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Roy Hill: Southern Borefield Study Area (L47/642 and L47/735)

Detailed (Level 2) Flora and Vegetation Assessment (2017/2018)




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This document describes the results of a detailed (Level 2) flora and vegetation assessment carried out in October 2017 and April 2018 by Maia Environmental Consultancy (Maia) over Roy Hill's Southern Borefield and Southern Borefield Extension area (the Study Area). It also includes the results of a single phase Level 2 survey carried out over the Southern Borefield in 2009. The Study Area is on Roy Hill and Marillana stations in the Shire of East Pilbara, Western Australia.

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Acronyms and Abbreviations

aff.	Affinity
ALA	Atlas of Living Australia
ARI	Assessment on Referral Information
BVA	Beard vegetation association
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
DAFWA	Department of Agriculture and Food Western Australia (current DPIRD)
DBCA	Department of Biodiversity, Conservation and Attractions (former DPaW)
DEC	Former Department of Environment and Conservation (current DBCA)
DIWA	Directory of Important Wetlands in Australia
DotEE	Department of the Environment and Energy (federal, and former Department of the Environment (DotE))
DPaW	Department of Parks and Wildlife (current DBCA)
DPIRD	Department of Primary Industries and Regional Development (former DAFWA)
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally sensitive area
ESCAVI	Executive Steering Committee for Australian Vegetation Information
GDA94	Geocentric Datum of Australia 1994
GDE	Groundwater dependent ecosystem
GGE	G & G Environmental
GPS	Global Positioning System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
IDE	Inflow dependent ecosystem
km	Kilometres
Maia	Maia Environmental Consultancy Pty Ltd
MGA 50	Map Grid of Australia, zone 50
MS	Ministerial Statement
NVE	Native vegetation extent
NVIS	National Vegetation Information System

P (1-4)	Priority 1 to Priority 4
PEC	Priority ecological community
PER	Public Environmental Review
PIL, PIL2	Pilbara bioregion and Fortescue subregion
SLIP	Shared Landform Information Platform
sp.	Species (single)
SPAC	Species accumulation curve
spp.	Species (multiple)
subsp.	Subspecies
TEC	Threatened ecological community
TP	Threatened and Priority Flora List
TPFL	Threatened and Priority Flora database
var.	Variety
WA	Western Australia
WAHerb/WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WC Act	*Wildlife Conservation Act 1950*
WoNS	Weed of National Significance
x	Crossed with

Summary

Background

- Roy Hill Iron Ore Stage 1 was assessed as a Public Environmental Review (PER) in November 2009 and approved with the issuing of Ministerial Statement (MS) 824 in December 2009. Stage 2 of the Mine, incorporating the southern borefield, was assessed on Assessment on Referral Information (ARI). Stage 2 was granted approval through the publication of MS 829 on 31 March 2010.
- Roy Hill has identified the need to potentially increase the clearing allowance under MS 824 and MS 829. The original baseline flora and vegetation surveys for the project were completed in 2009. The mining tenements were assessed by Ecologia and the southern borefield by G & G Environmental (GGE). Roy Hill engaged Maia Environmental Consultancy Pty Ltd (Maia) to conduct a Level 2 (detailed) flora and vegetation survey over the potential southern borefield extension area and a second phase of survey over the areas originally surveyed by GGE. Both areas combined are called the Study Area in this report.
- The Study Area is in the Shire of East Pilbara administrative region of Western Australia (WA) and on Roy Hill and Marillana stations. It lies mostly within tenements L47/642 and L47/735, however, a section lies outside of and adjacent to the eastern boundary of these tenements. The southern boundary of L47/735 is approximately 37 kilometres (km) north north-east of Newman.
- This report includes information on: the Study Area, the results of database and literature searches and on the Level 2 flora and vegetation survey carried out in October 2017 and April 2018. It also collates the flora and vegetation information from the earlier survey (including the vegetation map) and assesses the local and regional conservation significance of the flora and vegetation of the Study Area.

Surveys, vegetation analysis and species list

- The original survey of the Southern Borefield area was carried out in July/August 2009 by GGE. The first survey of the Southern Borefield Extension area was carried out in October 2017 and the second phase in April 2018. A second phase of survey was also carried out over the Southern Borefield area in April 2018.
- Pattern analysis was carried out on data from 49 quadrats assessed in the Study Area between July/August 2009 and April 2018 (this included full reassessment of 57% of GGE's quadrats and partial assessment of another 34%). Floristic communities were defined by pattern analysis and the vegetation of the Study Area was mapped using the results of the pattern analysis, an aerial photograph captured in March 2018 and information collected while walking traverses in the Study Area.

Results

- Including species (sp.), subspecies (subsp.), varieties (var.), affinities (aff.) and crosses (x), 253 taxa from 34 families and 106 genera have been recorded in the Study Area (GGE and Maia). The 253 taxa comprised 30% annual taxa, 70% perennial taxa. Native taxa comprised 96.4% of the 253 taxa and introduced/weed taxa 3.6% (nine taxa). The most common families were Fabaceae, Poaceae and Malvaceae and the most common genera *Acacia*, *Senna* and *Ptilotus*. Using data from Maia specimens, flowering material was used to identify 9.1% of the combined species list, fruiting material 34.8% and flowering and fruiting material 25.7%; 69.6% of the combined species list was identified from fertile material.
- Thirteen range extension species have been recorded in the Study Area, five of them in 2017/2018.
- No threatened species have been located in the Study Area.
- One priority species (*Goodenia nuda*, Priority 4)) – has been located in the Study Area.
- None of the weeds located in the Study Area is nationally significant or declared in WA.
- None of the species recorded is considered a regional endemic in the Fortescue subregion.

- Maia mapped nine vegetation types on the alluvial plains comprising the Study Area: Triodia Hummock Grassland, Aristida Tussock Grassland, Acacia Low Woodland, five different Acacia Tall Shrublands and a Mixed Tussock Grassland. The Acacia Low Woodland was mapped in mosaics with two of the Acacia Tall Shrublands (A**SL**-3 and A**SL**-5). While A**SL**-3 is mapped on its own in some areas A**SL**-5 is not.
- The largest area mapped was of the mosaic of the Acacia Low Woodland (A**WL**) and Acacia Tall Shrubland A**SL**-5 (48.4%) while the smallest was the Acacia Tall Shrubland A**SL**-2 (0.8%).
- Vegetation condition was mostly Very Good (84.2%) while some areas were Poor or Poor/Degraded (0.2%). Vegetation condition was best in the Triodia Hummock Grasslands and poorest adjacent to bores and in drainage foci.

Significance of the Environment, Flora and Vegetation of the Study Area

- No environmentally sensitive, Red Book or Schedule 1 areas occur in the Study Area and it lies in zone 3b (Marillana plain), the lowest environmental significance of the Fortescue Marsh management zones.
- The one priority flora species, *Goodenia nuda* (Priority 4), located in the Study Area is rated as having Moderate local significance based on the relatively high number of records located in the Study Area compared with FloraBase records in the surrounding area. However, the surrounding area records do not include all of the locations where *G. nuda* has been recorded e.g. they were recorded at many locations on the Roy Hill mining tenements, but those records are not all on FloraBase.
- None of the 13 range extension species is a listed species, and no regional endemics were recorded in the Study Area.
- None of the vegetation types mapped in the Study Area match the descriptions for the three priority ecological communities (PEC) that occur in the surrounding area.
- Some of the habitats of the Study Area are subject to sheet flow and the banded mulga in these areas will depend on this sheet flow.
- Small drainage foci occur in the Study Area and *Eucalyptus victrix* was recorded at two of them. As *E. victrix* can be facultatively phreatophytic any reduction in the water table level from water extraction could affect the health of this species in these areas. Another drainage focus in the north-eastern corner of the Study Area appears to have large trees at its centre and, while this area was not assessed, given the apparent size of the trees in the aerial image they could possibly depend on groundwater to some degree.
- In 2001, one of the ecosystems at risk listed for the Fortescue subregion was the perennial tussock grasslands - two tussock grasslands were mapped in the Study Area.
- The nine vegetation types (including the two mosaics) mapped in the Study Area are all rated as having Moderate local significance. These ratings reflect the area covered by the vegetation type, the presence of *Goodenia nuda* (Priority 4), the number of weeds in the vegetation type, potential groundwater dependent vegetation, sheet flow dependent mulga and tussock grasslands and their reservation in protected areas.

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Roy Hill: Southern Borefield Study Area

Detailed (Level 2) Flora and Vegetation Assessment (2017/2018)

1 Project Scope and Location

1.1 Project Scope of Work

Roy Hill Iron Ore Stage 1 was assessed as a Public Environmental Review (PER) in November 2009 and approved with the issuing of Ministerial Statement (MS) 824 in December 2009 (EPA, 2009). Stage 2 of the Mine, incorporating the southern borefield, was assessed on Assessment on Referral Information (ARI). Stage 2 was granted approval through the publication of MS 829 on 31 March 2010 (EPA, 2010).

Roy Hill has identified the need to potentially increase the clearing allowance under MS 824 and MS 829. Roy Hill is therefore required to submit a Section 38 referral to the Environmental Protection Authority (EPA) Services of the Department of Water and Environmental Regulation (DWER). The original baseline flora and vegetation surveys for the project were completed in 2009. The mining tenements were assessed by Ecologia (2009c) and the southern borefield by G & G Environmental (GGE) (2009).

Roy Hill contracted Maia Environmental Consultancy (Maia) to conduct a Level 2 (detailed) flora and vegetation survey over the potential southern borefield extension area and a second phase of survey over the areas surveyed by GGE. The areas surveyed are referred to as the Study Area in this report and they are shown on **Map 9.1, Section 9**.

1.2 This Report and Surveys

This report presents the results of the surveys carried out by Maia and also incorporates the results of the survey carried out by GGE. Data collected by Maia has been combined with that collected by GGE, analysed, and the vegetation mapped over the whole of the Study Area.

The initial GGE survey was carried out over the southern borefield in July/August 2009, the first phase (supplementary) Maia survey was carried out over the extension areas in October 2017 and the second phase (main) survey was carried out over the extension and southern borefield areas in April 2018.

1.3 Study Area Location and Size

The Study Area is in the Shire of East Pilbara administrative region of Western Australia (WA) and on Roy Hill and Marillana stations. It lies mostly within tenements L47/642 and L47/735, however, a section lies outside of and adjacent to the eastern boundary of these tenements (**Map 9.1, Section 9**). The southern boundary of L47/735 is approximately 37 kilometres (km) north north-east of Newman.

Tenement areas (hectares, ha) and the areas surveyed are listed in **Table 1.1**.

Table 1.1: Extent of tenements and Study Area

Tenement area (ha)			Study Area (ha)			
L47/642	L47/735	Total	L47/642	L47/735	Outside tenements	Total
63,809.7	12,093.0	75,902.7	35,289.4	12,092.8	884.8	48,267.1

2 BACKGROUND INFORMATION

2.1 DATABASE AND LITERATURE SEARCHES – METHODS AND RESULTS

Information on the bioregion, geology, Beard's pre-European vegetation, land systems, soils and surface geology of the Study Area is included in **Table 2.1**. The extent (previous and current) of Beard's pre-European vegetation, along with any Pilbara ecosystems at risks are included in **Table 2.2** and the extent of land systems of the Study Area and bioregional representation in **Table 2.3**. The results of various database searches are included in **Table 2.4** (land type, significant areas, groundwater dependent ecosystems (GDE)) and wetlands, conservation significant ecological communities and flora species and weeds), while summary information from flora and vegetation surveys previously carried out in the Study Area and surrounds is included in **Table 2.5**. The data sources used to gather this information are referenced in each table along with any maps included in **Section 9**.

Information on the conservation significant ecological communities and flora species of the Study Area and surrounds was sourced from reports on surveys carried out in the area previously and from the following databases:

- EPBC Act Protected Matters Search Tool (Department of the Environment and Energy (DotEE), 2018a);
- NatureMap (Department of Parks and Wildlife (DPaW), 2007 -);
- Threatened and Priority Flora database (TPFL) (Department of Biodiversity, Conservation and Attactions (DBCA), 2018, 25-0318FL);
- Threatened and Priority Flora List (TP) (DBCA, 2018, 25-0318FL);
- Western Australian Herbarium (WAHerb) (DBCA, 2018, 25-0318FL); and,
- Threatened Ecological Communities database (DBCA, 2018, 04-0418EC).

The areas over which these database searches were carried out are shown on **Map 9.5 (Section 9**). The EPBC Act Protected Matters Search Tool search results are included as **Figure A1.1, Appendix 1** and the NatureMap search results in **Figures A1.2 to A1.4** (one for a central point buffered by 40 km and one for each tenement). A table listing the conservation significant flora species produced from all database and literature search results is included as **Table A1.1** (**Appendix 1**), and **Table A1.2** (**Appendix 1**) lists the weed species. Locations for any priority flora species listed in the NatureMap searches but not listed in the results of the DBCA database searches were sourced from FloraBase (WAH, 1998 -). A likelihood of occurrence assessment was carried out for the conservation significant flora species listed in the WAH database search results and the NatureMap 40 km search area results and they are listed in **Table A1.3** (**Appendix 1**).

The vegetation associations mapped previously in the Southern Borefield area are listed in **Table 2.6** and shown on **Map 9.4, Section 9**.

Conservation significance categories for threatened and priority flora species and ecological communities noted in the database search and survey results are included in **Appendix 5,** and control categories for declared weed species in **Appendix 6**.

Table 2.1: Background information on the Study Area

Subject	Attribute	Unit and/or Description	Reference	Map (Section 9)
IBRA	**IBRA region (IBRA code)**	Pilbara (PIL)	Australian Government (2018)	**9.2**
	IBRA subregions (IBRA code)	Fortescue (PIL02)		
	IBRA region and subregion current vegetation extent (ha)	Pilbara = 17,733,583.9 ha; Fortescue = 1,951,000.9	Government of WA (GoWA) (2018)	
DPaW region		Pilbara	Australian Government (2018)	Not mapped
Shires / Towns		Shire of East Pilbara	Department of Mines, Industry Regulation and Safety (DMIRS) (2018)	Not mapped
Pre-European vegetation (Beard vegetation associations)		29: Sparse Low Woodland; mulga, discontinuous in scattered groups 111: Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex See **Table 2.2** for extent of Beard vegetation associations (BVA) in Pilbara and Study Area.	Australian Government (2018); Beard (1975)	**9.2**
Land systems		Divide: Gently undulating sandplains with minor dunes, supporting hard spinifex hummock grasslands with numerous shrubs. Fan: Washplains and gilgai plains supporting groved mulga tall shrublands and minor tussock grasslands. See **Table 2.3** for extent of land systems in Pilbara and Study Area.	Australian Government (2018)	**9.2**
Soils		The Survey Area lies in the Fortescue Soil-Landscape Province. This Province is characterised by hills and ranges with some stony plains, alluvial plains and sandplains on the volcanic, granitic and sedimentary rocks of the Pilbara Craton. Stony soils with red loamy earths and red shallow loams are present in the Fortescue Province. The Fortescue Soil-Landscape Province is further divided into 10 zones and the Survey Area occurs in the Fortescue Valley Zone. The Fortescue Valley Zone is described as: alluvial plains, hardpan wash plains and sandplains on alluvial deposits over Hamersley Basin sedimentary rocks with Red deep sands, Red loamy earths and Red/brown non-cracking clays.	Tille (2006) DPIRD (2018a)	Not mapped

Subject	Attribute	Unit and/or Description	Reference	Map (Section 9)
Geology	**WA surface geology** **1:1,000,000**	The surface geology of the Study Area is mapped as two units: Czs – sand or gravel plains; may include some residual alluvium; quartz sand sheets commonly with ferruginous pisoliths or pebbles; local clay, calcrete, laterite, silcrete, silt, colluvium. Qrc - Colluvium, and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; include minor alluvial or sand plain deposits, local calcrete and reworked laterite.	Australian Government (2018); Stewart *et al*., (2008)	**9.2**

Table 2.2: Pilbara extent and reservation prioritisation of Beard vegetation associations of the Study Area

Beard vegetation association number (DPIRD, 2018a)	Pre-European extent (ha) by Pilbara IBRA bioregion	Current extent (ha) by Pilbara IBRA bioregion	Remaining (%)	Current extent protected (IUCN 1-4) for conservation (proportion of pre-European extent) in the Pilbara bioregion (%)	Current extent in all DPaW-Managed Land (proportion of Current Extent) in the Pilbara bioregion (%)	Prioritisation for reservation of ecosystem in the Fortescue subregion (Kendrick, 2001)
29	1,133,219.76	1,132,939.20	99.98	1.91	9.38	Low
111	550,286.99	550,232.45	99.99	1.29	6.96	Low

Note: Areas and percent in columns 2, 3, 4 and 5 from GoWA, 2018.

Table 2.3: Pilbara extent of land systems of the Study Area

Land system	Pilbara bioregion original extent (ha)	Pilbara bioregion current extent (ha)	Remaining (%)	Current extent in all DPaW-Managed Land in the Pilbara bioregion (ha)
Divide	437,577.28	437,553.15	99.99	115.53
Fan	148,205.27	148,122.51	99.94	0

Note: Areas in column 2 derived by intersecting land systems (DAFWA, 2014) and IBRA bioregion (DotE, 2012) shape files. Areas in column 3 derived by intersecting land systems (DAFWA, 2014) with IBRA bioregion (DotE, 2012) and native vegetation extent (NVE; DPIRD, 2018a) shape files. Areas in column 5 derived by intersecting land systems (DAFWA, 2014) with IBRA bioregion (DotE, 2012) and native vegetation extent (NVE; DPIRD, 2018b) and DPaW Managed Lands (DBCA, 2017a).

Table 2.4: Database search results

	Attribute	Significance				Overall comment	Source or reference (year)	Map or figure / table number
		International	National	State	Other			
Property / land	**World heritage property**	No				None in search results.	DotEE (2018a)	Not mapped
	Register of National Estate		No			None in search results.	DotEE (2018a)	**9.3**
	DBCA Legislated Lands and Waters			No		None in Study Area.	DBCA (2018a)	**9.3**
	DBCA Lands of Interest			No		Closest is UCL, former leasehold, 2015 excision – proposed for conservation – ex Roy Hill Station, which is approximately 11 km north-west at its closest.	DBCA (2018b)	**9.3**
Significant areas	**EPA Redbook Recommended Conservation Reserves**			No		The closest is Hamersley Range National Park approximately 110 km to the north-west of the Study Area.	DBCA (2018c)	**9.3**
	Environmentally Sensitive Area (ESA)			No		The closest is the Fortescue Marshes approximately 16 km to the north and the Ethel Gorge stygobiont community is 23 km to the south (at their closest points).	DWER (2018a)	**9.3**
	Schedule 1 Area			No		The closest are the Fortescue Marshes approximately 16 km to the north, Panderumba Pool approximately 14 km to the north north-east and an area around Roy Hill homestead approximately 22 km to the east.	DWER (2018b)	**9.3**
	Fortescue Marsh Management Area				Yes	The Study Area lies in zone 3b (Marillana plain), lowest environmental significance of the Fortescue Marsh management zones.	EPA (2013)	**9.3**
Groundwater dependent ecosystems	**Groundwater dependent ecosystem (GDE) - Terrestrial**				Potl.	Some areas with low potential (potl.) GDE (national assessment) – in areas where the Divide land system is mapped.	BoM (2018a)	**Figure A1.5**

	Attribute	Significance				Overall comment	Source or reference (year)	Map or figure / table number
		International	National	State	Other			
	Inflow dependent ecosystems (IDE) - Terrestrial				Likely	Some small patches of vegetation are classified as likely to be an IDE - in areas where the Divide land system is mapped.	BoM (2018a)	**Figure A1.6**
Wetlands	**Ramsar sites**	No				The Fortescue Marshes are approximately 16 km north-west of the Study Area at their closest and are indicated on NatureMap as a DRAFT Proposed Ramsar Addition.	DPaW (2007-)	Not mapped
	Directory of Important Wetlands in Australia (National) (DIWA)		No			The closest is Fortescue Marshes approximately 16 km north-west of the Study Area at its closest.	Australian Government (2018)	**9.3**
	Waterbodies including watercourses, rivers and springs etc				No	There are no rivers in the Study Area but there are some broad drainage tracts and drainage foci.	DPaW (2007-) DAFWA (2014)	Not mapped
Ecological communities within database search area	**Threatened ecological communities (TEC) - EPBC Act**		No			None in search area (**Appendix 1**)	DotEE (2018a)	**Figure A1.1**
	Threatened ecological communities (TEC)– WC Act			No		Two in the Pilbara bioregion: • Themeda grasslands (Themeda grasslands on cracking clays (Hamersley Station, Pilbara)) and Ethel Gorge (Ethel Gorge stygobiont community). Neither occurs in the Study Area.	DPaW, 2016 DBCA (2018h)	**9.7**

	Attribute	Significance				Overall comment	Source or reference (year)	Map or figure / table number
		International	National	State	Other			
	Priority ecological communities (PEC)			No		Forty-two in the Pilbara region: • Three PECs are mapped in the vicinity of the Study Area but not within it: 1) Priority 3 'Vegetation of sand dunes of the Hamersley Range/Fortescue Valley' (approximately 2 km west of the Study Area at its closest point); 2) Priority 1 'Fortescue Marsh (Marsh Land System)' PEC (approximately 14 km north north-west at its closest); and, 3) Priority 3 'Narbung Land System' PEC (approximately 25 km north-west at its closest).	DBCA (2017a) DBCA (2018h)	**9.7**
Conservation significant flora within database search area	**Threatened flora (EPBC Act)**		No			No flora species (or potential habitat) protected by the EPBC Act were listed in the search results.	DotEE (2018a) DPaW (2007-) DBCA (2018g)	**Figures A1.1 to A1.4 and Table A1.1, Appendix 1**
	Threatened flora (WC Act)			No		No threatened flora species were listed in the NatureMap search results for the wider area or for the two tenements. No threatened flora species were listed in the DBCA database search results.	DPaW (2007-) DBCA (2018g)	**Figures A1.2 to A1.4 and Table A1.1, Appendix 1** **9.6**

	Attribute	Significance				Overall comment	Source or reference (year)	Map or figure / table number
		International	National	State	Other			
	Priority flora			Yes		Twenty-five flora species were listed in the results of the NatureMap search over 40 km from the centre of the Study Area: eight Priority (P) 1, two P2, 12 P3 and three P4. Four of these species have been recorded in L47/642 (*Stemodia* sp. Battle Hill (A. L. Payne 1006 (P1), *Eucalyptus rowleyi* and *Rhagodia* sp. Hamersley (both P3), *Eremophila youngii* subsp. *lepidota* (P4)) and none of them in L47/735. Two priority flora species were listed in the DBCA database search results as occurring in the Study Area – *Eucalyptus rowleyi* and *Rhagodia* sp. Hamersley (both P3). The species list collated from all of the search results is included as **Table A1.1** and a likelihood of occurrence in **Table A1.3, Appendix 1**.	DPaW (2007-) DBCA (2018g)	**Figures A1.2 to A1.4 and Table A1.1 and A1.3, Appendix 1** **9.6**
	Regional endemics				No	Two taxa were listed in the wider area (40 km) NatureMap search results as regional endemics - *Acacia bivenosa* weeping variant and *Iotasperma* sp..	DPaW (2007-)	**Figure A1.2, Appendix 1**
Weeds	**National weed lists**		No			None listed in the NatureMap search results.	DPaW (2007-)	**Figures A1.2 to A1.4 and Table A1.2, Appendix 1**
	Declared pest			No		None listed in the wider area or tenements L47/642 and L47/735 NatureMap search results.	DPaW (2007-)	**Figures A1.2 to A1.4 and Table A1.2, Appendix 1**
	Other weed species				Yes	Fifteen weed/naturalised species were listed in the NatureMap search results. Two of the 15 have records in tenement L47/642 (*Cenchrus ciliaris* (Buffel Grass) and *Portulaca pilosa* (Djanggarra)) and none of them in L47/735.	(DPaW, 2007-)	**Figures A1.2 to A1.4 and Table A1.2, Appendix 1**

Table 2.5: Surveys carried out previously in or in the vicinity of the Study Area

Reference	Report title	Tenement/s	Survey type	Survey timing (season)	Number of taxa / native taxa / weed species	Currently listed CSF – Number of locations Species (rank)	Currently listed weed species DP number (species) EW number and (species)
Ecologia Environment, 2009a	Ethel Creek Tenements E46/687, E47/1609 and E47/1610 Rare and Priority flora Survey, March 2009	46/687, E47/1609 and E47/1610	Targeted flora	March 2009	Targeted flora survey and no species list collated for survey area	*1* *2* *Goodenia nuda* (P4)	None
Ecologia Environment, 2009b	Roy Hill Borefield: Desktop Vegetation and Flora Survey, August 2009	12 including L47/642	Desktop	No survey	No survey	No survey	No survey
G & G Environmental, 2009	Flora and Vegetation Survey of a borefield for the Roy Hill 1 Iron Ore Project.	L47/642	Level 2 – single phase	July/August, 2009	131 / 125 / 6	*1* *22* *Goodenia nuda* (P4)	6 0 6 (*Cenchrus ciliaris*, *Chloris virgata, Citrullus lanatus, Malvastrum americanum*, *Sonchus oleraceus, Vachellia farnesiana*)

Reference	Report title	Tenement/s	Survey type	Survey timing (season)	Number of taxa / native taxa / weed species	Currently listed CSF – Number of locations Species (rank)	Currently listed weed species DP number (species) EW number and (species)
Ecologia Environment, 2009c	Roy Hill 1 Vegetation and Flora Assessment	E46/334, 335, 586, 592 and E47/1326	Level 2 – three phases	Oct/Nov 2005, May/Jun 2006 and Mar 2008	477 / 458 / 19	4 49 *Rhagodia* sp. Hamersley (P3); *Rostellularia adscendens* var. *latifolia* (P3); *Eremophila youngii* subsp. *lepidota (P4*; *Goodenia nuda* (P4)	19 1 (*Parkinsonia aculeata* Weed of National Significance (WoNS) and Declared Plant) 18 (*Heliotropium europaeum, Argemone ochroleuca* Sweet subsp. *ochroleuca, Trianthema portulacastrum, Aerva javanica, Bidens bipinnata, Sonchus oleraceus, Citrullus colocynthis, C. lanatus, Cucumis melo, Malvastrum americanum, Vachellia farnesiana, Cenchrus ciliaris, Chloris virgata, Echinochloa colona, Eragrostis cilianensis, Setaria verticillata, Portulaca pilosa, Cymbalaria muralis*)

Reference	Report title	Tenement/s	Survey type	Survey timing (season)	Number of taxa / native taxa / weed species	Currently listed CSF – Number of locations Species (rank)	Currently listed weed species DP number (species) EW number and (species)
Ecoscape, 2012	Newman-Roy Hill Transmission Line Survey, Alinta Energy. October 2012	No tenements, 123 km long and 200 m wide corridor along the Newman-Marble Bar Road from Newman.	Level 2 – single phase flora survey	August, 2012	264 / 8 / 256	5 9 populations *Eremophila pilosa* (P1) *Eremophila youngii* subsp. *lepidota* (P4) *Goodenia ?nuda* (P4) *Rhagodia* sp. Hamersley (M. Trudgen 17794) (P3) *Themeda* sp. Hamersley Station (M. Trudgen 11431) (P3)	7 0 7 (*Aerva javanica, Bidens bipinnata, Cenchrus ciliaris, Heliotropium europaeum, Malvastrum americanum, Tribulus ?terrestris, Vachellia farnesiana*)

Table 2.6: Vegetation mapped in the Southern Borefield (G & G Environmental, 2009)

Code	Vegetation association description
Woodland associations	
W1	A low *Acacia aneura* woodland over scattered shrubs to an open shrubland with *Acacia victoriae*, *A. tetragonophylla* and *Ptilotus obovatus* common over scattered low shrubs to low chenopod shrubland with *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena cornishiana* common over scattered tussocks to very open tussock grassland with *Aristida latifolia* and *A. contorta* common and very open to open herbs frequently *Goodenia prostrata*.
W2	A low open woodland to woodland of *Acacia aneura* and/or *A. pruinocarpa* with occasional *Corymbia hamersleyana* low trees over scattered high shrubs to high shrubland with *A. ancistrocarpa*, *A. pachyacra*, *Rhagodia eremaea* and *Eremophila forrestii* common over scattered low shrubs with *Bonamia rosea* common in a *Triodia basedowii* grassland with scattered herbs.
W3	A low open *Acacia aneura* forest over an open shrubland with *Acacia tetragonophylla* and *Eremophila forrestii* common over open herbs, frequently *Sida platycalyx* and *Goodenia prostrata* and scattered grasses to open grassland of *Eragrostis* species, *Aristida latifolia* and *Eulalia aurea*.
W4	A low woodland to open forest of *Acacia citrinoviridis* occasionally with *A. aneura* over a low mixed shrubland of *Senna* and chenopod species over scattered grasses and herbs.
W5	A low *Acacia aneura* and *A. pruinocarpa* woodland over a high open to high shrubland of *Acacia* and *Eremophila* species over a low *Ptilotus obovatus* and *Senna* species shrubland in a mixed grassland with *Aristida latifolia* and *Eragrostis* species common with very open to open herbs, frequently *Sida platycalyx* and *Goodenia prostrata*.
W6	A low open woodland to woodland of *Acacia pruinocarpa* with scattered *Corymbia hamersleyana* and *Hakea lorea* trees over a high open shrubland with *Acacia ancistrocarpa* and *Anthobolus leptomerioides* common over scattered low *Bonamia rosea* shrubs in *Triodia schinzii* hummock grassland with scattered *Eragrostis eriopoda* tussocks and scattered herbs.
W7	Low open *Corymbia aspera* woodland with *Corymbia hamersleyana* over an *Acacia aneura* and *Acacia ancistrocarpa* shrubland in a *Chrysopogon fallax* and *Eulalia aurea* grassland with very open herbs.
Shrubland associations	
S1	Scattered *Acacia aneura* and *A. paraneura* trees over scattered shrubs to open shrubland with *Acacia tetragonophylla* common over scattered low shrubs, herbs and grasses with *Sclerolaena cornishiana*, *Aristida contorta* and *A. latifolia* common.
S2	Scattered low *Acacia aneura* and *A. pruinocarpa* trees over scattered high shrubs to open shrubland with *Acacia ancistrocarpa* and *A. tetragonophylla* common over a low open *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* shrubland in an *Aristida contorta*, *A. latifolia* and *Eragrostis* species tussock grassland and very open to open herbs.
S3	Scattered *Acacia aneura* trees over an open *Acacia victoriae* scrub over scattered low shrubs in an *Eragrostis setifolia* open tussock grassland with scattered herbs.
Grassland association	
G1	An *Aristida latifolia*, *Eragrostis eriopoda* and *E. setifolia* grassland with patches of a low open shrubland to low shrubland of *Senna artemisioides* subsp, *helmsii* and *S. artemisioides* subsp. *oligophylla* and scattered to very open herbs with *Goodenia prostrata* and Asteraceae species common.

Note: *Acacia aneur*a var. *aneura* in original descriptions changed to *Acacia aneura* in this table.

2.2 RAINFALL

The closest weather station to the Study Area is Newman Aero located approximately 37 km south of the southern boundary of L47/735.

The mean annual maximum temperature at Newman Aero is 32.0˚C while the mean annual minimum temperature is 16.4˚C. The mean maximum daytime temperature is highest in December, 39.1˚C, and the mean maximum winter temperature is highest in January at 25.0˚C (BoM, 2018b).

Monthly rainfall records for Newman Aero for 2009, 2017 and up to April 2018 are included in **Table 2.7**, along with long-term (1971 to March 2018) and 10-year average monthly rainfall and total annual mean rainfall (BoM, 2018b).

Long-term records show that most rain is received in the summer and early autumn months. It starts to decrease from April, is relatively stable between May and July and is at its lowest between August and October before increasing in November (**Table 2.7**).

The differences between received and long-term monthly rainfall totals for the six months preceding the 2009, 2017 and 2018 surveys are included in **Table 2.7**. In 2009 rainfall received over the six months before the late July early August survey was higher than the long-term mean for those six months but lower than the 10 year mean. In 2017 rainfall received over the six months before the late October survey was higher than both the long-term and 10 year means for those six months. In 2018 rainfall received over the six months before the April survey was lower than the long-term and 10 year means.

Table 2.7: Rainfall data – Newman Aero (BoM, 2018b)

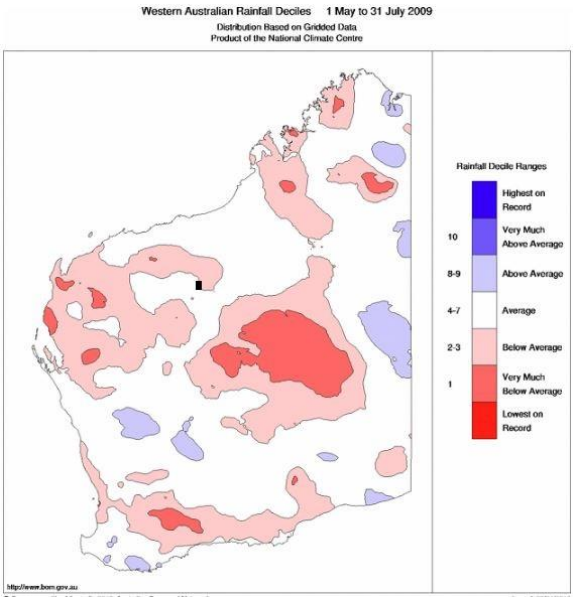
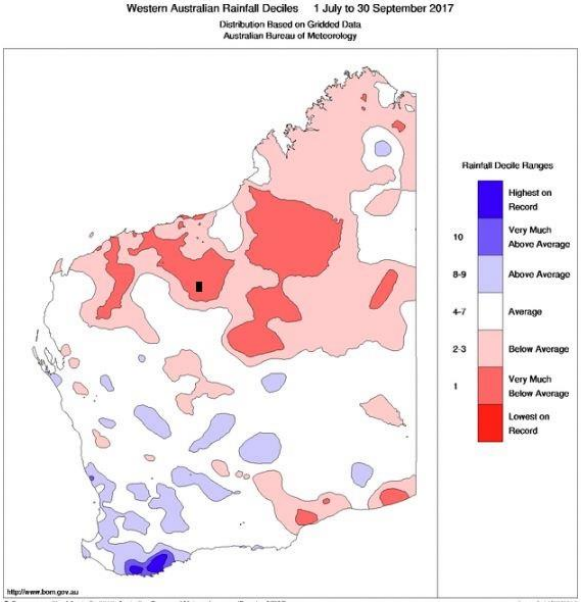
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Newman Aero (site number 007176, records from 1971–March 2018)													
2009	39.0	42.2	122.8	8.2	0	39.2	1.8	0	0.4	0.4	65.2	1.8	321.0
2017	150.4	56.2	152.4	106.8	10.6	0.0	0.0	0.6	0.6	30.8	8.6	2.0	519.0
2018	84.2	37.2	11.2										132.6
L-t	67.9	71.0	44.0	22.2	19.5	15.3	15.4	6.7	3.9	5.9	12.9	36.2	332.6
10 year mean	90.2	48.9	59.3	31.9	19.1	22.0	13.5	2.6	4.8	8.5	27.2	29.1	357.0
Total rainfall for six months before each survey month and equivalent long-term and 10 year means													
							Total for 6 months before survey		Equivalent long-term total		Equivalent 10 year total		
2009	39.0	42.2	122.8	8.2	0	39.2	251.4		239.9		271.4		
2017	106.8	10.6	0.0	0.0	0.6	0.6	118.6		83.0		70.5		
2017/2018	30.8	8.6	2.0	84.2	37.2	11.2	174.0		237.9		263.2		

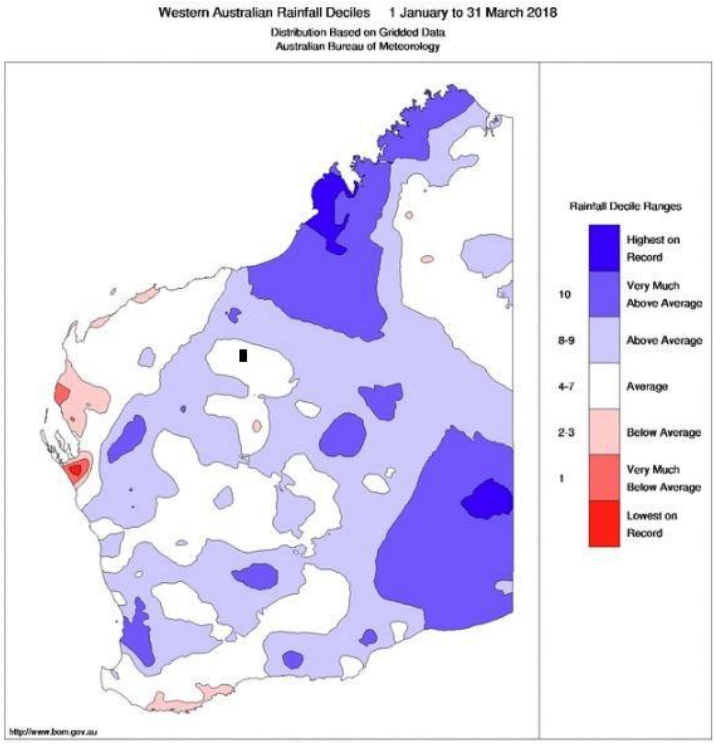
Note: monthly data is total monthly rainfall (mm). Tot = total annual rainfall for 2017 and total to end of April for 2018. L-t = long-term mean monthly and total annual rainfall (mm). 10 year mean = records from 2008 to 2017.

Rainfall deciles (BoM, 2018b) for the three months preceding the 2009, 2017 and 2018 surveys are shown in **Table 2.8** (the approximate location of the Study Area is indicated by the black rectangle on each map). Over the three months before the 2009 survey rainfall in the Study Area was average to below average for that time period and location. Over the three months before the 2017 survey Study Area rainfall was very much below average and rainfall over the three months before the 2018 survey was average for that time period and location.

Based on this data the vegetation would have been in average to below average condition when the surveys were carried out.

Table 2.8: Rainfall deciles for the three months before each survey (BoM, 2018b)

May to July 2009	July to September 2017
	

January to March 2018


3 Survey and Reporting Methods

3.1 Survey Methodology, Survey Effort, Team and Limitations

3.1.1 Survey Methodology

The survey methodology for the 2017 and 2018 surveys was designed with reference to the following documents:

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

Before undertaking the surveys the botanists familiarised themselves with the conservation significant species produced by the database and literature searches and found in the area previously.

Table 3.1 lists the three surveys that have been carried out on the two tenements since July 2009.

Table 3.1: Surveys carried out in July/August 2009, October 2017 and April 2018

Survey dates	Number of days	Number of botanists	Total survey days	Area surveyed
July 29 to August 5, 2009	8	2	16	Southern Borefield
October 19 to 23, 2017	5	2	10	Southern Borefield Extension
April 6 to 15, 2018	10	3	30	Southern Borefield and Southern Borefield Extension
Total survey days expended in Study Area			56	

A single phase Level 2 flora and vegetation assessment was carried out in the Southern Borefield area in July/August 2009. Forty-three, 50 m by 50 m quadrats/vegetation sampling points were assessed and 35 of the 43 were used in the statistical analyses carried out at that time. A targeted flora survey was also carried out at 19, 100 m by 100 m, notional bore locations, and transect searches for priority flora and significant vegetation communities were also conducted in each of the different vegetation associations noted in the field (GGE, 2009).

The supplementary survey phase of a detailed Level 2 survey in the Southern Borefield Extension area was carried out in October 2017 (Maia) and the primary phase in April 2018. The number of quadrats assessed by Maia in the Southern Borefield Extension area was informed by: the number of Beard vegetation associations (two), land systems (two), geological and soil units mapped in the Study Area and by GGE's sampling intensity in the Southern Borefield area (which was assessed under MS 829). Fifteen quadrats were assessed in the Southern Borefield Extension area in October 2017 and selected sites assessed in the Southern Borefield by GGE in 2009 were visited to check the identity of some of the dominant species at the sites used in the analysis, to search for the *Ptilotus* sp. collected in 2009 and to revisit some of the *Goodenia nuda* locations.

In April 2018 the 15 quadrats in the Southern Borefield Extension area were reassessed and two additional quadrats assessed. Selected quadrats were assessed in Southern Borefield area in 2018 and more transects were walked in the area. Twenty (57%) of the 35 quadrats used in GGE's Southern Borefield ordination analysis (site by species matrix supplied by Roy Hill) were completely reassessed in April 2018; another 12 of the 35 quadrats (34%) were revisited (but not fully reassessed) to check the dominant species and any queried species in the species list. Three of the 35 quadrats used in the 2009 ordination analysis (9%) were in an area now excised from the Study Area and they were not reassessed or revisited. One relevé was also assessed in the Southern Borefield area in

April 2018. The Southern Borefield quadrats were reassessed or revisited: a) because of the time since the area was last surveyed; b) so that vegetation condition could be assessed at each site; and, c) so that the data collected at GGE sites could be used in the pattern analysis with the data from the quadrats in the Southern Borefield Extension area and the vegetation mapped over the whole of the Study Area using the results of that combined analysis.

The quadrats assessed in the Southern Borefield Extension area in 2017 and 2018 were selected using aerial imagery and project area boundaries. Quadrats were placed to capture the habitats visible on the aerial imagery. Quadrats were also positioned in the land systems mapped in that area. The final placement of each quadrat was selected by the botanists while at site. The following information was recorded at each quadrat:

- Site code.
- Location details including GPS co-ordinates for the four corners and datum.
- Size and shape of assessment area.
- Photographs (including from the north-west corner).
- Site parameters such as soil description, landform, topography and general habitat description, rock type and cover.
- A description of the vegetation structure including the height, percentage cover and dominant species within each stratum.
- Notes on any other factors useful to the vegetation classification e.g. aspect, litter, grazing, fire.
- Vegetation condition using the scale and criteria in EPA, 2016b (**Table 3.5**) and notes on any disturbance relevant to vegetation condition e.g. weed cover.
- The name, height, percentage cover and any other significant recording details for each species located at the quadrat / assessment site (including any conservation significant flora and weed species).

If quadrats were located in linear habitats (e.g. along creek beds or banks) where a 50 m x 50 m quadrat could not be assessed the area surveyed was amended to fit into that habitat, however, the same area (2,500 m^2) was assessed. Quadrats established in the Southern Borefield Extension area were marked with a fence dropper in the north-west corner, as were quadrats reassessed in the Southern Borefield. The Southern Borefield quadrats that were revisited to record the dominant species were not marked with a fence dropper.

As the location where the coordinate was recorded at GGE quadrats was not known i.e. at which corner of the quadrat it was recorded. The GGE quadrats were resampled by going to the relevant coordinate, comparing the species in that area with the relevant species list in the 2009 site sheets, and placing the quadrat in the location that best matched the species list. In 2018 some annual and weakly perennial species on the site species lists could not be found within 50 m of the supplied coordinate and therefore the dominant perennial species were used to position the quadrat.

The vegetation at one of the GGE quadrat coordinates supplied to Maia, HB15+, was in an area described by GGE as a Tussock Grassland (G1) on crabhole plains. However, when that location was visited in April 2018 it was in an *Acacia* shrubland on hardpan plains and the species within 100 m of the supplied coordinate were very different to those originally described for that area. As the original location was not known the quadrat was sampled at the coordinates in the different vegetation unite. It is also possible that coordinates for other resampled quadrats may have been incorrect or slightly off due to differences in GPS and aerial imagery quality between 2009 and 2018; however, they were sampled in the vegetation units described by GGE.

Traverses were walked in the Study Area and their alignment was chosen from aerial imagery before going to the Study Area. When walking traverses each botanist assessed a band of vegetation approximately 30 m wide. Conservation significant species known to occur in the area and surrounds, any novel species and introduced species were targeted while walking traverses. The botanists also recorded information when any apparently

different vegetation types were encountered. These areas were treated as photo points or points of interest - coordinates were recorded and photographs taken at photo points, while the following information was collected at points of interest:

- Notes on the vegetation type of the area including any changes in habitat. (Used to help define vegetation type boundaries when mapping the vegetation.)
- Changes in vegetation condition and notes on any disturbance to the vegetation.
- Notes on landform and soil type.
- Any taxa not previously collected.
- Locations of any known or suspected conservation significant species or weeds.

When known or suspected conservation significant flora or weed species were encountered they were counted (or estimated when populations were large) and their locations recorded on a GPS.

At least one specimen of each species recorded by Maia in the Study Area was collected.

Coordinates for the quadrats and relevé assessed in the Study Area are listed in **Table A2.1** (**Appendix 2**). Transects walked and quadrats assessed by Maia are shown on **Map 9.8** (**Section 9**).

3.1.2 Survey Effort

The number of quadrats assessed by GGE and Maia and the length of traverses walked by Maia in the Study Area are listed in **Table 3.2** along with an estimate of the survey coverage achieved.

The combined coverage achieved in the Study Area is approximately 1.2%. This amount does not include any area for the traverses walked by GGE in the Southern Borefield area; neither does it include any area for reassessed quadrats.

Table 3.2: Quadrats assessed in July/August 2009 and quadrats assessed and traverses walked in October 2017 and April 2018

		Number of quadrats and length of traverses	
Survey time	**Assessment type**	**Southern Borefield**	**Southern Borefield Extension**
July / August 2009 (GGE)	Quadrats (50 m x 50 m)	43	Not surveyed
	Traverses (km)	Not known	
	Notional bore locations (100 m x 100 m)	19	
October 2017	Quadrats (50 m x 50 m)	0	15
	Traverses (km)	1.2	18.4
April 2018	Quadrats (50 m x 50 m)	Reassessed – 20 Relevé - 1	17
		Revisited for dominants - 12	
	Traverses (km)	92.9	61.2
Total area surveyed (ha) (excluding repeat assessments)		**555.4**	
Study Area (ha)		**48,267.1**	
Coverage achieved (%)		**1.2**	

3.1.3 Project Team

Maia's 2017/2018 flora and vegetation assessment was carried out by the team members listed in **Table 3.3**.

Table 3.3: Project team

Project Team			
Name	**Qualification**	**Project role**	**Flora license #**
Christina Cox	PhD	Botanist –report	Not applicable
Scott Hitchcock	BSc	Botanist – field survey (October 2017 and April 2018) and report	SL012086 (April 30 2018)
Michael Pezzaniti	MSc	Trainee botanist – field survey (April 2018) and report	SL012332 (exp. Mar 31, 2019)
Raimond Orifici	BSc Hons	Botanist – field survey (April 2018) and plant identifications	SL012332 (exp. Mar 31, 2019)
Conrad Slee	BSc Hons	Botanist – field survey and plant identifications (October 2017)	SW019130 (exp. Oct 19 2018)
Catherine Tauss	BSc Hons	Plant identifications 2018	Not applicable

3.2 Taxonomy and Nomenclature

At least one specimen of every taxon encountered during the October 2017 and April 2018 surveys was collected for taxonomic verification in Perth. In addition, 20 Southern Borefield quadrats were resurveyed in April 2018 and 12 were visited to collect and confirm the identity of the dominant species. In many cases multiples of flowering or fruiting specimens were collected to assist with identification.

The specimens collected were identified by Conrad Slee, Catherine Tauss and Raimond Orifici using relevant taxonomic keys and/or reference specimens at the WA Herbarium; specialists at the WA Herbarium were consulted as necessary. Specimens of selected *Triodia* species (particularly those identified as *T. lanigera* or *T. basedowii*) and potential conservation significant flora specimens were sent to the WA Herbarium for confirmation (excluding *Goodenia nuda* specimens, which were identified from reproductive material).

Species names used in this report are those adopted by the WA Herbarium and they were checked against FloraBase records in May/June 2018 (WAH, 1998-). Undescribed taxa, subspecies, varieties and affinities are referred to in the report and listed in the species list as sp./spp., subsp., var. and aff. respectively, while crosses are indicated by an x.

3.3 Statistical Analysis

Version 3.12 of the multivariate statistical analysis package PATN (Belbin, 1989; Belbin, 2004) was used to analyse the site data collected.

Maia carried out pattern analysis on the data collected from 49 quadrats in the Study Area. GGE used 35 of the 43 quadrats assessed in the ordination test carried out to define the vegetation associations in 2009. Maia used data from 32 of these 35 quadrats (the 19 quadrats completely reassessed in April 2018, plus one sampled in a different location, and the 12 quadrats visited to check the dominant species and any queried species) and from the 17 quadrats established and assessed in the Southern Borefield Extension area.

Pattern analysis was carried out using presence, absence and cover data for native perennial taxa recorded at each site. Pearson complete linkage analysis with the Bray Curtis association measure was used to group sites

with similar species composition and to define the vegetation types of the Study Area. Annual, singleton and weed species were removed from the data before running the analyses. These are not usually representative of a vegetation association as they are influenced by factors such as disturbance and rainfall.

Names were updated as required and some species were combined before analyses based on their similarity, the number of subspecies, or due to current taxonomic uncertainty. Taxa that were combined are listed in **Table 3.4** along with the rationale for combining them.

Table 3.4: Taxa combinations pre pattern analysis

Taxa combined	Combined name	Rationale
Senna ferraria and *Senna glaucifolia*	*Senna ferraria* / *glaucifolia*	Both species are superficially similar and if the specimen was grazed or in a less than perfect state then differences in identification could have resulted.
Streptoglossa macrocephala and *Streptoglossa odora*	*Streptoglossa macrocephala* / *odora*	Maia recorded both species in 2018 but GGE recorded *S. odora* only in 2009. Both species were recorded from GGE quadrats resampled in 2018, and to avoid confusion the two species were combined for the analysis.

An indicator species analysis was run on the data collected at quadrats. PC-Ord (McCune & Mefford, 2010) was used selecting the Dufrêne and Legendre (1997) analysis option to determine indicator species for each vegetation community. A Monte Carlo Permutation Test was used to determine the significance of the indicator species resulting from this test and the test results are included as **Table A3.2, Appendix 3**.

Species accumulation curves (SPAC) are used to measure the estimated sampling adequacy of an area. In essence, as sampling intensity increases the incidence of new taxa recorded will decrease and eventually all species in a survey area will be recorded. This is represented by the total records (vertical axis) becoming asymptotic (levelling out) and remaining level as new sample sites are added. A SPAC was generated for the data collected from the Study Area using the software package EstimateS and the methodology outlined in Colwell (2013); the analysis was run using the information collected at quadrats only. The results of the species accumulation analysis are used to estimate the percentage of the flora of the area that was sampled. This estimate is calculated using the last Sobs (Mao Tau) result divided by the last Chao2 Mean listed in the results table (where: Sobs is the total number of species observed in a sample or set of samples; Sobs (Mao Tau) is the number of samples expected in the pooled quadrat samples given the empirical data; and, the Chao2 Mean is the Chao2 richness estimator (mean among runs) (Colwell, 2013)). By dividing the species richness observed (Sobs (Mao Tau)) by the species richness predicted (Chao2 Mean) the sampling effort can be estimated.

3.4 Vegetation Mapping

The vegetation of the Study Area (Southern Borefield and Southern Borefield Extension areas) was mapped using quadrat data described above.

An aerial photograph captured in March 2018 was used to map the vegetation at a scale ranging from 1:5,000 to 1:20,000. Vegetation descriptions and the presence, absence, cover and structural information for taxa recorded at sites assessed by Maia and GGE were used to describe the vegetation types. The results of the floristic analyses were used to define and map the boundaries of the vegetation types of the Study Area.

The following information was also used to refine the boundaries of vegetation types mapped: notes and/or photographs on vegetation types and boundaries recorded at points of interest and numerous photo points; notes

recorded while traversing the area on foot and while driving along tracks and fencelines; and, notes recorded at quadrats on vegetation structure and habitat (e.g. fire age and topography).

The growth form, height classes and cover characteristics of the vegetation are described using the current National Vegetation Inventory System (NVIS) methodology at the association level (Level 5). At this level up to three strata and a maximum of three taxa per stratum are used to describe the association (Executive Steering Committee for Australian Vegetation Information (ESCAVI), 2003).

3.5 Vegetation Condition

Vegetation condition was mapped using: data collected at quadrats and photo points; notes made while walking from site to site; and, any obvious disturbances visible on the aerial photograph. Vegetation condition assessed during the surveys was updated as necessary once the plant identifications had been confirmed and the invasiveness of any weed species located had been determined. Aggressive weed species are considered to be those rated as having a rapid invasiveness and a high environmental impact rating by DBCA. The vegetation condition ratings used are those for the Eremaean and Northern Botanical Provinces indicated in EPA (2016b) (**Table 3.5**). These vegetation condition ratings are based on the scale developed by Trudgen (1988) and modified and adapted by Keighery (1994).

Table 3.5: Vegetation condition scale (EPA, 2016b)

Vegetation condition	Eremaean and Northern Botanical Provinces
Pristine	
Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds or occasional vehicle tracks.
Good	More obvious signs of damage caused by human activity since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly aggressive weeds.
Poor	Still retains basic vegetation structure or ability to regenerate it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
Degraded	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

4 SURVEY RESULTS - FLORA

A combined list of all flora species recorded in the Study Area to date is included as **Table A4.3 (Appendix 4)**. This list includes records from:

- GGE species list;
- 17 quadrats assessed in October 2017 and April 2018 in the Southern Borefield Extension area;
- 20 GGE quadrats in the Southern Borefield area that were reassessed in April 2018;
- 12 GGE quadrats revisited in April 2018 to confirm dominant species, any queried species and vegetation condition e.g. *Acacia citrinoviridis* and *Acacia victoriae*; and,
- 1 relevé assessed in the Southern Borefield area in April 2018.

4.1 GENERAL FLORA

GGE recorded 129 taxa (including species (sp.), subspecies (subsp.), varieties (var.) and crosses (x)) from 28 families and 71 genera in July/August 2009. Natives comprised 93.8% (121) of the 129 taxa and weeds 6.2% (8 taxa), while 27.1% were annuals and 72.9% perennials (**Table A4.2, Appendix 4**). The most common families were Fabaceae (22 taxa), Poaceae (19 taxa) and Amaranthaceae and Malvaceae (12 taxa each), while the most common genera were *Acacia* and *Ptilotus* (both 11 taxa) followed by *Goodenia* and *Senna* (both six taxa).

[Note: GGE's original species list names have been checked against FloraBase (WAH, 1998-) and have been changed to reflect current listings and naming conventions e.g. *Portulaca oleracea* is no longer listed as a weed species while *Portulaca pilosa* is, and *Flaveria australasica* was not listed as a weed in 2009 but it is now known as *Flaveria trinervia,* which is currently listed as a weed. Also, while not currently indicated on FloraBase as a Pilbara species, *Calandrinia quadrivalvis* has been left in the species list: records for this species are shown in the Pilbara on NatureMap (DPaW, 2007-) and on the Atlas of Living Australia (ALA, 2018).]

Table A4.3 (Appendix 4) presents a combined species list from GGE and Maia surveys. Some of GGE's taxa have been changed post quadrat reassessments carried out by Maia. For example *Acacia citrinoviridis* and *A. cuthbertsonii* subsp. *cuthbertsonii* ? are listed in **Table A4.2**; however, both are listed as *Acacia xiphophylla* in **Table A4.3**. Also, *Acacia victoriae* is listed in **Table A4.2** but it is listed as *A. synchronicia* in **Table A4.3**. These changes were made after specimens were recollected from GGE sites in 2017 and 2018. While the location of the *Ptilotus* sp. collected by GGE was revisited no *Ptilotus* species were located in that area.

Including sp., subsp., var. and crosses, 253 taxa from 34 families and 106 genera have been located in the Study Area.

- Annual taxa (76) comprise 30.0% of the taxa list and perennial taxa (177) 70.0%.
- Native taxa comprise 96.4% of the taxa list (245 taxa) and introduced / weed taxa 3.6% (nine taxa).
- The most common families are Fabaceae (47 taxa), Poaceae (46 taxa) and Malvaceae (26 taxa).
- The most common genera are *Acacia* (21 taxa), *Senna* (13 taxa) and *Ptilotus* (12 taxa).
- Flowering material collected by Maia in October 2017 and April 2018 is used to provide an indication of the proportion of the combined species list identified from fertile material. Flowering material was used to identify 9.1% of the species list, fruiting material 34.8% and both flowering and fruiting material 25.7%, and 69.6% of the combined species list was identified from fertile material. Flowering and/or fruiting specimens collected by Maia are indicated in the combined species list (**Table A4.3, Appendix 4**).
- Twenty-one of the 253 taxa recorded in the Study Area were collected opportunistically by Maia and were not recorded at any of the sites assessed in 2017 and 2018.

The counts and percentages in the previous paragraphs exclude specimens that could not be fully identified due to a lack of flowering or fruiting material. These include: specimens identified to family only, specimens identified to a genus with multiple species already in the species list, specimens queried as a species already in the species list and listed as compares to (cf.) when the species is already in the list. Therefore the following taxa were not used for counts and percentage calculations but are included in the species list: ASTERACEAE sp., MALVACEAE sp., *Ptilotus* sp., *Senna* cf. *sericea*, *Senna* ? *stricta*, *Boerhavia* ? *coccinea* and *Aristida* sp. (inadequate material). Other collections either identified to genus only or to a queried species have been included when no other specimens in that genus were collected e.g. *Nicotiana* sp., or when a genus has many species records in the surrounding area and they could be one of those e.g. *Paspalidium* sp., *Sporobolus* sp. and *Pterocaulon* ? *serrulatum*.

At least one specimen of each species on the species list was collected at the sites assessed by Maia and 569 specimens were collected over the two surveys carried out in 2017 and 2018.

A selection of *Triodia* specimens collected from the Study area in October 2017 and April 2018 and identified as *Triodia lanigera* or *Triodia basedowii* were submitted to the WA Herbarium for confirmation. All of the specimens were identified as *T. basedowii*. Specimens initially identified as the P3 species *Rhagodia* sp. *Hamersley* and the P3 species *Glycine falcata* were also submitted to the WA Herbarium for confirmation and they were identified as the non-conservation significant species *Rhagodia eremaea* and *Glycine canescens* respectively.

A site by species matrix for the quadrats assessed by Maia and GGE is included as **Table A3.1** (**Appendix 3**).

The species accumulation analysis was run using the combined data from all quadrats assessed in the Study Area. The species accumulation curve (SPAC) is included as **Figure 4.1** and the results of the analysis as **Table A4.1 (Appendix 4)**. The species accumulation analysis indicates that 69% of the flora estimated to be in the Study Area were recorded when the 205 taxa recorded from 49 quadrats and one relevé assessed in the Study Area were used in the analysis. As this estimate does not include the additional taxa recorded opportunistically or those identified to a queried species, the proportion of the flora collected from the Study Area is actually higher than that indicated by the species accumulation analysis.

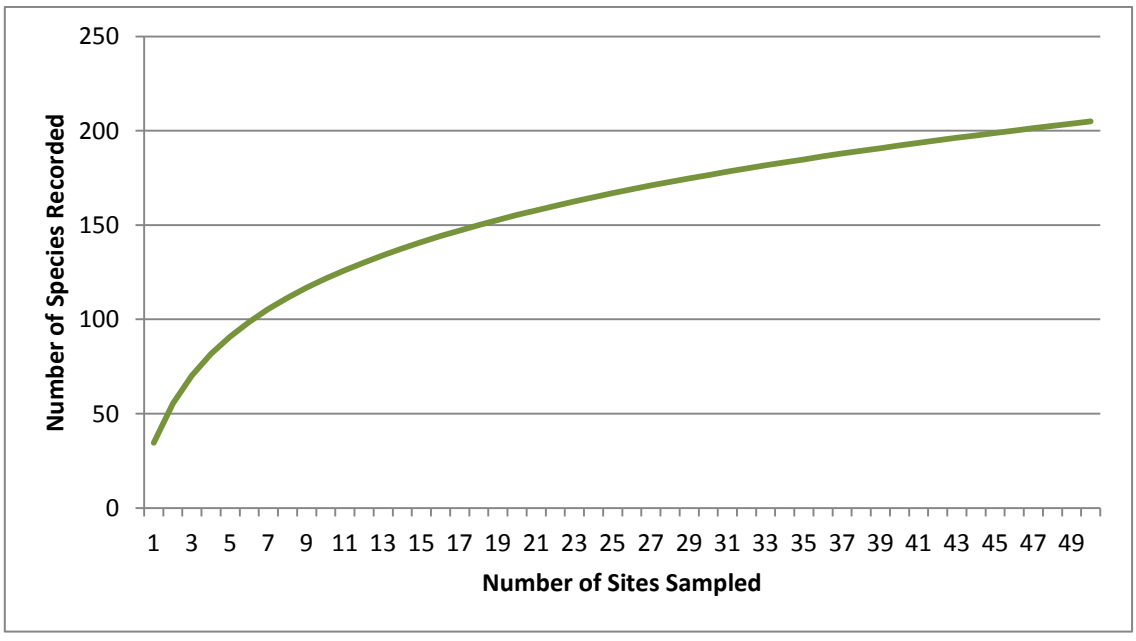


Figure 4.1: Species accumulation curve (quadrat and relevé data)

A comparison of the flora recorded at quadrats assessed during this detailed Level 2 survey and that recorded during other Level 2 surveys carried out in the vicinity of the Study Area is included in **Table 4.1**. Based on this

comparison the sample effort for the Survey Area was adequate, especially given the flat plains and historically grazed habitat of the Study Area compared with the more diverse habitats of the Newman-Roy Hill Transmission Line and Roy Hill Flora and Vegetation survey areas e.g. 13 and 10 land systems occur in those survey areas respectively compared with only two in the Study Area.

Table 4.1: Taxa collected at quadrats – Maia and other surveys

Survey location	Survey type	Taxa recorded	Survey timing (season)	Number of quadrats / relevé	Reference
Roy Hill Southern Borefield L47/642 and L47/735	Level 2 – three-phase (including GGE)	253	July/August 2009 (winter), October 2017 (spring) and April 2018 (autumn)	50	This report
Flora and Vegetation Survey of a Proposed Borefield for the Roy Hill 1 Iron Ore Project	Level 2 – single phase	129	July / August 2009 (winter)	43	GGE, 2009
Newman-Roy Hill Transmission Line Survey	Level 2 – single phase	264	August 2012 (winter)	16	Ecoscape Australia, 2012
Roy Hill Flora and Vegetation Survey	Level 2 – three phase	477	October / November 2005; May / June 2006; March 2008	258	Ecologia, 2009c

4.2 Regional Endemics

Regional endemics are plants that are geographically restricted to a particular locality or region. The distribution of each species in the species list was checked against FloraBase records/maps and no regional endemics were recorded in the Study Area i.e. species that are found only in the Fortescue subregion.

4.3 Range Extensions

Species have a typical range which is indicated by their known distribution records. Sometimes species are recorded during a survey, which have not been located previously in the area, and these species are described as range extensions. In many cases a range extension reflects a lack of surveys in a particular area or lack of submissions of flora records to the WA Herbarium rather than a true range extension.

Using 100 km as the minimum distance from an existing record to define a range extension (and NatureMap to estimate the distance from the approximate centre of the Study Area to the closest record shown on NatureMap), 13 range extension species were recorded in the Study Area (eight in 2009 and five in 2017/2018; **Table 4.2**). None of these species is listed as conservation significant and four of the five recorded in 2017/2018 - *Acacia glaucocaesia, Boerhavia paludosa, Euphorbia drummondii* and *Ipomoea polymorpha* - were located on Roy Hill's mining tenements (Ecologia, 2009c). The mining tenements are within 100 km of the Study Area but the locations are not shown on FloraBase or NatureMap. If these locations were included on FloraBase of NatureMap they would not be highlighted as range extensions in this section.

It is possible that some of the range extension species were misidentified, for example it is likely that *Bonamia rosea* was *B. erecta* (multiple NatureMap records around the Study Area). However, others were identified from flowering material e.g. *Glycine tomentella*.

Table 4.2: Range extension species recorded in the Study Area

Species (Survey)	Closest NatureMap record to approximate centre of Study Area (DPaW, 2007-)
Acacia glaucocaesia (2018)	Approximately 125 km south south-west of closest NM record; however, recorded previously on Roy Hill mining tenements within 100 km of Study Area.
Boerhavia paludosa (2017 & 2018)	Approximately 116 km east north-east of closest NM record; however, recorded previously on Roy Hill mining tenements within 100 km of Study Area.
Bonamia rosea (2009)	Approximately 250 km south of closest NM record (this is most likely *Bonamia erecta*).
Euphorbia drummondii (2018)	Approximately 110 km east north-east of closest NM record; however, FloraBase records shown to the south-east and north-east but not in the Fortescue subregion; however, recorded previously on Roy Hill mining tenements within 100 km of Study Area.
Glycine tomentella (2017 & 2018)	Approximately 170 km north-east of closest record on NM.
Hibiscus sp. Gardneri (A.L. Payne PRP 1435) (2009)	Approximately 105 km south-west of closest NM record; however, FloraBase records shown to the east but not in the Fortescue subregion.
Ipomoea ? *polymorpha* (2018)	Approximately 110 km north-west of closest NM location; records to the west and east of Study Area; however, recorded previously on Roy Hill mining tenements within 100 km of Study Area..
Leiocarpa semicalva (2009)	Approximately 115 km east north-east of closest NM record.
Maireana tomentosa subsp. *tomentosa* (2009)	Approximately 125 km south-west of closest record on NM; this marks a range extension into the southern section of the Fortescue subregion, however, there are records all around this on FloraBase and it was recorded previously on the Roy Hill mining tenements.
Ptilotus obovatus var. *obovatus* (2009)	Approximately 135 km south-east of closest NM record. However, *P. obovatus* is mapped extensively in that area and some of those records will be *P. obovatus* var. *obovatus*. It also was recorded previously on the Roy Hill mining tenements.
Tinospora smilacina (2009)	Approximately 135 km south-east of closest NM record.
Vittadinia dissecta (2009)	Approximately 325 km south-east of closest Pilbara NM record; however, a record is shown on ALA (2018) that appears to be less than 100 km from the approximate centre of the Study Area.
Calandrinia quadrivalvis (2009)	Approximately 150 km south south-east of closest record on NM; however, ALA (2018) shows this species having many more records in the Pilbara bioregion and one of them is less than approximately 50 km from the Study Area.

Note: NM = NatureMap.

4.4 Conservation Significant Flora

Conservation significant flora species can be protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Wildlife Conservation Act 1950* (WC Act) and significant flora species are listed as threatened species if protected by these acts.

In December 2016 selected parts of the new *Biodiversity Conservation Act 2016* (BC Act; to replace the WC Act and the *Sandalwood Act 1929*) came into effect; however, the whole act will not come into effect until the Biodiversity Conservation Regulations associated with the act have been made. The sections of the BC Act relating to threatened species and ecological communities will come into effect once the new regulations have been made (DBCA, 2018d).

Because of the large WA flora, many species are known from only a few collections, or a few sites, and have not been adequately surveyed or 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 and these species can be placed on a priority species list (listed as Priority (P) 1 to 4). Categories and definitions for threatened and priority flora species are included in **Table A5.1** and **A5.3 of Appendix 5**.

4.4.1 Threatened Flora Species

No flora species protected by the EPBC Act were recorded in the Study Area.

No flora species protected by the WC Act were recorded in the Study Area.

4.4.2 Priority Flora Species

Two of the conservation significant flora species listed in the Western Australian Herbarium database search results have been located in the Study Area previously – *Eucalyptus rowleyi* and *Rhagodia* sp. Hamersley (both P3 species). The locations at which they had been recorded previously were visited and those species were not found. Following the survey an aerial photograph of the Study Area captured in March 2018 was used to try to identify any eucalypts in the vicinity of the *E. rowleyi* record and there appear to be some approximately 450 m to the south-east of the coordinates supplied, outside of the Study Area. Other patches of what appear to be eucalypts can be seen in the aerial photograph in the north-eastern corner of the Study Area and it is possible that some of these could be *Eucalyptus rowleyi* as they are typically found on the sandy soils of the Divide land system to the east of the Study Area and there is a patch of the Divide land system mapped in the north-eastern corner of the Study Area.

Rhagodia sp. Hamersley (P3) is difficult to distinguish from *Rhagodia eremaea* (not conservation significant). There is no published taxonomic description for *R*. sp. Hamersley and its main distinguishing features are that it lacks a distinctive odour to the leaves common in *R. eremaea* and its longer spathulate leaves compared to the lanceolate leaves of *R*. *eremaea*. However, both the smell and leaf shape are variable. Twenty-one *Rhagodia* specimens were collected from the Study Area and one of those was initially identified as *R.* sp. Hamersley. The specimen was submitted to the WA Herbarium for identification (along with a specimen of *R. eremaea*) and both were identified as *R. eremaea*.

One priority flora species was recorded in the Study Area – *Goodenia nuda* (P4).

***Goodenia nuda* (P4)**

G. nuda is an erect to ascending herb growing up to 0.5 m high (WAH, 1998 -). The basal leaves are sometimes serrated and are prominently three-veined from the base. The yellow flowers have a maroon centre and are produced from April to August. **Photographs 1** and **2** show the growth habit and a flower of *Goodenia nuda* (photographs are from Maia's library and not taken in the Study Area).

G. nuda was recorded at 22 locations in the Study Area in 2009 and at four locations in 2017/2018 (**Map 9.9, Section 9; Table A5.6, Appendix 5**). It was located on the hardpan plains and broad drainage flats in the Southern Borefield and on the hardpan plains in the Southern Borefield Extension area.

Photograph 4: Growth habit

Photograph 5: Close-up of flower

4.5 Introduced Flora

A number of lists of weeds of national interest are currently recognised (e.g. weeds of national significance, WoNS). The lists are available on the Australian Government's website (Australian Government, 2017) and are for: WoNS, National Environmental Alert, Sleeper Weeds, Species Targeted for National Eradication, and Species Targeted for Biological Control.

To protect WA agriculture the Department of Primary Industries and Regional Development (DPIRD) regulates harmful plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act; GoWA, 2017). Plants that are prevented entry into WA or have control or keeping requirements within WA are listed on the Western Australian Organism List (WAOL), which has been created to easily find out the status of organisms that have been classified as part of the enactment of the BAM Act (DPIRD, 2018c). Organisms are grouped into four main classifications: Declared pests; Permitted; Prohibited; and Permitted requiring a permit (DPIRD, 2018c).

Under the BAM Act, all declared pests are placed in one of three categories, namely, C1 (exclusion), C2 (eradication) or C3 (management) (DPIRD, 2018b). These three categories are described in **Table A6.1, Appendix 6**. Some declared pests are unassigned and the description for these plants is also included in **Table A6.1**.

In addition to nationally important weeds and declared pest plants, the DBCA prioritises environmental weeds in each region based on their invasiveness, ecological impact, potential and current distribution and feasibility of control. The resulting priorities focus on weeds considered to be high impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained to a manageable size (DBCA, 2018e).

Summaries of the species' ecological impact and invasiveness rankings are provided to help landholders, community groups and private enterprises manage weeds that might impact on the natural environment (DBCA, 2018e). Most recent species-led ecological impact and invasiveness ranking summary results are available for the different government regions in WA.

The Pilbara region species prioritisation process 2014 impact and invasiveness ratings spread-sheet lists 90 weed species for which the impact and invasiveness have been ranked and a further 15 weed species that have been listed as priority alert species (DBCA, 2018f).

4.5.1 Weeds on National Weeds Lists

No weeds on any of the national weeds lists were recorded in the Study Area.

4.5.2 Plants Declared in Western Australia

No plants declared as pest plants in WA were recorded in the Study Area.

4.5.3 Environmental Weeds

Nine weed species were recorded in the Study Area over the three surveys (**Table 4.3**). Five of the nine were recorded during the 2017/2018 surveys (**Map 9.10, Section 9**).

Most of the weed species located in the Study Area have been recorded within 40 km of it (**Table A1.2, Appendix 1**). **Chloris virgata* and **Citrullus lanatus* do not have records within 40 km of the Study Area, however they have been located within approximately 55 km of it (DPaW, 2007-).

The impact and invasiveness ratings for the weed species recorded in 2009, 2017 and 2018 are listed in **Table 4.3**.

Table 4.3. Weed species located in the Study Area and Pilbara region rankings (DBCA, 2018f)

Species	Common name	Ecological impact rating	Invasiveness rating
Bidens bipinnata (Maia)	Bipinnate Beggartick	Unknown	Rapid
Cenchrus ciliaris (GGE & Maia)	Buffel Grass	High	Rapid
Chloris virgata (GGE)	Feathertop Rhodes Grass	High	Rapid
Citrullus lanatus (GGE)	Pie Melon	Unknown	Moderate
Flaveria trinervia (GGE)	Speedy Weed	Not listed	Not listed
Malvastrum americanum (GGE & Maia)	Spiked Malvastrum	High	Rapid
Portulaca pilosa (GGE & Maia)	Djanggara	Not listed	Not listed
Sonchus oleraceus (GGE)	Common Sowthistle	Low	Rapid
Vachellia farnesiana (GGE & Maia)	Mimosa Bush	High	Rapid

Note: rows highlighted orange to indicate species with High ecological impact and Rapid invasiveness ratings.

The most common weed species recorded in 2017/2018 were: **Cenchrus ciliaris* (16 locations), **Malvastrum americanum* (15 locations) and **Portulaca pilosa* (11 locations).

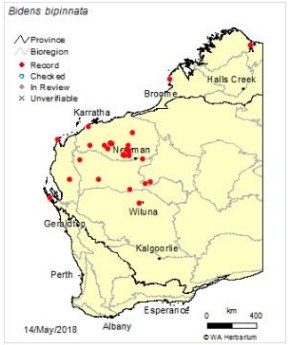
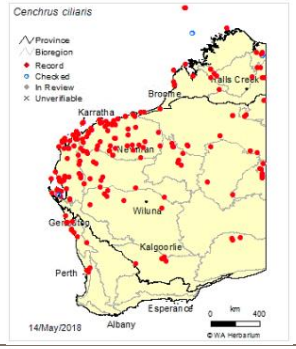
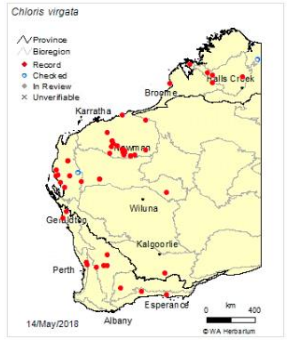
Four of the nine confirmed weed species recorded during the surveys are listed as having High ecological impact and Rapid invasiveness ratings: **Cenchrus ciliaris* (Buffel Grass), **Chloris virgata* (Feathertop Rhodes Grass), **Malvastrum americanum* (Spiked Malvastrum) and **Vachellia farnesiana* (Mimosa Bush).

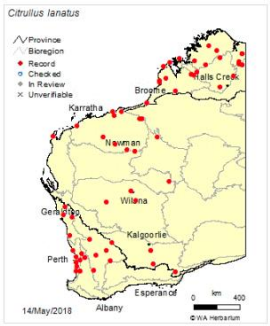
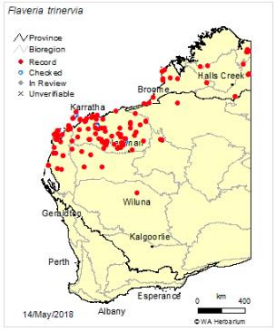
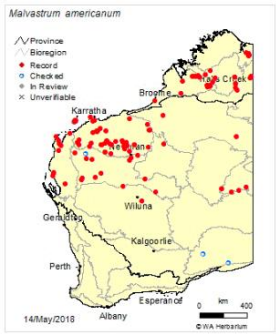
A recent study carried out by CSIRO (Webber *et al.*, 2017) collated weed records from numerous sources for the Pilbara IBRA region and carried out a weed risk assessment for the region. Various lists are included in this report and the weed species in **Table 4.3** have been compared with species in selected tables. None of the weed species

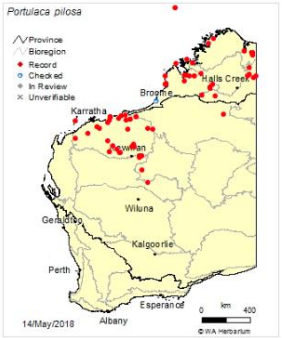
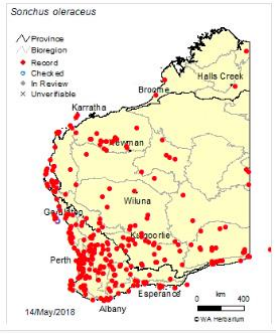
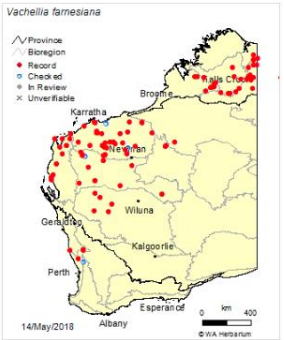
recorded in the Study Area are on the list of weeds to assess for eradication in the Pilbara region; **Cenchrus ciliaris* is included in the list of widespread weeds that are probably beyond containment and for which management should consider a focus on asset protection in the Pilbara region; **Chloris virgata*, **Malvastrum americanum* and **Portulaca pilosa* are in the list of weeds that are a priority for research to determine their environmental impact in the Pilbara IBRA region and other adjacent areas; and, **Sonchus oleraceus* and **Citrullus lanatus* are in the list of weeds that are unlikely to cause environmental impact or at the upper limit of their ecoclimatic acclimatisation in the Pilbara IBRA region (Webber *et al*., 2017).

Further information on the weed species located in the Study Area is provided in **Table 4.4**. A FloraBase map showing the known distribution of these weed species is also included in **Table 4.4**; all nine species have been recorded in the surrounding area previously.

Table 4.4: Weed species recorded in the Study Area (descriptions)

Weed	Description	Habitat	Known WA Distribution	Distribution in the Study Area	Photograph
Bidens bipinnata	Erect, annual herb growing to 0.9 m high. It produces yellow flowers from March to September.	Along rivers and creeks, coastal areas, rocky hillsides.		*B. bipinnata* was recorded at nine locations and was located in mulga groves growing under the acacias.	
Cenchrus ciliaris	A tufted or sometimes stoloniferous perennial grass-like or herb growing to 1.5 m high. It produces a cylindrical flower stalk with purple flowers between February and October.	White, red or brown sand, stony red loam and black cracking clay.		*C. ciliaris* was recorded at 16 locations and was recorded in a number of habitats but in higher numbers close to bores.	
Chloris virgata	Annual, grass-like or herb growing to 0.45 m high. Produces green-purple flowers from April to May or September	Clay, sand. Sand dunes.		*C. virgata* was recorded by GGE and no number and location data available. Photograph: Sheldon Navie (Lucid Key, 2018).	

Weed	Description	Habitat	Known WA Distribution	Distribution in the Study Area	Photograph
Citrullus lanatus	Trailing annual, herb or climber. Flowers are yellow and produced from January to December.	Plains, river banks, centres of dry lakes, drainage areas, disturbed areas.		*C. lanatus* was recorded by GGE and no number and location data available.	
Flaveria trinervia	Much-branched erect or procumbent annual herb. Produces yellow flower heads (ALA, 2018). Flowering specimens have been collected in March, April, May, June, July, August, September and October (WAH, 1998-)	Sandy flats, dunes, gentle hill, undulating stony plain, minor flow line, creekbed, cracking clay plain, disturbed areas.		*F. trinervia* was recorded by GGE and no number and location data available.	
Malvastrum americanum	Erect hairy perennial herb or shrub growing to 1.3 m high. The flowers are yellow to orange and are produced from April to July.	Stony ridges and hillsides, floodplains and along drainage lines.		*M. americanum* was recorded at 15 locations in mulga groves and adjacent to bores.	

Weed	Description	Habitat	Known WA Distribution	Distribution in the Study Area	Photograph
Portulaca pilosa	Succulent, erect of prostrate annual, herb growing to 0.2 m high. It produces yellow/pink flowers from January to July or in November.	Sandy, loamy and clayey soils.		*P. pilosa* was recorded at 11 locations close to bores Photography by G. Byrne & C.P. Campbell, FloraBase (see note below table).	
Sonchus oleraceus	Erect annual herb growing to 1.5 m high and produces yellow flowers from January to December.	It is a weed of waste places and disturbed ground.		*S. oleraceus* was recorded by GGE and no number and location data available.	
Vachellia farnesiana	Erect, spreading, thicket-forming, thorny tree or shrub, to 4 m high. Flowers are yellow, produced from June to August.	Stony sandy, clay or loam soils, gravel. Low-lying areas, river and creek banks, disturbed sites.		*V. farnesiana* was recorded at two locations on hardpan and loamy plains.	

Descriptions and habitats from WAH (1998 -) and Atlas of Living Australia (2018). Map showing known WA Distributions from WAH (1998 -). Mapping by Paul Gioia. Unless otherwise indicated, photographs are by Maia. Map and one photograph image used with the permission of the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions (https://florabase.dpaw.wa.gov.au/help/copyright). Accessed on Thursday 17th of May. Descriptions by the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions (unless otherwise indicated). Text used with permission (https://florabase.dpaw.wa.gov.au/help/copyright). Accessed on Thursday 17th of May.

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5 SURVEY RESULTS - VEGETATION

5.1 VEGETATION TYPES

Pattern analysis divided the quadrat data into two broad groups at the 1.15 similarity scale. It further divided the data into nine groups at approximately the 0.7 similarity scale with a final stress value of 0.21. The overall dendrogram produced for the combined data set and the group dendrogram are included as **Figures A3.1** and **A3.2** (**Appendix 3**). The statistical methodology (PATN recipes) used to generate a site by species classification is included as **Figure A3.3** (**Appendix 3**).

Based on the results of the statistical analysis and field observations, nine vegetation types occur in the Study Area. Three vegetation types, A**WL** and A**SL**-5/A**SL**-3 have been mapped as mosaics in areas of mulga banding. Most of the mulga groves (A**WL**) and inter-groves (A**SL**-5/A**SL**-3) were relatively small and could not be mapped separately. Vegetation type A**SL**-4 was represented by two quadrats (HBR21 and HBR6) and both quadrats grouped with other vegetation types in the analysis. These quadrats have been combined into vegetation type A**SL**-4 based on the dominant species - mainly *Acacia xiphophylla*.

Growth forms, height classes and cover characteristics of the vegetation are described using the current NVIS methodology at the association level (ESCAVI, 2003), and this methodology is outlined in **Appendix 7** and information collected at each site is included in **Appendix 8**.

The vegetation types of the Study Area are described and shown on **Map 9.11** (legend), **Map 9.12** (vegetation types) and **Map 9.13** (vegetation types with assessment sites and conservation significant flora located in the Study Area) (Section 9).

Vegetation descriptions have been ordered using the dominant cover class as the indicator and not the dominant stratum in order to correlate with the broad floristic formation descriptions e.g. Hummock Grassland of *Triodia basedowii* with Scattered Low Trees of *Acacia pruinocarpa*.

The codes used for each vegetation type include the first letter of the genus of the dominant taxon or taxa along with the first letters of the dominant stratum of the broad floristic formation in bold font e.g. T**HG** is a Triodia Hummock Grassland.

Cleared areas such as tracks and bores/wells and surrounds have been mapped as **D** (disturbed).

Descriptions for and photographs of the mapped vegetation types are presented in **Table 5.1**. Broad floristic formation descriptions are included at the top of each vegetation type description followed by the full vegetation type description.

The observed indicator value and results of the Monte Carlo Permutation Test for indicator species resulting from the indicator species analysis are included as **Table A3.2, Appendix 3**. Twenty two species were identified as indicator species in the analysis. Those species with a High indicator species for a vegetation type (>64%) are underlined in **Table 5.1**.

Table 5.1: Vegetation types of the Study Area

T**HG:** Triodia Hummock Grassland.

T**HG** occurs on the undulating sandy-loam plains of the Study Area. The domininant hummock grasses were *Triodia schinzii* (HBR7 and HBR7b) and *Triodia basedowii* (the remaining seven quadrats). HBR7 grouped in the centre of the clade while HBR7b grouped to the far right in the analysis indicating that there may be little difference between them and the *T. basedowii* quadrats. As a result they have been mapped and decribed as one vegetation unit. An area of vegetation burnt approximately 12 months before the April 2018 survey was dominated by *Triodia pungens*. Three quadrats grouped as outliers of the main group (HB3, HB10 and Q08) but have been included with this vegetation type based on the dominant and associated species. Species richness was lower than the average at HB3, HB10 and Q08 (average of 31.1; 19, 16 and 25 species at each site respectively) and this may have affected their grouping in the analysis.

GGE quadrats in this vegetation type were originally mapped as W2 (HB3, HB10, HB12 and HBR7 and HBR9) and W6 (HBR7 and HBR7b).

Vegetation condition ranged from Excellent (56%) to Very Good (44%) with an average rating of Excellent; the main disturbances were weeds, grazing, animal tracks and trampled vegetation.

Description	Associated species and species richness	Sites
Hummock Grassland of *Triodia basedowii* / or *T. schinzii* with a Sparse mixed Tall Shrubland of (*Acacia ancistrocarpa*, *A. pachyacra* and *A. melleodora*) with Isolated Low Trees of *Acacia pruinocarpa*.	*Acacia aptaneura*, *A. tetragonophylla*, *Anthobolus leptomerioides*, *Aristida latifolia*, *Eriachne aristidea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Trichodesma zeylanicum* var. *zeylanicum.* The average species richness is 31.1 (+/- 10.5).	HB3, HB10, HB12, HBR7, HBR7b, HBR9, Q01, Q05, Q08

A**TG:** Aristida Tussock Grassland.

A**TG** occurs on the low lying loamy and stony plains of the Study Area. The four quadrats assessed in this vegetatin type grouped together.

Quadrats from this vegetation type were originally mapped and described as G1 (HB8 and HB11) and S3 (HB4b) (GGE, 2009).

Vegetation condition was rated as Very Good at all quadrats and the main disturbances noted in this vegetation type were cattle grazing and trampling.

Description	Associated species and species richness	Sites
Open Tussock Grassland of *Aristida contorta* and *A. latifolia* with a Sparse Mid Shrubland of *Senna glaucifolia*, *S. artemisioides* subsp. *helmsii* and *Acacia synchronicia* and Isolated Tall Shrubs of *Acacia synchronicia* and *A. tetragonophylla.*	*Acacia aptaneura*, *Eragrostis setifolia*, *Eragrostis xerophila, Goodenia prostrata*, *Rhagodia eremaea*, *Salsola australis, Sclerolaena cornishiana*, *Senna notabilis, Sida platycalyx*, *Solanum lasiophyllum.* The average species richness is 32.3 (+/- 9.9).	HB11, HB4b, HB8, Q15

A**WL:** Acacia Low Woodland.

This vegetation type occurs in the lower lying areas on loamy and hardpan plains and on broad drainage flats. It has not been mapped as a discrete vegetation type because it occurs mostly with A**SL**-5 (A**WL** in bands and A**SL**-5 between the bands). It has therefore been mapped as a mosaic of A**WL**/A**SL**-5. A**WL** also occurs as a mosaic with A**SL**-3. The nine quadrats in A**WL** grouped together.

Quadrats in this vegetation type were originally mapped as S1 (HB24), W2 (HBR33), W3 (HBR18 and HBR28) and W5 (HB19) (GGE, 2009).

Vegetation condition ranged from Excellent (44%) to Very Good (66%) with an average rating of Very Good; the main disturbances noted were weeds, grazing and vegetation trampling by cattle and other feral hard hooved animals (donkeys and horses).

Description	Associated species and species richness	Sites
Low Woodland of *Acacia aptaneura* and *A. macraneura* with a mixed Tussock Grassland (*Aristida latifolia*, *A. contorta* and *Enneapogon caerulescens*) and an Open Low Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and/or *Ptilotus obovatus* var. *obovatus.*	*Acacia tetragonophylla*, *Evolvulus alsinoides* var. *villosicalyx*, *Hibiscus burtonii*, *Ptilotus obovatus* var. *obovatus*, *Psydrax latifolia*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Sida platycalyx*, *Solanum lasiophyllum.* The average species richness is 35 (+/- 6.9).	HB19, HB24, HBR18, HBR28, HBR33, Q06, Q07, Q16, Q17

A**SL**-1**:** Acacia Tall Shrubland.

This vegetation type occurs on broad drainage flats in the Study Area, mostly in the Southern Borefield Extension area. Quadrats from **ASL**-1 grouped to the right of the clade with quadrats from A**WL**. They have been mapped as a separate vegetation type due to the *Corymbia* tree species in the upper stratum.

Small drainage foci/claypans occur in the Study Area and the vegetation in these areas is dominated mostly by species from A**SL**-1; however, *Eucalyptus victrix* also occurred in the upper stratum in these areas, which were less than 100 m in diameter, had been heavily grazed, were weedy and generally degraded (Poor condition).

GGE's quadrat in this vegetation type was originally mapped as W7 (HBR45) (GGE, 2009).

Vegetation condition at the quadrats assessed in this vegetation type ranged from Very Good (60%) to Good (40%) and it was rated as Poor at the relevé assessed at one of the drainage foci - the average rating was Good; the main disturbances noted were grazing and vegetation trampling by cattle and other feral hard hooved animals (donkeys and horses).

Description	Associated species and species richness	Sites
Open Tall *Acacia* Shrubland (*Acacia macraneura*, *A. tetragonophylla*, *A. ancistrocarpa*) with an Open mixed Tussock Grassland (commonly *Chrysopogon fallax*, *Aristida latifolia* and *Eulalia aurea*) and Isolated Low Trees of *Corymbia hamersleyana*, *C. aspera* and/or *Acacia pruinocarpa*.	*Acacia aptaneura, Abutilon otocarpum, Boerhavia paludosa, Cucumis variabilis, Enneapogon polyphyllus, Evolvulus alsinoides* var. *villosicalyx, Maireana villosa, Paraneurachne muelleri, Perotis rara, Rhynchosia minima, Senna artemisioides* subsp. *helmsii, Sida fibulifera, Tephrosia supina.* The average species richness is 41.3 (+/- 6.8).	HBR45, Q10, Q11, Q14, R01

A**SL**-2**:** Acacia Tall Shrubland.

This vegetation type occurs mainly on the lower lying areas of the hardpan plains of the Study Area. The four quadrats in this vegetation type grouped together.

Quadrats in A**SL**-2 were originally mapped as W1 (HBR13), W5 (HBR17), S2 (HBR35) and S3 (HBR4) (GGE, 2009).

Vegetation condition was rated as Very Good at all of the quadrats sampled; the main disturbances were weeds and grazing and vegetation trampling by cattle and other feral hard hooved animals (donkeys and horses).

Description	Associated species and species richness	Sites
Open mixed *Acacia* Tall Shrubland (commonly *Acacia aptaneura*, A. *tetragonophylla*, *A. synchronicia*) with an Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana*, *Eremophila lanceolata* over a Sparse Tussock Grassland of *Aristida latifolia*, *A. contorta* and *Eragrostis xerophila*.	*Acacia tetragonophylla*, *Aristida contorta*, *Enneapogon polyphyllus*, *Evolvulus alsinoides* var. *villosicalyx*, *Hibiscus burtonii*, *Maireana planifolia*, *Rhagodia eremaea*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *S. platycalyx*, *Solanum lasiophyllum*. The average species richness is 40 (+/- 4.5).	HBR13, HBR17, HBR35, HBR4

A**SL**-3**:** Acacia Tall Shrubland.

This vegetation type occurs on the hardpan and stony plains of the Study Area and also between the mulga bands of A**WL**. It has been mapped as a discrete unit where it was present in large patches but also as a mosaic of A**S**L-3 and A**W**L. All quadrats grouped together in this vegetation type. Q02 was located adjacent to an area mapped as T**HG** in a spinifex/mulga interface and, while *Triodia basedowii* was a dominant species at this quadrat, it is not representative of the vegetation type.

Quadrats in A**SL**-3 were originally mapped as S1 (HBR22, HBR38), S2 (HBR32), W1 (HBR26), W4 (HBR21) and W5 (HBR30) (GGE, 2009).

Vegetation condition ranged from Excellent (50%) to Very Good (50%) with an average rating of Very Good; the main disturbances were grazing and trampling of vegetation from cattle and other feral hard hooved animals (donkeys and horses).

Description	Associated species and species richness	Sites
Open mixed *Acacia* Tall Shrubland (commonly *Acacia incurvaneura*, A. *tetragonophylla* and *A. aptaneura*) with an Open mixed Mid Shrubland (*Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *oligophylla, S. ? sericea x symonii*) over a Sparse Tussock Grassland of *Aristida latifolia* and *A. contorta*.	*Acacia pruinocarpa*, *Anthobolus leptomerioides*, *Enneapogon polyphyllus*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Hibiscus burtonii*, *Paraneurachne muelleri*, *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana*, *Sida platycalyx*, *Solanum lasiophyllum*, *Triodia basedowii*. The average species richness is 39.5 (+/- 6.7).	HB34, HBR22, HBR26, HBR30, HBR32, HBR38, Q02, Q09

A**SL**-4**:** Acacia Tall Shrubland.

This vegetation type occurs on the stony and loamy plains and was often recorded in small isolated patches. A**SL**-4 was recorded in the Southern Borefield area only (not in the Southern Borefield Extension area) and it is characterised by *Acacia xiphophylla* in the tall shrub stratum. Areas mapped as A**SL**-4 were originally mapped as W4 and the dominant taxon in W4 was *Acacia citrinoviridis* (GGE, 2009). Multiple acacia specimens were collected from these quadrats (some with fruit), and also oppurtunistically in this vegetation type throughout the Study Area, and all of the specimens collected were identified as *Acacia xiphopylla*. The two quadrats surveyed in this vegetation type grouped with quadrats from different vegetation types. HBR21 grouped as an outlier from A**TG** while HBR6 grouped to the right of A**SL**-2. These quadrats have been mapped as A**SL**-4 because of the presence and dominance of *Acacia xiphophylla*.

Vegetation condition was rated as Good at both quadrats; the main disturbances were grazing and vegetation trampling from cattle and other feral hard hooved animals (donkeys and horses).

Description	Associated species and species richness	Sites
Open Tall Shrubland of *Acacia xiphophylla* +/- *A. aptaneura* over an Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Solanum lasiophyllum* and *Senna artemisioides* subsp. *oligophylla* over a Low Sparse Chenopod Shrubland of *Sclerolaena cornishiana*.	*Acacia synchronicia*, *A. tetragonophylla*, **Cenchrus ciliaris*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Evolvulus alsinoides* var. *villosicalyx*, *Maireana planifolia*, **Malvastrum americanum*, *Salsola australis*, *Senna* ? *sericea* x *symonii*, *Sporobolus australasicus.* The average species richness is 31 (+/- 8.5).	HBR6 and HBR21.

A**SL**-5**:** *Acacia* Tall Shrubland.

This vegetation type occurs on hard pan and stony plains between bands of mulga (A**WL**) and the two vegetation types have been mapped as a mosaic of A**WL** and A**SL**-5. All five quadrats grouped together.

Quadrat HB31 was originally mapped as S2 and HBX15 as G1 (GGE, 2009). In 2018 quadrat HBX15 was sampled 100 m from its original location (the original quadrat was located in a Tussock Grassland) because the coordinates supplied were not correct. This is therefore a new rather than a reassessed/resampled quadrat.

Vegetation condition ranged from Very Good (60%) to Excellent (40%) with an average rating of Very Good; the main disturbances were pastoral activities and grazing and trampling of vegetation from cattle and other feral animals (donkeys and horses).

Description	Associated species/Species richness	Sites
Sparse to Open Tall Shrubland of *Acacia aptaneura*, *A tetragonophylla* +/- *A. paraneura* with a Sparse Tussock Grassland of *Aristida contorta* and *A. latifolia* and Isolated Low Trees of *Acacia pruinocarpa*.	*Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *E. latrobei* subsp. *filiformis*, *Polycarpaea corymbosa* var. *corymbosa*, *Ptilotus obovatus* var. *obovatus*, *P. schwartzii* var. *schwartzii*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Sida platycalyx*, *Solanum lasiophyllum*, *Triodia basedowii.* The average species richness is 36.6 (+/- 8.8).	HB31, HBX15, Q03, Q04, Q13

M**TG:** Mixed Tussock Grassland.

This vegetation type occurs on cracking clay-loam and crabhole plains of the Study Area. All quadrats grouped together. M**TG** is mostly mapped in the Southern Borefield area and only small patches extend into the Southern Borefield Extension area.

This vegetation type was mapped and described as G1 in 2009 and *Eragrostis setifolia* was a dominant species (GGE, 2009). In 2018 *Eragrostis xerophila* was the dominant grass recorded at all quadrats mapped as M**TG**.

Vegetation condition ranged from Very Good (75%) to Good (25%) with an average rating of Very Good; the main disturbances were cattle and other introduced animals grazing and trampling.

Description	Associated species/Species richness	Sites
Closed Tussock Grassland of *Eragrostis xerophila* and *Aristida latifolia* with an Open Low Shrubland of *Senna symonii* and *Senna artemisioides* subsp. *helmsii*.	*Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *Solanum lasiophyllum*, *Streptoglossa odora*. The average species richness is 18.8 (+/- 4.3).	HB27, HB29, HBR39, Q12

5.2 Vegetation Type Cover

The area of each of the vegetation types mapped is listed in **Table 5.2**.

The smallest vegetation types mapped are A**SL**-2 and A**SL**-4 (approximately 363 and 773 ha respectively), while the largest mapped unit is the mosaic of A**WL** and A**SL**-5 (approximately 23,364 ha).

Table 5.2: Vegetation types of the Study Area – description, area and cover

Vegetation type code	Description	Mapped over	
		Area (ha)	Cover (%)
A**SL**-1	Open Tall *Acacia* Shrubland (*Acacia macraneura*, *A. tetragonophylla*, *A. ancistrocarpa*) with an Open mixed Tussock Grassland (commonly *Chrysopogon fallax*, *Aristida latifolia* and *Eulalia aurea*) and Isolated Low Trees of *Corymbia hamersleyana*, *C. aspera* and/or *Acacia pruinocarpa*	2,540.10	5.26
A**SL**-2	Open mixed *Acacia* Tall Shrubland (commonly *Acacia aptaneura*, A. *tetragonophylla*, *A. synchronicia*) with an Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana*, *Eremophila lanceolata* over a Sparse Tussock Grassland of *Aristida latifolia*, *A. contorta* and *Eragrostis xerophila*	362.82	0.75
A**SL**-3	Open mixed *Acacia* Tall Shrubland (commonly *Acacia incurvaneura*, A. *tetragonophylla* and *A. aptaneura*) with an Open mixed Mid Shrubland (*Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *oligophylla, S. ? sericea x symonii*) over a Sparse Tussock Grassland of *Aristida latifolia* and *A. contorta*	1,155.82	2.39
A**SL**-4	Open Tall Shrubland of *Acacia xiphophylla* +/- *A. aptaneura* over an Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Solanum lasiophyllum* and *Senna artemisioides* subsp. *oligophylla* over a Low Sparse Chenopod Shrubland of *Sclerolaena cornishiana*	772.63	1.60
A**TG**	Open Tussock Grassland of *Aristida contorta* and *A. latifolia* with a Sparse Mid Shrubland of *Senna glaucifolia*, *S. artemisioides* subsp. *helmsii* and *Acacia synchronicia* and Isolated Tall Shrubs of *Acacia synchronicia* and *A. tetragonophylla*	3,579.00	7.41
A**WL** / A**SL**-3	A**WL**: Low Woodland of *Acacia aptaneura* and *A. macraneura* with a mixed Tussock Grassland (*Aristida latifolia*, *A. contorta* and *Enneapogon caerulescens*) and an Open Low Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and/or *Ptilotus obovatus* var. *obovatus* A**SL**-3: Open mixed *Acacia* Tall Shrubland (commonly *Acacia incurvaneura*, A. *tetragonophylla* and *A. aptaneura*) with an Open mixed Mid Shrubland (*Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *oligophylla, S. ? sericea x symonii*) over a Sparse Tussock Grassland of *Aristida latifolia* and *A. contorta*	4,420.08	9.16
A**WL** / A**SL**-5	A**WL**: Low Woodland of *Acacia aptaneura* and *A. macraneura* with a mixed Tussock Grassland (*Aristida latifolia*, *A. contorta* and *Enneapogon caerulescens*) and an Open Low Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and/or *Ptilotus obovatus* var. *obovatus* A**SL**-5: Sparse to Open Tall Shrubland of *Acacia aptaneura*, *A tetragonophylla* +/- *A. paraneura* with a Sparse Tussock Grassland of *Aristida contorta* and *A. latifolia* and Isolated Low Trees of *Acacia pruinocarpa*	23,363.80	48.41
M**TG**	Closed Tussock Grassland of *Eragrostis xerophila* and *Aristida latifolia* with an Open Low Shrubland of *Senna symonii* and *Senna artemisioides* subsp. *helmsii*	6,978.55	14.46
T**HG**	Hummock Grassland of *Triodia basedowii* / or *T. schinzii* with a Sparse mixed Tall Shrubland of (*Acacia ancistrocarpa*, *A. pachyacra* and *A.*	4,974.52	10.31

Vegetation type code	Description	Mapped over	
		Area (ha)	Cover (%)
	melleodora) with Isolated Low Trees of *Acacia pruinocarpa*		
Disturbed (including bore areas and regrowth)		119.73	0.25
Total		48,267.05	100.00

5.3 Vegetation Condition

The condition of the vegetation of the Study Area is rated mostly as Very Good (84.23%), while 10.29% is rated as Excellent, 5.23% as Good, 0.24% as Poor/Degraded and 0.01% as Poor (**Map 9.14, Section 9**). Additional information on vegetation condition in the Study Area is included in **Table 5.3**.

Table 5.3: Vegetation condition in the Study Area

Vegetation Condition	Area (ha)	Cover (%)	Comment
Excellent	4,969.03	10.29	Vegetation condition in vegetation type T**HG** was mostly Excellent, particularly in areas of the hard spinifex *Triodia basedowii*. Although there were signs of cattle passing through these areas, there were few weeds and little evidence of grazing.
Very Good	40,655.34	84.23	Vegetation condition over most of the Study Area was rated as Very Good. Grazing and trampling were evident but generally less than at areas rated as Good. Some weeds (**Cenchrus ciliaris* and **Malvastrum americanum*, both have High ecological impact and Rapid invasiveness ratings) were recorded throughout these areas, but mostly in low numbers.
Good	2,523.61	5.23	In areas mapped as Good signs of cattle grazing and trampling were more evident than in areas mapped as Very Good. The understorey in these areas was mostly intact but there was high weed cover (**Cenchrus ciliaris* and **Malvastrum americanum*, both having High ecological impact and Rapid invasiveness ratings, were common). Lower lying areas with a sparse to open tree cover that provide shade to cattle were heavily trampled and had been grazed.
Poor	3.98	0.01	Vegetation condition at and directly adjacent to station bores/wells was rated as Poor. The understorey was generally absent or had been grazed and trampled by cattle. The mid stratum was sometimes dominated by the (weed) shrub **Vachellia farnesiana*.
Poor / Degraded	115.09	0.24	The areas where vegetation condition was mapped as Poor/Degraded are those cleared for tracks and fencelines. These areas occasionally contained some native regrowth but were mostly cleared.
Total	48,267.05	100.00	

5.4 Maia Vegetation Types, Land Systems and Beard Vegetation Associations

The vegetation types mapped in the Study Area and their occurrence in the land systems and Beard vegetation associations (BVA) of the Study Area are listed in **Table 5.4**.

Multiple vegetation types were mapped in the small patches of the Divide land system and BVA 111 mapped in the Study Area and this reflects the more detailed mapping of the vegetation types for this smaller scale Level 2 assessment.

Table 5.4: Area and cover of vegetation types mapped in the Study Area

Maia vegetation type code	Mapped in	
	Land system	Beard vegetation association
A**SL**-1	Divide & Fan	29 & 111
A**SL**-2	Fan	29
A**SL**-3	Fan	29 & 111
A**SL**-4	Divide & Fan	29 & 111
A**TG**	Divide & Fan	29 & 111
A**WL** / A**SL**-3	Divide & Fan	29 & 111
A**WL** / A**SL**-5	Divide & Fan	29 & 111
M**TG**	Divide & Fan	29 & 111
T**HG**	Divide & Fan	29 & 111

5.5 Ecological Communities and Other Vegetation of the Survey Area

5.5.1 Ecological Communities

None of the vegetation types mapped in the Study Area resembles any of the currently-listed Pilbara TECs.

A**SL**-4 is similar to the description for the Narbung Land System Priority 3 (iii) PEC listed for the Pilbara (Alluvial washplains with prominent internal drainage foci supporting snakewood and mulga shrublands with halophytic low shrubs); however, the Narbung land system does not occur in the Study Area.

5.5.2 Groundwater Dependent Vegetation

No rivers or wetlands occur in the Study Area; however, broad drainage tracts run through some areas and the tree species commonly recorded in these areas were *Corymbia hamersleyana* and *C. aspera*. These two species are not generally regarded as being groundwater dependent.

Two almost circular patches of vegetation (circular drainage foci) were observed on aerial imagery before going to site in April 2018 (**Table 5.5** and **Figures 5.1** and **5.2**). Both areas were visited and a relevé was assessed at the southern-most. The vegetation at these areas was similar to A**SL**-1 but *Eucalyptus victrix* occurred at both and this species was not seen in the other larger areas of A**SL**-1. The *E. victrix* in these areas could use groundwater at some time during the year.

Table 5.5: Drainage foci

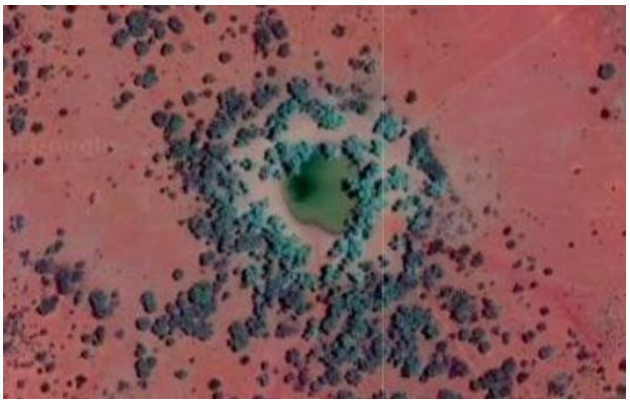
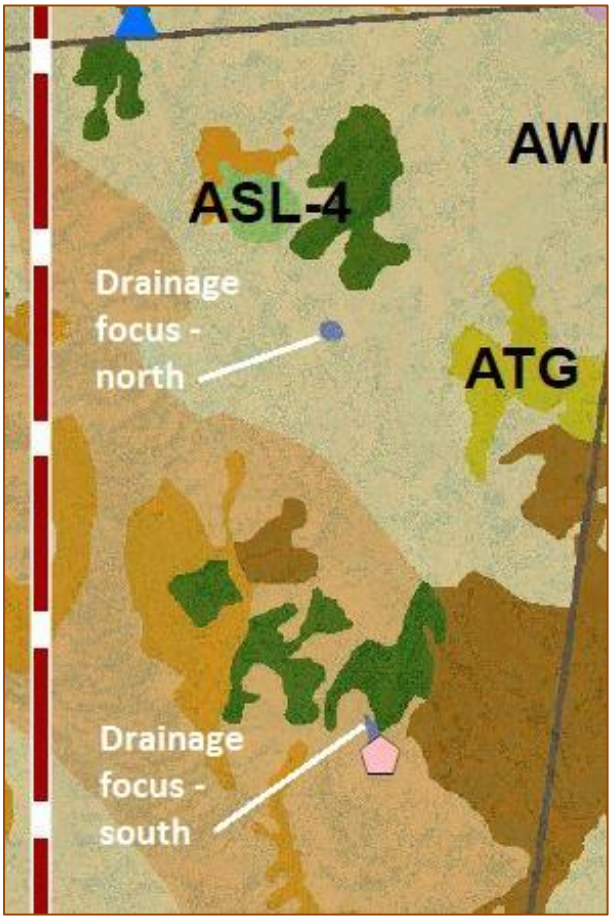
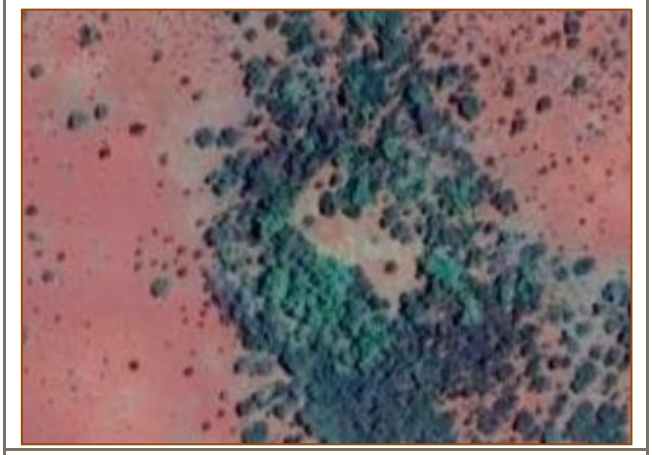
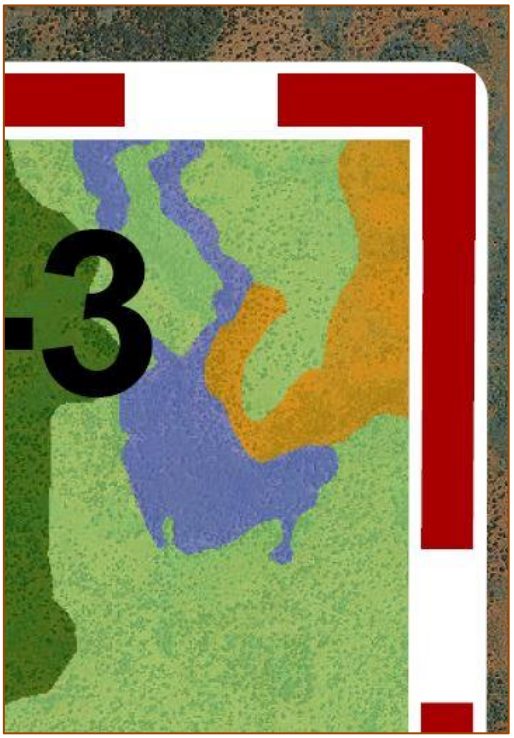
Aerial photograph	Extract from vegetation map
	
Northern drainage focus	
	
Southern drainage focus	

Figure 5.1: *Eucalyptus victrix* at northern drainage focus

Figure 5.2: *Eucalyptus victrix* at southern drainage focus

While mapping the vegetation in the north-eastern corner of the Study Area, using aerial imagery captured in March 2018, a dense patch of what had looked like acacias on older imagery, appeared to have large trees in the south-eastern section and eucalypts to the north and north-east (**Table 5.6**); the large trees and eucalypts could potentially be groundwater dependent. GDEs and the vegetation of the Study Area are discussed further in **Section 6**.

Table 5.6: North-eastern corner of Study Area

Aerial photograph	Extract from vegetation map
	

5.5.3 Sheet Flow Dependent Vegetation

Large areas of banded mulga occur in the Study Area (**Figure 5.3**) and banded mulga is known to be sheet flow dependent. This vegetation is discussed further in **Section 6**.

Figure 5.3: Banded mulga in the Study Area

6 DISCUSSION

The conservation significance of the flora and vegetation of the Study Area is discussed below. As per the Technical Guidance (EPA, 2016b) significance is assessed at both regional and local scales.

6.1 FLORA OF CONSERVATION SIGNIFICANCE

The regional conservation significance of the one priority species recorded in the Study Area is discussed below. Significance ratings (Low, Moderate or High) are based on the species' current conservation rank, the number of subregions in which it occurs, the number of protected lands in which it occurs, its spread in the relevant subregion and an estimate of the proportion of all known populations that occur in the subregion.

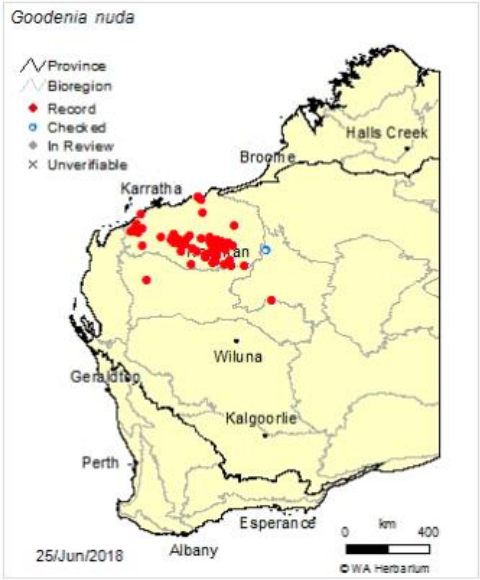
6.1.1 Regional Significance

Goodenia nuda (P4)

Goodenia nuda has 96 records listed on FloraBase (WAH, 1998-) and 116 on NatureMap (DPaW, 2007-). All are located within 465 km of Newman and are in the Augustus and Carnegie subregions of the Gascoyne bioregion, the Trainor subregion of the Little Sandy Desert and the Chichester, Fortescue, Hamersley and Roebourne subregions of the Pilbara bioregion. The number of plants, when recorded, at a location varies from one to 200.

Approximately 20 of the locations shown on NatureMap lie over two areas mapped as DPaW Tenure (DPaW, 2007-). In the Fortescue subregion *G. nuda* locations are relatively widespread and an estimated 21 of the Fortescue subregion location points are outside areas mapped as DPaW estate and 14 within. Based on this information the plants located in the Study Area are rated as having Low regional significance.

While this species has been located in the Study Area previously (GGE, 2009), the records are not shown on FloraBase or NatureMap.



Note: Image used with the permission of the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions (https://florabase.dpaw.wa.gov.au/help/copyright). Accessed on Saturday, 30 June 2018.

6.1.2 Local Significance

The local conservation significance of the *Goodenia nuda* in the Study Area is discussed below. Significance ratings (Low, Moderate or High) are based on the species' rank, any protected lands in which the species occurs in the local area, the species' spread in the local area (and number of vegetation types in which it occurs), an estimate of the proportion of the total number of plants that occur in the local area and of the populations in WA recorded in the local area.

Goodenia nuda (P4) has been recorded at seven locations within the database search area but outside the Study Area. Plant numbers (when noted) ranged from 2-5 to 16 (DBCA, 2018g). *G. nuda* was recorded at 22 locations in the Southern Borefield area in 2009, it was not recorded in 2017, and it was recorded at four locations in 2018 (three in the Southern Borefield Extension area and one in the Southern borefield area) – 26 locations in total. GGE recorded 113 *G. nuda* plants in July/August 2009 and Maia recorded 23 in April 2018; the number of plants recorded at a location varied from 1 to 30 and they were recorded in six of the nine vegetation types/mosaics: A**SL**-1, A**SL**-2, A**SL**-3, A**WL**/A**SL**-3, A**WL**/A**SL**-5 and A**TG**.

Based on its spatial (and temporal) records in the Study Area, relative to the number of records produced by the DBCA database search, the *G. nuda* in the Study Area are rated as having Moderate local conservation significance. [However, the surrounding area has not been surveyed like the Study Area (and in areas that have some records have not been lodged at the WA Herbarium (e.g. Ecologia, 2009c; 12 records reported and two shown on NatureMap), and there will be more than seven locations in the surrounding area. If these were allowed for the scores for the proportion of all known plants and populations that occur in the Study Area and the overall rating would be lower (less significant)].

6.1.3 Range Extensions

Thirteen range extension species were recorded in the Study Area (none is listed as a conservation significant). Using NatureMap locations, the range extensions estimated were between 110 km and 170 km from the approximate centre of the Study Area to the closest record.

Five of the 13 species were located during the 2017/2018 surveys and four of the five were identified from reproductive material (*Acacia glaucocaesia* from pods, *Boerhavia paludosa* from flowers and fruit, *Euphorbia drummondii* from fruit, and *Glycine tomentella* from flowers). *Ipomoea* ? *polymorpha* was identified from sterile material and potentially could be one of the other *Ipomoea* species that occur in the Fortescue subregion.

According to FloraBase and NatureMap *Acacia glaucocaesia* has not been located in the Fortescue subregion previously; however, the specimen collected had pods and keyed out to *A. glaucocaesia* and not *A. synchronicia*, a similar species. *Glycine tomentella* and *Ipomoea polymorpha* have not been located in the Fortescue subregion previously; however, the habitat in the Study Area is consistent with that stated for those species on FloraBase (sand, loam, banks of creeks, plains and sandy soils, alluvium, creeklines and moist depressions respectively). In addition, *Acacia glaucocaesia, Boerhavia paludosa, Euphorbia drummondii* and *Ipomoea polymorpha* were located on Roy Hill's mining tenements during detailed flora and vegetation surveys carried out by Ecologia (2009c) but the locations are not on FloraBase or NatureMap. As the mining tenements are within 100 km of the Study Area, if these locations were on NatureMap there would be four fewer range extensions.

6.2 VEGETATION

6.2.1 Regional Significance

Conservation significance of the vegetation of the Study Area at a regional level is based on the representation of the habitats recorded within the Study Area at a bioregion and subregion level. Beard's vegetation mapping and land systems mapping have been used to assess the significance of vegetation of the Study Area at this level because regional vegetation mapping for the Pilbara is not currently available.

6.2.1.1 LAND SYSTEMS

Two land systems are mapped in the Study Area and the approximate current extent of each in the Pilbara bioregion, the Fortescue subregion and Study Area is listed in **Table 6.1**. The data in the following land systems sections uses estimated current extents and distributions for the land systems in the Pilbara bioregion (PIL) and Fortescue subregion (PIL02) (approximated by intersecting shapefiles for IBRA bioregions (DotE, 2012), land systems (DAFWA, 2014), and native vegetation extent (DPIRD, 2018b).

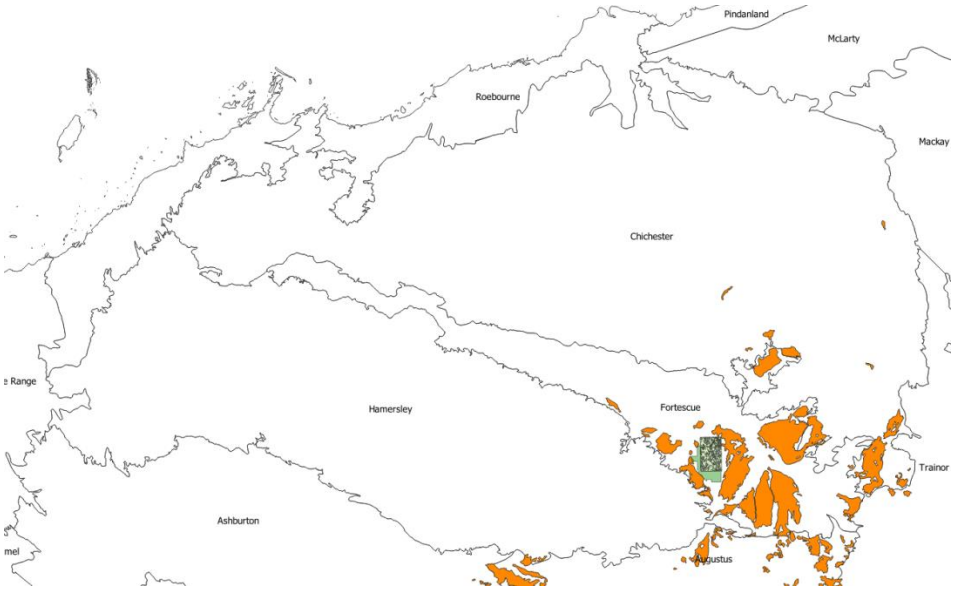
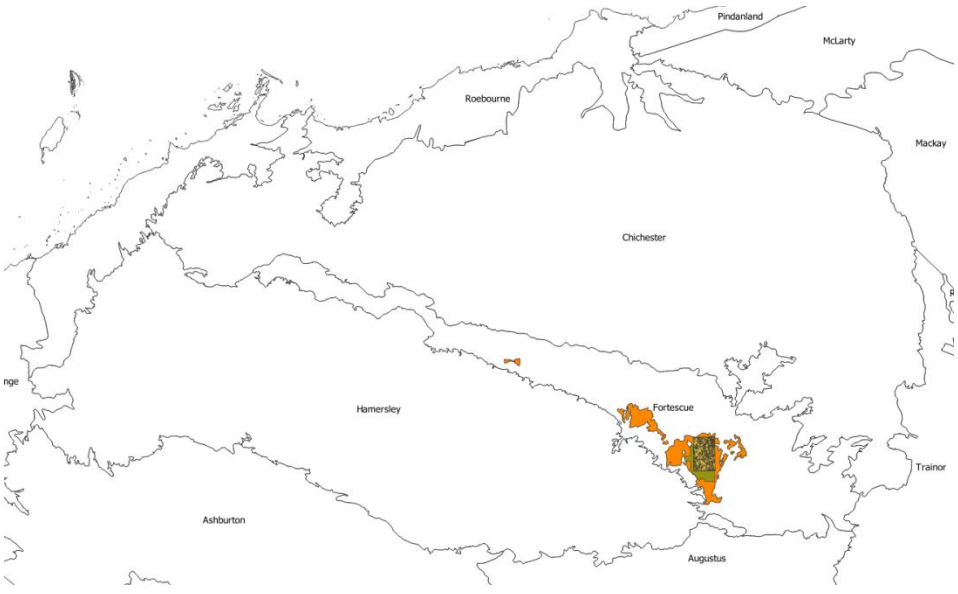
The maps in **Table 6.2** show the Study Area in green and the extent of the land system in the Pilbara bioregion (with subregions) and surrounds in orange.

Table 6.1: Distribution and extent of land systems of the Study Area

Land system	Current extent in PIL (ha)	Current extent in PIL02 (ha)	Area in Study Area (ha)	Cover in Study Area (%)	PIL current extent in Study Area (%)	PIL02 current extent in Study Area (%)
Divide	437,553.2	344,963.0	969.2	2.0	0.2	0.3
Fan	148,122.5	148,122.5	47,297.9	98.0	31.9	31.9
Total	585,675.7	493,085.5	48,267.1	100.0	8.2	9.8

Note: PIL = Pilbara bioregion and PIL02 = Fortescue subregion.

Table 6.2: Distribution of land systems of the Study Area - Pilbara bioregion and subregions

Land system Pilbara mapped extent and occurrence	
	The **Divide** land system is mapped in the Chichester, Fortescue and Hamersley subregions of the Pilbara bioregion (344,963 ha). Some of this land system's current Pilbara extent lies in Unallocated Crown Land proposed for conservation (an estimated 116 ha). The Divide land system in the Survey Area is rated as having Moderate regional significance.
	The **Fan** land system is mapped only in the Fortescue subregion of the Pilbara bioregion. It is mapped over 148,123 ha. None of the Fan land system is reserved in DBCA Legislated Lands and Waters or DBCA Lands of Interest (Australian Government, 2018 and shapefile intersects, see notes below table). This land system is rated as having High regional significance.

Note: IBRA subregion mapping = DotE (2012) and land system mapping = DAFWA (2014). Areas in this table were calculated by intersecting land system shapefiles (DAFWA, 2014) with native vegetation extent shapefiles (DPIRD, 2018b), IBRA bioregion shapefiles (DotE, 2012) and DBCA Lands of Interest (DBCA, 2018b).

6.2.1.2 BEARD VEGETATION ASSOCIATION MAPPING

Two of Beard's vegetation associations (BVA) are mapped in the Study Area and the current extent of each in the Pilbara bioregion, Fortescue subregion and the Study Area are listed in **Table 6.3** and shown in **Table 6.4**.

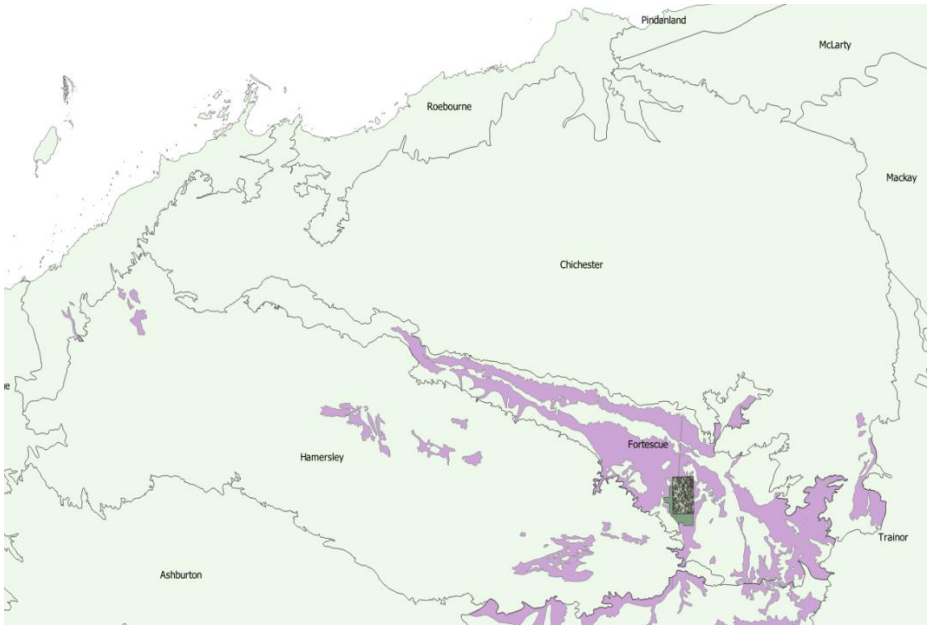
The areas in columns 2 and 3 of **Table 6.3** are from GoWA, 2018 and the maps in **Table 6.4** show the Study Area in green and the extent of the BVA in the Pilbara bioregion and subregions and surrounds in purple.

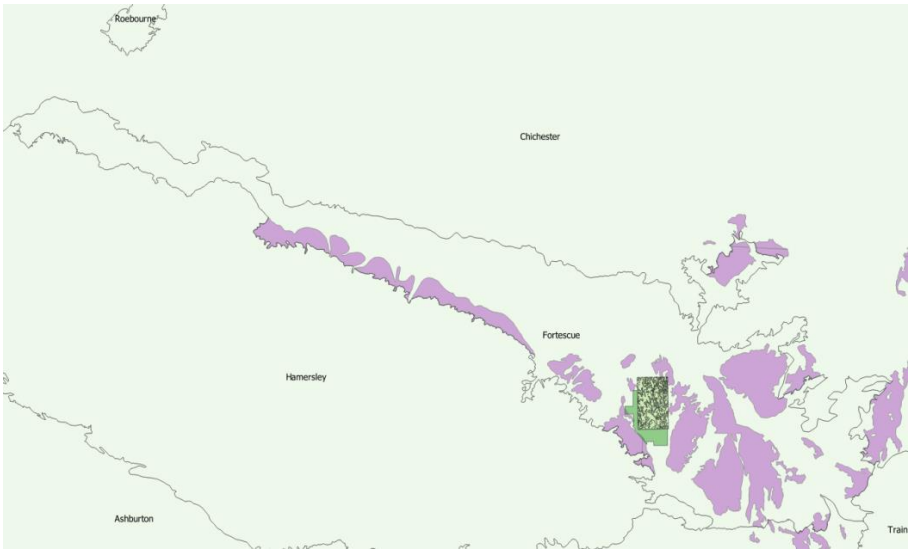
Table 6.3: Beard vegetation associations – current extent in the Pilbara bioregion, Fortescue subregion and Study Area

Beard vegetation association	Current extent in PIL (ha)	Current extent in PIL02 (ha)	Area in Study Area (ha)	Cover of Study Area (%)	PIL current extent in Study Area (%)	PIL02 current extent in Study Area (%)
29	1,132,939.2	893,221.9	46,860.7	97.1	4.1	5.2
111	550,232.5	454,730.4	1,406.3	2.9	0.3	0.3
Total	1,683,171.7	1,347,952.3	48,267.1	100.0	2.9	3.6

Note: PIL = Pilbara bioregion and PIL02 = Fortescue subregion.

Table 6.4: Pilbara extent, distribution and protection of Beard vegetation associations 29 and 111 in the Pilbara bioregion

Beard vegetation association Pilbara mapped extent and occurrence

BVA 29 is mapped in six bioregions and 12 subregions – and in all four subregions of the Pilbara bioregion. Approximately 1.13 million ha currently remains In the Pilbara, which is 99.98% of its pre-European extent; 1.91% of its current extent is protected in IUCN I-IV land and 9.38% in all DPaW Managed Land. BVA 29 had low priority for reservation in the Fortescue subregion (Kendrick, 2001). Most of its Pilbara extent (approximately 0.89 million ha) is mapped in the Fortescue subregion and 99.98% currently remains (0.26% in IUCN I-IV land and 9.41% in all DPaW Managed Land). Based on this information, the 4.1% (Pilbara) and 5.2% (Fortescue) of BVA 29 in the Study Area is rated as having Low to Moderate regional significance.

Beard vegetation association Pilbara mapped extent and occurrence

BVA **111** is mapped in three bioregions and six subregions and in three of the four subregions of the Pilbara (not the Roebourne). Most of its current extent is in the Pilbara bioregion where approximately 0.55 million ha currently remains (99.99% of its pre-European extent); 1.29% of this BVA's Pilbara current extent is protected in IUCN I-IV land and 6.96% of it in all DPaW Managed Land. BVA 111 had low priority for reservation in the Fortescue subregion (Kendrick, 2001). Most (approximately 0.45 million ha) of it is mapped in the Fortescue subregion and 99.99% currently remains (1.51% in IUCN I-IV land and 8.34% in all DPaW Managed Land). Based on this information, the 0.3% of the Pilbara and Fortescue extent of BVA 111 in the Study Area is rated as having Low regional significance.

Note: IBRA subregion mapping = DotE (2012) and Beard vegetation association mapping = DAFWA (2012).

6.2.2 Local Significance

Local significance of the BVAs and land systems is rated using information on: the cover of each land system/BVA occurring in the Study Area and surrounds; current extent in the local area, area mapped in protected lands in the local area, the number of conservation significant flora species located in it and any other attributes e.g. whether the land system or BVA occurs in a PEC in the local area.

6.2.2.1 LAND SYSTEMS

The Divide system comprises only 2% of the Study Area and the Fan makes up the remaining 98% (**Table 6.1**). The extent of the Fan land system in the Study Area - relative to its current extent in the Pilbara bioregion/Fortescue subregion - is relatively high (31.9%/31.9%) and the Divide's is low (0.2%/0.3%) (**Table 6.1**). The local significance of the Fan land system is rated as Moderate to High and the Divide's as Low.

6.2.2.2 BEARD VEGETATION ASSOCIATIONS

Approximately 97% of the Study Area has been mapped as BVA 29 and 3% as BVA 111 (**Table 6.3**). The proportion of the current Pilbara bioregion/Fortescue subregion extent of BVAs 29 and 111 in the Study Area is approximately 4.1%/5.2% and 0.3%/0.3% respectively (**Table 6.3**). The local significance rating for BVA 29 is Low to Moderate and BVA 111 is Low.

6.2.2.3 VEGETATION TYPES MAPPED BY MAIA

Maia's vegetation types have been compared with the descriptions for the vegetation communities of the Divide and Fan land systems of the Pilbara (Van Vreeswyck *et al*., 2004). The comparable vegetation communities are listed in **Table 6.5** along with associated site type descriptions. The following paragraphs include the main information from the table along with a comment on the nature conservation status of each community as indicated by Van Vreeswyck *et al*., (2004).

T**HG** is mapped over 4,974.52 ha (10.31%) of the Study Area on the sandy-loam plains. T**HG** is similar to two of Van Vreeswyck *et al*.'s vegetation communities, SHSG and SSSG. SHSG is characterised by hard spinifex species while SSSG is characterised by soft spinifex species. Van Vreeswyck *et al*. noted that the two communities were floristically similar; however, sites from SSSG had higher species diversity. Species richness in the two quadrats assessed in T**HG** in which the dominant spinifex was the soft spinifex *Triodia schinzii* (like SSSG) was higher than the mean species richness of 31.1 species for this vegetation type. SSSG is poorly represented in conservation reserves in the Pilbara survey area (but was recorded on unallocated Crown land) while SHSG is not recorded on conservation reserves within the Pilbara survey area but it is represented on the Rudall River National Park, east of the Pilbara survey area.

A**SL**-1 is mapped over 2,540.10 ha (5.26%) of the Study Area on the broad drainage flats. It is similar to vegetation community DEGW of Van Vreeswyck *et al*., (2004). The vegetation is characterised by an acacia (*Acacia aneur*a) and/or eucalypt (*Eucalyptus victrix*, *Corymbia hamersleyana*) woodland or tall shrub layer. DEGW is well represented on conservation reserves (Karijini National Park, Cane River Nature Reserve and Meentheena Conservation Park).

A**SL**-2 is mapped over 362.82 ha (0.75%) on lower lying areas of hardpan plains of the Study Area and is similar to vegetation community HPMS of Van Vreeswyck *et al*. (2004). It is characterised by very scattered to scattered tall shrubland of mulga. While HPMS is widespread across a number of LS, it is poorly represented in reserves (one site was recorded in Karijini National Park).

A**SL**-3 is mapped over 1,155.82 ha (2.39%) on hardpan and stony plains of the Study Area and is similar to vegetation community HPMS of Van Vreeswyck *et al*., (2004). It is characterised by very scattered to scattered tall shrubland of mulga. HPMS commonly grades into vegetation community GMUW (Grove mulga woodland/shrubland) which is similar to Maia vegetation type A**WL**. A**SL**-3 has been mapped as a mosaic with A**WL** in the Study Area. Although HPMS is widespread across a number of LS, it is poorly represented in reserves (one site was recorded in Karijini National Park). A**SL**-3 is likely to be the ecosystem at risk, 'Grove-intergrove mulga communities of the southern end of the northern apron of Hamersley Range', in Kendrick, 2001.

A**SL**-4 is mapped over 772.63 ha (1.6%) on stony and loamy plains of the Study Area and is similar to vegetation community PSCS of Van Vreeswyck *et al*., (2004). PSCS is considered to be a threatened site type under extensive pastoral use as it is preferentially grazed and has fragile soils. It is known from Karijini National Park and Cane River Nature Reserve.

A**SL**-5 is mapped as a mosaic with A**WL** over 23,363.80 ha (48.41%) of the Study Area on loamy and hardpan plains. A**SL**-5 closely resembles vegetation community HPMS of Van Vreeswyck *et al*. (2004). HPMS commonly grades into vegetation community GMUW (Grove mulga woodland/shrubland) and although widespread across a number of LS it is poorly represented in reserves (one site was recorded in Karijini National Park). A**SL**-5 is likely to be the ecosystem at risk, 'Grove-intergrove mulga communities of the southern end of the northern apron of Hamersley Range', in Kendrick, 2001.

A**TG** is mapped over 3,579.00 ha (7.41%) of the Study Area on the low lying loamy and stony plains. A**TG** is similar to but not the same as vegetation community HPMS of Van Vreeswyck *et al*. (2004). HPMS is described as a usually very scattered to scattered tall shrubland of mulga with well-developed mid and low shrub layers. However, A**TG** is characterised by a dominant tussock grass stratum and not the tall shrub layer of HPMS. HPMS is represented poorly in Karijini National Park.

A**WL** is mapped in a mosaic with A**SL**-3 over 4,420.08 ha (9.16%) and with A**SL**-5 over 23,363.80 ha (48.41%) of the Study Area. A**WL** occurs in bands and groves between A**SL**-3 and A**SL**-5 in the lower lying areas of loamy and hardpan plains and on broad drainage flats of the Study Area. A**W**L is similar to vegetation community GMUW in Van Vreeswyck *et al*., (2004); GMUW is a minor component of 14 LS and is represented only in Karijini National Park. A**WL** is likely to be the ecosystem at risk, 'Grove-intergrove mulga communities of the southern end of the northern apron of Hamersley Range', in Kendrick, 2001.

M**TG** is mapped over 6,978.55 ha (14.46%) of the Study Area on cracking clay gilgai plains. M**TG** is similar to vegetation community ARPG of Van Vreeswyck *et al*. (2004) and it is known to occasionally occur on conservation reserves in the Pilbara survey area but should be considered for further reservation. This site type was recommended to be considered for conservation and is likely one of the 'Perennial grassland communities in the Fortescue Valley', an ecosystem at risk in Kendrick, 2001.

While the grove-intergrove mulga communities and the perennial grassland communities in the Fortescue Valley were listed as ecosystems at risk in Kendrick, 2001 they have not been listed as a TEC or PEC since the report was produced.

The reservation priority for Beard's vegetation associations was assessed as part of the Biodiversity Audit carried out in the early 2000s (Kendrick, 2001), and Beard vegetation associations 29 and 111 were assessed as having low priority for reservation. Information on Biodiversity Audit II is available on DBCA's website (DBCA, 2018i); however, it does not include similar information on the reservation priorities for the vegetation associations of the Fortescue subregion. It does include a list of four community biodiversity assets and they are: Fortescue Marsh, Fortescue Valley Sand Dunes, Freshwater claypans of the Fortescue Valley and Millstream. None of these communities occurs in the Study Area.

An overall significance assessment of the vegetation types mapped by Maia within the Study Area was carried out and the factors assessed are listed in **Table 6.6**. Each vegetation type was assessed as having Moderate local significance. The Moderate ratings reflect the small area mapped of some of the vegetation types, the priority flora species recorded in most of the vegetation types and the potential GDE vegetation, sheet flow dependent vegetation and perennial tussock grassland in the more extensively mapped vegetation types. As the vegetation types have been previously described by Van Vreeswyck et al., occur in the surrounding areas and are not similar to the descriptions for any of the conservation significant ecological communities none of them have a high rating.

Table 6.5: Vegetation of the Divide and Fan land systems (Van Vreeswyck *et al*., 2004)

LS	Unit	Unit cover of LS (%)	Landform	Soil	Vegetation	Site description	Maia vegetation type
Divide	3	76%	**Sandplains** – level or gently undulating plains up to 10 km in extent, hummocky loose surfaces.	Red deep sands and red sandy earths	Hummock Grassland of hard spinifex species *Triodia lanigera* and *T. basedowii* with *Acacia* spp. and other shrubs, occasional mallee eucalypts and occasional *T. schinzii* (soft spinifex).	**SHSG** (sandplain hard spinifex grassland). *Triodia* hummock grassland with variable shrub layers. **SSSG** (sandplain soft spinifex grassland). Hummock grassland of *Triodia pungens, T. epactia* or *T. schinzii* with variable shrubs and occasional trees.	**THG**
Fan	3	60%	**Washplains** – almost level alluvial plains subject to overland sheet flow, occasionally with surface mantles of few to abundant pebbles of quartz and ironstone.	Red loamy earths.	Very scattered to scattered tall shrublands of *A. aneura* and other acacias with sparse *Senna* and *Ptilotus* spp. low shrubs. Also *A. xiphophylla* (snakewood) tall shrublands with chenopod low shrubs.	**HPMS** (hardpan plain mulga shrubland). Very scattered to scattered tall shrubland of mulga with well-developed mid and low shrub layers. **PSMS** (plain sparse mulga shrubland). Very scattered tall mulga shrubland with very sparse mid or low shrubs of *Acacia, Eremophila* and *Ptilotus* species which rarely form defined strata. **PSCS** (plain snakewood shrubland with chenopod low shrubs). Mid or tall very scattered to scattered shrubland of snakewood (*Acacia xiphophylla*) with a patchy understorey of chenopod low shrubs, other low shrubs and a few perennial grasses.	A**SL**-2, A**SL**-3, A**SL**-4, A**SL**-5, A**TG,**

LS	Unit	Unit cover of LS (%)	Landform	Soil	Vegetation	Site description	Maia vegetation type
Fan	4	15%	**Groves** – drainage foci occurring as prominent bands on units 2 and 3 mostly arcuate in shape, 10-50 m wide by up to 750 m long and arranged transverse to direction of sheet flow.	Red loamy earths	Moderately close to close tall shrublands / woodlands of *A. aneura* with tussock grasses in ground layer.	**GMGW** (grove mulga grassy woodland/shrubland). Moderately close to closed acacia woodland with a tussock grass ground layer. The dominant acacia is commonly *Acacia aneura* (mulga) but may occasionally be *A. catenulata*. **GMUW** (grove mulga woodland/shrubland). Moderately close to closed acacia woodland or tall shrubland.	A**WL**
Fan	5	5%	**Gilgai plains** – level plains up to 750 m in extent, gilgai microrelief.	Self-mulching cracking clays and red/brown non-cracking clays	Tussock grasslands of *Eragrostis xerophila* and *E. setifolia*.	**ARPG** (alluvial plain Roebourne Plains grass grassland). An *Eragrostis xerophila* tussock grassland with other minor grass species and occasionally with a poorly developed low shrub stratum.	M**TG**
Fan	6	3%	**Drainage tracts** – almost level drainage corridors up to 500 m wide on units 2 and 3, receiving more concentrated sheet flow, occasionally with shallow channels.	Red loamy earths	Scattered to moderately close tall shrublands with *A. aneura* and *A. xiphophylla*, tussock grasses in ground layer.	**DEGW** (drainage eucalypt and acacia grassy woodland). Occurs as an acacia and/or eucalypt woodland or tall shrubland with a tussock grass layer. **GMGW** (grove mulga grassy woodland/shrubland). Moderately close to closed acacia woodland with a tussock grass ground layer. The dominant acacia is commonly *Acacia aneura* (mulga) but may occasionally be *A. catenulata*.	A**SL**-1

Table 6.6: Extent, condition and local significance of the vegetation types of the Study Area

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10
Veg type	Area in Study Area (ha)	Cover in Study Area (%)	CSF in vegetation type (rank)	Vegetation condition	Weed species in vegetation type	Other attributes increasing conservation value e.g. TEC, PEC, GDE, sheet flow?	Occurs outside Study Area	Reservation status (Van Vreeswyck *et al.*, 2004)	Local conservation significance
A**SL**-1	2,540.10	5.26	*Gn* (P4)	Good	*Ma*, *Bb*, *Cc*	Potential GDE (*Eucalyptus victrix* in drainage foci)	Yes	Well represented	Moderate
A**SL**-2	362.82	0.75	*Gn* (P4)	Very good	*Ma*, *Pp*		Yes	Poor	Moderate
A**SL**-3	1,155.82	2.39	*Gn* (P4)	Very good	*Cc*, *Pp*	Sheet flow (mulga)	Yes	Poor	Moderate
A**SL**-4	772.63	1.60	No	Good	*Cc*, *Ma*		Yes	Moderate but considered a threatened site type	Moderate
A**TG**	3,579.00	7.41	*Gn* (P4)	Very good	*Cc*, *Ma*, *Vf*	Perennial tussock grassland	Yes	Poor	Moderate
A**WL**/A**SL**-3	4,420.08	9.16	*Gn* (P4)	Very good	*Bb*, *Cc*, *Ma*	Sheet flow (mulga)	Yes	Poor	Moderate
A**WL**/A**SL**-5	23,363.80	48.41	*Gn* (P4)	Very good	*Bb*, *Cc*, *Ma*, *Pp*, *Vf*	Sheet flow (mulga)	Yes	Poor	Moderate
M**TG**	6,978.55	14.46	No	Very good	*Cc*, *Ma*, *Pp*	Perennial tussock grassland	Yes	Occasional	Moderate
T**HG**	4,974.52	10.31	No	Excellent	*CC*, *Ma*		Yes	Poor	Moderate
Disturbed	119.73	0.25	NA	Poor /	NA	NA	NA	NA	NA
Total	48,267.0	100.00							

Notes: Column 1 – Veg type = vegetation type; Column 4 – CSF = conservation significant flora, *Gn* = *Goodenia nuda* and P4 = Priority Four species (*Goodenia nuda* recorded by GGE (2009) also included in conservation significance assessment); Column 6 - *Bb* = *Bidens bipinnata*; *Cc* = *Cenchrus ciliaris*; *Ma* = *Malvastrum americanum*; *Pp* = *Portulaca pilosa*; *Vf* = *Vachellia farnesiana*; Column 8 – assessment of occurrence outside Study Area based on land systems information and comparison of aerial imagery within and around the Study Area.

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6.3 Ecological Communities

The Study Area does not fall within/over the boundaries of a currently listed TEC.

Three PECs occur close to, but not within, the boundaries of the Study Area:

- The closest is a buffered patch of the Priority 3 'Vegetation of sand dunes of the Hamersley Range/Fortescue Valley' PEC, which is approximately 2 km from the south-western section of the Study Area at its closest.
- The second closest is the buffer in place around the Priority 1 'Fortescue Marsh (Marsh Land System)' PEC, which is approximately 8 km north north-west of the north western section of the Study Area.
- The third closest is the buffer in place around the Priority 3 Narbung Land System PEC, which is approximately 128 km north-west of the north-western corner of the Study Area.

These PECs (or the habitat/land system) do not occur in the Study Area.

Kendrick (2001) lists the Fortescue Marsh saltbush community; perennial grassland communities in the Fortescue Valley; and, grove-intergrove mulga communities of the southern end of the northern apron of Hamersley Range as ecosystems at risk in the Fortescue Plains subregion. Grove-intergrove mulga communities and perennial grassland communities of the Fortescue Valley occur in the Study Area. The grove-intergrove mulga communities occur in vegetation types A**WL** (Acacia Low Woodland), A**SL**-3 (Acacia Tall Shrubland) and A**SL**-5 (Acacia Tall Shrubland) and the perennial grassland communities in M**TG** (mixed Tussock Grassland) and A**TG** (Aristida Tussock Grassland). While these were noted as ecosystems at risk in the early 2000s they are not listed as conservation significant ecological communities.

6.4 Groundwater Dependent Vegetation

Large scale mapping (BoM, 2017a) indicates a low potential for terrestrial GDE vegetation in the areas of the Study Area where some of the Divide LS is mapped. These areas were visited but no eucalypts were found. The vegetation in these areas ranged from Acacia woodlands/tall shrublands (A**WL**/A**SL**-5) to Triodia hummock grassland (T**HG**).

Eucalyptus victrix occurs adjacent to a couple of areas where water appears to pond on the ground surface following rainfall events. *E. victrix* is regarded to be a facultative phreatophytic species, commonly utilising water from the unsaturated zone, and when necessary groundwater storage (Astron, 2015). It has been shown that short term declines in groundwater can have a significant impact on foliage density and sapwood flow in this species (Pfautsch *et al*., 2014; Rio Tinto, 2016). Trees that occur over shallow groundwater are more likely to be affected by groundwater abstraction than those growing over deeper groundwater; however, both have the potential to recover if there is significant rainfall in wet seasons (Astron, 2015; Pfautsch *et al*., 2014). Thus groundwater abstraction could have a negative impact on the health of *E. victrix* in the Study Area. However, information on current and predicted groundwater levels have not been used in this assessment.

6.5 Sheet Flow Dependent Vegetation

Mulga communities are one of the dominant vegetation types in semi-arid and arid Australia and the mulga species complex has many distinct growth forms, phyllodes and pod characteristics (Page and Grierson, 2010). Mulga is the common name for *Acacia aneura* but it is also applied to closely related species that often co-occur with mulga e.g. *A. ayersiana*, *A. minyura* and *A. paraneura*. Mulga covers approximately 20% of the Australian continent and occurs in the Chichester, Fortescue and Hamersley subregions of the Pilbara bioregion (Page and Grierson, 2010).

Mulga vegetation has been extensively shown to be highly dependent on sheet-flow (Winkworth, 1973; Dawson and Ahern, 1973; Tongway and Hindley, 2004) and to be sensitive to alterations to sheet flow (Saco *et al.*, 2010).

The 'level to very gently inclined alluvial plains with loamy soils over hardpan' of the Fan land system are subject to sheet water flow during and after rainfall. Surface hydrology processes are important for the ecological integrity of these systems. Any disturbance that restricts, diverts or concentrates surface sheet flows will affect vegetation communities (Van Vreeswyck *et al.*, 2004).

The vegetation in these areas is often densely clumped in arcuate bands (groves and sandy banks) with the long axes of the bands at right angles to the direction of sheet flow. The patterning is associated with the gently inclined surfaces receiving overland sheet flow and is further controlled by soil type and differential rates of water infiltration on variable depth soils over hardpan. The groves receive and retain sheet flow from up slope intergrove areas. Although generally stable, groves can be degraded by excessive grazing or by alterations to surface water flows (Van Vreeswyck *et al.*, 2004).

The vegetation types in which arcuate bands of mulga occur in the Study Area are highly likely to be sheet-flow dependent i.e. the mosaics of vegetation types A**W**L/A**SL**-3 and A**WL**/A**SL**-5.

6.6 LIMITATIONS

Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessement (EPA, 2016b) states that reports produced on flora and vegetation surveys for environmental impact assessment in Western Australia should contain a section outlining the limitations of the survey, and any survey-specific issues/limitations should be addressed in the limitations section of the report. A list of limitations to be addressed as standard, whether a limitation of the survey or not, is included in the Technical Guidance. The list of limitations is addressed with respect to this Level 2 survey in **Table 6.7**.

Table 6.7: Survey limitations

Limitation	Comment
Availability of contextual information at a regional and local scale	No regional contextual information is currently available for the Pilbara (the results of DPaW's Pilbara flora and vegetation survey are not available yet). Broad scale regional context is therefore provided by land systems mapping and Beard's vegetation mapping. Searches of relevant DBCA databases were requested and the EPBC Act search tool and NatureMap databases were used for background information. Some information is publicly available on different flora and vegetation surveys conducted in the vicinity of the Study Area and the closest of these have been used in this report.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	Scott Hitchcock, Conrad Slee and Raimond Orifici have conducted numerous surveys in the Pilbara region over the past 10 to 20 years. Michael Pezzaniti is a trainee botanist and was accompanied by either Scott Hitchcock or Raimond Orifici when on the survey. At least one specimen of all species recorded by Maia was collected. The specimens were identified by Conrad Slee, Cate Tauss and Raimond Orifici. They each have more than 10 years of experience in the taxonomy of the flora of the Pilbara. In addition to this, staff members at the WA Herbarium were liaised with when necessary and potential conservation significant flora taxa and *Triodia* specimens were submitted to the WA Herbarium for confirmation.

Limitation	Comment
Proportion of flora recorded and/or collected, any identification issues	Forty-nine quadrats and 1 relevé were assessed in the Study Area over various phases of the surveys carried out in the Study Area. Approximately 174 km of traverses were walked In the Study Area (not including those walked by GGE). Two hundred and fifty-three taxa from 34 families and 106 genera were recorded from the Study Area. Of these, 30% were annual species and 70% perennial. Twenty-one of the 253 taxa recorded were collected opportunistically and were not recorded at the quadrats/relevé assessed. Flowering material was used to identify 9.1% of the species list, fruiting material 34.8% and both flowering and fruiting material 25.7% of the species list i.e. 69.6% of the species list was identified from fertile material. These counts and percentages do not include two taxa that could not be confirmed beyond family and five beyond genus: ASTERACEAE sp., MALVACEAE sp., *Ptilotus* sp., *Senna* cf. *sericea*, *Senna* ? *stricta*, *Boerhavia* ? *coccinea* and *Aristida* sp. (inadequate material). A NatureMap search carried out for a circle centred on the centre of the Study Area and buffered by 20 km listed 42 plant species and another buffered by 30 km listed 225 plant species. The species list for the Study Area appears to be representative of the wider area. A species accumulation analysis was carried out and it indicated that 69% of the flora estimated to be in the Study Area was recorded. However, this percentage does not include the 21 taxa recorded opportunistically or those mentioned above. Selected specimens (*Rhagodia* spp., *Glycine* ? *falcata* and selected triodias) collected from the Study Area were submitted to the WA Herbarium for confirmation.
Was the appropriate area fully surveyed (effort and extent)?	Botanists assessed quadrats and walked traverses in the Study Area and also observed the vegetation while driving along the tracks and fencelines of the Study Area. Approximately 1.2% of the Study Area was directly assessed (not including traverses walked through the Southern Borefield area in 2009 by GGE. • Sixteen person days were spent by GGE in July/August 2009 in the Southern Borefield area (two botanists). • Ten person survey days were spent by Maia in October 2017 in the Southern Borefield Extension area (two botanists). • Thirty person days were spent by Maia in April 2018 in the Study Area (two experienced botanists and one trainee botanist). Therefore the botanists spent 56 survey days in the Study Area by botanists. Proposed clearing boundaries were not provided to Maia and therefore targeted surveys were not carried out over areas to be cleared for the borefield works. Also, predicted water drawdown contours were not supplied and it is not known whether the vegetation in all areas that could be affected by any potential change in water table level was assessed. Once modelled water drawdown contours are known, and if the water level in the north-eastern section of the Study Area is predicted to be lowered, a targeted survey should be carried out in the area where the large trees and eucalypts are to determine what species they are.

Limitation	Comment
Access restrictions within the survey area	While tracks cross through most of the Study Area and fence lines run north-south and west-east in some sections, there were areas with no tracks or fencelines. The botanists therefore walked traverses through most of these areas to sample the habitats shown in the aerial photograph.
Survey timing, rainfall, season of survey	The surveys were carried out in July/August 2009 (winter), October 2017 (spring) and April 2018 (autumn). The two main surveys were carried out at appropriate times of the year while the supplementary survey was carried out in spring but late in the year for the Pilbara. It was carried out at this time to meet the environmental assessment timelines for the project. Rainfall deciles modelled for Western Australia for the three months before the 2009, 2017 and 2018 surveys indicate that rainfall in the Study Area was average to below average (winter main survey), very much below average (spring supplementary survey) and average (autumn main survey). Based on this information, the vegetation could have been in average to below average condition when the surveys were carried out.
Disturbances that may have affected the results of the survey such as fire, flood or clearing	In October 2017 it rained while the botanists were at site; however, it took only half a day for the tracks to dry out and there was no flooding in the Study Area. A large patch in the north-eastern section of the Southern Borefield area had been burned within approximately 12 months of the April 2018 survey. This affected one of the GGE quadrats to be resampled, therefore a new quadrat was sampled at a location out of the burnt area but in the same vegetation type. Traverses were walked through the burnt area and diversity appeared to be no higher in this area than in the surrounding area; however, some of the species were more dominant than in unburnt areas e.g. *Cleome viscosa* and *Triodia pungens* juveniles. Smaller, more isolated patches that had been burnt at different times (estimated to have been from 2 to 5 years earlier) were also noted in 2017 and 2018. Traverses were also walked through these areas. As noted in GGE (2009), the Study Area is on active pastoral leases and some areas could be considered degraded from grazing pressure; particularly areas around the numerous wells and bores in the Study Area (12 currently functioning). The same was true at the few small drainage foci that were targeted and visited in April 2018, as these areas had been heavily grazed and trampled.

7 CONCLUSIONS

Dot points follow on the main findings regarding the flora and vegetation of the Study Area. Sets of dot points are followed by overall conclusions on the main areas covered by the preceding dot points.

7.1 FLORA

- Since 2009 253 taxa from 34 families and 106 genera have been recorded in the Study Area.
- No species protected by the EPBC Act or the WC Act were located in the Study Area.
- One priority species – *Goodenia nuda* (P4) – was recorded at 26 locations over the three surveys carried out in the Study Area.
- Using NatureMap records, 13 range extension species have been recorded in the Study Area (none are conservation significant flora species). Four of the five located in 2017/2018 have been recorded on the Roy Hill mining tenements (within 100 km of the Study Area) but they are not shown on NatureMap.
- No regional endemics were recorded in the Study Area and no novel species.

Species richness in the Study Area is less than that in study sites in the surrounding areas with more diverse topography, geology and soils.

- No nationally listed weed species were recorded in the Study Area and no plants declared in WA.
- Fifteen general weed species have been recorded in the Study Area since 2009. Four of the 15 have a high ecological impact and invasiveness rating – **Cenchrus ciliaris, *Chloris virgata, Malvastrum americanum* and *Vachellia farnesiana*. **Chloris virgata*, **Malvastrum americanum* and **Portulaca pilosa* are in the list of weeds that are a priority for research to determine their environmental impact in the Pilbara IBRA region and other adjacent areas; and, **Sonchus oleraceus* and **Citrullus lanatus* are in the list of weeds that are unlikely to cause environmental impact or at the upper limit of their ecoclimatic acclimatisation in the Pilbara IBRA region (Webber *et al*., 2017).

The weeds located in the Study Area reflect past and current grazing patterns. None of the weed species are nationally listed or declared species in WA.

7.2 VEGETATION

- Nine vegetation types have been mapped in the Study Area (including two mosaics). The most species rich types are Acacia Tall Shrublands A**SL**-1 (41.3 ± 6.8) and A**SL**-2 (40.0 ± 4.5) and the least species rich vegetation type is the Mixed Tussock Grassland M**TG** (18.8 ± 4.3).
- Vegetation condition ratings recorded in the Study Area ranged from Excellent to Poor/Degraded. The condition of approximately 84% of the Study Area vegetation is rated as Very Good, 10% as Excellent and 5% as Good, and the remaining 1% as either Poor or Poor/Degraded. Vegetation condition is best in areas mapped as Triodia Hummock Grassland (Excellent) and poorest (Poor) in the areas adjacent to station bores/wells and at drainage foci.

Species richness is highest in two of the Acacia Tall Shrublands mapped in the lower/wetter parts of the Study Area and lowest in the Mixed Tussock Grassland. Vegetation condition ratings mostly reflect the palatability of the vegetation to grazing cattle and proximity to bores/wells and drainage foci in the Study Area.

7.3 REGIONAL AND LOCAL SIGNIFICANCE - FLORA AND VEGETATION

- The regional significance of the *Goodenia nuda* (P4) located in the Study Area has been assessed as Low and the local significance as Moderate.

The regional and local conservation significance ratings for the *Goodenia nuda* of the Study Area reflect their listing level, their widespread distribution in the Fortescue subregion and surrounding bioregions and large number of plants recorded in the Study Area. The local significance rating (Moderate) reflects the number of plants that have been recorded in the Study Area relative to the surrounding, local, areas, and this will be affected by the survey effort in the Study Area and flora records vouchered at the WA Herbarium. For example, Ecologia recorded *G. nuda* at 13 locations in the Roy Hill 1 project tenements (Ecologia, 2009**c**) and these are not shown on NatureMap.

- The regional significance of the Divide land system in the Study Area has been assessed as Moderate and the Fan as High. These ratings reflect the mapped extent of these two land systems in the Fortescue subregion and their reservation in DBCA managed lands. The local significance ratings are Low (Divide land system) and Moderate to High (Fan land system). These ratings reflect the current area of these land systems in the Study Area and their extent in the bioregion/subregion.
- The regional significance of BVA 29 and 111 of the Study Area is rated as Low to Moderate and Low respectively. This rating is based on the protection level of these BVAs in the Fortescue subregion. The local significance ratings are Low to Moderate for BVA 29 and Low for BVA 111. The ratings reflect the current area of the BVAs in the Study Area relative to their extent and reservation in the bioregion/subregion.

The regional and local significance of the land systems and BVAs of the Study Area reflects their cover in the Study Area relative to their regional and local mapped extent and the degree of reservation in DBCA lands e.g. the Fan land system is mapped over a relatively small area in the Fortescue subregion, none of it occurs on reserved lands and therefore it is rated as having High regional significance. As 31.9% of its current extent occurs in the Study Area its local significance is rated as Moderate to High.

- None of the vegetation types mapped in the Study Area match the descriptions for the PECs located in the surrounding area.
- Some of the habitats of the Study Area are subject to sheet flow and the banded mulga in these areas will depend on this sheet flow.
- Small drainage foci occur in the Study Area and *Eucalyptus victrix* was recorded at two of them. As *E. victrix* can be facultatively phreatophytic any reduction in the water table level from water extraction could affect the health of this species in these areas. Another drainage focus in the north-eastern corner of the Study Area appears to have large trees at its centre and, while this area was not assessed, given the apparent size of the trees in the aerial image they could possibly depend on groundwater to some degree.
- In 2001 one of the ecosystems at risk listed for the Fortescue subregion was the perennial tussock grasslands - two tussock grasslands were mapped in the Study Area.
- The nine vegetation types (including the two mosaics) mapped in the Study Area are all rated as having Moderate local significance. These ratings reflect the area covered by the vegetation type, the presence of *Goodenia nuda* (P4), the number of weeds in the vegetation type, potential groundwater dependent vegetation, sheet flow dependent mulga and tussock grasslands and their reservation in protected areas.

Sheet flow dependent mulga, the facultatively phreatophytic *Eucalyptus victrix* and the perennial grasslands could be affected by development of the borefield.

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9 MAPS

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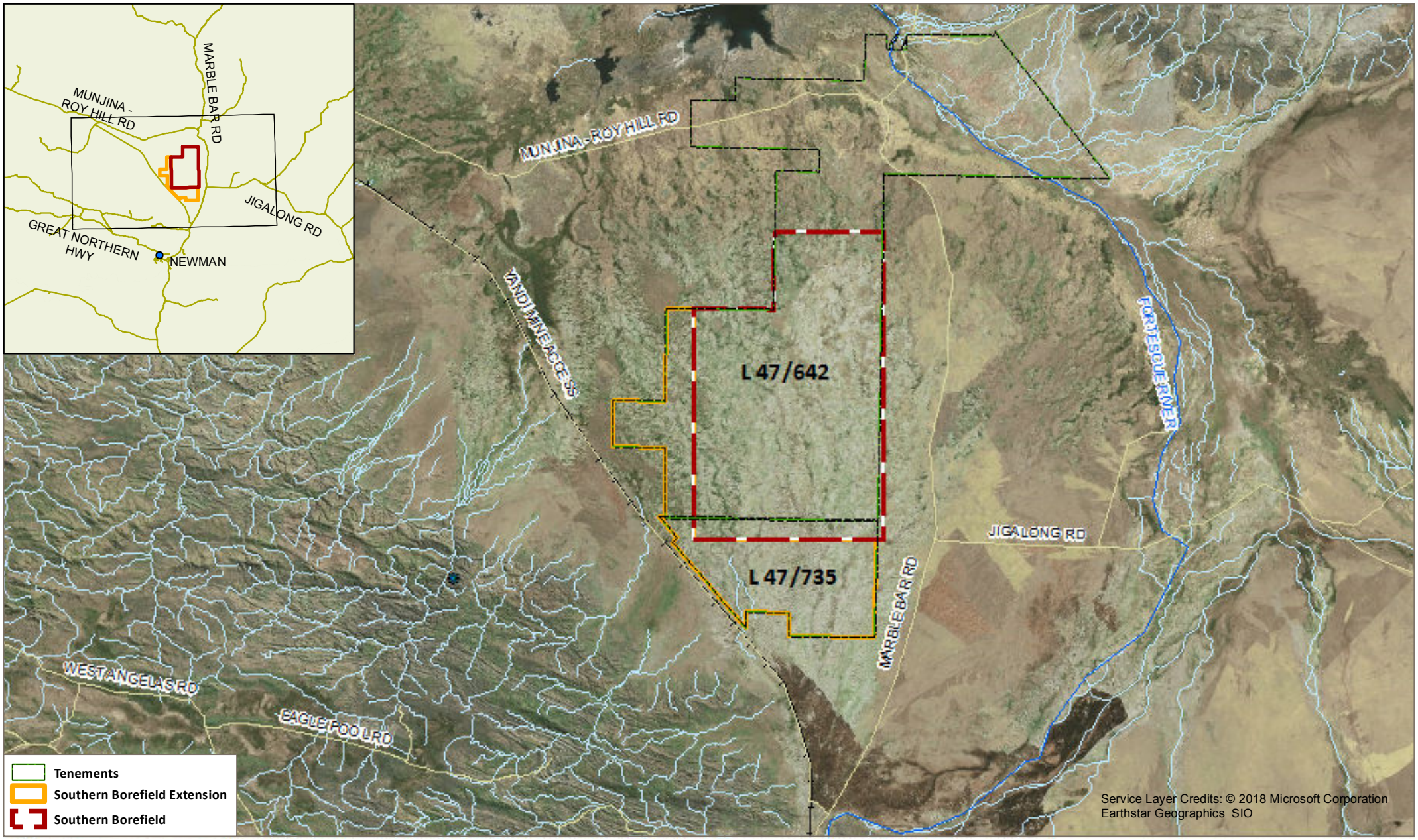

Location Map

Towns
Roads
Railways
Springs
Rivers
Watercourse lines

General location

maia

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.1
Prepared for: Roy Hill
Drawn by: SH
Date: 02/07/2018
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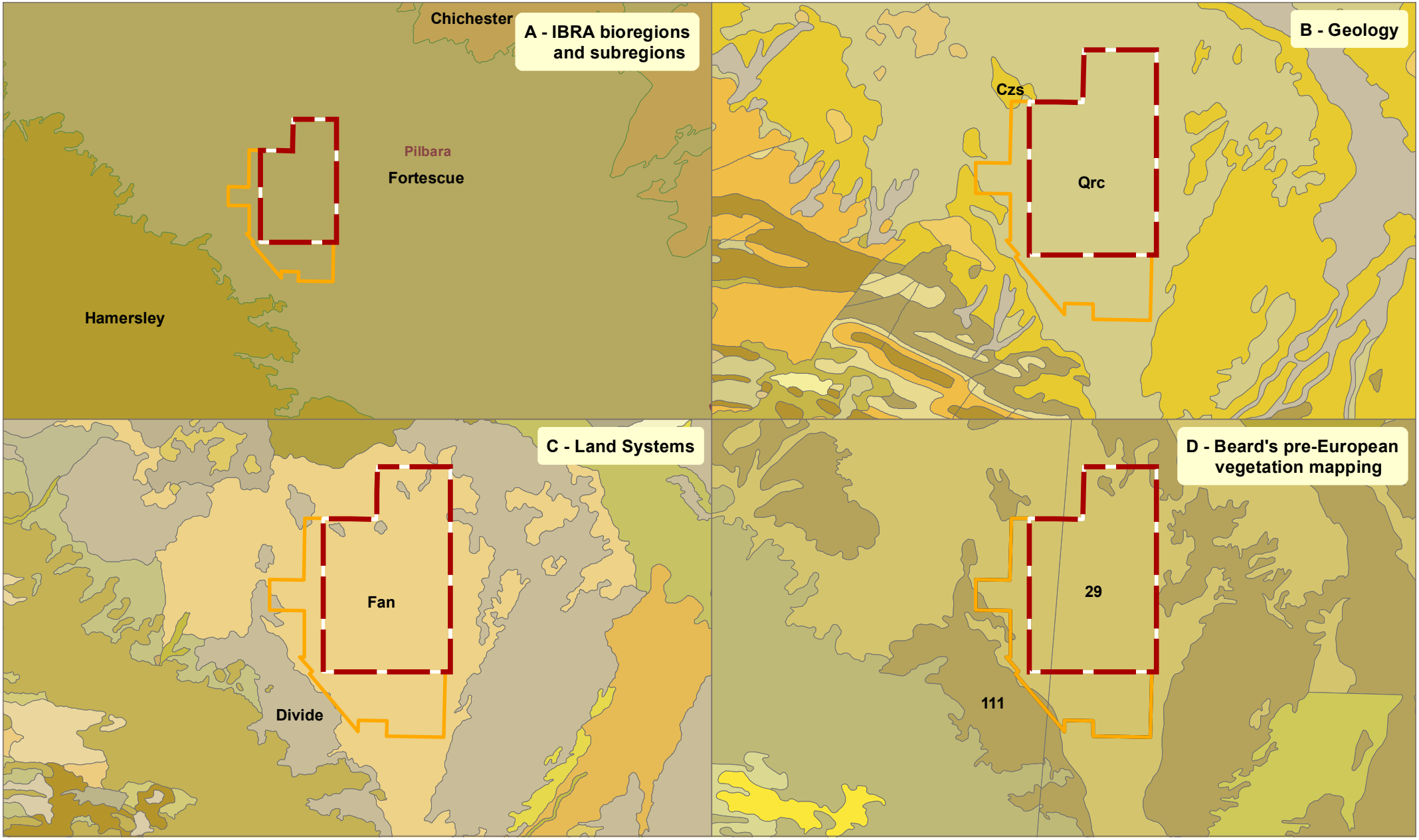

Location Map
Karatha
Newman
Wiluna
Geraldton
Kalgoorlie
Perth

Southern Borefield Extension
Southern Borefield

IBRA bioregions and subregions, geology, land systems and Beard's pre-European vegetation mapping (vegetation associations)

maia

N

Datum: GDA 1994, MGA 50

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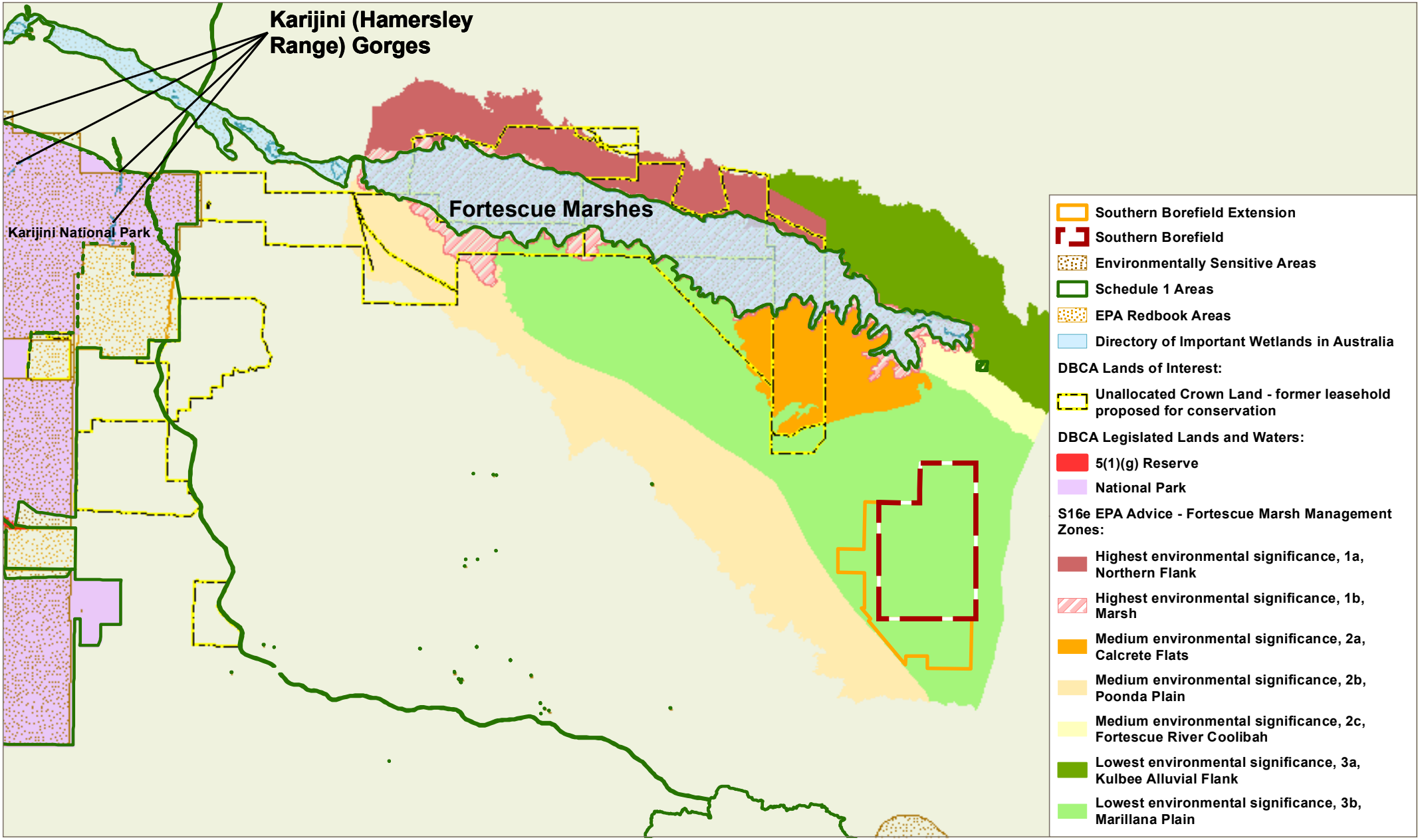

Protected and significant areas

maia

N

0 17.5

Kilometres

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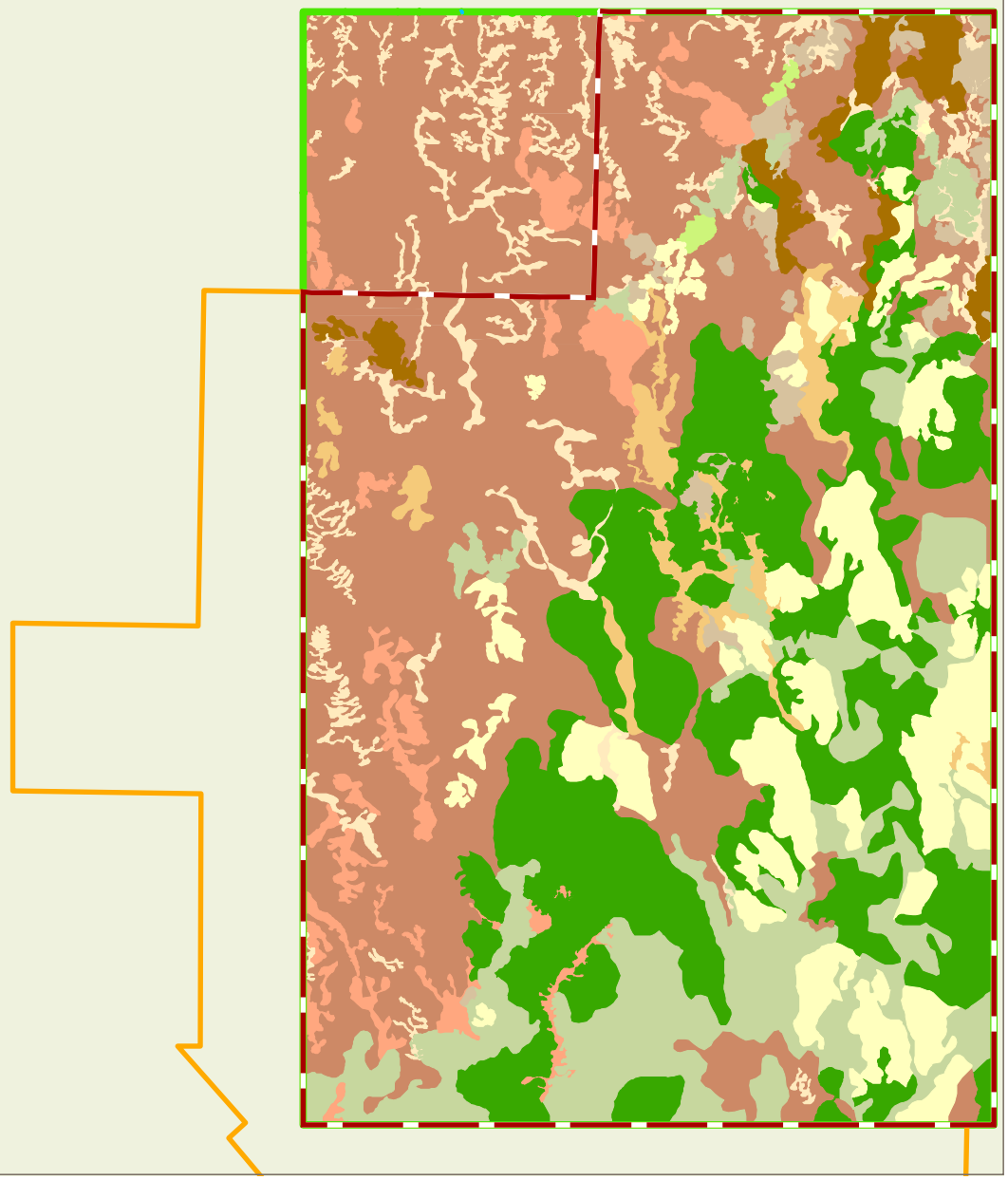

GGE survey area

Southern Borefield Extension

Southern Borefield

W1 Low Woodland of *Acacia aneura* over Isolated Mid Shrubs to a Sparse Mid Shrubland with *Acacia victoriae*, *A. tetragonophylla* and *Ptilotus obovatus* common over Isolated Chenopod Shrubs to an Open Chenopod Shrubland with *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena cornishiana* common.

W2 Open Low Woodland to Low Woodland of *Acacia aneura* and/or *A. pruinocarpa* and +/- Isolated Low Trees of *Corymbia hamersleyana* with Isolated Tall Shrubs to an Open Tall Shrubland with *Acacia ancistrocarpa*, *A. pachyacra* and *Rhagodia eremaea* common and a Hummock Grassland of *Triodia basedowii*.

W3 A Low Open Forest of *Acacia aneura* over a Sparse Mid Shrubland with *Acacia tetragonophylla* and *Eremophila forrestii* common over Isolated Tussock Grasses to an Open Tussock Grassland of *Eragrostis* species, *Aristida latifolia* and *Eulalia aurea*.

W4 Open Low Woodland to Open Low Forest of *Acacia citrinoviridis*+/- *A. aneura* over an Open Low Shrubland of *Senna* and chenopod species over Isolated Tussock Grasses and Forbs.

W5 A Low Woodland of *Acacia aneura* and *A. pruinocarpa* over a Sparse Tall Shrubland to Open Tall Shrubland of *Acacia* and *Eremophila* species over a mixed Tussock Grassland with *Aristida latifolia* and *Eragrostis* species common.

W6 Open Low Woodland to Tall Woodland of *Acacia pruinocarpa* over a Sparse Tall Shrubland with *Acacia ancistrocarpa* and *Anthobolus leptomerioides* common in a Hummock Grassland of *Triodia schinzii*.

W7 Low Open Woodland of *Corymbia aspera* +/- *Corymbia hamersleyana* over an Open Mid Shrubland of *Acacia aneura* and *A. ancistrocarpa* in a Tussock Grassland of *Chrysopogon fallax* and *Eulalia aurea*.

S1 Isolated Tall Trees of *Acacia aneura* and *A. paraneura* over Isolated Mid Shrubs to Sparse Mid Shrubland with *Acacia tetragonophylla* common over Isolated Low Shrubs, Forbs and Tussock Grasses with *Sclerolaena cornishiana*, *Aristida contorta* and *A. latifolia* common.

S2 Isolated Tall Shrubs to a Sparse Tall Shrubland with *Acacia ancistrocarpa* and *A. tetragonophylla* common over an Open Low Shrubland of *Senna artemisioides* subsp. *helmsii* and *S. artemisioides* subsp. *oligophylla* over a Tussock Grassland of *Aristida contorta*, *A. latifolia* and *Eragrostis* species.

S3 Isolated Tall Trees of *Acacia aneura* over a Tall Shrubland of *Acacia victoriae* over an Open Tussock Grassland of *Eragrostis setifolia*.

G1 Tussock Grassland of *Aristida latifolia*, *Eragrostis eriopoda* and *E. setifolia* with patches of a Sparse Low Shrubland to Open Low Shrubland of *Senna artemisioides* subsp. *helmsii* and *S. artemisioides* subsp. *oligophylla* and Isolated Forbs to Sparse Forbland with *Goodenia prostrata* and Asteraceae species common.

G & G Environmental (2009) vegetation mapping

maia

N

0 3.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.4

Prepared for: Roy Hill

Drawn by: RH SH

Date:30/06/2018

Version: 2 **Size:** A4

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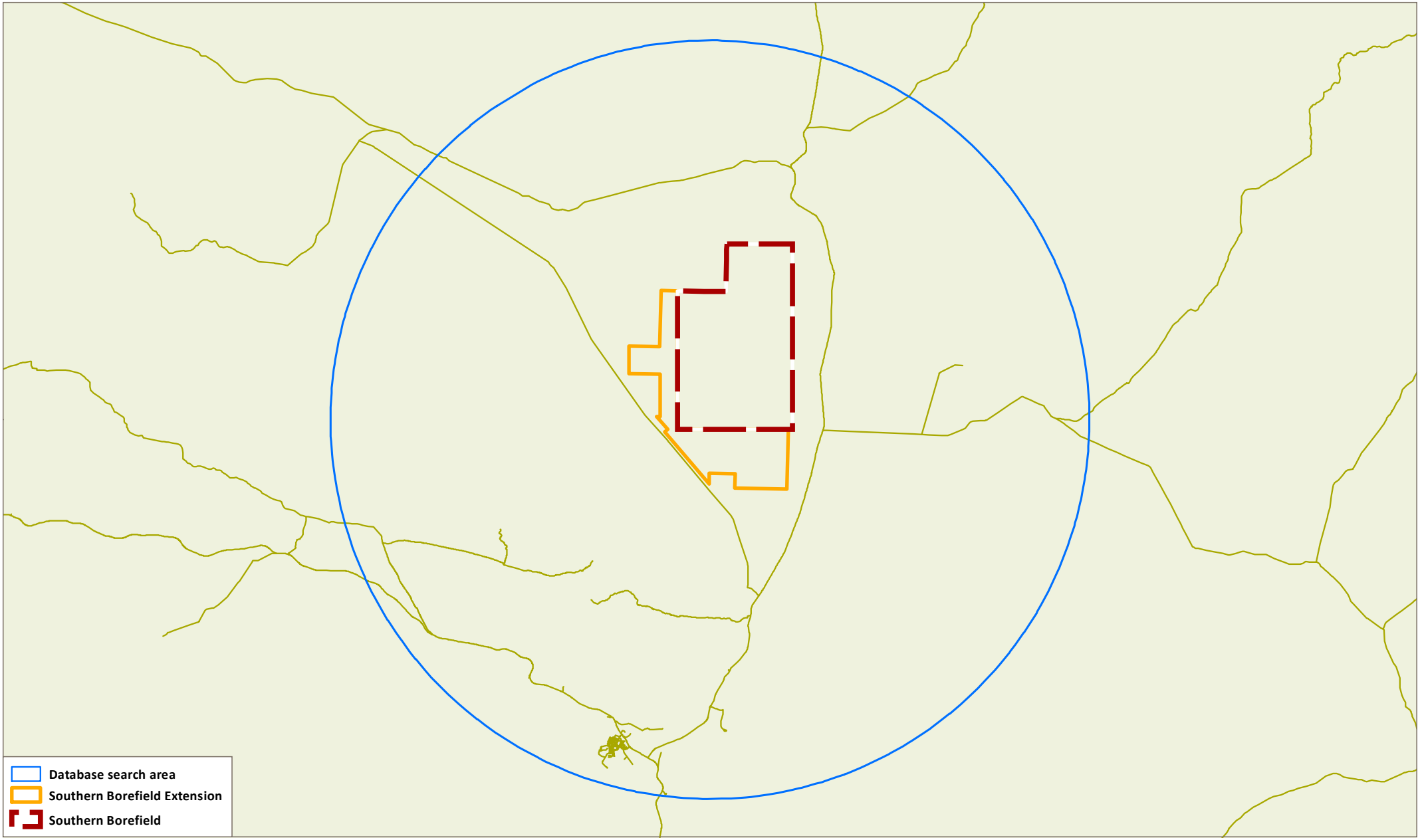

Location Map

Roads

Database search area

maia

N

0 15

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.5
Prepared for: Roy Hill
Drawn by: SH
Date: 30/06/2018
Version: 2 **Size:** A4

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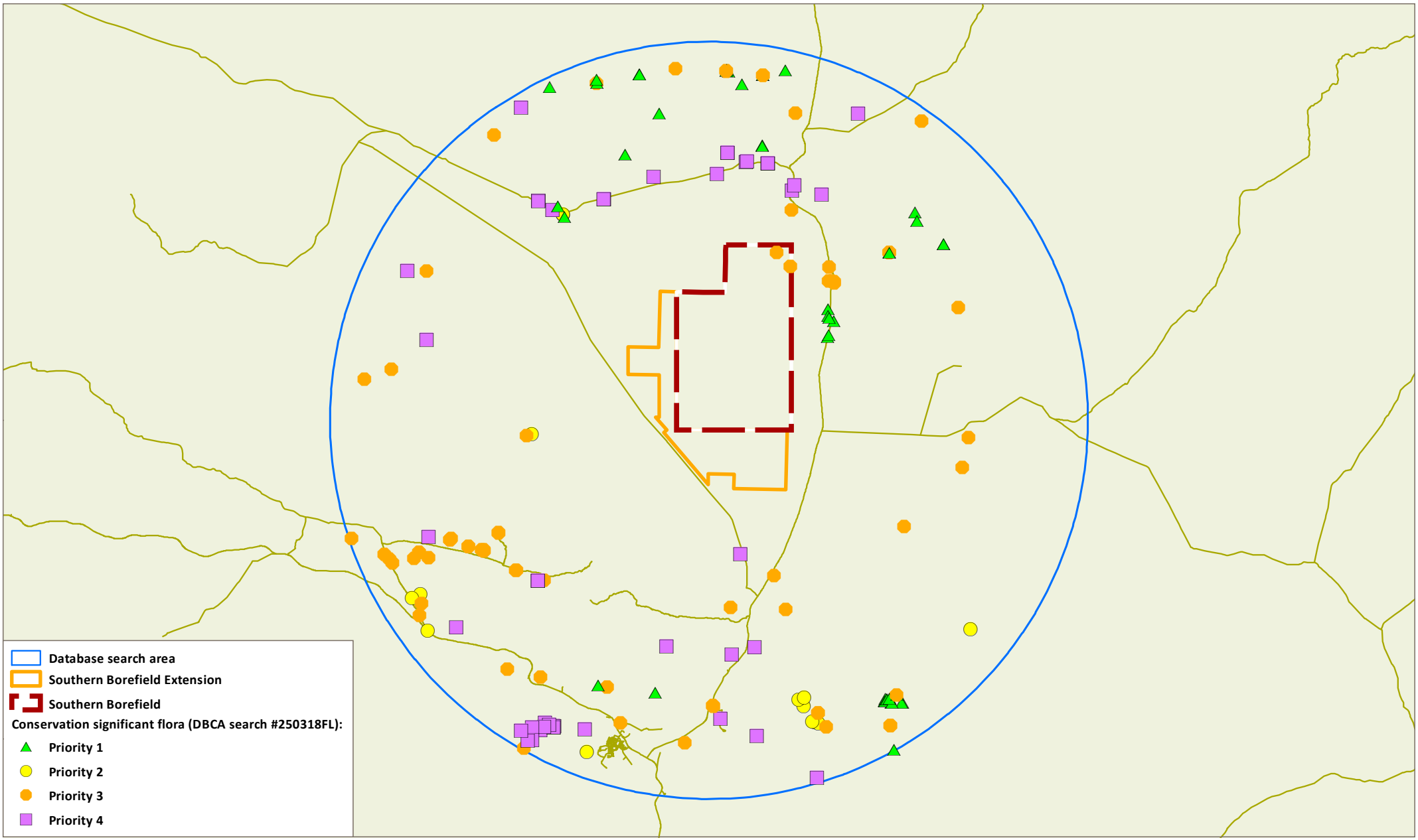

Location Map

Roads

Conservation Significant Flora
(DBCA search reference #250318FL)

maia

N

0 15

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.6
Prepared for: Roy Hill
Drawn by: SH
Date: 30/06/2018
Version: 2 **Size:** A4

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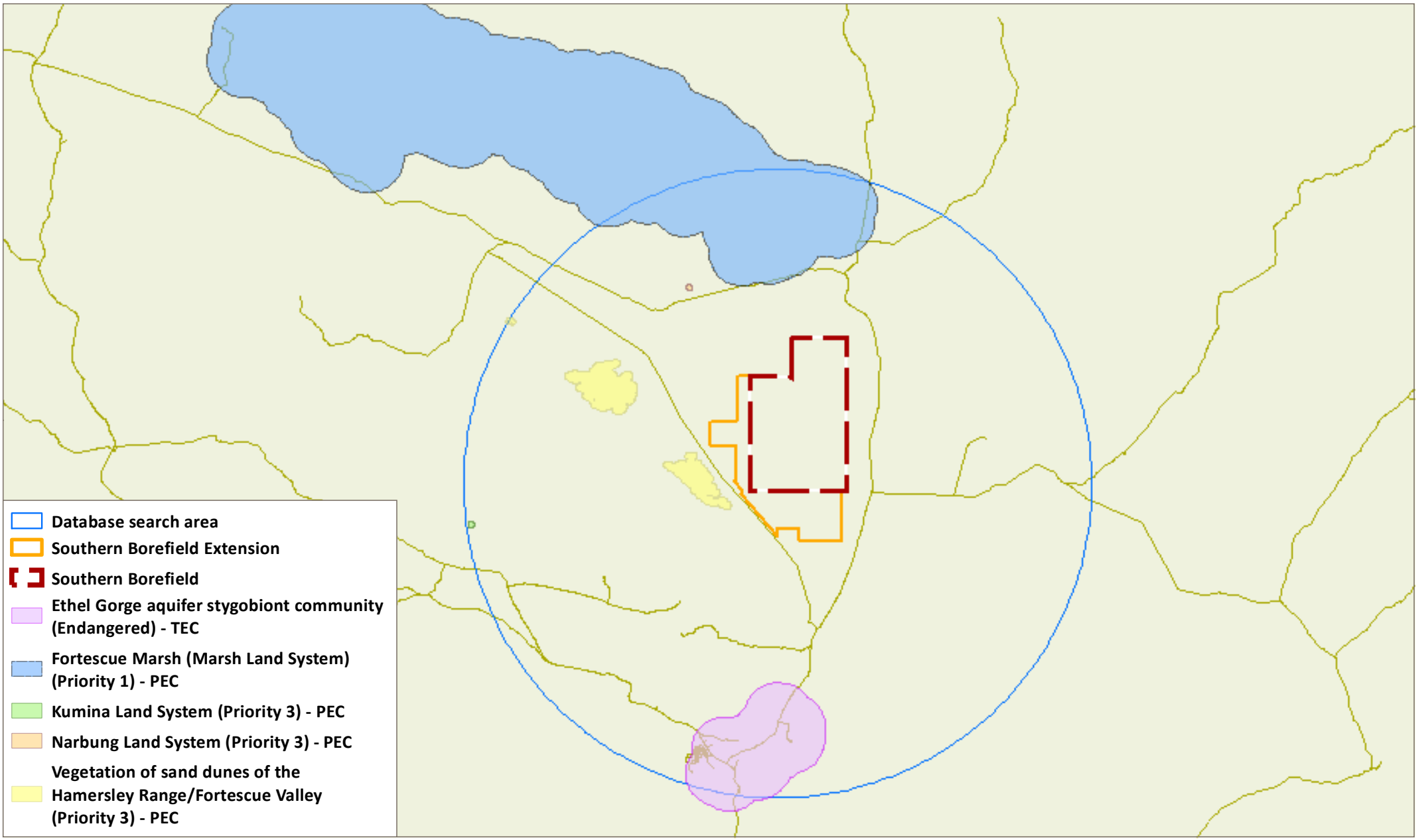

Location Map

Roads

Significant Ecological Communities
(DBCA search reference #04-0418EC)

maia

N

0 17.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.7
Prepared for: Roy Hill
Drawn by: SH
Date: 03/07/2018
Version: 4 **Size:** A4

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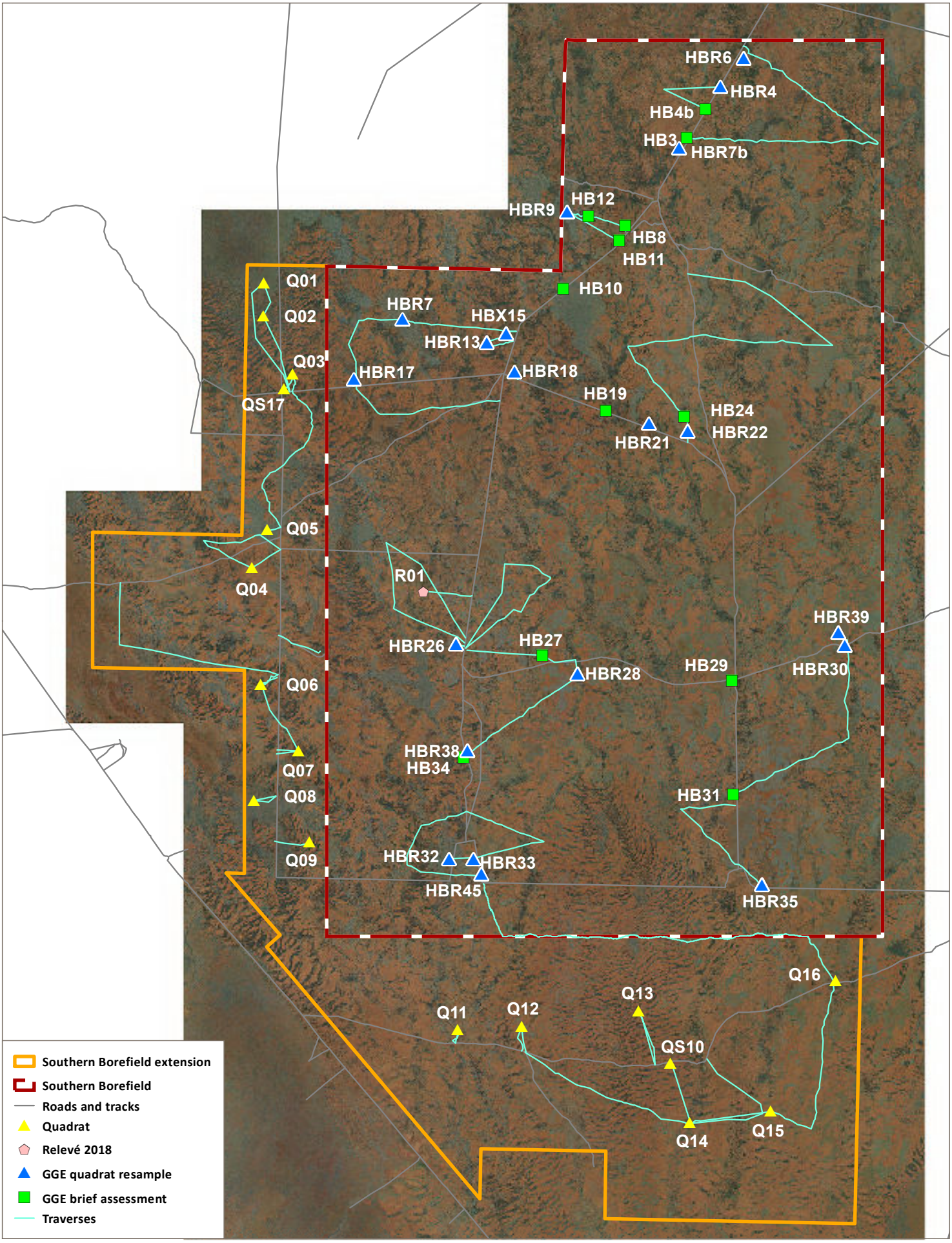

maia

Location Map

Quadrats, relevés and traverses

N

0 2.25

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.8

Prepared for: Roy Hill

Drawn by: SH

Date:01/07/2018

Version: 3 **Size:** A4

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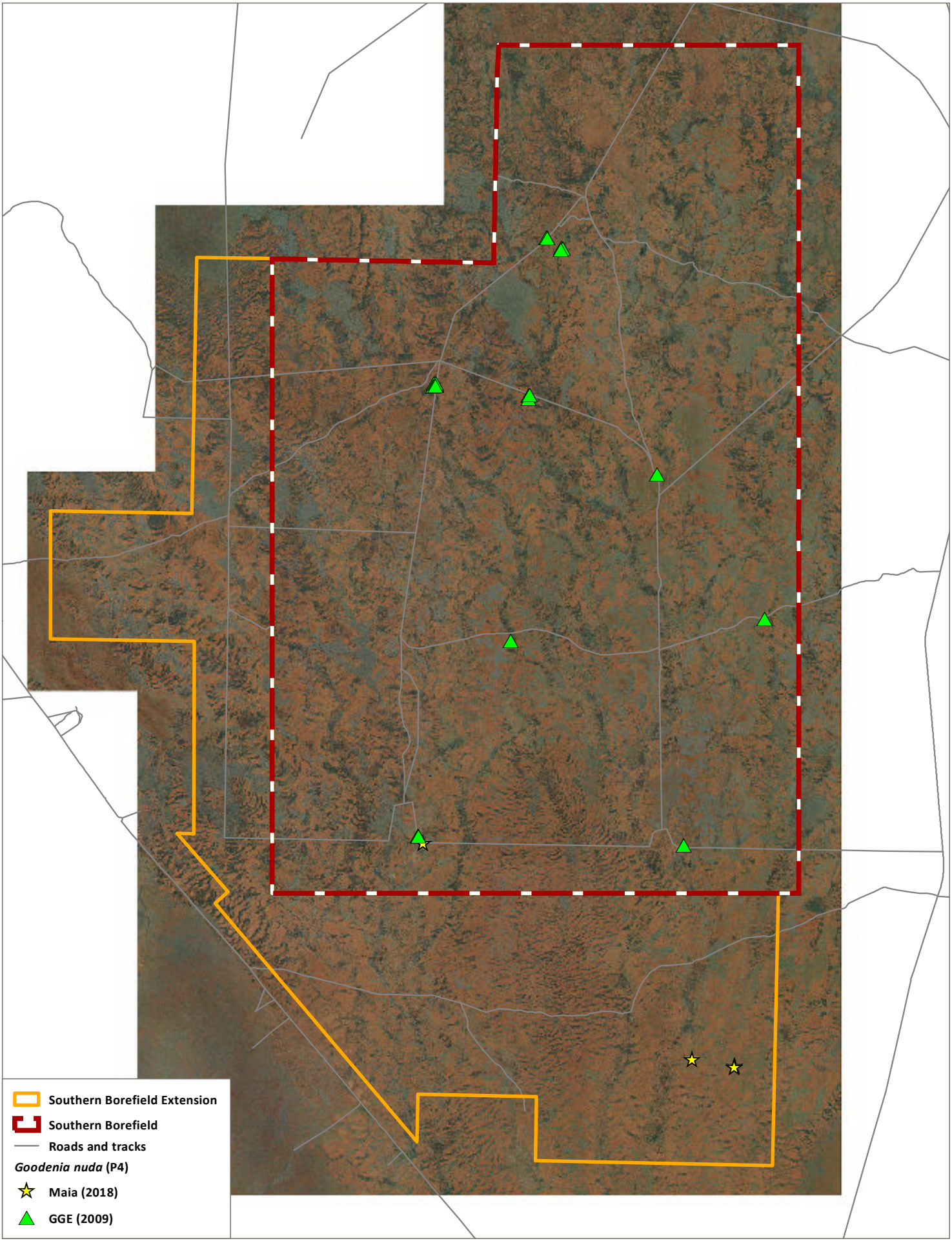

maia

Location Map

Conservation significant flora

N

0 2.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.9

Prepared for: Roy Hill

Drawn by: SH

Date: 19/06/2018

Version: 2 **Size:** A4

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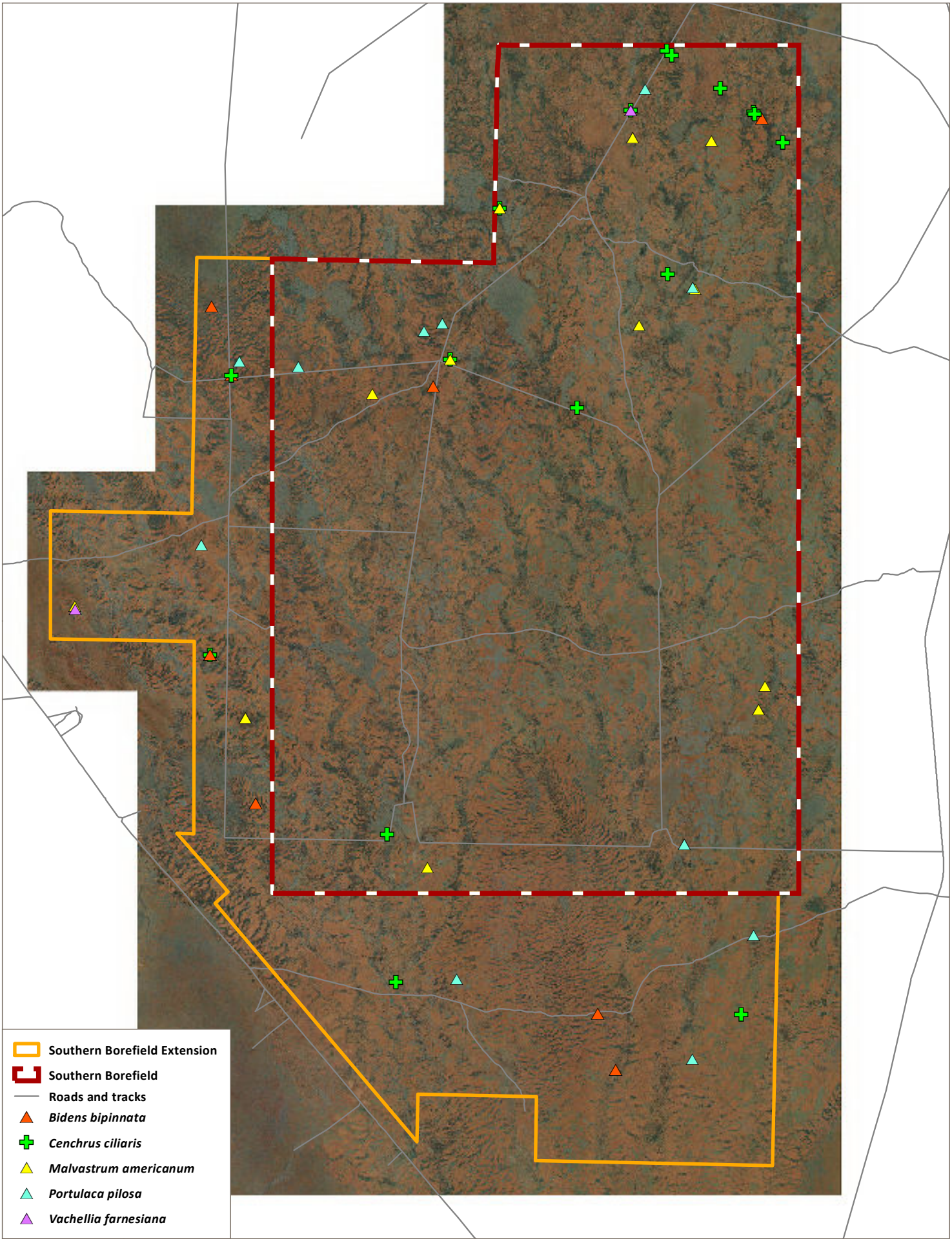

maia

Location Map

Weeds

N

0 2.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.10

Prepared for: Roy Hill

Drawn by: SH

Date: 30/06/2018

Version: 2 **Size:** A4

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Southern Borefield Extension

Southern Borefield

Maia quadrat

Relevé 2018

GGE quadrat resample

GGE brief assessment

Vegetation types:

ASL-1 Open Tall Acacia Shrubland (*Acacia macraneura*, *A. tetragonophylla*, *A. ancistrocarpa*) with an Open mixed Tussock Grassland (*Chrysopogon fallax*, *Aristida latifolia* and *Eulalia aurea* common) and Isolated Low Trees of *Corymbia hamersleyana*, *C. aspera* and/or *Acacia pruinocarpa*.

ASL-2 Open mixed Acacia Tall Shrubland (*Acacia aptaneura*, *A. tetragonophylla*, *A. synchronicia* common) with an Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana*, *Eremophila lanceolata* over a Sparse Tussock Grassland of *Aristida latifolia*, *A. contorta* and *Eragrostis xerophila*.

ASL-3 Open mixed Acacia Tall Shrubland (*Acacia incurvaneura*, *A. tetragonophylla* and *A. aptaneura* common) with an Open mixed Mid Shrubland (*Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *oligophylla*, *S.* ? *sericea* x *symonii*) over a Sparse Tussock Grassland of *Aristida latifolia* and *A. contorta*.

ASL-4 Open Tall Shrubland of *Acacia xiphophylla* +/- *A. aptaneura* over an Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Solanum lasiophyllum*, and *Senna artemisioides* subsp. *oligophylla* over a Low Sparse Chenopod Shrubland of *Sclerolaena cornishiana*.

ATG Open Tussock Grassland of *Aristida contorta* and *A. latifolia* with a Sparse Mid Shrubland of *Senna glaucifolia*, *S. artemisioides* subsp. *helmsii* and *Acacia synchronicia* and Isolated Tall Shrubs of *Acacia synchronicia* and *A. tetragonophylla*.

AWL/ASL-3 Mosaic - AWL: Low Woodland of *Acacia aptaneura* and *A. macraneura* with a mixed Tussock Grassland (*Aristida latifolia*, *A. contorta* and *Enneapogon caerulescens* common) and an Open Low Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and/or *Ptilotus obovatus* var. *obovatus*.
ASL-3: Open mixed Acacia Tall Shrubland (*Acacia incurvaneura*, *A. tetragonophylla* and *A. aptaneura* common) with an Open mixed Mid Shrubland (*Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *oligophylla*, *S.* ? *sericea* x *symonii*) over a Sparse Tussock

AWL/ASL-5 AWL: Low Woodland of *Acacia aptaneura* and *A. macraneura* with a mixed Tussock Grassland (*Aristida latifolia*, *A. contorta* and *Enneapogon caerulescens* common) and an Open Low Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and/or *Ptilotus obovatus* var. *obovatus*.
ASL-5: Sparse to Open Tall Shrubland of *Acacia aptaneura*, *A. tetragonophylla* +/- *A. paraneura* with a Sparse Tussock Grassland of *Aristida contorta* and *A. latifolia* and Isolated

MTG Closed Tussock Grassland of *Eragrostis xerophila* and *Aristida latifolia* with an Open Low Shrubland of *Senna symonii* and *Senna artemisioides* subsp. *helmsii*.

THG Hummock Grassland of *Triodia basedowii* / or *T. schinzii* with a Sparse Tall Shrubland of *Acacia ancistrocarpa*, *A. pachyacra and A. melleodora* with Isolated Low Trees of *Acacia pruinocarpa*.

Cleared

maia

Location Map

Legend for vegetation types

N

0 3.25

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.11

Prepared for: Roy Hill

Drawn by: SH

Date: 30/06/2018

Version: 2 **Size:** A4

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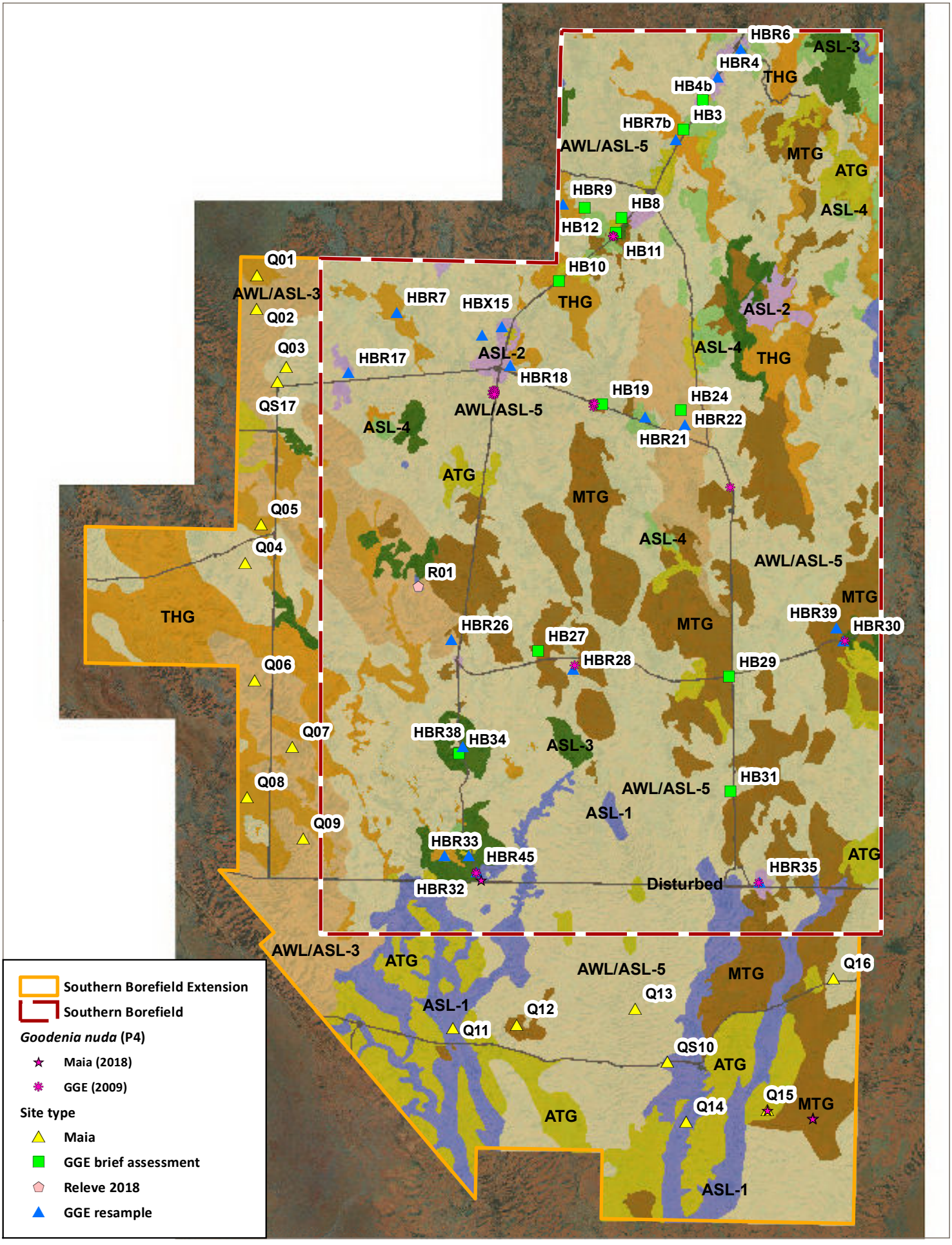

maia

Location Map

Vegetation types

N

0 2.25

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.12

Prepared for: Roy Hill

Drawn by: SH

Date: 03/07/2018

Version: 6 **Size:** A4

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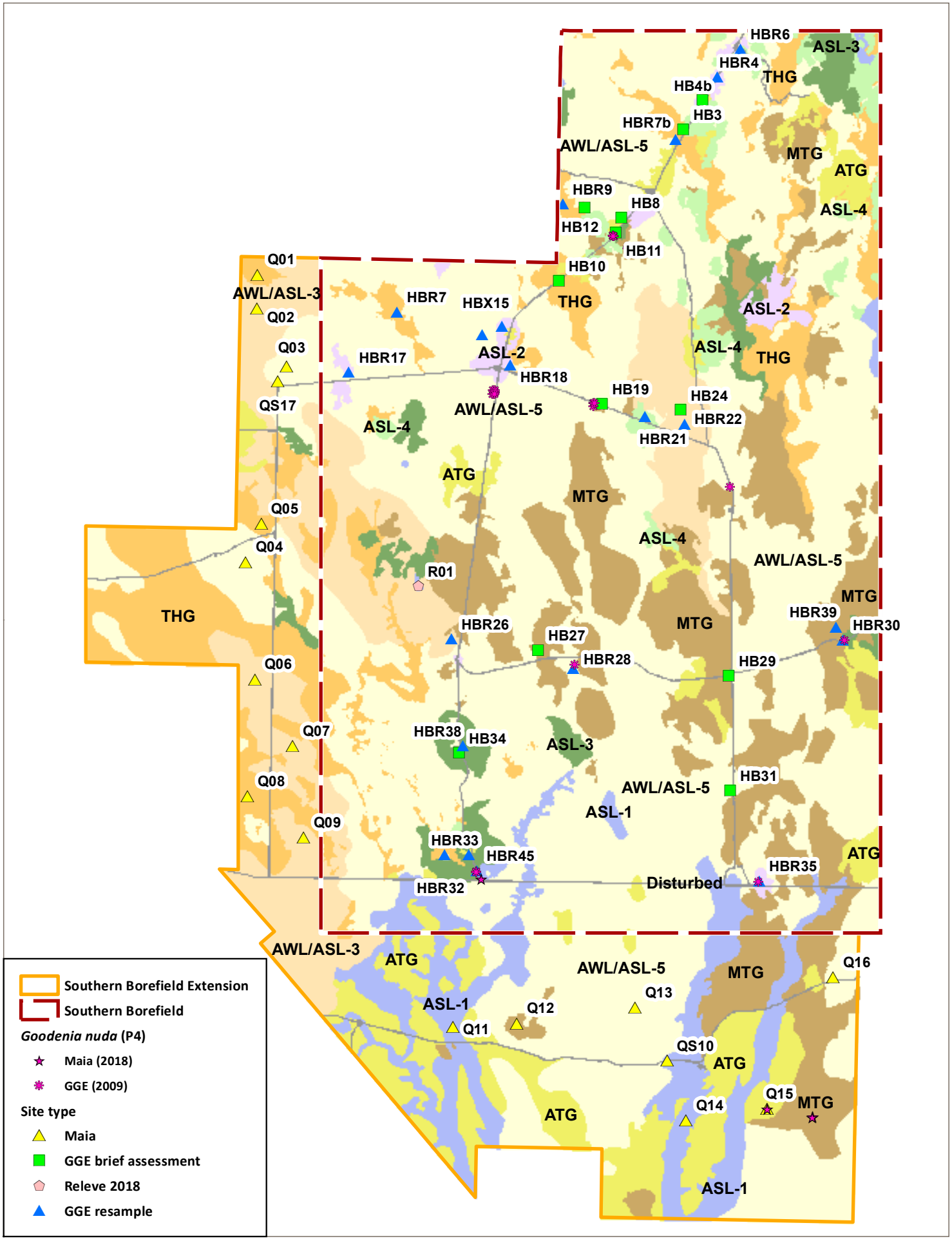

Location Map

Karatha
Newman
Wiluna
Geraldton
Kalgoorlie
Perth

Vegetation types

N

0 2.25

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.13
Prepared for: Roy Hill
Drawn by: SH
Date: 03/07/2018
Version: 6 **Size:** A4

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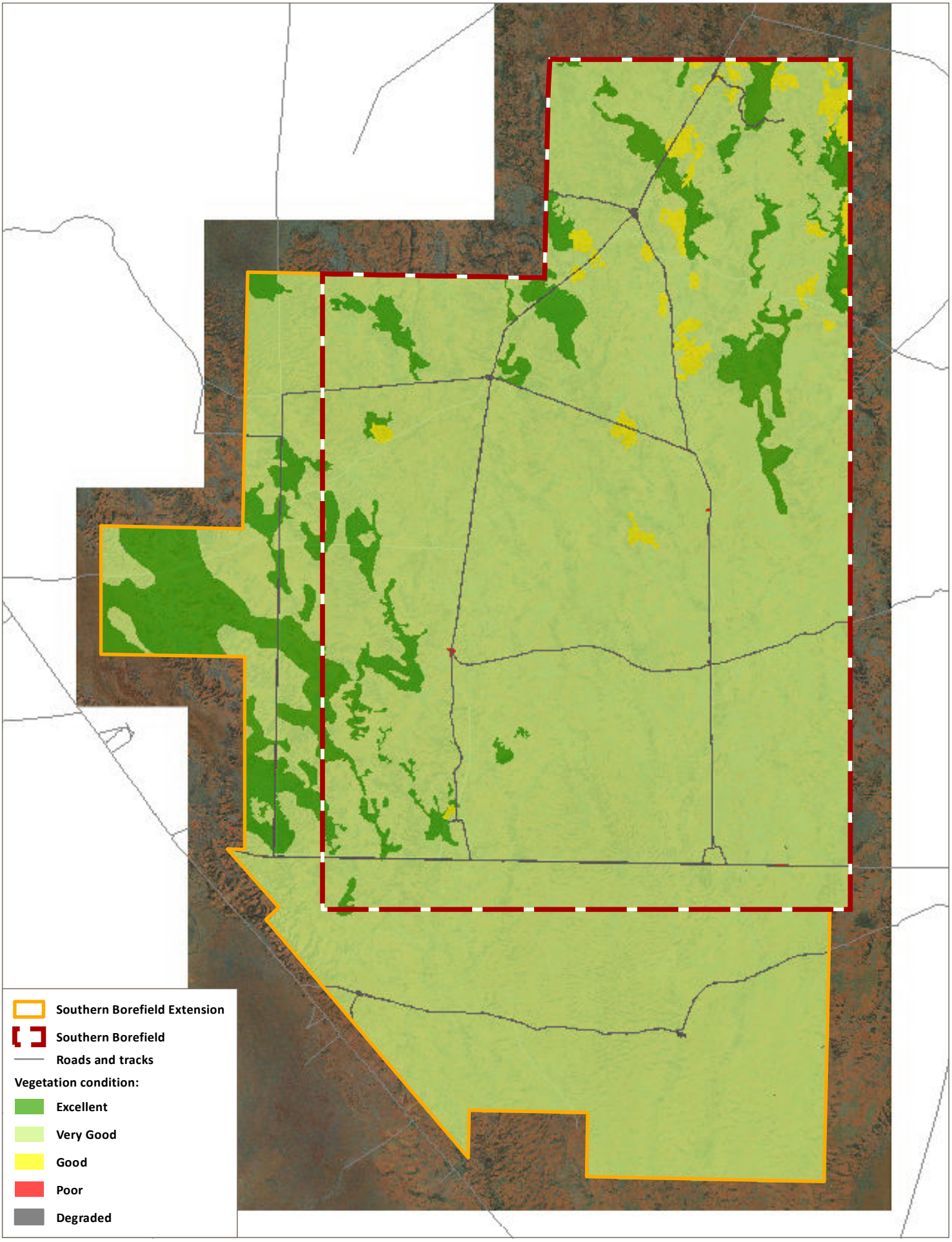

maia

Location Map

Vegetation condition

N

0 2.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 9.14

Prepared for: Roy Hill

Drawn by: SH

Date: 30/06/2018

Version: 2 **Size:** A4

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APPENDIX 1: DATABASE AND LITERATURE SEARCH RESULTS

Figure A1.1: EPBC Act Protected Matters Search Tool results (DotEE, 2018a; search number DHW02E)

Australian Government
Department of the Environment and Energy

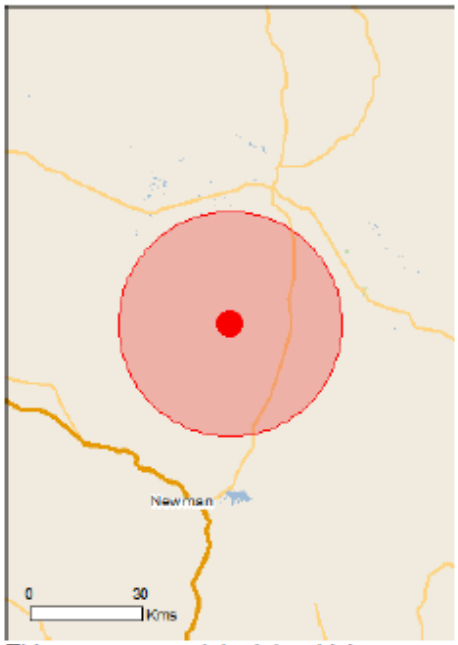
EPBC Act Protected Matters Report

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.

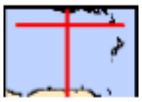
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/03/18 14:53:43



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

Coordinates
Buffer: 30.0Km



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:	9
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:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	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:	10
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 likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	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
Rhinonicteris 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		

Name	Threatened	Type of Presence
Hirundo rustica Barn Swallow [662]		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
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

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 known 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
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 Resouces 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
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur 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

Name	Status	Type of Presence 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

-22.96917 119.84944

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.

Figure A1.2: NatureMap search results (wider area 40 km buffer) (DPaW, 2007-)

NatureMap

NatureMap Species Report_40km

Created By Scott Hitchcock on 27/02/2018

Kingdom	Plantae
Core Datasets Only	Yes
Method	'By Circle'
Centre	119° 50' 58" E,22° 58' 09" S
Buffer	40km
Group By	Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	482	865
Priority 1	8	20
Priority 2	2	4
Priority 3	12	37
Priority 4	3	26
TOTAL	507	952

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Priority 1					
1.	15028	*Eremophila pilosa*		P1	
2.	40643	*Eremophila sp. Hamersley Range (K. Walker KW 136)*		P1	
3.	17363	*Eremophila spongiocarpa*		P1	
4.	8030	*Helichrysum oligochaetum*		P1	
5.	48312	*Hibiscus campanulatus*		P1	
6.	19420	*Myriocephalus scalpellus*		P1	
7.	44061	*Samolus sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)*		P1	
8.	17296	*Stemodia sp. Battle Hill (A.L. Payne 1006)*		P1	
Priority 2					
9.	40560	*Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 16706)*		P2	
10.	17790	*Isotropis parviflora*		P2	
Priority 3					
11.	23528	*Acacia subtiliformis*		P3	
12.	34810	*Amaranthus centralis*		P3	
13.	17918	*Aristida jerichoensis var. subspinulifera*		P3	
14.	14859	*Crotalaria smithiana*		P3	
15.	20264	*Eucalyptus rowleyi*		P3	
16.	29381	*Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (O'Meara's Goodenia)*		P3	
17.	12832	*Gymnanthera cunninghamii*		P3	
18.	17716	*Indigofera gilesii*		P3	
19.	19594	*Iotasperma sessilifolium*		P3	
20.	20168	*Rhagodia sp. Hamersley (M. Trudgen 17794)*		P3	
21.	16616	*Sida sp. Barlee Range (S. van Leeuwen 1642)*		P3	
22.	17820	*Themeda sp. Hamersley Station (M.E. Trudgen 11431)*		P3	
Priority 4					
23.	16040	*Eremophila youngii subsp. lepidota*		P4	
24.	7530	*Goodenia nuda*		P4	
25.	3022	*Lepidium catapycnon (Hamersley Lepidium)*		P4	
Non-conservation taxon					
26.	4886	*Abutilon ampium*			
27.	4891	*Abutilon fraseri (Lantern Bush)*			
28.	4895	*Abutilon lepidum*			
29.	4901	*Abutilon otocarpum (Desert Chinese Lantern)*			
30.	42920	*Abutilon sp. Dioicum (A.A. Mitchell PRP 1615)*			
31.	14113	*Abutilon sp. Pilbara (W.R. Barker 2025)*			
32.	11215	*Acacia adoxa var. adoxa*			
33.	3205	*Acacia adsurgens*			
34.	3209	*Acacia ampliceps*			
35.	3214	*Acacia ancistrocarpa (Fitzroy Wattle)*			
36.	3217	*Acacia aneura (Mulga, Wanari)*			

NatureMap is a collaborative project of the Department of Parks and Wildlife and the Western Australian Museum.

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Mapping Western Australia's Biodiversity

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
37.	37260	*Acacia aptaneura*			
38.	3223	*Acacia arida*			
39.		*Acacia ayersiana hybrid*			
40.	3241	*Acacia bivenosa*			
41.		*Acacia bivenosa weeping variant*			Y
42.	23524	*Acacia catenulata subsp. occidentalis*			
43.	3260	*Acacia citrinoviridis*			
44.	17013	*Acacia colei var. colei*			
45.	13502	*Acacia coriacea subsp. pendens*			
46.	3300	*Acacia dictyophleba (Sandhill Wattle, Ngarkaiya)*			
47.		*Acacia dictyophleba / melleodora*			
48.	3305	*Acacia distans*			
49.	16174	*Acacia elachantha*			
50.		*Acacia elachantha (Silvery hairy variant)*			
51.	3370	*Acacia hilliana*			
52.	37240	*Acacia macraneura*			
53.	3434	*Acacia maitlandii (Maitland's Wattle)*			
54.	19305	*Acacia melleodora*			
55.	3447	*Acacia monticola (Gawar, Liwardi)*			
56.	3475	*Acacia pachyacra*			
57.	15724	*Acacia paraneura*			
58.	3500	*Acacia prulnocarpa (Gidgee)*			
59.	36800	*Acacia pteraneura*			
60.	3501	*Acacia ptychophylla*			
61.	29016	*Acacia pyrifolia var. morrisonii*			
62.	29015	*Acacia pyrifolia var. pyrifolia*			
63.	3534	*Acacia sclerosperma (Limestone Wattle)*			
64.	29135	*Acacia sericophylla*			
65.	3544	*Acacia sibilans*			
66.	8949	*Acacia sibirica (Bastard Mulga)*			
67.		*Acacia sp. Juliflorae Pilbara Region*			
68.	3553	*Acacia spondylophylla*			
69.	13070	*Acacia synchronicia*			
70.	3573	*Acacia tenuissima*			
71.	3577	*Acacia tetragonophylla (Kurara, Wakalpuka)*			
72.	3579	*Acacia trachycarpa (Minni Ritchi, Balgal)*			
73.	23521	*Acacia trudgeniana*			
74.	20319	*Acacia tumida var. pilbarensis*			
75.	3595	*Acacia victoriae (Bramble Wattle, Ngatunpa)*			
76.	3598	*Acacia wanyu*			
77.	3606	*Acacia xiphophylla*			
78.	2646	*Aerva javanica (Kapok Bush)*	Y		
79.	3680	*Aeschynomene indica (Budda Pea)*			
80.	2647	*Alternanthera angustifolia*			
81.	2648	*Alternanthera denticulata (Lesser Joyweed)*			
82.	2652	*Alternanthera nodiflora (Common Joyweed)*			
83.	2660	*Amaranthus cuspidifolius*			
84.	2667	*Amaranthus pallidiflorus*			
85.	20018	*Amaranthus undulatus*			
86.	5278	*Ammannia multiflora*			
87.	196	*Amphipogon caricinus (Long Greybeard Grass)*			
88.	11614	*Amyema gibberula var. gibberula*			
89.	2383	*Amyema preissii (Wireleaf Mistletoe)*			
90.	40910	*Androcalva luteiflora (Yellow-flowered Ruingla)*			
91.	7828	*Anglanthus cyathifer*			
92.	2333	*Anthobolus leptomerioides*			
93.	207	*Aristida contorta (Bunched Kerosene Grass)*			
94.	210	*Aristida holathera*			
95.		*Aristida sp.*			
96.	229	*Astrebla pectinata (Barley Mitchell Grass)*			
97.	6202	*Astrotricha hamptonii (Ironplant)*			
98.	4740	*Atalaya hemiglauca (Whitewood)*			
99.	2450	*Atriplex amnicola (Swamp Saltbush)*			
100.	2453	*Atriplex codonocarpa (Flat-topped Saltbush)*			
101.	2476	*Atriplex semilunaris (Annual Saltbush)*			
102.	11642	*Bergia perennis subsp. obtusifolia*			
103.	11912	*Bergia perennis subsp. perennis*			
104.	2770	*Boerhavia coccinea (Tar Vine, Wituka)*			
105.	11167	*Bonamia erecta*			
106.	7413	*Brunonia australis (Native Cornflower)*			

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	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
107.	750	*Bulbostylis barbata*			
108.		*Bybils sp.*			
109.	2864	*Calandrinia ptychosperma*			
110.	2865	*Calandrinia pumila*			
111.	2866	*Calandrinia quadrivalvis*			
112.	2870	*Calandrinia stagnensis*			
113.	14090	*Calocephalus beardii*			
114.	7891	*Calocephalus francisii (Fine-leaf Beauty-heads)*			
115.	7893	*Calocephalus knappii*			
116.	48223	*Calocephalus pilbarensis*			
117.	7905	*Calotis multicaulis (Many-stemmed Burr-daisy)*			
118.	7906	*Calotis plumulifera*			
119.	7907	*Calotis porphyroglossa*			
120.	2976	*Capparis lasiantha (Spilt Jack, Balgarda)*			
121.	2982	*Capparis umbonata (Wild Orange, Nanggalu)*			
122.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
123.	29721	*Cenchrus setiger (Birdwood Grass)*	Y		
124.	7919	*Centipeda minima (Spreading Sneezewood, Kanjirraiaa, Inteng-inteng, Karengkal, Kata-palkalpa, Munyu-parnti-parnti)*			
125.	19762	*Centipeda minima subsp. macrocephala*			
126.	7921	*Centipeda thespidioides (Desert Sneezewood)*			
127.	2485	*Chenopodium auricomum (Queensland Bluebush)*			
128.	269	*Chloris pectinata (Comb Chloris)*			
129.	270	*Chloris pumilio*			
130.	33516	*Chrysocephalum gilesii*			
131.	12614	*Chrysocephalum pterochaetum*			
132.	2988	*Cleome viscosa (Tickweed, Tjinduwadhu)*			
133.	2778	*Codonocarpus cotinifolius (Native Poplar, Kundurangu)*			
134.	6612	*Convolvulus clementii*			
135.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
136.	13560	*Corchorus crozophorifolius*			
137.	4857	*Corchorus elachocarpus*			
138.	13659	*Corchorus laniflorus*			
139.	18415	*Corchorus sidoides subsp. sidoides*			
140.	20242	*Corchorus sp. Hamersley Range hilltops (S. van Leeuwen 3826)*			
141.	17661	*Corchorus tectus*			
142.	16783	*Corymbia candida*			
143.	16780	*Corymbia candida subsp. dipsodes*			
144.	17083	*Corymbia deserticola subsp. deserticola*			
145.	17077	*Corymbia ferriticola*			
146.	17093	*Corymbia hamersleyana*			
147.	3774	*Crotalaria cunninghamii (Green Birdflower, Bilbun)*			
148.	12039	*Cucumis melo subsp. agrestis (Ulcardo Melon, Gagalum)*	Y		
149.	41721	*Cucumis variabilis*			
150.	17117	*Cullen cinereum*			
151.	17439	*Cullen lachnostachys*			
152.	17118	*Cullen leucanthum*			
153.	17116	*Cullen martinii*			
154.		*Cullen sp.*			
155.	13733	*Cuscuta victoriana*			
156.	279	*Cymbopogon ambiguus (Scentgrass)*			
157.	282	*Cymbopogon procerus (Lemon Grass)*			
158.	283	*Cynodon dactylon (Couch)*	Y		
159.	46555	*Cynodon prostratus*			
160.	774	*Cyperus bifax (Downs Nutgrass)*			
161.	782	*Cyperus concinnus*			
162.	786	*Cyperus cunninghamii*			
163.	12808	*Cyperus hesperius*			
164.	798	*Cyperus iria*			
165.	807	*Cyperus pulchellus*			
166.	808	*Cyperus pygmaeus*			
167.	814	*Cyperus squarrosus*			
168.	818	*Cyperus vaginatus (Stiffleaf Sedge)*			
169.	290	*Dactyloctenium radulans (Button Grass)*			
170.	7424	*Dampiera candicans*			
171.	303	*Dichanthium fecundum (Curly Bluegrass)*			
172.	11964	*Dichanthium sericeum subsp. sericeum*			
173.	7164	*Diclidanthera forrestii*			
174.	6754	*Dicrastylis cordifolia*			
175.	310	*Digitaria brownii (Cotton Panic Grass)*			

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	Name ID	Species Name	Naturalised	Conservation Code	†Endemic To Query Area
176.	313	*Digitaria ctenantha (Comb Finger Grass)*			
177.	12023	*Diplopeltis stuartii var. stuartii (Desert Pepperflower)*			
178.	7169	*Dipteracanthus australasicus*			
179.	4759	*Dodonaea coriacea*			
180.	11406	*Dodonaea lanceolata var. lanceolata*			
181.	43544	*Drosera finlaysoniana*			
182.	44508	*Duma florulenta*			
183.	31274	*Duperreya commixta*			
184.	2502	*Dysphania kalpari (Rat's Tail, Kalpari)*			
185.	33479	*Dysphania melanocarpa (Black Crumbweed)*			
186.	33596	*Dysphania melanocarpa forma leucocarpa*			
187.	2505	*Dysphania platycarpa*			
188.	11653	*Dysphania rhadinostachya subsp. inflata*			
189.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			
190.	32348	*Eccremidium arcuatum*			
191.	328	*Echinochloa colona (Awnless Barnyard Grass)*	Y		
192.	7057	*Elacholoma hornii*			
193.	357	*Enneapogon caerulescens (Limestone Grass)*			
194.	360	*Enneapogon lindleyanus (Wiry Nineawn, Purple-head Nineawn)*			
195.	20377	*Enneapogon robustissimus*			
196.	368	*Enteropogon ramosus (Windmill Grass, Curly Windmill Grass)*			
197.	375	*Eragrostis cumingii (Cuming's Love Grass)*			
198.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
199.	380	*Eragrostis eriopoda (Woollybutt Grass, Wangumu)*			
200.	388	*Eragrostis leptocarpa (Drooping Lovegrass)*			
201.	17608	*Eragrostis olida*			
202.	392	*Eragrostis pergracilis*			
203.	393	*Eragrostis setifolia (Neverfail Grass)*			
204.	395	*Eragrostis speciosa (Handsome Lovegrass)*			
205.	398	*Eragrostis tenellula (Delicate Lovegrass)*			
206.	399	*Eragrostis xerophila (Knotty-butt Neverfail)*			
207.	7192	*Eremophila cuneifolia (Pinyuru, Tiranju)*			
208.	7208	*Eremophila forrestii (Wilcox Bush)*			
209.	15052	*Eremophila forrestii subsp. forrestii*			
210.	7228	*Eremophila lachnocalyx (Woolly-calyxed Eremophila)*			
211.	16940	*Eremophila lanceolata*			
212.	17597	*Eremophila latrobei subsp. filiformis*			
213.	17576	*Eremophila latrobei subsp. latrobei*			
214.	7234	*Eremophila longifolia (Berrigan, Tuiypurpa)*			
215.	16363	*Eremophila maculata subsp. brevifolia (Native Fuchsia)*			
216.	7239	*Eremophila margarethae (Sandbank Poverty Bush)*			
217.	400	*Eriachne aristidea*			
218.	408	*Eriachne flaccida (Claypan Grass)*			
219.	13660	*Eriachne lanata*			
220.	414	*Eriachne obtusa (Northern Wanderie Grass)*			
221.	421	*Eriachne tenuiculmis*			
222.	425	*Eriochloa procera (Cupgrass)*			
223.	426	*Eriochloa pseudoacrotricha (Perennial Cupgrass)*			
224.	35343	*Eucalyptus camaldulensis subsp. refulgens*			
225.	5655	*Eucalyptus gamophylla (Twin-leaf Mallee, Warlu)*			
226.	5684	*Eucalyptus kingsmillii (Kingsmill's Mallee)*			
227.	5698	*Eucalyptus leucophloia (Snappy Gum, Milgum)*			
228.	18088	*Eucalyptus leucophloia subsp. leucophloia*			
229.	5703	*Eucalyptus lucasii (Barlee Box)*			
230.	5744	*Eucalyptus pilbarensis*			
231.	5773	*Eucalyptus socialis (Red Mallee, Altarpa)*			
232.	19576	*Eucalyptus socialis subsp. eucentrica*			
233.	29733	*Eucalyptus trivalva (Victoria Spring Mallee)*			
234.	14548	*Eucalyptus victrix*			
235.	15592	*Eucalyptus xerothermica*			
236.	11011	*Eulalia aurea*			
237.	4617	*Euphorbia australis (Namana)*			
238.	4619	*Euphorbia biconvexa*			
239.		*Euphorbia biconvexa/coghlanii*			
240.	4620	*Euphorbia boophthona (Gascoyne Spurge)*			
241.	4623	*Euphorbia coghlanii (Namana)*			
242.	42879	*Euphorbia trigonosperma*			
243.	11200	*Evolvulus alsinoides var. villosicalyx*			
244.	1753	*Ficus platypoda (Native Fig, Makartu)*			
245.	12159	*Fimbristylis simulans*			

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	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
246.	35558	*Flaveria trinervia (Speedy Weed)*	Y		
247.	5212	*Frankenia setosa (Bristly Frankenia)*			
248.		*Frankenia sp.*			
249.	2835	*Glinus lotoides (Hairy Carpet Weed)*			
250.	7060	*Glossostigma diandrum*			
251.	3938	*Glycine canescens (Silky Glycine)*			
252.	7985	*Gnaphalum polycaulon (Indian Cudweed)*	Y		
253.	7989	*Gnephosis brevifolia (Short-leaved Gnephosis)*			
254.		*Gompholobium karijini x oreophilum*			
255.	41245	*Gompholobium oreophilum*			
256.	10995	*Gompholobium polyzygum*			
257.	2676	*Gomphrena canescens (Batchelors Buttons)*			
258.	2680	*Gomphrena cunninghamii*			
259.	18367	*Gomphrena kanisii*			
260.	11131	*Gomphrena sordida*			
261.	6151	*Gonocarpus ephemerus*			
262.	7490	*Goodenia armitiana*			
263.	20523	*Goodenia azurea subsp. hesperia*			
264.	12517	*Goodenia cusackiana*			
265.	7521	*Goodenia lamprosperma*			
266.	7526	*Goodenia microptera*			
267.	12552	*Goodenia muelleriana*			
268.	12574	*Goodenia prostrata*			
269.	7544	*Goodenia ramelli*			
270.	29673	*Goodenia sp. Sandy Creek (R.D. Royce 1653)*			
271.	10982	*Goodenia stobbsiana*			
272.	7556	*Goodenia tenuiloba*			
273.	7560	*Goodenia vilmoriniae*			
274.	7564	*Goodenia wilunensis*			
275.	15845	*Grevillea juncifolia subsp. juncifolia*			
276.	2079	*Grevillea pyramidalis (Caustic Bush, Tjungu)*			
277.	19478	*Grevillea wickhamii subsp. hispidula*			
278.	19137	*Hakea lorea subsp. lorea*			
279.	30258	*Halgania solanacea var. Mt Doreen (G.M. Chippendale 4206)*			
280.	23465	*Haloragis gossei var. gossei*			
281.	29594	*Helichrysum luteoalbum (Jersey Cudweed)*			
282.	6706	*Heliotropium cunninghamii*			
283.	6712	*Heliotropium heteranthum*			
284.	17307	*Heliotropium inexplicitum*			
285.	4925	*Hibiscus coatesii*			
286.		*Hibiscus sp.*			
287.	40640	*Hibiscus sp. Mt Robinson (G. Byrne 3637)*			
288.	48203	*Hyperlelis cerviana*			
289.	3973	*Indigofera colutea (Sticky Indigo)*			
290.	45473	*Indigofera fractiflexa subsp. fractiflexa*			
291.	3974	*Indigofera georgei (Bovine Indigo)*			
292.	3982	*Indigofera monophylla*			
293.	3985	*Indigofera rugosa*			
294.		*Iotasperma sp.*			Y
295.	6633	*Ipomoea muelleri (Poison Morning Glory, Yumbu)*			
296.	6636	*Ipomoea plebeia (Bellvine)*			
297.	459	*Iseilema eremaeum*			
298.	3989	*Isotropis atropurpurea (Poison Sage)*			
299.	3996	*Jacksonia aculeata*			
300.	4043	*Kennedia prorepens*			
301.	20019	*Lachnagrostis filiformis*			
302.	5846	*Lamarchea sulcata*			
303.	19727	*Leiocarpa semicalva subsp. semicalva*			
304.	3025	*Lepidium echinatum*			
305.	3032	*Lepidium muelleri-ferdinandi*			
306.	3033	*Lepidium oxytrichum*			
307.	3035	*Lepidium pedicellosum*			
308.	3037	*Lepidium phlebopetalum (Veined Peppercress)*			
309.	3038	*Lepidium phyllodogynum*			
310.	471	*Leptochloa digitata (Whorled Cane Grass)*			
311.	952	*Lipocarpha microcephala*			
312.	7403	*Lobelia heterophylla (Wing-seeded Lobelia)*			
313.	4061	*Lotus cruentus (Redflower Lotus)*			
314.	6136	*Ludwigia perennis*			
315.	4728	*Macgregoria racemigera (Snow Flower)*			

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	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
316.	2543	*Malreana eriosphaera*			
317.	2544	*Malreana georgei (Satiny Bluebush)*			
318.	2551	*Malreana melanocoma (Pussy Bluebush)*			
319.	2556	*Malreana planifolia (Low Bluebush)*			
320.	2567	*Malreana tomentosa (Felty Bluebush)*			
321.	2569	*Malreana tripterа (Threewinged Bluebush)*			
322.	2571	*Malreana villosa*			
323.	4962	*Malvastrum americanum (Spiked Malvastrum)*	Y		
324.	76	*Marsilea hirsuta (Nardoo)*			
325.		*Marsilea spp.*			
326.	5915	*Melaleuca glomerata*			
327.	5991	*Melaleuca xerophila*			
328.	7082	*Mimulus gracilis*			
329.	4105	*Mirbelia viminalis*			
330.	6519	*Mitrasacme connata*			
331.	4111	*Muelleranthus trifoliolatus*			
332.	17158	*Myoporum montanum (Native Myrtle)*			
333.	8121	*Myriocephalus rudallii*			
334.	6786	*Newcastelia cephalantha*			
335.	6791	*Newcastelia hexamhena (Lambs' Tails)*			
336.	6971	*Nicotiana benthamiana (Tjuntiwari)*			
337.	6976	*Nicotiana occidentalis (Native Tobacco)*			
338.	11331	*Nicotiana occidentalis subsp. obliqua*			
339.	505	*Panicum laevinode*			
340.	514	*Paractaenum refractum*			
341.	515	*Paraneurachne mueller (Northern Mulga Grass)*			
342.	519	*Paspalidium constrictum (Knottybutt Grass)*			
343.	523	*Paspalidium rarum (Rare Paspalidium)*			
344.	12486	*Peplidium althocheilum*			
345.	7091	*Peplidium maritimum*			
346.	18463	*Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 6166)*			
347.	18462	*Peplidium sp. E Evol. Fl. Fauna Arid Aust. (A.S. Weston 12766)*			
348.	35001	*Peripleura virgata*			
349.	546	*Perotis rara (Comet Grass)*			
350.	3674	*Petalostylis cassioides*			
351.	3675	*Petalostylis labicheoides (Slender Petalostylis)*			
352.	17817	*Pluchea dunlopii*			
353.	8168	*Pluchea rubelliflora*			
354.	8173	*Podolepis capillaris (Wiry Podolepis)*			
355.	45239	*Podolepis eremaea*			
356.	12075	*Polycarpaea corymbosa var. corymbosa*			
357.	2902	*Polycarpaea involucrata*			
358.	2903	*Polycarpaea longiflora*			
359.	4572	*Polygala isingii*			
360.	6655	*Polymeria calycina*			
361.	2879	*Portulaca cyclophylla*			
362.	2884	*Portulaca oleracea (Pursiane, Wakati)*			
363.	2886	*Portulaca pilosa (Djanggara)*	Y		
364.	18154	*Psydrax latifolia*			
365.	8192	*Pterocaulon sphacelatum (Apple Bush, Fruit Salad Plant)*			
366.	8193	*Pterocaulon sphaerantholdes*			
367.	2690	*Ptilotus aervoides*			
368.	2693	*Ptilotus aphyllus*			
369.	2696	*Ptilotus astrolasius*			
370.	2699	*Ptilotus axillaris (Mat Mulla Mulla)*			
371.	2704	*Ptilotus calostachyus (Weeping Mulla Mulla)*			
372.	2706	*Ptilotus carinatus*			
373.	2708	*Ptilotus chamaecladus*			
374.	2721	*Ptilotus exaltatus (Tall Mulla Mulla)*			
375.	2728	*Ptilotus gomphrenoides*			
376.	2731	*Ptilotus helipteroides (Hairy Mulla Mulla)*			
377.	2741	*Ptilotus macrocephalus (Featherheads)*			
378.	41001	*Ptilotus nobilis subsp. nobilis (Yellow Tails)*			
379.	2747	*Ptilotus obovatus (Cotton Bush)*			
380.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
381.	2755	*Ptilotus rotundifolius (Royal Mulla Mulla)*			
382.	2757	*Ptilotus schwartzii*			
383.	11219	*Ptilotus schwartzii var. georgei*			
384.	2582	*Rhagodia eremaea (Thorny Saltbush)*			
385.	13308	*Rhodanthe charsleyae*			

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	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
386.	13301	*Rhodanthe floribunda*			
387.	13310	*Rhodanthe margarethae*			
388.	13303	*Rhodanthe sterilescens*			
389.		*Riccia crinita*			
390.	45178	*Roebuckiella similis*			
391.	12088	*Rostellularia adscendens var. clementii*			
392.	5285	*Rotala diandra*			
393.	2443	*Rumex vesicarius (Ruby Dock)*	Y		
394.	116	*Ruppia polycarpa*			
395.	18599	*Salsola tragus*			
396.	12578	*Scaevola acacioides*			
397.	7633	*Scaevola parvifolia (Camel Weed)*			
398.	13172	*Scaevola parvifolia subsp. pilbarae*			
399.	7644	*Scaevola spinescens (Currant Bush, Maroon)*			
400.	41660	*Schenkia australis*			
401.	48355	*Schoenoplectiella dissachantha*			
402.	48362	*Schoenoplectiella laevis*			
403.	962	*Schoenoplectus dissachanthus*			
404.	963	*Schoenoplectus laevis*			
405.	2603	*Sclerolaena cornishiana (Cartwheel Burr)*			
406.	2604	*Sclerolaena costata*			
407.	2607	*Sclerolaena densiflora*			
408.	2609	*Sclerolaena diacantha (Grey Copperburr)*			
409.	2611	*Sclerolaena eriacantha (Tall Bindii)*			
410.	2623	*Sclerolaena minuta*			
411.	12280	*Senna artemisioides subsp. oligophylla*			
412.	17558	*Senna artemisioides subsp. x artemisioides*			
413.	12307	*Senna glutinosa subsp. glutinosa*			
414.	12308	*Senna glutinosa subsp. x luerssenii*			
415.	18451	*Senna hamersleyensis*			
416.	12312	*Senna notabilis*			
417.	19347	*Senna sericea*			
418.	14578	*Senna sp. Billabong (J.D. Alonzo 721)*			
419.	14577	*Senna sp. Meekatharra (E. Bailey 1-26)*			
420.	12319	*Senna venusta*			
421.	46816	*Seringia elliptica (Showy fire-bush)*			
422.	46821	*Seringia nephrosperma (Free carpel fire-bush)*			
423.	4966	*Sida arenicola*			
424.	31758	*Sida arsinata*			
425.	4970	*Sida calyxhymenia (Tall Sida)*			
426.	4971	*Sida cardiophylla*			
427.	4976	*Sida echinocarpa*			
428.	4986	*Sida platycalyx (Lifesaver Burr)*			
429.	33698	*Sida sp. Pilbara (A.A. Mitchell PRP 1543)*			
430.	42547	*Solanum australiceum*			
431.	6995	*Solanum centrale (Desert Raisin, Kampurarpa)*			
432.	6998	*Solanum cleistogamum*			
433.	42544	*Solanum elatius*			
434.	7007	*Solanum esuriale (Quena)*			
435.	7018	*Solanum lasiophyllum (Flannel Bush, Mindjulu)*			
436.	9258	*Solanum morrisonii*			
437.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
438.	42546	*Solanum piceum*			
439.	7036	*Solanum sturtianum (Thargomindah Nightshade)*			
440.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
441.	619	*Sorghum plumosum (Plume Canegrass)*			
442.	13575	*Spermacoce brachystema*			
443.	628	*Sporobolus actinocladus (Ray Grass, Katoora)*			
444.	629	*Sporobolus australasicus (Fairy Grass)*			
445.	19555	*Stackhousia muricata subsp. annual (W.R. Barker 2172)*			
446.	7098	*Stemodia grossa (Marsh Stemodia, Minqlaara)*			
447.	7102	*Stemodia viscosa (Pagurda)*			
448.	3075	*Stenopetalum deciplens*			
449.	8234	*Streptoglossa adscendens*			
450.	8235	*Streptoglossa bubakii*			
451.	8236	*Streptoglossa cylindriceps*			
452.	8238	*Streptoglossa liatroides*			
453.	8239	*Streptoglossa macrocephala*			
454.	8240	*Streptoglossa odora*			
455.		*Streptoglossa sp.*			

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	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
456.	8241	*Streptoglossa tenuiflora*			
457.	12492	*Striga squamigera*			
458.	7711	*Stylidium desertorum*			
459.	3182	*Stylobasium spathulatum (Pebble Bush)*			
460.	4223	*Swainsona decumens*			
461.	4231	*Swainsona kingii*			
462.	13586	*Swainsona pauciflollolata*			
463.	13339	*Synaptantha tillaeacea var. tillaeacea*			
464.	48206	*Synostemon rhytidospermus*			
465.	31492	*Tecticornia disarticulata*			
466.	4252	*Templetonia egena (Round Templetonia)*			
467.	41986	*Tephrosia oxalidea*			
468.		*Tephrosia sp.*			
469.	17768	*Tephrosia sp. Bungaroo Creek (M.E. Trudgen 11601)*			
470.	41811	*Tephrosia sp. Fortescue (A.A. Mitchell 606)*			
471.	42225	*Tephrosia sp. Newman (A.A. Mitchell PRP 29)*			
472.	43963	*Tephrosia sp. deserts (J.R. Maconochie 1403)*			
473.	4285	*Tephrosia supina*			
474.	17819	*Themeda sp. Mt Barricade (M.E. Trudgen 2471)*			
475.	673	*Themeda triandra*			
476.	6265	*Trachymene biaiata*			
477.	6278	*Trachymene oleracea*			
478.	19043	*Trachymene oleracea subsp. oleracea*			
479.	44305	*Trianthema pilosum*			
480.	2832	*Trianthema triquetra (Red Spinach)*			
481.	44362	*Trianthema triquetrum*			
482.	4374	*Tribulus astrocarpus*			
483.	4375	*Tribulus cistoides*			
484.	4377	*Tribulus hirsutus*			
485.	4379	*Tribulus macrocarpus*			
486.		*Tribulus sp.*			
487.	18072	*Tribulus suberosus*			
488.	4383	*Tribulus terrestris (Caltrop)*	Y		
489.	6727	*Trichodesma zeylanicum (Camel Bush, Kumbaiin)*			
490.	11750	*Trichodesma zeylanicum var. zeylanicum*			
491.	48201	*Trigastrotheca molluginea*			
492.	679	*Triodia angusta*			
493.	680	*Triodia basedowii (Lobed Spinifex)*			
494.	13131	*Triodia epactia*			
495.	690	*Triodia longiceps (Giant Grey Spinifex)*			
496.	696	*Triodia pungens (Soft Spinifex)*			
497.	48463	*Triodia vanleeuwenii*			
498.	704	*Triodia wiseana (Limestone Spinifex)*			
499.	706	*Triraphis mollis (Needle Grass)*			
500.	4879	*Triumfetta leptacantha*			
501.	14942	*Triumfetta maconochieana*			
502.	98	*Typha domingensis (Bulrush, Djandjid)*			
503.	10865	*Urochloa subquadripara*			
504.	7654	*Velleia connata (Cup Velleia)*			
505.	7393	*Wahlenbergia tumidifructa*			
506.	730	*Xerochloa imberbis (Rice Grass)*			
507.	11894	*Yakirra australiensis var. australiensis*			

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 wholely 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.

Figure A1.3: NatureMap search results (L47/642) (DPaW, 2007-)

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NatureMap SppRpt L47 642

Created By Guest user on 22/03/2018

Current Names Only	Yes
Core Datasets Only	Yes
Method	'Predefined Area Intersect'
Area Type	Mining Tenements (live)
Intersect	L 47/642

	Name ID	Species Name	Naturalised	Conservation Code	†Endemic To Query Area
1.	4901	*Abutilon otocarpum (Desert Chinese Lantern)*			
2.	3205	*Acacia adsurgens*			
3.	3217	*Acacia aneura (Mulga, Wanari)*			
4.	37260	*Acacia aptaneura*			
5.	3434	*Acacia maitlandii (Maitland's Wattle)*			
6.	3534	*Acacia sclerosperma (Limestone Wattle)*			
7.	3595	*Acacia victoriae (Bramble Wattle, Ngatunpa)*			
8.	3606	*Acacia xiphophylla*			
9.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
10.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
11.		*Acariformes sp.*			
12.		*Acarina sp.*			
13.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
14.	25536	*Accipiter fasciatus (Brown Goshawk)*			
15.	3680	*Aeschynomene indica (Budda Pea)*			
16.		*Allodessus bistrigatus*			
17.		*Alona rectangula novaezealandiae*			
18.	2647	*Alternanthera angustifolia*			
19.		*Aname ellenae*			
20.	24312	*Anas gracilis (Grey Teal)*			
21.	24316	*Anas superciliosa (Pacific Black Duck)*			
22.	7828	*Anglanthus cyathifer*			
23.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
24.		*Anisops canaliculatus*			
25.		*Anisops sp.*			
26.	2333	*Anthobolus leptomerioides*			
27.	24285	*Aquila audax (Wedge-tailed Eagle)*			
28.		*Arcella sp. P1*			
29.	25558	*Ardea ibis (Cattle Egret)*		IA	
30.	41324	*Ardea modesta (great egret, white egret)*		IA	
31.	24340	*Ardea novaehollandiae (White-faced Heron)*			
32.	24341	*Ardea pacifica (White-necked Heron)*			
33.	24610	*Ardeotis australis (Australian Bustard)*			
34.	207	*Aristida contorta (Bunched Kerosene Grass)*			
35.	210	*Aristida holathera*			
36.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
37.	4740	*Atalaya hemiglauca (Whitewood)*			
38.	2453	*Atriplex codonocarpa (Flat-topped Saltbush)*			
39.	2476	*Atriplex semilunaris (Annual Saltbush)*			
40.		*Australosplius elongatus*			
41.		*Baetidae sp.*			
42.		*Barnardius zonarius*			
43.	11642	*Bergia perennis subsp. obtusifolia*			
44.		*Berosus munitipennis*			
45.	2770	*Boerhavia coccinea (Tar Vine, Wituka)*			
46.		*Brachionus urceolaris s.l.*			
47.		*Branchinella mcraei*			
48.		*Branchinella occidentalis*			
49.		*Branchipodidae sp.*			
50.		*Buddelundia sp.*			
51.		*Bybils sp.*			
52.	24725	*Cacatua roseicapilla subsp. assimilis (Galah)*			
53.	25716	*Cacatua sanguinea (Little Corella)*			

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	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
54.	24727	*Cacatua sanguinea subsp. westralensis (Little Corella)*			
55.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
56.		*Calamoecia halsei*			
57.	2870	*Calandrinia stagnensis*			
58.	14090	*Calocephalus beardii*			
59.	7891	*Calocephalus francisii (Fine-leaf Beauty-heads)*			
60.	7893	*Calocephalus knappii*			
61.	7906	*Calotis plumulifera*			
62.	7907	*Calotis porphyroglossa*			
63.	2982	*Capparis umbonata (Wild Orange, Nanggalu)*			
64.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
65.	7919	*Centipeda minima (Spreading Sneezewood, Kanjirralaa, Inteng-inteng, Karengkal, Kata-palkalpa, Mununyu-parnti-parnti)*			
66.		*Ceratopogonidae sp.*			
67.	24564	*Certhionyx variegatus (Pied Honeyeater)*			
68.		*Chaetogaster diastrophus*			
69.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
70.		*Chironominae sp.*			
71.	269	*Chloris pectinata (Comb Chloris)*			
72.	2988	*Cleome viscosa (Tickweed, Tjinduwadhu)*			
73.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
74.		*Conchostraca (unident.)*			
75.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
76.	18415	*Corchorus sidoides subsp. sidoides*			
77.		*Cordulidae sp.*			
78.		*Corixidae sp.*			
79.	24416	*Corvus bennetti (Little Crow)*			
80.	25593	*Corvus orru (Torresian Crow)*			
81.	24418	*Corvus orru subsp. ceciliae (Western Crow)*			
82.	17083	*Corymbia deserticola subsp. deserticola*			
83.	17093	*Corymbia hamersleyana*			
84.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
85.	25596	*Cracticus torquatus (Grey Butcherbird)*			
86.		*Craticula cuspidata (Grun. ex. Van Heurck) Mann*			
87.	24876	*Ctenophorus isolepis subsp. isolepis (Crested Dragon, Military Dragon)*			
88.	24882	*Ctenophorus nuchalis (Central Netted Dragon)*			
89.	25036	*Ctenotus duricola*			
90.		*Culicidae sp.*			
91.	17117	*Cullen cinereum*			
92.	24322	*Cygnus atratus (Black Swan)*			
93.	12808	*Cyperus hesperius*			
94.	798	*Cyperus iria*			
95.	814	*Cyperus squarrosus*			
96.		*Cypretta baylyi*			
97.	25547	*Dacelo leachii (Blue-winged Kookaburra)*			
98.	290	*Dactyloctenium radulans (Button Grass)*			
99.	24091	*Dasykaluta rosamondae (Little Red Kaluta)*			
100.	25002	*Delma pax*			
101.	24325	*Dendrocygna eytoni (Plumed Whistling Duck)*			
102.		*Diacyclops humphreysi humphreysi*			
103.		*Diaphanosoma unguiculatum*			
104.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
105.	24470	*Dromaius novaehollandiae (Emu)*			
106.	31274	*Duperreya commixta*			
107.	2505	*Dysphania platycarpa*			
108.	11653	*Dysphania rhadinostachya subsp. inflata*			
109.	11890	*Dysphania rhadinostachya subsp. rhadinostachya*			
110.		*Dytiscidae sp.*			
111.		*Ecnomidae sp.*			
112.		*Egretta garzetta*			
113.		*Egretta novaehollandiae*			
114.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
115.	360	*Enneapogon lindleyanus (Wiry Nineawn, Purple-head Nineawn)*			
116.		*Eolophus roseicapillus*			
117.	375	*Eragrostis cumingii (Cuming's Love Grass)*			
118.	378	*Eragrostis dielsii (Mallee Lovegrass)*			
119.	380	*Eragrostis eriopoda (Woollybutt Grass, Wangumu)*			
120.	388	*Eragrostis leptocarpa (Drooping Lovegrass)*			
121.	392	*Eragrostis pergracilis*			
122.	393	*Eragrostis setifolia (Neverfail Grass)*			

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	Name ID	Species Name	Naturalised	Conservation Code	†Endemic To Query Area
123.	398	*Eragrostis tenellula (Delicate Lovegrass)*			
124.	399	*Eragrostis xerophila (Knotty-butt Neverfail)*			
125.	7192	*Eremophila cuneifolia (Pinyuru, Tiranju)*			
126.	7234	*Eremophila longifolia (Berrigan, Tulypurpa)*			
127.	16363	*Eremophila maculata subsp. brevifolia (Native Fuchsia)*			
128.	16040	*Eremophila youngii subsp. lepidota*		P4	
129.		*Eretes australis*			
130.	400	*Eriachne aristidea*			
131.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
132.	5655	*Eucalyptus gamophylla (Twin-leaf Mallee, Wanlu)*			
133.	18088	*Eucalyptus leucophloia subsp. leucophloia*			
134.	5703	*Eucalyptus lucasii (Bariee Box)*			
135.	5744	*Eucalyptus pilbarensis*			
136.	20264	*Eucalyptus rowleyi*		P3	
137.	29733	*Eucalyptus trivalva (Victoria Spring Mallee)*			
138.	4617	*Euphorbia australis (Namana)*			
139.	4620	*Euphorbia boophthona (Gascoyne Spurge)*			
140.	11200	*Evolvulus alsinoides var. villosicalyx*			
141.	25621	*Falco berigora (Brown Falcon)*			
142.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
143.		*Filinia cf. pejleri (SAP)*			
144.	24478	*Fregata ariel (Lesser Frigatebird)*		IA	
145.	24959	*Gehyra variegata*			
146.	24401	*Geopelia cuneata (Diamond Dove)*			
147.	25585	*Geopelia striata (Zebra Dove)*			
148.	24403	*Geopelia striata subsp. placida (Peaceful Dove)*			
149.	24404	*Geophaps plumifera (Spinifex Pigeon)*			
150.	7989	*Gnephosis brevifolia (Short-leaved Gnephosis)*			
151.	12517	*Goodenia cusackiana*			
152.	7526	*Goodenia microptera*			
153.	12574	*Goodenia prostrata*			
154.	7560	*Goodenia vilmoriniae*			
155.	24443	*Grallina cyanoleuca (Magpie-lark)*			
156.		*Gyrinidae sp.*			
157.	24295	*Haliastur sphenurus (Whistling Kite)*			
158.	24297	*Hamirostra melanosternon (Black-breasted Buzzard)*			
159.		*Hantzschia amphioxys (Ehr.) Grun.*			
160.		*Hemicorduliidae sp.*			
161.		*Heterocypris sp.*			
162.	24961	*Heteronotia binoei (Bynoe's Gecko)*			
163.		*Hexarthra mira*			
164.	47965	*Hieraaetus morphnoides (Little Eagle)*			
165.		*Hydroglyphus leai*			
166.		*Hydrophilidae sp.*			
167.		*Ilyocypris australiensis*			
168.	6625	*Ipomoea diamantinensis*			
169.		*Isosticidae sp.*			
170.		*Keratella procurva*			
171.		*Keratella sp. nov. (aff. australis grp) (CB)*			
172.		*Lecane cf. spenceri (PSW)*			
173.		*Lecane lunaris*			
174.	3037	*Lepidium phlebopetalum (Veined Peppercress)*			
175.		*Leptoceridae sp.*			
176.		*Leptophlebiidae sp.*			
177.	25155	*Lerista muelleri*			
178.	42411	*Lerista timida*			
179.		*Lesquereusia spiralis*			
180.	25005	*Liaiis burtonis*			
181.	25661	*Lichmera indistincta (Brown Honeyeater)*			
182.		*Limnesia sp.*			
183.	952	*Lipocarpha microcephala*			
184.	25392	*Litoria rubella (Little Red Tree Frog)*			
185.	4061	*Lotus cruentus (Redflower Lotus)*			
186.	30933	*Lucasium stenodactylum*			
187.	6136	*Ludwigia perennis*			
188.	4728	*Macgregoria racemigera (Snow Flower)*			
189.	24168	*Macrotis lagotis (Bilby, Dalgyte)*		T	
190.	2543	*Maireana eriosphaera*			
191.	2567	*Maireana tomentosa (Felty Bluebush)*			
192.	25651	*Malurus lamberti (Variegated Fairy-wren)*			

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	Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
193.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
194.	24583	*Manorina flavigula (Yellow-throated Miner)*			
195.		*Mastogloia smithii Thwaites*			
196.	24736	*Melopsittacus undulatus (Budgerigar)*			
197.	25184	*Menetia greyii*			
198.	25187	*Menetia surda subsp. surda*			
199.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
200.		*Mesostigmata sp.*			
201.		*Microcarbo melanoleucos*			
202.		*Micronecta sp.*			
203.		*Microturbellaria sp.*			
204.	25542	*Milvus migrans (Black Kite)*			
205.	25545	*Mirafra javanica (Horsfield's Bushlark, Singing Bushlark)*			
206.		*Missulena rutraspina*			
207.	25193	*Morethia ruficauda subsp. exquisita*			
208.		*Mydiocypris nsp 'moojan'*			
209.		*Navicula cryptocephala Kütz.*			
210.		*Nematoda sp.*			
211.		*Neopsephotus bourkii*			
212.		*Nephila edulis*			
213.	24972	*Nephrurus wheeleri subsp. cinctus*			
214.	24095	*Ningaui timealeyi (Pilbara Ningaui)*			
215.		*Nitzschia filiformis (W. Sm.) Van Heurck*			
216.		*Nitzschia frustulum (Kütz.) Grun.*			
217.		*Notonectidae sp.*			
218.	24742	*Nymphicus hollandicus (Cockatiel)*			
219.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
220.	24618	*Oreoica gutturalis (Crested Bellbird)*			
221.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
222.	24627	*Pardalotus rubricatus (Red-browed Pardalote)*			
223.	25682	*Pardalotus striatus (Striated Pardalote)*			
224.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
225.	12486	*Peplidium althocheilum*			
226.	48060	*Petrochelidon ariel (Fairy Martin)*			
227.	48061	*Petrochelidon nigricans (Tree Martin)*			
228.	24659	*Petroica goodenovii (Red-capped Robin)*			
229.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
230.	24409	*Phaps chalcoptera (Common Bronzewing)*			
231.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
232.	24842	*Platalea regia (Royal Spoonbill)*			
233.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
234.	17817	*Pluchea dunlopii*			
235.	8168	*Pluchea rubelliflora*			
236.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
237.	25706	*Pomatostomus temporalis (Grey-crowned Babbler)*			
238.	2879	*Portulaca cyclophylla*			
239.	2884	*Portulaca oleracea (Purslane, Wakati)*			
240.	2886	*Portulaca pilosa (Djanggara)*	Y		
241.	24235	*Pseudomys desertor (Desert Mouse)*			
242.	24237	*Pseudomys hermannsburgensis (Sandy Inland Mouse)*			
243.	24390	*Psophodes occidentalis (Western Wedgebill, Chiming Wedgebill)*			
244.	8192	*Pterocaulon sphacelatum (Apple Bush, Fruit Salad Plant)*			
245.	8193	*Pterocaulon sphaerantholdes*			
246.	2696	*Ptilotus astrolasius*			
247.	2699	*Ptilotus axillaris (Mat Mulla Mulla)*			
248.	2708	*Ptilotus chamaecladus*			
249.	2728	*Ptilotus gomphrenoides*			
250.	2741	*Ptilotus macrocephalus (Featherheads)*			
251.	2747	*Ptilotus obovatus (Cotton Bush)*			
252.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
253.	42344	*Purnella albifrons (White-fronted Honeyeater)*			
254.	20168	*Rhagodia sp. Hamersley (M. Trudgen 17794)*		P3	
255.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
256.	13303	*Rhodanthe sterilescens*			
257.	24982	*Rhynchoedura ornata (Western Beaked Gecko)*			
258.	12088	*Rostellularia adscendens var. clementii*			
259.	41660	*Schenkia australis*			
260.	2604	*Sclerolaena costata*			
261.	14577	*Senna sp. Meekatharra (E. Bailey 1-26)*			
262.	31758	*Sida arsinlata*			

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	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
263.	30948	*Smicromis brevirostris (Weebill)*			
264.	24116	*Sminthopsis macroura (Stripe-faced Dunnart)*			
265.	9258	*Solanum morrisonii*			
266.	19555	*Stackhousia muricata subsp. annual (W.R. Barker 2172)*			
267.	17296	*Stemodia sp. Battle Hill (A.L. Payne 1006)*		P1	
268.		*Strandesia sp 466 (PSW)*			
269.		*Strandesia sp. PSW61 (PSW)*			Y
270.	8234	*Streptoglossa adscendens*			
271.	8235	*Streptoglossa bubakii*			
272.	8238	*Streptoglossa liatroides*			
273.	8240	*Streptoglossa odora*			
274.	24949	*Strophurus wellingtonae*			
275.	4231	*Swainsona kingii*			
276.	48206	*Synostemon rhytidospermus*			
277.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
278.	30870	*Taeniopygia guttata (Zebra Finch)*			
279.		*Tanypodinae sp.*			
280.		*Testudinella parva*			
281.		*Testudinella patina*			
282.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
283.	42351	*Todiramphus pyrrhopygius (Red-backed Kingfisher)*			
284.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
285.	24309	*Todiramphus sanctus subsp. sanctus (Sacred Kingfisher)*			
286.	4374	*Tribulus astrocarpus*			
287.	4375	*Tribulus cistoides*			
288.	4377	*Tribulus hirsutus*			
289.	4379	*Tribulus macrocarpus*			
290.	13131	*Triodia epactia*			
291.	690	*Triodia longiceps (Giant Grey Spinifex)*			
292.		*Triops australiensis australiensis*			
293.		*Turbellaria sp.*			
294.	24851	*Turnix velox (Little Button-quail)*			
295.	7393	*Wahlenbergia tumidifructa*			
296.		*Xenochironomus sp P2 (PSW)*			

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.

Figure A1.4: NatureMap search results (L47/735) (DPaW, 2007-)

NatureMap
Mapping Western Australia's Biodiversity

NatureMap SppRpt L47 735

Created By Guest user on 22/03/2018

Current Names Only	Yes
Core Datasets Only	Yes
Method	'Predefined Area Intersect'
Area Type	Mining Tenements (live)
Intersect	L 47/735

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24926	*Diplodactylus conspicillatus (Fat-tailed Gecko)*			
2.	12308	*Senna glutinosa subsp. x luerssenii*			

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 wholely 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.

NatureMap is a collaborative project of the Department of Parks and Wildlife and the Western Australian Museum.

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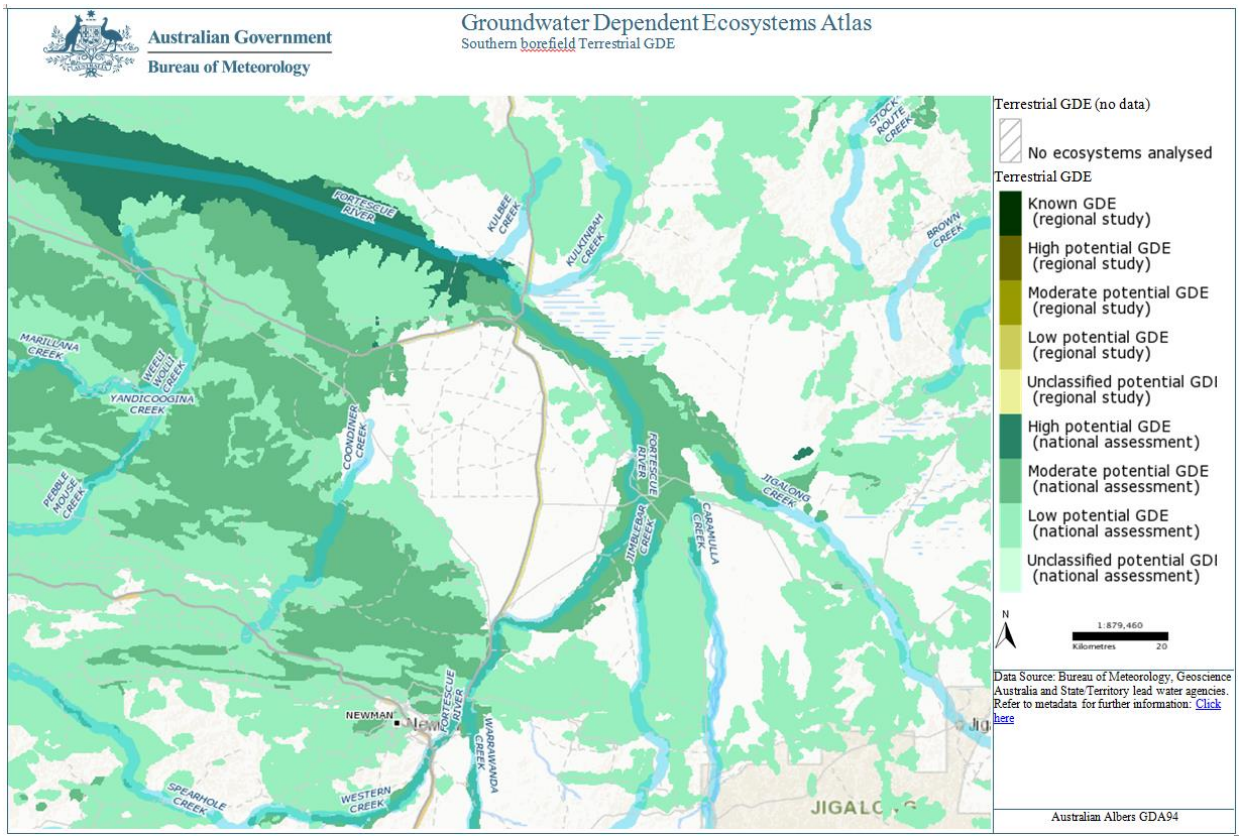

Figure A1.5: Terrestrial GDEs (BoM, 2018b)

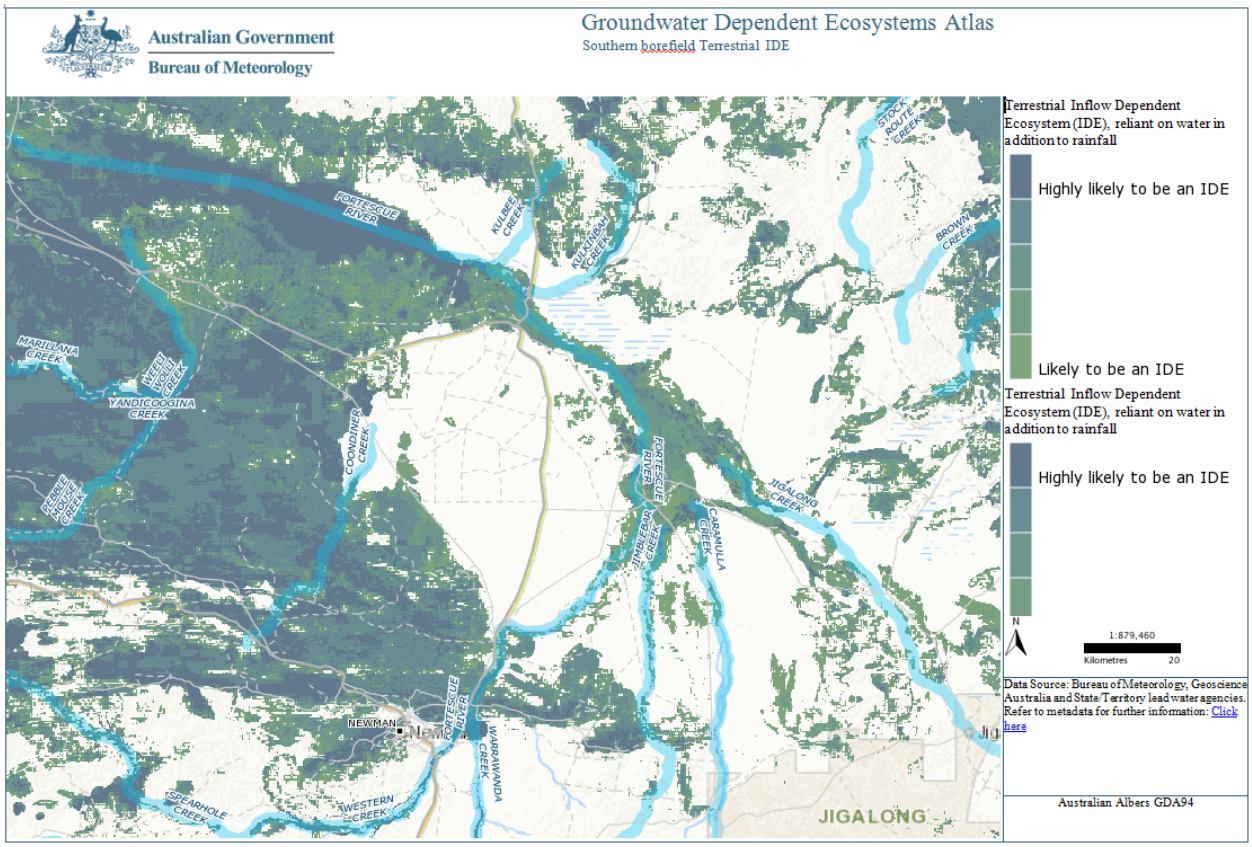

Figure A1.6: Terrestrial IDEs (BoM, 2018b)

Table A1.1: Conservation significant flora - database search results and literature

Taxon	Priority Rank	Source					
		TPList	WAHerb	TPFL	NM 40	EPBC	Literature
Acacia aphanoclada	1	✓					
Acacia cyperophylla var. *omearana*	1	✓					
Acacia fecunda	1	✓					
Acacia sp. East Fortescue (J. Bull & D. Roberts ONS A 27.01)	1		✓				
Acacia sp. Nullagine (B.R. Maslin 4955)	1	✓					
Atriplex spinulosa	1	✓					
Cochlospermum macnamarae	1	✓					
Dipteracanthus chichesterensis	1	✓					
Eremophila capricornica	1		✓				
Eremophila pilosa	1	✓	✓	✓	✓		Ecos
Eremophila sp. Hamersley Range (K. Walker KW 136)	1	✓	✓		✓		
Eremophila spongiocarpa	1	✓	✓	✓	✓		
Goodenia pedicellata	1	✓					
Helichrysum oligochaetum	1		✓	✓	✓		
Hibiscus campanulatus	1				✓		
Myriocephalus scalpellus	1	✓	✓	✓	✓		
Ptilotus wilsonii	1	✓					
Samolus sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	1		✓		✓		
Solanum sp. Mosquito Creek (A.A. Mitchell et al. AAM 10795) PN	1	✓					
Stemodia sp. Battle Hill (A.L. Payne 1006)	1	✓	✓		✓		
Synostemon hamersleyensis	1	✓					
Tecticornia globulifera	1		✓				
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	1	✓	✓				
Tribulus minutus	1	✓					
Triodia triticoides	1	✓					
Aristida lazaridis	2		✓				
Cardamine paucijuga	2		✓				
Goodenia hartiana	2	✓					
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	2		✓		✓		
Indigofera ixocarpa	2	✓					
Ipomoea racemigera	2	✓	✓				
Isotropis parviflora	2		✓		✓		
Teucrium pilbaranum	2	✓					
Acacia effusa	3	✓					
Acacia subtiliformis	3	✓	✓	✓	✓		
Amaranthus centralis	3	✓	✓	✓	✓		
Aristida jerichoensis var. *subspinulifera*	3	✓	✓		✓		
Atriplex flabelliformis	3	✓					
Calotis latiuscula	3		✓				
Crotalaria smithiana	3	✓	✓		✓		
Eremophila magnifica subsp. *velutina*	3	✓					

Taxon	Priority Rank	Source					
		TPList	WAHerb	TPFL	NM 40	EPBC	Literature
Eucalyptus rowleyi	3	✓	✓		✓		
Glycine falcata	3	✓					
Goodenia lyrata	3	✓					
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	3	✓	✓	✓	✓		
Grevillea saxicola	3	✓					
Gymnanthera cunninghamii	3		✓	✓	✓		
Indigofera ammobia	3	✓					
Indigofera gilesii	3		✓		✓		
Iotasperma sessilifolium	3	✓	✓		✓		
Nicotiana heterantha	3	✓	✓	✓			
Nicotiana umbratica	3	✓					
Rhagodia sp. Hamersley (M. Trudgen 17794)	3		✓	✓	✓		Ecos
Sida sp. Barlee Range (S. van Leeuwen 1642)	3		✓		✓		
Stylidium weeliwolli	3	✓	✓				
Tecticornia medusa	3	✓	✓				
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	3		✓		✓		Ecos
Triodia sp. Mt Ella (M.E. Trudgen 12739)	3		✓				
Xerochrysum boreale	3	✓	✓				
Acacia bromilowiana	4	✓					
Eremophila magnifica subsp. *magnifica*	4		✓				
Eremophila youngii subsp. *lepidota*	4	✓	✓		✓		Ecos
Goodenia berringbinensis	4		✓				
Goodenia nuda	4	✓	✓		✓		Ecol, Ecos, GGE
Lepidium catapycnon	4	✓	✓	✓	✓		

Note: 1 – P = Priority 1 to Priority 4 species. Ecol = Ecologia (2009b), Ecos = Ecoscape (2012), EPBC = EPBC Act PMST search (DotEE, 2018a), GGE = GGE (2009), NM = NatureMap searches (DPaW, 2007-).

Table A1.2: Weeds - database search results and literature

Species	Impact rating (DBCA, 2018f)	Invasiveness rating (DBCA, 2018f)	Searches
Aerva javanica	High	Rapid	NM40, Ecos
Bidens bipinnata	Unknown	Rapid	Ecos
Cenchrus ciliaris	High	Rapid	NM40, NM642, Ecos, EPBC, GGE
Cenchrus setiger	High	Rapid	NM40
Chloris virgata	High	Rapid	GGE
Citrullus lanatus	Unknown	Medium	GGE
Conyza bonariensis	Not listed	Not listed	NM40
Cucumis melo subsp. *agrestis*	Unknown	Medium	NM40
Cynodon dactylon	High	Rapid	NM40

Species	Impact rating (DBCA, 2018f)	Invasiveness rating (DBCA, 2018f)	Searches
Echinochloa colona	High	Rapid	NM40
Flaveria trinervia	Not listed	Not listed	NM40, GGE
Gnaphalium polycaulon	Not listed	Not listed	NM40
Heliotropium europaeum	Not listed	Not listed	Ecos
Malvastrum americanum	High	Rapid	NM40, Ecos, GGE
Portulaca pilosa	Not listed	Not listed	NM40, NM642, GGE
Rumex vesicarius	Not listed	Not listed	NM40
Solanum nigrum	Low	Rapid	NM40
Sonchus oleraceus	Low	Rapid	NM40, GGE
Tribulus terrestris	Unknown	Medium	NM40, Ecos*
Vachellia farnesiana	High	Rapid	GGE, Ecos

Note: Ecos = Ecoscape (2012), EPBC = EPBC Act PMST search (DotEE, 2018a), GGE = GGE (2009), NM40 = NatureMap 40 km buffer (DPaW, 2007-) and NM642 = NatureMap tenement L47/642. * = *Tribulus* ?*terrestris* recorded.

Table A1.3: Likelihood of occurrence for conservation significant flora recorded in the database search area

Taxon	Priority Rank	Source		Habitat	Soils	Rock	Locations	Likelihood of occurrence	No. FB records
		WAHerb	NM 40						
Acacia sp. East Fortescue (J. Bull & D. Roberts ONS A 27.01)	1	✓		Hill slope above minor drainage line	Red-brown sandy loam soils	Nil	8 km ENE of Shovelanna Hill; 10.6 km NNW of Jimblebar	Unlikely, the habitat doesn't occur in the Study Area	12
Eremophila capricornica	1	✓		Plain in rangeland, hardpan plain over granite	Red loam soil	Nil	10 km E towards Jigalong from the Mundiwindi	Possible on the spinifex plains (T**HG**)	3
Eremophila pilosa	1	✓	✓	Flats, minor depressions	Sand, sandy-loam, clay-loam	Nil	60 km N of Newman; 25 km SE of Roy Hill Homestead	Possible on the spinifex plains (T**HG**)	5
Eremophila sp. Hamersley Range (K. Walker KW 136)	1	✓	✓	Upper slope of range, hill crest, cliff top, gorge top	Skeletal brown-red soil	BIF,	Metawandy, Orebody 24	Unlikely, the habitat doesn't occur in the Study Area	15
Eremophila spongiocarpa	1	✓	✓	Marsh flats, clay depression in stony plain	Sandy clay soil	Nil	18.4 km NE of Coondiner Pool; 110 km NW of Newman	Unlikely, the habitat doesn't occur in the Study Area	29
Helichrysum oligochaetum	1	✓	✓	Clay pan, dry rocky creekline, depression in alluvial plain	Red loam/clay	Ironstone rocks and pebbles	11.4 km NE of Coondiner Pool; 60 km NW of Tom Price	Possible in minor depressions of the Study Area.	9
Hibiscus campanulatus	1		✓	Minor drainage line though ironstone hills, base of breakaway in mid slope of ironstone range	Brown sandy loam soil	Nil	15.6 km E of Mount Newman; 17.4 km SE of Parburdoo	Unlikely, the habitat doesn't occur in the Study Area	22
Myriocephalus scalpellus	1	✓	✓	Clay depression on flood plain	Clay	Nil	Coondiner Pool, Mungthannannie Pool	Unlikely, the habitat doesn't occur in the Study Area	2
Samolus sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	1	✓	✓	Calcrete salt pan, flat freshwater flood-out area on lake margin	Red-brown, deep, heavy clay soils	Nil	Fortescue Marsh	Unlikely, the habitat doesnt occur in the Study Area	13
Stemodia sp. Battle Hill (A.L. Payne 1006)	1	✓	✓	Flat on valley floor, broad floodplain with cracking clay soil	Reddish - brown clay	Nil	30 km SE of Roy Hill Station	Possible on the cracking clay gilgai plains (M**TG**)	3
Tecticornia globulifera	1	✓		Lake bed, flat floodplain	Sandy clay loam soil	Nil	18 km NNE of Coondiner Pool	Unlikely, the habitat doesn't occur in the Study Area	11
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	1	✓		Open depression, hill	Dry brown loam	Nil	18.4 km NNE of Coondiner Pool; 36.6. km NW of the intersection of Munjina - Roy Hill Road	Unlikely, the habitat doesn't occur in the Study Area	25
Aristida lazaridis	2	✓		Minor drainage zone, floodplain	Red brown loam	Nil	48.2 km WSW of Marillana Homestead; 16.58 km S of Mount Robinson	Possible on broad drainage tracts (A**SL**-1)	19

Taxon	Priority Rank	Source		Habitat	Soils	Rock	Locations	Likelihood of occurrence	No. FB records
		WAHerb	NM 40						
Cardamine paucijuga	2	✓		Swamp winter wet, riparian slope at water's edge	Calcareous clay, Black peaty sand over mud	Nil	71 km N of Newman	Unlikely, the habitat doesn't occur in the Study Area	10
Hibiscus sp. Gurinbiddy Range (M.E. Trudgen MET 15708)	2	✓	✓	Rocky gully running NW-SE amongst low rocky hills, drainage line between two hills	Loamy skeletal soils	Nil	Turee Syncline, 27 km ENE of Paraburdoo	Unlikely, the habitat doesn't occur in the Study Area	18
Ipomoea racemigera	2	✓		Flat bedded creekline in a basalt upland	Brown silty loam soil	Nil	21.8 km NE of Shovelanna Hill; 20.2 km NNE of Jimblebar	Unlikely, the habitat doesn't occur in the Study Area	6
Isotropis parviflora	2	✓	✓	Rangeland, rocky sandplain, broad plateau/gentle slopes of extensive hill	Dry red rocky sand	Nil	10.5 km N of Mount Webb	Unlikely, the habitat doesn't occur in the Study Area	27
Acacia subtiliformis	3	✓	✓	Gently undulating, calcrete hills, Low calcrete rise	Light brown rocky loam soils with calcrete	Nil	43 km SW of Marillana Homestead; 71 km north west of Newman	Unlikely, the habitat doesn't occur in the Study Area	23
Amaranthus centralis	3	✓	✓	Granite outcrop, sand plain	Silty sand amongst granite boulders	Nil	31.8 km WSW of Marillana Homestead; 43.7 km ENE of Packsaddle Hill	Unlikely, the habitat doesn't occur in the Study Area	6
Aristida jerichoensis var. *subspinulifera*	3	✓	✓	Plain, loamy clay plain	Red-brown clay to orange sandy clay	Ironstone	Juna Downs, 98 km ESE of Tom Price	Possible in heavily wooded mulga	35
Calotis latiuscula	3	✓		Floodplain, Calcrete plain	Red/brown sandy clay, clay loam	Nil	Angelo River, 96 km W of Newman	Unlikely, the habitat doesn't occur in the Study Area	23
Crotalaria smithiana	3	✓	✓	Alluvium on floodplain, floodplain of major river	Orange brown loam	Nil	13.3 km from Ethel Creek Homestead; 35 km SE of Ethel Creek Homestead	Unlikely, the habitat doesn't occur in the Study Area	7
Eucalyptus rowleyi	3	✓	✓	Plain, minor creekline	Brown clay/loam, reddish loam	Nil	S of Roy Hill on Nullagine	Possible on the spinifex plains (**THG**) one WAHerb location in the Study Area. Location visited by Maia in 2018 and none located	31
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	3	✓	✓	Low rocky hills and dissecting drainage lines	Soil calcrete	Ironstone	21 km NW of Wittenoom	Unlikely, the habitat doesn't occur in the Study Area	41
Gymnanthera cunninghamii	3	✓	✓	Drainage line and nearby floodplain, creekline	Red-brown clay sand over basalt	Nil	19.7 km NW of Tom Price townsite; 21.3 km NE of Mount Turner	Unlikely, the habitat doesn't occur in the Study Area	32
Indigofera gilesii	3	✓	✓	Ironstone cliff/steep scree hillslope, minor creekline	Red clay loam	Ironstone	8 km E of Mount Newman; 14.3 km NW of Newman	Unlikely, the habitat doesn't occur in the Study Area	22

Taxon	Priority Rank	Source		Habitat	Soils	Rock	Locations	Likelihood of occurrence	No. FB records
		WAHerb	NM 40						
Iotasperma sessilifolium	3	✓	✓	Broad clay plain surrounded by ranges of hills	Dark reddish brown clay	Nil	40.9 km N of Tom Price and 103.3 km ESE of Silver Grass Peak	Unlikely, the habitat doesn't occur in the Study Area	14
Nicotiana heterantha	3	✓		Floodplain, gravelly silt and clay on alluvial floodplain	Orange-brown alluvial sand	Ironstone	18 km NNE of Coondiner Pool; 27.4 km WNW of Roy Hill Station Homestead	Unlikely, the habitat doesn't occur in the Study Area	29
Rhagodia sp. Hamersley (M. Trudgen 17794)	3	✓	✓	Mulga plains	Red / brown sandy clay soil	Nil	8.9 km ENE of Shovelanna Hill; 10.9 km NNW of Jimblebar	Possible; 1 record in Study Area; however, spp. was not identified from 21 collections of *Rhagodia* from the Study Area	63
Sida sp. Barlee Range (S. van Leeuwen 1642)	3	✓	✓	Rocky slope with small drainage line	Brown silty loam soil	Nil	46.9 km ESE of Mount Wall; 67.15 km WSW of Tom Price	Unlikely, the habitat doesn't occur in the Study Area	47
Stylidium weeliwolli	3	✓		Granite seepage area, watercourse	Brown sandy loam	Nil	0.75 km W of Hillside - Marble Bar Road; 31 km SW of Marble Bar	Unlikely, the habitat doesn't occur in the Study Area	29
Tecticornia medusa	3	✓		Flat floodplain, northern edge of large salt lake	Red clayey sand	Nil	7 km W along the Old Bore Rd and Lower Marsh Road	Unlikely, the habitat doesn't occur in the Study Area	18
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	3	✓	✓	Plain, flood plain	Orange sandy clay	Nil	40 km NE of Tom Price; 132 km NW of Newman	Possible in low open woodlands (A**WL**, A**SL**-3, A**SL**-5)	43
Triodia sp. Mt Ella (M.E. Trudgen 12739)	3	✓		Slope of a rock gully, scree	Skeletal red/brown soil	Nil	3.6 km E of Mount Newman; 18.3 km NW of Newman	Unlikely, the habitat doesn't occur in the Study Area	34
Xerochrysum boreale	3	✓		Stony plain, flat	Red/brown clay	Nil	30 km NW of Newman	Possible on the cracking clay /gilgai (MTG)	5
Eremophila magnifica subsp. *magnifica*	4	✓		Hillslope/gully	Red-brown sandy loam	Nil	57 km NW of Tom Price	Unlikely, the habitat doesn't occur in the Study Area	41
Eremophila youngii subsp. *lepidota*	4	✓	✓	Salt lake edge, flood plain, rangeland	Red sand/loam	Nil	14.8 km NW of Shovelanna Hill; 27.4 km NW of Jimblebar	Unlikely, the habitat doesn't occur in the Study Area	46
Goodenia berringbinensis	4	✓		Gilgai/soak, Ephemeral wetland to 30 cm deep below granite	Light yellow-brown clay soil	Nil	7.4 km SSW of Shovelanna Hill; 13.5 km W of Jimblebar	Unlikely, the habitat doesn't occur in the Study Area	27
Goodenia nuda	4	✓	✓	Floodplain/undulating plain, sandy floodplain	Red brown clay loam	Ironstone and quartz	31 km NW of Wittenoom; 10.4 km W of Shovelanna Hill	Recorded in the Study Area	96

Taxon	Priority Rank	Source		Habitat	Soils	Rock	Locations	Likelihood of occurrence	No. FB records
		WAHerb	NM 40						
Lepidium catapycnon	4	✓	✓	Steep hill slope, shales	Red clay loam	Nil	18.2 km SW of Mount Meharry; 29.7 km WNW of West Mount Hilditch	Unlikely, the habitat doesn't occur in the Study Area	33

APPENDIX 2: QUADRAT AND RELEVÉ LOCATIONS

Table A2.1: Quadrat and relevé locations (GDA94, MGA50)

Site	Easting (mE)	Northing (mN)	Site	Easting (mE)	Northing (mN)
HB10	794328	7473432	HBR4	798625	7478945
HB11	795871	7474744	HBR45	792097	7457436
HB12	795025	7475409	HBR6	799261	7479707
HB19	795499	7470101	HBR7	789944	7472582
HB24	797633	7469933	HBX7b	797506	7477253
HB27	793772	7463412	HBR9	794439	7475506
HB29	798938	7462728	Q01	786149	7473586
HB3	797705	7477539	Q02	786136	7472680
HB31	798976	7459609	Q03	786937	7471097
HB34	791616	7460633	Q04	785826	7465800
HB4b	798221	7478332	Q05	786254	7466844
HB8	796027	7475150	Q06	786080	7462617
HBR13	792784	7472195	Q07	787102	7460812
HBX15	792246	7471957	Q08	785887	7459446
HBR17	788626	7470942	Q09	787399	7458327
HBR18	793013	7471146	QS10	797265	7452268
HBR21	796673	7469746	Q11	791450	7453188
HBR22	797739	7469529	Q12	793195	7453284
HBR26	791410	7463715	Q13	796397	7453712
HBR28	794724	7462905	Q14	797788	7450650
HBR30	802033	7463676	Q15	799990	7450971
HBR32	791888	7457859	Q16	801769	7454535
HBR33	791222	7457857	QS17	786705	7470695
HBR35	799766	7457154	R01	790519	7465165
HBR38	791725	7460809			
HBR39	791725	7460809			

Note: In Site columns prefix HB = G and G Environmental (2009) original quadrat not resampled by Maia; prefix HBR = G and G Environment (2009) original quadrat resampled by Maia in 2018; prefix HBX = G and G Environmental (2009) original quadrat sampled in new area; prefix Q = Maia quadrats sampled in October 2017 and April 2018; prefix QS = additional quadrat assessed by Maia only in April 2018; R = relevé sampled by Maia in April 2018.

APPENDIX 3: SITE BY SPECIES MATRIX, STATISTICAL ANALYSIS INPUTS AND OUTPUTS

Table A3.1: Site by species matrix

Taxa	HB10	HB11	HB12	HB19	HB24	HB27	HB29	HB3	HB31	HB34	HB4b	HB8	HBR13	HBX15	HBR17	HBR18	HBR21
	THG	ATG	THG	AWL	AWL	MTG	MTG	THG	ASL-(5)	ASL-(3)	ATG	ATG	ASL-(2)	ASL-(5)	ASL-(2)	AWL	ASL-(4)
Abutilon leucopetalum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abutilon macrum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Abutilon otocarpum	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0	0.1	0
Abutilon sp. Pilbara (W.R. Barker 2025)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia adsurgens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia ancistrocarpa	1	0	1	4	0.1	0	0	0	1	1	0	0	0	0	0	0	0
Acacia aneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia aptaneura	0.1	0.1	3	3	3	0	0	0	2	3	0.1	0	3	3	3	3	0.1
Acacia incurvaneura	0.1	0	0	1	0	0	0	0	0	3	0	1	0	0	0	0	0
Acacia macraneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia melleodora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia pachyacra	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Acacia paraneura	0	0	0	0	3	0	0	0.1	0	0.1	0	0	0	0	0	0	0
Acacia pruinocarpa	2	0	0.1	2	2	0	0	3	0.1	0.1	1	0	0	0	0	0	0
Acacia pteraneura	0	0.1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Acacia rhodophloia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia sclerosperma subsp. *sclerosperma*	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia synchronicia	0.1	0.1	1	0	0	0	0	0.1	0	0	3	0.1	1	0	0.1	0	0.1
Acacia tetragonophylla	0	0.1	0.1	0	3	0.1	0	0.1	0.1	0.1	0.1	0.1	2	1	2	1	0.1
Acacia xiphophylla	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	3
Anthobolus leptomerioides	0.1	0	1	0.1	0.1	0	0	0.1	0	1	0	0	0.1	0	0.1	0	0
Aristida latifolia	0	0.1	0	1	4	4	1	0.1	3	1	1	1	1	2	4	2	0
Boerhavia coccinea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boerhavia paludosa	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Bonamia erecta	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
Cheilanthes sieberi subsp. *sieberi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysopogon fallax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Corchorus sidoides subsp. *sidoides*	0	0.1	0	2	0	0	0	0	0.1	0	0.1	0	1	0	0	0	0
Corchorus tectus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corymbia aspera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corymbia hamersleyana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cucumis variabilis	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Cymbopogon ambiguus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cymbopogon obtectus	0	0	0.1	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
Digitaria brownii	0	0	0	0	0	0	0	0	0	1	0	0	0.1	0	0	0.1	0
Dodonaea petiolaris	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Duperreya commixta	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	1	0
Dysphania rhadinostachya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Enchylaena tomentosa var. *tomentosa*	0	0	0	0	0	0	0	0	0	0.1	0.1	0	1	1	1	0	1
Enneapogon caerulescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1
Enteropogon ramosus	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0
Eragrostis eriopoda	0	0	0.1	0	3	0	3	0.1	0.1	0	0	0	0	0	0	0	0
Eragrostis setifolia	0	2	0	1	3	0	0	0	0	0	2	2	1	0	3	1	0.1
Eragrostis xerophila	0	0	0	0	0	3	4	0	0	0	1	1	1	0	3	1	0.1
Eremophila cuneifolia	0	0	0.1	0.1	0.1	0	0	0	0	0	0.1	0.1	0	0	0	0	0
Eremophila forrestii subsp. *forrestii*	0	0	0.1	1	0	0	0	0	0.1	2	0	0	0	0	0.1	1	0
Eremophila lanceolata	0	0	0	0.1	0.1	0.1	0	0	0.1	0	0	1	1	0.1	1	0	0
Eremophila latrobei subsp. *filiformis*	0	0	0	0	0	0	0	0	0	1	0	0	0	0.1	1	1	0
Eremophila longifolia	0	0	0	0	1	0	0	0	0	0	0.1	0.1	0	0.1	0	0.1	0
Eriachne mucronata	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0
Eulalia aurea	0	0	0	0	0	0.1	0	0	0.1	1	0	0	0	0	0	1	0
Evolvulus alsinoides var. *villosicalyx*	0	0	0	0.1	0.1	0	0	0	0	0	0	0	0.1	0.1	0.1	0	1
Fimbristylis dichotoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glycine canescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glycine tomentella	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Taxa	HB10	HB11	HB12	HB19	HB24	HB27	HB29	HB3	HB31	HB34	HB4b	HB8	HBR13	HBX15	HBR17	HBR18	HBR21
	THG	ATG	THG	AWL	AWL	MTG	MTG	THG	ASL-(5)	ASL-(3)	ATG	ATG	ASL-(2)	ASL-(5)	ASL-(2)	AWL	ASL-(4)
Hakea chordophylla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hakea lorea subsp. *lorea*	0.1	0	1	0	0	0	0	0	0	0	0	0.1	0.1	0	0	0	0
Hibiscus burtonii	0	0	1	0.1	0.1	0	0	0	0	0	0	0	0.1	0	0.1	0.1	0
Hibiscus sturtii var. *campylochlamys*	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0	0
Hibiscus sturtii var. *platychlamys*	0	0	0.1	1	0	0	0	0	0	0.1	0	0	1	0	0	0	0
Indigofera georgei	0	0	0	1	0	0	0	0	0	0	0	0	0.1	0	0	0	0
Ipomoea calobra	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ipomoea muelleri	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Maireana planifolia	0	0	0.1	0	0	0	0	0.1	0.1	0.1	0	0.1	0.1	0	0.1	0.1	0.1
Maireana tomentosa subsp. *tomentosa*	0	0	0	0	0	0	0	0.1	0	2	0.1	0.1	0	0	0	0	0
Maireana villosa	0	0.1	0	0	0	0	0	0.1	0	0	0.1	0.1	0	0.1	0	0	0
Neptunia dimorphantha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Panicum effusum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paraneurachne muelleri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psydrax latifolia	0	0	0.1	1	0.1	0	0	0	0	1	0	0	0	0.1	0.1	1	0
Pterocaulon sphacelatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Ptilotus astrolasius	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ptilotus obovatus var. *obovatus*	0.1	0.1	0.1	2	2	0	0	0.1	0.1	0	0	0	2	0.1	2	1	1
Ptilotus schwartzii var. *schwartzii*	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0.1	0	0	0
Rhagodia eremaea	0	0.1	0	1	0.1	0	0	0.1	0	1	0	0.1	1	0	1	0	1
Rhynchosia minima	0	0	0	0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	1	0.1	0
Salsola australis	0	0.1	0	0	0	0	0	0.1	0.1	0	1	0.1	0.1	0	0	0	1
Scaevola parvifolia subsp. *pilbarae*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sclerolaena cornishiana	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2	0.1	2	1	2	1	1
Sclerolaena cuneata	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senna ? sericea x *symonii*	0	0	1	0	0	0	0	0	0	1	0	1	0	0.1	0	0	1
Senna artemisioides subsp. *artemisioides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senna artemisioides subsp. *helmsii*	0	2	0	0	0	1	2	0	0	0	0	3	0	0	0.1	1	3
Senna artemisioides subsp. *oligophylla*	0.1	0	0.1	0.1	0.1	2	0	0	2	0.1	0.1	0	2	3	2	0	0.1
Senna ferraria / glaucifolia	0.1	0.1	0	0	0	0	0	0	0	0	0.1	2	0	0	0	0	0
Senna glutinosa subsp. *glutinosa*	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Senna glutinosa subsp. x *luerssenii*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Senna notabilis	0	0.1	0	0.1	0.1	0	0	0	0.1	0.1	0.1	0	0	0	0	0	0
Senna symonii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sida echinocarpa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sida fibulifera	0	0	0	0.1	0.1	0	0.1	0	0	0	0.1	0.1	0.1	0	1	0	1
Sida platycalyx	0	1	0	2	2	0	0	0	1	1	0	1	1	0	1	1	0
Solanum cleistogamum	0	0.1	0	0	0	0	0	0.1	0	0	0.1	0	0.1	0.1	0	0.1	0
Solanum lasiophyllum	0.1	0.1	1	0	0.1	0.1	0	0.1	0.1	0	0.1	1	1	0.1	1	1	0.1
Solanum morrisonii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sporobolus australasicus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Streptoglossa macrocephala / odora	0	0.1	0	0	0	0.1	0.1	0	0	0.1	0	0.1	0	0	3	0	0
Tephrosia supina	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Triodia basedowii	4	0.1	4	0	0	0	0	4	0.1	0.1	0	0	0	1	0	0	0
Triodia schinzii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Taxa	HBR22	HBR26	HBR28	HBR30	HBR32	HBR33	HBR35	HBR38	HBR39	HBR4	HBR45	HBR6	HBR7	HBX7b	HBR9	Q01	Q02
	ASL-(3)	ASL-(3)	AWL	ASL-(3)	ASL-(3)	AWL	ASL-(2)	ASL-(3)	MTG	ASL-(2)	ASL-(1)	ASL-(4)	THG	THG	THG	THG	ASL-(3)
Abutilon leucopetalum	0	0	0	0	0.1	0	0	0	0	0	0.1	0	0	0	0.1	0	0
Abutilon macrum	0	0	0	0	0	0.1	0	0	0	0.1	0	0	0	0	0	0	1
Abutilon otocarpum	0	0	1	0.1	0	0	1	0	0	1	0	1	0.1	1	0	0	0.1
Abutilon sp. Pilbara (W.R. Barker 2025)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Acacia adsurgens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0
Acacia ancistrocarpa	0	0	0	1	1	0	0	0	0	0	2	0	0.1	3	1	2	0
Acacia aneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Acacia aptaneura	1	0	4	0	0	2	1	0	0	0	4	2	1	1	0	1	1
Acacia incurvaneura	0	3	0	2	1	0	0	2	0	0.1	0	0	0	0	0	0	0
Acacia macraneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Acacia melleodora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Acacia pachyacra	0	0	0	1	1	1	0	0.1	0	0	0	0	0	0	0	0	0
Acacia paraneura	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Acacia pruinocarpa	1	1	1	1	1	0	1	0	0	0	2	0	2	2	3	1	1
Acacia pteraneura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Acacia rhodophloia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia sclerosperma subsp. *sclerosperma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Acacia synchronicia	0	0	0	0	0	0	0	0	0	1	0.1	1	0	0	0.1	0	0
Acacia tetragonophylla	1	1	1	1	1	1	1	2	0	1	2	1	1	1	2	1	0.1
Acacia xiphophylla	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
Anthobolus leptomerioides	1	1	0	0.1	1	1	0	1	0	0	1	0	1	0.1	0.1	1	1
Aristida latifolia	1	2	0	3	4	2	1	2	1	1	0	2	0.1	2	2	1	1
Boerhavia coccinea	0	0	1	0	0	0	1	0.1	0	1	0	1	0	1	0	0	0
Boerhavia paludosa	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Bonamia erecta	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Cheilanthes sieberi subsp. *sieberi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrysopogon fallax	0	0.1	0.1	0	0	0	1	0	0.1	0	2	0	0	0	0	0	0.1
Corchorus sidoides subsp. *sidoides*	0	0	0	0	0	0	0	0	0	0.1	0	1	0	0	0	0	0
Corchorus tectus	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.1	0
Corymbia aspera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corymbia hamersleyana	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Cucumis variabilis	0	0	0.1	1	0	0	0	0	0	0	0.1	0	0	0	0	0.1	0
Cymbopogon ambiguus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	1
Cymbopogon obtectus	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Digitaria brownii	0	1	0	0	1	0.1	0	1	0	0	0	0	0	0	1	0	0
Dodonaea petiolaris	0	1	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	1
Duperreya commixta	0	0.1	0	0	0	0.1	0	0.1	0	0	0	0	0.1	0.1	0	0.1	0
Dysphania rhadinostachya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Enchylaena tomentosa var. *tomentosa*	0	0	0	0	0	0.1	0	0	0	1	0.1	0	0	0	1	0	1
Enneapogon caerulescens	1	0	0	1	0	0	1	0	0	0.1	0	0	1	2	0	0	0
Enteropogon ramosus	0	0	0	0	0	0	0	0	0	0.1	0	1	0	0	0	0	0
Eragrostis eriopoda	1	1	0	1	1	0	0	0	0	0	2	0	0	4	1	0	0
Eragrostis setifolia	0	0	0	1	0	1	1	0	0	2	1	1	0	1	0	1	0
Eragrostis xerophila	0	0.1	0	0	0	0	1	0	3	0	0	1	0	0	0	0	0
Eremophila cuneifolia	0	0	0	0	0	0	0	0	0	1	0	0	0	0.1	0.1	0.1	0
Eremophila forrestii subsp. *forrestii*	0	2	0.1	0	0.1	1	0	1	0	0	0	1	1	0	0	1	3
Eremophila lanceolata	0	0	0	0	0	1	1	1	0.1	1	0	0	0	0	0	0	0
Eremophila latrobei subsp. *filiformis*	0	0.1	0	0	0	0	0	0.1	0	1	0	0	0	0	0	0	1
Eremophila longifolia	0	0	0	0	0	0	0	0.1	0	0	0	0.1	1	1	0.1	0	0
Eriachne mucronata	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Eulalia aurea	0	1	1	1	2	1	0	1	0	0	4	0	1	0	0	0	0.1
Evolvulus alsinoides var. *villosicalyx*	0	0.1	1	1	0.1	0	0.1	0.1	0	0.1	1	1	0	1	0.1	0.1	1
Fimbristylis dichotoma	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Glycine canescens	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1	0	0
Glycine tomentella	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Taxa	HBR22	HBR26	HBR28	HBR30	HBR32	HBR33	HBR35	HBR38	HBR39	HBR4	HBR45	HBR6	HBR7	HBX7b	HBR9	Q01	Q02
	ASL-(3)	ASL-(3)	AWL	ASL-(3)	ASL-(3)	AWL	ASL-(2)	ASL-(3)	MTG	ASL-(2)	ASL-(1)	ASL-(4)	THG	THG	THG	THG	ASL-(3)
Hakea chordophylla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hakea lorea subsp. *lorea*	0	0.1	0	1	0.1	0	0	0.1	0	0	0.1	0	1	0	0	0	0
Hibiscus burtonii	1	0.1	1	0.1	0.1	0.1	0.1	1	0	0.1	0	1	0.1	1	0.1	0	1
Hibiscus sturtii var. *campylochlamys*	0	0	0	1	1	0.1	0	0	0	0.1	0	0	0	0.1	0	0	0
Hibiscus sturtii var. *platychlamys*	0	0	0	0	0	0	1	0	0	0	1	0	1	0.1	0.1	0	1
Indigofera georgei	0	1	1	1	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0.1
Ipomoea calobra	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0.1
Ipomoea muelleri	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maireana planifolia	0	1	1	0	0	1	1	0	0	0.1	0	1	0.1	1	0.1	0	1
Maireana tomentosa subsp. *tomentosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maireana villosa	0	0	0	0	1	0.1	2	0.1	0	1	0	1	0.1	0	0	0	0.1
Neptunia dimorphantha	0	0	0	0	0	0	0.1	0	1	0	0	0	0	0	0	0	0
Panicum effusum	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1
Paraneurachne muelleri	1	0	0	1	2	0	0	1	0	0	0.1	0	1	2	1	1	1
Psydrax latifolia	0	1	1	1	0	1	0	0	0	0	1	0.1	0.1	0	0	0.1	1
Pterocaulon sphacelatum	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0
Ptilotus astrolasius	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0
Ptilotus obovatus var. *obovatus*	1	1	1	1	1	1	1	1	0	1	1	2	0	2	1	0	1
Ptilotus schwartzii var. *schwartzii*	1	0	0	0	0.1	0.1	0	1	0	0	0	0	0	0	0	0	0
Rhagodia eremaea	0	1	0	0.1	0	1	1	0	0	0.1	1	0	0.1	0.1	0.1	0	1
Rhynchosia minima	0	0	0	0.1	0	0	1	0	1	0.1	1	0	0	0	0	0	0.1
Salsola australis	1	0	0	0.1	0	0	1	1	0	0.1	0	1	0	0	0	0	0
Scaevola parvifolia subsp. *pilbarae*	0	0	0	0	1	0	0	0	0	0	0	0	0	0.1	0	0.1	0
Sclerolaena cornishiana	1	1	1	0.1	1	1	1	1	0	1	1	2	0	1	0	0	0
Sclerolaena cuneata	1	0	0	0	0	0	1	0	0	0	0	0.1	0	0	0	0	0
Senna ? *sericea* x *symonii*	1	1	0	1	1	0	0	1	0	1	0	2	0	1	0	0	0
Senna artemisioides subsp. *artemisioides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senna artemisioides subsp. *helmsii*	1	1	1	0.1	0.1	0.1	1	2	0	0	2	0	0	0	0.1	0	0
Senna artemisioides subsp. *oligophylla*	0	0.1	0	1	1	0.1	1	2	3	1	2	0.1	1	0	0.1	0	0.1
Senna ferraria / glaucifolia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senna glutinosa subsp. *glutinosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Senna glutinosa subsp. x *luerssenii*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.1	0	0
Senna notabilis	1	0	1	1	0.1	0	0	0	0	0.1	0	0.1	0.1	1	0	0.1	0
Senna symonii	1	0	0	0.1	0	0	0.1	0	1	0	0	0	0	0	0	0	0
Sida echinocarpa	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Sida fibulifera	0	0	0	1	0	0	1	0.1	1	1	0.1	0	0	0.1	0.1	0	1
Sida platycalyx	1	1	1	1	1	1	0	1	0	1	0.1	1	0	1	0	0	1
Solanum cleistogamum	1	0	0	0	0	0	0	0	0	0	0	0.1	0	0.1	0.1	0	0
Solanum lasiophyllum	1	1	1	1	1	1	1	1	1	1	0.1	1	1	1	1	0.1	1
Solanum morrisonii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Sporobolus australasicus	0	0	0	0	0	0	0	0	0.1	0.1	0	1	0	1	0	0	0
Streptoglossa macrocephala / odora	0	0	0	0.1	0	0	0	0	0	0.1	0	0	0	0	0	0	0
Tephrosia supina	0	0	0	1	0.1	0	1	0	0	0	0.1	1	0	0	0	0	0
Triodia basedowii	1	1	0	0.1	3	2	0	2	0	0	0	0	0.1	3	4	3	2
Triodia schinzii	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0

Taxa	Q03	Q04	Q05	Q06	Q07	Q08	Q09	QS10	Q11	Q12	Q13	Q14	Q15	Q16	QS17
	ASL-(5)	ASL-(5)	THG	AWL	AWL	THG	ASL-(3)	ASL-(1)	ASL-(1)	MTG	ASL-(5)	ASL-(1)	ATG	AWL	AWL
Abutilon leucopetalum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abutilon macrum	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0
Abutilon otocarpum	0	0.1	0.1	2	0	0	0	1	1	0	0	1	0	0.1	0.1
Abutilon sp. Pilbara (W.R. Barker 2025)	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Acacia adsurgens	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
Acacia ancistrocarpa	0	0.1	2	0	0	2	0	0	2	0	0	0	0	0.1	0
Acacia aneura	0.1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Acacia aptaneura	2	0.1	0	4	1	0	1	0	2	0	2	0	1	3	4
Acacia incurvaneura	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0
Acacia macraneura	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Acacia melleodora	0	0.1	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0
Acacia pachyacra	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Acacia paraneura	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Acacia pruinocarpa	0.1	1	0.1	0	1	1	1	1	0.1	0	0	2	1	0.1	2
Acacia pteraneura	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Acacia rhodophloia	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Acacia sclerosperma subsp. *sclerosperma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acacia synchronicia	0	0.1	0	0	0	0	0	0	0	0	0	0	1	0	0
Acacia tetragonophylla	0.1	0.1	0.1	1	1	0	1	1	1	0	0.1	1	1	1	1
Acacia xiphophylla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthobolus leptomerioides	0.1	0.1	0.1	0	0	0.1	0	0	0	0	0	0.1	0	0	1
Aristida latifolia	0.1	2	1	1	1	0.1	1	1	1	2	1	2	1	2	2
Boerhavia coccinea	0	0	0	0	0	0	0.1	0	0	0	0	0	0.1	1	1
Boerhavia paludosa	0	0	0	0.1	0	0	0	1	1	0	0	1	0.1	0	0
Bonamia erecta	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Cheilanthes sieberi subsp. *sieberi*	0.1	0	0	0	0	0	0	0.1	0	0	0.1	0	0	0	0
Chrysopogon fallax	0	0	0	0	2	0.1	0	1	1	0	0.1	0.1	0	0	0
Corchorus sidoides subsp. *sidoides*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corchorus tectus	0	0	1	0	0	0.1	0	0	0.1	0	0	0	0	0	0
Corymbia aspera	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0
Corymbia hamersleyana	0	0	0	0.1	0	0	0	0	1	0	0	0.1	0	0	0
Cucumis variabilis	0.1	0	0	1	0	0	0	0.1	0.1	0	0	0	0	0	1
Cymbopogon ambiguus	0	0	0.1	0	0	0.1	0	0	0	0	0	0	1	0	0
Cymbopogon obtectus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Digitaria brownii	0.1	0	1	3	0	0	0	0	1	0	0.1	0	0	1	1
Dodonaea petiolaris	0.1	0	0.1	2	1	0	0.1	1	0	0	1	1	0	0.1	2
Duperreya commixta	0	0	0	0.1	0	0	0	0	0	0	0	1	0	0	1
Dysphania rhadinostachya	0	0	0	0	0.1	0	1	0	0	0	0	0	0	0	0
Enchylaena tomentosa var. *tomentosa*	0	0	0	0.1	0	0	1	0	0	0	0.1	0	0	0.1	0
Enneapogon caerulescens	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Enteropogon ramosus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eragrostis eriopoda	0	0.1	1	0	0	0	0	0	2	0	0	0	0	0	0
Eragrostis setifolia	1	2	0	0	0	0	0	0	0	0	1	0.1	0	0.1	0
Eragrostis xerophila	0	0	0	0	0.1	0	0	0	0	5	0	0.1	1	0.1	0
Eremophila cuneifolia	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Eremophila forrestii subsp. *forrestii*	0.1	0.1	0	2	2	0	1	1	0	0	1	1	0	2	1
Eremophila lanceolata	0	0	0	0	0	0	0	0	0	0.1	0.1	0.1	1	0.1	0
Eremophila latrobei subsp. *filiformis*	1	0.1	0	0	0	0	0	0	0	0	0.1	0	0	0.1	1
Eremophila longifolia	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Eriachne mucronata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eulalia aurea	0.1	0	1	0	0	0	0.1	1	1	0	1	1	1	1	0
Evolvulus alsinoides var. *villosicalyx*	1	0.1	1	2	0.1	0	0.1	1	1	0	0.1	1	0.1	0.1	1
Fimbristylis dichotoma	0	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Glycine canescens	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Glycine tomentella	0	0	0	0.1	0	0	0	0	0.1	0	0	0.1	0	0	0

Taxa	Q03	Q04	Q05	Q06	Q07	Q08	Q09	QS10	Q11	Q12	Q13	Q14	Q15	Q16	QS17
	ASL-(5)	ASL-(5)	THG	AWL	AWL	THG	ASL-(3)	ASL-(1)	ASL-(1)	MTG	ASL-(5)	ASL-(1)	ATG	AWL	AWL
Hakea chordophylla	0	0	0	0	0	0	1	0.1	0	0	0	1	0	0	0
Hakea lorea subsp. *lorea*	0	0.1	1	0.1	0	0	0.1	0	0	0	0.1	0	1	0	0.1
Hibiscus burtonii	0.1	0.1	1	1	1	0	0	0	0.1	0	1	0	0	0.1	1
Hibiscus sturtii var. *campylochlamys*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hibiscus sturtii var. *platychlamys*	0	0	1	0	0	0	0	1	0.1	0.1	0	0.1	0	0	0
Indigofera georgei	0	0	0	0.1	0	0	0	1	0.1	0	0.1	0	0	0.1	0.1
Ipomoea calobra	0	0	0	0	0	0	0	1	0	0	0	0	0	0.1	0.1
Ipomoea muelleri	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0
Maireana planifolia	0.1	0.1	1	0	0	0	1	0	0	0	0	0	0	0	1
Maireana tomentosa subsp. *tomentosa*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maireana villosa	0	0	0	1	2	0	1	1	1	0	1	0.1	0.1	2	1
Neptunia dimorphantha	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Panicum effusum	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Paraneurachne muelleri	0	0.1	1	0	0	0.1	0.1	0	1	0	0.1	1	1	0.1	0.1
Psydrax latifolia	0.1	0	0.1	1	1	0	0.1	1	1	0	0.1	1	0	1	1
Pterocaulon sphacelatum	0	0	1	2	0	0	0	0	0	0	0	1	0.1	0	1
Ptilotus astrolasius	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
Ptilotus obovatus var. *obovatus*	1	0.1	0.1	2	2	0	0.1	0.1	1	0	0	2	1	2	3
Ptilotus schwartzii var. *schwartzii*	1	1	0	0	0.1	0	1	0	0	0	2	0	0	0.1	0.1
Rhagodia eremaea	0	0.1	0	0	0.1	0	1	0	0.1	0	0	0	0.1	0.1	0.1
Rhynchosia minima	0	0	0	0.1	0.1	0	0	1	0	1	0	0.1	0	0	0
Salsola australis	0	0.1	0	0	0	0	0.1	0	0.1	0	0	0	0	0	0
Scaevola parvifolia subsp. *pilbarae*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Sclerolaena cornishiana	0.1	1	0	0	0	0	1	0	1	0.1	0.1	0	2	0.1	0.1
Sclerolaena cuneata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Senna ? *sericea* x *symonii*	0.1	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Senna artemisioides subsp. *artemisioides*	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Senna artemisioides subsp. *helmsii*	0	0.1	1	0.1	1	0	0	0	2	2	1	2	2	1	1
Senna artemisioides subsp. *oligophylla*	0	2	1	0	0	0	0	1	0.1	1	2	0.1	0.1	1	1
Senna ferraria / glaucifolia	0.1	0	0	0	0	0	2	0	1	0	0	1	2	0	0
Senna glutinosa subsp. *glutinosa*	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
Senna glutinosa subsp. x *luerssenii*	0	2	0	0	0	0.1	0.1	0	0	0	0.1	0	0	0	0
Senna notabilis	0	0	0.1	0.1	0	0.1	0.1	1	0	0	0	0	0.1	0.1	0
Senna symonii	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0
Sida echinocarpa	0	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0
Sida fibulifera	0	0	0	0.1	0	0	0.1	1	1	1	0.1	0	0	0.1	0
Sida platycalyx	0.1	1	0	1	2	0	1	1	1	0	0.1	1	1	0.1	1
Solanum cleistogamum	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Solanum lasiophyllum	0.1	0.1	0.1	0	0.1	0.1	1	0.1	1	1	0.1	0.1	1	1	0.1
Solanum morrisonii	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0
Sporobolus australasicus	0.1	0	0	2	1	0	0	0	0	0	0	0	0	0.1	1
Streptoglossa macrocephala / odora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Tephrosia supina	0	0	0	0	0	0	0.1	1	0.1	0	0	0	0	0	0
Triodia basedowii	1	1	4	0	0	3	0	0	0	0	0	0	0	0	0
Triodia schinzii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: In site columns prefix HB = G and G Environmental (2009) original quadrat visited by Maia; prefix HBR = G and G Environment (2009) original quadrat resampled by Maia in 2018; prefix HBX = G and G Environmental (2009) original quadrat sampled in new area; prefix Q = Maia quadrats sampled in October 2017 and April 2018; prefix QS = additional quadrat assessed by Maia only in April 2018.

Figure A3.1: PATN analysis dendrogram

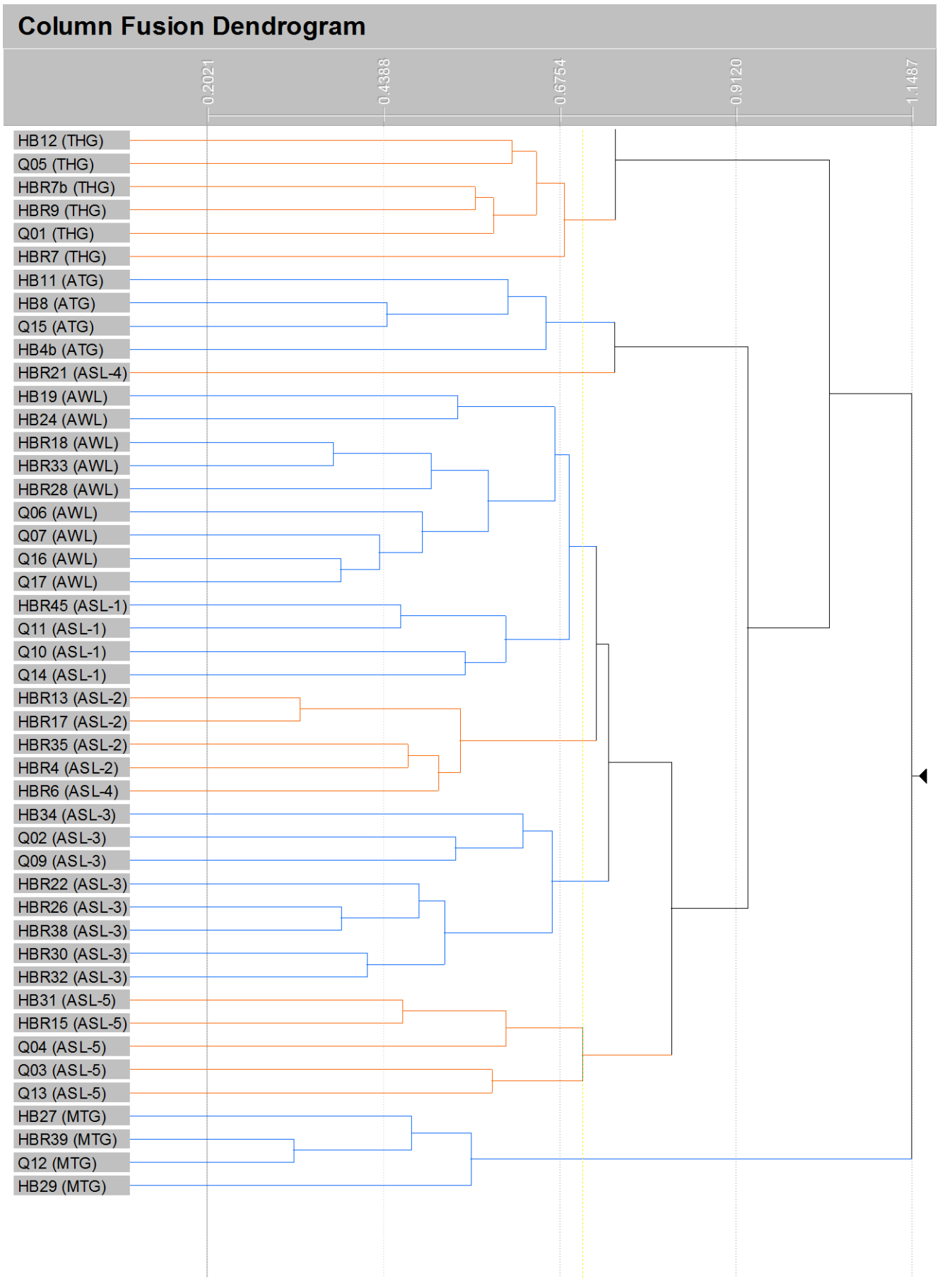

Figure A3.2: PATN analysis group dendrogram

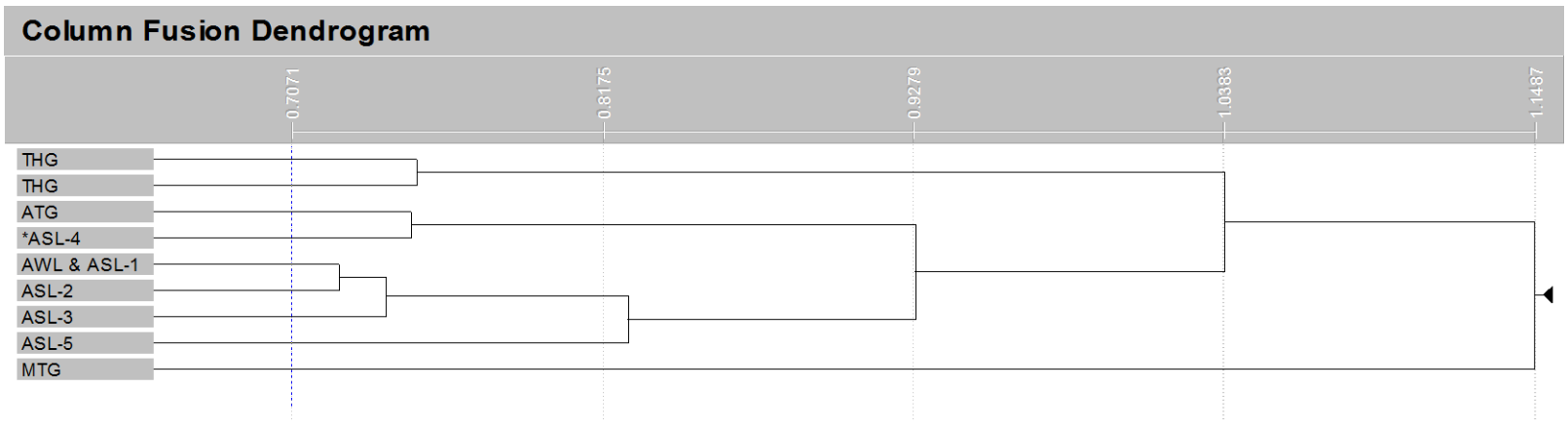

Figure A3.3: PATN recipe for statistical analyses

```
Recipe of analysis to be performed on    at  17:11:13, June 05, 2018


Analysis based on rows -
   Association Measure: Bray Curtis
   Classification Strategy: Agglomerative Hierarchical Fusion
      Technique: Flexible UPGMA
      Beta: -0.1000
      Number of groups to produce: 7
   Ordination Method: SSH
      CutOff = 0.900
      3 Dimensions
      Number of random starts: 1000
      Max iterations: 50
      Random Seed Value: 1235

Analysis based on columns -
   Association Measure: Bray Curtis
   Classification Strategy: Agglomerative Hierarchical Fusion
      Technique: Flexible UPGMA
      Beta: -0.1000
      Number of groups to produce: 10
```

Table A3.2: Indicator species for vegetation types recorded in the Study Area

Species	p value	Group/Observed indicator value							Indicator level
		THG	ATG	AWL	ASL-(1)	ASL-(2)	MTG	ASL-(4)	
Acacia pruinocarpa	0.001	20.4							Low
Anthobolus leptomerioides	0.001	26.9							Low
Triodia basedowii	0.001	32.9							Low
Bonamia erecta	0.011	44.4							Moderate
Acacia ancistrocarpa	0.013	31.6							Low
Ptilotus astrolasius	0.026	34.7							Moderate
Senna ferraria / glaucifolia	0.006		51.6						Moderate
Maireana tomentosa subsp. *tomentosa*	0.05		34.0						Moderate
Hibiscus burtonii	0.003			21.5					Low
Psydrax latifolia	0.005			22.6					Low
Corymbia aspera	0.003				**75.0**				High
Hibiscus sturtii var. *platychlamys*	0.004				37.5				Moderate
Corymbia hamersleyana	0.006				57.9				Moderate
Chrysopogon fallax	0.008				39.5				Moderate
Eulalia aurea	0.01				27.5				Low
Ipomoea calobra	0.046				29.5				Low
Glycine tomentella	0.05				29.5				Low
Hakea chordophylla	0.05				34.0				Moderate
Hibiscus sturtii var. *campylochlamys*	0.026					46.0			Moderate
Rhynchosia minima	0.04						30.3		Low
Acacia xiphophylla	0.002							**80.0**	High
Sporobolus australasicus	0.016							42.3	Moderate

Note: Indicator values are shown only for taxa that were significant at p<0.05 (Monte Carlo Permutation Tests).

APPENDIX 4: SPECIES ACCUMULATION ANALYSIS AND SPECIES LIST

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Table A4.1: EstimateS species accumulation analysis results*

EstimateS (Version 9.1.0), Copyright R. K. Colwell: http://purl.oclc.org/estimates

Diversity Output from Input File: RHL2 SPAC v1 (8 June, 2018)

Samples	Individuals (computed)	Sobs (est)	Sobs (est) 95% CI Lower Bound	Sobs (est) 95% CI Upper Bound	Sobs (est) SD	Sobs Mean (runs)	Singletons Mean	Singletons SD (runs)	Doubletons Mean	Doubletons SD (runs)	Uniques Mean	Uniques SD (runs)	Duplicates Mean	Duplicates SD (runs)	ACE Mean	ACE SD (runs)	ICE Mean	ICE SD (runs)	Chao 1 Mean	Chao 1 95% CI Lower Bound	Chao 1 95% CI Upper Bound	Chao 1 SD (analytical)	Chao 2 Mean
1	35.72	34.5	28.28	40.72	3.17	33.86	33.45	9.85	0	0	33.86	9.78	0	0	705.15	397.96	33.86	9.78	609.56	339.96	1123.64	191.72	33.86
2	71.44	55.42	46.67	64.17	4.46	55.45	41.23	7.7	13.45	6.15	41.62	7.81	13.83	6.19	172.91	92.21	263.16	171.98	133.51	88.7	240.46	35.96	94.69
3	107.16	70.26	60.1	80.42	5.18	69.78	43.43	7.41	17.86	4.62	43.78	7.57	18.34	4.58	133.16	37.04	159.93	46.4	124.14	94.98	187.31	22.21	105.91
4	142.88	81.69	70.63	92.75	5.64	81.14	44.86	7.48	19.99	4.2	45.19	7.64	20.42	4.22	133.34	28.36	150.64	32.23	131.5	105	187.7	19.96	118.9
5	178.6	90.97	79.3	102.64	5.95	90.47	45.62	7.49	21.17	4.08	45.96	7.62	21.56	4.13	137.85	22.53	151.12	25.08	139.05	113.69	192.36	19.01	129.41
6	214.32	98.77	86.66	110.89	6.18	98.35	46.22	7.5	21.71	4.2	46.54	7.59	22.1	4.25	144.15	21.27	155.21	23.26	147.18	121.78	200.34	18.99	139.05
7	250.04	105.52	93.07	117.96	6.35	105.14	46.67	6.98	21.88	4.09	46.98	7.05	22.18	4.1	150.37	18.8	160.05	20.58	154.2	128.75	207.32	19.01	147.32
8	285.76	111.47	98.76	124.17	6.48	111.6	47.55	6.91	21.94	4.21	47.87	6.96	22.23	4.22	157.46	18.19	166.65	20	162.56	136.24	217.16	19.59	156.31
9	321.48	116.8	103.89	129.71	6.59	116.97	47.86	6.61	21.89	4.15	48.2	6.65	22.13	4.17	162.76	17.06	171.64	18.76	168.55	141.95	223.63	19.78	163.08
10	357.2	121.64	108.56	134.71	6.67	121.8	48.04	6.5	21.89	4.08	48.38	6.54	22.1	4.09	167.8	16.72	176.32	18.4	173.67	146.94	228.99	19.87	168.78
11	392.92	126.07	112.85	139.3	6.75	126.51	48.7	6.32	21.72	4.39	49.07	6.37	21.89	4.39	172.99	16.25	181.11	17.81	180.62	152.79	238.08	20.66	176.12
12	428.64	130.18	116.83	143.52	6.81	130.61	49.08	6.25	21.62	4.46	49.45	6.28	21.79	4.49	177.06	16.03	184.48	17.4	186	157.53	244.74	21.13	181.79
13	464.36	134	120.54	147.45	6.87	134.37	49.4	6.13	21.72	4.79	49.78	6.14	21.89	4.81	180.88	15.8	187.72	17	190.79	161.81	250.58	21.51	186.88
14	500.08	137.57	124.02	151.13	6.92	137.85	49.64	6.13	22.01	4.46	50.04	6.15	22.2	4.5	184.46	15.71	190.8	16.84	193.73	165.12	252.52	21.19	190.21
15	535.8	140.94	127.29	154.59	6.96	141.11	50.08	6.18	22.04	4.36	50.49	6.18	22.25	4.39	188.2	15.71	194.12	16.75	197.67	168.81	256.75	21.33	194.33
16	571.52	144.12	130.39	157.85	7.01	144.29	50.58	5.95	22.21	4.09	50.99	5.93	22.42	4.12	191.9	15.08	197.47	15.98	201.13	172.23	260.07	21.32	198.01
17	607.24	147.13	133.33	160.94	7.04	147.26	50.98	5.84	22.48	4.23	51.39	5.82	22.72	4.27	195.34	14.87	200.63	15.67	204.45	175.44	263.47	21.37	201.48
18	642.96	150	136.12	163.88	7.08	150.08	51.2	5.75	22.56	4.27	51.61	5.71	22.83	4.29	198.31	14.35	203.31	15.06	207.65	178.47	266.92	21.47	204.73
19	678.68	152.73	138.78	166.68	7.12	152.7	51.56	5.5	22.73	4.25	51.96	5.46	23.04	4.24	201.33	13.8	206.13	14.39	210.59	181.3	269.94	21.53	207.67
20	714.4	155.34	141.33	169.36	7.15	155.45	52.01	5.54	23.03	4.11	52.4	5.49	23.37	4.08	204.73	13.71	209.35	14.25	213.53	184.26	272.64	21.48	210.65
21	750.12	157.84	143.76	171.92	7.18	157.9	52.22	5.49	23.37	4.12	52.62	5.48	23.75	4.09	207.58	13.6	212.09	14.17	215.58	186.56	274.07	21.27	212.82
22	785.84	160.23	146.1	174.37	7.21	160.21	52.5	5.4	23.3	4.02	52.91	5.38	23.7	4.01	210.36	13.53	214.78	14.02	218.55	189.23	277.58	21.48	215.87
23	821.56	162.53	148.34	176.73	7.24	162.59	52.68	5.44	23.46	4.12	53.08	5.4	23.9	4.08	212.99	13.61	217.32	14.06	220.97	191.68	279.88	21.45	218.28
24	857.28	164.75	150.5	179	7.27	164.71	52.87	5.36	23.62	4.08	53.26	5.32	24.1	4.07	215.43	13.47	219.69	13.87	223.05	193.81	281.76	21.39	220.38
25	893	166.88	152.57	181.19	7.3	166.77	53.06	5.23	23.75	3.92	53.44	5.19	24.27	3.9	217.85	13.36	222.06	13.75	224.95	195.84	283.32	21.28	222.26
26	928.72	168.94	154.58	183.3	7.33	168.85	53.26	5.23	23.75	4.02	53.64	5.19	24.3	4.01	220.32	13.44	224.5	13.81	227.58	198.21	286.42	21.46	224.91
27	964.44	170.93	156.51	185.34	7.36	170.87	53.47	5.06	23.96	3.87	53.81	5.01	24.54	3.85	222.74	12.81	226.85	13.18	229.41	200.18	287.87	21.34	226.66
28	1000.16	172.85	158.38	187.32	7.38	172.85	53.58	5.03	24.1	3.95	53.93	4.98	24.71	3.94	225.04	12.66	229.12	13.03	231.45	202.21	289.87	21.33	228.72

Samples	Individuals (computed)	Sobs (est)	Sobs (est) 95% CI Lower Bound	Sobs (est) 95% CI Upper Bound	Sobs (est) SD	Sobs Mean (runs)	Singletons Mean	Singletons SD (runs)	Doubletons Mean	Doubletons SD (runs)	Uniques Mean	Uniques SD (runs)	Duplicates Mean	Duplicates SD (runs)	ACE Mean	ACE SD (runs)	ICE Mean	ICE SD (runs)	Chao 1 Mean	Chao 1 95% CI Lower Bound	Chao 1 95% CI Upper Bound	Chao 1 SD (analytical)	Chao 2 Mean
29	1035.88	174.71	160.19	189.24	7.41	174.67	53.76	5.14	24.08	3.82	54.11	5.07	24.69	3.8	227.31	12.75	231.36	13.09	233.75	204.31	292.51	21.47	231.06
30	1071.6	176.52	161.94	191.1	7.44	176.49	53.84	5.02	24.06	3.89	54.18	4.96	24.7	3.89	229.32	12.31	233.36	12.67	235.84	206.27	294.88	21.57	233.12
31	1107.32	178.28	163.64	192.91	7.47	178.35	54.11	4.85	24.04	3.87	54.46	4.78	24.7	3.87	231.77	11.94	235.8	12.26	238.35	208.48	297.9	21.77	235.62
32	1143.04	179.98	165.29	194.67	7.49	180.04	54.21	4.74	24.05	3.97	54.55	4.69	24.74	3.98	233.7	11.58	237.72	11.93	240.36	210.33	300.19	21.87	237.6
33	1178.76	181.64	166.9	196.38	7.52	181.76	54.36	4.66	24.11	3.84	54.69	4.61	24.84	3.84	235.81	11.4	239.82	11.72	242.07	212.09	301.74	21.83	239.26
34	1214.48	183.25	168.45	198.05	7.55	183.31	54.5	4.47	23.9	3.76	54.8	4.43	24.67	3.75	237.59	10.97	241.54	11.3	244.31	213.99	304.66	22.08	241.32
35	1250.2	184.83	169.97	199.69	7.58	184.76	54.57	4.33	23.74	3.81	54.87	4.3	24.53	3.82	239.21	10.66	243.14	10.99	246.31	215.71	307.22	22.28	243.33
36	1285.92	186.38	171.46	201.29	7.61	186.34	54.82	4.35	23.56	3.74	55.07	4.34	24.38	3.75	241.23	10.64	245.06	10.98	248.87	217.81	310.64	22.61	245.7
37	1321.64	187.98	173	202.97	7.64	187.9	55.01	4.22	23.27	3.58	55.24	4.19	24.12	3.55	243.07	10.28	246.83	10.58	251.56	219.95	314.4	23	248.17
38	1357.36	189.34	174.3	204.38	7.67	189.46	55.47	3.98	22.85	3.47	55.67	3.96	23.72	3.41	245.3	9.83	249.03	10.12	255.17	222.57	319.93	23.71	251.55
39	1393.08	190.78	175.68	205.88	7.71	190.92	55.71	3.83	22.52	3.5	55.9	3.81	23.41	3.47	247.04	9.43	250.72	9.73	258.09	224.76	324.25	24.23	254.31
40	1428.8	192.19	177.02	207.36	7.74	192.28	55.95	3.76	22.26	3.28	56.13	3.76	23.16	3.28	248.68	9.2	252.29	9.5	260.55	226.71	327.7	24.6	256.71
41	1464.52	193.57	178.33	208.8	7.77	193.62	56.2	3.64	21.94	3.06	56.37	3.65	22.86	3.1	250.25	8.99	253.81	9.28	263.2	228.73	331.57	25.05	259.28
42	1500.24	194.92	179.61	210.23	7.81	194.92	56.63	3.48	21.43	3.01	56.78	3.47	22.36	2.99	252.04	8.57	255.55	8.84	267.14	231.37	338.06	25.99	262.94
43	1535.96	196.25	180.87	211.63	7.85	196.31	57.02	3.34	21.02	2.95	57.18	3.33	21.95	2.93	253.83	8.13	257.3	8.36	270.86	233.94	344	26.81	266.49
44	1571.68	197.56	182.1	213.01	7.88	197.54	57.3	3.17	20.52	2.76	57.44	3.15	21.48	2.73	255.16	7.7	258.53	7.91	274.39	236.32	349.84	27.66	269.68
45	1607.4	198.84	183.31	214.37	7.92	198.78	57.68	2.93	20.04	2.58	57.79	2.91	21.02	2.54	256.62	7.26	259.91	7.46	278.25	238.88	356.31	28.61	273.18
46	1643.12	200.11	184.5	215.72	7.97	200.16	58.2	2.54	19.39	2.34	58.29	2.53	20.39	2.33	258.27	6.34	261.48	6.54	283.34	242.13	365.05	29.95	277.9
47	1678.84	201.35	185.66	217.05	8.01	201.4	58.63	2.26	18.91	2.12	58.69	2.25	19.9	2.11	259.58	5.62	262.69	5.78	287.65	244.91	372.39	31.05	281.9
48	1714.56	202.59	186.81	218.37	8.05	202.62	59.08	1.89	18.28	1.77	59.12	1.88	19.29	1.79	260.78	4.65	263.78	4.79	292.64	248	381.18	32.44	286.46
49	1750.28	203.8	187.93	219.67	8.1	203.83	59.5	1.32	17.73	1.32	59.53	1.32	18.73	1.36	261.65	3.3	264.52	3.43	297.31	250.94	389.35	33.71	290.88
50	1786	205	189.04	220.96	8.14	205	60	0	17	0	60	0	18	0	262.25	0	264.93	0	303.28	254.48	400.22	35.5	296.29

*All variables beyond the Chao 2 Mean have been removed as they are not used in SPAC analysis.

Table A4.2: Vascular flora taxa list – G & G Environmental (2009)

Family	Taxon	A or P
Aizoaceae	*Trianthema glossostigmum*	P
Amaranthaceae	*Gomphrena canescens*	A
Amaranthaceae	*Ptilotus aervoides*	A
Amaranthaceae	*Ptilotus astrolasius*	P
Amaranthaceae	*Ptilotus gaudichaudii*	A
Amaranthaceae	*Ptilotus gomphrenoides*	A
Amaranthaceae	*Ptilotus helipteroides*	A
Amaranthaceae	*Ptilotus macrocephalus*	A
Amaranthaceae	*Ptilotus nobilis*	A
Amaranthaceae	*Ptilotus obovatus*	P
Amaranthaceae	*Ptilotus polystachyus*	A
Amaranthaceae	*Ptilotus schwartzii*	P
Amaranthaceae	*Ptilotus* sp.	A
Asteraceae	*Calocephalus pilbarensis*	A
Asteraceae	***Flaveria trinervia****	A
Asteraceae	*Leiocarpa semicalva*	P
Asteraceae	*Pterocaulon sphacelatum*	P
Asteraceae	*Rhodanthe sterilescens*	A
Asteraceae	***Sonchus oleraceus****	A
Asteraceae	*Streptoglossa adscendens*	A
Asteraceae	*Streptoglossa odora*	P
Asteraceae	*Vittadinia dissecta*	A
Boraginaceae	*Heliotropium heteranthum*	A
Boraginaceae	*Heliotropium inexplicitum*	A
Boraginaceae	*Trichodesma zeylanicum*	A
Brassicaceae	*Lepidium echinatum*	P
Chenopodiaceae	*Dissocarpus paradoxus*	P
Chenopodiaceae	*Dysphania kalpari*	P
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*	P
Chenopodiaceae	*Maireana georgei*	P
Chenopodiaceae	*Maireana planifolia*	P
Chenopodiaceae	*Maireana tomentosa* subsp. *tomentosa*	P
Chenopodiaceae	*Maireana triptera*	P
Chenopodiaceae	*Maireana villosa*	P
Chenopodiaceae	*Rhagodia eremaea*	P
Chenopodiaceae	*Salsola australis*	P
Chenopodiaceae	*Sclerolaena cornishiana*	P
Chenopodiaceae	*Sclerolaena cuneata*	P
Cleomaceae	*Cleome viscosa*	A
Convolvulaceae	*Bonamia rosea*	P
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*	P
Convolvulaceae	*Ipomoea diamantinensis*	A
Convolvulaceae	*Ipomoea muelleri*	P
Cucurbitaceae	***Citrullus lanatus****	A
Cucurbitaceae	*Cucumis variabilis*	P
Cyperaceae	*Fimbristylis microcarya*	P
Euphorbiaceae	*Euphorbia australis*	P
Euphorbiaceae	*Euphorbia boophthona*	P

Family	Taxon	A or P
Euphorbiaceae	*Euphorbia coghlanii*	A
Fabaceae	*Acacia ancistrocarpa*	P
Fabaceae	*Acacia aneura*	P
Fabaceae	*Acacia citrinoviridis*	P
Fabaceae	*Acacia cuthbertsonii* subsp. *cuthbertsonii* ?	P
Fabaceae	*Acacia pachyacra*	P
Fabaceae	*Acacia paraneura*	P
Fabaceae	*Acacia pruinocarpa*	P
Fabaceae	*Acacia rhodophloia*	P
Fabaceae	*Acacia sclerosperma* subsp. *sclerosperma*	P
Fabaceae	*Acacia tetragonophylla*	P
Fabaceae	*Acacia victoriae*	P
Fabaceae	*Glycine canescens*	P
Fabaceae	*Indigofera colutea*	A
Fabaceae	*Rhynchosia minima*	P
Fabaceae	*Senna artemisioides* subsp. *helmsii*	P
Fabaceae	*Senna artemisioides* subsp. *oligophylla*	P
Fabaceae	*Senna ferraria*	P
Fabaceae	*Senna glutinosa*	P
Fabaceae	*Senna notabilis*	P
Fabaceae	*Senna symonii*	P
Fabaceae	*Tephrosia virens*	P
Fabaceae	***Vachellia farnesiana****	P
Goodeniaceae	*Goodenia muelleriana*	P
Goodeniaceae	***Goodenia nuda* (P4)**	P
Goodeniaceae	*Goodenia pascua*	P
Goodeniaceae	*Goodenia prostrata*	P
Goodeniaceae	*Goodenia stobbsiana*	P
Goodeniaceae	*Goodenia vilmoriniae*	A
Goodeniaceae	*Scaevola amblyanthera*	P
Lamiaceae	*Dicrastylis cordifolia*	P
Lythraceae	*Ammannia multiflora*	A
Malvaceae	*Abutilon lepidum*	P
Malvaceae	*Abutilon otocarpum*	P
Malvaceae	*Corchorus parviflorus*	P
Malvaceae	*Hibiscus burtonii*	P
Malvaceae	*Hibiscus* sp. Gardneri (A.L. Payne PRP 1435)	P
Malvaceae	*Hibiscus sturtii*	P
Malvaceae	***Malvastrum americanum****	P
Malvaceae	*Seringia elliptica* C.F. Wilkins	P
Malvaceae	*Sida fibulifera*	P
Malvaceae	*Sida platycalyx*	P
Malvaceae	*Sida rohlenae*	P
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)	P
Montiaceae	*Calandrinia quadrivalvis* (Note: not a Pilbara species)	P
Myrtaceae	*Corymbia aspera*	P
Myrtaceae	*Corymbia hamersleyana*	P
Nyctaginaceae	*Boerhavia burbidgeana*	A
Poaceae	*Aristida contorta*	P
Poaceae	*Aristida latifolia*	P

Family	Taxon	A or P
Poaceae	***Cenchrus ciliaris****	A
Poaceae	***Chloris virgata****	P
Poaceae	*Chrysopogon fallax*	P
Poaceae	*Cymbopogon obtectus*	A
Poaceae	*Dichanthium sericeum* subsp. *humilius*	P
Poaceae	*Enneapogon caerulescens*	P
Poaceae	*Enteropogon ramosus*	P
Poaceae	*Eragrostis eriopoda*	A
Poaceae	*Eragrostis pergracilis*	P
Poaceae	*Eragrostis setifolia*	A
Poaceae	*Eriachne aristidea*	P
Poaceae	*Eriachne flaccida*	P
Poaceae	*Eulalia aurea*	A
Poaceae	*Perotis rara*	P
Poaceae	*Sporobolus australasicus*	P
Poaceae	*Triodia basedowii*	P
Poaceae	*Triodia schinzii*	A
Portulacaceae	*Portulaca oleracea*	A
Portulacaceae	***Portulaca pilosa****	A
Proteaceae	*Hakea lorea*	P
Rubiaceae	*Psydrax latifolia*	P
Santalaceae	*Anthobolus leptomerioides*	P
Sapindaceae	*Dodonaea petiolaris*	P
Scrophulariaceae	*Eremophila cuneifolia*	P
Scrophulariaceae	*Eremophila forrestii*	P
Scrophulariaceae	*Eremophila lanceolata*	P
Scrophulariaceae	*Eremophila latrobei* subsp. *filiformis*	P
Scrophulariaceae	*Eremophila longifolia*	P
Solanaceae	*Solanum dioicum*	P
Solanaceae	*Solanum lasiophyllum*	P
Zygophyllaceae	*Tribulus macrocarpus*	A

Note: A or P = annual or perennial; P4 = Priority Four; * = environmental weed. Nomenclature based on current Western Australian Herbarium terminology and confirmed on FloraBase (WAH, 1998 -).

Table A4.3: Combined vascular flora taxa list – Maia and G & G Environmental (2009)

Family	Combined taxa list - Maia and G & G Environmental	A or P	Fl Fr	Opp Coll
Aizoaceae	*Trianthema glossostigmum*	P	FlFr	✓
Aizoaceae	*Trianthema triquetrum*	A	Fr	
Amaranthaceae	*Alternanthera nodiflora*	A	FlFr	
Amaranthaceae	*Gomphrena canescens*	A	FlFr	
Amaranthaceae	*Gomphrena cunninghamii*	A	Fr	
Amaranthaceae	*Gomphrena kanisii*	A	FlFr	
Amaranthaceae	*Ptilotus aervoides*	A	FlFr	
Amaranthaceae	*Ptilotus astrolasius*	P	Fl	
Amaranthaceae	*Ptilotus gaudichaudii*	A		
Amaranthaceae	*Ptilotus gomphrenoides*	A	FlFr	
Amaranthaceae	*Ptilotus helipteroides*	A	FlFr	
Amaranthaceae	*Ptilotus macrocephalus*	A		
Amaranthaceae	*Ptilotus nobilis*	A	Fl	
Amaranthaceae	*Ptilotus obovatus* var. *obovatus* **RE**	P	Fl	
Amaranthaceae	*Ptilotus polystachyus*	A	Fl	
Amaranthaceae	*Ptilotus rotundifolius*	P	Fl	
Amaranthaceae	*Ptilotus schwartzii*	P		
Amaranthaceae	*Ptilotus schwartzii* var. *schwartzii*	P	Fl	
Amaranthaceae	*Ptilotus* sp.			
Asteraceae	****Bidens bipinnata***	**A**	**Fr**	
Asteraceae	*Blumea tenella*	A	FlFr	✓
Asteraceae	*Calocephalus pilbarensis*	A		
Asteraceae	*Centipeda minima*	A		
Asteraceae	****Flaveria trinervia***	**A**		
Asteraceae	*Leiocarpa semicalva* **RE**	P		
Asteraceae	*Minuria integerrima*	P	Fl	
Asteraceae	*Pterocaulon sphacelatum*	P	Fl	
Asteraceae	*Pterocaulon* ? *serrulatum*	P		
Asteraceae	*Rhodanthe sterilescens*	A		
Asteraceae	****Sonchus oleraceus***	**A**		
Asteraceae	*Streptoglossa adscendens*	A		
Asteraceae	*Streptoglossa decurrens*	P		
Asteraceae	*Streptoglossa macrocephala*	P	Fl	
Asteraceae	*Streptoglossa odora*	P	FlFr	
Asteraceae	*Vittadinia dissecta* **RE**	A		
Asteraceae	ASTERACEAE sp. (inadequate material)			
Boraginaceae	*Heliotropium heteranthum*	A	FlFr	
Boraginaceae	*Heliotropium inexplicitum*	A	Fl	
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*	A	Fl	
Brassicaceae	*Lepidium echinatum*	P		
Caryophyllaceae	*Polycarpaea corymbosa* var. *corymbosa*	A	FlFr	
Chenopodiaceae	*Dissocarpus paradoxus*	P	Fr	
Chenopodiaceae	*Dysphania kalpari*	P		
Chenopodiaceae	*Dysphania rhadinostachya*	P	Fr	
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*	P		
Chenopodiaceae	*Maireana georgei*	P		
Chenopodiaceae	*Maireana planifolia*	P	FlFr	
Chenopodiaceae	*Maireana tomentosa* subsp. *tomentosa* **RE**	P		

Family	Combined taxa list - Maia and G & G Environmental	A or P	Fl Fr	Opp Coll
Chenopodiaceae	*Maireana triptera*	P		
Chenopodiaceae	*Maireana villosa*	P	FlFr	
Chenopodiaceae	*Rhagodia eremaea*	P	FlFr	
Chenopodiaceae	*Salsola australis*	P	Fr	
Chenopodiaceae	*Sclerolaena cornishiana*	P	Fr	
Chenopodiaceae	*Sclerolaena cuneata*	P	Fr	
Chenopodiaceae	*Sclerolaena densiflora*	P		
Cleomaceae	*Cleome oxalidea*	A	FlFr	✓
Cleomaceae	*Cleome viscosa*	A	FlFr	
Convolvulaceae	*Bonamia erecta*	P		
Convolvulaceae	*Bonamia rosea* **RE**	P		
Convolvulaceae	*Duperreya commixta*	P	Fr	
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*	P	Fr	
Convolvulaceae	*Ipomoea calobra*	P		
Convolvulaceae	*Ipomoea diamantinensis*	A		
Convolvulaceae	*Ipomoea muelleri*	P	FlFr	
Convolvulaceae	*Ipomoea plebeia*	A	Fr	✓
Convolvulaceae	*Ipomoea* ? *polymorpha* **RE**	A		✓
Cucurbitaceae	****Citrullus lanatus***	A		
Cucurbitaceae	*Cucumis variabilis*	P	FlFr	
Cyperaceae	*Bulbostylis barbata*	A	Fr	
Cyperaceae	*Fimbristylis dichotoma*	P	Fr	
Cyperaceae	*Fimbristylis microcarya*	P		
Euphorbiaceae	*Euphorbia australis*	P		
Euphorbiaceae	*Euphorbia australis* var. *australis*	A	Fr	
Euphorbiaceae	*Euphorbia australis* var. *subtomentosa*	A	Fr	
Euphorbiaceae	*Euphorbia biconvexa*	A	FlFr	
Euphorbiaceae	*Euphorbia boophthona*	P	Fr	
Euphorbiaceae	*Euphorbia coghlanii*	A	Fl	
Euphorbiaceae	*Euphorbia drummondii* **RE**	A	Fr	
Euphorbiaceae	*Euphorbia vaccaria* var. *vaccaria*	A	FlFr	
Fabaceae	*Acacia adsurgens*	P	Fr	
Fabaceae	*Acacia ancistrocarpa*	P	FlFr	
Fabaceae	*Acacia aneura*	P	FlFr	
Fabaceae	*Acacia aptaneura*	P	FlFr	
Fabaceae	*Acacia ayersiana*	P		
Fabaceae	*Acacia dictyophleba*	P	FlFr	
Fabaceae	*Acacia glaucocaesia* **RE**	P	Fr	✓
Fabaceae	*Acacia inaequilatera*	P		✓
Fabaceae	*Acacia incurvaneura*	P	Fr	
Fabaceae	*Acacia macraneura*	P	flFr	
Fabaceae	*Acacia melleodora*	P	Fr	
Fabaceae	*Acacia pachyacra*	P	FlFr	
Fabaceae	*Acacia paraneura*	P	Fr	
Fabaceae	*Acacia pruinocarpa*	P	FlFr	
Fabaceae	*Acacia pteraneura*	P	Fr	
Fabaceae	*Acacia rhodophloia*	P		
Fabaceae	*Acacia sclerosperma* subsp. *sclerosperma*	P	Fr	
Fabaceae	*Acacia sibirica*	P	Fr	✓

Family	Combined taxa list - Maia and G & G Environmental	A or P	Fl Fr	Opp Coll
Fabaceae	*Acacia synchronicia*	P	FlFr	
Fabaceae	*Acacia tetragonophylla*	P	FlFr	
Fabaceae	*Acacia xiphophylla*	P	Fr	
Fabaceae	*Glycine canescens*	P		
Fabaceae	*Glycine tomentella* **RE**	P	Fl	
Fabaceae	*Indigofera colutea*	A	Fr	
Fabaceae	*Indigofera georgei*	P	Fr	
Fabaceae	*Indigofera linifolia*	A	FlFr	
Fabaceae	*Indigofera monophylla*	P		✓
Fabaceae	*Neptunia dimorphantha*	P	Fr	
Fabaceae	*Rhynchosia minima*	P	Fr	
Fabaceae	*Senna artemisioides* subsp. x *artemisioides*	P		
Fabaceae	*Senna artemisioides* subsp. *helmsii*	P	Fr	
Fabaceae	*Senna artemisioides* subsp. *oligophylla*	P		✓
Fabaceae	*Senna ferraria*	P		
Fabaceae	*Senna glaucifolia*	P		
Fabaceae	*Senna glutinosa*	P		
Fabaceae	*Senna glutinosa* subsp. *glutinosa*	P	Fl	
Fabaceae	*Senna glutinosa* subsp. x *luerssenii*	P		
Fabaceae	*Senna notabilis*	P	Fr	
Fabaceae	*Senna sericea x artemisioides* subsp. *oligophylla*	P		
Fabaceae	*Senna ?sericea* x *symonii*	P		
Fabaceae	*Senna* cf. *sericea*			
Fabaceae	*Senna stricta*	P		
Fabaceae	*Senna ?stricta*			
Fabaceae	*Senna symonii*	P	Fr	
Fabaceae	*Tephrosia* sp. clay soils (S. van Leeuwen et al. PBS 0273)	p	FlFr	
Fabaceae	*Tephrosia supina*	P	FlFr	
Fabaceae	*Tephrosia virens*	P		
Fabaceae	****Vachellia farnesiana***	**P**		
Fabaceae	*Vigna* sp. Hamersley Clay (A.A. Mitchell PRP 113)	p	Fl	✓
Goodeniaceae	*Goodenia microptera*	P	FlFr	
Goodeniaceae	*Goodenia muelleriana*	P	Fl	
Goodeniaceae	***Goodenia nuda* (Priority 4)**	**P**	**FlFr**	
Goodeniaceae	*Goodenia pascua*	P		
Goodeniaceae	*Goodenia prostrata*	P	Fl	
Goodeniaceae	*Goodenia stobbsiana*	P		
Goodeniaceae	*Goodenia tenuiloba*	P		✓
Goodeniaceae	*Goodenia triodiophila*	P	Fl	✓
Goodeniaceae	*Goodenia vilmoriniae*	A	Fl	
Goodeniaceae	*Scaevola amblyanthera*	P		
Goodeniaceae	*Scaevola parvifolia* subsp. *pilbarae*	P	Fl	
Goodeniaceae	*Scaevola spinescens*	P		
Gyrostemonaceae	*Codonocarpus cotinifolius*	P		✓
Lamiaceae	*Dicrastylis cordifolia*	P	FlFr	
Lythraceae	*Ammannia multiflora*	A		
Malvaceae	*Abutilon lepidum*	P	FlFr	
Malvaceae	*Abutilon leucopetalum*	P	Fr	
Malvaceae	*Abutilon macrum*	P	FlFr	

Family	Combined taxa list - Maia and G & G Environmental	A or P	Fl Fr	Opp Coll
Malvaceae	*Abutilon otocarpum*	P	FlFr	
Malvaceae	*Abutilon* sp. Pilbara (W.R. Barker 2025)	P	Fr	
Malvaceae	*Corchorus parviflorus*	P		
Malvaceae	*Corchorus sidoides* subsp. *sidoides*	P	Fr	
Malvaceae	*Corchorus tectus*	P	FlFr	
Malvaceae	*Corchorus tridens*	P	Fr	
Malvaceae	*Gossypium australe*	P	Fr	✓
Malvaceae	*Gossypium robinsonii*	P	Fr	✓
Malvaceae	*Hibiscus burtonii*	P	FlFr	
Malvaceae	*Hibiscus* sp. Gardneri (A.L. Payne PRP 1435) **RE**	P		
Malvaceae	*Hibiscus sturtii*	P		
Malvaceae	*Hibiscus sturtii* var. *campylochlamys*	P	FlFr	
Malvaceae	*Hibiscus sturtii* var. *platychlamys*	P	FlFr	
Malvaceae	****Malvastrum americanum***	**P**	**Fr**	
Malvaceae	*Seringia elliptica* C.F. Wilkins	P		
Malvaceae	*Sida echinocarpa*	P	FlFr	
Malvaceae	*Sida fibulifera*	P	FlFr	
Malvaceae	*Sida platycalyx*	P	Fr	
Malvaceae	*Sida rohlenae*	P		
Malvaceae	*Sida* sp. dark green fruits (S. van Leeuwen 2260)	P	Fr	
Malvaceae	*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)	P		
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)	P		
Malvaceae	*Sida* sp. verrucose glands (F.H. Mollemans 2423)	P	Fl	
Malvaceae	MALVACEAE sp. (inadequate material)			
Menispermaceae	*Tinospora smilacina* **RE**	P		
Molluginaceae	*Trigastrotheca molluginea*	A	Fl	✓
Montiaceae	*Calandrinia quadrivalvis* **RE**	A		
Myrtaceae	*Corymbia aspera*	P	Fr	
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*	P	Fr	
Myrtaceae	*Corymbia hamersleyana*	P	FlFr	
Myrtaceae	*Eucalyptus gamophylla*	P	Fr	
Myrtaceae	*Eucalyptus victrix*	P		
Nyctaginaceae	*Boerhavia burbidgeana*	P		
Nyctaginaceae	*Boerhavia coccinea*	P	FlFr	
Nyctaginaceae	*Boerhavia* ?*coccinea*			
Nyctaginaceae	*Boerhavia paludosa* **RE**	P	FlFr	
Nyctaginaceae	*Boerhavia repleta*	A	Fr	✓
Phyllanthaceae	*Phyllanthus erwinii*	P		
Poaceae	*Aristida contorta*	A	Fr	
Poaceae	*Aristida holathera* var. *holathera*	A		
Poaceae	*Aristida latifolia*	P	FlFr	
Poaceae	*Aristida* sp. (inadequate material)			
Poaceae	****Cenchrus ciliaris***	**P**	**Fr**	
Poaceae	****Chloris virgata***	**A**		
Poaceae	*Chloris pectinata*	A	Fr	
Poaceae	*Chrysopogon fallax*	P	Fr	
Poaceae	*Cymbopogon ambiguus*	P	Fr	
Poaceae	*Cymbopogon obtectus*	P	Fr	
Poaceae	*Dactyloctenium radulans*	A	Fr	

Family	Combined taxa list - Maia and G & G Environmental	A or P	Fl Fr	Opp Coll
Poaceae	*Dichanthium sericeum* subsp. *humilius*	A	Fr	
Poaceae	*Digitaria brownii*	P	Fr	
Poaceae	*Enneapogon caerulescens*	P	FlFr	
Poaceae	*Enneapogon polyphyllus*	A	FlFr	
Poaceae	*Enteropogon ramosus*	P	Fr	
Poaceae	*Eragrostis cumingii*	A		
Poaceae	*Eragrostis eriopoda*	P	Fr	
Poaceae	*Eragrostis pergracilis*	A	Fr	
Poaceae	*Eragrostis setifolia*	P	Fr	
Poaceae	*Eragrostis tenellula*	A	Fr	
Poaceae	*Eragrostis xerophila*	P	Fr	
Poaceae	*Eriachne aristidea*	A	Fr	
Poaceae	*Eriachne benthamii*	P		
Poaceae	*Eriachne flaccida*	P		
Poaceae	*Eriachne mucronata*	P	FlFr	
Poaceae	*Eriachne pulchella* subsp. *pulchella*	A	Fr	
Poaceae	*Eulalia aurea*	P	FlFr	
Poaceae	*Iseilema dolichotrichum*	A	Fr	
Poaceae	*Iseilema eremaeum*	A	Fr	
Poaceae	*Iseilema vaginiflorum*	A	Fr	
Poaceae	*Panicum effusum*	P	Fr	
Poaceae	*Paraneurachne muelleri*	P	Fr	
Poaceae	*Paspalidium basicladum*	A	Fr	
Poaceae	*Paspalidium rarum*	A	Fr	
Poaceae	*Paspalidium* sp.	A		
Poaceae	*Perotis rara*	A	Fr	
Poaceae	*Setaria* sp.	A		
Poaceae	*Sporobolus australasicus*	P	Fr	
Poaceae	*Sporobolus* sp.	P		
Poaceae	*Themeda triandra*	P	Fr	
Poaceae	*Tragus australianus*	A	FlFr	
Poaceae	*Triodia basedowii*	P	FlFr	
Poaceae	*Triodia pungens*	P	FlFr	✓
Poaceae	*Triodia schinzii*	P	FlFr	
Poaceae	*Triraphis mollis*	P	Fr	
Poaceae	*Yakirra australiensis* var. *australiensis*	A	Fr	
Portulacaceae	*Portulaca cyclophylla*	A	FlFr	
Portulacaceae	*Portulaca oleracea*	A	FlFr	
Portulacaceae	****Portulaca pilosa***	**A**	**FlFr**	
Proteaceae	*Grevillea wickhamii* subsp. *hispidula*	P	Fr	
Proteaceae	*Hakea chordophylla*	P	Fr	
Proteaceae	*Hakea lorea* subsp. *lorea*	P	Fr	
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	P		
Rubiaceae	*Oldenlandia crouchiana*	A	Fr	
Rubiaceae	*Psydrax latifolia*	P	Fl	
Rubiaceae	*Spermacoce brachystema*	P	Fr	
Rubiaceae	*Synaptantha tillaeacea* var. *tillaeacea*	A	Fr	
Santalaceae	*Anthobolus leptomerioides*	P	Fr	
Sapindaceae	*Dodonaea coriacea*	P		

Family	Combined taxa list - Maia and G & G Environmental	A or P	Fl Fr	Opp Coll
Sapindaceae	*Dodonaea petiolaris*	P	Fr	
Scrophulariaceae	*Eremophila clarkei*	P	FlFr	✓
Scrophulariaceae	*Eremophila cuneifolia*	P	FlFr	
Scrophulariaceae	*Eremophila forrestii*	P		
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*	P	FlFr	
Scrophulariaceae	*Eremophila lanceolata*	P	FlFr	
Scrophulariaceae	*Eremophila latrobei* subsp. *filiformis*	P	FlFr	
Scrophulariaceae	*Eremophila longifolia*	P		
Solanaceae	*Nicotiana* sp.	A		
Solanaceae	*Solanum cleistogamum*	P	Fr	
Solanaceae	*Solanum dioicum*	P		
Solanaceae	*Solanum lasiophyllum*	P	FlFr	
Solanaceae	*Solanum morrisonii*	P	Fr	
Zygophyllaceae	*Tribulus astrocarpus*	A	Fr	
Zygophyllaceae	*Tribulus hirsutus*	A	Fr	✓
Zygophyllaceae	*Tribulus macrocarpus*	A	Fr	

Note: RE after a species name = range extension; P4 = Priority Four; * before a species name = indicates an environmental weed; A or P = annual or perennial; Fl = flowering material present, Fr = fruiting material present and FlFr = flowering and fruiting material present; Opp Coll = opportunistic collection and not recorded at a quadrat or relevé. Nomenclature based on current Western Australian Herbarium terminology as indicated on FloraBase (WAH, 1998 -).

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APPENDIX 5: CONSERVATION SIGNIFICANCE – FLORA AND ECOLOGICAL COMMUNITIES AND CONSERVATION SIGNIFICANT SPECIES LOCATED IN THE STUDY AREA

Commonwealth *Environment Protection and Biodiversity Act* 1999

Table A5.1: Categories and definitions for threatened species (DotEE, 2018b)

Criteria for listing species in the critically endangered, endangered or vulnerable categories			
Criterion	**Critically Endangered**	**Endangered**	**Vulnerable**
1. It has undergone, is suspected to have undergon or is likely to undergo in the immediate future:	a very severe reduction in numbers	a severe reduction in numbers	a substantial reduction in numbers
2. Its geographic distribution is precarious for the survival of the species and is:	very restricted	restricted	limited
3. The estimated total number of individuals is:	very low	low	limited
And either of (a) or (b) is true:			
a) Evidence suggests that the number will continue to decline at: **b) The number is likely to continue to decline and its geographic distribution is:**	A very high rate Precarious for its survival	A high rate Precarious for its survival	A substantial rate Precarious for its survival
4. The estimated total number of mature individuals is:	extremely low	very low	low
5. The probability of its extinction in the wild is at least:	50% in the immediate future	20% in the near future	10% in the medium-term future

Eligibility for listing species in the extinct, extinct in the wild, or conservation dependent categories	
Category	**Definition**
Extinct*	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: a) it is only known to survive in cultivation, in captivity or as a naturalized population well outside its past range; or b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Conservation dependent*	A native species is eligible to be included in the conservation dependent category if, at that time: a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; **or** b) the following subparagraphs are satisfied; I. the species is a species of fish; II. the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; III. the plan of management is in force under a law of the Commonwealth or of a State or Territory; IV. cessation of the plan of management would adversely affect the conservation status of the species.
*Note: Species listed as 'conservation dependent' and 'extinct' are not matters of national environmental significance and therefore do not trigger the EPBC Act.	

Table A5.2: Criteria for listing threatened ecological communities (TECs) under the EPBC Act (Austlii, 2018)

Criteria for listing species in the critically endangered, endangered or vulnerable categories				
Item	**Criterion**	**Category**		
		Critically Endangered	**Endangered**	**Vulnerable**
1	Its decline in geographic distribution is:	Very severe	severe	substantial
2	Its geographic distribution is: and the nature of its distribution makes it likely that the action of a threatening process could cause it to be lost in:	Very restricted The immediate future	Restricted The near future	Limited The medium-term future
3	For a population of a native species that is likely to play a major role in the community, there is a: to the extent that restoration of the community is not likely to be possible in:	Very severe decline The immediate future	Severe decline The near future	Substantial decline The medium-term future
4	The reduction in its integrity across most of its geographic distribution is: As indicated by degradation of the community or its habitat, or distruption of important community processes that is:	Very severe Very severe	Severe severe	Substantial substantial
5	Its rate of continuing detrimental change is: As indicated by: a) A rate of continuing decline in its geographic distribution, or a population of a native species that is believed to play a major role in the community, that is: Or b) Intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	Very severe Very severe Very severe	Severe Severe Severe	Substantial Substantial Serious
6	A quantitative analysis shows that its probability of extinction, or extreme degradation over all of its geographic distribution is:	At least 50% in the immediate future	At least 20% in the near future	At least 10% in the medium-term future

Western Australian *Wildlife Conservation Act* 1950

Table A5.3: Conservation codes for Western Australian flora and fauna (DPaW, 2017)

Code	Definition
Specially protected fauna or flora[1] are species[2] 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. Categories of specially protected fauna and flora are:	
T	**Threatened species** Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 4 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). **Threatened fauna** is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act. **Threatened flora** is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EN	**Endangered species** Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
VU	**Vulnerable species** Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EX	**Presumed extinct species** 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 *Wildlife Conservation Act 1950*, 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.
IA	**Migratory birds protected under an international agreement** Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.
CD	**Conservation dependent fauna** Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Code	Definition
OS	**Other specially protected fauna** Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950*, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.
P	**Priority species** Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened 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 species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	**Priority 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 are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

[1] The definition of flora includes algae, fungi and lichens

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

Table A5.4: Categories, definitions and criteria for threatened ecological communities (TECs) in WA (DEC, 2013)

Category	Definition and Criteria
Presumed Totally Destroyed (PD)	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. 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): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats; or B) All occurrences recorded within the last 50 years have since been destroyed.
Critically Endangered (CR)	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. 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): 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): • (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); • (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. 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 immediate future (within approximately 10 years); • (ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; • (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. 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).

Category	Definition and Criteria
Endangered (EN)	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).
Vulnerable (VU)	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.

Table A5.5: Definitions and criteria for priority ecological communities (PECs) in WA (DEC, 2013)

Category	Definition and Criteria
Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. 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.	
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 ≤ 100ha). 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.
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 ≤200ha). 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.
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.

Category	Definition and Criteria
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 a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
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.

Table A5.6: Conservation significant flora species located in Study Area

Species	Location	No. of plants	Collector
Goodenia nuda (Priority 4)	1	1	Maia
	2	1	Maia
	3	1	Maia
	4	20	Maia
	5	1	GGE
	6	2	GGE
	7	4	GGE
	8	1	GGE
	9	1	GGE
	10	1	GGE
	11	3	GGE
	12	5	GGE
	13	8	GGE
	14	1	GGE
	15	3	GGE
	16	6	GGE
	17	30	GGE
	18	20	GGE
	19	2	GGE
	20	1	GGE
	21	1	GGE
	22	7	GGE
	23	2	GGE
	24	2	GGE
	25	7	GGE
	26	5	GGE

Note: exact locations have been supplied to client.

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APPENDIX 6: DECLARED PESTS CATEGORIES AND CONTROLS AND WEED LOCATIONS

Declared pests can be assigned to a C1, C2 or C3 control category under the Biosecurity and Agriculture Management Regulations 2013. The control categories are listed in **Table A6.1**: some declared pests are unassigned and the description for these plants is also included in **Table A6.1**.

Table A6.1: Control categories for Declared Pest – s22(2) (DPIRD, 2018c)

Category	Description
C1 Exclusion	Organisms which should be excluded from part or all of Western Australia
C2 Eradication	Organisms which should be eradicated from part or all of Western Australia
C3 Management	Organisms that should have some form of management applied that will alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism
Unassigned	Unassigned: Declared pests that are recognised as having a harmful impact under certain circumstances, where their subsequent control requirements are determined by a Plan or other legislative arrangements under the Act.

Table A6.1: Weed species locations (GDA94, Zone 50)

Taxon	Easting (m E)	Northing (m N)	Number of Plants
Bidens bipinnata	786080	7462617	10
Bidens bipinnata	786136	7472680	1
Bidens bipinnata	786080	7462617	1
Bidens bipinnata	787399	7458327	1
Bidens bipinnata	797265	7452268	1
Bidens bipinnata	797788	7450650	1
Bidens bipinnata	786705	7470695	1
Bidens bipinnata	792528	7470358	10
Bidens bipinnata	802009	7478084	1000
Cenchrus ciliaris	786080	7462617	10
Cenchrus ciliaris	791450	7453188	10
Cenchrus ciliaris	798221	7478332	1
Cenchrus ciliaris	793013	7471146	1
Cenchrus ciliaris	796673	7469746	1
Cenchrus ciliaris	794439	7475506	1
Cenchrus ciliaris	786705	7470695	1
Cenchrus ciliaris	799287	7473610	50
Cenchrus ciliaris	791188	7457443	1
Cenchrus ciliaris	799263	7480050	10
Cenchrus ciliaris	799403	7479920	1
Cenchrus ciliaris	800799	7478976	1

Taxon	Easting (m E)	Northing (m N)	Number of Plants
Cenchrus ciliaris	801768	7478269	1
Cenchrus ciliaris	801789	7478234	100
Cenchrus ciliaris	802606	7477392	50
Cenchrus ciliaris	801404	7452254	1
Malvastrum americanum	787102	7460812	5
Malvastrum americanum	797788	7450650	5
Malvastrum americanum	798221	7478332	1
Malvastrum americanum	792784	7472195	1
Malvastrum americanum	793013	7471146	1
Malvastrum americanum	794439	7475506	1
Malvastrum americanum	802097	7461725	10
Malvastrum americanum	801910	7461048	10
Malvastrum americanum	782183	7464041	30
Malvastrum americanum	792345	7456495	1,000
Malvastrum americanum	800078	7473179	10
Malvastrum americanum	798460	7472141	20
Malvastrum americanum	790768	7470165	10
Malvastrum americanum	800551	7477455	2
Malvastrum americanum	798270	7477536	2
Portulaca pilosa	792784	7472195	1
Portulaca pilosa	792246	7471957	1
Portulaca pilosa	788626	7470942	1
Portulaca pilosa	799766	7457154	1
Portulaca pilosa	798625	7478945	1
Portulaca pilosa	786937	7471097	1
Portulaca pilosa	785826	7465800	1
Portulaca pilosa	793195	7453284	1
Portulaca pilosa	799990	7450971	1
Portulaca pilosa	801769	7454535	1
Portulaca pilosa	800008	7473218	3
Vachellia farnesiana	798221	7478332	1
Vachellia farnesiana	782201	7463942	4

APPENDIX 7: NATIONAL VEGETATION INFORMATION SYSTEM VEGETATION CLASSIFICATION

Table A7.1: NVIS growth forms and descriptions

Growth Form	Description
Tree	Woody plants, more than 2m tall with a single stem or branches well above the base.
Tree Mallee	Woody perennial plant usually of the genus *Eucalyptus*. Multi-stemmed with fewer than 5 trunks of which at least 3 exceed 100 mm at breast height (1.3 m). Usually 8 m or more in height.
Shrub	Woody plants multi-stemmed at the base (or within 200 mm from ground level) or if single stemmed, less than 2 m in height.
Mallee Shrub	Commonly less than 8 m tall, usually with 5 or more trunks, of which at least 3 of the largest do not exceed 100 mm at breast height (1.3 m).
Heath Shrub	Shrub usually less than 2 m, with sclerophyllous leaves having high fibre: protein ratios and with an area of nanophyll or smaller (less than 225 sq. m.). Often a member of the following families: Epacridaceae, Myrtaceae, Fabaceae and Proteaceae. Commonly occur in nutrient-poor substrates.
Chenopod Shrub	Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.
Samphire Shrub	Genera (of Tribe Salicornioideae, viz: *Halosarcia*, *Pachycornia, Sarcocornia*, *Sclerostegia*, *Tecticornia* and *Tegicornia*) with articulate branches, fleshy stems and reduced flowers within the Chenopodiaceae family, succulent chenopods. Also genus *Suaeda*.
Tussock Grass	Forms discrete but open tussocks usually with distinct individual shoots, or if not, then forming a hummock. These are common agricultural grasses.
Hummock Grass	Coarse xeromorphic grass with a mound-like form often dead in the middle; genera are *Triodia* and *Plectrachne*.
Sedge	Herbaceous, usually perennial erect plant generally with a tufted habit and of the families Cyperaceae (true sedges) or Restionaceae (node sedges).
Rush	Herbaceous, usually perennial erect monocot that is neither a grass nor sedge. For the purposes of NVIS, rushes include the monocotyledon families Juncaceae, Typhaceae, Liliaceae, Iridaceae, Xyridaceae and the genus *Lomandra* (i.e. "graminoid" or grass-like genera).
Forb	Herbaceous or slightly woody, annual or sometimes perennial plant (usually a dicotyledon).
Grass-tree	Australian grass trees. Members of the family Xanthorrhoeaceae.
Cycad	Members of the families Cycadaceae and Zamiaceae.

Table A7.2: Height classes defined for the NVIS

Height Classes	Height Range (m)	Tree	Shrub, Heath Shrub, Chenopod Shrub, Samphire Shrub, Cycad, Grass-tree	Tree Mallee, Mallee Shrub	Tussock Grasses, Sedges, Rushes and Forbs
8	**>30**	tall			
7	**10-30**	mid		tall	

Height Classes	Height Range (m)	Tree	Shrub, Heath Shrub, Chenopod Shrub, Samphire Shrub, Cycad, Grass-tree	Tree Mallee, Mallee Shrub	Tussock Grasses, Sedges, Rushes and Forbs
6	**<10**	low		mid	
5	**<3**			low	
4	**>2**		tall		tall
3	**1-2**		mid		tall
2	**0.5-1**		low		mid
1	**<0.5**		low		low

Table A7.3: NVIS structural formation terminology

Growth Form	Height (m)	Foliage Cover (%)					
		>70	**30-70**	**10-30**	**2-10**	**<2 (isolated)**	**<2 (isolated clump)**
Tree	**<10,10-30, >30**	Closed Forest	Open Forest	Woodland	Open Woodland	Isolated Trees	Isolated Clumps Of Trees
Tree Mallee	**<3, <10, 10-30**	Closed Mallee Forest	Open Mallee Forest	Mallee Woodland	Open Mallee Woodland	Isolated Mallee Trees	Isolated Clumps Of Mallee Trees
Shrub	**<1,1-2,>2**	Closed Shrubland	Shrubland	Open Shrubland	Sparse Shrubland	Isolated Shrubs	Isolated Clumps Of Shrubs
Mallee Shrub	**<3, <10, 10-30**	Closed Mallee Shrubland	Mallee Shrubland	Open Mallee Shrubland	Sparse Mallee Shrubland	Isolated Mallee Shrubs	Isolated Clumps Of Mallee Shrubs
Heath Shrub	**<1,1-2,>2**	Closed Heathland	Heathland	Open Heathland	Sparse Heathland	Isolated Heath Shrubs	Isolated Clumps Of Heath Shrubs
Chenopod Shrub	**<1,1-2,>2**	Closed Chenopod Shrubland	Chenopod Shrubland	Open Chenopod Shrubland	Sparse Chenopod Shrubland	Isolated Chenopod Shrubs	Isolated Clumps Of Chenopod Shrubs
Samphire Shrub	**<0.5,>0.5**	Closed Samphire Shrubland	Samphire Shrubland	Open Samphire Shrubland	Sparse Samphire Shrubland	Isolated Samphire Shrubs	Isolated Clumps Of Samphire Shrubs
Hummock Grass	**<2,>2**	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Sparse Hummock Grassland	Isolated Hummock Grasses	Isolated Clumps Of Hummock Grasses
Tussock Grass	**<0.5,>0.5**	Closed Tussock Grassland	Tussock Grassland	Open Tussock Grassland	Sparse Tussock Grassland	Isolated Tussock Grasses	Isolated Clumps Of Tussock Grasses

Growth Form	Height (m)	Foliage Cover (%)					
		>70	**30-70**	**10-30**	**2-10**	**<2 (isolated)**	**<2 (isolated clump)**
Sedge	**<0.5,>0.5**	Closed Sedgeland	Sedgeland	Open Sedgeland	Sparse Sedgeland	Isolated Sedges	Isolated Clumps Of Sedges
Rush	**<0.5,>0.5**	Closed Rushland	Rushland	Open Rushland	Sparse Rushland	Isolated Rushes	Isolated Clumps Of Rushes
Forb	**<0.5,>0.5**	Closed Forbland	Forbland	Open Forbland	Sparse Forbland	Isolated Forbs	Isolated Clumps Of Forbs

Source: **Tables A7.1 to A7.3** from ESCAVI (2003).

APPENDIX 8: SITE DATA

In described by: GGE = G & G Environmental, SH = Scott Hitchcock, CS = Conrad Slee, RO = Raimond Orifici & MP = Michael Pezzaniti

Q:	HB3	Described by:	GGE		Date:	2/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	797705	mE	7477539	mN	
Habitat:		Flat plain					
Soil:		Red sandy-loam					
Rocks:		Nil					
Mapped as:		T**HG**					
Vegetation Type		A Hummock Grassland of *Triodia basedowii* with a Low Woodland of *Acacia pruinocarpa* over Isolated Shrubs and Forbs.					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Recent (<1 year)					
Species:		*Acacia pachyacra*, *Acacia paraneura*, *Acacia pruinocarpa*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida latifolia*, *Bonamia erecta*, *Eragrostis eriopoda*, *Maireana planifolia*, *Maireana tomentosa* subsp. *tomentosa*, *Maireana villosa*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Solanum cleistogamum*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HB4b	Described by:	GGE		Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	798221	mE	7478332	mN	
Habitat:		Minor depression					
Soil:		Red clay-loam					
Rocks:		Nil					
Mapped as:		A**TG**					
Vegetation Type		An Open Tussock Grassland of *Eragrostis setifolia* and *Eragrostis xerophila* with an Open Mid Shrubland of *Acacia synchronicia* and Isolated Low Trees of *Acacia aptaneura* with an Open Low Chenopod Shrubland of *Sclerolaena cornishiana* with Isolated Forbs.					
Vegetation Condition:		Good					
Disturbances:		Animal tracks, trampled vegetation, grazing					
Fire Age:		Old (> 5years)					
Species:		*Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Acacia xiphophylla*, *Aristida contorta*, *Aristida latifolia*, **Cenchrus ciliaris*, *Corchorus sidoides* subsp. *sidoides*, *Enchylaena tomentosa* var. *tomentosa*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila cuneifolia*, *Eremophila longifolia*, *Goodenia prostrata*, *Maireana georgei*, *Maireana tomentosa* subsp. *tomentosa*, *Maireana villosa*, **Malvastrum americanum*, *Ptilotus nobilis*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Senna ferraria*, *Senna notabilis*, *Sida fibulifera*, *Solanum cleistogamum*, *Solanum lasiophyllum*, **Vachellia farnesiana*					

Q:	HB8	Described by:	GGE		Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	796027	mE	7475150	mN	
Habitat:		0					
Soil:		Red clay-loam					
Rocks:		Nil					
Mapped as:		A**TG**					
Vegetation Type		A Low Shrubland of *Senna artemisioides* subsp. *helmsii* with an Open Tussock Grassland of *Aristida contorta*, *Aristida latifolia* and *Eragrostis xerophila* over Isolated Low Mixed Shrubs and forbs.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Moderate (1-5 years)					
Species:		*Acacia incurvaneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila cuneifolia*, *Eremophila lanceolata*, *Eremophila longifolia*, *Goodenia prostrata*, *Hakea lorea* subsp. *lorea*, *Maireana planifolia*, *Maireana tomentosa* subsp. *tomentosa*, *Maireana villosa*, *Ptilotus nobilis*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna ferraria*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Streptoglossa odora*					

Q:	HB10	Described by:	GGE		Date:	2/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	794328	mE	7473432	mN	
Habitat:		Flat plain					
Soil:		Red clay-loam					
Rocks:		Nil					
Mapped as:		T**HG**					
Vegetation Type		Hummock Grassland of *Triodia basedowii* with a Low Open woodland of *Acacia pruinocarpa* and an Open Tall Shrubland of *Acacia ancistrocarpa* and *Acacia pachyacra.*					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Moderate (1-5 years)					
Species:		*Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia incurvaneura*, *Acacia pachyacra*, *Acacia pruinocarpa*, *Acacia synchronicia*, *Anthobolus leptomerioides*, *Hakea lorea* subsp. *lorea*, *Ptilotus astrolasius*, *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Senna ferraria*, *Senna glutinosa* subsp. *glutinosa*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HB11	Described by:	GGE	Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	795871 mE	7474744 mN		
Habitat:		Flat plain				
Soil:		Red loam				
Rocks:		Ironstone gravel, Quartz gravel				
Mapped as:		A**TG**				
Vegetation Type		Open Tussock Grassland of *Aristida contorta* and *Eragrostis setifolia* with a Low Open Shrubland of *Senna artemisioides* subsp. *helmsii* over very open forbs				
Vegetation Condition:		Very Good				
Disturbances:		Animal tracks, trampled vegetation and grazing				
Fire Age:		Moderate (1-5 years)				
Species:		*Acacia aptaneura*, *Acacia pteraneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Corchorus sidoides* subsp. *sidoides*, *Eragrostis setifolia*, *Goodenia prostrata*, *Maireana triptera*, *Maireana villosa*, *Ptilotus helipteroides*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Sclerolaena cuneata*, *Senna artemisioides* subsp. *helmsii*, *Senna ferraria*, *Senna glutinosa* subsp. *glutinosa*, *Senna notabilis*, *Sida platycalyx*, *Solanum cleistogamum*, *Solanum lasiophyllum*, *Streptoglossa odora*, *Triodia basedowii*				

Q:	HB12	Described by:	GGE	Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	795025 mE	7475409 mN		
Habitat:		Flat plain				
Soil:		Red loam				
Rocks:		Nil				
Mapped as:		T**HG**				
Vegetation Type		Hummock Grassland of *Triodia basedowii* with a Low Woodland of *Acacia aptaneura* over an Open Mid Shrubland of *Eremophila forrestii* subsp. *forrestii* and Isolated Tall mixed *Acacia* Shrubs.				
Vegetation Condition:		Excellent				
Disturbances:		Animal tracks, trampled vegetation				
Fire Age:		Old (> 5years)				
Species:		*Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Cucumis variabilis*, *Cymbopogon obtectus*, *Eragrostis eriopoda*, *Eremophila cuneifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eriachne aristidea*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Maireana planifolia*, *Psydrax latifolia*, *Ptilotus helipteroides*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus polystachyus*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *oligophylla*, *Solanum lasiophyllum*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*				

Q:	HB19	Described by:	GGE		Date:	1/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	795499	mE	7470101	mN	
Habitat:		Flat plain					
Soil:		Red clay-loam					
Rocks:		Nil					
Mapped as:		A**WL**					
Vegetation Type		Tall Shrubland of *Acacia ancistrocarpa* with a Low Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* (burnt) with a Low Shrubland of *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* var. *obovatus* over forbs with *Goodenia prostrata* and *Sida platycalyx* prominent in an Open Tussock Grassland.					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Moderate (1-5 years)					
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia incurvaneura*, *Acacia pruinocarpa*, *Anthobolus leptomerioides*, *Aristida latifolia*, *Corchorus sidoides* subsp. *sidoides*, *Cucumis variabilis*, *Eragrostis setifolia*, *Eremophila cuneifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Evolvulus alsinoides* var. *villosicalyx*, *Goodenia prostrata*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Indigofera georgei*, *Ipomoea muelleri*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Sida rohlenae*, *Sporobolus australasicus*					

Q:	HB24	Described by:	GGE		Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	797633	mE	7469933	mN	
Habitat:		Flat plain					
Soil:		Red clay					
Rocks:		Nil					
Mapped as:		A**WL**					
Vegetation Type		A Low Woodland of *Acacia aptaneura*, *Acacia paraneura* and *Acacia pruinocarpa* with an Open Tall Shrubland of *Acacia tetragonophylla*, a Low Shrubland of *Ptilotus obovatus* var. *obovatus* and an Open Tussock Grassland of *Aristida latifolia*, *Eragrostis eriopoda* and *Eragrostis setifolia*					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Moderate (1-5 years)					
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia paraneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Eragrostis eriopoda*, *Eragrostis setifolia*, *Eremophila cuneifolia*, *Eremophila lanceolata*, *Eremophila longifolia*, *Evolvulus alsinoides* var. *villosicalyx*, *Goodenia prostrata*, *Hibiscus burtonii*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Sida rohlenae*, *Solanum lasiophyllum*					

Q:	HB27	Described by:	GGE		Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	793772	mE	7463412	mN	
Habitat:		Flat plain					
Soil:		Red clay-loam					
Rocks:		Nil					
Mapped as:		M**TG**					
Vegetation Type		A Tussock Grassland of *Aristida latifolia* and *Eragrostis xerophila* with an Open Low Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* over isolated Forbs.					
Vegetation Condition:		Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Calocephalus pilbarensis*, *Eragrostis xerophila*, *Eremophila lanceolata*, *Eulalia aurea*, *Euphorbia boophthona*, *Goodenia prostrata*, *Indigofera linifolia*, *Portulaca oleracea*, *Ptilotus gomphrenoides*, *Ptilotus macrocephalus*, *Ptilotus nobilis*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Solanum lasiophyllum*, *Streptoglossa adscendens*, *Streptoglossa odora*, *Vittadinia dissecta*					

Q:	HB29	Described by:	GGE		Date:	4/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	798938	mE	7462728	mN	
Habitat:		Flat plain					
Soil:		Red clay-loam					
Rocks:		Nil					
Mapped as:		M**TG**					
Vegetation Type		A Tussock Grassland of *Eragrostis eriopoda* and *Eragrostis xerophila* with an Open Low Shrubland of *Senna artemisioides* subsp. *helmsii* over isolated Forbs.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation, grazing					
Fire Age:		Moderate (1-5 years)					
Species:		*Aristida latifolia*, *Dichanthium sericeum* subsp. *humilius*, *Eragrostis eriopoda*, *Eragrostis xerophila*, *Heliotropium inexplicitum*, *Portulaca oleracea*, *Ptilotus gomphrenoides*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Sida fibulifera*, *Streptoglossa odora*					

Q:	HB31	Described by:	GGE		Date:	3/08/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	798976	mE	7459609	mN	
Habitat:		Flat plain					
Soil:		Red loam					
Rocks:		Nil					
Mapped as:		A**SL**-(5)					
Vegetation Type		An Open Low Woodland of *Acacia aptaneura* and *Acacia pruinocarpa* with an Open Low Shrubland of *Senna artemisioides* subsp. *oligophylla*, an Open Tussock Grassland of *Aristida latifolia* and Isolated Tall Shrubs of *Acacia ancistrocarpa*					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Cleome viscosa*, *Corchorus sidoides* subsp. *sidoides*, *Eragrostis eriopoda*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eriachne aristidea*, *Eulalia aurea*, *Goodenia prostrata*, *Heliotropium inexplicitum*, *Maireana planifolia*, *Portulaca oleracea*, *Ptilotus helipteroides*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus polystachyus*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tephrosia supina*, *Triodia basedowii*					

Q:	HB34	Described by:	GGE		Date:	30/07/ 2009	Photo: Maia 2018
Location (GDA94):		MGA50	791616	mE	7460633	mN	
Habitat:		Flat plain					
Soil:		Red loam					
Rocks:		Nil					
Mapped as:		A**SL**-(3)					
Vegetation Type		An Open Low Woodland of *Acacia aptaneura* with an Open Tall Shrubland of *Acacia ancistrocarpa* and *Acacia aptaneura*, an Open Mid Shrubland of *Eremophila forrestii* subsp. *forrestii* an Open Low mixed Shrubland over Isolated Tussock Grasses and Forbs.					
Vegetation Condition:		Excellent					
Disturbances:		Vehicle tracks, animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia incurvaneura*, *Acacia paraneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Digitaria brownii*, *Dodonaea petiolaris*, *Dysphania kalpari*, *Enchylaena tomentosa* var. *tomentosa*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Eulalia aurea*, *Glycine tomentella*, *Goodenia pascua*, *Goodenia prostrata*, *Heliotropium inexplicitum*, *Hibiscus sturtii* var. *platychlamys*, *Maireana planifolia*, *Maireana tomentosa* subsp. *tomentosa*, *Psydrax latifolia*, *Ptilotus helipteroides*, *Ptilotus polystachyus*, *Ptilotus schwartzii* var. *schwartzii*, *Rhagodia eremaea*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida platycalyx*, *Streptoglossa odora*, *Tinospora smilacina*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*					

Q:	HBR13	Described by:	RO & MP (Phase 2)		Date:	8/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	792784	mE	7472195	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (60%)					
Rocks:		Ironstone stones (5%), Quartz stones					
Mapped as:		A**SL**-(2)					
Vegetation Type		Open Tall Shrubland of *Acacia aptaneura*, *Acacia pteraneura* and *Acacia tetragonophylla* with Open Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana* and *Sida platycalyx* with Sparse Mid Shrubland of *Acacia* synchronicia, *Rhagodia eremaea* and *Senna artemisioides* subsp. *oligophylla* and Sparse Tussock Grassland of *Aristida latifolia*, *Aristida contorta*, *Eragrostis setifolia* and *Eragrostis xerophila*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia aptaneura*, *Acacia pteraneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Boerhavia paludosa*, *Chloris pectinata*, *Corchorus sidoides* subsp. *sidoides*, *Cymbopogon obtectus*, *Digitaria brownii*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Enteropogon ramosus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila lanceolata*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Hibiscus sturtii* var. *platychlamys*, *Indigofera georgei*, *Maireana planifolia*, **Malvastrum americanum*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *Sida platycalyx*, *Solanum cleistogamum*, *Solanum lasiophyllum*					

Q:	HBX15	Described by:	RO & MP (Phase 2)		Date:	8/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	792246	mE	7471957	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (50%)					
Rocks:		Ironstone stones (3%), Quartz stones					
Mapped as:		A**SL**-(4)					
Vegetation Type		Open Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Acacia tetragonophylla* and *Senna artemisioides* subsp. *oligophylla* with Sparse Tussock Grassland of *Aristida contorta* and *Aristida latifolia* and Isolated Low Shrubs of *Enchylaena tomentosa* var. *tomentosa*, *Sclerolaena cornishiana* and *Sida platycalyx.*					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Acacia aptaneura*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Cleome viscosa*, *Duperreya commixta*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eremophila latrobei* subsp. *filiformis*, *Eremophila longifolia*, *Eriachne mucronata*, *Evolvulus alsinoides* var. *villosicalyx*, *Maireana villosa*, *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *oligophylla*, *Solanum cleistogamum*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HBR17	Described by:	RO & MP (Phase 2)		Date:	8/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	788626	mE	7470942	mN	
Habitat:		Hardpan plain (Cracking clay plain)					
Soil:		Red-brown clay-loam shallow cracking clay (70%)					
Rocks:		Ironstone gravel (1%)					
Mapped as:		A**SL**-(2)					
Vegetation Type		Tussock Grassland of *Aristida latifolia*, *Eragrostis setifolia* and *Eragrostis xerophila* with Open Tall Shrubland of *Acacia aptaneura* and *Acacia tetragonophylla* with Sparse Mid Shrubland of *Acacia tetragonophylla*, *Eremophila lanceolata* and *Senna artemisioides* subsp. *oligophylla* with Sparse Low Shrubland of *Enchylaena tomentosa* var. *tomentosa*, *Rhagodia eremaea* and *Senna artemisioides* subsp. *helmsii* and Isolated Forbs of *Streptoglossa macrocephala.*					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Acacia aptaneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Boerhavia paludosa*, **Cenchrus ciliaris*, *Chrysopogon fallax*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eragrostis pergracilis*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eremophila latrobei* subsp. *filiformis*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Maireana planifolia*, *Perotis rara*, **Portulaca pilosa*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Streptoglossa macrocephala*					

Q:	HBR18	Described by:	SH, RO, MP (Phase 2)		Date:	8/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	793013	mE	7471146	mN	
Habitat:		Hardpan plain (Cracking clay plain, shallow)					
Soil:		Red-brown clay-loam surface crust (35%)					
Rocks:		Ironstone gravel (2%), Quartz gravel					
Mapped as:		A**WL**					
Vegetation Type		Low Woodland of *Acacia aptaneura* with Open Tussock Grassland of *Aristida latifolia*, *Eragrostis setifolia* and *Eragrostis xerophila* with Isolated Tall Shrubs of *Acacia tetragonophylla* and Isolated Mid Shrubs of *Eremophila forrestii* subsp. *forrestii*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon macrum*, *Abutilon otocarpum*, *Acacia aptaneura*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, **Cenchrus ciliaris*, *Cucumis variabilis*, *Digitaria brownii*, *Duperreya commixta*, *Enneapogon caerulescens*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Eremophila longifolia*, *Eulalia aurea*, *Hibiscus burtonii*, *Maireana planifolia*, **Malvastrum americanum*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Ptilotus obovatus* var. *obovatus*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna glutinosa* subsp. *glutinosa*, *Sida platycalyx*, *Solanum cleistogamum*, *Solanum lasiophyllum*					

Q:	HBR21	Described by:	RO & MP (Phase 2)		Date:	7/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	796673	mE	7469746	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (30%)					
Rocks:		Ironstone stones (3%), Quartz stones					
Mapped as:		A**SL**-(4)					
Vegetation Type		Open Tall Shrubland of *Acacia xiphophylla* with Open Low Shrubland of *Senna artemisioides* subsp. *helmsii* and *Ptilotus obovatus* var. *obovatus* with Sparse Forbland of *Ptilotus nobilis*, *Salsola australis* and *Sclerolaena cornishiana* and Isolated Mid Shrubs of *Senna* ? *sericea* x *symonii*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Acacia aptaneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Acacia xiphophylla*, **Cenchrus ciliaris*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon caerulescens*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Maireana planifolia*, **Malvastrum americanum*, *Ptilotus gomphrenoides*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. x *luerssenii*, *Sida fibulifera*, *Solanum lasiophyllum*, *Sporobolus australasicus*					

Q:	HBR22	Described by:	SH (Phase 2)		Date:	7/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	797739	mE	7469529	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown sandy-loam loose soil (60%)					
Rocks:		Ironstone gravel, Quartz gravel					
Mapped as:		A**SL**-(3)					
Vegetation Type		Isolated Tall Shrubs of *Acacia aptaneura* and *Acacia tetragonophylla* with Isolated Mid Shrubs of *Acacia tetragonophylla* with Isolated Low Shrubs of *Ptilotus schwartzii* and Isolated Tussock Grasses of *Aristida contorta*, *Aristida latifolia* and *Eragrostis eriopoda*.					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Enneapogon caerulescens*, *Eragrostis eriopoda*, *Eriachne mucronata*, *Eriachne pulchella* subsp. *pulchella*, *Gomphrena canescens*, *Goodenia prostrata*, *Heliotropium heteranthum*, *Hibiscus burtonii*, *Paraneurachne muelleri*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Salsola australis*, *Sclerolaena cornishiana*, *Sclerolaena cuneata*, *Sclerolaena densiflora*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna notabilis*, *Senna symonii*, *Sida platycalyx*, *Solanum cleistogamum*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HBR26	Described by:	RO & MP (Phase 2)		Date:	11/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	791410	mE	7463715	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (20%)					
Rocks:		Ironstone stones (2%), quartz stones					
Mapped as:		A**SL**-(3)					
Vegetation Type		Open Tall Shrubland of *Acacia aptaneura* and *Psydrax latifolia* with Open Tussock Grassland of *Aristida latifolia* and *Eragrostis eriopoda* with Open Low Woodland of *Acacia pruinocarpa* with Sparse Mid Shrubland of *Eremophila forrestii* subsp. *forrestii* and *Senna* ? *sericea* x *symonii* with Sparse Low Shrubland of *Indigofera georgei*, *Sclerolaena cornishiana* and *Solanum lasiophyllum* and Isolated Hummock Grasses of *Triodia basedowii*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Acacia incurvaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida holathera* var. *holathera*, *Aristida latifolia*, *Chrysopogon fallax*, *Digitaria brownii*, *Dodonaea petiolaris*, *Duperreya commixta*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eragrostis xerophila*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Indigofera georgei*, *Maireana planifolia*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Sida platycalyx*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HBR28	Described by:	SH (Phase 2)		Date:	9/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	794724	mE	7462905	mN	
Habitat:		Hardpan plain (Broad drainage flat)					
Soil:		Red-brown clay-loam surface crust (100%), shallow cracking clay					
Rocks:		Nil					
Mapped as:		A**WL**					
Vegetation Type		Open Tall Shrubland of *Acacia aptaneura* with Sparse Low Shrubland of *Ptilotus obovatus* var. *obovatus* and *Sclerolaena cornishiana*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Boerhavia* ? *coccinea*, **Cenchrus ciliaris*, *Chrysopogon fallax*, *Cleome viscosa*, *Cucumis variabilis*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Glycine tomentella*, *Gomphrena kanisii*, *Goodenia pascua*, *Hibiscus burtonii*, *Indigofera georgei*, *Indigofera linifolia*, *Ipomoea muelleri*, *Maireana planifolia*, *Perotis rara*, *Psydrax latifolia*, *Ptilotus helipteroides*, *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna notabilis*, *Sida platycalyx*, *Solanum lasiophyllum*					

Q:	HBR30	Described by:	SH & MP (Phase 2)		Date:	10/04/ 2108	Photo: Maia 2018
Location		MGA50	802033	mE	7463676	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam shallow cracking clay (100%)					
Rocks:		Nil					
Mapped as:		A**SL**-(3)					
Vegetation Type		Tussock Grassland of *Aristida latifolia* and *Eulalia aurea* with Open Low Woodland of *Acacia incurvaneura* and *Acacia pruinocarpa* and Sparse Tall Shrubland of *Acacia ancistrocarpa* and *Acacia pachyacra*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, track, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia incurvaneura*, *Acacia pachyacra*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Centipeda minima*, *Cleome viscosa*, *Corchorus tridens*, *Cucumis variabilis*, *Cymbopogon obtectus*, *Enneapogon caerulescens*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eragrostis setifolia*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Glycine canescens*, *Gomphrena kanisii*, *Goodenia muelleriana*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Indigofera georgei*, *Paraneurachne muelleri*, *Psydrax latifolia*, *Pterocaulon* ? *serrulatum*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Senna symonii*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Streptoglossa macrocephala*, *Tephrosia supina*, *Themeda triandra*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*					

Q:	HBR32	Described by:	RO & MP (Phase 2)		Date:	9/04/ 2018	Photo: Maia 2018
Location		MGA50	791888	mE	7457859	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown sandy-loam surface crust (35%)					
Rocks:		Ironstone stones (1%)					
Mapped as:		A**SL**-(3)					
Vegetation Type		Open Hummock Grassland of *Triodia basedowii* with Sparse Tall Shrubland of *Acacia incurvaneura*, *Acacia paraneura* and *Acacia pruinocarpa* with Sparse Mid Shrubland of *Acacia ancistrocarpa*, *Acacia pachyacra* and *Senna artemisioides* subsp. *oligophylla* and Isolated Low Shrubs of *Ptilotus obovatus* var. *obovatus*, *Sclerolaena cornishiana* and *Solanum lasiophyllum*.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon leucopetalum*, *Acacia ancistrocarpa*, *Acacia dictyophleba*, *Acacia incurvaneura*, *Acacia pachyacra*, *Acacia paraneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida holathera* var. *holathera*, *Aristida latifolia*, *Cleome viscosa*, *Corchorus tectus*, *Digitaria brownii*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eremophila forrestii* subsp. *forrestii*, *Eriachne aristidea*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Fimbristylis dichotoma*, *Gomphrena kanisii*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Maireana villosa*, *Paraneurachne muelleri*, *Ptilotus astrolasius*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Scaevola parvifolia* subsp. *pilbarae*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. *glutinosa*, *Senna notabilis*, *Sida echinocarpa*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tephrosia supina*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*					

Q:	HBR33	Described by:	RO & MP (Phase 2)		Date:	9/04/ 2018	Photo: Maia 2018
Location		MGA50	791222	mE	7457857	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (20%)					
Rocks:		Ironstone stones (1%), Quartz stones					
Mapped as:		A**WL**					
Vegetation Type		Open Tall Shrubland of *Acacia aptaneura* and *Acacia tetragonophylla* with Sparse Mid Shrubland of *Anthobolus leptomerioides*, *Eremophila forrestii* subsp. *forrestii* and *Senna artemisioides* subsp. *oligophylla* with Sparse Hummock Grassland of *Triodia basedowii* with Sparse Tussock Grassland of *Aristida contorta*, *Aristida latifolia*, *Eragrostis setifolia* and *Eulalia aurea* and Isolated Low Shrubs of *Eremophila lanceolata*, *Ptilotus obovatus* var. *obovatus* and *Sclerolaena cornishiana*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon macrum*, *Acacia aptaneura*, *Acacia pachyacra*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Cleome viscosa*, *Digitaria brownii*, *Dodonaea petiolaris*, *Duperreya commixta*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eriachne mucronata*, *Eulalia aurea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Indigofera georgei*, *Maireana planifolia*, *Maireana villosa*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Rhagodia eremaea*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Sida platycalyx*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HBR35	Described by:	SH & MP (Phase 2)		Date:	10/04/ 2018	Photo: Maia 2018
Location		MGA50	799766	mE	7457154	mN	
Habitat:		Hardpan plain					
Soil:		Red-orange clay-loam surface crust (60%)					
Rocks:		Ironstone gravel (40%)					
Mapped as:		A**SL**-(2)					
Vegetation Type		Open Low Shrubland of *Eremophila lanceolata* and *Maireana villosa* with Sparse Mid Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* and Isolated Tall Shrubs of *Acacia aptaneura*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, track, animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Abutilon otocarpum*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Boerhavia coccinea*, *Boerhavia paludosa*, *Chrysopogon fallax*, *Enneapogon caerulescens*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila lanceolata*, *Euphorbia coghlanii*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens*, *Goodenia prostrata*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Indigofera georgei*, *Maireana planifolia*, *Maireana villosa*, *Neptunia dimorphantha*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, *Portulaca cyclophylla*, *Portulaca oleracea*, **Portulaca pilosa*, *Ptilotus helipteroides*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus polystachyus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Salsola australis*, *Sclerolaena cornishiana*, *Sclerolaena cuneata*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna symonii*, *Sida fibulifera*, *Solanum lasiophyllum*, *Tephrosia supina*, *Tragus australianus*					

Q:	HBR38	Described by:	RO & MP (Phase 2)		Date:	9/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	791725	mE	7460809	mN	
Habitat:		Hardpan plain (open)					
Soil:		Red-brown clay-loam surface crust (40%)					
Rocks:		Ironstone gravel (2%), quartz stones					
Mapped as:		A**SL**-(3)					
Vegetation Type		Sparse Tall Shrubland of *Acacia incurvaneura* and *Acacia tetragonophylla* with Sparse Mid Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* with Sparse Low Shrubland of *Ptilotus schwartzii* var. *schwartzii*, *Sclerolaena cornishiana* and *Solanum lasiophyllum* with Sparse Hummock Grassland of *Triodia basedowii* and Sparse Tussock Grassland of *Aristida latifolia*, *Aristida contorta*, *Digitaria brownii* and *Eulalia aurea*.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Acacia incurvaneura*, *Acacia pachyacra*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Boerhavia coccinea*, *Digitaria brownii*, *Dodonaea coriacea*, *Duperreya commixta*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eremophila latrobei* subsp. *filiformis*, *Eremophila longifolia*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Maireana villosa*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. x *luerssenii*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	HBR39	Described by:	SH & MP (Phase 2)		Date:	10/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	801853	mE	7464031	mN	
Habitat:		Stony plain					
Soil:		Red-brown clay-loam loose soil (70%), shallow cracking clay (20%)					
Rocks:		Ironstone stones (5%), Quartz stones (5%)					
Mapped as:		M**TG**					
Vegetation Type		Tussock Grassland of *Aristida latifolia*, *Eragrostis xerophila* with Open Mid Shrubland of *Senna artemisioides* subsp. *oligophylla*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Aristida latifolia*, *Chrysopogon fallax*, *Dactyloctenium radulans*, *Eragrostis xerophila*, *Eremophila lanceolata*, *Euphorbia biconvexa*, *Euphorbia drummondii*, *Goodenia muelleriana*, *Indigofera linifolia*, *Iseilema vaginiflorum*, *Neptunia dimorphantha*, *Rhynchosia minima*, *Senna artemisioides* subsp. *oligophylla*, *Senna symonii*, *Sida fibulifera*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Tephrosia* sp. clay soils (S. van Leeuwen et al. PBS 0273)					

Q:	HBR4	Described by:	SH, RO & MP (Phase 2)		Date:	6/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	798625	mE	7478945	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (70%)					
Rocks:		Ironstone gravel (1%)					
Mapped as:		A**SL**-(2)					
Vegetation Type		Open Tussock Grassland of *Aristida contorta*, *Eragrostis setifolia* and *Eragrostis xerophila* with Sparse Tall Shrubland of *Acacia synchronicia* with Sparse Mid Shrubland of *Acacia synchronicia* and Sparse Low Shrubland of *Enchylaena tomentosa* var. *tomentosa*, *Maireana villosa* and *Sclerolaena cornishiana*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Abutilon macrum*, *Abutilon otocarpum*, *Acacia incurvaneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Boerhavia coccinea*, *Corchorus sidoides subsp. sidoides*, *Dactyloctenium radulans*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon caerulescens*, *Enneapogon polyphyllus*, *Enteropogon ramosus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila cuneifolia*, *Eremophila lanceolata*, *Eremophila latrobei* subsp. *filiformis*, *Euphorbia coghlanii*, *Euphorbia vaccaria* var. *vaccaria*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Maireana planifolia*, *Maireana villosa*, **Malvastrum americanum*, **Portulaca pilosa*, *Ptilotus aervoides*, *Ptilotus gomphrenoides*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna ? sericea* x *symonii*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Streptoglossa macrocephala*, *Trianthema triquetrum*					

Q:	HBR45	Described by:	RO & MP (Phase 2)		Date:	9/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	792097	mE	7457436	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown sandy-loam surface crust (15%)					
Rocks:		Nil					
Mapped as:		A**SL**-(1)					
Vegetation Type		Tall Shrubland of *Acacia ancistrocarpa*, *Acacia aptaneura* and *Acacia pruinocarpa* with Tussock Grassland of *Chrysopogon fallax*, *Eragrostis eriopoda* and *Eulalia aurea* with Open Low Woodland of *Corymbia aspera* and *Corymbia hamersleyana* with Sparse Mid Shrubland of *Anthobolus leptomerioides*, *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* and Isolated Low Shrubs of *Sclerolaena cornishiana*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon leucopetalum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Chrysopogon fallax*, *Cleome viscosa*, *Corymbia aspera*, *Corymbia hamersleyana*, *Cucumis variabilis*, *Enchylaena tomentosa* var. *tomentosa*, *Eragrostis eriopoda*, *Eragrostis setifolia*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hakea lorea* subsp. *lorea*, *Hibiscus sturtii* var. *platychlamys*, *Ipomoea calobra*, **Malvastrum americanum*, *Paraneurachne muelleri*, *Perotis rara*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tephrosia supina*, *Trichodesma zeylanicum* var. *zeylanicum*					

Q:	HBR6	Described by:	SH, RO & MP (Phase 2)		Date:	6/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	799261	mE	7479707	mN	
Habitat:		Hardpan plain					
Soil:		Red sandy-loam loose soil (90%)					
Rocks:		Ironstone gravel (5%)					
Mapped as:		A**SL**-(4)					
Vegetation Type		Sparse Tall Shrubland of *Acacia aptaneura* and *Acacia xiphophylla* with Sparse Mid Shrubland of *Acacia tetragonophylla* and *Acacia xiphophylla* with Sparse Low Shrubland of *Ptilotus obovatus* var. *obovatus*, *Senna* ? *sericea* x *symonii* and *Sclerolaena cuneata* and Sparse Chenopod Shrubland of *Aristida contorta*, *Aristida latifolia*, *Eragrostis setifolia* and *Eragrostis xerophila*.					
Vegetation Condition:		Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia aptaneura*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Acacia xiphophylla*, *Aristida contorta*, *Aristida latifolia*, *Boerhavia coccinea*, **Cenchrus ciliaris*, *Cleome viscosa*, *Corchorus sidoides* subsp. *sidoides*, *Enneapogon polyphyllus*, *Enteropogon ramosus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila longifolia*, *Euphorbia australis* var. *australis*, *Evolvulus alsinoides* var. *villosicalyx*, *Hibiscus burtonii*, *Maireana planifolia*, *Maireana villosa*, **Malvastrum americanum*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Salsola australis*, *Sclerolaena cornishiana*, *Sclerolaena cuneata*, *Senna* ? *sericea* x *symonii*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida platycalyx*, *Solanum cleistogamum*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Tephrosia supina*, *Tribulus macrocarpus*					

Q:	HBR7	Described by:	SH (Phase 2)		Date:	8/04/ 2018	Photo: Maia 2018
Location (GDA94):		MGA50	789944	mE	7472582	mN	
Habitat:		Undulating plain					
Soil:		Red-orange sandy-loam loose soil (100%)					
Rocks:		Nil					
Mapped as:		T**HG**					
Vegetation Type		Open Hummock Grassland of *Triodia schinzii* with Open Low Woodland of *Acacia aptaneura*, *Acacia pruinocarpa* and *Hakea lorea* subsp. *lorea* and Isolated Mid Shrubs of *Acacia tetragonophylla* and *Rhagodia eremaea*.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Bonamia erecta*, *Cleome viscosa*, *Duperreya commixta*, *Enneapogon caerulescens*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila longifolia*, *Eriachne aristidea*, *Eulalia aurea*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Maireana planifolia*, *Maireana villosa*, *Paraneurachne muelleri*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Rhagodia eremaea*, *Scaevola spinescens*, *Senna artemisioides* subsp. *oligophylla*, *Solanum lasiophyllum*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*, *Triodia schinzii*					

Q:	HBR7b	Described by:	RO & MP (Phase 2)		Date:	11/04/2018	Photo: Maia 2018
Location (GDA94):		MGA50	797506	mE	7477253	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown sandy-loam surface crust (35%)					
Rocks:		Ironstone stones (1%), quartz stones (1%)					
Mapped as:		T**HG**					
Vegetation Type		Hummock Grassland of *Triodia basedowii* and *Triodia schinzii* with Tussock Grassland of *Aristida latifolia*, *Enneapogon polyphyllus*, *Eragrostis eriopoda* and *Paraneurachne muelleri* with Open Tall Shrubland of *Acacia ancistrocarpa*, *Acacia pruinocarpa* and *Acacia tetragonophylla* with Sparse Low Shrubland of *Maireana planifolia*, *Ptilotus obovatus* var. *obovatus* and *Senna* ? *sericea* x *symonii*, with Isolated Low Trees of *Acacia pruinocarpa* and Isolated Mid Shrubs of *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia synchronicia* and *Rhagodia eremaea*.					
Veg Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Moderate (1-5 years)					
Species:		*Abutilon lepidum*, *Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida holathera* var. *holathera*, *Aristida latifolia*, *Boerhavia coccinea*, *Bonamia erecta*, *Bulbostylis barbata*, *Cleome viscosa*, *Duperreya commixta*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eragrostis setifolia*, *Eremophila cuneifolia*, *Eremophila longifolia*, *Euphorbia vaccaria* var. *vaccaria*, *Evolvulus alsinoides* var. *villosicalyx*, *Goodenia microptera*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *campylochlamys*, *Hibiscus sturtii* var. *platychlamys*, *Maireana planifolia*, *Panicum effusum*, *Paraneurachne muelleri*, *Pterocaulon sphacelatum*, *Ptilotus astrolasius*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Scaevola parvifolia* subsp. *pilbarae*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Sida* sp. verrucose glands (F.H. Mollemans 2423), *Solanum cleistogamum*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Streptoglossa decurrens*, *Triodia basedowii*, *Triodia schinzii*					

Q:	HBR9	Described by:	RO & MP (Phase 2)		Date:	7/04/2018	Photo: Maia 2018
Location (GDA94):		MGA50	794439	mE	7475506	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam loose soil (35%)					
Rocks:		Nil					
Mapped as:		T**HG**					
Vegetation Type		Hummock Grassland of *Triodia basedowii* with Open Low Woodland of *Acacia pruinocarpa* and *Corymbia hamersleyana* with Sparse Tall Shrubland of *Acacia ancistrocarpa*, *Acacia sclerosperma* subsp. *sclerosperma* and *Acacia tetragonophylla* and Isolated Low Shrubs of *Ptilotus obovatus* var. *obovatus* and *Solanum lasiophyllum*.					
Veg Condition:		Very Good					
Disturbances:		Weeds, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon leucopetalum*, *Abutilon* sp. Pilbara (W.R. Barker 2025), *Acacia ancistrocarpa*, *Acacia pruinocarpa*, *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, **Cenchrus ciliaris*, *Cleome viscosa*, *Corymbia hamersleyana*, *Cucumis variabilis*, *Cymbopogon ambiguus*, *Digitaria brownii*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eremophila cuneifolia*, *Eremophila longifolia*, *Eriachne aristidea*, *Evolvulus alsinoides* var. *villosicalyx*, *Glycine canescens*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Maireana planifolia*, **Malvastrum americanum*, *Paraneurachne muelleri*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. x *luerssenii*, *Sida fibulifera*, *Solanum cleistogamum*, *Solanum lasiophyllum*, *Triodia basedowii*					

Q:	Q01	Described by:	SH (Phase 1 & 2)		Date:		22/10/2017 (Phase 1) 13/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	786149	mE	7473586	mN		
Habitat:		Hill gentle (Hillslope low sandy hill)						
Soil:		Red-brown sandy-loam surface crust (60%), loose soil (40%)						
Rocks:		Nil						
Mapped as:		T**HG**						
Vegetation Type		Hummock Grassland of *Triodia basedowii* with Sparse Tall Shrubland of *Acacia ancistrocarpa* and *Acacia melleodora* with Isolated Low Trees of *Acacia pruinocarpa* and Isolated Low Shrubs of *Solanum morrisonii*.						
Vegetation Condition:		Excellent						
Disturbances:		Grazing, animal tracks, trampled vegetation						
Fire Age:		None evident						
Species:		*Abutilon* sp. Pilbara (W.R. Barker 2025), *Acacia adsurgens*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia melleodora*, Acacia *pruinocarpa*, *Acacia sclerosperma* subsp. *sclerosperma*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida latifolia*, *Corchorus tectus*, *Cymbopogon ambiguus*, *Duperreya commixta*, *Eragrostis setifolia*, *Eremophila cuneifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eucalyptus gamophylla*, *Evolvulus alsinoides* var. *villosicalyx*, *Goodenia prostrata*, *Hakea chordophylla*, *Paraneurachne muelleri*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Ptilotus astrolasius*, *Scaevola parvifolia* subsp. *pilbarae*, *Senna glutinosa* subsp. *glutinosa*, *Senna notabilis*, *Solanum lasiophyllum*, *Solanum morrisonii*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*						

Q:	Q02	Described by:	SH (Phase 1 & 2)		Date:		22/10/2017 (Phase 1) 13/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	786084	mE	7472680	mN		
Habitat:		Sandplain (Hardpan plain in places)						
Soil:		Red-brown sandy-loam loose soil (60%), surface crust (30%)						
Rocks:		Ironstone gravel (10%)						
Mapped as:		A**SL**-(3)						
Vegetation Type		Open Tall Shrubland of *Acacia aneura*, *Acacia aptaneura* and *Acacia pteraneura* with an Open Mid Shrubland of *Eremophila forrestii* subsp. *forrestii* and an Open Hummock Grassland of *Triodia basedowii*.						
Vegetation Condition:		Excellent						
Disturbances:		Animal tracks, trampled vegetation						
Fire Age:		Old (> 5years)						
Species:		*Abutilon macrum*, *Abutilon otocarpum*, *Acacia aneura*, *Acacia aptaneura*, *Acacia macraneura*, *Acacia pruinocarpa*, *Acacia pteraneura*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, **Bidens bipinnata*, *Chrysopogon fallax*, *Cleome viscosa*, *Dodonaea petiolaris*, *Dysphania rhadinostachya*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens*, *Goodenia microptera*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Indigofera georgei*, *Ipomoea calobra*, *Maireana planifolia*, *Maireana villosa*, *Panicum effusum*, *Paraneurachne muelleri*, *Paspalidium basicladum*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus polystachyus*, *Ptilotus rotundifolius*, *Rhagodia eremaea*, *Rhynchosia minima*, *Senna artemisioides* subsp. *oligophylla*, *Sida fibulifera*, *Sida platycalyx*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*, *Sporobolus* sp., *Tribulus astrocarpus*, *Triodia basedowii*						

Q:	Q03	Described by:	CS (Phase 1) RO & MP (Phase 2)		Date:		22/10/2017 &13/04/2018 (Phase 1 & 2)	Photo:
Location (GDA94):		MGA50	786937	mE	7471097	mN		
Habitat:		Hardpan plain very gentle (Gravelly and hardpan plain)						
Soil:		Red-brown clay shallow cracking clay (15%), loose soil (25%)						
Rocks:		Ironstone gravel (50%), quartz gravel (10%)						
Mapped as:		A**SL**-(5)						
Vegetation Type		Open Low Woodland of *Acacia pruinocarpa*, *Acacia paraneura* and *Acacia pteraneura* with a Sparse Tall Shrubland of *Acacia aptaneura* with a Sparse Tussock Grassland of *Aristida contorta* with a Sparse Forbland of *Goodenia prostrata* and Isolated Low Shrubs of *Ptilotus schwartzii* var. *schwartzii.*						
Veg Condition:		Very Good						
Disturbances:		Grazing						
Fire Age:		None evident						
Species:		*Acacia aneura*, *Acacia aptaneura*, *Acacia paraneura*, *Acacia pruinocarpa*, *Acacia pteraneura*, *Acacia rhodophloia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida holathera* var. *holathera*, *Aristida latifolia*, *Cheilanthes sieberi* subsp. *sieberi*, *Cleome viscosa*, *Cucumis variabilis*, *Digitaria brownii*, *Dodonaea petiolaris*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena cunninghamii*, *Goodenia prostrata*, *Hibiscus burtonii*, *Maireana planifolia*, *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Psydrax latifolia*, *Ptilotus helipteroides*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Sclerolaena cornishiana*, *Senna* ? *sericea* x *symonii*, *Senna* ? *stricta*, *Senna glaucifolia*, *Sida platycalyx*, *Sida* sp. verrucose glands (F.H. Mollemans 2423), *Solanum cleistogamum*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Triodia basedowii*						

Q:	Q04	Described by:	CS (Phase 1) RO & MP (Phase 2)		Date:		20/10/2017 13/04/2018 (Phase 1 & 2)	Photo:
Location (GDA94):		MGA50	785826	mE	7465800	mN		
Habitat:		Sandplain (Almost a gravelly plain)						
Soil:		Red-brown sandy-loam loose soil (80%)						
Rocks:		Ironstone gravel (20%)						
Mapped as:		A**SL**-(5)						
Vegetation Type		Sparse Low Shrubland of *Eremophila cuneifolia*, *Senna artemisioides* subsp. *oligophylla* and *Senna glutinosa* subsp. x *luerssenii* with a Sparse Tussock Grassland of *Aristida latifolia* and *Eragrostis setifolia* and Isolated Tall Shrubs of *Acacia pruinocarpa*.						
Vegetation Condition:		Excellent						
Disturbances:		Grazing						
Fire Age:		Old (> 5years)						
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia melleodora*, *Acacia pruinocarpa*, *Acacia synchronicia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida holathera* var. *holathera*, *Aristida latifolia*, *Aristida* sp. (inadequate material), *Cleome viscosa*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eragrostis setifolia*, *Eremophila cuneifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Eriachne aristidea*, *Evolvulus alsinoides* var. *villosicalyx*, *Fimbristylis dichotoma*, *Gomphrena canescens*, *Goodenia prostrata*, *Hakea lorea* subsp. *lorea*, *Heliotropium heteranthum*, *Hibiscus burtonii*, *Maireana planifolia*, *Minuria integerrima*, *Paraneurachne muelleri*, *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. x *artemisioides*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. x *luerssenii*, *Senna stricta*, *Senna symonii*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tribulus astrocarpus*, *Triodia basedowii*						

Q:	Q05	Described by:	SH (Phase 1) RO & MP (Phase 2)		Date:	22/10/2017, 13/04/2018 (Phase 1 &2)	Photo:
Location (GDA94):		MGA50	786254	mE	7466844	mN	
Habitat:		Sandplain (Undulating)					
Soil:		Red-brown sandy-clay loose soil (25%)					
Rocks:		Nil					
Mapped as:		T**HG**					
Vegetation Type		Hummock Grassland of *Triodia basedowii* with a Sparse Tall Shrubland of *Acacia ancistrocarpa* and *Acacia pachyacra* with a Sparse Forbland of *Scaevola parviflora* and Isolated Low Trees of *Hakea lorea* subsp. *lorea*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia melleodora*, *Acacia pachyacra*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida holathera* var. *holathera*, *Aristida latifolia*, *Bonamia erecta*, *Corchorus tectus*, *Cymbopogon ambiguus*, *Cymbopogon obtectus*, *Dicrastylis cordifolia*, *Digitaria brownii*, *Dodonaea coriacea*, *Dodonaea petiolaris*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eremophila longifolia*, *Eriachne aristidea*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Fimbristylis dichotoma*, *Goodenia microptera*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Maireana planifolia*, *Paraneurachne muelleri*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Ptilotus obovatus* var. *obovatus*, *Scaevola parvifolia* subsp. *pilbarae*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida echinocarpa*, *Sida* sp. Pilbara (A.A. Mitchell PRP 1543), *Solanum lasiophyllum*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*, *Yakirra australiensis* var. *australiensis*					

Q:	Q06	Described by:	Scott Hitchcock (Phase 1 & 2)		Date:	20/10/2017 (Phase 1) 14/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	786080	mE	7462617	mN	
Habitat:		Mulga grove					
Soil:		Red-brown sandy-clay loose soil (100%)					
Rocks:		Nil					
Mapped as:		A**WL**					
Vegetation Type		Open Low Forest of *Acacia aptaneura* and *Psydrax latifolia* with a Tussock Grassland of *Enneapogon polyphyllus* and *Sporobolus australasicus* a Sparse Mid Shrubland of *Dodonaea petiolaris* and a Sparse Low Shrubland of *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* var. *obovatus*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon macrum*, *Abutilon otocarpum*, *Abutilon* sp. Pilbara (W.R. Barker 2025), *Acacia aptaneura*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, **Bidens bipinnata*, *Boerhavia paludosa*, **Cenchrus ciliaris*, *Cleome viscosa*, *Corymbia hamersleyana*, *Cucumis variabilis*, *Digitaria brownii*, *Dodonaea petiolaris*, *Duperreya commixta*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Evolvulus alsinoides* var. *villosicalyx*, *Glycine tomentella*, *Gomphrena canescens*, *Goodenia pascua*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Indigofera colutea*, *Indigofera georgei*, *Ipomoea muelleri*, *Iseilema eremaeum*, *Maireana villosa*, *Nicotiana* sp. (inadequate material), *Panicum effusum*, *Paspalidium rarum*, *Perotis rara*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Ptilotus obovatus* var. *obovatus*, *Rhynchosia minima*, *Senna artemisioides* subsp. *helmsii*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Sporobolus australasicus*, *Streptoglossa odora*, *Trichodesma zeylanicum* var. *zeylanicum*					

Q:	Q07	Described by:	SH (Phase 1) RO & MP (Phase 2)		Date:	20/10/2017 (Phase 1) 14/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	787102	mE	7460812	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown loam loose soil (90%)					
Rocks:		Ironstone gravel (5%), quartz gravel (5%)					
Mapped as:		A**WL**					
Vegetation Type		Open Low Forest of *Acacia aptaneura* with Tussock Grassland of *Aristida latifolia* and *Enneapogon polyphyllus* and Open Mid Shrubland of *Eremophila forrestii* subsp. *forrestii*.					
Vegetation Condition:		Excellent					
Disturbances:		Grazing					
Fire Age:		Old (> 5years)					
Species:		*Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Chrysopogon fallax*, *Cleome viscosa*, *Dodonaea petiolaris*, *Dysphania rhadinostachya*, *Enneapogon polyphyllus*, *Eragrostis xerophila*, *Eremophila forrestii* subsp. *forrestii*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens*, *Hibiscus burtonii*, *Maireana villosa*, **Malvastrum americanum*, *Paspalidium* sp., *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Psydrax latifolia*, *Ptilotus gomphrenoides*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Rhagodia eremaea*, *Rhynchosia minima*, *Senna artemisioides* subsp. *helmsii*, *Sida platycalyx*, *Sida* sp. dark green fruits (S. van Leeuwen 2260), *Solanum lasiophyllum*, *Sporobolus australasicus*, *Streptoglossa odora*, *Trichodesma zeylanicum* var. *zeylanicum*					

Q:	Q08	Described by:	CS (Phase 1) SH (Phase 2)		Date:	23/10/2017 (Phase 1) 14/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	785887	mE	7459446	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown sandy-clay surface crust (20%), shallow cracking clay (20%)					
Rocks:		Ironstone gravel (1%), quartz gravel (1%)					
Mapped as:		T**HG**					
Vegetation Type		Hummock Grassland of *Triodia basedowii* with Sparse Mid Shrubland of *Acacia ancistrocarpa* and *Acacia pachyacra* and Isolated Tall Shrubs of *Acacia pruinocarpa*.					
Vegetation Condition:		Excellent					
Disturbances:		Nil					
Fire Age:		None evident					
Species:		*Acacia adsurgens*, *Acacia ancistrocarpa*, *Acacia melleodora*, *Acacia pachyacra*, *Acacia pruinocarpa*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, *Chrysopogon fallax*, *Corchorus tectus*, *Cymbopogon ambiguus*, *Eriachne aristidea*, *Gomphrena canescens*, *Goodenia vilmoriniae*, *Paraneurachne muelleri*, *Ptilotus astrolasius*, *Senna glutinosa* subsp. *glutinosa*, *Senna glutinosa* subsp. x *luerssenii*, *Senna notabilis*, *Sida echinocarpa*, *Solanum lasiophyllum*, *Solanum morrisonii*, *Trichodesma zeylanicum* var. *zeylanicum*, *Triodia basedowii*					

Q:	Q09	Described by:	SH (Phase 1 & 2)		Date:	23/10/2017 (Phase 1) 14/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	787399	mE	7458327	mN	
Habitat:		Hardpan plain, Intergrove					
Soil:		Red-brown sandy-loam loose soil (70%), surface crust (20%)					
Rocks:		Ironstone gravel 10%					
Mapped as:		A**SL**-(3)					
Vegetation Type		Sparse Tall Shrubland of *Acacia aptaneura* with Sparse Mid Shrubland of *Senna glaucifolia* with Isolated Low Trees of *Acacia pruinocarpa* and Isolated Tussock Grasses of *Aristida contorta*.					
Vegetation Condition:		Excellent					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Acacia aneura*, *Acacia aptaneura*, *Acacia incurvaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, **Bidens bipinnata*, *Boerhavia coccinea*, *Cleome viscosa*, *Dodonaea petiolaris*, *Dysphania rhadinostachya*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens*, *Hakea chordophylla*, *Hakea lorea* subsp. *lorea*, *Maireana planifolia*, *Maireana villosa*, *Paraneurachne muelleri*, *Psydrax latifolia*, *Ptilotus aervoides*, *Ptilotus helipteroides*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*., *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna* cf *sericea*, *Senna glaucifolia*, *Senna glutinosa* subsp. x *luerssenii*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tephrosia supina*					

Q:	QS10	Described by:	SH & MP (Phase 2)		Date:	15/04/ 2018	Photo:
Location (GDA94):		MGA50	797265	mE	7452268	mN	
Habitat:		Hardpan plain (Broad drainage flat)					
Soil:		Red-brown clay-loam surface crust (60%), loose soil (20%)					
Rocks:		Ironstone stones (2%), quartz stones (2%)					
Mapped as:		A**SL**-(1)					
Vegetation Type		Open Tall Shrubland of *Acacia incurvaneura* broad with Open Tussock Grassland of *Chrysopogon fallax* and *Eulalia aurea* with Isolated Low Trees of *Corymbia aspera* and Isolated Mid Shrubs of *Eremophila forrestii* subsp. *forrestii*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia incurvaneura*, *Acacia pruinocarpa*, *Acacia tetragonophylla*, *Alternanthera nodiflora*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, **Bidens bipinnata*, *Boerhavia paludosa*, *Cheilanthes sieberi* subsp. *sieberi*, *Chrysopogon fallax*, *Cleome viscosa*, *Corymbia aspera*, *Cucumis variabilis*, *Dodonaea petiolaris*, *Enneapogon polyphyllus*, *Eremophila forrestii* subsp. *forrestii*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens*, *Hakea chordophylla*, *Hibiscus sturtii* var. *platychlamys*, *Indigofera georgei*, *Ipomoea calobra*, *Iseilema vaginiflorum*, *Maireana villosa*, *Perotis rara*, **Portulaca pilosa*, *Psydrax latifolia*, *Ptilotus obovatus* var. *obovatus*, *Rhynchosia minima*, *Senna artemisioides* subsp. x *artemisioides*, *Senna artemisioides* subsp. *oligophylla*, *Senna notabilis*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tephrosia supina*					

Q:	Q11	Described by:	SH (Phase 1) RO & MP (Phase 2)		Date:	21/10/2017 (Phase 1) 12/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	791450	mE	7453188	mN	
Habitat:		Broad drainage flat					
Soil:		Orange sandy-loam loose soil (100%)					
Rocks:		Nil					
Mapped as:		A**SL**-(1)					
Vegetation Type		Open Tussock Grassland of *Aristida latifolia*, *Eragrostis eriopoda* and *Eulalia aurea* with a Sparse Tall Shrubland of *Acacia ancistrocarpa* and Isolated Low Trees of *Corymbia hamersleyana*.					
Vegetation Condition:		Very Good					
Disturbances:		Grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia ancistrocarpa*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia pteraneura*, *Acacia tetragonophylla*, *Aristida latifolia*, *Boerhavia paludosa*, **Cenchrus ciliaris*, *Chrysopogon fallax*, *Cleome viscosa*, *Corchorus tectus*, *Corymbia hamersleyana*, *Cucumis variabilis*, *Digitaria brownii*, *Enneapogon polyphyllus*, *Eragrostis eriopoda*, *Eriachne aristidea*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Glycine tomentella*, *Gomphrena canescens*, *Hibiscus burtonii*, *Hibiscus sturtii* var. *platychlamys*, *Indigofera georgei*, *Maireana villosa*, *Paraneurachne muelleri*, *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia eremaea*, *Salsola australis*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glaucifolia*, *Setaria* sp., *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tephrosia supina*, *Triraphis mollis*					

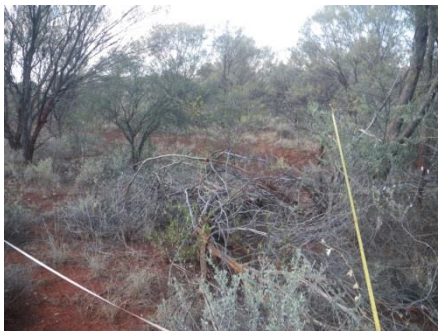
Q:	Q12	Described by:	CS (Phase 1) RO & MP (Phase 2)		Date:	21/10/2017 (Phase 1) 12/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	793195	mE	7453284	mN	
Habitat:		Gilgai lowland (Crabhole plain)					
Soil:		Red clay deep cracking clay (100%)					
Rocks:		Nil					
Mapped as:		M**TG**					
Vegetation Type		Closed Tussock Grassland of *Aristida latifolia* and *Eragrostis xerophila* with an Open Low Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna symonii*.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Aristida contorta*, *Aristida latifolia*, *Cleome viscosa*, *Eragrostis xerophila*, *Eremophila lanceolata*, *Goodenia muelleriana*, *Hibiscus sturtii* var. *platychlamys*, *Iseilema eremaeum*, *Neptunia dimorphantha*, *Oldenlandia crouchiana*, *Paspalidium rarum*, **Portulaca pilosa*, *Ptilotus nobilis*, *Rhynchosia minima*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna symonii*, *Sida fibulifera*, *Solanum lasiophyllum*, *Streptoglossa odora*					

Q:	Q13	Described by:	SH (Phase 1 RO & MP (Phase 2)		Date:	21/10/2017 (Phase 1) 12/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	796397	mE	7453712	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam shallow cracking clay (70%)					
Rocks:		Ironstone gravel (15%), quartz gravel (15%)					
Mapped as:		A**SL**-(4)					
Vegetation Type		Open Low Woodland of *Acacia aptaneura* and *Acacia paraneura* with Sparse Tall Shrubland of *Acacia aptaneura* and *Acacia paraneura* with a Sparse Low Shrubland of *Eremophila forrestii* subsp. *forrestii* and *Senna artemisioides* subsp. *oligophylla* and a Sparse Tussock Grassland of *Aristida contorta* and *Aristida latifolia*.					
Vegetation Condition:		Excellent					
Disturbances:		Nil					
Fire Age:		None evident					
Species:		*Acacia aptaneura*, *Acacia ayersiana*, *Acacia paraneura*, *Acacia tetragonophylla*, *Aristida contorta*, *Aristida latifolia*, *Cheilanthes sieberi* subsp. *sieberi*, *Chrysopogon fallax*, *Digitaria brownii*, *Dodonaea petiolaris*, *Enchylaena tomentosa* var. *tomentosa*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eremophila latrobei* subsp. *filiformis*, *Eriachne aristidea*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena canescens*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Indigofera georgei*, *Maireana villosa*, *Paraneurachne muelleri*, *Polycarpaea corymbosa* var. *corymbosa*, *Psydrax latifolia*, *Ptilotus helipteroides*, *Ptilotus nobilis*, *Ptilotus schwartzii* var. *schwartzii*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glutinosa* subsp. x *luerssenii*, *Sida fibulifera*, *Sida platycalyx*, *Solanum lasiophyllum*, *Spermacoce brachystema*, *Tribulus astrocarpus*					

Q:	Q14	Described by:	SH (Phase 1 & 2)		Date:	21/10/2017 (Phase 1) 12/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	797788	mE	7450650	mN	
Habitat:		Broad drainage flat					
Soil:		Red-orange sandy-loam loose soil (100%)					
Rocks:		Nil					
Mapped as:		A**SL**-(1)					
Vegetation Type		Tall Shrubland of *Acacia macraneura* with Low Woodland of *Acacia pruinocarpa*, *Acacia macraneura* and *Corymbia aspera* and an Open Mid Shrubland of *Senna artemisioides* subsp. *helmsii*.					
Vegetation Condition:		Good					
Disturbances:		Grazing					
Fire Age:		Old (> 5years)					
Species:		*Abutilon macrum*, *Abutilon otocarpum*, *Acacia macraneura*, *Acacia pruinocarpa*, *Acacia pteraneura*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, **Bidens bipinnata*, *Boerhavia paludosa*, *Chrysopogon fallax*, *Cleome viscosa*, *Corymbia aspera*, *Corymbia deserticola* subsp. *deserticola*, *Corymbia hamersleyana*, *Dactyloctenium radulans*, *Dissocarpus paradoxus*, *Dodonaea* petiolaris, *Duperreya commixta*, *Enneapogon caerulescens*, *Enneapogon polyphyllus*, *Eragrostis setifolia*, *Eragrostis xerophila*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eulalia aurea*, *Evolvulus alsinoides* var. *villosicalyx*, *Glycine tomentella*, *Gomphrena canescens*, *Goodenia prostrata*, *Hakea chordophylla*, *Hibiscus sturtii* var. *platychlamys*, *Maireana villosa*, **Malvastrum americanum*, *Paraneurachne muelleri*, *Paspalidium* sp., *Perotis rara*, *Polycarpaea corymbosa* var. *corymbosa*, *Portulaca oleracea*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Ptilotus obovatus* var. *obovatus*, *Rhynchosia minima*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Senna glaucifolia*, *Sida platycalyx*, *Solanum lasiophyllum*, *Tragus australianus*					

Q:	Q15	Described by:	SH (Phase 1 & 2)		Date:	21/10/2017 (Phase 1) 12/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	799990	mE	7450971	mN	
Habitat:		Hardpan plain					
Soil:		Red-orange clay-loam surface crust (80%), loose soil (15%)					
Rocks:		Ironstone gravel (5%)					
Mapped as:		A**TG**					
Vegetation Type		Open Tussock Grassland of *Aristida contorta* and *Aristida latifolia* with a Sparse Mid Shrubland of *Acacia synchronicia*, *Senna artemisioides* subsp. *helmsii* and *Senna glaucifolia* and Isolated Tall Shrubs of *Acacia synchronicia*.					
Vegetation Condition:		Very Good					
Disturbances:		Animal tracks, trampled vegetation					
Fire Age:		Old (> 5years)					
Species:		*Acacia aptaneura, Acacia pruinocarpa, Acacia synchronicia, Acacia tetragonophylla, Aristida contorta, Aristida latifolia, Boerhavia* ? *coccinea, Boerhavia paludosa, Cleome viscosa, Cymbopogon ambiguus, Dactyloctenium radulans, Enneapogon polyphyllus, Eragrostis cumingii, Eragrostis xerophila, Eremophila lanceolata, Eriachne aristidea, Eriachne pulchella* subsp. *pulchella, Eulalia aurea, Euphorbia australis* var. *subtomentosa, Evolvulus alsinoides* var. *villosicalyx, Gomphrena canescens,* ***Goodenia nuda* (P4),** *Goodenia prostrata, Hakea lorea* subsp. *lorea, Maireana villosa, Paraneurachne muelleri, Paspalidium* sp., *Perotis rara, Phyllanthus erwinii, Polycarpaea corymbosa* var. *corymbosa, Portulaca oleracea, *Portulaca pilosa, Pterocaulon sphacelatum, Ptilotus aervoides, Ptilotus helipteroides, Ptilotus obovatus* var. *obovatus, Rhagodia eremaea, Sclerolaena cornishiana, Senna* ? *sericea* x *symonii, Senna artemisioides* subsp. *helmsii, Senna artemisioides* subsp. *oligophylla, Senna glaucifolia, Senna notabilis, Sida platycalyx, Solanum lasiophyllum, Synaptantha tillaeacea* var. *tillaeacea, Tribulus astrocarpus*					

Q:	Q16	Described by:	CS (Phase 1) RO & MP (Phase 2)		Date:	21/10/2017 (Phase 1) 12/04/2018 (Phase 2)	Photo:
Location (GDA94):		MGA50	801769	mE	7454535	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (40%), loose soil (60%)					
Rocks:		Nil					
Mapped as:		A**WL**					
Vegetation Type		Low Woodland of *Acacia aptaneura* and *Psydrax latifolia* with Sparse Mid Shrubland of *Senna artemisioides* subsp. *helmsii* and *Senna artemisioides* subsp. *oligophylla* with Sparse Low Shrubland of *Eremophila forrestii* subsp. *forrestii* and *Ptilotus obovatus* var. *obovatus* with a Sparse Tussock Grassland of *Aristida contorta* and *Aristida latifolia* and Isolated Forbs of *Cleome viscosa*.					
Vegetation Condition:		Good					
Disturbances:		Pastoral activities, grazing, animal tracks, trampled vegetation					
Fire Age:		Moderate (1-5 years)					
Species:		*Abutilon otocarpum, Acacia ancistrocarpa, Acacia aptaneura, Acacia pruinocarpa, Acacia tetragonophylla, Aristida contorta, Aristida latifolia, Boerhavia coccinea, Cleome viscosa, Dactyloctenium radulans, Digitaria brownii, Dodonaea petiolaris, Enchylaena tomentosa* var. *tomentosa, Enneapogon polyphyllus, Eragrostis setifolia, Eragrostis xerophila, Eremophila forrestii* subsp. *forrestii, Eremophila lanceolata, Eremophila latrobei* subsp. *filiformis, Eulalia aurea, Evolvulus alsinoides* var. *villosicalyx, Gomphrena canescens, Gomphrena kanisii, Hibiscus burtonii, Indigofera georgei, Ipomoea calobra, Iseilema dolichotrichum, Maireana villosa, Paraneurachne muelleri, Perotis rara, Polycarpaea corymbosa* var. *corymbosa, *Portulaca pilosa, Psydrax latifolia, Ptilotus aervoides, Ptilotus helipteroides, Ptilotus obovatus* var. *obovatus, Ptilotus schwartzii* var. *schwartzii, Rhagodia eremaea, Sclerolaena cornishiana, Senna artemisioides* subsp. *helmsii, Senna artemisioides* subsp. *oligophylla, Senna notabilis, Sida fibulifera, Sida platycalyx, Solanum lasiophyllum, Sporobolus australasicus, Tragus australianus*					

Q:	QS17	Described by:	RO & MP (Phase 2)		Date:	16/04/ 2018	Photo:
Location (GDA94):		MGA50	786705	mE	7470695	mN	
Habitat:		Hardpan plain					
Soil:		Red-brown clay-loam surface crust (40%)					
Rocks:		Ironstone stones (<1%)					
Mapped as:		A**WL**					
Vegetation Type		Tall Shrubland of *Acacia aptaneura* and *Acacia tetragonophylla* with Open Mid Shrubland of *Eremophila forrestii* subsp. *forrestii*, *Dodonaea petiolaris* and *Senna artemisioides* subsp. *oligophylla* with Open Low Shrubland of *Maireana villosa*, *Ptilotus obovatus* var. *obovatus* and *Rhagodia eremaea* with Open Low Woodland of *Acacia pruinocarpa* and Sparse Tussock Grassland of *Aristida latifolia*, *Digitaria brownii* and *Enneapogon polyphyllum*.					
Vegetation Condition:		Very Good					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon otocarpum*, *Acacia aptaneura*, *Acacia pruinocarpa*, *Acacia rhodophloia*, *Acacia tetragonophylla*, *Anthobolus leptomerioides*, *Aristida contorta*, *Aristida latifolia*, **Bidens bipinnata*, *Boerhavia coccinea*, **Cenchrus ciliaris*, *Cleome viscosa*, *Cucumis variabilis*, *Digitaria brownii*, *Dodonaea petiolaris*, *Duperreya commixta*, *Enneapogon polyphyllus*, *Eragrostis tenellula*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila latrobei* subsp. *filiformis*, *Evolvulus alsinoides* var. *villosicalyx*, *Gomphrena kanisii*, *Hakea lorea* subsp. *lorea*, *Hibiscus burtonii*, *Indigofera georgei*, *Ipomoea calobra*, *Maireana planifolia*, *Maireana villosa*, *Paraneurachne muelleri*, *Polycarpaea corymbosa* var. *corymbosa*, **Portulaca pilosa*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Ptilotus nobilis*, *Ptilotus obovatus* var. *obovatus*, *Ptilotus schwartzii* var. *schwartzii*, *Rhagodia eremaea*, *Sclerolaena cornishiana*, *Senna artemisioides* subsp. *helmsii*, *Senna artemisioides* subsp. *oligophylla*, *Sida platycalyx*, *Sida* sp. verrucose glands (F.H. Mollemans 2423), *Solanum cleistogamum*, *Solanum lasiophyllum*, *Sporobolus australasicus*, *Streptoglossa macrocephala*					

R:	R01	Described by:	SH (Phase 2)		Date:	15/04/ 2018	Photo:
Location (GDA94):		MGA50	790519	mE	7465165	mN	
Habitat:		Minor depression (Clay pan)					
Soil:		Red-orange clay, shallow cracking clay (100%)					
Rocks:		Nil					
Mapped as:		A**SL**-1					
Vegetation Type		Open Low Forest of *Acacia aptaneura*, *Corymbia hamersleyana* and *Eucalyptus victrix* with Open Low Shrubland of **Malvastrum americanum* with Sparse Tall Shrubland of *Acacia tetragonophylla* and Sparse Tussock Grassland of *Eriachne benthamii* and *Eulalia aurea*.					
Vegetation Condition:		Poor					
Disturbances:		Weeds, grazing, animal tracks, trampled vegetation					
Fire Age:		None evident					
Species:		*Abutilon macrum*, *Abutilon otocarpum*, *Acacia aptaneura*, *Acacia macraneura*, *Acacia tetragonophylla*, *Alternanthera nodiflora*, **Cenchrus ciliaris*, *Centipeda minima*, *Chrysopogon fallax*, *Corymbia hamersleyana*, *Digitaria brownii*, *Eremophila longifolia*, *Eriachne benthamii*, *Eucalyptus victrix*, *Evolvulus alsinoides* var. *villosicalyx*, **Malvastrum americanum*, *Pterocaulon sphacelatum*, *Rhynchosia minima*, *Solanum lasiophyllum*, *Sporobolus australasicus*					