)			
23.	2718 <i>Ptilotus drummondii</i> (Narrowleaf Mulla Mulla)			
24.	2728 <i>Ptilotus gomphrenoides</i>			
25.	2731 <i>Ptilotus helipteroides</i> (Hairy Mulla Mulla)			
26.	2741 <i>Ptilotus macrocephalus</i> (Featherheads)			
27.	41001 <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> (Yellow Tails)			
28.	2747 <i>Ptilotus obovatus</i> (Cotton Bush)			
29.	2751 <i>Ptilotus polystachyus</i> (Prince of Wales Feather)			
30.	2757 <i>Ptilotus schwartzii</i>			
31.	12239 <i>Ptilotus trichocephalus</i>		P4	
Apocynaceae				
32.	6567 <i>Carissa lanceolata</i> (Conkerberry, Marnuwiji)			
33.	6599 <i>Rhyncharrhena linearis</i> (Bush Bean, Wintjulanypa)			
34.	13100 <i>Tylophora cinerascens</i>			
Araliaceae				
35.	6202 <i>Astrotricha hamptonii</i> (Ironplant)			
36.	19053 <i>Trachymene pilbarensis</i>			
Asphodelaceae				
37.	1364 <i>Asphodelus fistulosus</i> (Onion Weed)	Y		
Asteraceae				
38.	7836 <i>Angianthus tomentosus</i> (Camel-grass)			
39.	43104 <i>Apowollastonia hamersleyensis</i>			
40.	7878 <i>Brachyscome iberidifolia</i>			
41.	7893 <i>Calocephalus knappii</i>			
42.	7895 <i>Calocephalus multiflorus</i> (Yellow-top)			
43.	7905 <i>Calotis multicaulis</i> (Many-stemmed Burr-daisy)			
44.	19757 <i>Centipeda minima</i> subsp. <i>minima</i>			
45.	33516 <i>Chrysocephalum gilesii</i>			
46.	35558 <i>Flaveria trinervia</i> (Speedy Weed)	Y		
47.	8030 <i>Helichrysum oligochaetum</i>		P1	
48.	8088 <i>Ixiochlamys cuneifolia</i>			
49.	20311 <i>Pilbara trudgenii</i>		P3	
50.	8168 <i>Pluchea rubelliflora</i>			
51.	8189 <i>Pseudognaphalium luteoalbum</i> (Jersey Cudweed)			
52.	8192 <i>Pterocaulon sphacelatum</i> (Apple Bush, Fruit Salad Plant)			
53.	13301 <i>Rhodanthe floribunda</i>			
54.	13310 <i>Rhodanthe margarethae</i>			
55.	13238 <i>Rhodanthe maryonii</i>			
56.	13285 <i>Schoenia ayersii</i>			
57.	8213 <i>Senecio magnificus</i> (Showy Groundsel)			
58.	8231 <i>Sonchus oleraceus</i> (Common Sowthistle)	Y		
59.	8234 <i>Streptoglossa adscendens</i>			
60.	8237 <i>Streptoglossa decurrens</i>			
61.	8238 <i>Streptoglossa liatroides</i>			
62.	12729 <i>Taplinia saxatilis</i>			
63.	45613 <i>Taraxacum khatoonae</i>	Y		
Boraginaceae				
64.	17301 <i>Heliotropium chrysocarpum</i>			
65.	6704 <i>Heliotropium conocarpum</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
66.	6705 <i>Heliotropium crispatum</i>			
67.	6712 <i>Heliotropium heteranthum</i>			
68.	17307 <i>Heliotropium inexplicitum</i>			
69.	6713 <i>Heliotropium ovalifolium</i>			
70.	17309 <i>Heliotropium pachyphyllum</i>			
71.	6718 <i>Heliotropium tenuifolium (Mamukata)</i>			
72.	6727 <i>Trichodesma zeylanicum (Camel Bush, Kumbalin)</i>			

Brassicaceae

73.	3032 <i>Lepidium muelleri-ferdinandii</i>			
74.	3033 <i>Lepidium oxytrichum</i>			
75.	3035 <i>Lepidium pedicellosum</i>			
76.	3037 <i>Lepidium phlebopetalum (Veined Peppergrass)</i>			
77.	3038 <i>Lepidium pholidogynum</i>			
78.	3039 <i>Lepidium platypetalum (Slender Peppergrass)</i>			
79.	3072 <i>Sisymbrium orientale (Indian Hedge Mustard)</i>	Y		
80.	3074 <i>Stenopetalum anfractum</i>			

Campanulaceae

81.	37480 <i>Lobelia arnhemiaca</i>			
82.	36880 <i>Lobelia heterophylla subsp. pilbarensis</i>			
83.	7393 <i>Wahlenbergia tumidifruca</i>			

Capparaceae

84.	48291 <i>Capparis spinosa subsp. nummularia</i>			
-----	---	--	--	--

Caryophyllaceae

85.	2901 <i>Polycarpha holtzei</i>			
86.	2903 <i>Polycarpha longiflora</i>			

Chenopodiaceae

87.	2453 <i>Atriplex codonocarpa (Flat-topped Saltbush)</i>			
88.	2473 <i>Atriplex quadrivalvata</i>			
89.	2499 <i>Dissocarpus paradoxus (Curious Saltbush)</i>			
90.	2502 <i>Dysphania kalpari (Rat's Tail, Kalpari)</i>			
91.	2504 <i>Dysphania plantaginella</i>			
92.	2506 <i>Dysphania rhadinostachya</i>			
93.	11890 <i>Dysphania rhadinostachya subsp. rhadinostachya</i>			
94.	2511 <i>Enchylaena tomentosa (Barrier Saltbush)</i>			
95.	2513 <i>Eremophea spinosa</i>			
96.	2538 <i>Maireana carnosa (Cottony Bluebush)</i>			
97.	2543 <i>Maireana eriosphaera</i>			
98.	2544 <i>Maireana georgei (Satiny Bluebush)</i>			
99.	2547 <i>Maireana lanosa (Woolly Bluebush)</i>			
100.	2551 <i>Maireana melanocoma (Pussy Bluebush)</i>			
101.	2556 <i>Maireana planifolia (Low Bluebush)</i>			
102.	2557 <i>Maireana platycarpa (Shy Bluebush)</i>			
103.	2565 <i>Maireana suaedifolia</i>			
104.	2566 <i>Maireana thesioides (Lax Bluebush)</i>			
105.	2567 <i>Maireana tomentosa (Felt Bluebush)</i>			
106.	11662 <i>Maireana tomentosa subsp. tomentosa</i>			
107.	2571 <i>Maireana villosa</i>			
108.	2582 <i>Rhagodia erimaea (Thorny Saltbush)</i>			
109.	30434 <i>Salsola australis</i>			
110.	2597 <i>Sclerolaena bicornis (Goathead Burr)</i>			
111.	2603 <i>Sclerolaena cornishiana (Cartwheel Burr)</i>			
112.	2604 <i>Sclerolaena costata</i>			
113.	2606 <i>Sclerolaena cuneata (Yellow Bindii)</i>			
114.	2607 <i>Sclerolaena densiflora</i>			
115.	2611 <i>Sclerolaena eriacantha (Tall Bindii)</i>			
116.	8877 <i>Sclerolaena gardneri</i>			
117.	2619 <i>Sclerolaena lanicuspis (Spinach Burr)</i>			
118.	31492 <i>Tecticornia disarticulata</i>			

Cleomaceae

119.	2985 <i>Cleome oxalidea</i>			
120.	2988 <i>Cleome viscosa (Tickweed, Tjinduwadhu)</i>			

Convolvulaceae

121.	6606 <i>Bonamia media</i>			
122.	44782 <i>Bonamia pilbarensis</i>			
123.	6612 <i>Convolvulus clementii</i>			
124.	31274 <i>Duperreya commixta</i>			
125.	6617 <i>Evolvulus alsinoides (Tropical Speedwell)</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
126.	11200 <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>			
127.	6633 <i>Ipomoea muelleri</i> (Poison Morning Glory, Yumbu)			
128.	6651 <i>Operculina aequisepala</i>			
129.	6653 <i>Polymeria ambigua</i> (Morning Glory)			
Cucurbitaceae				
130.	7369 <i>Citrullus colocynthis</i>	Y		
131.	41721 <i>Cucumis variabilis</i>			
Cyperaceae				
132.	774 <i>Cyperus bifax</i> (Downs Nutgrass)			
133.	786 <i>Cyperus cunninghamii</i>			
134.	12811 <i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>			
135.	18318 <i>Cyperus involucratus</i>	Y		
136.	818 <i>Cyperus vaginatus</i> (Stiffleaf Sedge)			
137.	843 <i>Fimbristylis cephalophora</i>			
138.	16257 <i>Schoenoplectus subulatus</i>			
139.	989 <i>Schoenus falcatus</i>			
Euphorbiaceae				
140.	17422 <i>Adriana tomentosa</i> var. <i>tomentosa</i>			
141.	35307 <i>Euphorbia australis</i> var. <i>australis</i>			
142.	42844 <i>Euphorbia australis</i> var. <i>hispidula</i>			
143.	35303 <i>Euphorbia australis</i> var. <i>subtomentosa</i>			
144.	4619 <i>Euphorbia biconvexa</i>			
145.	4620 <i>Euphorbia boophthona</i> (Gascoyne Spurge)			
146.	9048 <i>Euphorbia careyi</i>			
147.	4623 <i>Euphorbia coghlanii</i> (Namana)			
148.	4629 <i>Euphorbia hirta</i> (Asthma Plant)	Y		
149.	<i>Euphorbia</i> sp.			
150.	4647 <i>Euphorbia tannensis</i>			
151.	12097 <i>Euphorbia tannensis</i> subsp. <i>eremophila</i> (Desert Spurge)			
152.	42879 <i>Euphorbia trigonosperma</i>			
153.	42876 <i>Euphorbia vaccaria</i> var. <i>vaccaria</i>			
Fabaceae				
154.	3209 <i>Acacia ampliceps</i>			
155.	44586 <i>Acacia ampliceps</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>			
156.	3217 <i>Acacia aneura</i> (Mulga, Wanari)			
157.	37260 <i>Acacia aptaneura</i>			
158.	3228 <i>Acacia atkinsiana</i>			
159.	3232 <i>Acacia ayersiana</i>			
160.	3241 <i>Acacia bivenosa</i>			
161.	44588 <i>Acacia bivenosa</i> x <i>sclerosperma</i> subsp. <i>sclerosperma</i>			
162.	3260 <i>Acacia citrinoviridis</i>			
163.	13502 <i>Acacia coriacea</i> subsp. <i>pendens</i>			
164.	3280 <i>Acacia cuspidifolia</i> (Bohemia)			
165.	36781 <i>Acacia fuscaneura</i>			
166.	3360 <i>Acacia hamersleyensis</i>			
167.	36418 <i>Acacia incurvaneura</i>			
168.	3399 <i>Acacia kempeana</i> (Witchetty Bush, Ilykuwara)			
169.	3434 <i>Acacia maitlandii</i> (Maitland's Wattle)			
170.	3435 <i>Acacia marramamba</i>			
171.	3500 <i>Acacia pruinocarpa</i> (Gidgee)			
172.	29016 <i>Acacia pyrifolia</i> var. <i>morrisonii</i>			
173.	29015 <i>Acacia pyrifolia</i> var. <i>pyrifolia</i>			
174.	3519 <i>Acacia rhodophloia</i>			
175.	44584 <i>Acacia rhodophloia</i> x <i>sibirica</i>			
176.	13078 <i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>			
177.	8949 <i>Acacia sibirica</i> (Bastard Mulga)			
178.	35939 <i>Acacia</i> sp. <i>Mulga Paraburdoo</i> (B.R. Maslin et al. BRM 9201)			
179.	3553 <i>Acacia spondylophylla</i>			
180.	13070 <i>Acacia synchronicia</i>			
181.	3577 <i>Acacia tetragonophylla</i> (Kurara, Wakalpuka)			
182.	3598 <i>Acacia wanyu</i>			
183.	3606 <i>Acacia xiphophylla</i>			
184.	3774 <i>Crotalaria cunninghamii</i> (Green Birdflower, Bilbun)			
185.	20175 <i>Crotalaria cunninghamii</i> subsp. <i>sturtii</i>			
186.	3783 <i>Crotalaria medicaginea</i>			
187.	20179 <i>Crotalaria medicaginea</i> var. <i>neglecta</i>			
188.	17118 <i>Cullen leucanthum</i>			
189.	17119 <i>Cullen leucochaites</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
190.	3941 <i>Glycine tabacina</i> (Glycine Pea)			
191.	3973 <i>Indigofera colutea</i> (Sticky Indigo)			
192.	16644 <i>Indigofera decipiens</i>			
193.	3981 <i>Indigofera linnaei</i> (Birdsville Indigo)			
194.	3982 <i>Indigofera monophylla</i>			
195.	3985 <i>Indigofera rugosa</i>			
196.	4061 <i>Lotus cruentus</i> (Redflower Lotus)			
197.	3614 <i>Neptunia dimorphantha</i> (Sensitive Plant)			
198.	3675 <i>Petalostylis labicheoides</i> (Slender Petalostylis)			
199.	4190 <i>Rhynchosia australis</i> (Rhynchosia)			
200.	4191 <i>Rhynchosia minima</i> (Rhynchosia)			
201.	17645 <i>Senna artemisioides</i>			
202.	12279 <i>Senna artemisioides</i> subsp. <i>helmsii</i>			
203.	12280 <i>Senna artemisioides</i> subsp. <i>oligophylla</i>			
204.	12307 <i>Senna glutinosa</i> subsp. <i>glutinosa</i>			
205.	12309 <i>Senna glutinosa</i> subsp. <i>pruinosa</i>			
206.	12308 <i>Senna glutinosa</i> subsp. <i>x luerssenii</i>			
207.	18451 <i>Senna hamersleyensis</i>			
208.	12312 <i>Senna notabilis</i>			
209.	18595 <i>Senna</i> sp. <i>Karjini</i> (M.E. Trudgen 10392)			
210.	14577 <i>Senna</i> sp. <i>Meekatharra</i> (E. Bailey 1-26)			
211.	18445 <i>Senna stricta</i>			
212.	4196 <i>Sesbania cannabina</i> (Sesbania Pea)			
213.	4198 <i>Sesbania formosa</i> (White Dragon Tree)			
214.	13596 <i>Swainsona complanata</i>			
215.	4228 <i>Swainsona forrestii</i>			
216.	4230 <i>Swainsona incei</i>			
217.	4233 <i>Swainsona leeana</i>			
218.	4234 <i>Swainsona maccullochiana</i> (Ashburton Pea)			
219.	42142 <i>Swainsona thompsoniana</i>		P3	
220.	41825 <i>Tephrosia rosea</i> var. <i>Fortescue creeks</i> (M.I.H. Brooker 2186)			
221.	41811 <i>Tephrosia</i> sp. <i>Fortescue</i> (A.A. Mitchell 606)			
222.	42442 <i>Tephrosia</i> sp. <i>NW Eremaean</i> (S. van Leeuwen et al. PBS 0356)			
223.	40060 <i>Tephrosia</i> sp. <i>clay soils</i> (S. van Leeuwen et al. PBS 0273)			
224.	4285 <i>Tephrosia supina</i>			
225.	30716 <i>Vachellia farnesiana</i> (Mimosa Bush)	Y		
226.	4323 <i>Vigna lanceolata</i> (Maloga Vigna, Wega)			
Frankeniaceae				
227.	5207 <i>Frankenia magnifica</i>			
228.	5212 <i>Frankenia setosa</i> (Bristly Frankenia)			
Gentianaceae				
229.	41646 <i>Schenkia clementii</i>			
Geraniaceae				
230.	4335 <i>Erodium cygnorum</i> (Blue Heronsbill)			
Goodeniaceae				
231.	12517 <i>Goodenia cusackiana</i>			
232.	7509 <i>Goodenia forrestii</i>			
233.	7526 <i>Goodenia microptera</i>			
234.	12552 <i>Goodenia muelleriana</i>			
235.	12571 <i>Goodenia pascua</i>			
236.	12574 <i>Goodenia prostrata</i>			
237.	7545 <i>Goodenia scaevolina</i> (Ngurubi)			
238.	29381 <i>Goodenia</i> sp. <i>East Pilbara</i> (A.A. Mitchell PRP 727) (O'Meara's Goodenia)		P3	
239.	10982 <i>Goodenia stobbsiana</i>			
240.	7556 <i>Goodenia tenuiloba</i>			
241.	12578 <i>Scaevola acacioides</i>			
242.	20263 <i>Scaevola</i> sp. <i>Hamersley Range basalts</i> (S. van Leeuwen 3675)		P2	
243.	7644 <i>Scaevola spinescens</i> (Currant Bush, Maroon)			
Lamiaceae				
244.	13689 <i>Clerodendrum tomentosum</i> var. <i>lanceolatum</i>			
245.	6910 <i>Plectranthus intraterraneus</i>			
246.	12707 <i>Prostanthera albiflora</i>			
Loranthaceae				
247.	2372 <i>Amyema fitzgeraldii</i> (Pincushion Mistletoe)			
248.	11614 <i>Amyema gibberula</i> var. <i>gibberula</i>			
249.	11874 <i>Amyema sanguinea</i> var. <i>sanguinea</i>			
250.	14307 <i>Amyema</i> sp. <i>Fortescue</i> (M.E. Trudgen 5358)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
251.	2396 <i>Lysiana casuarinae</i>			
Lythraceae				
252.	5277 <i>Ammannia baccifera</i>			
253.	5278 <i>Ammannia multiflora</i>			
Malvaceae				
254.	4886 <i>Abutilon amplum</i>			
255.	4889 <i>Abutilon cryptopetalum</i>			
256.	4891 <i>Abutilon fraseri</i> (Lantern Bush)			
257.	18120 <i>Abutilon fraseri</i> subsp. <i>fraseri</i>			
258.	4895 <i>Abutilon lepidum</i>			
259.	4901 <i>Abutilon otocarpum</i> (Desert Chinese Lantern)			
260.	43020 <i>Abutilon oxycarpum</i> subsp. <i>Prostrate</i> (A.A. Mitchell PRP 1266)			
261.	<i>Abutilon</i> sp.			
262.	42920 <i>Abutilon</i> sp. <i>Dioicum</i> (A.A. Mitchell PRP 1618)			
263.	40910 <i>Androcalva luteiflora</i> (Yellow-flowered Rulingia)			
264.	4999 <i>Brachychiton gregorii</i> (Desert Kurrajong, Ngalta)			
265.	13560 <i>Corchorus crozophorifolius</i>			
266.	18409 <i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>			
267.	18408 <i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>			
268.	4865 <i>Corchorus tridens</i>			
269.	4918 <i>Gossypium robinsonii</i> (Wild Cotton)			
270.	4924 <i>Hibiscus burtonii</i>			
271.	48312 <i>Hibiscus campanulatus</i>		P1	
272.	4925 <i>Hibiscus coatesii</i>			
273.	4930 <i>Hibiscus goldsworthii</i>			
274.	43022 <i>Hibiscus</i> sp. <i>Gardneri</i> (A.L. Payne PRP 1435)			
275.	4942 <i>Hibiscus sturtii</i> (Sturt's Hibiscus)			
276.	11651 <i>Hibiscus sturtii</i> var. <i>campylochlamys</i>			
277.	11477 <i>Hibiscus sturtii</i> var. <i>platychlamys</i>			
278.	4953 <i>Lawrenzia densiflora</i>			
279.	4955 <i>Lawrenzia glomerata</i>			
280.	19479 <i>Lawrenzia</i> sp. <i>Mulein Station</i> (Setter 317)			
281.	4962 <i>Malvastrum americanum</i> (Spiked Malvastrum)	Y		
282.	5051 <i>Melhania oblongifolia</i>			
283.	46821 <i>Seringia nephrosperma</i> (Free carpel fire-bush)			
284.	4969 <i>Sida brownii</i>			
285.	4970 <i>Sida calyxhymenia</i> (Tall Sida)			
286.	4976 <i>Sida echinocarpa</i>			
287.	4977 <i>Sida fibulifera</i> (Silver Sida)			
288.	15110 <i>Sida laevis</i>			
289.	16616 <i>Sida</i> sp. <i>Barlee Range</i> (S. van Leeuwen 1642)		P3	
290.	31854 <i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)			
291.	33697 <i>Sida</i> sp. <i>Hamersley Range</i> (K. Newbey 10692)		P1	
292.	33698 <i>Sida</i> sp. <i>Pilbara</i> (A.A. Mitchell PRP 1543)			
293.	19712 <i>Sida</i> sp. <i>dark green fruits</i> (S. van Leeuwen 2260)			
294.	16617 <i>Sida</i> sp. <i>spiciform panicles</i> (E. Leyland s.n. 14/8/90)			
295.	4989 <i>Sida spinosa</i> (Spiny Sida)			
296.	4875 <i>Triumfetta chaetocarpa</i> (Urchins)			
297.	14694 <i>Triumfetta clementii</i>			
298.	5106 <i>Waltheria indica</i>			
299.	5107 <i>Waltheria virgata</i>			
Marsileaceae				
300.	76 <i>Marsilea hirsuta</i> (Nardoo)			
Molluginaceae				
301.	48201 <i>Trigastrotheca molluginea</i>			
Montiaceae				
302.	48325 <i>Calandrinia holtumii</i>			
303.	2869 <i>Calandrinia schistorhiza</i>			
304.	31073 <i>Calandrinia</i> sp. <i>The Pink Hills</i> (F. Obbens FO 19/06)			
305.	2870 <i>Calandrinia stagnensis</i>			
Moraceae				
306.	19648 <i>Ficus brachypoda</i>			
Myrtaceae				
307.	19448 <i>Aluta quadrata</i>		T	
308.	16783 <i>Corymbia candida</i>			
309.	17077 <i>Corymbia ferritcola</i>			
310.	17093 <i>Corymbia hamersleyana</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
311.	17092 <i>Corymbia opaca</i>			
312.	41301 <i>Eucalyptus aridimontana</i>			
313.	35345 <i>Eucalyptus camaldulensis</i> subsp. <i>obtus</i> a (Blunt-budded River Red Gum)			
314.	35343 <i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>			
315.	5684 <i>Eucalyptus kingsmillii</i> (Kingsmill's Mallee)			
316.	18088 <i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>			
317.	5773 <i>Eucalyptus socialis</i> (Red Mallee, Altarpa)			
318.	29733 <i>Eucalyptus trivalva</i> (Victoria Spring Mallee)			
319.	15592 <i>Eucalyptus xerothermica</i>			
320.	5875 <i>Melaleuca argentea</i> (Silver Cadjeput, Bandaran)			
321.	5879 <i>Melaleuca bracteata</i> (River Teatree)			
322.	5915 <i>Melaleuca glomerata</i>			
323.	5933 <i>Melaleuca linophylla</i>			
Nyctaginaceae				
324.	2770 <i>Boerhavia coccinea</i> (Tar Vine, Wituka)			
325.	<i>Boerhavia</i> sp.			
326.	2776 <i>Commicarpus australis</i> (Perennial Tar Vine)			
Oleaceae				
327.	6501 <i>Jasminum didymum</i>			
328.	12059 <i>Jasminum didymum</i> subsp. <i>lineare</i> (Desert Jasmine)			
Papaveraceae				
329.	17797 <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>	Y		
Phrymaceae				
330.	18462 <i>Peplidium</i> sp. <i>E. Evol. Fl. Fauna Arid Aust. (A.S. Weston 12768)</i>			
Phyllanthaceae				
331.	38421 <i>Notoleptopus decaisnei</i>			
332.	38423 <i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B. Craig 428)			
333.	4680 <i>Phyllanthus maderaspatensis</i>			
334.	4706 <i>Sauropus crassifolius</i>			
Plantaginaceae				
335.	7098 <i>Stemodia grossa</i> (Marsh Stemodia, Mindjaara)			
Poaceae				
336.	19835 <i>Amphipogon sericeus</i>			
337.	203 <i>Aristida anthoxanthoides</i> (Yellow Threawn)			
338.	207 <i>Aristida contorta</i> (Bunched Kerosene Grass)			
339.	217 <i>Aristida nitidula</i> (Flat-awned Threawn)			
340.	229 <i>Astrebula pectinata</i> (Barley Mitchell Grass)			
341.	240 <i>Bothriochloa ewartiana</i> (Desert Bluegrass)			
342.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
343.	29721 <i>Cenchrus setiger</i> (Birdwood Grass)	Y		
344.	272 <i>Chloris virgata</i> (Feathertop Rhodes Grass)	Y		
345.	279 <i>Cymbopogon ambiguus</i> (Scentgrass)			
346.	46555 <i>Cynodon prostratus</i>			
347.	310 <i>Digitaria brownii</i> (Cotton Panic Grass)			
348.	311 <i>Digitaria ciliaris</i> (Summer Grass)	Y		
349.	323 <i>Diplachne fusca</i> (Brown Beetle Grass)			
350.	48378 <i>Diplachne fusca</i> subsp. <i>fusca</i>			
351.	357 <i>Enneapogon caerulescens</i> (Limestone Grass)			
352.	363 <i>Enneapogon pallidus</i> (Conetop Nineawn)			
353.	365 <i>Enneapogon polyphyllus</i> (Leafy Nineawn)			
354.	378 <i>Eragrostis dielsii</i> (Mallee Lovegrass)			
355.	380 <i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangurnu)			
356.	393 <i>Eragrostis setifolia</i> (Neverfail Grass)			
357.	<i>Eragrostis</i> sp.			
358.	398 <i>Eragrostis tenellula</i> (Delicate Lovegrass)			
359.	400 <i>Eriachne aristidea</i>			
360.	403 <i>Eriachne benthamii</i> (Swamp Wanderrrie)			
361.	407 <i>Eriachne festucacea</i> (Plains Wandarrrie Grass)			
362.	413 <i>Eriachne mucronata</i> (Mountain Wanderrrie Grass)			
363.	417 <i>Eriachne pulchella</i> (Pretty Wanderrrie)			
364.	421 <i>Eriachne tenuiculmis</i>			
365.	458 <i>Iseilema dolichotrichum</i>			
366.	465 <i>Iseilema vaginiflorum</i> (Red Flinders Grass)			
367.	503 <i>Panicum decompositum</i> (Native Millet, Kaltu-kaltu)			
368.	515 <i>Paraneurachne muelleri</i> (Northern Mulga Grass)			
369.	10975 <i>Paspalidium basicladum</i>			
370.	518 <i>Paspalidium clementii</i> (Clements Paspalidium)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
371.	519 <i>Paspalidium constrictum</i> (Knottybutt Grass)			
372.	629 <i>Sporobolus australasicus</i> (Fairy Grass)			
373.	17820 <i>Themeda</i> sp. <i>Hammersley Station (M.E. Trudgen 11431)</i>		P3	
374.	673 <i>Themeda triandra</i>			
375.	13131 <i>Triodia epactia</i>			
376.	704 <i>Triodia wiseana</i> (Limestone Spinifex)			
377.	706 <i>Triraphis mollis</i> (Needle Grass)			
Polygonaceae				
378.	2443 <i>Rumex vesicarius</i> (Ruby Dock)	Y		
Portulacaceae				
379.	2882 <i>Portulaca intraterranea</i>			
380.	2884 <i>Portulaca oleracea</i> (Purslane, Wakati)			
Potamogetonaceae				
381.	20426 <i>Potamogeton tepperi</i>			
382.	113 <i>Potamogeton tricarinatus</i> (Floating Pondweed)			
Primulaceae				
383.	6483 <i>Samolus junceus</i>			
Proteaceae				
384.	1963 <i>Grevillea berryana</i>			
385.	44441 <i>Grevillea saxicola</i>		P3	
386.	2096 <i>Grevillea stenobotrya</i>			
387.	2099 <i>Grevillea striata</i> (Beefwood)			
388.	2138 <i>Hakea chordophylla</i>			
389.	2177 <i>Hakea lorea</i> (Witinti)			
390.	19137 <i>Hakea lorea</i> subsp. <i>lorea</i>			
Pteridaceae				
391.	32 <i>Cheilanthes brownii</i>			
392.	37 <i>Cheilanthes lasiophylla</i> (Woolly Cloak Fern)			
Rhamnaceae				
393.	4846 <i>Ventilago viminalis</i> (Supplejack, Barndaragu)			
Rubiaceae				
394.	7338 <i>Oldenlandia crouchiana</i>			
395.	18154 <i>Psydrax latifolia</i>			
396.	18155 <i>Psydrax suaveolens</i>			
397.	13339 <i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>			
Santalaceae				
398.	2357 <i>Santalum lanceolatum</i> (Northern Sandalwood, Yarnguli)			
Sapindaceae				
399.	12023 <i>Diplopeltis stuartii</i> var. <i>stuartii</i> (Desert Pepperflower)			
400.	11406 <i>Dodonaea lanceolata</i> var. <i>lanceolata</i>			
401.	4772 <i>Dodonaea pachyneura</i>			
402.	4773 <i>Dodonaea petiolaris</i>			
403.	4782 <i>Dodonaea viscosa</i> (Sticky Hopbush)			
Scrophulariaceae				
404.	31471 <i>Eremophila accrescens</i>			
405.	15167 <i>Eremophila canaliculata</i>			
406.	15030 <i>Eremophila coacta</i>		P3	
407.	18053 <i>Eremophila cryptothrix</i>			
408.	7192 <i>Eremophila cuneifolia</i> (Pinyuru, T'irranju)			
409.	7205 <i>Eremophila exilifolia</i>			
410.	15052 <i>Eremophila forrestii</i> subsp. <i>forrestii</i>			
411.	17152 <i>Eremophila forrestii</i> subsp. <i>hastiana</i> (Grey Poverty Bush)			
412.	16696 <i>Eremophila fraseri</i> subsp. <i>fraseri</i>			
413.	17519 <i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>			
414.	7228 <i>Eremophila lachnocalyx</i> (Woolly-calyxed Eremophila)			
415.	7230 <i>Eremophila latrobei</i> (Warty Fuchsia Bush, Mintjingka)			
416.	17597 <i>Eremophila latrobei</i> subsp. <i>filiformis</i>			
417.	17576 <i>Eremophila latrobei</i> subsp. <i>latrobei</i>			
418.	7234 <i>Eremophila longifolia</i> (Berrigan, Tulypurpa)			
419.	14893 <i>Eremophila magnifica</i> subsp. <i>magnifica</i>		P4	
420.	18570 <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>			
421.	15164 <i>Eremophila petrophila</i> subsp. <i>petrophila</i>			
422.	17283 <i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>			
423.	15160 <i>Eremophila platycalyx</i> subsp. <i>pardalota</i>			
424.	15057 <i>Eremophila reticulata</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
425.	<i>Eremophila</i> sp.			
426.	40643 <i>Eremophila</i> sp. <i>Hammersley Range (K. Walker KW 136)</i>		P1	
427.	23997 <i>Eremophila tietkensis</i>			
Solanaceae				
428.	47241 <i>Datura leichhardtii</i> subsp. <i>leichhardtii</i>	Y		
429.	6971 <i>Nicotiana benthamiana</i> (<i>Tjuntiwari</i>)			
430.	6976 <i>Nicotiana occidentalis</i> (<i>Native Tobacco</i>)			
431.	11856 <i>Nicotiana occidentalis</i> subsp. <i>occidentalis</i>			
432.	6980 <i>Nicotiana umbratica</i>		P3	
433.	7002 <i>Solanum diversiflorum</i>			
434.	7009 <i>Solanum gabriellae</i>			
435.	7014 <i>Solanum horridum</i>			
436.	7018 <i>Solanum lasiophyllum</i> (<i>Flannel Bush, Mindjulu</i>)			
437.	7022 <i>Solanum nigrum</i> (<i>Black Berry Nightshade</i>)	Y		
438.	42541 <i>Solanum octonum</i>		P2	
439.	7029 <i>Solanum phlomoides</i>			
440.	42546 <i>Solanum piceum</i>			
Surianaceae				
441.	3182 <i>Stylobasium spathulatum</i> (<i>Pebble Bush</i>)			
Thymelaeaceae				
442.	5245 <i>Pimelea forrestiana</i>			
443.	11185 <i>Pimelea microcephala</i> subsp. <i>microcephala</i>			
Typhaceae				
444.	98 <i>Typha domingensis</i> (<i>Bulrush, Djandjid</i>)			
Violaceae				
445.	5215 <i>Hybanthus aurantiacus</i>			
Zygophyllaceae				
446.	4374 <i>Tribulus astrocarpus</i>			
447.	4377 <i>Tribulus hirsutus</i>			
448.	4380 <i>Tribulus occidentalis</i> (<i>Perennial Caltrop</i>)			
449.	18072 <i>Tribulus suberosus</i>			
450.	4392 <i>Zygophyllum iodocarpum</i>			
451.	4393 <i>Zygophyllum kochii</i>			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



EPBC Act Protected Matters Report

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

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

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

Report created: 11/07/18 15:57:39

[Summary](#)

[Details](#)

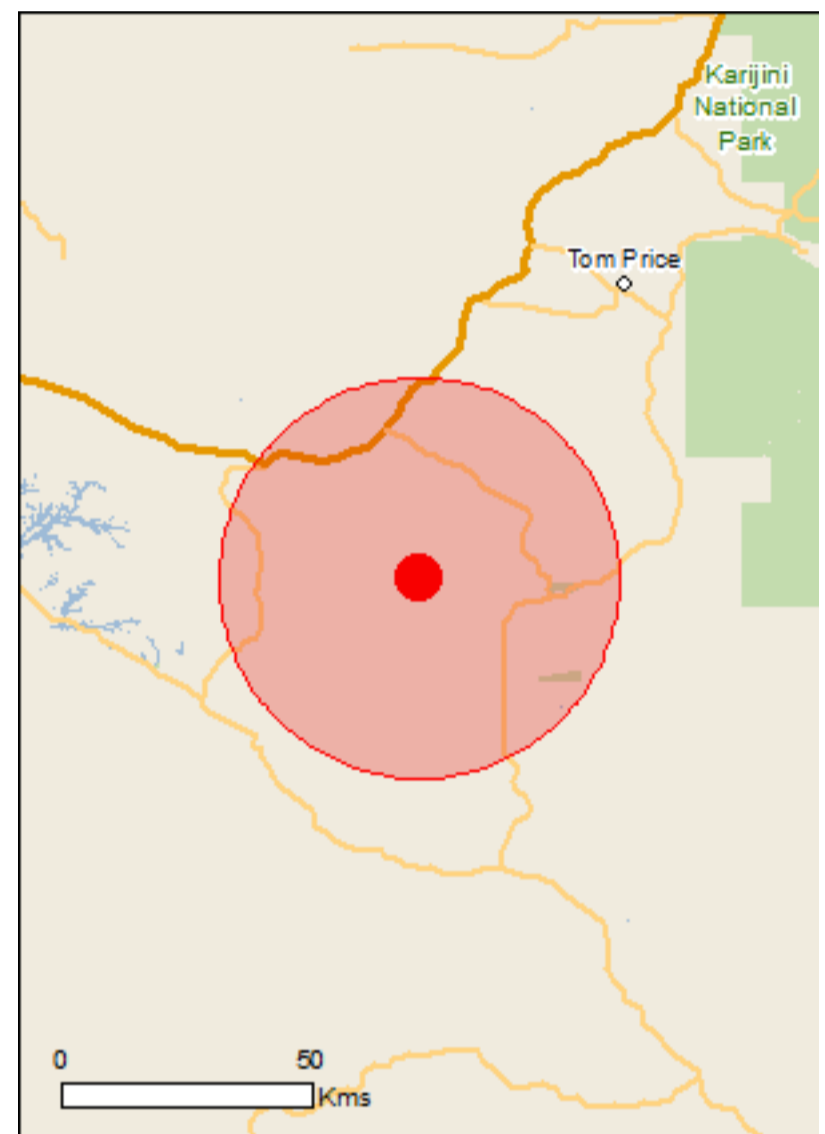
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

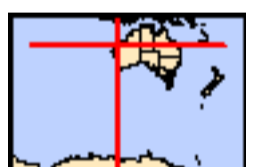
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 40.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	8
Listed Migratory Species:	9

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Rhinonictes aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species

[\[Resource Information \]](#)

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

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-23.17436 117.42261

Acknowledgements

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

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

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

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

Appendix E: Compiled Species List

This page has been left blank intentionally.

Table E.1: Vascular flora species list for the study area.

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Acanthaceae	<i>Dicladantha forrestii</i>	x	x		
	<i>Dipteracanthus australasicus</i>	x			
	<i>Dipteracanthus australasicus</i> subsp. <i>australasicus</i>		x		
Aizoaceae	<i>Trianthera glossostigmum</i>	x	x	x	
	<i>Trianthera triquetrum</i>	x		x	
	<i>Zaleya galericulata</i>				x
	<i>Zaleya galericulata</i> subsp. <i>galericulata</i>			x	
Amaranthaceae	* <i>Aerva javanica</i>			x	
	<i>Alternanthera denticulata</i>		x		
	<i>Alternanthera nodiflora</i>		x		
	<i>Amaranthus cuspidifolius</i>	x	x	x	
	<i>Amaranthus interruptus</i>			x	
	<i>Amaranthus undulatus</i>	x			
	<i>Gomphrena canescens</i> subsp. <i>canescens</i>				x
	<i>Gomphrena cunninghamii</i>	x	x	x	
	<i>Gomphrena kanisii</i>		x	x	
	<i>Ptilotus aervoides</i>	x	x	x	
	<i>Ptilotus auriculifolius</i>	x	x	x	
	<i>Ptilotus calostachyus</i>	x			
	<i>Ptilotus clementii</i>	x	x	x	
	<i>Ptilotus gomphrenoides</i>			x	
	<i>Ptilotus helipteroides</i>	x	x		
	<i>Ptilotus macrocephalus</i>	x			
	<i>Ptilotus nobilis</i> subsp. <i>nobilis</i>	x	x	x	
	<i>Ptilotus obovatus</i>	x			
	<i>Ptilotus obovatus</i> var. <i>obovatus</i>		x	x	
	<i>Ptilotus schwartzii</i>	x			
<i>Ptilotus schwartzii</i> var. <i>schwartzii</i>		x	x		
<i>Ptilotus trichocephalus</i> P4			x		
Apocynaceae	<i>Cynanchum floribundum</i>	x			
	<i>Marsdenia australis</i>	x		x	x
	<i>Rhyncharrhena linearis</i>	x		x	
Araliaceae	<i>Astrotricha hamptonii</i>	x			
	<i>Trachymene oleracea</i> subsp. <i>oleracea</i>		x	x	

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Araliaceae	<i>Trachymene pilbarensis</i>	x	x	x	
Asteraceae	<i>Angianthus milnei</i>				x
	Asteraceae sp.	x			
	* <i>Bidens bipinnata</i>			x	
	<i>Blumea tenella</i>		x		
	<i>Calocephalus beardii</i>				x
	<i>Calotis hispidula</i>	x			
	<i>Calotis plumulifera</i>	x			
	<i>Centipeda thespidioides</i>		x		
	<i>Gnephosis arachnoidea</i>	x			x
	<i>Ixiochlamys cuneifolia</i>	x			
	<i>Peripleura arida</i>		x		
	<i>Pterocaulon</i> sp.	x			
	<i>Pterocaulon sphacelatum</i>			x	
	<i>Pterocaulon sphaeranthoides</i>	x	x		
	<i>Rhodanthe margarethae</i>	x			x
	<i>Rhodanthe</i> sp.				x
	<i>Rhodanthe stricta</i>				x
	<i>Roebuckiella oncocarpa</i>	x			
	<i>Streptoglossa decurrens</i>		x	x	
<i>Taplinia saxatilis</i>				x	
Boraginaceae	<i>Heliotropium heteranthum</i>	x	x	x	
	<i>Heliotropium inexplicitum</i>			x	
	<i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>	x	x	x	
Brassicaceae	<i>Lepidium oxytrichum</i>	x	x		
	<i>Lepidium pedicellosum</i>	x	x		
	<i>Lepidium platypetalum</i>	x	x	x	
	<i>Lepidium</i> sp.	x			
	<i>Stenopetalum anfractum</i>				x
	<i>Stenopetalum</i> sp.	x			
Campanulaceae	<i>Lobelia heterophylla</i> subsp. <i>pilbarensis</i> N.G.Walsh	x			
	<i>Wahlenbergia tumidifructa</i>	x	x		
Capparaceae	<i>Capparis spinosa</i>	x			
Caryophyllaceae	<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>		x	x	
	<i>Polycarpaea longiflora</i>	x	x	x	

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Chenopodiaceae	<i>Atriplex codonocarpa</i>	x			
	<i>Dysphania rhadinostachya</i>	x	x	x	x
	<i>Dysphania rhadinostachya</i> subsp. <i>rhadinostachya</i>		x	x	
	<i>Dysphania</i> sp.			x	
	<i>Enchylaena tomentosa</i>	x			
	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	x	x	x	
	<i>Eremophea spinosa</i>		x	x	
	<i>Maireana georgei</i>		x	x	
	<i>Maireana melanocoma</i>	x	x	x	
	<i>Maireana planifolia</i>	x	x	x	
	<i>Maireana thesioides</i>	x			
	<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>	x	x	x	
	<i>Maireana triptera</i>	x			
	<i>Maireana villosa</i>			x	
	<i>Rhagodia eremaea</i>	x	x	x	
	<i>Salsola australis</i>	x	x	x	
	<i>Sclerolaena cornishiana</i>	x			
	<i>Sclerolaena cuneata</i>	x		x	
	<i>Sclerolaena densiflora</i>	x	x	x	
	<i>Sclerolaena eriacantha</i>	x	x	x	
<i>Sclerolaena</i> sp.			x		
<i>Tecticornia disarticulata</i>			x		
Cleomaceae	<i>Cleome viscosa</i>	x	x	x	
Convolvulaceae	<i>Bonamia media</i>	x			
	<i>Bonamia pilbarensis</i>		x	x	
	<i>Convolvulus clementii</i>	x			
	<i>Convolvulus remotus</i>		x		
	<i>Duperreya commixta</i>	x	x	x	
	<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	x	x		
	<i>Operculina aequisepala</i>		x		
Cucurbitaceae	<i>Cucumis variabilis</i>	x	x	x	
Cyperaceae	<i>Bulbostylis barbata</i>		x	x	
	<i>Cyperus cunninghamii</i>	x			
	<i>Cyperus cunninghamii</i> subsp. <i>cunninghamii</i>			x	x
	<i>Cyperus vaginatus</i>		x		

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Euphorbiaceae	<i>Euphorbia biconvexa</i>			x	
	<i>Euphorbia boophthona</i>			x	
	<i>Euphorbia careyi</i>	x			
	<i>Euphorbia</i> sp.	x	x	x	
	<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	x		x	
Fabaceae	<i>Acacia aneura</i>	x			
	<i>Acacia aneura</i> sens. lat		x	x	
	<i>Acacia aptaneura</i>	x			
	<i>Acacia arida</i>			x	
	<i>Acacia bivenosa</i>	x			
	<i>Acacia citrinoviridis</i>	x	x	x	
	<i>Acacia coriacea</i> subsp. <i>pendens</i>	x		x	
	<i>Acacia fusca</i>	x	x		
	<i>Acacia inaequilatera</i>	x			
	<i>Acacia kempeana</i>	x	x	x	
	<i>Acacia marramamba</i>	x	x	x	
	<i>Acacia pruinocarpa</i>	x	x	x	
	<i>Acacia pyrifolia</i>	x			
	<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>		x		
	<i>Acacia rhodophloia</i>	x	x	x	
	<i>Acacia rhodophloia</i> x <i>sibirica</i>		x		
	<i>Acacia sibirica</i>		x	x	
	<i>Acacia synchronicia</i>	x	x	x	
	<i>Acacia tetragonophylla</i>	x	x	x	
	<i>Acacia wanyu</i>	x	x	x	
	<i>Acacia xiphophylla</i>	x	x	x	
	<i>Crotalaria medicaginea</i> var. <i>neglecta</i>	x	x		
	<i>Glycine canescens</i>	x			
	<i>Indigofera colutea</i>	x		x	
	<i>Indigofera monophylla</i>	x	x	x	
	<i>Lotus cruentus</i>		x		
	<i>Petalostylis labicheoides</i>	x	x		
<i>Rhynchosia minima</i>	x	x	x		
<i>Senna artemisioides</i> subsp. <i>helmsii</i>	x	x	x		
<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	x	x	x		

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Fabaceae	<i>Senna glaucifolia</i>		x	x	
	<i>Senna glutinosa</i>		x		
	<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	x	x	x	
	<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	x	x	x	
	<i>Senna glutinosa</i> subsp. <i>x luerssenii</i>	x	x	x	
	<i>Senna hamersleyensis</i>			x	
	<i>Senna</i> sp. Meekatharra (E. Bailey 1-26)		x	x	
	<i>Senna stricta</i>	x	x	x	
	<i>Swainsona canescens</i>			x	
	<i>Swainsona decurrens</i>	x	x		
	<i>Tephrosia rosea</i> var. Fortescue creeks (M.I.H. Brooker 2186)	x	x		
	<i>Tephrosia</i> sp. Fortescue (A.A. Mitchell 606)	x	x		
	<i>Tephrosia supina</i>	x			
Frankeniaceae	<i>Frankenia magnifica</i>	x	x	x	
Geraniaceae	<i>Erodium cygnorum</i>	x			
Goodeniaceae	<i>Goodenia microptera</i>	x	x	x	
	<i>Goodenia muelleriana</i>		x	x	
	<i>Goodenia</i> sp.				x
	<i>Goodenia</i> sp. East Pilbara (A.A. Mitchell PRP 727) P3	x			x
	<i>Goodenia stobbsiana</i>			x	
	<i>Goodenia tenuiloba</i>	x	x	x	
	<i>Scaevola acacioides</i>		x	x	
	<i>Scaevola spinescens</i>	x	x	x	
Lamiaceae	<i>Clerodendrum floribundum</i>	x			
	<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>		x	x	
	<i>Clerodendrum tomentosum</i>	x			
Loranthaceae	<i>Amyema fitzgeraldii</i>	x			
	<i>Amyema gibberula</i> var. <i>gibberula</i>			x	
Malvaceae	<i>Abutilon fraseri</i> subsp. <i>fraseri</i>		x		
	<i>Abutilon lepidum</i>	x	x		
	<i>Abutilon otocarpum</i>			x	
	<i>Abutilon</i> sp. Dioicum (A.A. Mitchell PRP 1618)	x		x	
	<i>Corchorus crozophorifolius</i>	x	x	x	
	<i>Corchorus lasiocarpus</i> subsp. <i>lasiocarpus</i>			x	
	<i>Corchorus</i> sp.			x	

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Malvaceae	<i>Corchorus tridens</i>		x		
	<i>Hibiscus</i> aff. <i>coatesii</i>		x		
	<i>Hibiscus</i> aff. <i>sturtii</i>		x		
	<i>Hibiscus burtonii</i>	x			
	<i>Hibiscus goldsworthii</i>			x	
	<i>Hibiscus</i> sp.			x	
	<i>Hibiscus</i> sp. Gardneri (A.L. Payne PRP 1435)	x	x		
	<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>	x			
	<i>Lawrenzia glomerata</i>	x			
	* <i>Malvastrum americanum</i>	x	x		
	<i>Melhania oblongifolia</i>		x		
	<i>Sida</i> aff. <i>cardiophylla</i>				x
	<i>Sida arsinata</i>	x			
	<i>Sida brownii</i>	x	x		
	<i>Sida echinocarpa</i>	x		x	
	<i>Sida fibulifera</i>	x			
	<i>Sida</i> sp.	x	x	x	x
	<i>Sida</i> sp. Barlee Range (S. van Leeuwen 1642) P3	x			
	<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	x	x	x	
	<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)	x	x	x	
<i>Sida</i> sp. Golden calyces glabrous (H.N. Foote 32)			x		
<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/90)	x	x	x		
<i>Triumfetta clementii</i>	x	x	x		
Marsileaceae	<i>Marsilea hirsuta</i>		x		
Molluginaceae	<i>Trigastrotheca molluginea</i>	x	x	x	
Montiaceae	<i>Calandrinia ptychosperma</i>	x			
	<i>Calandrinia schistorhiza</i>	x		x	x
Moraceae	<i>Ficus</i> sp.	x			
Myrtaceae	<i>Aluta quadrata</i> T			x	x
	<i>Corymbia ferritcola</i>	x	x	x	
	<i>Eucalyptus camaldulensis</i> subsp. <i>refulgens</i>		x		
	<i>Eucalyptus leucophloia</i>	x			
	<i>Eucalyptus leucophloia</i> subsp. <i>leucophloia</i>	x		x	
	<i>Eucalyptus victrix</i>	x			
	<i>Melaleuca glomerata</i>	x	x		

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Nyctaginaceae	<i>Boerhavia coccinea</i>	x	x	x	
	<i>Boerhavia</i> sp.		x		
Oleaceae	<i>Jasminum didymum</i> subsp. <i>lineare</i>	x	x	x	
Phrymaceae	<i>Mimulus gracilis</i>		x		
Phyllanthaceae	<i>Notoleptopus decaisnei</i>	x	x		
	<i>Notoleptopus decaisnei</i> var. <i>Orbicularis</i> (A.B. Craig 428)	x	x	x	
	<i>Phyllanthus erwinii</i>	x		x	
	<i>Phyllanthus maderaspatensis</i>	x	x		
Plantaginaceae	<i>Stemodia grossa</i>	x		x	
Poaceae	<i>Amphipogon sericeus</i>	x		x	
	<i>Aristida contorta</i>	x	x	x	
	<i>Aristida nitidula</i>			x	
	<i>Aristida</i> sp.	x			
	* <i>Cenchrus ciliaris</i>	x	x	x	
	* <i>Cenchrus setiger</i>	x	x		
	<i>Cymbopogon ambiguus</i>	x	x	x	
	<i>Cymbopogon obtectus</i>		x		
	<i>Cymbopogon</i> sp.		x	x	
	<i>Cynodon prostratus</i>	x	x	x	
	<i>Dichanthium sericeum</i> subsp. <i>humilius</i>		x		
	<i>Digitaria ctenantha</i>		x	x	
	<i>Enneapogon caerulescens</i>	x	x	x	
	<i>Enneapogon lindleyanus</i>	x	x		
	<i>Enneapogon polyphyllus</i>		x	x	
	<i>Enteropogon ramosus</i>		x		
	<i>Eragrostis leptocarpa</i>		x		
	<i>Eragrostis tenellula</i>	x	x		
	<i>Eriachne mucronata</i>	x	x	x	x
	<i>Eriachne pulchella</i>			x	
	<i>Eriachne pulchella</i> subsp. <i>dominii</i>	x	x		
	<i>Eriachne pulchella</i> subsp. <i>pulchella</i>	x	x	x	
	<i>Eriachne</i> sp.		x		
	<i>Eriachne tenuiculmis</i>	x	x		x
<i>Iseilema dolichotrichum</i>	x	x	x		
<i>Paraneurachne muelleri</i>	x	x	x		

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Poaceae	<i>Paspalidium clementii</i>	x	x	x	
	<i>Paspalidium constrictum</i>			x	
	<i>Schizachyrium fragile</i>			x	
	* <i>Setaria verticillata</i>		x		
	<i>Sporobolus australasicus</i>		x	x	
	<i>Themeda triandra</i>	x	x		
	<i>Tragus australianus</i>		x		
	<i>Triodia angusta</i>	x			
	<i>Triodia epactia</i>	x	x	x	
	<i>Triodia wiseana</i>	x	x	x	
	<i>Tripogonella loliiformis</i>		x		
Polygalaceae	<i>Polygala glaucifolia</i>			x	
Polygonaceae	* <i>Rumex vesicarius</i>		x	x	
Portulacaceae	<i>Portulaca cyclophylla</i>			x	
	<i>Portulaca intraterranea</i>		x		
	<i>Portulaca oleracea</i>	x		x	
Proteaceae	<i>Grevillea berryana</i>	x	x	x	
	<i>Grevillea saxicola</i> P3	x			
	<i>Hakea chordophylla</i>	x			
Pteridaceae	<i>Cheilanthes brownii</i>	x		x	
	<i>Cheilanthes sieberi</i>	x			
Rubiaceae	<i>Oldenlandia crouchiana</i>		x	x	x
	<i>Psydrax latifolia</i>	x		x	
	<i>Psydrax suaveolens</i>		x	x	
Santalaceae	<i>Santalum lanceolatum</i>	x	x	x	
Sapindaceae	<i>Atalaya hemiglauca</i>		x		
	<i>Dodonaea pachyneura</i>	x	x	x	x
	<i>Dodonaea petiolaris</i>	x		x	
Scrophulariaceae	<i>Eremophila canaliculata</i>	x	x	x	
	<i>Eremophila cryptothrix</i>	x		x	x
	<i>Eremophila cuneifolia</i>	x	x	x	
	<i>Eremophila exilifolia</i>	x	x	x	
	<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	x	x	x	
	<i>Eremophila fraseri</i> subsp. <i>fraseri</i>		x	x	
	<i>Eremophila jucunda</i>	x			

Family	Species	Astron 2013	Biota 2012a	Biota 2012b	Biota 2003
Scrophulariaceae	<i>Eremophila jucunda</i> subsp. <i>pulcherrima</i>	x	x	x	
	<i>Eremophila latrobei</i>		x		
	<i>Eremophila latrobei</i> subsp. <i>filiformis</i>		x	x	
	<i>Eremophila latrobei</i> subsp. <i>glabra</i>	x			
	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	x	x	x	
	<i>Eremophila longifolia</i>	x	x		
	<i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>			x	
	<i>Eremophila petrophila</i> subsp. <i>petrophila</i>	x		x	x
	<i>Eremophila phyllopoda</i> subsp. <i>obliqua</i>		x	x	
	<i>Eremophila phyllopoda</i> subsp. <i>phyllopoda</i>	x			
	<i>Eremophila phyllopoda</i> x <i>cuneifolia</i>			x	
	<i>Eremophila platycalyx</i>	x			
	<i>Eremophila platycalyx</i> subsp. <i>pardalota</i>		x	x	x
	<i>Eremophila reticulata</i>	x	x		x
	<i>Eremophila</i> sp.				x
	<i>Eremophila tietkensis</i>			x	
Solanaceae	* <i>Datura leichhardtii</i>			x	
	<i>Nicotiana benthamiana</i>	x		x	
	<i>Nicotiana occidentalis</i> subsp. <i>obliqua</i>		x		
	<i>Nicotiana occidentalis</i> subsp. <i>occidentalis</i>		x		
	<i>Nicotiana simulans</i>	x			
	<i>Nicotiana umbratica</i> P3			x	
	<i>Solanum ferocissimum</i>		x		
	<i>Solanum horridum</i>	x		x	
	<i>Solanum lasiophyllum</i>	x	x	x	
	<i>Solanum piceum</i>	x			
	<i>Solanum</i> sp.		x	x	
<i>Solanum sturtianum</i>	x	x			
Violaceae	<i>Hybanthus aurantiacus</i>	x	x	x	
Zygophyllaceae	<i>Tribulus hirsutus</i>		x		
	<i>Tribulus suberosus</i>	x	x	x	
	<i>Zygophyllum retivalve</i>	x			

This page has been left blank intentionally.

Appendix F: Flora and Vegetation Sampling Site Locations

This page has been left blank intentionally.