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Strategen-JBS&G: Mulga Downs Iron Ore Project, Mine and Borefield Study Area Detailed Flora and Vegetation Assessment 2019-2022






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This document describes the results of a detailed flora and vegetation assessment carried out by Maia Environmental Consultancy (Maia) for Strategen-JBS&G over the mine and borefield sections of Hancock Prospecting Pty Ltd's (HPPL) Mulga Downs Iron Ore Project (MDIOP) area.

Photographs on cover page, left to right: *Dolichocarpa* sp. Hamersley Station, Gnalka Gnoona claypan area, *Euphorbia australis* var. *glabra*, hills in the northern section of the mine area.

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Acronyms and Abbreviations

aff.	Affinity
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
BOM	Bureau of Meteorology
CSF	Conservation significant flora
DAWE	Former Department of Agriculture, Water and Environment (Federal) (current DCCEEW)
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, Environment and Water
DEC	Former Department of Environment and Conservation (current DBCA)
DIWA	Directory of Important Wetlands in Australia
DMIRS	Department of Mines, Industry, Regulation and Safety
DPaW	Former Department of Parks and Wildlife (current DBCA)
DPIRD	Department of Primary Industries and Regional Development
DPP	Declared Pest Plant
DSA	Desktop Study Area
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally sensitive area
EW	Environmental weed
Fl	Flowering
Fr	Fruiting
GDA94	Geocentric Datum of Australia, 1994
GDE	Groundwater dependent ecosystem
GG	Gnalka Gnoona
GoWA	Government of Western Australia
GPS	Global Positioning System
ha	Hectare
HPPL	Hancock Prospecting Pty Ltd
IBRA	Interim Biogeographic Regionalisation for Australia
IBSA	Index of Biodiversity Surveys for Assessments
IUCN	International Union for Conservation of Nature
km	Kilometre
LS	Land system
Maia	Maia Environmental Consultancy Pty Ltd
MBSA	Mine and Borefield Survey Area
MBMA	Mine and Borefield Mapping Area
MDIOP	Mulga Downs Iron Ore Project

MGA50	Map Grid of Australia zone 50
MSA	Mine Survey Area
NIB	Not in buffer
NIMBSA	Not in MBSA
NVE	Native vegetation extent
NVIS	National Vegetation Information System
Opp Coll	Opportunistic collection
P (1-4)	Priority (1 to 4) flora species
PEC	Priority ecological community
REn	Regional endemic species
REx	Range extension species
sp.	Species, singular
sp. indet.	Indeterminate species
spp.	Species, multiple
subsp.	Subspecies
T	Threatened
TEC	Threatened ecological community
TPFL	Threatened and Priority Flora List
TSSC	Threatened Species Scientific Committee
VA	Vegetation association
var.	Variety
VSA	Vegetation system association
VT	Vegetation type
WA	Western Australia
WAHerb / WAH	WA Herbarium
WAMA	Wittenoom asbestos management area
WoNS	Weeds of National Significance

Summary

Background and Methods

- Hancock Prospecting Pty Ltd (HPPL) proposes to develop the Mulga Downs Iron Ore Project (MDIOP) on Mulga Downs Station in the Pilbara region of Western Australia. The MDIOP comprises the mine and borefield section and the transport corridor section. Strategen-JBS&G engaged Maia Environmental Consultancy Pty Ltd (Maia) to carry out a detailed flora and vegetation survey and follow-up targeted flora surveys over the mine and borefield section of the MDIOP. The area surveyed by Maia is referred to as the Mine and Borefield Study Area (MBSA) in this report. The report presents the results of multiple surveys carried out within the MBSA, which includes the following tenements: Mulga East (R47/12, M47/1621 and L45/380; Area 1), Mulga West (E47/1315; Area 2), Hester Peak South-east (L45/316; Area 3), a Mulga West to Mulga East linking corridor, Two Mile Well (E47/4264; Area 5), Hester Peak (E47/2044; Area 6) and Hester Peak East (L45/384 and E47/2044-I; Area 7). These areas cover approximately 58,940 hectares (ha). Most areas were surveyed; however, Hester Peak East was not, and it is covered by the desktop assessment in this report.
- Two standalone desktop assessments were carried out before the surveys, which were carried out over multiple phases in 2019, 2020 and 2022. Earlier detailed surveys were also carried out before 2019.
- Many targeted flora surveys, and some reconnaissance and detailed surveys have been carried out in the MBSA since 2008.

Desktop Study Results

- *Seringia exastia* (threatened) and 17 confirmed priority (P) flora (five P1, one P2, nine P3 and two P4), have been located along with *Seringia* ? *exastia* (potential threatened) and two potential / queried priority flora species (one potential P3 species and one potential P4).
- No threatened ecological community (TEC) is known to occur in the MBSA.
- Two priority ecological communities (PEC) are known to occur within the MBSA 'Freshwater claypans of the Fortescue Valley' (P1 PEC) and the 'Wona Land System' (P1 PEC).
- An environmentally sensitive area (ESA) lies within the MBSA. It is related to the Fortescue River (which flows through the MBSA) and associated floodplains and claypans (which also occur in the MBSA). The ESA is also a Schedule One area. The Fortescue Marsh has been proposed as a Ramsar wetland and the Marshes are listed as a Directory of Important Wetlands in Australia (DIWA) wetland. The Fortescue Marsh proper lies to the east, south-east of the MBSA, east of the Great Northern Highway and the Goodiadarrie Hills. To the west of the Goodiadarrie Hills the wetland includes the Fortescue River and associated floodplains and claypans. National assessment has identified some areas in the MBSA with moderate potential to be groundwater dependent ecosystems (GDE), while most of it is mapped as having low potential.

Survey Results - Flora

- Maia assessed 249 quadrats and one relevé in the MBSA, and approximately 64% were resampled. Data from another 32 quadrats assessed by other practitioners (former Department of Parks and Wildlife (DPaW), Coffey and *ecologia* Environment (*ecologia*) in the MBSA were also used.
- Seven hundred and forty-nine taxa from 206 genera and 60 families were recorded from all of these sites (65% perennial and 31% annual; species not fully determined result in the total being less than 100%). The species accumulation curve indicated that 87% of the species estimated to be in the MBSA were recorded from all quadrats assessed in the MBSA and 88% of the estimate from Maia quadrats. A further 135 taxa were located opportunistically and not at quadrats.
- One threatened flora species protected by the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act) was located in the MBSA – *Seringia exastia*. However, a nomination to delist the species due to no plausible significant threats to the species has been considered by the WA Threatened Species Scientific Committee.

- Twenty confirmed priority flora species have been recorded in the MBSA to date: the Priority (P) 1 species *Calotis squamigera*, *Helichrysum oligochaetum*, *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989), *Rhodanthe adscendens*, *Triodia veniciae;* the P2 species *Teucrium pilbaranum*; the P3 species *Aristida jerichoensis* var. *subspinulifera*, *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), *Eragrostis crateriformis*, *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), *Euphorbia australis* var. *glabra*, *Glycine falcata*, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727), *Iotasperma sessilifolium*, *Rostellularia adscendens* var. *latifolia*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), *Triodia basitricha*; and, the P4 species *Bulbostylis burbidgeae*, *Goodenia nuda* and *Rhynchosia bungarensis*. The underlined species were located during the detailed and follow-up targeted flora surveys carried out since 2019.
- Seven regional endemic species (*Calotis squamigera, Corchorus incanus* subsp*. lithophilus, Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), *Euphorbia australis* var. *glabra, Rostellularia adscendens* var. *latifolia, Teucrium pilbaranum and Triodia veniciae*), nine range extension / gap filler species, and one new species, *Hibiscus* sp. Mulga Downs have also been recorded in the MBSA.
- Sandalwood (*Santalum spicatum*) was located in the MBSA.
- No nationally or WA listed weed species were located in the MBSA, while 22 general environmental weed species were - 10 of the 22 have both a high ecological impact and rapid invasiveness rating.

Survey Results - Vegetation

- Nineteen discrete vegetation types, and one mosaic of two of the 19, were mapped over the MBSA. They were mapped on stony and hardpan plains, low and steeper hills, major drainage lines and banks and associated cracking clay floodplains and claypans and broad flowlines, stony washout flats, minor drainage lines and rises and calcrete tables of the Fortescue River system.
- Four of the vegetation types were mapped over between 10% and 20% of the section of the MBSA where the vegetation was mapped (an *Acacia* and *Eucalyptus* low woodland, an *Acacia* low woodland / tall shrubland, an *Acacia* tall shrubland and a *Triodia* hummock grassland), while four others were each mapped over less than 1% of the mapping area (one *Triodia* hummock grasslands, two mixed tussock grasslands and a *Bergia* forbland).
- Vegetation in the northern hillier sections of the MBSA is generally in Excellent condition (about 24% of the MBSA), as there has been little exploration and cattle tend not to access these areas. Good condition vegetation occurs mostly around the homestead and cattle yards at Mulga East and in the southern half of Mulga West (17%), while most of the MBSA (59% of it) is mapped as Very Good condition and 1% is mapped as Degraded. Many areas have been affected by historical and current grazing and exploration and large populations of weeds are present in some areas.

Ecological Communities, Significant Vegetation and Potentially Sheet Flow and Groundwater Dependent Vegetation

- No TEC occurs in the MBSA.
- Two claypan areas in the MBSA are listed as the P1 PEC 'Freshwater claypans of the Fortescue Valley'. Vegetation types *EfEb*TG, *AdEv*WL, *Bpo*Fl, the mosaic of *AdEv*WL / *Bpo*FL, AWL(3), *AxAs*SL, *Ev*WL, MSL(1), MSL(2) and MTG (3) are mapped within these Freshwater claypans and their buffers. The vegetation has not been mapped in Area 7, where the P1 Wona Land System PEC buffer occurs.
- Eleven of the 19 vegetation types (and the one mosaic) mapped in the MBSA are considered locally significant: ASL (2), AWL (1), AWL (2), AWL (3), *AdEv*WL, MSL (1), MSL (2), *EfE*bTG, *Bpo*FL, MTG (2) and *Tv*HG, plus the mosaic of *AdEv*WL and *Bpo*FL.
- To date, the obligate phreatophyte *Melaleuca argentea* has not been located in the MBSA, and neither has the facultative phreatophyte *Eucalyptus camaldulensis*. *Eucalyptus victrix*, recorded in the larger drainage areas in the hills in the northern section of the MBSA, is also regarded as a facultative phreatophyte in the Pilbara, and it is the dominant eucalypt species in the Fortescue River.
- The MBSA comprises some gently sloping hardpan gravelly or stony plains. Groves and bands of mulga occur in vegetation type AWL (1), AWL (2) and AWL (3).

Strategen-JBS&G: Mulga Downs Iron Ore Project, Mine and Borefield Study Area

Detailed Flora and Vegetation Assessment 2019-2022

1 Introduction

1.1 Project Scope of Work

Strategen-JBS&G engaged Maia Environmental Consultancy Pty Ltd (Maia) to carry out baseline flora and vegetation investigations for Hancock Prospecting Pty Ltd's (HPPL) Mulga Downs Iron Ore Project (MDIOP). The flora and vegetation baseline surveys were required to:

- Establish baseline flora and vegetation conditions.
- Inform further detailed flora and vegetation assessments (as required).
- Assist with the overall environmental and social impact assessment in support of relevant primary and secondary Project approvals.
- Inform ongoing Project planning and the progressive design phases of the Project.

Maia was engaged to carry out surveys over tenements covering all or parts of the following areas:

- Area 1: Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I).
- Area 2: Mulga West (E47/1315-I).
- Area 3: Hester Peak South-east (L45/316)
- Area 4: Mulga West to Mulga East linking corridor.
- Area 5: Two Mile Well (E47/4264).
- Area 6: Hester Peak (E47/2044-I)
- Area 7: Hester Peak East (L45/384 and E47/2044-I).

The seven areas are shown on **Maps 1 and 2,** provided in **Section 10**. Collectively, these seven areas are referred to as the Mine and Borefield Study Area (MBSA) in this report, and it presents the results of the surveys carried out by Maia in these sections of the MDIOP project area.

The MBSA covers 58,940.17 hectares (ha); it is in the Pilbara region of Western Australia (WA), in the Shire of Ashburton and it is approximately 186 km south of Port Hedland at its closest point (the northern-most part of Area 7).

2 Background Information

2.1 Biophysical Setting

Information on the bioregion and subregion, surface geology, soil landscape, land systems, pre-European vegetation, protected and significant areas, rare features, ecosystems at risk, potential sheet flow dependent vegetation, watercourses and wetlands, and potential groundwater dependent ecosystems of most of the MBSA was included in two earlier reports:

- Maia (2021a). Strategen-JBS&G: Mulga East Iron Ore Project, Mine Study Area, Detailed Flora and Vegetation Assessment 2019 - 2020. Version 1. 15 March 2021.
- Maia (2021b). Strategen-JBS&G: Mulga Downs West Flora and Vegetation Desktop Study. Draft 1. 22 October 2021.

The background information on Mulga East (Area 1; R47/12-I, M 47/1621 and L45/380) and Mulga Well(E47/2117 I) and Mulga West (Area 2; E47/1315-I) presented in those reports is not repeated in full here; however, information is included on the additional areas not covered by those reports i.e., Area 3 (Hester Peak South-east (L45/316)), Area 4 (Mulga West to Mulga East linking corridor), Area 5 (Two Mile Well (E47/4264)), Area 6 (Hester Peak (E47/2044-I)) and Area 7 (Hester Peak East (L45/384 and E47/2044-I)). While detailed information on Areas 3, 4, 5, 6 and 7 is included in **Table 2.1**, the maps referred to in the table show the relevant information for the whole of the MBSA.

Table 2.1: Background information

Background information	
IBRA bioregion and subregion **(Map 3A, Section 10)**	All of the MBSA lies in the Pilbara IBRA (Interim Biogeographic Regionalisation for Australia) bioregion. The Pilbara bioregion is divided into four subregions – Chichester, Fortescue, Hamersley and Roebourne. Areas 3, 4 and 5 are in the Fortescue (PIL02) subregion, most of Area 6 is in the Fortescue subregion with a small section in the Chichester (PIL01) subregion, and all of Area 7 is in the Chichester subregion. The remainder of the MBSA lies mostly within the Fortescue subregion with very small sections in the Chichester and Hamersley subregions. Source: Department of Agriculture, Water and Environment (DAWE) (2012).
Surface geology **(Map 3B, Section 10)**	Seven surface geology units are mapped in the additional areas (Stewart et al., 2008): • **Abfm (Area 7)**: Massive, vesicular and amygdaloidal basalt, basaltic andesite, and andesite, minor dacite, dolerite sills; bedded lapilli, vitric, crystal and lithic tuff, volcaniclastic siltstone, shale, chert, sandstone, dolomite. • **Achm (Areas 3 & 6)**: Chert, ferruginous chert, jaspilite, banded iron-formation, minor shale, siltstone, mudstone. • **Awfj (Areas 3, 6 & 7)**: Shale, sandstone, siltstone, mudstone, dolomite, local micro-banded chert, jaspilite, conglomerate; fine-grained massive rhyolite; mafic tuff with local accretionary lapilli and agglomerate; thin basalt/dolerite and andesitic basalt flows. • **Czims (Areas 4 & 5)**: Dolomite, calcareous dolomite, calcrete; with silcrete, clay, chert breccia, and local basal conglomerate. • **Czl (Area 3)**: Pisolitic, nodular or vuggy ferruginous laterite; some lateritic soils; ferricrete; magnesite; ferruginous and siliceous duricrusts and reworked products, calcrete, kaolinised rock, gossan; residual ferruginous saprolite. • **Qa (Areas 4 & 5)**: Channel and flood plain alluvium; gravel, sand, silt, clay, locally calcreted. • **Qrc (Areas 3 & 7)**: Colluvium, sheetwash, talus; gravel piedmonts and aprons over and around bedrock; clay-silt-sand with sheet and nodular kankar; alluvial and aeolian sand-silt-gravel in depressions and broad valleys in Canning Basin; local calcrete, reworked laterite. Abfm is the only unit that is not mapped in other parts of the MBSA.
Soil-landscape region, province and zones	Tille (2006) compiled available detailed mapping information on WA's rangelands and arid interior into a hierarchy of soil-landscape units providing descriptions of soil-landscape regions, provinces and zones. The additional areas all lie in Tille's Fortescue Province. The Fortescue Province is characterised by hills and ranges on the volcanic, granitic and sedimentary rocks of the Pilbara Craton. The Fortescue Province is further divided into 10 soil-landscape zones and the additional areas lie in the Chichester

Background information	
	Ranges and the Fortescue Valley zones. Areas 4 and 5 are in the Fortescue Valley zone, Areas 6 and 7 are in the Chichester Ranges zone, and Area 3 is in the Fortescue and Chichester zones (mostly in the Chichester). Areas 1 and 2 are also in the same two zones. The Chichester Ranges zone is described as hills and dissected plateaux (with some stony plains) on basalt and sedimentary rocks of the Hamersley Basin. Stony soils with some Red shallow loams and Hard cracking clays. Spinifex grasslands with kanji and snappy gum (and some tussock grasslands). They are located in the northern Pilbara between Pannawonica and Nullagine. The Fortescue Valley Zone is described as alluvial plains, hardpan wash plains and sandplains (with stony plains, floodplains and some salt lakes) on alluvial deposits over sedimentary rocks of the Hamersley Basin. Red deep sands, Red loamy earths and Red/brown non-cracking clays with some Red shallow loams and Hard cracking clays. Mulga shrublands and spinifex grasslands (with some tussock grasslands and halophytic shrublands). It is located in the Pilbara along the Fortescue River between Millstream National Park and Ethel Creek Station.
Land systems **(Map 3C, Section 10)**	Land systems (LS) are described as discreet units of landforms, soils, vegetation and geology. LS are an important tool in assessing the potential risks to biodiversity by quantifying the extent and condition of potential habitat for conservation significant species and vegetation complexes. Nine land systems are mapped in the additional areas: • **Bonney (Area 7):** Low rounded hills and undulating stony plains supporting soft spinifex grasslands. • **Boolgeeda (Areas 6 & 7)**: Stony lower slopes and plains below hill systems supporting hard and soft spinifex grasslands or mulga shrublands. • **Coolibah (Area 5)**: Flood plains with weakly gilgaied clay soils supporting coolibah woodlands with tussock grass understorey. • **Hooley (Areas 4 & 5)**: Alluvial clay plains supporting a mosaic of snakewood shrublands and tussock grasslands. • **Jamindie (Area 3)**: Stony hardpan plains and rises supporting groved mulga shrublands, occasionally with spinifex understorey. • **Jurrawarrina (Areas 4 & 5)**: Hardpan plains and alluvial tracts supporting mulga shrublands with tussock and spinifex grasses. • **McKay (Areas 3, 6 & 7)**: Hills, ridges, plateaux remnants and breakaways of meta sedimentary and sedimentary rocks supporting hard spinifex grasslands with acacias and occasional eucalypts. • **Newman (Areas 3 & 6)**: Rugged jaspilite plateaux, ridges and mountains supporting hard spinifex grasslands. • **Wona (Area 7)**: Basalt upland gilgai plains supporting Roebourne Plains grass and Mitchell grass tussock grasslands, minor hard spinifex grasslands or annual grasslands/herbfields. Three land systems are mapped in Areas 1 and 2 (Maia 2021a and 2021b), and they do not occur in the additional areas - the Brockman, Calcrete and Urandy land systems. • **Brockman (Areas 1 & 2):** Gilgai alluvial plains with cracking clay soils supporting tussock grasslands and low woodlands. • **Calcrete (Area 1)**: Low calcrete platforms and plains supporting shrubby hard spinifex grasslands. • **Urandy (Areas 1 & 2)**: Stony plains, alluvial plains and drainage lines supporting shrubby soft spinifex grasslands. The land systems listed for the additional areas also occur in Areas 1 and 2: Boolgeeda (Areas 1 & 2), Coolibah (Areas 1 & 2), Hooley (Area 1), Jamindie (Area 1), Jurrawarrina (Areas 1 & 2), McKay (Areas 1 & 2), Newman (Area 1). Data source: Department of Primary Industries and Rural Development (DPIRD) (2019a).

Background information	
Pre-European vegetation associations and system associations **(Map 3D, Section 10)**	The Environmental Protection Authority's (EPA) broad principles for the protection of native terrestrial vegetation and flora indicate that biodiversity should be maintained at sustainable levels. This generally means that ecological communities should be retained at an overall level of at least 30% of the original extent of the ecological community in each region. This level is the threshold level below which species loss appears to accelerate exponentially at an ecosystem level. A level of 10% of the original extent is regarded as being a level representing "endangered" (EPA, 2000). Seven pre-European vegetation associations (VA) and eight vegetation system associations (VSA) are mapped in the MBSA (DPIRD, 2019b). The VAs and VSAs that occur in the MBSA, the areas in which they occur and the description for each is listed in **Table A3.5, Appendix 3**. All VAs and VSAs are included here because they are included in the Discussion. Seven VAs - 29, 111, 151, 173, 175, 562 and 645 and eight VSAs 29, 111.1, 151.1, 173.2, 175.2, 175.3, 562 and 645.1 occur in the MBSA. The pre-European extent for all of the VAs and VSAs in the Pilbara bioregion and Chichester, Fortescue and Hamersley subregions along with the current extent, the percentage remaining, and the current extent protected for conservation (IUCN I-IV) in the bioregion, the three subregions and the Shire of Ashburton are listed in **Table A3.6, Appendix 3**. The reservation priority given in the early 2000s for VAs 173, 175 and 562 in the Chichester subregion was listed as Moderate / Low, High and Moderate, respectively (Kendrick and McKenzie, 2001). While the reservation priority for VAs 29, 111, 151, 175, 562 and 645 in the Fortescue subregion are listed as Low, Low, High, High, Moderate and Moderate, respectively (Kendrick, 2001a). The reservation priority for 111 and 645 in the Hamersley subregion is listed as High and High (Kendrick, 2001b). More recently, Biodiversity Audit II lists VA 173 and 175 as dominant vegetation associations and 173 as a unique vegetation association in the Chichester subregion (Pilbara 1). Similarly, VAs 29, 111, 175 562 and 645 are listed as dominant vegetation associations in the Fortescue subregion (Pilbara 2), and 562 is listed as a unique one in the subregion. Neither of the rare vegetation associations listed for the Chichester subregion occur in the MBSA and no rare vegetation associations are listed for the Fortescue subregion (DBCA, 2022a; however, the 2014 sub-regional profile PDFs are no longer available for download, Maia downloaded the Chichester and Fortescue profiles previously). The reservation priorities for the VAs are not noted in Biodiversity Audit II. Maia does not have the sub-regional profile for the Hamersley subregion. Currently, more than 99.7% of the seven VAs remains in the Pilbara bioregion, the relevant subregions and in the Shire of Ashburton. Between 0% and 22.97% of their current extents is protected for conservation in the bioregion, subregions and Shire (Government of Western Australia (GoWA), 2019; **Table A3.6, Appendix 3**). Similarly, more than 99.8% of the eight VSAs remains in the Pilbara bioregion, the relevant subregions and the Shire of Ashburton, and between 0.26% and 23.04% of their current extents is protected for conservation in the bioregion, relevant subregions and Shire. VAs 151, 562 and 645 are not protected in the Pilbara bioregion, while VSAs 151.1, 175.3, 562 and 645.1 are not protected in the bioregion (**Table A3.6, Appendix 3**).

Background information	
Protected and significant areas **(Map 4, Section 10)**	• None of the additional areas lie in Department of Biodiversity, Conservation and Attractions (DBCA) Legislated Lands and Waters (DBCA, 2021a). The closest is Mungaroona Range Nature Reserve, which is approximately 10.5 km north-west of the northern-most part of Area 7 at its closest. • None of the additional areas lie in a DBCA Lands of Interest (DBCA, 2021b). The closest is former leasehold ex Mt Florence, approximately 12.7 km to the south-west of the western end of Area 4. Former leasehold lands ex Mulga Downs Station and ex Marillana Station form part of the Proposed Fortescue National Park under Plan. The closest of these areas is Former leasehold ex Marillana Station, which is approximately 22.7 km south south-east of the western end of Area 3. • The lower portion of the eastern-most section of Area 4 lies over the buffer around an Environmentally Sensitive Area (ESA) (Department of Water, Environment and Regulation (DWER), 2021). The ESA relates to the Fortescue River and associated floodplains and claypans; the ESA is also a Schedule One Area and the northern section of Area 7 also lies within a Schedule One Area (DWER, 2017). • None of the additional areas lie over an EPA Redbook Recommended Conservation Reserves 1976-1991 area (DBCA, 2017a). The closest is Mungaroona Range Nature Reserve, which is approximately 10.5 km north-west of the northern-most part of Area 7 at its closest. • A section of a crown reserve occurs within Area 5 (DMIRS, 2022) – R1470, which is reserved for water (not shown on **Map 4** because shape files are not freely available). No other protected or significant areas occur in or close to Areas 1 and 2, which were discussed in detail in Maia 2021a and Maia 2021b.
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 shown to be dependent on sheet-flow of water (Winkworth, 1973; Tongway and Hindley, 2004), and is sensitive to alterations to sheet flow (Saco et al., 2007). Mulga vegetation (including banded mulga) has been mapped in parts of the MBSA previously (Maia, 2021a and Maia 2021b), and it is likely that it will occur in some of the additional areas.
Watercourses and wetlands (**Map 5, Section 10**)	• None of the MBSA is in a current Ramsar Site (DBCA Australian Government, 2022; DBCA, 2017b). The Fortescue Marsh has been proposed as a Ramsar wetland (DBCA, 2017b). The proposed Ramsar listing covers most of the Fortescue Marsh, the Directory of Important Wetlands in Australia (DIWA) wetland, the claypan areas in Area 1, the upper section of the Lower Fortescue River and associated floodplains (not shown on **Map 5**). • One DIWA wetland is mapped in the MBSA - the Fortescue Marshes (DBCA, 2018a). However, the Marsh proper lies to the south-east of the MBSA, east of the Great Northern Highway and the Goodiadarrie Hills (DBCA, 2018b). To the west of the Goodiadarrie Hills the wetland includes the Fortescue River and associated floodplains and claypans. The DIWA wetland is mapped in Area 1 and Area 2 but in none of the additional areas. • No springs are mapped in the MBSA, while Gnalka Gnoona and Koodjeepindarranna pools occur within it (Geoscience Australia, 2006). • Some minor non-perennial watercourses are mapped in all areas of the MBSA except for Area 4 (Geoscience Australia, 2006).

Background information	
	• None of the tenements lie over the Fortescue Marsh Management Area. The western boundary of the Management Area is approximately 29 km south-east of the south-eastern corner of Area 3 at its closest. • Floodplain wetlands are common and diverse in the Fortescue Valley upstream and downstream of the Fortescue Marsh. Between 2015 and 2017, 47 wetland sites between Mt Florence and Balfour Downs Stations were surveyed by the then Department of Parks and Wildlife (DPaW: Lyons, 2015; Markey, 2017; and Pinder et al., 2017). And any of these sites lying in the MBSA were used in the statistical analysis carried out.
Groundwater dependent ecosystems (GDEs) (**Map 6, Section 10**)	Aquatic GDEs: a national assessment has mapped the Fortescue River and associated floodplains and claypans within the MBSA as having high potential to be an aquatic GDE (BoM, 2022a). Terrestrial GDEs: a national assessment has mapped areas of low and moderate potential to be a GDE in the MBSA (BoM, 2022b); most of Areas 4 and 5 are mapped as having moderate potential to be a GDE via this national assessment along with the north-western corner of Area 1 and parts of the western edge of Area 2. Much of the remainder of the MBSA is mapped as having low or no potential to be a GDE. Riparian species in the Pilbara represent the mesic or wet end of an ecological gradient of decreasing water availability. Although vegetation higher in the ecological gradient may draw upon groundwater at times, riparian vegetation is considered the main groundwater-dependent vegetation of the Pilbara. It is also likely to be the most sensitive and least tolerant to decreased water availability (Loomes, 2010). Dominant riparian Pilbara species are often widespread and common to other Pilbara systems (e.g., floodplains, springs, river pools). Loomes (2010) used the following dominant Pilbara riparian tree and shrub species in an assessment of water level ranges of Pilbara riparian species: *Eucalyptus camaldulensis, Melaleuca argentea, Eucalyptus victrix, Sesbania formosa, Atalaya hemiglauca, Melaleuca glomerata, M. bracteata, Livistona alfredii, Bauhinia cunninghamii, Ficus opposita* (does not occur in WA (WAHerb, 1998-) and is most likely *Ficus aculeata*), *Hakea lorea* and *Acacia ampliceps*. It is possible that at least some of these species could occur along drainage lines in the additional areas because they have been recorded previously in the MBSA (Maia 2021a and Maia 2021b). In the Pilbara, *Melaleuca argentea* is an obligate phreatophyte and *Eucalyptus camaldulensis* and, to a lesser extent, *Eucalyptus victrix* are facultative phreatophytes (Astron Environmental Services, 2008 as cited in McFarlane, 2015). To date, *Melaleuca argentea* and *Eucalyptus camaldulensis* have not been recorded in the riparian areas of the MBSA previously surveyed - the dominant eucalypt species in these areas has been *Eucalyptus victrix* (Maia 2021a and Maia 2021b).

3 DESKTOP ASSESSMENT

A desktop assessment was carried out over an approximately 235 km by 112 km Desktop Study Area (DSA). This area was chosen so that it encompassed the whole of the MDIOP and large sections of transport corridor projects in the eastern section of the Fortescue Valley. The results of the assessment are discussed in the following sub-sections and information collated for the DSA as a whole and the smaller MBSA is shown on **Maps 7 to 17, Section 10**: **Map 7** shows the extent of Maia 2021a and 2021b and relevant results are included in the tables in **Appendix 3**.

Appendix 1 provides information on conservation significance of flora and ecological communities and where to find current listings, while **Appendix 2** provides information on the classification of significant weeds. **Appendix 3** presents the tables of data collated for the desktop assessment:

- **Table A3.1** lists reports on surveys carried out within the DSA (or data in Maia's database)

- **Table A3.2** lists any significant vegetation types noted in relevant reports
- **Table A3.3** lists the CSF collated from the desktop assessment
- **Table A3.4** lists the weeds collated from the desktop assessment
- **Tables A3.5 and A3.6** provide information on the pre-European vegetation mapped in the MBSA and associated areas.

3.1 FLORA

3.1.1 Conservation Significant Flora

Searches were requested of DBCA's Threatened and Priority Flora List (TPFL) and WA Herbarium (WAHerb) databases in 2018 and 2020 (DBCA search references #31-0818FL, #55-0820FL and #41-1120FL) to gather information on conservation significant flora (CSF) species that could potentially occur in the DSA and MBSA. NatureMap searches were not requested for this report because the web site has not been operational since late 2021; however, results from earlier searches carried out for Maia 2021a and Maia 2021b are included. EPBC Act protected matters searches were not carried out because of the extensive survey effort that has been carried out in the DSA and the MBSA (and because they were carried out for, and the results are included in, Maia 2021a and Maia 2021b). The results of DBCA significant ecological community searches carried out in 2018 and 2020 were checked on NationalMap (Australian Government, 2022) for currency. The results of a literature search to find reports on botanical surveys that have been carried out within the DSA previously were also used and added to when other relevant reports were found. While many publicly available reports on surveys that have been carried out within the DSA were found, and Index of Biodiversity Surveys for Assessments (IBSA; DWER, 2022) was checked for information and data, there will undoubtedly be more information on surveys that have been carried out in the DSA that is not available publicly.

3.1.1.1 THREATENED FLORA

Four Threatened flora species currently have records in the Pilbara bioregion (WAH, 1998-):

- *Aluta quadrata* (Endangered, BC Act).
- *Quoya zonalis* (Endangered, EPBC Act and BC Act (was previously *Pityrodia* sp. Marble Bar (G. Woodman & D. Coultas GWDC Opp 4) and is listed as that under both acts).
- *Seringia exastia* (Critically Endangered, EPBC Act and BC Act).
- *Thryptomene wittweri* (Vulnerable, EPBC Act and BC Act) (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2022b; GoWA, 2018b).

Aluta quadrata, *Quoya zonalis* and *Thryptomene wittweri* occur some distance from the MBSA and in different habitats to those of the MBSA and it is unlikely that they will occur there. *Seringia exastia* has been located within the DSA and MBSA, however, see the following text regarding this species in an email response from DBCA to questions from Maia.

"Seringia exastia was a threatened species previously known from the Kimberley region. *S. elliptica* is common and widespread through the Pilbara region, central WA and the Northern Territory and extends into South Australia. A recent taxonomic study has concluded that *S. exastia* and *S. elliptica* are the same species, and the two species have been synonymised under the oldest name – *S. exastia* (i.e., the threatened species). A nomination to delist the species due to no plausible significant threats to the species has been prepared and considered by the WA Threatened Species Scientific Committee (TSSC). It is anticipated that at a future TSSC meeting recommendations will be made to the Minister to delist. However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as threatened flora, and authorisation to take under section 40 of the *Biodiversity Conservation Act 2016* is still required. Although some loss of plants is likely to have occurred and will continue to occur during mining and road works in some parts of the species' distribution, this is not expected to be significant

in the context of the entire population. Therefore, there should be no impediments to granting authorisation, following the standard process of application made to DBCA's Species and Communities Program" (Pers. comm., Melanie Smith, DBCA, 9 December 2020).

Seringia exastia is still listed as Critically Endangered under the EPBC Act (DCCEEW, 2022b) and the BC Act (GoWA, 2018b). Collections of *Seringia elliptica* were made from the MBSA during targeted flora surveys carried out by Maia between 2012 and early 2020. However, as the species was not synonymised with *Seringia exastia* until April 2020 (Binks et al, 2020), and *Seringia elliptica* was not listed as a conservation significant species, the plant specimens were collected to collate survey area species lists, and their locations were not recorded. Therefore, the currently listed threatened species *S. exastia* occurs in areas where earlier targeted flora surveys have been carried out in the MBSA but there are no specific locations for the plants. Records for *Seringia elliptica* collected at quadrats assessed before 2020 are available.

3.1.1.2 PRIORITY FLORA

One hundred and eight priority flora species have been recorded in the DSA. **Table A3.3 (Appendix 3)** lists the results of past NatureMap and DBCA database searches. The table also includes any additional CSF recorded in other survey areas that were not already in the database search results, and the source for the additional species is cited.

- The 108 species comprise 21 P1 species, 19 P2 species, 59 P3 species and nine P4 species.
- NatureMap search results (carried out pre-2021) listed 82 priority flora species.
- DBCA TPFL and WAHerb database searches resulted in 100 priority flora species collectively (DBCA search reference #31-0818FL and #41-1120FL) within the DSA, and those with locations are shown on **Map 8, Section 10**).
- Five priority flora species that were not in the NatureMap or DBCA search results were listed in reports on surveys carried out within the DSA:
    - *Sida* sp. Hamersley Range (K. Newbey 10692) (P1; Biota, 2012a),
    - *Whiteochloa capillipes* (P1; Biota, 2018),
    - *Phragmites karka* (P3; Lyons, 2015),
    - *Grevillea saxicola* (P3), and
    - *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301) (P3) (both in Biota, 2018).

Many surveys have been carried out within the MBSA since 2008, and these include targeted flora surveys along drill lines, drill pad areas and reconnaissance and detailed surveys over wider areas. These surveys, along with CSF located during surveys carried out by other organisations in parts of the MBSA, resulted in 17 confirmed priority flora species with records in the MBSA:

- The P1 species *Calotis squamigera*, *Helichrysum oligochaetum*, *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989), *Rhodanthe ascendens*, *Triodia veniciae*.
- The P2 species *Teucrium pilbaranum*
- The P3 species *Eragrostis crateriformis*, *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), *Euphorbia australis* var. *glabra*, *Glycine falcata, Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727), *Iotasperma sessilifolium*, *Rostellularia adscendens* var. *latifolia*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), *Triodia basitricha*.
- The P4 species *Bulbostylis burbidgeae* and *Goodenia nuda* (**Table A3.3, Appendix 3**).

One queried priority flora species has also been recorded: *Rostellularia adscendens* ? var. *latifolia* (potential P3), along with one other potential priority flora species, *Bulbostylis burbidgeae* – atypical form (? P4). These records are shown on **Maps 9 and 10 (Section 10)**. Confirmed CSF species located within the MBSA during an earlier detailed survey (Maia, 2012) and within the MBSA during later detailed survey phases and associated targeted flora surveys

are considered in **Section 6**; however, two potentially significant taxa that were recorded during the detailed survey carried out in 2012 are discussed below.

3.1.1.3 POTENTIALLY SIGNIFICANT TAXA

Two potentially significant flora taxa were collected from the MBSA during earlier surveys carried out by Maia (Maia, 2012):

- *Goodenia* aff. *muelleriana*: The quadrats where the *Goodenia* aff. *muelleriana* specimens were collected (Maia, 2012) have been revisited (and the surrounding area) and the *Goodenia* specimens collected were identified as *Goodenia muelleriana* (which is not conservation significant); no different *Goodenia* specimens have been recollected from the two areas where the specimens identified as *Goodenia* aff. *muelleriana* were initially collected.
- *Hibiscus* sp. ? nov.: The areas where the *Hibiscus* sp. ? nov. specimens were collected (Maia database and Maia 2012) were revisited and no atypical *Hibiscus* specimens were found. The best specimen collected from each survey when it was found was submitted to the WA Herbarium and both are listed on Florabase as *Hibiscus* sp..

3.1.2 Weeds

The past NatureMap search results (from searches carried out for the MSA (Area 1; Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I)) and Mulga West (Area 2; E47/1315-I) sections of the MBSA) list weed species that could potentially occur in the DSA and MBSA or that have been recorded in the area previously. This information was collated along with weed data from selected botanical surveys carried out within the DSA to produce a list of weeds that have been recorded in the DSA and MBSA.

3.1.2.1 WEEDS OF NATIONAL INTEREST

Two weed species on national weed lists were in the collated list of species (**Table A3.4, Appendix 3**). *Parkinsonia aculeata* (Parkinsonia) and *Prosopis glandulosa* (Mesquite), which are listed as Weeds of National Significance (WoNS) in Australia (weedsAUSTRALIA, 2022).

These species have not been recorded in the MBSA to date (**Table A3.4, Appendix 3**).

3.1.2.2 DECLARED PEST PLANTS

Three weed species declared as pests in WA (Declared Pest Plant (DPP)) have been recorded within the DSA:

- *Parkinsonia aculeata* (Parkinsonia),
- *Prosopis glandulosa* (Mesquite), and
- *Argemone mexicana* (Mexican Prickly Poppy) (**Table A3.4, Appendix 3**).

It is likely that the *Argemone mexicana* record is *Argemone ochroleuca*, which is not a declared pest in WA (DPIRD, 2022). There are no Pilbara records for *A. mexicana* on Florabase (WAH, 1998-).

These species have not been recorded in the MBSA to date (**Table A3.4, Appendix 3**).

3.1.2.3 ENVIRONMENTAL WEEDS

Forty-nine other weed species (Environmental Weeds (EW); excluding WoNS and DPP) have been recorded in the DSA:

- 38 were listed in the NatureMap search results (carried out in 2020).

- Nine additional species were in biological survey reports used for the literature review but were not listed in the NatureMap search results.
- Two were from Maia's database.

The 49 species are listed in **Table A3.4 (Appendix 3**), only those species not already in the NatureMap search results have been added to the table with their source. The ecological impact and invasiveness ratings are also listed for each species.

Nineteen of the 49 environmental weed species have been recorded in the MBSA during previous surveys:

- *Aerva javanica* (Kapok Bush).
- *Bidens bipinnata* (Bipinnate Begger's Tick).
- *Cenchrus ciliaris* (Buffel Grass).
- *Cenchrus setiger* (Birdwood Grass).
- *Chloris virgata* (Feathertop Rhodes Grass).
- *Citrullus amarus* (Pie Melon).
- *Citrullus colocynthis* (Colocynth).
- *Cynodon dactylon* (Couch).
- *Echinochloa colona* (Awnless Barnyard Grass).
- *Echinochloa microstachya* (Prickly Barnyard Grass).
- *Flaveria trinervia* (Speedy Weed)
- *Malvastrum americanum* (Spiked Malvastrum).
- *Medicago polymorpha* (Burr Medic).
- *Panicum miliaceum* (Millet Panic).
- *Rumex vesicarius* (Ruby Dock).
- *Setaria verticillata* (Whorled Pigeon Grass).
- *Sonchus oleraceus* (Common Sowthistle).
- *Tribulus terrestris* (Caltrop).
- *Vachellia farnesiana* (Mimosa Bush) (**Maps 11 to 15, Section 10**).

The Pilbara Region species prioritisation process impact and invasiveness ratings spreadsheet lists 90 weed species for which impact and invasiveness have been rated, and a further 15 weed species that have been listed as priority alert species (Department of Parks and Wildlife (DPaW), 2014).

Twelve of the 49 environmental weed species recorded in the DSA (**Table A3.4, Appendix 3**) are listed as having High ecological impact and Rapid Invasiveness:

- *Aerva javanica.*
- *Cenchrus ciliaris.*
- *Cenchrus setiger.*
- *Chloris barbata.*
- *Chloris virgata.*
- *Cynodon dactylon.*
- *Distimake dissectus* var. *dissectus.*
- *Echinochloa colona.*
- *Malvastrum americanum.*
- *Rumex vesicarius.*
- *Setaria verticillata*.
- *Vachellia farnesiana*.

Nine of the 19 weed species with records in the MBSA are listed as having High ecological impact and Rapid Invasiveness:

- *Aerva javanica.*
- *Cenchrus ciliaris.*
- *Cenchrus setiger.*
- *Chloris virgata.*
- *Echinochloa colona.*
- *Malvastrum americanum.*
- *Rumex vesicarius.*
- *Setaria verticillata*.
- *Vachellia farnesiana* (**Table A3.4, Appendix 3**).

3.2 VEGETATION

3.2.1 Significant Ecological Communities

A search of DBCA's Ecological Communities database was requested in 2020 (search reference #07-0820EC; August 2020), and the results were used to gather information on significant ecological communities that are known to or could potentially occur in the MBSA. The 2020 results were checked on National Map for currency (Australian Government, 2022).

3.2.1.1 THREATENED ECOLOGICAL COMMUNITIES

No Threatened Ecological Communities (TECs) listed under the EPBC Act occur within the DSA or the MBSA (DAWE, 2022c).

The most recent list of TECs protected by the WA BC Act is correct to June 28, 2018 (DBCA, 2018c), and it includes two TECs listed for the Pilbara bioregion:

- Themeda grasslands (Themeda grasslands on cracking clays Hamersley Station, Pilbara) and
- Ethel Gorge (Ethel Gorge aquifer stygobiont community)).

One of these TECs occurs within the DSA, the Themeda grasslands on cracking clays (Hamersley Station, Pilbara), which is listed as Vulnerable (DBCA, 2018c; DBCA search reference #07-0820EC) (**Map 16, Section 10**). This TEC is not mapped as occurring in the MBSA.

3.2.1.2 PRIORITY ECOLOGICAL COMMUNITIES

The most recent Priority Ecological Community (PEC) list is dated June 1, 2022 (DBCA, 2022d) and it has 43 PECs listed for DBCA's Pilbara Region; the 43 PECs have not changed since the database search was requested in late 2020.

Five PECs occur within the DSA (DBCA search reference #07-0820EC; **Map 16, Section 10**):

- The P1 PEC Brockman Iron cracking clay communities of the Hamersley Range.
- The P1 PEC Fortescue Marsh (Marsh Land System).
- The P1 PEC Freshwater claypans downstream of the Fortescue Marsh – Goodiadarrie Hills on Mulga Downs Station.
- The P1 PEC Four plant assemblages of the Wona Land System.
- The P3(iii) PEC Kumina Land System.

Two of these PECs occur within the MBSA:

- The P1 PEC Freshwater claypans of the Fortescue Valley.
- P1 PEC Wona Land System.

Two polygons indicating the freshwater claypans PEC are in Area 1(Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I)) and Area 5 (Two Mile Well (E47/4264)) of the MBSA and the northern extent of Area 7 (Hester Peak East (L45/384 and E47/2044-I)) intersects a section of the Wona Land System PEC (DBCA search reference #07-0820EC; **Map 16, Section 10**).

3.2.2 Previously Mapped Vegetation of the MBSA

The vegetation mapped for past MDIOP work within or in areas intersecting the MBSA is discussed below. Any vegetation units / types / associations regarded as significant in the reports on surveys previously carried out in the DSA are included in **Table A3.2 (Appendix 3)**.

A Level 1 survey was conducted over Murrays Hill (previously tenement M47/206 and now included in M47/1621 (previously R47/12); within Area 1) (*ecologia*, 2008d). Six main vegetation units and three sub-units were mapped in the survey area (inset C, **Map 17, Section 10**). None were considered conservation significant.

A Level 2 survey was carried out within a proposed transport corridor linking Murrays Hill to the Great Northern Highway (inset D, **Map 17;** G&G, 2009). Most of the mapped area sits within Area 1 but some is in the western section of Area 3. Nine vegetation associations were mapped within the corridor and eight within the MBSA. None were considered conservation significant.

A detailed flora and vegetation assessment was carried out over a section of Area 1 (R47/12 (previously E47/1244 and M47/206)) and all of Area 3 (the haul road corridor (L45/316) linking the eastern boundary of E47/1244 to the Great Northern Highway) (inset B, **Map 17;** Maia, 2012). Thirteen vegetation associations and one mosaic were mapped within the MBSA. Nine vegetation associations were considered to have high conservation significance. The report noted that one of the clay pan vegetation associations was probably the P1 PEC 'Freshwater claypans of the Fortescue Valley'. Descriptions for two of the vegetation associations resembled the description for the P3 'Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community' PEC and Maia contacted the then Department of Environments and Conservation (DEC) for further information about that PEC. Following advice received from the DEC it was noted that the two vegetation associations were a different community with a different description. The DEC recommended mapping the community and providing a description to them using the identifier 'Coolibah-Lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community of the Fortescue River' (pers. comm. Jill Pryde, DEC, November 2012). A site by species matrix for the relevant quadrats was sent to the then DEC.

A single-phase detailed flora and vegetation assessment was carried out along a potential transport corridor linking HPPL's Mulga Downs project area to the Roy Hill railway (Maia, 2013a). Sixteen vegetation associations (including two mosaics) were described for the area surveyed and four occur within parts of Area 1 and Area 6 of the MBSA that intersect that vegetation mapping (inset E, **Map 17**). None of the associations within the MBSA were considered conservation significant.

A preliminary flora and vegetation map was developed for Area 2 in 2021 (Maia, 2021b). Vegetation data collected during many targeted flora surveys carried out at Mulga West, in essence reconnaissance surveys because vegetation data was also collected at points of interest, was used to produce the preliminary vegetation map. Ten vegetation types were described and mapped in the Area 2 section of the MBSA, Mulga West (inset A, **Map 17**). As this was preliminary mapping, no comment was made on conservation significance of the vegetation types.

A large part of Area 2 was mapped for FMG's Solomon Iron Ore Project PER (FMG, 2015), and 26 vegetation communities were mapped in this section of the MBSA. [No map is included as shape files aren't publicly available.] A regional assessment of the significance of the vegetation communities occurring in the Solomon development envelopes was carried out using vegetation mapping from within and beyond FMG's development envelopes (FMG, 2015). This assessment resulted in vegetation community CddAdTw being indicated as regionally significant; this vegetation community was not mapped in FMG's Lower Borefield development envelope, which includes most of Area 2. Similarly, a local significance assessment was carried out and AaVfTH1 and EllHcTw1 were identified as locally significant; however, neither of these communities was mapped in Area 2.

Seven partially sheet flow dependent vegetation communities were identified in the Solomon PER project area, and six of the seven communities - AaElCf, AaElfTe, AalmTe, AaPlAc, AaSfAl, AaSvCc – were mapped in Area 2.

Groundwater dependent ecosystems and potential groundwater dependent ecosystems were indicated in the Solomon PER document: groundwater dependent – EcApCa, EcAcEu, EcEvAcTw, EcMaMlCv; potential groundwater dependent – EvAcCc, EvAcEa, EvAtpTe, EvVfCc. Two of the potentially groundwater dependent communities were mapped in Area 2 – EvAcCc and EvAcEa.

4 Survey and Reporting Methods

4.1 Survey Methodology

The survey methodology was developed to comply with the following:

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

Before undertaking the surveys, the botanists familiarised themselves with any conservation significant species produced by the database searches that had not been located previously by Maia in the MBSA, and those previously recorded in the area.

The initial detailed survey of the MSA was carried out over the phases listed in **Table 4.1**; the surveys carried out since the MSA surveys report was prepared in 2005 are also listed along with the type of survey and its timing.

Quadrats measuring 50 m x 50 m were sampled in the areas surveyed. When sampled in linear habitats (e.g., along drainage areas), where a 50 m x 50 m quadrat would not fit, the area surveyed was amended to fit into that habitat and the same area (2,500 m^2) was assessed. Quadrat locations were selected before going to site using aerial imagery and tenement boundaries. Quadrats were placed to capture the different habitats visible on the aerial imagery. Quadrats were also positioned in each land system and in each of the pre-European vegetation associations mapped in the MBSA. The final placement of the quadrats was selected by the botanists while at site. A fence dropper was placed in the north-west corner of each quadrat.

Table 4.1: Survey areas, phases and seasons

Survey area	Phase	Season	Survey month	Comments
Mulga East (R47/12-I; M47/1621) Area 1	1	Winter	June, July, August 2012	Survey carried out post excellent summer rains (including two tropical cyclones - Heidi and Lua). Some areas were still flooded along the river.
	2	Winter	August 2019	The 2012 quadrats that were still intact and accessible, so were re-sampled. The first 2019 survey was originally scheduled for late March 2019. However, it was postponed because localised heavy rainfall from Severe Tropical Cyclone Veronica in late March affected the use of station and exploration tracks; accommodation constraints further delayed the survey. By August 2019, the vegetation was generally dry and there were few annual species.
		Spring	September 2019	Low winter rainfall meant that the spring season was sub-optimal. The vegetation was generally dry and there were few annual species.
	3	Autumn	May 2020	The survey was carried out post good summer rains.
Mulga Well (E47/2117) Area 1	1	Autumn	May 2019	The survey was carried out after average summer rains. The vegetation was relatively dry and many of the summer grasses that generally follow summer rains were absent. Cattle were being mustered at the time and the vegetation was heavily grazed and trampled in areas that cattle were moved through.
	2	Spring	September 2019	Very low winter rainfall and cattle mustering was being carried out. The vegetation was generally dry and there were few annual species.
	3	Autumn	May 2020	Post good summer rains, the vegetation was in excellent condition.
L45/384 (part of) Area 1	1	Winter	August 2012	Post excellent summer rains and two cyclones, some areas were still flooded along the river even though rainfall was lower than long-term average over the three months before the August survey.
	2	Autumn	May 2017	Excellent summer and early autumn rains, the vegetation was in excellent condition.
	3	Winter	August 2019	Very low winter rainfall the vegetation was notably dry and lacking annual species.
Hester Peak SE (L45/316) Area 3	1	Winter	August 2012	Survey carried out post excellent summer rains (including two tropical cyclones - Heidi and Lua); although rain received over the three months before the August survey was lower than the long-term mean for those three months.
	2	Autumn	March 2022	Average rainfall was received over the three months before the survey was carried out.

Survey area	Phase	Season	Survey month	Comments
Hester Peak (E47/2044-I) Area 6	1	Winter	August 2012	Survey carried out post excellent summer rains (including two tropical cyclones - Heidi and Lua); although rain received over the three months before the August survey was lower than the long-term mean for those three months.
	2	Autumn	March 2022	Average rainfall was received over the three months before the survey.
Two Mile Well (E47/4264) Area 5	1	Autumn	March 2022	Average rainfall was received over the three months before the survey.
Mulga West (E 47/1315-I) Area 2	1	Autumn	March 2022	Average rainfall was received over the three months before the survey.
Mulga West to Mulga East linking corridor Area 4	1	Autumn	March 2022	Average rainfall was received over the three months before the survey.
Hester Peak East (L45/384 and E47/2044-I) Area 7	Two quadrats assessed and traverses walked close to the boundary with Area 1; however, most of this area has not been surveyed and is assessed via desktop study in this report.			
2021 targeted flora surveys Area 1 (inside and outside)	1	May	Autumn	Average rainfall received before the survey.
	2	July	Winter	Average rainfall received before the survey.
	3	September	Spring	Average rainfall received before the survey.

Note: Map 1 shows each of the seven areas.

The following information was recorded at each quadrat assessed:

- Location details including GPS co-ordinates for the four corners at each site.
- Site parameters such as soil description, topography and general habitat description, rock type and cover.
- At least one photograph of the site.
- Vegetation condition using the scale and criteria in EPA, 2016b.
- Notes on any disturbance to the vegetation.
- Fire history.
- A description of the vegetation structure including the height, percentage cover and dominant species within each stratum.
- The name, height, percentage cover and any other significant recording details for each species located around the site.

Traverses were walked between quadrats during the different phases of the detailed survey and their path was either chosen by the botanists while walking from quadrat to quadrat or selected from aerial imagery before

carrying out the survey. When walking traverses each botanist surveyed a band of vegetation approximately 20 m wide. Conservation significant species known to occur in the area and surrounds, any novel species and introduced species were targeted while walking. In May 2020 traverses were walked along sections of the Fortescue River (including river edges, river flow lines and claypans associated with the river).

While walking traverses the botanists also recorded information when any apparently different vegetation types were encountered - the vegetation type boundaries were noted, and georeferenced photographs were also taken.

When known or suspected conservation significant or weed species were encountered a waypoint was taken to mark the location and their numbers were counted. Population boundaries were also recorded for larger populations of priority flora.

In areas where multiple phase surveys were carried out, additional quadrats were established in areas where preliminary vegetation mapping indicated gaps in quadrat distribution or for taxonomic reasons i.e., if sterile specimens of dominant taxa were collected during the first phase those quadrats were revisited during the second phase. Quadrats were resampled during follow-up phases and nearly all quadrats established in the first phase were resampled during follow-up phases.

Subsequent to the MSA surveys being carried out for the flora and vegetation assessment, a series of targeted surveys were carried out within and outside of a development envelope provided to Maia. These surveys were carried out to target CSF species that had been recorded in the MSA previously and to survey the area in different seasons.

4.2 Taxonomy and Nomenclature

At least one specimen from every taxon encountered during the surveys was collected for taxonomic verification. In many cases multiples of flowering or fruiting specimens were collected to assist with identification. Specimens collected were identified using taxonomic keys and reference specimens at the WA Herbarium. Specialists at the WA Herbarium were sent selected collections for verification, particularly CSF, some range extension species and any novel taxa.

Species names used in this report are those adopted by the WA Herbarium, and they have been checked against current Florabase records (WAH, 1998 -). Undescribed species, potentially new species and affinities are referred to in the report and listed in the species list as “sp.”, “? nov.” and “aff.”. Species, subspecies and varieties are referred to as sp. or spp. (single and multiple species respectively), subsp. and var..

4.3 Statistical Analyses

Version 4.00 of the multivariate statistical analysis package PATN (Belbin, 1989; Belbin, 2019) was used to carry out pattern analysis on the quadrat data. The analysis was run using quadrat data collected during the surveys carried out by: Maia in July 2012, May, July and August 2019, May 2020, and March 2022 (249 quadrats); *ecologia*, 22 quadrats at Murrays Hill (2008d); Biota, 44 quadrats (2012a and 2012b); Coffey, 49 quadrats (2010a and 2010b); McKenzie et al., 39 quadrats (2009); Lyons three quadrats (2015); and Pinder et al., 20 quadrats (2017). In total, 426 quadrats were used in the analyses. The presence and absence of perennial taxa, Pearson complete linkage analysis and the Bray Curtis association measure were used to group sites with similar species composition, and to define the vegetation types of the MBSA. Annual, singleton and weed species were removed from the data before running any analysis, as well as weakly perennial taxa.

Some species were combined before the analyses were carried out, either because of similarity or current taxonomic uncertainty. The combined taxa are listed in **Table 4.2** along with the combined name and the reason for their combination.

Table 4.2: Taxa amendments and combinations pre pattern analysis

Taxa combined	Combined name	Reason for combining
Acacia aneura, Acacia aneura var. *aneura, Acacia aptaneura, Acacia incurvaneura, Acacia pteraneura.*	*Acacia aneura* (complex)	Since the *ecologia* (2008d), Coffey (2010a and 2010b) and McKenzie (2009) surveys a taxonomic revision has been carried out of the *Acacia aneura* complex (Maslin and Reid, 2012), and the varieties recorded during these earlier surveys are no longer current. For consistency, all *Acacia aneura* alliance specimens in the remaining regional quadrat data were also combined.
Acacia pyrifolia, Acacia pyrifolia var. *morrisonii, Acacia pyrifolia* var. *pyrifolia*	*Acacia pyrifolia*	These subspecies occur in similar habitats and sterile material was only identified to species level.
Corchorus lasiocarpus subsp. *lasiocarpus, Corchorus lasiocarpus* subsp. *parvus*	*Corchorus lasiocarpus*	Both subspecies occur on hills and rocky slopes and were therefore combined.
Eremophila forrestii, Eremophila forrestii subsp. *forrestii, Eremophila forrestii* subsp. *hastieana*	*Eremophila forrestii*	Sterile material was identified to species level, as both subspecies share similar habitats they were combined.
Grevillea wickhamii, Grevillea wickhamii subsp. *aprica, Grevillea wickhamii* subsp. *hispidula*	*Grevillea wickhamii*	Sterile material was identified to species level, as both subspecies share similar habitats they were combined.
Triodia epactia and *Triodia pungens* (*ecologia* records only)	*Triodia epactia*	*ecologia* (2008d) only recorded *Triodia pungens* from the Murrays Hill tenement while most of Maia collections from Mulga Downs East were *T. epactia* with only one or two *T. pungens* - collected from drainage lines.
Triodia lanigera (*ecologia* records only) and *T. basedowii*	*Triodia basedowii*	*ecologia* (2008d) recorded *Triodia lanigera* from hill slopes and stony flats, while Maia recorded *T. basedowii* from similar habitats.

4.4 Vegetation Type Mapping

Aerial imagery captured in 2018 and 2021 was used to map the vegetation at a scale of 1:10,000. The presence and absence of taxa and the structural information (height and cover) recorded at sites assessed by Maia in the MBSA were used to describe the vegetation types. Statistical analyses were carried out on quadrat data and the results of the analyses were used to define and map the boundaries of the vegetation types of the MBSA. The vegetation mapping was extended to a 1 km wide corridor for the Mulga West – Mulga East linking corridor (Area 4) and the Hester Peak SE corridor (Area 3). The vegetation was not mapped in Area 7 because that area was not included in Maia's survey scope of works and was added after the surveys had been carried out. While Maia has assessed two

quadrats in the southern section of the area in the past and has walked selected traverses in the southern section, the whole of Area 7 could not be mapped based on that limited data. Therefore, vegetation types were mapped over a Mine and Borefield Mapping Area (MBMA) and not over the whole of the MBSA. The MBSA and MBMA are detailed in **Table 4.3**.

Table 4.3: Survey and vegetation mapping areas

Descriptive area	Includes	Covers (ha)
MBSA (Mine and Borefield Study Area)	Area 1, Area 2, Area 3, Area 4, Area 5, Area 6, Area 7	58,940.17
MBMA (Mine and Borefield Mapping Area) – vegetation types and vegetation condition	Area 1, Area 2, Area 3 (mapping extended beyond the survey area so that it is a 1 km wide corridor), Area 4 (mapping extended beyond the survey area so that it is a 1 km wide corridor), Area 5, Area 6 (does not include Area 7)	59,527.18

Information on vegetation type boundaries noted while walking traverses through the MBSA and recorded at points of interest / photo points (e.g., vegetation structure and habitat, fire age and topography), were also used to map the vegetation types.

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. At this level up to three strata and a maximum of three taxa per stratum are used to describe the association (NVIS Technical Working Group, 2017).

An indicator species analysis was run on the quadrat data used in the pattern analysis. PC-Ord (McCune & Mefford, 2011) was used selecting the Dufrêne and Legendre (1997) analysis option to determine indicator species for the vegetation types. A Monte Carlo Permutation Test was used to determine the significance of the indicator species resulting from this test. Species with a 100% observed indicator value and a p value of ≤ 0.05 are considered perfect indicator species. Species with an observed indicator value of 80% - 99% and a p value of ≤ 0.05 are considered high indicator species. Species with an observed indicator value of 50% to 79% and a p value ≤ 0.05 are considered moderate indicator species. Species with an observed indicator value of > 30% to 49% and p value of ≤ 0.05 are considered low indicator species. Species with an observed indicator value of ≤ 30% and a p value of ≤ 0.05 are considered poor indicator species. Those species with a p value ≥ 0.05 are not considered to be indicator species.

Species accumulation curves (SPACs) 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 MSA using the software package EstimateS and the methodology outlined in Colwell (2019); the analysis was run using only the information collected at quadrats within the MBSA. The results of the species accumulation analysis are used to estimate the percentage of the flora of the area that was sampled.

4.5 Vegetation Condition

MBSA vegetation condition was assessed using the vegetation condition scale for the Eremaean and Northern Botanical Provinces recommended in EPA, 2016b (**Appendix 4**). Vegetation condition noted in the description for each vegetation type is based on vegetation condition at the quadrats assessed by Maia in the relevant vegetation type. The vegetation condition ratings on the vegetation condition map are derived using a selection of different information (data collected at quadrats and at photo points, notes recorded while walking from site to site, any

disturbance visible on aerial imagery, and any weeds located at quadrats). Vegetation condition was not mapped in Area 7 (see explanation in Section 4.4 above) and, like vegetation type mapping, the vegetation condition is mapped over the MBMA rather than the MBSA.

5 RAINFALL

The MBSA is in the sub-eremaean – tropical desert climatic class (Beard, 1975). The area receives on average between 250 and 350 millimetres (mm) of rainfall per annum with a greater chance of summer rainfall, while it is generally dry for 9-11 months of the year (Tille, 2006).

The closest Bureau of Meteorology (BOM) weather station to the MBSA with a complete data set for the times when surveys were carried out before August 2018 is Wittenoom, approximately 7 km south-west of the MBSA. Wittenoom station was decommissioned after August 2018 and a new weather station was installed at Karijini North, which is now the closest weather station to the MBSAat ,approximately 12 km to the south.

Long-term (10 years from 2008 to 2017) average monthly and total annual rainfalls for Wittenoom are listed in **Table 5.1** along with monthly rainfall totals from January 2008 to August 2018. Monthly rainfall totals for Karijini North from September 2018 to March 2022 are also listed in **Table 5.1** (BOM, 2022c).

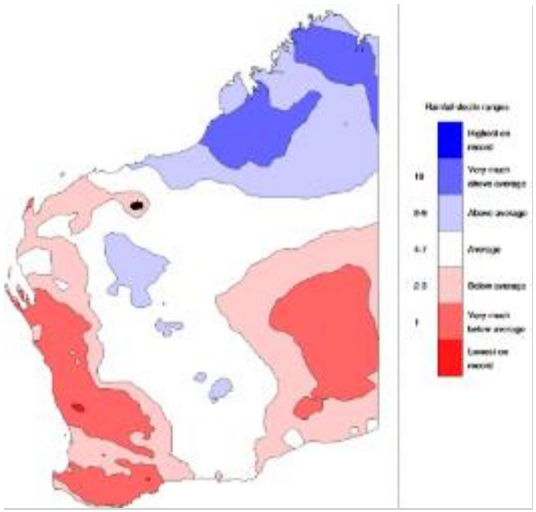
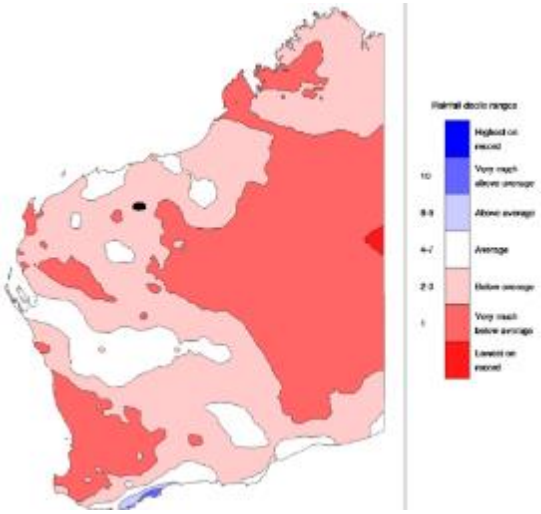
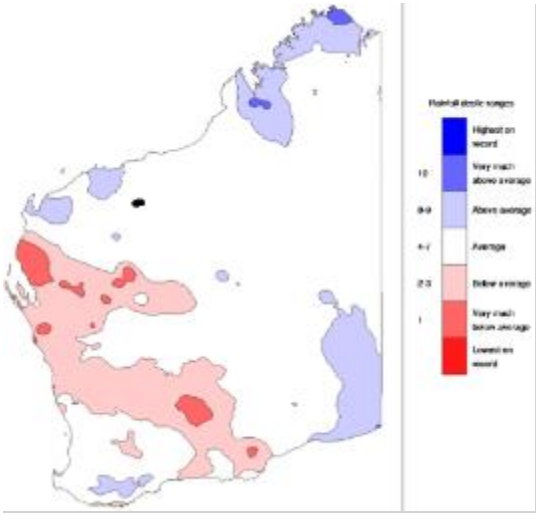
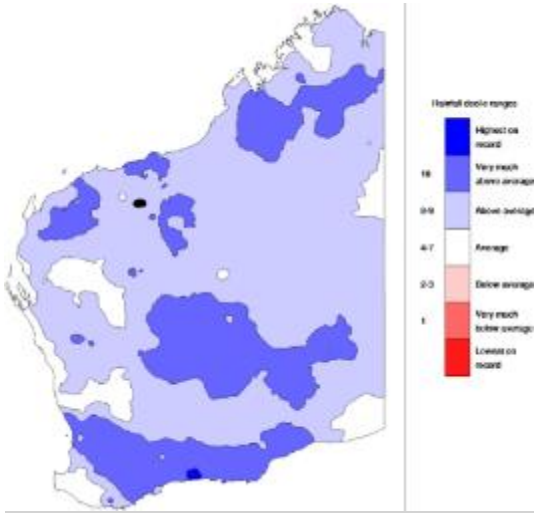
Table 5.1: Wittenoom (Station Number 5026, decommissioned September 2018) and Karijini North (Station Number 5098) rainfall from January 2008 to March 2022 (BOM, 2022c)

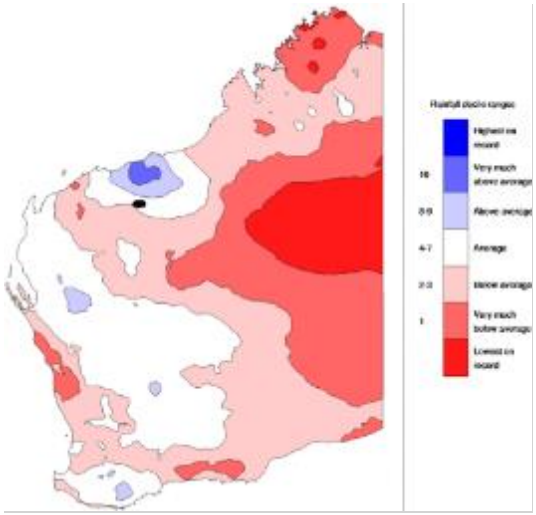
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wittenoom (Station Number 5026)													
2008	44.2	139.1	72.3	9.2	0.0	43.8	0.0	2.8	0.2	6.2	22.4	93.8	**434.0**
2009	162.6	171.0	40.0	3.4	0.0	14.5	4.0	0.0	0.0	0.0	50.2	5.6	**451.3**
2010	68.8	8.4	15.1	0.0	3.2	2.0	11.0	7.0	61.2	0.0	12.4	92.0	**281.1**
2011	79.9	294.0	52.6	27.0	41.3	14.2	6.9	0.0	0.0	0.0	49.3	0.8	**566.0**
2012	469.8	2.0	28.8	1.8	0.0	13.0	0.0	0.0	0.0	24.2	0.0	64.4	**604.0**
2013	430.6	20.6	23.4	11.2	15.8	87.2	0.0	0.0	0.0	3.8	2.0	110.2	**704.8**
2014	214.6	5.4	58.6	3.6	18.4	2.4	34.2	0.0	0.0	2.0	31.2	24.4	**394.8**
2015	67.2	16.4	167.6	64.8	112.6	0.0	24.8	0.0	0.0	12.0	16.2	0.8	**482.4**
2016	82.2	14.2	3.0	21.4	11.2	104.4	25.6	0.4	0.0	0.0	11.2	43.0	**316.6**
2017	137.0	138.6	104.2	27.4	0.4	0.0	0.0	0.0	0.0	0.6	7.4	35.4	**451.0**
2018	238.8	56.6	43.6	0.0	0.0	88.6	0.0	0.0	Station closed				-
2008-2017	**175.7**	**81.0**	**56.6**	**17.0**	**20.3**	**28.2**	**10.7**	**1.0**	**6.1**	**4.9**	**20.2**	**47.0**	**468.6**
Karijini North (Station Number 5098)													
2018	Station not yet open								0.0	0.2	0.0	2.8	-
2019	77.6	13.0	84.0	3.2	0.0	18.2	0.0	1.2	0.0	1.6	2.2	9.0	**210.0**
2020	75.8	131.6	24.4	12.8	34.6	0.0	22.0	5.4	0.0	2.2	4.6	141.8	**455.2**
2021	35.4	164.2	38.2	78.0	46.6	16.4	0.0	0.0	0.0	0.0	8.8	5.0	**392.6**
2022	79.0	112.0	31.2										

Note: orange shading = months when 2019, 2020, 2021 and 2022 MBSA surveys were carried out; blue shading = months when earlier Mulga Downs East detailed survey was carried out (Maia, 2012; 2013a; 2014c; and a 2017 reconnaissance survey (no report). The results from all of these surveys have been used in this report.

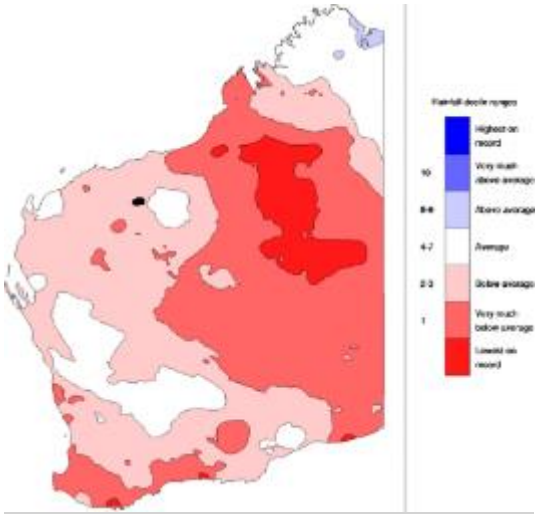
Rainfall deciles for the three months before each of the MBSA surveys are shown in **Table 5.2** (BOM, 2022d).

Table 5.2: Three-month rainfall deciles before MBSA surveys in 2012, 2014, 2017, 2019, 2020, 2021 and 2022

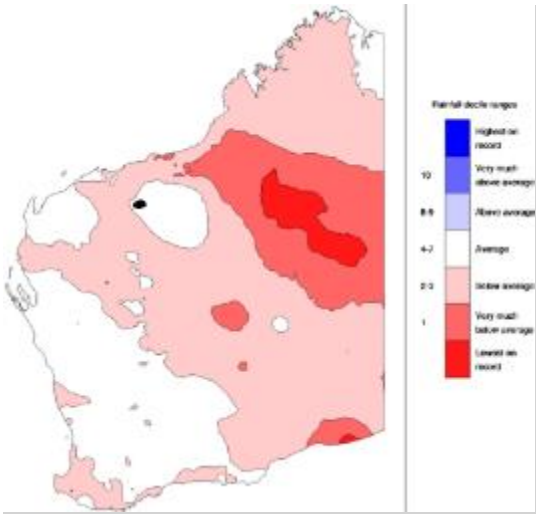
A – 1 March to 31 May 2012 for June-July 2012 (Maia, 2012)	B – 1 May to 31 July 2012 for August 2012 (Maia, 2013a)
	
C – 1 May to 31 Jul 2014 for August 2014 (Maia, 2014c)	**D – 1 February to 30 April 2017 for May 2017 (no report)**
	
E – 1 February to 30 April 2019 for May 2019 (this report)	**F – May 1 to 31 July 2019 for August 2019 (this report)**



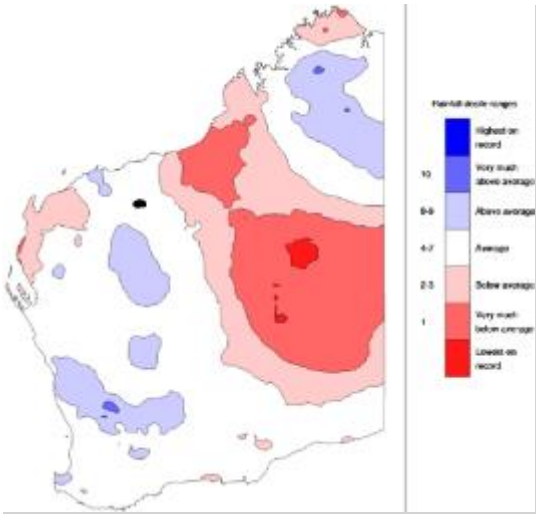
G – 1 June to 31 August 2019 for Sept. 2019 (this report)



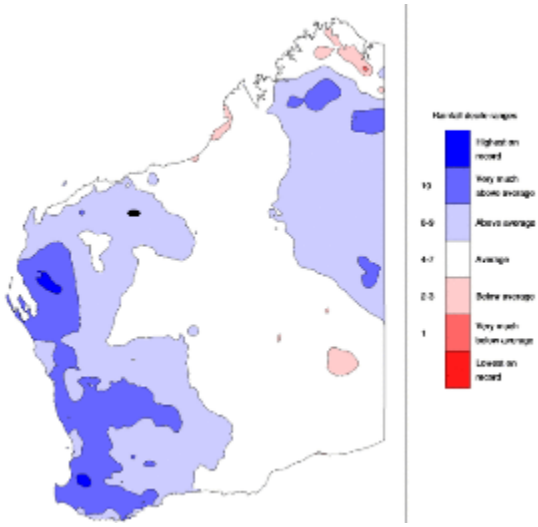
H – 1 February to 30 April 2020 for May 2020 (this report)

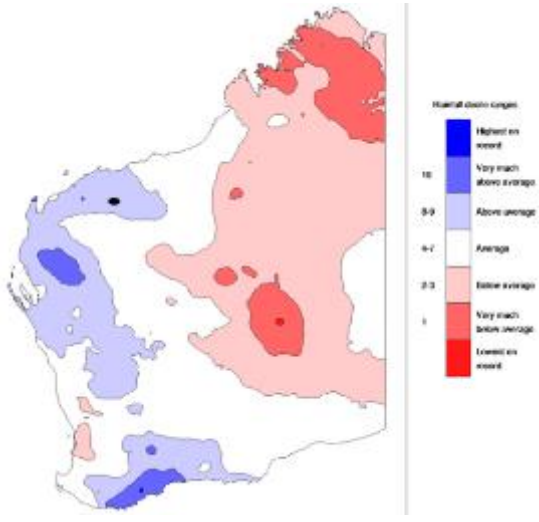


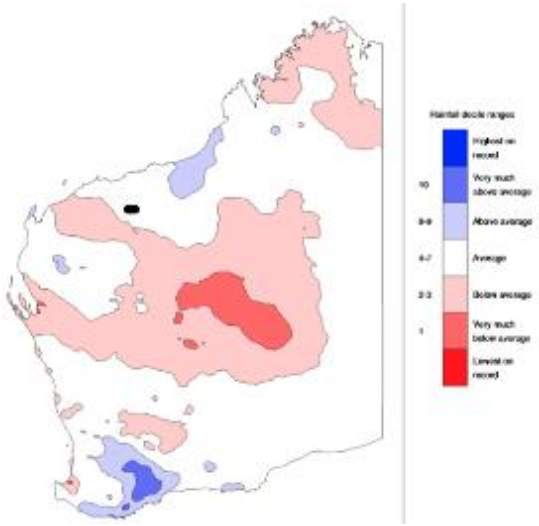
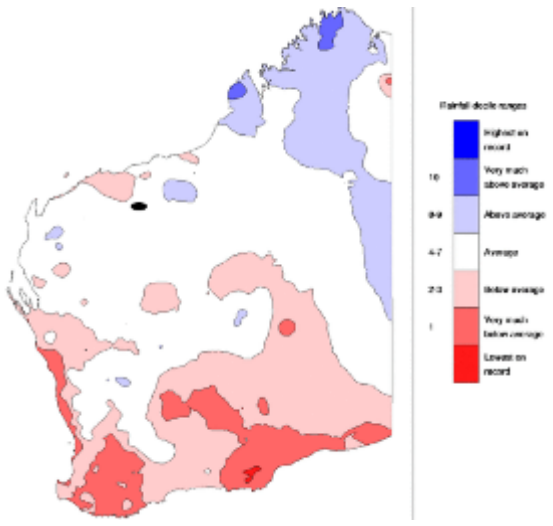
I – 1 Febuary to 30 April for May 2021 (this report)



J – 1 April to 30 June for July 2021 (this report)





K – 1 June to 31 August for September 2021 (this report)	K – 1 December to 28 Febuary for March 2022 (this report)
	

Note: Rainfall decile maps from BOM (2022d); black polygon indicates MBSA.

Rainfall over the three months before each survey is discussed below:

A. Below-average rainfall deciles occurred before the June-July 2012 detailed survey carried out at Mulga Downs East (Area 1; Mulga East (R47/12-I, M 47/1621 and L45/380)) and Hester Peak South-east (Area 3; L45/316) (Maia, 2012). However, excellent summer rains fell over the area in January 2012 (470 mm), and some areas associated with the Fortescue River were still flooded.

B. Below-average rainfall before an August 2012 survey for a transport corridor option from Mulga Downs to Great Northern Highway (which includes part of Area 1; Mulga East (L45/380)) (Maia, 2013a) (however see above).

C. Average rainfall before the August 2014 reconnaissance survey and TFS for transport corridor options K and J (Maia, 2014c). A small bit of this corridor occurs within the L45/380 section of the MBSA (Area 1; Mulga East (L45/380)).

D. Above-average rainfall before the May 2017 reconnaissance flora and vegetation survey (no separate report produced). A section of this corridor occurs within the L45/380 section of the MBSA (Area 1; Mulga East (L45/380)).

E. Average rainfall before the May 2019 MBSA (Area 1; Mulga Well (E47/2117-I), this report).

F. Below-average rainfall before the August 2019 MBSA survey (Area 1: Mulga East (R47/12-I, M 47/1621 and L45/380).

G. Average rainfall before the September 2019 MBSA survey (Area 1: Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I), this report).

H. Average rainfall before the May 2020 MBSA survey (Area 1: Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I), this report).

I. Average rainfall before the May 2021 MBSA survey, this report (targeted flora surveys within the MSA section of the MBSA – the development envelope (MSA = Area 1; Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I)).

J. Average rainfall before the July 2021 MBSA survey (targeted flora surveys, within but mostly outside of the MSA section of the MBSA – targeting a new *Hibiscus* species) (MSA = Area 1; Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I)).

K. Average rainfall before the September 2021 MBSA survey (follow-up targeted flora surveys, within the MSA section of the MBSA – the development envelope) (MSA = Area 1; Mulga East (R47/12-I, M 47/1621 and L45/380) and Mulga Well (E47/2117-I)).

L. Average rainfall before March 2022 MBSA survey (quadrats assessed in Areas 2, 3, 4, 5 and 6).

6 Survey Results

6.1 Survey Effort

Two hundred and seventy-one quadrats were assessed within and outside of the MBSA by Maia (249) and *ecologia* (22). One of the Maia quadrats was established in an ecotone, and this was treated as a relevé rather than a quadrat. Coordinates for all sites assessed are listed in **Table A6.1 (Appendix 6**). The number of quadrats assessed over the different surveys is listed in **Table 6.1** and the specific quadrats assessed during / at each phase / date are listed in **Table A6.2 (Appendix 6**). Quadrat locations are shown on **Maps 18, 19 and 20 (Section 10)** along with traverses walked by Maia during reconnaissance, detailed and targeted flora surveys in the MBSA (and selected areas outside).

Table 6.1: Quadrats assessed

Survey area	Survey #	Season	Survey timing	Quadrats assessed by Maia (#)
Area 1: Mulga Downs East (R47/12)	1	Winter	June, July 2012	98 established in MBSA & 11 outside MBSA
	2	Winter / Spring	August 2019	43 resampled
			September 2019	45 resampled & 2 established in MBSA
	3	Autumn	May 2020	2 resampled
Area 1: Mulga Well (E47/2117)	1	Autumn	May 2019	55 established in MBSA
	2	Spring	September 2019	55 resampled
	3	Autumn	May 2020	53 resampled
Area 1: L45/380 (part of)	1	Winter	August 2012	3 established in MBSA & 3 outside MBSA
	2	Winter	August 2014	Reconnaissance and TFS, no quadrats established
	3	Autumn	May 2017	5 established in MBSA
	4	Winter	August 2019	7 established in MBSA & 5 resampled
	5	Winter	May 2020	3 resampled
Area 2: Mulga West (E47/1315-I)	1	Autumn	March 2022	52 established
Area 3: Hester Peak South-east (L45/316)	1	Winter	August 2012	6 established
	2	Autumn	March 2022	5 resampled and 2 established
Area 4: Corridor linking Mulga West and East	1	Autumn	March 2022	3 established
Area 5: Two Mile Well (E47/4264)	1	Autumn	March 2022	4 established
Area 6: Hester Peak (E47/12044-I)	1	Autumn	March 2022	2 resampled
Area 7: Hester Peak East (L45/384)	No survey			Desktop assessment only

6.2 FLORA

6.2.1 General Flora

Maia has access to data collected at 282 sites that have been assessed within the MBSA (249 Maia quadrats and one releve, 22 *ecologia* quadrats (2008d), four Pinder et al. quadrats (2017), three Coffey quadrats (2010b), and three Lyons quadrats (2015)). Overall, 749 taxa have been recorded in the MBSA from the quadrats assessed and additional opportunistic collections; however, this total includes some specimens queried to species, variety or subspecies or those in a genus identified to species and associated subspecies or varieties. All data was used to generate the general information on the flora of the MBSA in **Table 6.2** and the list of all vascular flora taxa recorded in the MBSA is included as **Table A7.1, Appendix 7**.

While used to generate counts in this section, all taxa were not used in the SPAC analysis. One hundred and thirty-five species that did not occur in quadrats but were collected opportunistically were not used. In addition, some of the taxa listed were not used due to their similarity (e.g., *Abutilon fraseri* and *Abutilon fraseri* subsp. *fraseri*, were combined to *A. fraseri* subsp. *fraseri*), while others were not included due to current taxonomic uncertainty (e.g., *Abutilon* aff. *lepidum* and *Acacia* ?*aptaneura* were not included because *Abutilon lepidum* and *Acacia aptaneura* were already in the list) (**Table A7.2, Appendix 7**). Some of the taxonomically uncertain collections were included in the accumulation analyses because there were no other similar taxa in the list (**Table A7.3, Appendix 7)**.

Table 6.2: General flora of the MBSA

Parameter	MBSA overall	Maia only
Number of taxa	749	703
Number of families	60	60
Number of genera	206	204
Perennials (%)	65	66
Annuals (%)	31	30
Specimens collected with flowers, fruit, or both flowers & fruit (%)	17, 16, 41 73% of the species list was identified with the aid of fertile material (calculated using Maia data only, as this information is not available from other surveys)	18, 16,43 76% of the species list was identified with the aid of fertile material
Most common families (all taxa)	Fabaceae (130), Poaceae (127), Malvaceae (81), Asteraceae (53), Amaranthaceae (35)	Fabaceae (121), Poaceae (122), Malvaceae (75), Asteraceae (48), Amaranthaceae (31)
Most common genera (all taxa)	*Acacia* (64), *Ptilotus* (20), *Sida* (25), *Senna* (20), *Goodenia* (19), *Eragrostis* (17)	*Acacia* (61), *Sida* (23), *Senna, Ptilotus* (19 each), *Goodenia* (18) and *Eragrostis* (17)
Number of taxa when queried collections excluded	704	659

Note: the total percentage does not equal 100% for annuals and perennials because some collections were not determined to species level. Flowering and fruiting information is generated from Maia specimens for which that information was noted and from specimens collected across the different phases of survey.

A comparison of the flora recorded in the MBSA (excluding queried collections) with the flora recorded during other single or two-phase detailed surveys carried out in the DSA is shown in **Figure 6.1**.

Species richness results for the MBSA (all surveys combined and Maia surveys) lie above the trendline curve indicating that there is either higher species richness in the MBSA compared with other study areas in the DSA or that a higher level of survey coverage was achieved in the MBSA; the latter is more likely given the intensity of survey effort that has been carried out in the MBSA since 2008.

Two species accumulation analyses were run using the combined data from: (A) all quadrats established and assessed in the MBSA; and (B) quadrats established and assessed by Maia. The species accumulation curves (SPAC) are shown on **Figure 6.2**. The results of the species accumulation analyses indicate that:

A. 87% of the species estimated to be in the MBSA were recorded using the taxa combined from all quadrats assessed in the MBSA.

B. 88% of the species estimated to be in the MBSA were recorded using the taxa combined from quadrats assessed by Maia in the MBSA.

As these estimates do not include the 135 additional taxa that have been recorded opportunistically while carrying out different surveys in the MBSA (i.e., not from quadrats), the proportion of the flora collected is even higher than the 87% and 88% indicated by the SPAC analyses.

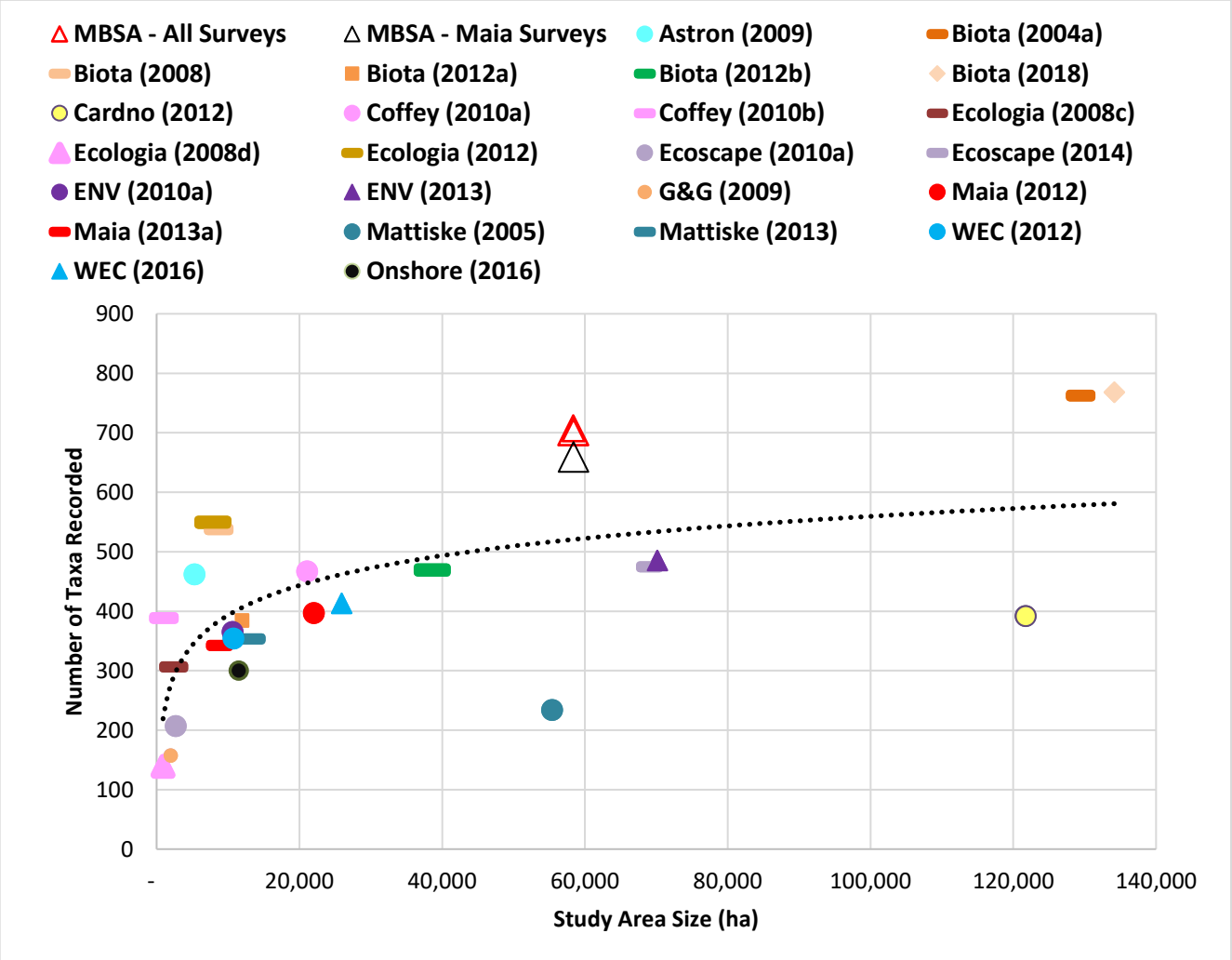


Figure 6:1: Number of taxa recorded in different study areas (ha) (pre combination for analyses and counts and excluding queried taxa)

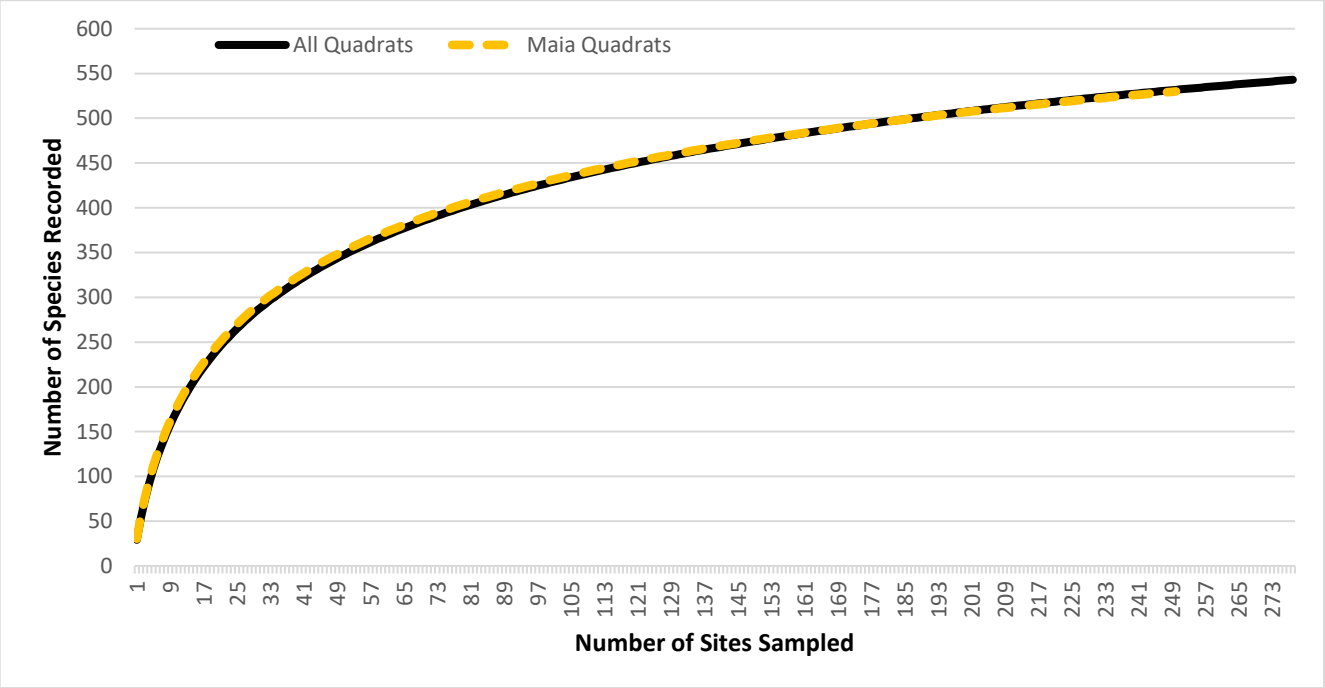


Figure 6:2: Species accumulation curves: all quadrat data (black line) and Maia quadrat data (orange dashed line)

6.2.2 Significant Flora

6.2.2.1 THREATENED AND PRIORITY FLORA

Threatened Flora

One threatened flora species protected by the EPBC Act and the BC Act has been recorded in the MBSA – *Seringia exastia* (Critically Endangered). Two collections from the targeted flora surveys carried out by Maia in 2021 were identified as the non-conservation significant *Seringia nephrosperma*. As many locations of plants believed to be *S. exastia* were way-pointed during the targeted flora surveys, and *Seringia exastia* has been recorded at quadrats assessed in the general area, Maia has adopted the precautionary principle and has recorded the plants at all other waypoints as *Seringia* ? *exastia*. See text in **Section 3.1.1.1** regarding this species. Its locations in the MBSA are shown on **Maps 21** and **22, Section 10**, and photographs are included in **Appendix 8**.

Priority Flora

The 11 confirmed and three queried Priority species recorded during the current surveys are listed below and their locations are shown on **Maps 21** and **22, Section 10**.

- P1 species: *Helichrysum oligochaetum* and *Triodia veniciae* P2 species: *Teucrium pilbaranum.*
- P3 species: *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), *Euphorbia australis* var. *glabra*, *Glycine falcata*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), *Triodia basitricha.*
- P4 species: *Rhynchosia bungarensis* and *Goodenia nuda.*
- Queried P3 species: *Goodenia* ? *lyrata* and *Rostellularia adscendens* ? var. *latifolia*.

In total, 20 confirmed priority flora species have been recorded in the MBSA to date (including previous and current surveys records):

- The P1 species: *Calotis squamigera*, *Helichrysum oligochaetum*, *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989), *Rhodanthe adscendens*, *Triodia veniciae.*
- The P2 species: *Teucrium pilbaranum.*
- The P3 species: *Aristida jerichoensis* var. *subspinulifera*, *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), *Eragrostis crateriformis*, *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), *Euphorbia australis* var. *glabra*, *Glycine falcata*, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727), *Iotasperma sessilifolium*, *Rostellularia adscendens* var. *latifolia*, *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), *Triodia basitricha*.
- The P4 species: *Bulbostylis burbidgeae*, *Goodenia nuda* and *Rhynchosia bungarensis*.

Photographs for most of the confirmed CSF species located to date in the MBSA are included in **Appendix 8**. The coordinates for the significant flora records have been supplied to HPPL / Strategen-JBS&G electronically and they are not listed in this report. The currently known distribution for each species is shown in **Table 7.1**, and the number of plants and populations known to Maia for the confirmed CSF species (and *Seringia* ? *exastia*) are listed in **Table 7.2**.

6.2.2.2 REGIONAL ENDEMIC SPECIES

The distribution for each of the species located in the MBSA was checked on Atlas of Living Australia and seven species endemic to the Pilbara bioregion have been located in the MBSA. *Triodia veniciae* (P1) has records in the Fortescue and Chichester subregions (including Maia records), while *Calotis squamigera* (P1) and *Corchorus incanus* subsp. *lithophilus* (not a CSF species) have records in the Hamersley and Fortescue subregions. *Teucrium pilbaranum* (P2), *Euphorbia australis* var. *glabra* (P3) and *Rostellularia adscendens* var. *latifolia* (P3) have records in the Hamersley, Fortescue, and Chichester subregions, while *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) has records in all four subregions. The species' distribution records are shown in **Table 6.4**.

6.2.2.3 POTENTIALLY SIGNIFICANT TAXA

See **Section 3.1.1.3** for a discussion of the potentially significant taxa located in the project area before 2019. One potentially significant taxon was located during the later detailed surveys.

- Two *Acacia* sp. nov. specimens were collected from an *Acacia* with miniritchie bark growing in shaley areas (quadrats M-MDEQ061 and M-XTC01). The shrubs were sterile when the surveys were carried out; however, one specimen was submitted to the WA Herbarium for identification, and it was indicated to be a potential new species. The specimen did not clearly fit any currently recognised taxon or hybrid. As it was sterile, the WA Herbarium indicated that fruiting or flowering material would need to be collected to get a better idea of where its affinities might lie (Pers. comm., Mike Hislop, WA Herbarium, 25 February 2020). More specimens were collected during a follow-up targeted flora survey in 2021, and they were submitted to the WA Herbarium for identification. They were determined to be *Acacia doreta*, which is a northerly range extension for the species. While both specimens were identified as *A. doreta*, and the WA Herbarium was reasonably confident with the identification, it was noted that it would be good to see fruiting material to confirm (Pers. comm., Mike Hislop, WA Herbarium, 16 June 2021).

- A *Hibiscus* sp. nov. specimen was originally collected from the MBSA (Area 1, Mulga East) in 2012. While areas where the specimens were found were searched when botanists were in the area in following years it was not found. However, in 2021 targeted flora surveys were carried out and it was found at multiple locations in May, July and September 2021. Specimens were submitted to the WA Herbarium for determination, and they were identified as a new species and were given the phrase name of *Hibiscus* sp. Mulga Downs. Its earlier and recent locations are shown on **Map 10 and 22, Section 10**.

6.2.2.4 RANGE EXTENSIONS

Species have a typical range which is indicated by their known distribution records. Sometimes species are recorded during a survey and their distribution records show that they have not been located in the area previously. The new records can either extend the range of a species out from its known distribution or fill a gap in the distribution records. The new distribution records can be a result of few surveys having been carried out in an area; of the degree of coverage achieved previously and of the habitats surveyed; or the time of year of survey with respect to season and rainfall. However, range extensions and gap fillers can also reflect a lack of submission of flora records to the WA Herbarium, as relatively common species or those not classified as significant are not often submitted.

Using 100 km as the minimum distance from an existing record to define a range extension, nine range extension species have been collected from the MBSA. These species are discussed in **Table 6.3** and their distribution records are shown in **Table 6.4**. The extensive surveys carried out in the MBSA and the multiple survey times and years with respect to season and rainfall has likely helped these range extension species to be found.

Table 6.3: Range extension / range gap filler species

Species	Closest Atlas of Living Australia (2022) record from MBSA	Distance and direction from MBSA and comment on the MBSA record	Survey type and area
Acacia doreta	Karlamilyi National Park (Little Sandy Desert bioregion)	Approximately 400 km east south-east of the MBSA.	Maia TFS 2021 and 2020 survey Mulga East (Area 1)
Aristida anthoxanthoides	Roy Hill Station (Pilbara bioregion)	Approximately 190 km south-east. The species has possibly been poorly collected because it is an annual species found commonly on Mitchell grass plains. It was recorded in May 2018, and 339 mm of rain fell over Jan, Feb and Mar of that year. The record fills a gap in the Pilbara records, as there is a record to the south south-west and north-west of the MBSA, which is between the two existing records.	Maia TFS Mulga East (Area 1)
Abildgaardia oxystachya	Little Sandy Desert bioregion	The closest Atlas of living Australia record is approximately 325 km east south-east, and the closest Florabase record is approximately 170 km to the north-north-east in the Little Sandy Desert bioregion. This occurrence probably reflects the survey effort in the MBSA, particularly in its sandy and riverine areas (it is an annual species that grows preferentially on red sand, gravelly sandy loam, swamps and red sand dunes). The record fills a gap between existing records to the north-west, north, north-east and south-east.	Opportunistic collection (Area 1)

Species	Closest Atlas of Living Australia (2022) record from MBSA	Distance and direction from MBSA and comment on the MBSA record	Survey type and area
Goodenia occidentalis	Kennedy National Range National Park (Carnarvon bioregion)	Approximately 420 km south-west. This has been identified from three specimens collected from three different targeted flora surveys carried out at Mulga East and surrounding tenements. It is a short-lived annual herb. However, given its currently known distribution, the specimens could be *Goodenia prostrata* rather than *G. occidentalis* - *G. prostrata* has a similar growth habit.	Maia TFS, Mulga East (Area 1)
Maireana aphylla	Ashburton Valley (Gascoyne bioregion)	Approximately 200 km south-west. The existing records for this species are sparse and disjunct and the MBSA record extends its known range.	Detailed (quadrats M-MDEQ011 and M-MDEQ070; Mulga East, Area 1)
Olearia muelleri	Ninghan Station (Gascoyne bioregion)	Approximately 195 km south-west. There are records in the Murchison and other bioregions outside of its main distribution area (which is the Coolgardie and Avon Wheatbelt bioregions), for example, the Nullarbor, Great Victoria Desert and Gascoyne bioregions. This record marks a range extension rather than filling a gap.	This report (quadrat M-MWQ17, Mulga Well, Area 1)
Roepera iodocarpa	Pilbara bioregion	Approximately 165 km west. This species has records that occur in seven bioregions including the Pilbara and the Gascoyne in the north of WA, each record with more than 100 km between them. Most of the records are found in the Nullarbor to the south-east and with the range extending to the north of the MBS this species is a range gap filler. It is an annual herb and finding it would depend on survey timing, rainfall before surveys etc.	TFS in Area 1
Stemodia linophylla	Pilbara bioregion	Approximately 125 km south. This species is a perennial herb with disjunct records in the Pilbara, Little Sandy Desert (most records), Gibson Desert, Great Sandy Desert. Other genera look similar when not in flower, which could explain the disjunct records.	This report (opportunistic collection) and TFS in Area 1

Species	Closest Atlas of Living Australia (2022) record from MBSA	Distance and direction from MBSA and comment on the MBSA record	Survey type and area
Vittadinia sulcata	Birriburu Indigenous Protected Area (Little Sandy Desert bioregion))	Approximately 370 km south-east on Florabase, however, within 80 km of the MBSA on Atlas of Living Australia. The species is an annual herb that was collected with seed; these small Asteraceae species can be difficult to differentiate when in seed and it is possible that it is a more commonly occurring *Vittadinia* species that has Pilbara records e.g., *V. eremaea,* rather than *V. sulcata.*	Maia TFS Area 1

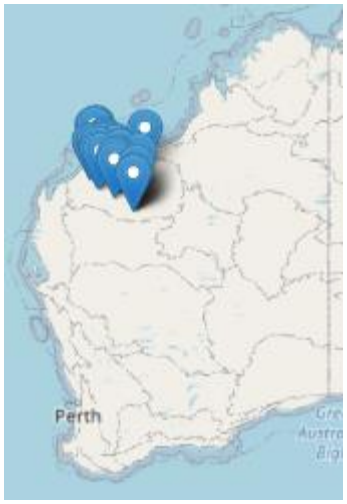
In addition to the notes in the table above, some of these species could have been carried into the area by cattle if transported to the MBSA from other regions.

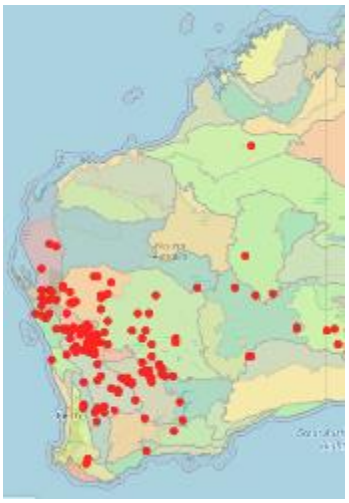
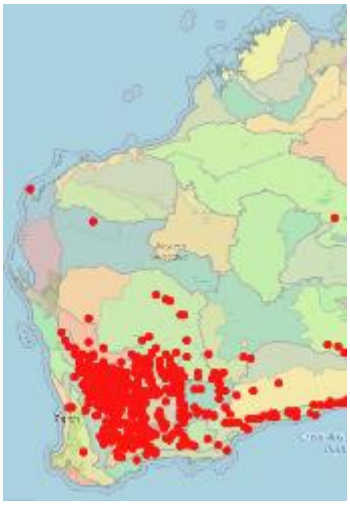
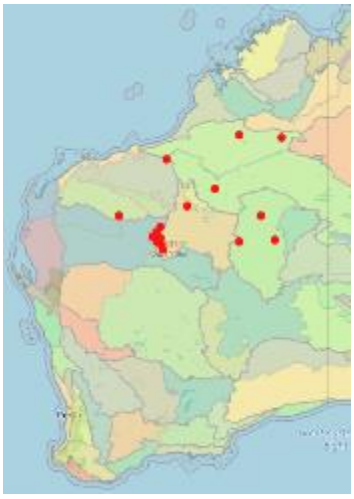
None of the range extension / range gap filling species is listed as conservation significant.

6.2.2.5 SANDALWOOD (SANTALUM SPICATUM)

One Sandalwood tree was recorded at one location in the MBSA (**Map 22, Section 10**). Sandalwood (*Santalum spicatum*) is a controlled species under the BC Act (if it has a diameter of greater than 25 mm at the smallest end when stripped of bark; or roots of sandalwood) and it cannot be taken from private land or from Crown land to be processed without a licence (flora taking (sandalwood) licence) (GoWA, 2018a), unless an exemption applies.

Table 6.4: Regional endemic and range extension / range gap filling species – regional distribution

Species endemic to the Pilbara bioregion		
Triodia veniciae (P1)	*Calotis squamigera* (P1)	*Corchorus incanus* subsp. *lithophilus*
		
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3)	*Euphorbia australis* var. *glabra* (P3)	*Rostellularia adscendens var. latifolia* (P3)
		
Teucrium pilbaranum (P2)		
		

Range extension / range gap filling species		
Acacia doreta	*Aristida anthoxanthoides*	*Abildgaardia oxystachya*
		
Goodenia occidentalis	*Maireana aphylla*	*Olearia muelleri*
		
Roepera iodocarpa	*Stemodia linophylla*	*Vittadinia sulcata*
		

Most figures produced using Atlas of Living Australia (Atlas of Living Australia, 2022a); *Dolichocarpa* sp. Hamersley Station produced using Florabase (WAH, 1998-). Shaded areas indicate bioregion and subregion boundaries and red dots plant records. Note: according to Florabase *Vittadinia sulcata* is a range extension species; however, on the Atlas of Living Australia there is a record within 80 km of the MBSA.

6.2.3 Introduced Flora

6.2.3.1 NATIONAL WEEDS LISTS AND PLANTS DECLARED IN WESTERN AUSTRALIA

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

No weed species declared as a pest in WA were recorded in the MBSA.

6.2.3.2 ENVIRONMENTAL WEEDS

Twenty-two general weed species have been recorded in the MBSA over all surveys carried out in the area (**Table 6.5** and **Maps 11 to 15** (previous survey records), **23** and **24** (current surveys records) (**Section 10**)). The Pilbara Region impact and invasiveness ratings for these species (DPaW, 2014) are also included in **Table 6.5**; 10 of the 22 species recorded have a high ecological impact and rapid invasiveness rating (orange shading in **Table 6.5**). Three of the 22 species were recorded during the most recent MBSA survey work and had not been recorded in the MBSA previously – *Melochia pyramidata*, *Portulaca pilosa* and *Solanum nigrum* (bold font).

Weed locations have been supplied electronically and their coordinates are not listed in this report.

Table 6.5: Weed species located in the MBSA, and ecological impact and invasiveness ratings

Taxa	Ecological impact	Invasiveness	Survey Area
Aerva javanica (Kapok Bush)	High	Rapid	Area 1
Bidens bipinnata (Bipinnate Begger's Tick)	Unknown	Rapid	Area 1
Cenchrus ciliaris (Buffel Grass)	High	Rapid	Area 1, Area 2
Cenchrus setiger (Birdwood Grass)	High	Rapid	Area 1, Area 2
Chloris virgata (Feathertop Rhodes Grass)	High	Rapid	Area 1
Citrullus amarus (Pie Melon)	Unknown	M	Area 1
Citrullus colocynthis (Colocynth)	Unknown	M	Area 1
Cynodon dactylon (Couch)	High	Rapid	Area 1
Echinochloa colona (Awnless Barnyard Grass)	High	Rapid	Area 1
Echinochloa microstachya (Prickly Barnyard Grass)	Not rated		Area 1
Flaveria trinervia (Speedy Weed)	Not rated		Area 1
Malvastrum americanum (Spiked Malvastrum)	High	Rapid	Area 1, Area 2
Medicago polymorpha (Burr Medic)	Low	M	Area 1
***Melochia pyramidata* (Pyramid Flower)**	Not rated		Area 2
***Portulaca pilosa* (Dianggara)**	Not rated		Area 1
Panicum miliaceum (Millet Panic)	Not rated		Area 2
Rumex vesicarius (Ruby Dock)	High	Rapid	Area 1
Setaria verticillata (Whorled Pigeon Grass)	High	Rapid	Area 1
***Solanum nigrum* (Black Berry Nightshade)**	Low	Rapid	Area 1
Sonchus oleraceus (Common Sowthistle)	Low	Rapid	Area 1
Tribulus terrestris (Caltrop)	Unknown	M	Area 1
Vachellia farnesiana (Mimosa Bush)	High	Rapid	Area 1, Area 2

Note: Columns 2 and 3 from DPaW, 2014.

6.3 VEGETATION

6.3.1 Vegetation Types

Pattern analysis divided the quadrat data into two broad groups including 26 vegetation types overall. Group one consisted of vegetation types associated with hardpan and stony plains, hills and drainage areas of the MBSA, while group two was associated with one vegetation type from claypans and major flow lines of the Fortescue River system. Nineteen of the 26 vegetation types identified by pattern analysis were within the MBSA and seven were outside of it; the seven outside the MBSA are not discussed further in this report. A mosaic of two of the vegetation types was also mapped in the MBSA.

The stress value for the pattern analysis provides an indication of the uniformity of the data used. The stress value for the final pattern analysis run on the quadrat data was 0.28. A stress value of 0.28 is considered high, and it is most likely a result of the use of data collected from multiple surveys by different botanists and from a wide variety of habitats for the analysis.

A species by vegetation type matrix (using the species list collated from all quadrats assessed in the MBSA) is included as **Table A9.1, Appendix 9**, and the quadrats that grouped together in the pattern analysis, along with their respective vegetation type, are listed in **Table A9.2**. The overall dendrogram for the combined data set is included as **Figure A9.1** (**Appendix 9**). Sub-sections of the full dendrogram are included as **Figure A9.2**. The group dendrogram is included as **Figure A9.3,** and the statistical methodology (PATN recipe) used to generate the site by species classification is included as **Figure A9.4**. The results of the indicator species analysis, carried out using the quadrat data included in the pattern analysis, are included as **Table A9.3**.

The area and the cover of each vegetation type and mosaic mapped in the MBMA is listed in **Table 6.6** (see **Table 4.3** for information on MBMA and MBSA). Each of the vegetation types is described in **Table 6.7** and their distribution is shown on **Maps 26 and 27 (Section 10,** with the vegetation type legend on **Map 25)**. Areas already cleared (for roads, and exploration tracks or fencelines) are mapped as cleared.

The average vegetation condition noted in **Table 6.7** uses the condition of the vegetation at the quadrats assessed in each vegetation type; it is not the same as the vegetation condition in **Table 6.8**, which uses a range of parameters (data collected at quadrats and photo points, notes recorded while walking from site to site and any disturbance visible on aerial imagery). **Maps 28** and **29** show vegetation types with quadrats assessed, while vegetation types with CSF recorded during the current surveys are shown on **Maps 30** and **31**.

Two high indicator species were identified for the vegetation types mapped inside the MBSA - *Triodia veniciae* for vegetation type *Tv*HG and *Tecticornia verrucosa* for *Bpo*FL. The remaining indicator species were mostly low or poor indicators, while three were moderate. Two of the vegetation types had no statistically significant indicator species – AWL (3) and MSL (1).

Maia (prefixed with an M) and *ecologia* (prefixed with an E) quadrats were used to calculate the species richness and average vegetation condition noted in **Table 6.7**. Conservation significant flora species listed for each vegetation type are from all surveys carried out in the MBSA, and not just those located during detailed and targeted surveys carried out for the MDIOP.

Information collected at the quadrats assessed by Maia is included as **Appendix 10, Quadrat Data**; however, as Maia assessed 250 sites in the MBSA, the data is provided as a separate document. Similarly, the species by vegetation and site matrix is included as a separate document (**Appendix 11**) because it is so large.

The regional and local significance of the vegetation types mapped in the MBSA is discussed in **Section 7**.

Table 6.7 includes the following information on each vegetation type:

- The vegetation code and its broad floristic formation e.g., AWL (1) *Acacia* Low Woodland / Tall Shrubland.
- A broad description of the habitat/s in which the vegetation type occurs and a comment on the grouping of the vegetation type with respect to other types in the dendrogram along with any other salient information relating to the vegetation type e.g., any CSF located in the vegetation type (CSF are from past, 2019 and 2020 surveys).
- The average vegetation condition (using Maia and *ecologia* quadrat vegetation condition ratings), and a comment on any weeds recorded in the vegetation type.
- A detailed description of the vegetation type.
- Associated species and average species richness (species richness recorded at Maia and *ecologia* quadrats).
- The quadrats assessed in the vegetation type.
- A photograph typical of the vegetation type.

Vegetation types are described using the current NVIS methodology at the vegetation type level (Level 5). At this level up to three strata and a maximum of three taxa per stratum are used to describe a vegetation type (NVIS Technical Working Group, 2017). The NVIS structural formation terminology is outlined in the three tables in **Appendix 5**; the structural formation terminology utilises height classes (**Table A5.1**), growth forms (**Table A5.2**) and structural formation (**Table A5.3**) characteristics.

Vegetation type descriptions are ordered using the dominant cover class as the indicator and not the dominant stratum so that they correlate with the broad floristic formation descriptions e.g., Hummock Grassland of *Triodia veniciae* with isolated shrubs of *Acacia marramamba* and *A. atkinsiana*. For the same reason vegetation type descriptions have been ordered using the dominant genera in each structural class e.g. THG (1)'s broad floristic formation is described as *Triodia* Hummock Grassland, and its vegetation type description is: Mixed Hummock Grassland mainly of *Triodia basedowii*, *Triodia brizoides* and *T. vanleeuwenii* with a Tall Sparse Shrubland of mixed *Acacia* species mainly *Acacia atkinsiana*, *A. maitlandii*, *A. ancistrocarpa* with Low Isolated Trees of *Eucalyptus leucophloia* subsp. *leucophloia* +/- *Corymbia hamersleyana*.

Vegetation type codes include the first letter from the genus and species of the dominant taxon or taxa in the vegetation type along with the first letters of the dominant stratum e.g., *AaAx*SL is an *Acacia aneura* (complex) and *A. xiphophylla* Shrubland, while THG is a *Triodia* Hummock Grassland.

Table 6.6: Vegetation types and their area (ha) and cover (%) in the MBMA and the MBSA

Vegetation type code: broad floristic formation	Mapped in the MBMA		Mapped in the MBSA	
	Area (ha)	Cover (%)	Area (ha)	Cover (%)
*AaAx*SL: *Acacia* Tall Sparse Shrubland	1,887.54	3.17	1,854.63	3.18
*AdEv*WL: *Acacia* and Eucalyptus Low Open Woodland	6,284.97	10.56	6,249.51	10.70
*A*SL (1): *Acacia* Tall Sparse to Open Shrubland	894.74	1.50	894.74	1.53
*A*SL (2): *Acacia* Tall Shrubland	2,021.02	3.40	1,990.27	3.41
*A*WL (1): *Acacia* Low Woodland or Tall Shrubland	7,389.72	12.41	7,134.51	12.22
*A*WL (2): *Acacia* Low Woodland or Tall Shrubland	4,875.85	8.19	4,841.39	8.29
*A*WL (3): *Acacia* Low Woodland	3,963.01	6.66	3,945.87	6.76
*AxAs*SL: *Acacia* Tall Shrubland	7,152.76	12.02	6,968.19	11.93
*Bpo*FL: *Bergia* Forbland	333.38	0.56	333.38	0.57
*EfEb*TG: *Eriachne* Tussock Grassland	992.62	1.67	874.50	1.50
*Ev*WL: *Eucalyptus* Low Open Woodland	1,016.96	1.71	1,016.96	1.74
Mosaic of *AdEv*WL / *Bpo*FL	1,707.56	2.87	1,707.56	2.92
MSL (1): Mixed Mid Shrubland	592.73	1.00	592.73	1.02
MSL (2): Mixed Tall Shrubland	2,511.80	4.22	2,511.80	4.30
MTG (1): Mixed Tussock Grassland	303.70	0.51	303.70	0.52
MTG (2): Mixed Tussock Grassland	312.78	0.53	312.78	0.54
MTG (3): Mixed Tussock Grassland	832.53	1.40	604.90	1.04
*T*HG (1): *Triodia* Hummock Grassland	11,360.58	19.08	11,235.00	19.24
*T*HG (2): *Triodia* Hummock Grassland	4,674.48	7.85	4,611.78	7.90
*Tv*HG: *Triodia* Hummock Grassland	48.20	0.08	48.20	0.08
Cleared	370.25	0.61	358.02	0.61
Total area mapped (ha) / Cover (%)	59,527.18	100	58,390.42	100

Note: MBMA = Mine and Borefield Mapping Area. The mapping was extended beyond the original MBSA boundaries in Area 3 and Area 4 to map corridors approximately 1 km wide; therefore, the area of the vegetation types mapped in the MBMA (59,527.18 ha) is not the same as the area of vegetation mapped in the MBSA (58,390.42 ha). In addition, Area 7 was not mapped (as it was not part of the survey scope of works) and therefore, the area of vegetation mapped in the MBSA (58,390.70 ha) is not the same as the total area of the MBSA (58,940.17 ha).

Table 6.7: Vegetation type descriptions

***AaAx*SL: *Acacia* Tall Sparse Shrubland**

This vegetation type generally occurs on the stony plains and between the rolling hills of the MBSA. It also occurs in patches on the lower to mid slopes of low mesas in the north of the MBSA where one site, M-MDEQ003, was sampled in this habitat. *AaAx*SL often occurs in small patches (some as small as 50 m by 50 m) and may not have been evident on the aerial imagery and therefore could not be mapped as discrete units. *Seringea exastia* (T) and *Seringea* ? *exastia* (? T*)*, *Triodia veniciae* (P1) and *Aristida jerichoensis* var. *subspinulifera* (P3) were located in this vegetation type and approximately 0.02 ha (<1%) of it is mapped within the Fortescue River ESA boundary and none of it is within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition ranking was Excellent and the main disturbances were from weeds and pastoral and exploration activities.

Vegetation type description	Associated species and species richness	Quadrats
Tall Sparse Shrubland of *Acacia aneura* (alliance) and *A. xiphophylla* with a Low Sparse Shrubland of *Eremophila cuneifolia* and a Sparse Hummock Grassland of *Triodia epactia* and/or *T. basedowii*	*Acacia aptaneura*, *A. paraneura*, *A. pruinocarpa*, *A. tetragonophylla*, *Enneapogon polyphyllus*, *Eremophila latrobei* subsp. *filiformis*, *Eriachne mucronata*, *Hibiscus coatesii*, *Ptilotus obovatus*, *Senna glutinosa* subsp. *glutinosa*, *Sida* sp. dark green fruits (S. van Leeuwen 2260) The average species richness is 31.36 (+/- 9.48)	M-HR017, M-HR02, M-MDEQ003, M-MDEQ035, M-MDEQ073, M-MDEQ087, M-MDEQ095, M-MDEQ101, M-MDEQ102, M-TCQ04, M-XTC04



***AdEv*WL: *Acacia* and *Eucalyptus* Low Open Woodland**

This vegetation type occurs within the Fortescue River ESA and surrounds and ranges from scattered *Acacia distans* and / or *Eucalyptus victrix* trees with little to no understorey to a dense overstorey of *Acacia distans*. It has been mapped in places as a mosaic with *Bpo*FL, which occurs on clay pans, flow lines and pooling points of the Fortescue River. The photograph shows the bare flow line / pooling point with *Bpo*FL in the foreground and *AdEv*WL behind. The areas associated with the Fortescue River system are used to hold cattle during mustering because of the soft grasses and the water in the area, and during surveys in 2012, 2019 and 2020, many cattle were present in these areas. Many of the newly sprouting sedges and grasses in this area had been grazed to the base. *Helichrysum oligochaetum* (P1), *Teucrium pilbaranum* (P2), *Eragrostis crateriformis* and *Euphorbia australis* var. *glabra* (both P3), and *Goodenia* ? *lyrata* (? P3) have been recorded in this vegetation type. 2,595.70 ha (41.30%) of *AdEv*WL and 1,221.62 ha (71.54%) of *AdEv*WL / *Bpo*FL is mapped within the Fortescue River ESA boundary, while 1,316.57 ha (20.95%) of *AdEv*WL and 634.42 ha (37.15%) of *AdEv*WL / *Bpo*FL is mapped within the buffer of the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Very Good, and the main disturbances are current and historic cattle grazing. This area is used as a holding yard for cattle during mustering.

Vegetation type description	Associated species and species richness	Quadrats
Low Open Woodland to Low Woodland of *Acacia distans* and *Eucalyptus victrix* sometimes with a Tall Sparse Shrubland of *Acacia stenophylla* or *A. tetragonophylla* and a Shrubland to a Sparse Shrubland of *Duma florulenta*	*Abutilon fraseri* subsp. *fraseri*, *Acacia synchronicia*, *Bergia perennis* subsp. *obtusifolia*, *Cyperus iria*, *Eleocharis pallens*, *Eragrostis dielsii*, *Eulalia aurea*, *Fimbristylis microcarya*, *Schoenoplectiella dissachantha*, *Solanum cleistogamum*, *S. lasiophyllum*, *Sporobolus australasicus* The average species richness is 33.77 (+/- 15)	L-PSW04a, L-PSW05a, M-MDEQ017 M-MDEQ030, M-MDEQ034, M-MDEQ038, M-MWQ02, M-MWQ11, M-MWQ13, M-MWQ14, M-MWQ16, M-MWQ17, M-MWQ19, M-MWQ21, M-MWQ22, M-MWQ26, M-MWQ28, M-MWQ33, M-MWQ37, M-MWQ38, M-MWQ43, M-MWQ45, M-MWQ46, M-MWQ48, M-MWQ49, M-MWQ52, M-MWQ53, M-MWQ54, M-MWQ55, M-MWQ56, M-MWQ57



ASL (1): *Acacia* Tall Sparse to Open Shrubland

This vegetation type occurs on hardpan plains mostly upslope of the Fortescue River and mostly between vegetation types AWL (1) and *AdEv*WL. Five *ecologia* (2008d) quadrats grouped in this vegetation type with one Biota (2012b) quadrat, which is located in mulga banding to the south-east of the MBSA and five McKenzie et al. (2009) quadrats that were sampled approximately 120 km to the south-east of the MBSA. This vegetation type is most likely an altered form of *AxAs*SL which is the next group in the dendrogram. Quadrats from ASL (1) were lacking the grass species *Eragrostis xerophylla* as well as a few perennial herb species which were common in *AxAs*SL. *Seringea exastia* (T) and *Seringia* ?*exastia* (?T), *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3) and *Hibiscus* sp. Mulga Downs (TOI) were located in this vegetation type. Approximately 116.26 ha (12.99%) of this vegetation type is mapped within the Fortescue River ESA boundary, and none of it is mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition ranking was Good and the main disturbances were from cattle (trampling and grazing), weeds and pastoral and exploration activities. Weed cover was generally high in these areas particularly **Cenchrus setiger* and **Vachellia farnesiana* and water bores were mainly found in this vegetation type contributing to increased grazing pressure and trampling.

Vegetation type description	Associated species and species richness	Quadrats
Tall Sparse to Open mixed Shrubland mainly of *Acacia synchronicia*, *A. tetragonophylla*, *A. xiphophylla* with a mixed Sparse Chenopod Shrubland mainly of *Sclerolaena densiflora*, *S. cuneata* and *S. costata* and Isolated mixed Tussock Grasses mainly of *Sporobolus australasicus*, *Enneapogon polyphyllus* and *Dactyloctenium radulans*	*Acacia aptaneura*, *Eremophila cuneifolia*, *Ptilotus exaltatus*, *Salsola australis* The average species richness is 10.4 (+/- 8.47)	B-KOE22-F, E-S01, E-S07, E-S08, E-S18, E-S21, PB-RHNE02, PB-RHNE04, PB-RHNE14, PB-RHNE17, PB-RHNW15.



ASL (2): *Acacia* Tall Shrubland

This vegetation type occurs on creek banks, minor drainage channels and floodplains. *Eucalyptus victrix* was scattered throughout the broad, channelled creek lines; however, there was little difference in the floristics of these different habitats and no clear separation in the dendrogram based on habitat e.g., minor creek, major creek or floodplain. Sites M-MDEQ083 and M-MDEQ 086 were both sampled in minor gullies but were mapped with vegetation type THG (1), as the gullies could not be distinguished on the imagery at tha scale the vegetation was mapped. *Seringea exastia* (T) and *Seringia* ?*exastia* (?T), *Triodia veniciae* (P1), *Goodenia nuda* (P4), *Rhynchosia bungarensis* (P4) and the potential P3 species *Aristida* ?*jerichoensis* subsp. *subspinulifera* were located in this vegetation type. None of it is mapped in the Fortescue River ESA boundary or within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Very Good. Weeds were often common in the understorey of drainage lines and floodplains and evidence of cattle grazing was also common on the floodplains.

Vegetation type description	Associated species and species richness	Quadrats
Mixed Tall *Acacia* Shrubland mainly of *Acacia tumida* var. *pilbarensis*, *A. pyrifolia* and *A. maitlandii* with a Sparse Tussock Grassland of *Themeda triandra* and Low Isolated Trees of *Corymbia hamersleyana* and / or *Eucalyptus victrix*	*Afrohybanthus aurantiacus*, *Arivela viscosa*, *Corchorus lasiocarpus* subsp. *lasiocarpus*, *Indigofera monophylla*, *Ptilotus exaltatus*, *Themeda triandra*, *Triodia epactia* The average species richness is 47.00 (+/- 10.23)	C-SUP15-F, M-HR013, M-HR06, M-MDEQ004, M-MDEQ007, M-MDEQ040, M-MDEQ042, M-MDEQ052, M-MDEQ059, M-MDEQ060, M-MDEQ071, M-MDEQ078, M-MDEQ083, M-MDEQ086, M-MDEQ092, M-MDW025, M-MDW050, M-MDW054, M-TCQ02, M-TCQ14, PB-RHNC13, PB-RHNW03



AWL (1): *Acacia* Low Woodland or Tall Shrubland

This vegetation type occurs on the stony washout flats. Using presence / absence data analysis, quadrats in this vegetation type grouped tightly; however, if the cover of the dominant stratum were to be analysed there would be two distinct groups – one in the vegetation bands and one in the open areas between the bands. Maia quadrats from AWL (1) grouped with Coffey (2010a and 2010b) quadrats which are located between 750 m and 6.9 km to the west and north-west of the MBSA. Three quadrats that grouped with AWL (2) have been moved to this vegetation type based on the dominant understorey species at each quadrat. These three quadrats are in bold in the table below. *Seringia* ? *exastia* (?T), *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) (P1), *Aristida jerichoensis* var. *subspinulifera* (P3), *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3), *Euphorbia australis* var. *glabra* (P3), *Goodenia nuda* (P4) and *Hibiscus* sp. ?Mulga Downs and *Hibiscus* sp. Mulga Downs. (TOI) were located in this vegetation type. Approximately 6.40 ha (0.09%) is mapped in the Fortescue River ESA boundary and none of it is mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition ranking was Very Good and the main disturbances noted were cattle (trampling and

Vegetation type description	Associated species and species richness	Quadrats
Low Woodland / Tall Shrubland to Low Isolated Trees / Shrubs of *Acacia aneura* (complex) with a mixed Low Sparse Shrubland mainly of *Dodonaea petiolaris*, *Eremophila forrestii* and *Abutilon otocarpum* and Isolated Low Trees of *A. pruinocarpa*	*Acacia aptaneura, A. aneura, *Bidens bipinnata*, *Cheilanthes sieberi* subsp. *sieberi*, *Chrysopogon fallax*, *Cucumis argenteus*, *Psydrax latifolia*, *Pterocaulon sphacelatum*, *Spermacoce brachystema* and *Sporobolus australasicus* Average species richness is 31.55 (+/- 10.91)	**C-INV018-F**, **E-S05**, **E-S11**, E-S17, E-S22, M-HR05, M-MDEQ009, M-MDEQ026, M-MDEQ028, M-MDEQ045, M-MDEQ048, M-MDEQ056, M-MDEQ058, M-MDEQ062, M-MDEQ066, M-MDEQ069, M-MDEQ070, M-MDEQ072, M-MDEQ074, M-MDEQ076, M-MDEQ079, M-MDEQ080, M-MDEQ081, M-MDEQ085, M-MDEQ088, M-MDEQ089, M-MDEQ093, M-MDEQ094, M-MDEQ099, M-MDEQ107, M-MDEQ109, M-MDEQ110, M-MDEW003, M-MDW018, M-MDW033, M-MDW035, M-MDW038



AWL (2): *Acacia* Low Woodland or Tall Shrubland

This vegetation type occurs on hardpan and stony plains close to the Fortescue River and can occur in groves. This is most evident in the south-western corner of Area 1 and the south-eastern section of Area 2. It is similar to AWL (1) which also occurs in groves; however, AWL (2) contains *Acacia synchronicia* with *Acacia aneura* (complex) in the intergroves. AWL (1) is mapped mostly to the north of the Fortescue river, while AWL (2) is mapped mainly to the south of the river. *Teucrium pilbaranum* (P2), *Euphorbia australis* var. *glabra* (P3) and *Hibiscus* sp. Mulga Downs (TOI) were recorded in this vegetation type. Maia quadrats from AWL (2) grouped with Coffey quadrats (2010a and 2010b), which are located to the west and north-west of the MBSA. Approximately 362.66 ha (7.44%) of this vegetation type is mapped within the boundary of the Fortescue River ESA and none of it is mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition ranking was Very Good and the main disturbances were from cattle (trampling and grazing), weeds and pastoral activities.

Vegetation type description	Associated species and species richness	Quadrats
Low Woodland / Tall Shrubland to Low Isolated Trees / Tall Shrubs of *Acacia aneura* (complex) *A. synchronicia* and *A. tetragonophylla* with a mixed Low Sparse Shrubland mainly of *Solanum lasiophyllum*, *Abutilon otocarpum* and *Sida platycalyx* and a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of *Sporobolus australasicus*, *Enneapogon cylindricus* and *Aristida contorta*	*Abutilon otocarpum*, *Acacia aptaneura*, *A. pteraneura*, *Cheilanthes sieberi* subsp. *sieberi*, *Dodonaea petiolaris*, *Eremophila forrestii* subsp. *forrestii*, *Eremophila lanceolata*, *Eremophila latrobei* subsp. *filiformis*, *Grevillea berryana*, *Hakea lorea* subsp. *lorea*, *Maireana villosa*, *Psydrax latifolia*, *Sclerolaena cornishiana*, *S. costata*, *Trianthema triquetrum* The average species richness is 25.4 (+/- 11.59)	C-INV051-F, C-INV063-F, C-SUP21-F, E-S04, E-S12, E-S14, E-S15, E-S16, E-S24, M-MDW034, M-MDW041, M-MDW047, M-MWQ05, M-MWQ06, M-MWQ34, M-MWQ35, M-MWQ36, M-MWQ39, M-MWQ40, M-MWQ42, M-MWQ44



AWL (3): *Acacia* Low Woodland

This vegetation type occurs on broad drainage lines, drainage basins and hardpan and stony plains. Maia quadrats from AWL (3) grouped with three Coffey (2010a and 2010b) quadrats which are located approximately 500 m to 1.2 km to the north-west of the MBSA. One quadrat that grouped with this vegetation type has been moved to MSL (1), as it was located on a calcrete rise at Mulga West (Area 2) and the dominant species was *Triodia wiseana*. *Teucrium pilbaranum* (P2), and *Euphorbia australis* var. *glabra* (P3) were located in this vegetation type. Approximately 2.25 ha (0.06%) is mapped within the Fortescue River ESA boundary and 206.86 ha (5.22%) is mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition ranking was Good and the main disturbances were from cattle (trampling and grazing), erosion, weeds and pastoral and exploration activities.

Vegetation type description	Associated species and species richness	Quadrats
Low Woodland of *Acacia aneura* (complex) mainly *Acacia aptaneura*, *A. aneura* and *A. incurvaneura* with a mixed Tall Shrubland mainly of *A. synchronicia*, *A. tetragonophylla* and *Hakea lorea* subsp. *lorea* with a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of *Sporobolus australasicus*, *Enneapogon cylindricus* and *Aristida contorta*	*Abutilon otocarpum*, *Arivela viscosa*, *Boerhavia coccinea*, *Chrysopogon fallax*, *Eriachne mucronata*, *Grevillea berryana*, *Hibiscus sturtii* var. *campylochlamys*, *Ipomoea muelleri*, *Maireana villosa* The average species richness is 18.36 (+/- 9.49)	C-INV016-F, C-INV031-F, C-INV032-F, M-MDEQ020, M-MDEQ065, M-MDW003, M-MDW005, M-MDW012, M-MDW013, M-MDW014, M-MDW019, M-MDW040, M-MEN005, M-MEN006



***AxAs*SL: *Acacia* Tall Shrubland**

This vegetation type occurs mainly on hardpan and stony plains. *Acacia xiphophylla* and *A. synchronicia* generally co-occur but only one of them occurs in some areas. Historic grazing in the area may have led to the unpalatable *Sclerolaena* species and *Acacia synchronicia* becoming dominant in this vegetation type. Maia quadrats from *AxAs*SL grouped with six Coffey (2010a and 2010b) quadrats which are located approximately 6 km to the west and 2 km to north-west of the MBSA. *Teucrium pilbaranum* (P2), *Euphorbia australis* var. *glabra*, *Glycine falcata*, *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727), *Rostellularia adscendens* var. *latifolia* and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) all P3, *Goodenia nuda* and *Bulbostylis burbidgeae*-like (atypical form) (P4) were located in this vegetation type. Approximately 12.56 ha (0.18%) of it is mapped within the Fortescue River ESA boundary and 439.42 ha (6.14 %) was mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition ranking was Good and the main disturbances were from cattle (trampling and grazing), weeds and pastoral and exploration activities. Areas mapped as *AxAs*SL have been used for mustering cattle because they are close to the river, the homestead and to temporary holding yards.

Vegetation type description	Associated species and species richness	Quadrats
Tall Sparse Shrubland of *Acacia xiphophylla* and / or *A. synchronicia* with a mixed Sparse Chenopod Shrubland mainly of *Sclerolaena cuneata*, *S. bicornis*, *S. cornishiana* and a Sparse Tussock Grassland of *Eragrostis xerophila*	*Aristida contorta*, *Arivela viscosa*, *Eriachne benthamii*, *Portulaca oleracea*, *Sporobolus australasicus* The average species richness is 17.95 (+/- 6.61)	C-INV019-F, C-INV101-F, C-SUP22-F, C-SUP25-F, C-SUP27-F, C-SUP29-F, M-MDEQ006, M-MDEQ010, M-MDEQ011, M-MDEQ013, M-MDEQ019, M-MDEQ023, M-MDEW001, M-MDW001, M-MDW010, M-MDW016, M-MDW042, M-MEN002, M-MWQ07, PB-PE05, PB-RHNW05, PB-RHNW06



***Bpo*FL: *Bergia* Forbland**

This vegetation type occurs within the Fortescue River ESA on ephemeral claypans and broad flowlines of the Fortescue River. Three Maia quadrats and two Pinder et al. (2017) sites are on the Gnalka Gnoona claypan, and three Maia quadrats and one Pinder et al. (2017) site are located on flow lines / pooling points of the Fortescue River. The remaining Pinder et. al. (2017) site is in a claypan approximately 26 km south-east of the MBSA. Scattered *Eucalyptus victrix* and *Acacia stenophylla* small trees and large shrubs occur across the claypans and the short-lived perennial / annual species *Tecticornia verrucosa* occasionally grows in high numbers when the water level recedes following inundation, and it is a high indicator species for the vegetation type. No conservation significant flora were recorded in *Bpo*FL, while *Helichrysum oligochaetum* and *Rhodanthe ascendens* (both P1) and *Eragrostis crateriformis* (P3) have been recorded in areas mapped as the mosaic *AdEv*WL / *Bpo*FL. About 331.56 ha (99.45%) of *Bpo*FL and 1,221.62 ha (71.54%) of *AdEv*WL / *Bpo*FL lies within the Fortescue River ESA boundary and 333.38 ha (100%) of *Bpo*FL and 634.42 ha (37.15%) of *AdEv*WL / *Bpo*FL lies within the buffer of the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley'.

The average vegetation condition was rated as Very Good and the main disturbance was from cattle (grazing).

Vegetation type description	Associated species and species richness	Quadrats
Claypans mostly bare of vegetation but with scattered *Bergia perennis* subsp. *obtusifolia* and mixed tussock grasses mainly of *Eriachne benthamii* and *Sporobolus mitchellii*	*Acacia stenophylla*, *Alternanthera angustifolia*, *A. nodiflora*, *Duma florulenta*, **Echinochloa colona*, *Eragrostis dielsii*, *Eucalyptus victrix*, *Mimulus gracilis*, *Tecticornia verrucosa*, *Trianthema triquetrum* The average species richness is 17.66 (+/- 9.62)	L-PSW04b, M-MDEQ022, M-MDEQ025, M-MWQ20, M-MWQ51, M-XMDE01, M-XMDE02, P-FV08A-F, P-FV14A-F, P-FV17A-F, P-FV19A-F



***EfEb*TG: *Eriachne* Tussock Grassland**

This vegetation type is mapped on slightly raised claypans. Three of the seven Maia sites sampled in this vegetation type (underlined) were outside the MBSA but within the Priority 1 "Freshwater Claypans of the Fortescue Valley" PEC buffer to the south-east of the MBSA. Three Coffey (2010a and 2010b) quadrats from this group are located between the MEIOP and proposed bore field. Seven Pinder et. al. (2017) quadrats grouped with Maia quadrats from this vegetation type. Four of these are in the same system approximately 20 km to the south-east of the MBSA and the other is approximately 6 km to the south of the MBSA. It forms part of the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley" and is dominated by tussock grasses. Generally, *Eucalyptus victrix* was scattered throughout the grasslands on slightly raised areas within the claypans. *Calotis squamigera* (P1) and *Euphorbia australis* var. *glabra* (P3) were located in this vegetation type. Approximately 539.08 ha (54.31%) is mapped in the Fortescue River ESA boundary and 123.63 ha (12.45%) is within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Very Good and the main disturbance was from cattle (grazing and vegetation trampling).

Vegetation type description	Associated species and species richness	Quadrats
Tussock Grassland of *Eriachne flaccida* and *E. benthamii* with Isolated Trees of *Eucalyptus victrix*	*Acacia tetragonophylla*, *Alternanthera nodiflora*, *Arivela viscosa*, *Eragrostis dielsii*, *E. tenellula*, *Gomphrena affinis* subsp. *pilbarensis* The average species richness is 12.71 (+/- 7.2)	C-SUP23-F, C-SUP24-F, C-SUP26-F, M-MDEQ005, M-MDEQ057, M-MDEQ105, M-MDEQ108, M-MDW008, M-MDW009, M-MWQ08, PB-PE17, PB-RHNW18, P-FV02A-F, P-FV03A-F, P-FV09A-F, P-FV13A-F, P-FV15A-F, P-FV16A-F, P-FV39A-F



***Ev*WL: *Eucalyptus* Low Open Woodland**

This vegetation type occurs on the Fortescue River and is similar to *AdEv*WL but tends to occur further to the west where the river flow line is more defined. As with *AdEv*WL these areas are used to hold cattle during mustering and cattle water points and bores were often located close to *Ev*WL. Maia quadrats grouped with six Pinder et al. (2017) sites. One site was from within the MBSA and the remainder were all from the Fortescue river system ranging from approximately 120 km to the south-east of the MBSA to approximately 18 km north-west of the MBSA. *Helichrysum oligochaetum* (P1), *Teucrium pilbaranum* (P2), *Euphorbia australis* var. *glabra*, *Glycine falcata*, *Iotasperma sessilifolium Rostellularia adscendens* var. *latifolia* (all P3), *Bulbostylis burbidgeae*-like (atypical form) and *Goodenia nuda* (P4) have been recorded in this vegetation type. Approximately 36.68 ha (3.61%) is mapped within the Fortescue River ESA boundary, while 97.68 ha (9.61%) is mapped within the buffer of the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Good, and the main disturbances are current and historic cattle grazing, weeds and exploration activities.

Vegetation type description	Associated species and species richness	Quadrats
Low Open Woodland of *Eucalyptus victrix* and +/- *Acacia distans* with a Tussock Grassland of *Eulalia aurea*, *Eriachne benthamii* and *E. flaccida* and an Open Shrubland of *Melaleuca glomerata*	*Acacia stenophylla*, *Centipeda minima*, *Cyperus iria*, *Duma florulenta*, *Eragrostis setifolia*, *Mimulus gracilis*, *Operculina aequisepala*, *Panicum laevinode*, *Rhynchosia minima*, *Rostellularia adscendens* var. *clementii*, *Sida spinosa*, *Teucrium pilbaranum*, *T. racemosum* The average species richness is 27 (+/- 7.33).	M-MDW032, M-MDW043, M-MDW044, P-FV38A-F, P-FV39B-F, P-FV41A-F, P-FV46A-F, P-FV47A-F, P-P40A-F



MSL (1): Mixed Mid Shrubland

This vegetation type occurs on low rises within the Fortescue River and surrounds and has been divided into two sub-units, MSL (1) and MSL (2). MSL (1) is interspersed within vegetation type *AdEv*WL and areas of MSL (1) that are higher in the landscape are dominated by *Triodia epactia,* while those in lower areas are dominated by tussock grasses. Maia's MSL (1) quadrats grouped with two McKenzie et al. (2009) quadrats. One is located approximately 140 km to the south-west of the MBSA in the Marsh Landsystem and the other is approximately 40 km to the south-east of the MBSA in the western extent of the Marsh Landsystem. *Teucrium pilbaranum* (P2) and *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (both P3) have been recorded in this vegetation type. Approximately 31.84 ha (5.37%) lies within the Fortescue River ESA boundary and 70.12 ha (11.83%) lies within the buffer for the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley'.

The average vegetation condition rating was Very Good and the most common and obvious disturbance was from cattle. Many of the sprouting grasses had been recently grazed. These areas are often used as a temporary holding yard for cattle, as they are close to but rarely inundated by water.

Vegetation type description	Associated species and species richness	Quadrats
Sparse to Open mixed Shrubland mainly of *Melaleuca glomerata*, *Acacia tetragonophylla* and *A. synchronicia* with a mixed Tussock grassland mainly of *Eragrostis pergracilis*, *Eriachne benthamii* and **Cenchrus setiger* or occasionally with a Hummock Grassland of *Triodia epactia* and Low Isolated Trees of *Eucalyptus victrix*	*Acacia distans*, *Centipeda minima* subsp. *macrocephala*, *Eremophila longifolia*, *Eulalia aurea*, *Sporobolus australasicus* The average species richness is 25.54 (+/- 8.66)	B-KOE20-F, M-MDEQ008, M-MDEQ027, M-MDEQ031, M-MDEQ033, M-MDEQ036, M-MDEQ041, M-MDEQ047, M-MDEQ104, M-MDEQ106, M-MWQ15, M-MWQ23, PB-RHNE15, PB-RHNW04



MSL (2): Mixed Tall Shrubland

This vegetation type occurs on calcrete tables within the Fortescue River ESA and occurs higher in the landscape, and often with a surface layer of calcrete, than sub-unit MSL (1). One quadrat (M-MWQ27) grouped as an outlier from this vegetation type and a second (M-MDW011_grouped with AWL (3) but have been included based on the dominance of *Melaleuca glomerata* in the tall shrub stratum. No regional quadrats grouped with this vegetation type. The vegetation in areas with a dominant ground cover of *Triodia epactia* is often less grazed than areas with *Eragrostis desertorum*. *Teucrium pilbaranum* (P2), *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), *Euphorbia australis* var. *glabra* (P3) and *Rostellularia adscendens* ? var. *latifolia* (?P3) have been recorded in this vegetation type. Approximately 165.16 ha (6.58%) lies within the Fortescue River ESA boundary and 112.73 ha (4.49%) lies within the buffer for the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley'.

Vegetation type description	Associated species and species richness	Quadrats
Sparse to Open mixed Tall Shrubland mainly of *Acacia synchronicia*, *A. tetragonophylla*, and *Melaleuca glomerata* over a mixed Low Shrubland mainly of *Indigofera monophylla*, *Solanum lasiophyllum* and *Stemodia grossa* and either a Sparse Tussock grassland of *Eragrostis desertorum* or a *Hummock* Grassland of *Triodia epactia*	*Acacia sclerosperma* subsp. *sclerosperma*, *Eremophila longifolia*, *Eulalia aurea*, *Euphorbia australis* var. *subtomentosa*, *Euphorbia biconvexa*, *Evolvulus alsinoides* var. *villosicalyx*, *Scaevola spinescens*, *Sclerolaena cornishiana* *Sida fibulifera*, *Sporobolus australasicus*, *Triodia wiseana* The average species richness is 36.54 (+/- 6.68)	M-MDEQ012, M-MDEQ014, M-MDEQ024, **M-MDW011**, M-MWQ01, M-MWQ03, M-MWQ09, M-MWQ10, M-MWQ12, M-MWQ18, M-MWQ25, **M-MWQ27**, M-MWQ31, M-MWQ47, M-MWQ50,



MTG (1): Mixed Tussock Grassland

This vegetation type is mapped in heavily grazed minor drainage areas and cracking clay floodplains close to the Mulga Downs homestead and holding yards. Cattle were frequently noted in these areas and the ground was often trampled and many of the grass species had been heavily grazed. Many weed and unpalatable species were recorded in this vegetation type. Maia quadrats from MTG (1) grouped with three Coffey (2010a and 2010b) quadrats which are located approximately 6 km to the west and 3.2 km to north-west of the MBSA. *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) and *Goodenia nuda* (P4) were located in this vegetation type. None of it is mapped within the Fortescue River ESA boundary or within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

Vegetation condition was rated as Good due to heavy and apparently continuous grazing from cattle.

Vegetation type description	Associated species and species richness	Quadrats
Mixed Tussock Grassland mainly of *Eragrostis xerophila*, *Eulalia aurea* and **Cenchrus setiger* with a mixed Tall Sparse Shrubland mainly of *Acacia coriacea* subsp. *pendens*, A. *tetragonophylla* and *A. synchronicia* with a Low mixed Sparse Shrubland mainly of *Pluchea rubelliflora, Pterocaulon sphacelatum* and *Salsola australis*	*Amaranthus cuspidifolius*, *Atalaya hemiglauca*, **Cenchrus ciliaris*, *Chrysopogon fallax*, *Eucalyptus victrix*, **Flaveria trinervia*, *Hakea lorea*, *Pluchea dunlopii* and **Vachellia farnesiana* The average species richness is 29.83 (+/- 6.34)	C-INV012-F, C-INV065-F, C-SUP30-F M-MDEQ015, M-MDEQ016, M-MDW039



MTG (2): Mixed Tussock Grassland

This vegetation type occurs mainly on crabhole plains and hardpan and stony plains close to the Fortescue River. *Teucrium pilbaranum* (P2), *Euphorbia australis* var. *glabra* and *Glycine falcata* (both P3) and *Rostellularia adscendens* ? var. *latifolia* (?P3) were located in this vegetation type. Approximately 23.73 ha of it (7.59%) is mapped within the Fortescue River ESA boundary, while none of it is mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Very Good. Grazing was evident in these areas and weeds were often common throughout.

Vegetation type description	Associated species and species richness	Quadrats
Sparse to Open mixed Tussock Grassland mainly of *Eriachne benthamii*, *Aristida latifolia* and **Cenchrus setiger* with a Sparse mixed Shrubland mainly of *Acacia synchronicia*, *A. tetragonophylla*, *A. distans* with Low Isolated Trees of *Eucalyptus victrix*	*Acacia victoriae*, *Eremophila longifolia*, *Evolvulus alsinoides* var. *villosicalyx*, *Ptilotus exaltatus*, *Rhynchosia minima*, *Sida fibulifera*, *S. rohlenae* subsp. *rohlenae* The average species richness is 33.83 (+/- 8.93)	M-MDW006, M-MDW007, M-MWQ04, M-MWQ30, M-MWQ32, M-MWQ24



MTG (3): Mixed Tussock Grassland

This vegetation type occurs mainly on gilgai and stony plains at Mulga West and the north-western section of Mulga East. Two McKenzie et al. (2009) quadrats grouped with this vegetation type and they are located about 39 km to the north-west of the MBSA. *Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3) was located in this vegetation type. None of MTG (3) is mapped within the Fortescue River ESA boundary, while 194.52 ha (23.36%) is mapped within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Good. Signs of heavy grazing were evident in these areas and weeds were often common throughout.

Vegetation type description	Associated species and species richness	Quadrats
Sparse to Open mixed Tussock Grassland mainly of *Eragrostis xerophylla*, *Eriachne benthamii*, and *Astrebla lappacea* with a mixed Forbland, mainly of *Stemodia kingii*, *Operculina aequisepala* and *Cullen cinereum* with Isolated shrubs of *Acacia synchronicia* or *Vachellia farnesiana*	*Alysicarpus muelleri*, *Arivela viscosa*, *Gomphrena kanisii*, *Portulaca oleracea*, *Ptilotus gomphrenoides*, *Sida sp. Supplejack Station* (T.S. Henshall 2345), *Sporobolus australasicus* The average species richness is 17.8 (+/- 4.21)	M-MDEW002, M-MDW017, M-MEN003, PB-PE01, PB-PE03



THG (1): *Triodia* Hummock Grassland

This vegetation type occurs on the low rolling and steeper hills of the MBSA. Large areas in the north-western section of the MBSA had been burnt in 2012 and small areas had also been burnt within 12 months of the August and September 2019 surveys. The dominant spinifex in these recently burnt areas tended to be *Triodia epactia*. Many of the understorey species in the recently burnt sites were indicative of the burn history rather than the vegetation type. The *Acacia* species recorded in the mixed mid stratum of T**HG** (1) often varied. The minor drainage channels between the low rolling hills were often dominated by the *Acacia* species that were dominant in the surrounding hills or by *Acacia montecola* or *A. maitlandii* in thin but dense groves. *Seringea exastia* (T) and *Seringia* ?*exastia* (?T), *Triodia veniciae* (P1), *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), *Triodia basitricha* (P3), *Bulbostylis burbidgeae* and *Goodenia nuda* (P4) plus *Aristida* ?*jerichoensis* var. *subspinulifera* (?P3) were located in this vegetation type. None of this vegetation is mapped within the Fortescue River ESA boundary or within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

Average vegetation condition was rated as Excellent and the main disturbances were exploration tracks and drill pads.

Vegetation type description	Associated species and species richness	Quadrats
Mixed Hummock Grassland mainly of *Triodia basedowii*, *Triodia brizoides* and *T. vanleeuwenii* with a Tall Sparse Shrubland of mixed *Acacia* species mainly *Acacia atkinsiana*, *A. maitlandii*, *A. ancistrocarpa* with Low Isolated Trees of *Eucalyptus leucophloia* subsp. *leucophloia* +/- *Corymbia hamersleyana*	*Acacia adoxa* var. *adoxa*, *A. ancistrocarpa*, *A. bivenosa*, *A. tenuissima*, *Corchorus lasiocarpus* subsp. *lasiocarpus*, *Goodenia stobbsiana*, *Hakea lorea* subsp. *lorea*, *Indigofera monophylla*, *Ptilotus calostachyus*, *Senna glutinosa* subsp. *glutinosa*, *S. glutinosa* subsp. *pruinosa*, *Sida* sp. Pilbara (A.A. Mitchell PRP 1543), ***Triodia basitricha* (P3)** and *T. epactia* The average species richness is 27.90 (+/- 9.40)	C-INV007-F, C-INV041-F, C-INV044-F, C-INV046-F, C-INV047-F, C-INV100-F, M-HR011, M-HR015, M-HR019, M-HR03, M-HR07, M-MDEQ001, M-MDEQ002, M-MDEQ018, M-MDEQ029, M-MDEQ043, M-MDEQ044, M-MDEQ051, M-MDEQ053, M-MDEQ054, M-MDEQ055, M-MDEQ061, M-MDEQ063, M-MDEQ064, M-MDEQ067, M-MDEQ075, M-MDEQ077, M-MDEQ082, M-MDEQ084, M-MDEQ090, M-MDEQ091, M-MDEQ096, M-MDEQ098, M-MDEQ103, M-MDESH001, M-MDHREK001, M-MDW020, M-MDW023, M-MDW028, M-MDW031, M-MDW055, M-MDW057, M-MDWSH001, M-TCQ01, M-TCQ03, M-TCQ09, M-XTC17, M-XTC18



THG (2): *Triodia* Hummock Grassland

This vegetation type occurs mainly in the transitional zone between the mulga vegetation type AWL (1) and THG (1), which occurs on the hills. It also occurs on lower ironstone hills within AWL (1). THG (2) appears to be widespread where the Murrays Hill tenement used to be, as seven of the 24 sites assessed by *ecologia* grouped within this vegetation type. Seven Coffey sites also grouped with THG (2) and they are located between Area 1 (Mulga Downs East) and Area 2 (Mulga Downs West). *Seringea exastia* (T) and *Seringia* ?*exastia* (?T), *Triodia veniciae* (P1), *Triodia basitricha* (P3) and the potential P3 species *Aristida* ? *jerichoensis* subsp. *subspinulifera* were located in this vegetation type. None of it is mapped within the Fortescue River ESA boundary or within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

The average vegetation condition was rated as Very Good and the main disturbances were exploration tracks and drill pads.

Vegetation type description	Associated species and species richness	Quadrats
Mixed Hummock Grassland mainly of *Triodia basedowii*, *T. epactia* and *T. vanleeuwenii* with a Sparse mixed Shrubland mainly of *Acacia aneura*, *A. aptaneura* and *A. atkinsiana* and Isolated Low Trees of *A. pruinocarpa* and / or *Eucalyptus leucophloia* subsp. *leucophloia*	*Acacia ancistrocarpa*, *Dodonaea petiolaris*, *Hakea lorea* subsp. *lorea*, *Indigofera monophylla*, *Ptilotus calostachyus*, *Senna glutinosa* subsp. *glutinosa* The average species richness is 25.76 (+/- 10.05)	C-INV013-F, C-INV015-F, C-INV019a-F, C-INV020-F, C-INV053-F, C-INV061-F, C-INV066-F, E-S02, E-S03, E-S06, E-S09, E-S13, E-S19, E-S20, M-HR04, M-MDEQ032, M-MDEQ037, M-MDEQ039, M-MDEQ046, M-MDEQ050, M-MDEQ068, M-MDEQ097, M-MDEQ100, M-MDW022, M-MDW024, M-MDW026, M-MDW027, M-MDW029, M-MDW030, M-MDW036, M-MDW048, M-MDW049, M-MDW053, M-MDW056, M-MDW058, M-MDW21, M-XTC01, PB-PE06



***Tv*HG: *Triodia* Hummock Grassland**

This vegetation type occurs on low rolling hills and undulating stony plains with a surface layer of shale. The dominance of *Triodia veniciae* (P1) in the hummock grassland layer potentially makes this vegetation type conservation significant. Florabase records indicate that *Triodia veniciae* occurs on low shale hills which sit on the northern side of the Fortescue River and Fortescue Marsh (WAH, 1998 -). The shale hills can be seen on aerial imagery and they trend generally east-west between Mulga Downs Station and the Roy Hill mine area. *Triodia veniciae* (P1) is a dominant taxon in this vegetation type. None of it is mapped within the Fortescue River ESA boundary or within the buffer for the Priority 1 PEC "Freshwater Claypans of the Fortescue Valley".

Vegetation condition was rated as Excellent at all sites and no disturbances were recorded.

Vegetation type description	Associated species and species richness	Quadrats
Hummock Grassland of *Triodia veniciae* with Isolated Shrubs of *Acacia marramamba* and *A. atkinsiana*	*Acacia aneura* type A, *A. maitlandii*, *A. pruinocarpa*, *A. doreta*, *A. spondylophylla*, *Bulbostylis barbata*, *Cassytha capillaris*, *Codonocarpus cotinifolius*, *Eremophila latrobei* subsp. *filiformis*, *Eriachne mucronata*, *Gompholobium oreophilum*, *Grevillea wickhamii* subsp. *aprica*, *Sida* sp. Excedentifolia (J.L. Egan 1925), *Triodia epactia* Species richness is 6.66 (+/-3.05)	M-MDHRSH001, M-TCQ06, M-TCQ08,



6.3.2 Vegetation Condition

Vegetation condition in the MBMA is mostly Very Good (58.60%), while 23.59% is rated as Excellent and 17.19% as Good (**Maps 32 and 33, Section 10**). Approximately 0.62% of the MBMA is mapped as Degraded where it has been cleared for drill lines, access tracks, fence lines and existing infrastructure. Shapefiles for some of the areas cleared for exploration were supplied to Maia by HPPL in 2012, and they have been integrated into the vegetation mapping. Station tracks and some of the more recent clearing, have been digitised for this assessment; however, numerous drill lines have been cleared since 2012 and they have not all been digitised because of their cover / extent in the MBMA. The area mapped as Degraded is therefore an underestimate of these areas.

Additional information on vegetation condition in the MBMA is included in **Table 6.8**.

Table 6.8: Vegetation condition in the MBMA

Condition	Area (ha) / Cover (%)	Vegetation types	Comment
Excellent	14,045.31 / 23.59	*AaAx*SL, THG (1), *Tv*HG	The vegetation of the hills in the north-eastern section of Area 1 (Mulga East) and the northern section Area 2 (Mulga West) is generally in excellent condition, as there has been little to no exploration and cattle tend not to access these areas.
Very Good	34,881.13 / 58.60	*AdEv*WL, ASL (2), AWL (1), AWL (2), AWL (3), *Bpo*FL, Mosaic of *AdEv*WL / *Bpo*FL, MSL (1), MSL (2), THG (2)	Just over half of the mapped area is in Very Good condition. This rating is a result of historical and current grazing, exploration activities and large and numerous weed populations in these areas. The understorey of vegetation association AWL (1) contained large populations of the weed *Bidens bipinnata,* which was particularly dense in the shaded areas under mulga. There were also areas of surface soil erosion throughout AWL (1) particularly at Mulga West (Area 2). Large populations of the weed species *Cenchrus ciliaris*, *C. setiger*, *Bidens bipinnata* and *Malvastrum americanum* were frequently noted in the lower stratum of vegetation types ASL (2).
Good	10,230.49 / 17.19	ASL (1), *AxAs*SL, *Ev*WL, MTG (1), MTG (3)	Good condition vegetation is mostly around the Mulga Downs homestead and cattle yards. There are few to no understorey plants present and many grasses and low shrubs are grazed down by cattle. Large numbers of the weed *Vachellia farnesiana* are evident in the mid shrub layer and it is the dominant shrub species in areas around the Mulga Downs Homestead (in Area 1) and cattle yards and water bores at both Mulga Downs and Mt Florence stations (in Area 2, Mulga West).
Degraded	370.25 / 0.62	NA	The areas mapped as Degraded are those that have been cleared for exploration or station tracks, the exploration camp and small borrow areas and fence lines.
Total area mapped (ha) and cover (%): 59,527.18 ha and 100%.			

7 DISCUSSION

A discussion of the significance of the threatened and confirmed priority flora and the vegetation of the MBSA follows. Significance is assessed at regional and local scales (EPA, 2016b).

7.1 FLORA

7.1.1 Regional and Local Significance – Conservation Significant Flora

7.1.1.1 REGIONAL SIGNIFICANCE

The regional significance of the one threatened and 20 confirmed priority flora species that have been recorded in the MBSA to date is indicated by the current conservation listing for each species.

In 2020, *Seringia elliptica* (a commonly occurring and widespread Pilbara species (not listed as conservation significant)) was synonymised with *Seringia exastia* (a Kimberley species listed as threatened) under *Seringia exastia* (Binks et al., 2020). *Seringia exastia* is listed as a Critically Endangered Threatened species under the EPBC Act and the BC Act. However, a nomination has been made to delist it because there are no plausible significant threats to the species. However, until changes are officially made to the threatened species list, *S. exastia* is still legally listed as threatened flora. The combining of *S. elliptica* and *S. exastia* occurred in 2020, and as *S. elliptica* was not a significant species before 2020 its locations were not recorded on a GPS if the species was located during targeted flora surveys or when walking from site to site during quadrat surveys. However, *S. exastia* information was collected from any quadrats assessed in the MBSA before 2020 and from quadrats assessed and targeted flora surveys carried out for the project since its combination in 2020.

The WA distribution for each species is shown in **Table 7.1** and information is included on the bioregional and subregional spread of each species' records in the table.

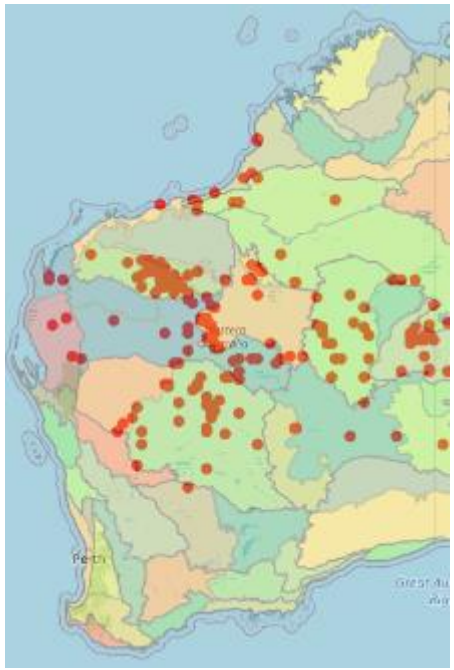
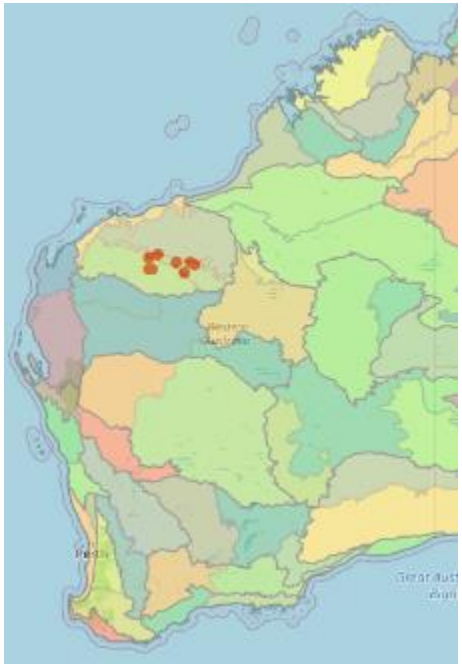
The Atlas of Living Australia (ALA, 2022) and Florabase (WAH, 1998-) indicate that the MBSA records for *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) and *Rhodanthe ascendens* are the only records for these species in the Fortescue subregion and they are therefore significant occurrences.

7.1.1.2 LOCAL SIGNIFICANCE

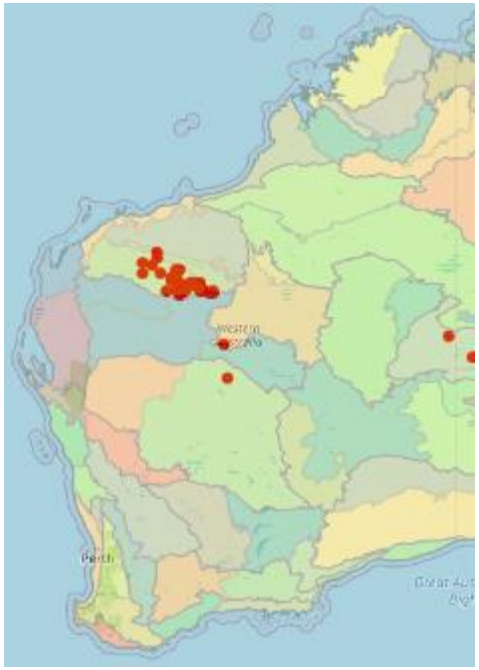
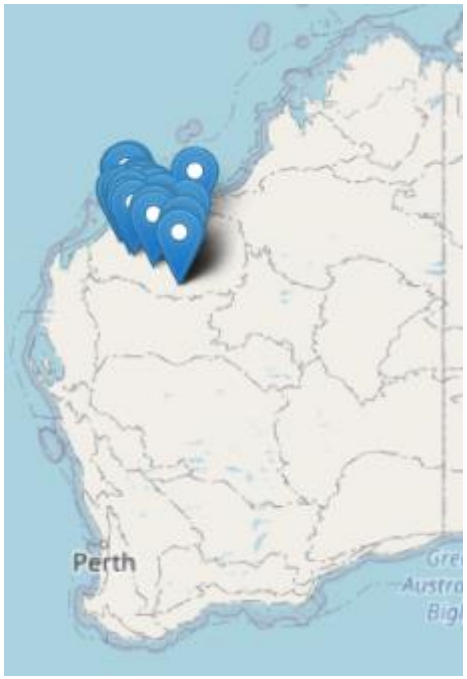
The number of plants of the confirmed and queried threatened species *Seringia exastia*, all of the confirmed priority species plus the *Hibiscus* sp. Mulga Downs located in the MSBA are listed in **Table 7.2** along with the number of populations known to Maia in the DSA and MBSA. The number of populations known to Maia that are in lands protected for conservation is also estimated.

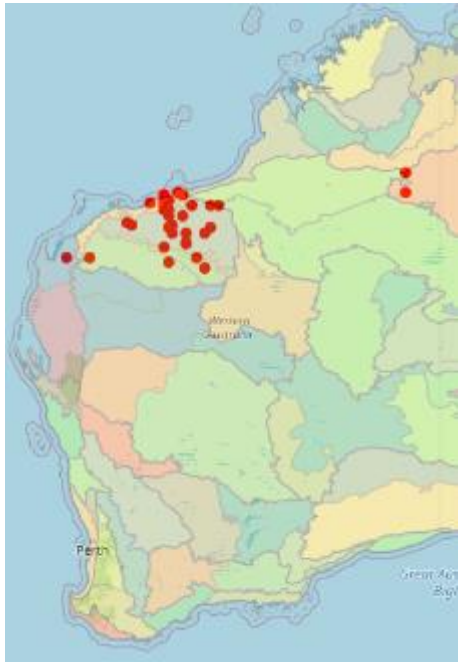
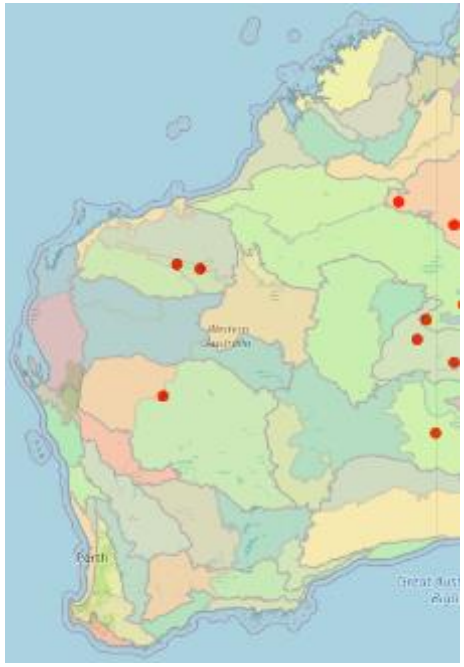
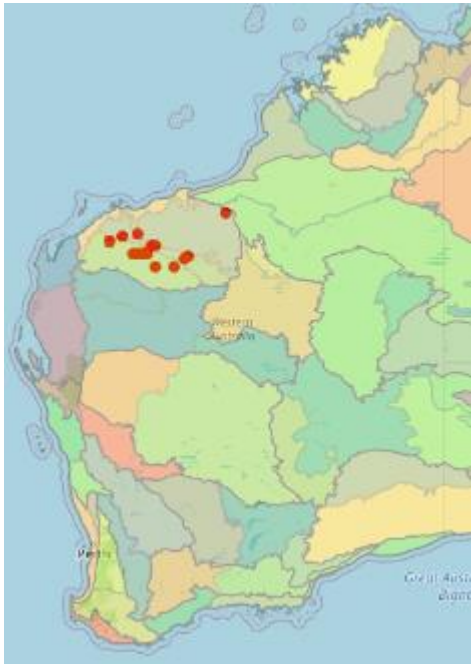
Based on the information in this table the *Calotis squamigera*, *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989), *Rhodanthe ascendens* and *Eragrostis* sp. Erect spikelets (P.K. Latz 2122) records in the MBSA are significant. There are fewer than 10 populations known to Maia for each of these species and only one population of each species occurs in the MBSA.

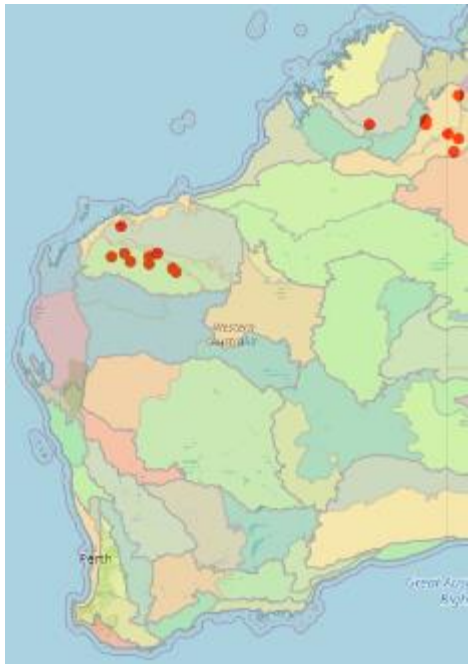
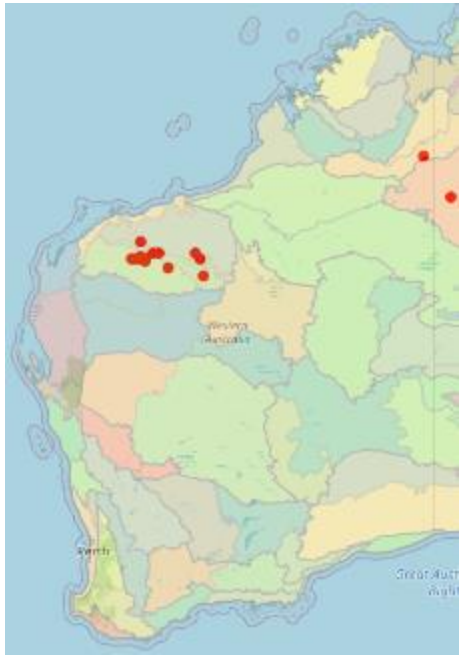
Table 7.1: Threatened and priority flora species - regional distribution

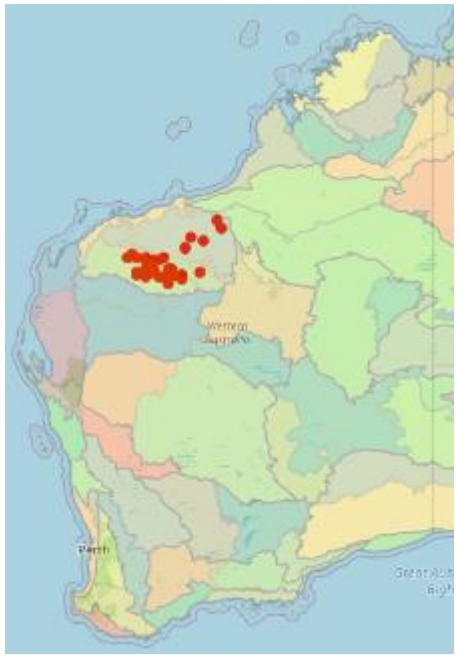
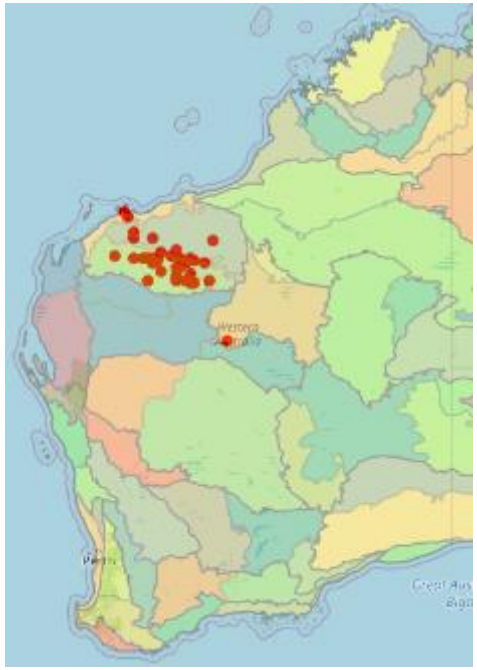
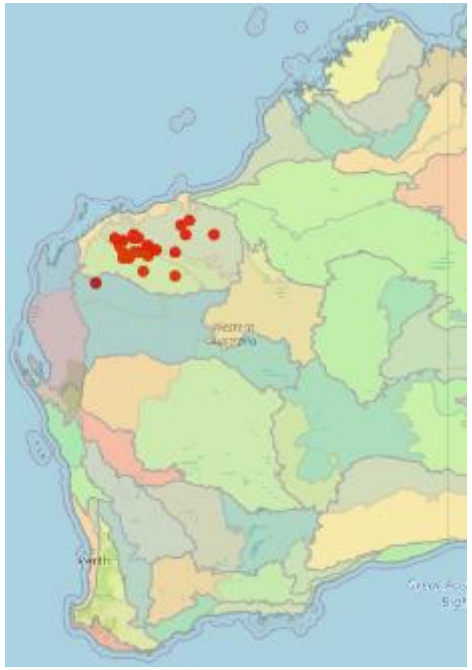
Seringia exastia (EPBC Act and BC Act, Threatened, Critically Endangered)	*Calotis squamigera* (Priority 1)	*Helichrysum oligochaetum* (Priority 1)
		
Seringia exastia has 293 records on Florabase (WAH, 1998-). The Atlas of Living Australia (ALA) has 309 records in WA and 316 records in the whole of Australia, and they are in 12 bioregions and 21 subregions (Atlas of Living Australia, 2022).	*C. squamigera* has 6 records on Florabase and 8 on Atlas of Living Australia for WA (76 records for all of Australia). The WA ALA records are in the Fortescue and Hamersley subregions of the Pilbara bioregion (WAH, 1998-).	*H. oligochaetum* has 12 records on Florabase and 18 on ALA. The ALA records are in the Gascoyne and Pilbara bioregions and in five subregions – Ashburton, Hamersley, Fortescue, Chichester and Roebourne; WAH, 1998-).
Figures produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.		

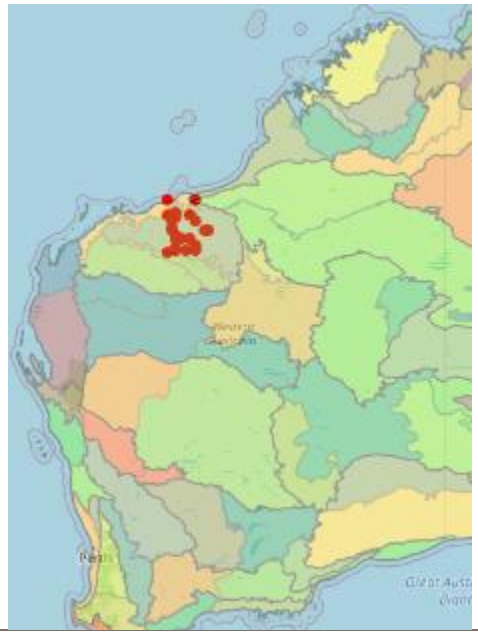
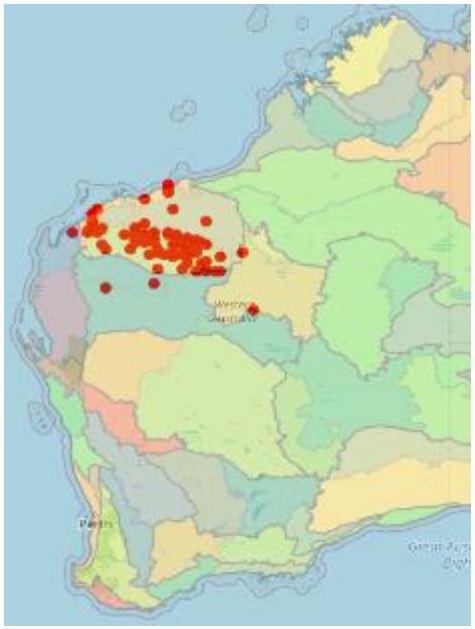
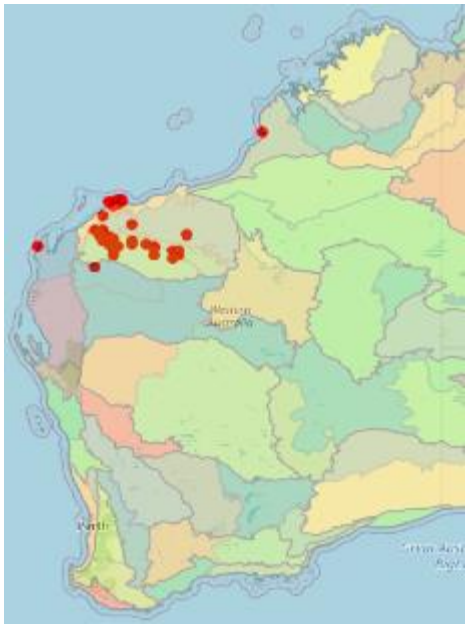
Josephinia sp. Woodstock (A.A. Mitchell PRP 989) (Priority 1)	*Rhodanthe ascendens* (Priority 1)	*Triodia veniciae* (Priority 1)
		
J. sp. Woodstock has 6 records on Florabase and ALA and they are located in the Pilbara and Gascoyne bioregions. Three records are in the Chichester, one in the Fortescue and two in the Ashburton subregions.	*R. ascendens* has 4 records on Florabase and 6 records on Atlas of Living Australia and the ALA records are in the Carnarvon and Pilbara bioregions and the Hamersley and Wooramel subregions.	*T. veniciae* has 24 records on Florabase and 21 records on ALA. The ALA records appear to be mostly in the Fortescue subregion, with one record in the Chichester subregion of the Pilbara bioregion.
Figures produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.		

Teucrium pilbaranum (Priority 2)	*Aristida jerichoensis* var. *subspinulifera* (Priority 3)	*Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (Priority 3)
		
T. pilbaranum has 21 records on Florabase and 26 on ALA: the ALA records are in the Chichester, Fortescue, and Hamersley subregions of the Pilbara bioregion.	*A. jerichoensis* var. *subspinulifera* has 42 records on Florabase and 36 records ALA in WA (2,105 records for all of Australia). The ALA records are in the Gascoyne, Murchison and Pilbara bioregions and five subregions – Hamersley, Fortescue, Augustus, Carnegie and Eastern Murchison.	*D.* sp. Hamersley Station (A.A. Mitchell PRP 1479) has 32 records on Florabase and 4 records on ALA. The Florabase records are all in the Pilbara bioregion (in the 4 subregions).
Figures produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.		Figure produced using Florabase (WAH, 1998-). Grey lines indicate bioregion boundaries. This species is not on ALA and therefore the Florabase distribution map is used.

Eragrostis crateriformis (Priority 3)	*Eragrostis* sp. Erect spikelets (P.K. Latz 2122) (Priority 3)	*Euphorbia australis* var. *glabra* (Priority 3)
		
E. crateriformis has 51 records on Florabase and 32 records on ALA for WA (67 records for whole of Australia). The records are in the Carnarvon, Great Sandy Desert, Tanami and Pilbara bioregions, and in 7 subregions including all four Pilbara subregions.	*E.* sp. Erect spikelets (P.K. Latz 2122) has 5 records on Florabase and 7 WA records on ALA (90 for the whole of Australia). The records are in the Great Sandy Desert, Murchison, Pilbara, Central Ranges and Tanami bioregions, in 5 subregions including two records in the Fortescue subregion.	*E. australis* var. *glabra* has 21 records on Florabase and 23 records on ALA. The ALA records are in the Pilbara bioregion and in the Chichester, Fortescue and Hamersley subregions.
Figures produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.		

Glycine falcata (Priority 3)	*Goodenia* sp. East Pilbara (Priority 3)	*Iotasperma sessilifolium* (Priority 3)
		
G. falcata has 13 records on Florabase and 12 records on ALA for WA (335 records for the whole of Australia). ALA WA records are in the Pilbara, Central Kimberley and Ord Victorian Plain bioregions, and in 5 subregions including the Fortescue, Hamersley and Chichester in the Pilbara.	*G.* sp. East Pilbara has 53 records on Florabase and 1 on ALA. The Florabase records are located mostly in the Pilbara bioregion in the Chichester, Fortescue and Hamersley subregions, with one in the Augustus subregion of the Gascoyne bioregion.	*I. sessilifolium* has 16 records on Florabase and 15 records on ALA in WA (97 records for the whole of Australia). The WA records are almost all in the Pilbara bioregion (in the Chichester, Fortescue and Hamersley subregions), while there is one record in the Ord Victorian Plain bioregion (South Kimberley Interzone).
Figure produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.	Figure produced using Florabase (WAH, 1998-). Grey lines indicate bioregion boundaries. This species is not on ALA and therefore the Florabase distribution map is used	Figure produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.

Rostellularia adscendens var. *latifolia* (Priority 4)	*Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (Priority 3)	*Triodia basitricha* (Priority 3)
		
R. adscendens var. *latifolia* has 42 records on Florabase and 33 records on ALA in WA (and 339 records for the whole of Australia). The WA records are only in the Pilbara bioregion in three of the four subregions – Hamersley, Fortescue and Chichester.	*T.* sp. Hamersley Station (M.E. Trudgen 11431) has 55 records on Florabase and 55 records on ALA. Almost all of the records are in the Pilbara bioregion, in all 4 subregions, while one record is in the Trainor subregion of the Little Sandy Desert bioregion.	*T. basitricha* has 32 records on Florabase and 35 records on ALA. The records are in three of the subregions of the Pilbara bioregion (Chichester, Fortescue, and Hamersley subregions) and one record is in the Ashburton subregion of the Gascoyne bioregion.
Figures produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.		

Bulbostylis burbidgeae (Priority 4)	*Goodenia nuda* (Priority 4)	*Rhynchosia bungarensis* (Priority 4)
		
B. burbidgeae has 35 records on Florabase and 37 records on ALA. The records are almost all in the Pilbara bioregion (Chichester, Fortescue and Roebourne subregions), while one record is in the McLarty subregion of the Great Sandy Desert bioregion.	*G. nuda* has 113 records on Florabase and 133 records on ALA. They are in the Gascoyne, Little Sandy Desert, Carnarvon and Pilbara bioregions (9 subregions including all four in the Pilbara).	*R. bungarensis* has 84 records on Florabase and 100 records on ALA. While they are in the Carnarvon, Gascoyne and Pilbara bioregions most records are in the Pilbara. The records are in 5 subregions including the Chichester, Hamersley and Roebourne in the Pilbara. ALA shows one record in the Dampierland bioregion, Pindanland subregion, which is not on Florabase.
Figures produced using Atlas of Living Australia (2022). Grey lines and shaded areas indicate bioregion and subregion boundaries.		

7.2 Land Systems and Pre-European Vegetation

The regional and local significance of the land systems and pre-European vegetation of the MBSA is discussed in the following sections.

7.2.1 Regional Significance

7.2.1.1 LAND SYSTEMS

The remaining Pilbara extent of the land systems occurring in the MBSA is presented in **Table 7.3**. Their mapped extents are shown on **Maps 34 and 35, Section 10**. Currently, between 99 and 100% remains in the Pilbara of each of the 12 land systems of the MBSA. Based on these remaining extents, their regional significance is low.

7.2.1.2 PRE-EUROPEAN VEGETATION

The remaining extent of the pre-European vegetation associations (VAs) and system associations (VSAs) of the MBSA is listed in **Table 2.1** and shown on **Maps 36 and 37, Section 10**. Currently, between 99 and 100% of the eight VAs and VSAs of the MBSA remains in the Pilbara bioregion, and also in the Chichester and Fortescue subregions. This is also true for the remaining extents in the Shire of Ashburton (GoWA, 2019). Based on these currently remaining extents, the regional significance of the VAs and VSAs of the MBSA is low.

7.2.2 Local Significance

Local significance of the land systems and VSAs occurring in the MBSA is based on the cover of each land system or VSA in the MBSA with respect to how much of its current Pilbara extent is in the MBSA.

7.2.2.1 LAND SYSTEMS

The percentage of the current Pilbara extent of nine of the 12 land systems that occur in the MBSA (**Table 7.4**) is less than 4% (from 0.04% (Wona) to 3.95% (Jamindie)), while 6.10% of the Hooley's current Pilbara extent occurs in it, 11.95% of the Coolibah and 15.32% of the of the Jurrawarrina. Using the data in **Table 7.4**, the most significant land systems in the MBSA are the Coolibah and Jurrawarrina, because they are mapped over 20.47% and 17.27% of it (column 5, **Table 7.4**), and 11.95% and 15.32% (respectively) of their current Pilbara extent occurs in the MBSA.

7.2.2.2 PRE-EUROPEAN VEGETATION

The percent of the current Pilbara extent of the VSAs in the MBSA (**Table 7.5**) ranges from 0.002% (VSA 175.2) to 66.71% (VSA 151.1). Using the data in **Table 7.5**, the most locally significant VSAs would be 175.3 and 562 because they are mapped over about one tenth and one quarter of the MBSA, and approximately 10% and 14% (respectively) of their current Pilbara extent is in the MBSA. Although about 67% of VSA 151.1's current Pilbara extent occurs in the MBSA it covers only approximately 3% of it, and while approximately 59% of the MBSA is mapped as VSA 29, this comprises about 4% of its Pilbara extent.

Table 7.2: Conservation significant flora species and *Hibiscus* sp. Mulga Downs located in the MBSA (all records, confirmed species only except for *Seringia* ? *exastia*)

Conservation significant species	Rank	Plants in MBSA							Populations		Distribution	Records within IUCN I-IV land (protected for cons)	ALA records (WA only)
		Maia - DS	Maia - TFS	Maia - PBs	Eco (2008d)	Lyons (2015)	DBCA (excl. Maia and other dups)	Total	WA (inc. MBSA)	MBSA			
Seringia exastia	T	7			4			11	NE	3	Much of WA, see Table 7.1	NE	309
Seringea ? *exastia*	?T		370					370	NE	6	As above	NE	NA
Calotis squamigera	P1		3					3	7	1	60 km x 245 km	None	8
Helichrysum oligochaetum	P1	2	7			1	2	12	17	4	300 km x 490 km	2	18
Josephinia sp. Woodstock (A.A. Mitchell PRP 989)	P1		1					1	4	1	60 km x 80 km	None	6
Rhodanthe ascendens	P1					1		1	4	1	320 km x 390 km	1	6
Triodia veniciae	P1	1,042	701					1,743	17	7	50 km x 140 km	None	21
Teucrium pilbaranum	P2	6,884	526	2,860,667			6	2,868,083	31	15	160 km x 180 km	2	26
Aristida jerichoensis var. *subspinulifera*	P3	3					11	14	51	6	475 km x 305 km	1	36
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	12	30					42	54	12	270 km x 370 km	5	4
Eragrostis crateriformis	P3		4					4	47	2	270 km x 1,280 km	2	32
Eragrostis sp. Erect spikelets (P.K. Latz 2122)	P3		1					1	6	1	530 km x 1,300 km	None	7
Euphorbia australis var. *glabra*	P3	2,579	667				100	3,346	59	22	220 km x 550 km	3	23
Glycine falcata	P3	1	121					122	21	11	85 km x 125 km	None	12
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3		3				20	23	36	2	150 km x 330 km	None	1
Iotasperma sessilifolium	P3					1		1	12	1	125 km x 300 km	None	15

Conservation significant species	Rank	Plants in MBSA							Populations		Distribution	Records within IUCN I-IV land (protected for cons)	ALA records (WA only)
		Maia - DS	Maia - TFS	Maia - PBs	Eco (2008d)	Lyons (2015)	DBCA (excl. Maia and other dups)	Total	WA (inc. MBSA)	MBSA			
Rostellularia adscendens var. *latifolia*	P3		2,831		10			2,841	64	9	260 km x 500 km	1	33
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3		522					522	89	2	490 km x 415 km	4	55
Triodia basitricha	P3	1,215					26	1,241	12	7	395 km x 170 km	None	35
Bulbostylis burbidgeae (inc atypical form)	P4		80					80	51	2	245 km x 450 km	3	37
Goodenia nuda	P4	132	262		3			397	238	18	680 km x 910 km	4	133
Rhynchosia bungarensis	P4	1						1	103	1	305 km x 760 km	35	100
Hibiscus sp. Mulga Downs	TOI	1	1,425					1,426	12	6	30 km x 5 km	None	None

Note: Rank – T = Threatened, P1 – P4 = Priority 1 to Priority 4, TOI = taxon of interest. MBSA = mine and borefield study area; ALA = Atlas of Living Australia (ALA, 2022). DS = detailed surveys, TFS = targeted flora surveys, PBs = population boundaries. Coincident/overlapping records were checked for and duplicates removed.

Note: CSF populations were determined by buffering records for a particular species in the desktop study area (DSA) by 500 m. Discrete, non-touching polygons are counted as separate populations. Populations were then intersected with DBCA Legislated Land and Waters shape files to determine how many occur in protected lands (column 13).

Table 7.3: Remaining Pilbara bioregion extent of the land systems of the MBSA

Column 1	2	3	4
Land system	Mapped extent in Pilbara bioregion (ha)	Current extent in the Pilbara bioregion (ha)	Remaining extent (%)
Bonney	74,940.55	74,940.55	100.00
Boolgeeda	961,637.09	955,011.33	99.31
Brockman	74,108.02	74,102.33	99.99
Calcrete	134,899.26	134,824.40	99.94
Coolibah	101,035.21	101,002.64	99.97
Hooley	59,081.14	59,081.14	100.00
Jamindie	192,227.16	192,227.16	100.00
Jurrawarrina	66,474.69	66,431.76	99.94
McKay	426,144.89	424,812.89	99.69
Newman	1,993,744.45	1,986,807.91	99.65
Urandy	132,478.92	132,268.14	99.84
Wona	194,821.41	194,792.87	99.99

Note: Column 2 - Pilbara IBRA 7 bioregion (DAWE, 2012) intersected with Land Systems (LS) (DPIRD, 2019a). Column 3 - LS shapefile (DPIRD, 2019a) intersected with NVE shapefile (DPIRD, 2020). Column 4 = Column 3 / Column 2 * 100. Hectares - rounded up or down to nearest whole numbers.

Table 7.4: Proportion of mapped and local extent of the land systems of the MBSA

Column 1	2	3	4	5
Land system	Current extent in Pilbara bioregion (ha)	Current extent in MBSA (ha)	Percent of current Pilbara extent in MBSA	Cover of land system in MBSA (%)
Bonney	74,940.55	76.31	0.10	0.13
Boolgeeda	955,011.33	8,973.42	0.94	15.22
Brockman	74,102.33	1,303.17	1.76	2.21
Calcrete	134,824.40	2,487.44	1.84	4.22
Coolibah	101,002.64	12,065.31	11.95	20.47
Hooley	59,081.14	3,603.15	6.10	6.11
Jamindie	192,227.16	7,594.05	3.95	12.88
Jurrawarrina	66,431.76	10,180.38	15.32	17.27
McKay	424,812.89	5,998.06	1.41	10.18
Newman	1,986,807.91	6,178.20	0.31	10.48
Urandy	132,268.14	410.76	0.31	0.70
Wona	194,792.87	69.92	0.04	0.12
Total	4,396,303.12	58,940.17		

Note: Column 2 - Pilbara IBRA 7 bioregion (DAWE, 2012) intersected with LS (DPIRD, 2019a) and intersected with Native Vegetation Extent (NVE) (DPIRD, 2020). Column 3 - LS shapefile (DPIRD, 2019a) intersected with NVE shapefile (DPIRD, 2020) and then with the MBSA. Column 4 = Column 3 / Column 2 * 100. Column 5 = Column 3 / total area of MSA * 100.

Table 7.5: Proportion of mapped and local extent of pre-European vegetation system associations of the MBSA

Column 1 Pre-European VSA	2 Current extent in the Pilbara bioregion (ha)	3 Current extent in the MBSA (ha)	4 Percentage of current Pilbara extent in the MBSA	5 Cover of VSA in the MBSA (%)
29	902,864.44	34,560.67	3.83	58.64
111.1	430,906.09	695.86	0.16	1.18
151.1	2,446.05	1,631.85	66.71	2.77
173.2	1,124,734.22	988.51	0.09	1.68
175.2	139,642.69	2.33	0.00	0.00
175.3	68,175.03	6,569.26	9.64	11.15
562	103,606.82	14,473.02	13.97	24.56
645.1	84,670.25	18.67	0.02	0.03
Total		58,940.17		

Note: VSA = vegetation system association. Column 2 data from GoWA (2019). Column 3 = pre-European vegetation mapping shapefile (DPIRD, 2019b) intersected with NVE shapefile (DPIRD, 2020) and then with the MBSA. Column 4 = Column 3 / Column 2 * 100. Column 5 = Column 3 / total area of MBSA * 100.

7.3 Vegetation Types Mapped in the MBSA

Eleven of the 19 vegetation types (and the one mosaic) mapped in the MBSA are considered locally significant for a number of reasons - ASL (2), AWL (1), AWL (2), AWL (3), *AdEv*WL, MSL (1), MSL (2), *EfE*bTG, *Bpo*FL, MTG (2) and *Tv*HG plus the mosaic of *AdEv*WL and *Bpo*FL.

Vegetation type ASL (2) is mapped along major and minor drainage lines and into adjacent flood plains of the MBSA. Drainage lines mapped as association ASL (2) harvest water from the surrounding hills in the north and north-eastern sections of the MBSA and feed it into the mulga and other vegetation downslope; therefore, any changes to the water flow into these drainage lines may affect the health of vegetation types that depend on water shedding off the hills.

Vegetation types AWL (1), AWL (2) and AWL (3) are dominated by mulga. They contain areas of both banded and non-banded mulga. AWL (1) is mapped north of the Fortescue River, AWL (2) is mapped mostly south of it, while AWL (3) is mapped to its north and south. As these vegetation types are dominated by mulga, they are likely to be susceptible to changes in surface water flow. Mulga is also at the northern limit of its distribution in these areas and only small patches occur north of the Jamindie LS, within which it is mapped mostly in a west-east trending line from Mulga Downs to Roy Hill stations. AWL (1) and AWL (2) are also the primary vegetation types in which the taxon of interest *Hibiscus* sp. Mulga Downs has been recorded. Currently, 229 of 311 *Hibiscus* sp. Mulga Downs waypoints / records (within the MBSA) are in vegetation type AWL (1) (74% of the MBSA records), and 77 records (25%) are in AWL (2); the remaining five are in ASL (1).

Vegetation type *Tv*HG is mapped only on shale hills and on the plains between the hills in the north-eastern and south-eastern sections of the MBSA (in Area 1 (Mulga East, R47/12), Area 6 (L47/380) and Area 3 (Hester Peak SE, L45/316)); the P1 species *Triodia veniciae* is the dominant and indicator species in and for this vegetation type. *Tv*HG occurs in the Jeerinah Formation stratigraphic unit, which runs in a generally east south-east to west north-west direction between Roy Hill mine site and Mulga Downs and extends beyond both areas (Ruddock, 2002). One of the geological characters of the Jeerinah Formation is the presence of shale (Geoscience Australia, 2020). Florabase records show that *Triodia veniciae* occurs on low shale hills mainly on the northern side of the Fortescue River and Fortescue Marsh (WAH, 1998 -).

The vegetation types mapped within the Fortescue River system (*AdEv*WL, *Ev*WL, *Bpo*FL, *EfEb*TG, MSL (1), MSL (2), MTG (2) and the mosaic of *AdEv*WL / *Bpo*FL) are regarded as significant. These riparian vegetation types are habitat specific, as they are restricted to the Fortescue River and associated habitats. Vegetation types *AdEv*WL, *Ev*WL, MSL (1) and MSL (2) support species that only occur in seasonally inundated habitats (*Duma florulenta, Cyperus difformis* and *Melaleuca glomerata*). MSL (1) and MSL (2) only occur on raised areas and calcrete tables within vegetation type *AdEv*WL. *Bpo*FL is mapped on the Gnalka Gnoona claypan (*Tecticornia verrucosa* is a high indicator species for this vegetation type), while most of the mosaic of *AdEv*WL and *Bpo*FL is mapped on the Koodjeepindarranna claypan and associated flow lines. Both claypans are interconnected and water flows from Gnalka Gnoona to Koodjeepindarranna. These areas are considered important habitat for migratory and local birds, invertebrate species during times of inundation and maintaining the connection between the two claypans is important to maintain their biodiversity values (Pinder et. al., 2017).

Vegetation types *EfEb*TG and MTG (2) occur on low-lying, seasonally inundated areas associated with the Fortescue River system. These areas are shallower than where *Bpo*FL and the mosaic of *AdEv*WL and *Bpo*FL are mapped and, as a result, are flooded less frequently and for a shorter time, and this has allowed a permanent cover of tussock grass to develop.

Two polygons indicating occurrences of the Priority 1 PEC 'Freshwater Claypans of the Fortescue Valley' are mapped in the MBSA (**Map 16, Section 10**). The south-eastern PEC polygon comprises the claypan (Geoscience Australia, 2006) plus a 500 m buffer. Vegetation types *AdEv*WL, *Bpo*FL (and the mosaic of *AdEv*WL and *Bpo*FL) and MSL (2)) are mapped in the actual claypan area, while the same vegetation types and mosaic plus some of MSL (1) and cleared areas lie within the buffer. The north-western PEC polygon is not centred on any specific feature that can be seen on aerial imagery; however, when the point location for Koodjeepindarranna Pool is buffered by 3,000 m it almost matches DBCA's buffer. Therefore a buffer centred on Koodjeepindarranna Pool was used to determine which vegetation types occur within the section of the buffer lying over the MBSA. *AdEv*WL, and the mosaic of *AdEv*WL and *Bpo*FL along with AWL (3), *AxAs*SL, *EfEb*TG, *Ev*WL, MSL (2), MTG (3) and disturbed / cleared areas are intersected by it. The area of each vegetation type in the two claypan areas and the relevant buffer is listed in **Table 7.6**. To define the boundaries of the PEC in the MBSA an analysis of the hydrogeology of the claypans would be needed: the PEC is described as freshwater claypans, and it is not defined by or described using the vegetation associated with those areas. The vegetation is considered significant in these areas because it occurs in the habitat. Changes to surface water flows into the claypans and lower lying areas may affect the degree and duration of inundation in these areas, which could adversely affect their biodiversity values.

Table 7.8 lists the key attributes for each of the vegetation types mapped in the MBSA.

Table 7.6: Vegetation types mapped in the Freshwater claypans P1 PEC buffers

Vegetation type code	Area mapped (ha) in:				
	MBSA	NW (Koodjeepindarranna) PEC buffer in MBSA	SE (Gnalka Gnoona (GG)) PEC claypan & buffer	SE (GG) PEC claypan only	SE (GG) PEC buffer minus claypan
*AdEv*WL	6,249.51	795.47	516.41	59.83	456.58
AWL (3)	3,945.87	206.86	Not in the buffer (NIB)		
*AxAs*SL	1,854.63	439.42	NIB		
*Bpo*FL	333.38	NIB	333.38	317.43	15.95
*EfEb*TG	874.5	111.62	NIB		
*Ev*WL	1,016.96	97.68	NIB		
Mosaic *AdEv*WL / *Bpo*FL	1,707.56	549.30	85.12	19.51	65.61
MSL (1)	592.73	NIB	70.12	0.00	70.12
MSL (2)	2,511.80	15.75	96.98	0.39	96.59
MTG (3)	604.9	194.52	NIB		
Disturbed / cleared	358.01	14.50	1.80	0.00	1.80
Total area (ha)	20,049.85	2,425.12	1,103.81	397.16	706.65

Note: NIB = not in the buffer.

7.4 Other Significant Vegetation

7.4.1 Significant Vegetation

Significant vegetation is defined in EPA Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b) as vegetation:

- Being identified as threatened or priority ecological communities.
- Restricted distribution.
- Degree of historical impact from threatening processes.
- A role as a refuge.
- Providing an important function required to maintain ecological integrity of a significant ecosystem.

These dot points are discussed with respect to the vegetation of the MBSA in the following sections.

7.4.2 Significant Ecological Communities and the MSA

The MBSA does not lie within or close to a federally listed TEC, and none of the Pilbara TECs protected by the BC Act occur in the MBSA.

Two claypan areas in the MBSA (**Map 16, Section 10**) comprise part of the P1 PEC 'Freshwater claypans of the Fortescue Valley' PEC. Vegetation types *EfEb*TG, *AdEv*WL, *Bpo*Fl, the mosaic of *AdEv*WL / *Bpo*FL, *AxAs*SL, AWL (3), *Ev*WL, MSL(1), MSL(2) and MTG (3) are mapped within the buffers for these Freshwater claypans (**Map 27, Section 10**). The dominant vegetation types in these areas are *AdEv*WL, *AxAs*SL, *Bpo*Fl and the mosaic of *AdEv*WL / *Bpo*FL. Quadrats sampled by Maia in the MBSA in these vegetation types grouped with quadrats sampled by Maia outside the MBSA, and also with quadrats sampled by Pinder et al. in claypan areas.

The 'Coolibah-lignum flats: *Eucalyptus victrix* over lignum community in the Pilbara' PEC (**Map 16, Section 10**; south of DSA boundary) is listed for the Pilbara bioregion (as either a P3(i) or P1 PEC depending on where it is found). While this PEC has no known occurrences in the MBSA (**Map 16, Section 10**), *AdEv*WL and the mosaic *AdEv*WL / *Bpo*FL resemble its description. In 2012 these two units were mapped in the Mulga Downs East tenement as R1, R2 and the mosaic of R1 and R2 (Maia, 2012). Because they were similar to the description for the Coolibah-lignum flats PEC, the quadrat data was sent to the Species and Communities Branch of the former Department of Environment and Conservation (DEC) so that it could be compared with any data available for the actual PEC. DEC said that the presence of two different *Acacia* species (*Acacia distans* and *A. stenophylla*) signifies different communities from the sub-types described for the PEC (pers. comm. Jill Pryde A/Senior Ecologist, Species and Communities Branch, DEC, November, 2012) i.e., it is not the Coolibah-lignum flats PEC.

7.4.3 Restricted Distribution, Historical Impact and Refugia

Four of the 19 vegetation types are mapped over less than 1% of the mapped section of the MBSA. Vegetation type *Tv*HG is restricted to patches of shale in the north-eastern and south-eastern sections of the MBSA (**Map 27, Section 10**) and is mapped over 0.08% of it. While this vegetation type occurs outside the MBSA, it is restricted to shaley areas that have a relatively narrow distribution and that occur between Mulga Downs and Roy Hill stations. The Jeerinah Formation, in which the shale unit occurs, extends to the west of Mulga Downs Station and to the east of Roy Hill Station. Two of the three Mixed Tussock Grasslands (MTG (1) and MTG (2); mapped over 0.52%, 0.54% respectively) are restricted to drainage lines, cracking clay floodplains, crabhole plains and hardpan stony plains close to the Fortescue River (**Maps 26 and 27, Section 10**). These tussock grasslands occur outside the boundary of the MBSA; however, they are associated with this section of the Fortescue River system and therefore will not have a wide subregional distribution. Similarly, *Bpo*Fl is mapped over 0.57% of the MBSA and it is restricted to the Gnalka Gnoona claypan / pool and in a mosaic with *AdEv*WL in the Koodjeepindarranna claypan / pool area and associated flow lines (**Map 27, Section 10**).

Historical impact is gauged by the current extent of the pre-European vegetation system associations and land systems mapped in the MBSA. As more than 99% of the vegetation system associations and land systems currently remain in the Pilbara the historical impact from vegetation clearing is low. However, locally, vegetation has been cleared for exploration activities, which is not reflected in the native vegetation current extent data, because native vegetation extent in the MBSA shows no clearing at all. **Table 7.7** presents information on clearing in the different VSAs that has been carried out in the MBSA; although, as noted previously, all of the clearing has not been captured because the exploration lines are so numerous and dense in some areas; therefore, the percentages will underestimate actual clearing. However, based on the current digitised clearing, less than 1% of each of the VSA's current MBSA extent has been impacted.

Vegetation condition has been affected by long-term grazing on the cattle stations, particularly in the lower and wetter areas associated with the Fortescue River system (**Maps 32 and 33, Section 10**).

The topography of the MBSA is relatively subdued and the river and its associated habitats will likely provide more refuge than the hills. There are no known refugia in the Chichester subregion (Kendrick and McKenzie, 2001), two refugia are indicated for the Fortescue subregion (Kendrick, 2001a) – Millstream wetlands and gorges of the Fortescue River within the Chichester ranges, while Kendrick (2001b) lists gorges of the Hamersley Ranges, calcrete deposits for troglofaunal, mountain tops of the Hamersley Range, and permanent spring systems for the Hamersley subregion. None of these refugia occur in the MBSA.

Table 7.7: Current clearing of pre-European vegetation system associations in the MBSA

Column 1	2	3	4
Vegetation system association (VSA)	Current extent in the MBSA (ha)	Cleared areas in VT in the MBSA (ha)	Clearing as a percentage of the VSAs current extent in the MBSA
29	34,560.67	321.57	0.93
111.1	695.86	0.19	0.03
151.1	1,631.85	3.95	0.24
173.2	988.51	0.68	0.07
175.2	2.33	Not in mapped areas of MBSA	NA
175.3	6,569.26	22.05	0.34
562	14,473.02	23.29	0.16
645.1	18.67	0	0
Total	58,940.17		

Note: Column 2 data as in Table 7.5. Column 3 = pre-European vegetation mapping shapefile (DPIRD, 2019b) intersected with Maia cleared areas mapped in the MBSA. Column 4 = Column 3 / Column 2 * 100. VSA 175.2 occurs only in Area 7, and the vegetation was not mapped in this area. Some of VSA 173.2 is in the not mapped Area 7 and a very small section of 562; therefore, clearing in these areas is either not or not all captured.

Table 7.8: Key attributes of the vegetation types mapped in the MBSA

Vegetation type (VT)	Cover in MBSA		Conservation significant flora in VT	Average VT condition (quadrats)	Pre-European vegetation system association/s	Land system/s	Any other key attributes increasing conservation value?	Does VT occur outside the MBSA?
	ha	%						
*AaAx*SL	1,854.63	3.18	Ajs, Se, S?e, Tv	Excellent	29, 173.2, 175.3, 562	Bgd, Cob, Hoy, Jam, Jur, Mck, New	Mulga, ? sheet flow	Yes
*AdEv*WL	6,249.51	10.70	Ec, Eag, G?l, Ho, Tp	Very Good	29, 151.1, 175.3	Bro, Cal, Cob, Hoy, Jam, Jur	ESA / PEC, drainage	Yes
ASL (1)	894.74	1.53	DspH, HspMD, Se, S?e	Good	29, 175.3	Cal, Cob, Hoy, Jam, Jur, New,	? Sheet flow	Yes
ASL (2)	1,990.27	3.41	A?js, Gn, Rb, Se, S?e, Ss, Tv	Very Good	29, 173.2, 562	Bgd, Hoy, Jam, Mck, New	Drainage	Yes
AWL (1)	7,134.51	12.22	Ajs, DspH, Eag, Gn, H?spMD, HspMD, JspW, S?e	Very Good	29, 175.3, 562	Bgd, Cob, Hoy, Jam, Jur, Mck, New	Mulga, sheet flow	Yes
AWL (2)	4,841.39	8.29	Eag, HspMD, Tp	Very Good	29, 111.1, 151.1,	Bgd, Cal, Cob, Jam, Jur, Ury	Mulga, sheet flow	Yes
AWL (3)	3,945.87	6.76	Eag, Tp	Very Good	29, 111.1, 151.1, 173.2, 562	Bgd, Cob, Hoy, Jam, Jur, Mck, Ura	Mulga, sheet flow, PEC	Yes
*AxAs*SL	6,968.19	11.93	Bb-atyp, Eag, Gf, Gam, Gn, GspEP, Ral, Tp, TspH	Good	29, 111.1, 151.1, 175.3, 562, 645.1	Bgd, Bro, Cob, Hoy, Jam, Jur, Mck, New, Ura	ESA / PEC, ? sheet flow	Yes
*Bpo*FL	333.38	0.57	None	Very Good	29, 175.3	Cob	ESA / PEC	Yes
*EfEb*TG	874.50	1.50	Cs, Eag	Very Good	29, 151.1, 175.3	Bro, Cob, Hoy, Jur	ESA / PEC	Yes
*Ev*WL	1,016.96	1.74	Bb, Eag, Gf, Gn, Ho, Is, Ral, Tp	Good	29, 151.1, 175.3	Bgd, Bro, Cob, Hoy, Jur	ESA / PEC, ? GDE, drainage	Yes
Mosaic of *AdEv*WL / *Bpo*FL	1,707.56	2.92	Ec, Ho, Ra	Very Good	29, 175.3	Bro, Cal, Cob, Hoy, Jur	ESA / PEC, drainage	Yes
MSL (1)	592.73	1.02	Tp, TspH	Very Good	29, 175.3	Cal, Cob, Jam, Jur	ESA, drainage	Yes
MSL (2)	2,511.80	4.30	EspES, Eag, Ra?l, Ss, Tp	Very Good	29, 151.1, 175.3	Bro, Cal, Cob, Jam, Jur	ESA / PEC, drainage	Yes
MTG (1)	303.70	0.52	Gn, TspH	Good	29, 175.3	Bro, Cob, Hoy, Jur	Drainage	Yes
MTG (2)	312.78	0.54	Eag, Gf, Ra?l, Tp	Very Good	29, 151.1, 175.3	Bro, Cal, Cob, Jur	ESA	Yes

Vegetation type (VT)	Cover in MBSA		Conservation significant flora in VT	Average VT condition (quadrats)	Pre-European vegetation system association/s	Land system/s	Any other key attributes increasing conservation value?	Does VT occur outside the MBSA?
	ha	%						
MTG (3)	604.90	1.04	GspEP	Good	29, 175.3	Bro, Cob, Hoy, Jur	PEC	Yes
THG (1)	11,235.00	19.24	A?js, Bb, DspH, Gn, Se, S?e, Tb, Tv	Excellent	29, 173.2, 562	Bgd, Cob, Hoy, Jam, Jur, Mck, New	No	Yes
THG (2)	4,611.78	7.90	A?js, Se, S?e, Tb, Tv	Very Good	29, 151.1, 562	Bgd, Cob, Hoy, Jam, Jur, Mck, New	Mulga	Yes
*Tv*HG	48.20	0.08	Tv	Excellent	562	Bgd, Mck	Restricted habitat	Yes
Disturbed	358.02	0.61	NA	Degraded	-		-	-
Total	58,390.42	100						

Notes re **Table 7.8**:

Species codes: A?js = *Aristida* ? *jerichoensis* var. *subspinulifera*; Ajs = *Aristida jerichoensis* var. *subspinulifera*; Bb-atyp = *Bulbostylis burbidgeae*-atypical form; Bb = *Bulbostylis burbidgeae*; Cs = *Calotis squamigera*; DspH = *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479); Ec = *Eragrostis crateriformis*; EspES = *Eragrostis* sp. Erect spikelets (P.K. Latz 2122); Eag = *Euphorbia australis* var. *glabra*; G?l = *Goodenia* ? *lyrata*; Gam = *Goodenia* aff. *muelleriana*; Gn = *Goodenia nuda*; Ho = *Helichrysum oligochaetum*; H?spMD = *Hibiscus* ? sp. Mulga Downs; HspMD = *Hibiscus* sp. Mulga Downs; *Josephinia* sp. Woodstock (A.A. Mitchell PRP 989), Ra = *Rhodanthe ascendens*; Rb = *Rhynchosia bungarensis*; Ra?l = *Rostellularia adscendens* ? var. *latifolia*; Se = *Seringia exastia*; S?e = *Seringia* ? *exastia*, Ss = *Santalum spicatum*; Tb = *Triodia basitricha*, Tp = *Teucrium pilbaranum*; TspH = *Themeda* sp. Hamersley Station (M.E. Trudgen 11431); Tv = *Triodia veniciae*.

Land systems codes: Bgd = Boolgeeda; Bro = Brockman; Cal = Calcrete; Cob = Coolibah; Hoy = Hooley; Jam = Jamindie; Jur = Jurrawarrina; Mck = McKay; New = Newman; Ury = Urandy.

The CSF records for each vegetation type are from all surveys and not just from quadrats assessed for detailed survey phases.

Vegetation was not mapped in Area 7; therefore, the total area is less than the whole of the MBSA.

7.4.4 Groundwater Dependent Ecosystems and Sheet Flow Dependent Vegetation

In the Pilbara *Melaleuca argentea* is an obligate phreatophyte while *Eucalyptus camaldulensis* and, to a lesser extent, *Eucalyptus victrix* are facultative phreatophytes (Astron Environmental Services, 2008 as cited in McFarlane, 2015). No *Eucalyptus camaldulensis* has been located in the MBSA during the surveys that have been carried out in the area, and neither has *Melaleuca argentea*. *Eucalyptus victrix* has been the dominant eucalypt recorded in the Fortescue River system.

Eucalyptus victrix occurs in 10 vegetation types: *AdEv*WL, ASL (2), AWL (2), *Bpo*Fl, *EfEb*TG, *Ev*WL, MSL (1), MSL (2), MTG (1) and MTG (2). It is possible that *E. victrix* in the vegetation types associated with the Fortescue River and associated flood-out areas, and larger drainage lines in the hills could use groundwater at some time during its life cycle i.e., *AdEv*WL, *Ev*WL, *EfEb*TG, *Bpo*Fl, ASL (2), MSL (1), MSL (2) and MTG (2). *Atalaya hemiglauca* also occurs in *AdEv*WL, *Ev*WL, ASL (2), AWL (1), MSL (1), MSL (2), MTG (1) and MTG (2) and *Melaleuca glomerata* in *AdEv*WL, *EfEb*TG, *Ev*WL, MSL (1), MSL (2) and MTG (1), and they were used (along with *Eucalyptus camaldulensis*, *E. victrix* and *Melaleuca argentea* and a few other riparian species) in a Pilbara study to determine the susceptibility of riparian species to altered water regimes (Loomes, 2010).

The potential for groundwater dependent ecosystems occurring in the MBSA is not discussed further, because a separate study is being carried out on this aspect of the MBSA.

Mulga is the common name for *Acacia aneura* but is also applied to closely related species that often co-occur with mulga e.g., *A. ayersiana*, *A. minyura* and *A. paraneura* (Page and Grierson, 2010). Mulga vegetation has been shown to be highly dependent on sheet flow (Winkworth, 1973; Tongway and Hindley, 2004) and is sensitive to alterations to sheet flow (Saco et al., 2010).

Maslin and Reid (2012) recognise 12 mulga species and eight of the 12 have been recorded in the MBSA: *Acacia aneura*, *A. aptaneura, A. ayersiana*, *A. incurvaneura, A. macraneura, A. minyura, A. paraneura* and *A. pteraneura* (**Appendix 7**). The MBSA comprises some gently sloping hardpan gravelly or stony plains, and groves and bands of mulga occur in vegetation type AWL (1), AWL (2) and AWL (3). Any alteration to sheet flow in these areas could affect the health of the mulga, particularly down slope of any sheet flow altering structures.

8 Limitations, Project Team and Licences

8.1 Limitations

Technical Guidance, Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b) states that any survey-specific issues / limitations should be addressed in a limitations section and that the limitations should be addressed as standard, whether they were a limitation of survey or not. **Table 8.1** addresses any survey-specific issues / limitations associated with any of the surveys carried out.

Table 8.1: Survey limitations

Limitation	Comment
Availability of contextual information at a regional and local scale	**No limitation**
	The surrounding areas have been relatively well surveyed via detailed and other surveys carried out for numerous projects – see map of projects known to Maia in the DSA. The MBSA and immediate surrounds have been well surveyed via detailed, targeted and reconnaissance surveys. Many reports were reviewed for the desktop assessment and various public and DBCA databases were searched to gather data on conservation significant flora and vegetation known to occur in the area. Pre-European vegetation mapping and land system mapping are also available for the MBSA.
Competency /experience of the team carrying out the survey, including experience in the bioregion surveyed	**No limitation**
	The field team leader (Scott Hitchcock) has more than 12 years of experience in the Pilbara bioregion and surveys on Mulga Downs Station and surrounding areas. He has been field team leader on and has been on all surveys carried out by Maia in the MBSA. Any botanists with less than five years of experience accompanied senior botanists while assessing quadrats. The specimens collected on the different phases of survey were identified by Malcolm Trudgen, Cate Tauss, Conrad Slee and Raimond Orifici – each has more than 10 years of experience in the taxonomy of the Pilbara flora. Selected specimens were sent to the WA Herbarium for confirmation by a DBCA taxonomist (Michael Hislop).
Proportion of flora recorded and/or collected, any identification issues	**No limitation**
	Seven hundred and forty-nine taxa from 60 families and 206 genera have been recorded from quadrats assessed by Maia, *ecologia*, Coffey, Lyons and Pinder in the MBSA: 31% were annual taxa and 65% perennial, and 73% of the species list was identified from specimens collected with reproductive material (flowers / fruit). A specimen for each of these taxa was collected from the MBSA, and sometimes multiple specimens. Vascular flora were recorded during the surveys, and most to the taxa collected were determined to species, variety or subspecies level; about 9% of the 749 taxa collected from the MBSA were not fully determined. The proportion of the flora collected and identified based on sampling, survey time, area surveyed, and the intensity of survey effort was good. SPAC analysis indicated that 88% of the diversity of the MBSA was collected in the quadrats assessed overall. As the SPAC does not include the additional 135 taxa collected opportunistically in the analysis, only species recorded at quadrats, more than the 88% of the diversity was collected from the MBSA.
Was the appropriate area fully surveyed (effort and extent)	**Slight limitation**
	A detailed flora and vegetation survey was carried out over the MBSA. Some of the vegetation was sampled over three survey phases in different seasons (winter, spring, autumn). Two hundred and forty-nine quadrats and one relevé were established and assessed in the MBSA and others were assessed outside of the MBSA (e.g., in claypans to the southeast). Most MBSA sites were resampled over the different survey phases. Data from quadrats assessed within the MBSA by other practitioners (*ecologia*, 2008d; Lyons, 2015; and Pinder et al., 2017) were used in the floristic analyses and in the collated MBSA species list. In areas where more than one phase of survey was carried out additional quadrats were placed where preliminary vegetation mapping highlighted any gaps in quadrat distribution. Nineteen vegetation types and one mosaic were mapped over the MBSA. Three of more quadrats were assessed in all 19 vegetation types. No quadrats were assessed in the section of vegetation mapped along the western section of Area 1 of the MBSA. This area is in the Wittenoom Asbestos Management Area (WAMA) and access to it is forbidden. However, a track goes through the area, Maia has carried out

Limitation	Comment
	targeted flora surveys in this area in the past, and the vegetation was mapped using data collected from the track and from the targeted flora surveys.
Access restrictions within the survey area	**No limitation**
	The MSA was accessed using existing station tracks, exploration tracks and drill lines. Access to some areas was restricted in 2012 due to heavy summer rainfall. Some areas associated with the Fortescue River, particularly the claypan areas, were still inundated in June, July and August 2012. However, these areas were assessed during following survey phases. Localised heavy rainfall at site following Severe Tropical Cyclone Veronica in late March 2019 limited access to station and exploration tracks and delayed the survey until May 2019. Cattle mustering in May, August and September 2019 also restricted access to some areas at Mulga Well and Mulga Downs East and some existing quadrats could not be resampled. Quadrats could not be established in one area south of the main holding yards at Mulga Well as it was being used as the temporary holding paddock and the area had to be avoided. Access to the western section of Mulga Well was not permitted in 2019 and 2020 because it is in the WAMA. There were no restrictions on access to most of the areas surveyed in 2022; however, rain during the survey limited access in Area 2 because tracks could not be driven on.
Survey timing, rainfall, season of survey	**No limitation**
	Over all phases of survey rainfall would have ranged from below average to above average. The surveys were carried out in winter, spring or autumn and timed to allow collection of flowering specimens and annual and weakly perennial species post summer rains and any other annual or weakly perennial species that could have grown post any winter rains. In addition to different quadrat survey phases, targeted surveys were carried out in the MBSA in May, July and September 2021 to target CSF species at different times of the year. Approximately 31% of the species list collated for the MBSA are annual or weakly perennial species and approximately 73% of the species were identified from fertile specimens. Based on this information the surveys were carried out at appropriate times.
Disturbances (fire, flood, accidental human intervention etc.)	**Minor limitation**
	Severe Tropical Cyclone Heidi resulted in higher-than-average rain falling over the general area in January 2012, and parts of the Fortescue River system were still flooded in June, July and August 2012 (e.g., the claypan areas). The 2012 survey was carried out at Mulga East because of the good summer rains that had been received, and the survey was carried out when most of the area was accessible. Some areas at Mulga Well and Mulga East were affected by cattle mustering in 2019. Small and localised fires, most likely from lightning strikes, had affected areas in the northern section of the MSA in 2012 and again in 2019. There were no major fires or storms in the few weeks before any of the surveys. No adverse weather or other disturbances affected the areas surveyed in May, July and September 2021. Rain during the March 2022 survey meant that some station tracks could not be driven on and so all of Mulga West (Area 2) could not be accessed. No fires had affected the vegetation in areas where quadrats were assessed and traverses walked during any survey phase.

8.2 Project Team and Licences

The surveys were carried out and the report prepared by the ecologists listed in **Tables 8.2** and **8.3**.

Table 8.2: Project team - report and taxonomy

Name	
Report	**Taxonomy**
Christina Cox	Malcolm Trudgen
Rochelle Haycock	Cate Tauss
Scott Hitchcock	Conrad Slee
Michael Pezzaniti	Raimond Orifici
Eva Karikis	WA Herbarium

Table 8.3: Project team - surveys

Survey area	Phase	Season	Survey month	Botanists	Flora licence numbers
Mulga Downs East (R47/12) Area 1	1	Winter	June, July, August 2012	Scott Hitchcock Rochelle Haycock Stuart Yandle Pali Jayasekara	SL009969 (exp. April 2013) SL009968 (exp. April 2013) SL009965 (exp. April 2013) SL009966 (exp. April 2013)
	2	Winter	August 2019	Scott Hitchcock Michael Pezzaniti	FB62000064 (exp. 30 Apr 2020) FB62000065 (exp. 31 Mar 2020)
	3	Spring	September 2019	Scott Hitchcock Michael Pezzaniti Bridget Duncan	FB62000064 (exp. 30 Apr 2020) FB62000065 (exp. 31 Mar 2020) Working with SH or MP
	4	Autumn	May 2020	Scott Hitchcock Michael Pezzaniti	FB62000064-2 (exp. 30 Apr 2023) FB62000065-2 (exp. 30 Apr 2021
Mulga Well (E47/2117) Area 1	1	Autumn	May 2019	Scott Hitchcock Michael Pezzaniti Mitchell Wright	FB62000064 (exp. 30 Apr 2020 FB62000065 (exp. 31 Mar 2020) Working with SH or MP
	2	Spring	September 2019	Scott Hitchcock Michael Pezzaniti Bridget Duncan	FB62000064 (exp. 30 Apr 2020) FB62000065 (exp. 31 Mar 2020) Working with SH or MP
	3	Autumn	May 2020	Scott Hitchcock Michael Pezzaniti	FB62000064-2 (exp. 30 Apr 2023) FB62000065-2 (exp. 30 Apr 2021
L45/380 (part of)	1	Winter	August 2012	Scott Hitchcock Rochelle Haycock Pali Jayasekara	SL009969 (exp. April 2013) SL009968 (exp. April 2013) SL009966 (exp. April 2013)
	2	Winter	August 2014	Scott Hitchcock Rochelle Haycock Manon Hannart	SL010983 (exp. April 2015) SL010985 (exp. April 2015) SL010910 (exp. April 2015)
	3	Autumn	May 2017	Scott Hitchcock Rochelle Haycock	SL012086 (exp. April 2018) SL012087 (exp. April 2018)
	4	Winter	August 2019	Scott Hitchcock Michael Pezzaniti	FB62000064 (exp. 30 Apr 2020) FB62000065 (exp. 31 Mar 2020)

Survey area	Phase	Season	Survey month	Botanists	Flora licence numbers
	5	Autumn	March 2022	Scott Hitchcock Eva Karikis	TFL 52-1920 (exp. Dec 2022) and FB62000064 (exp. April 2023) FB62000065 (exp. March 2024)
Area 2: Mulga West (E47/1315-I)	1	Autumn	March 2022	Scott Hitchcock Eva Karikis	
Area 3: Hester Peak SE (L45/316)	1	Winter	August 2012	Scott Hitchcock Rochelle Haycock Pali Jayasekara	SL009969 (exp. April 2013) SL009968 (exp. April 2013) SL009966 (exp. April 2013)
	2	Autumn	March 2022	Scott Hitchcock Eva Karikis	TFL 52-1920 (exp. Dec 2022) and FB62000064 (exp. April 2023) FB62000065 (exp. March 2024)
Area 4: Corridor linking Mulga West and East	1	Autumn	March 2022	Scott Hitchcock Eva Karikis	
Area 5: Two Mile Well (E47/4264)	1	Autumn	March 2022	Scott Hitchcock Eva Karikis	
Area 6: Hester Peak (E47/12044-I)	1	Autumn	March 2022	Scott Hitchcock Eva Karikis	

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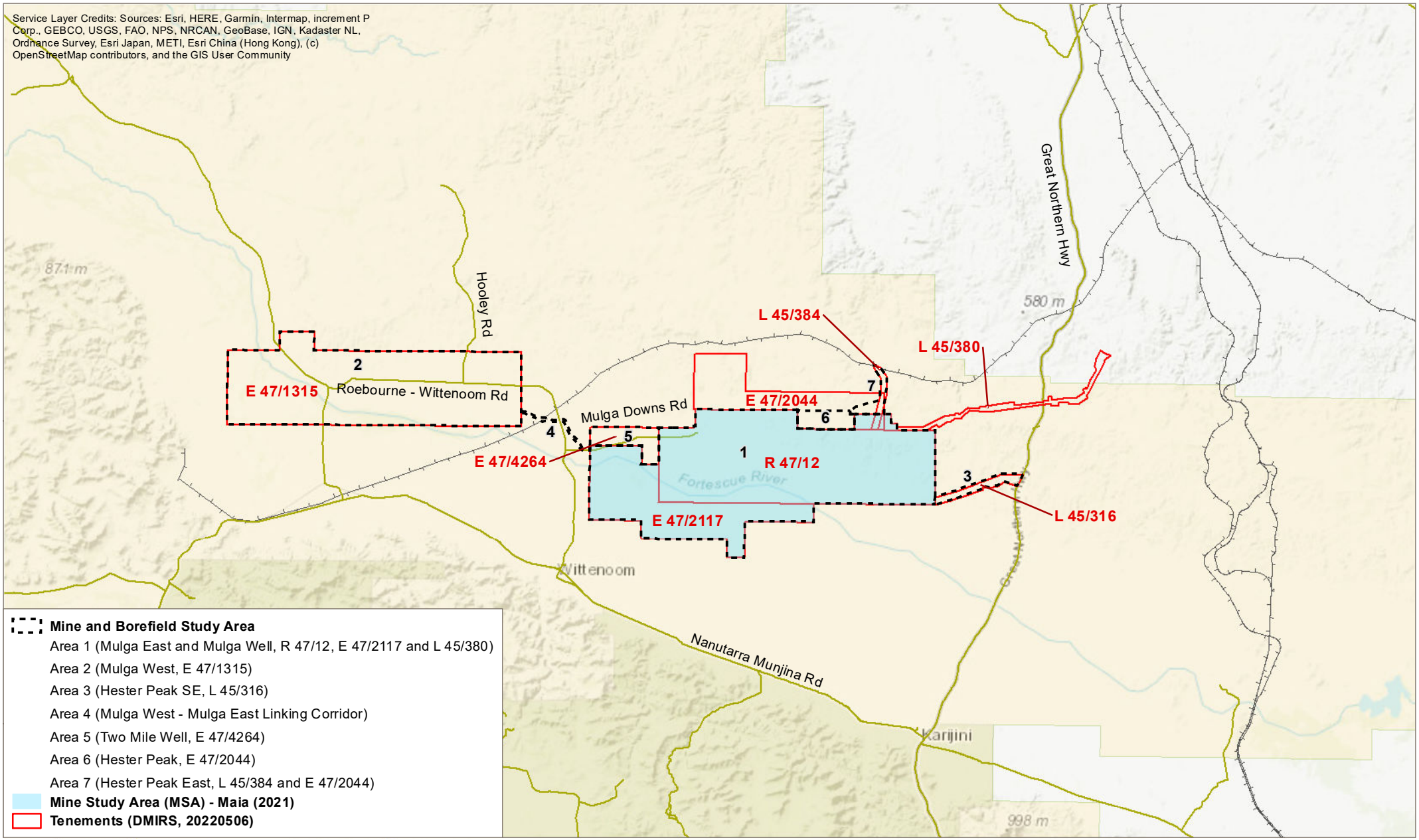
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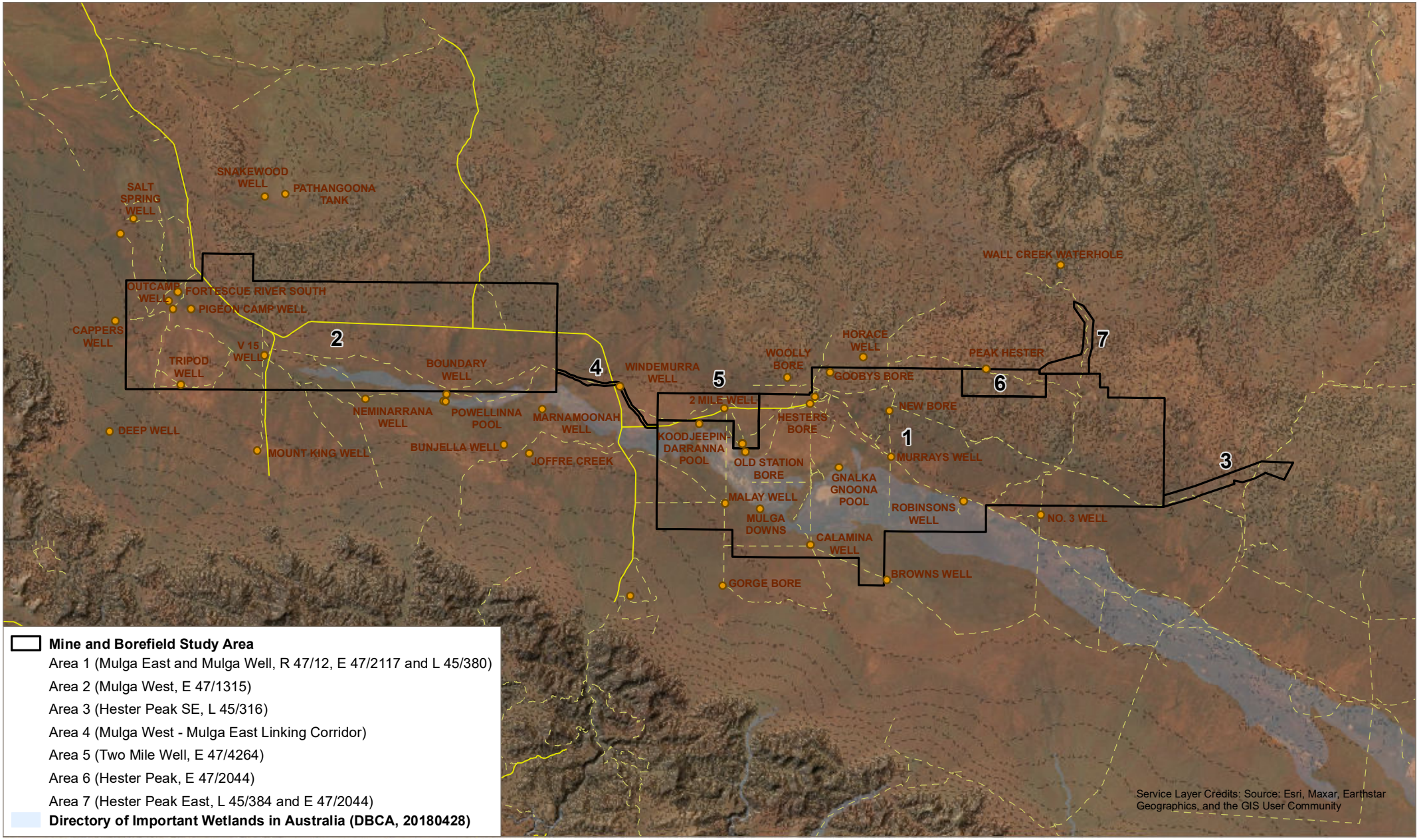
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10 MAPS


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871 m
Hooley Rd
Great Northern Hwy
580 m
L 45/384
L 45/380
E 47/1315
2
Roebourne - Wittenoom Rd
E 47/2044
7
6
Mulga Downs Rd
4
5
1
R 47/12
E 47/4264
3
L 45/316
Fortescue River
E 47/2117
Wittenoom
Nanutarra Munjina Rd
Karijini
998 m
Mine and Borefield Study Area
Area 1 (Mulga East and Mulga Well, R 47/12, E 47/2117 and L 45/380)
Area 2 (Mulga West, E 47/1315)
Area 3 (Hester Peak SE, L 45/316)
Area 4 (Mulga West - Mulga East Linking Corridor)
Area 5 (Two Mile Well, E 47/4264)
Area 6 (Hester Peak, E 47/2044)
Area 7 (Hester Peak East, L 45/384 and E 47/2044)
Mine Study Area (MSA) - Maia (2021)
Tenements (DMIRS, 20220506)
Location Map
Karatha
Newman
Wiluna
Geraldton
Perth
Road Network (Main Roads, 20190516)
Railways
Shire of Ashburton
General Location
maia
N
0
10
Kilometres
Datum: GDA 1994, MGA 50
Map: 1 Version: 1
Prepared for: JBSG
Drawn by: RH
Date: 10/05/2022
Project: 2204 Size: A4



Location Map



Water points, water holes and windmills

Minor road

Track

Contours (10 m; Geoscience Australia (2020) and QGIS (2020)

Mine and Borefield Study Area

maia

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

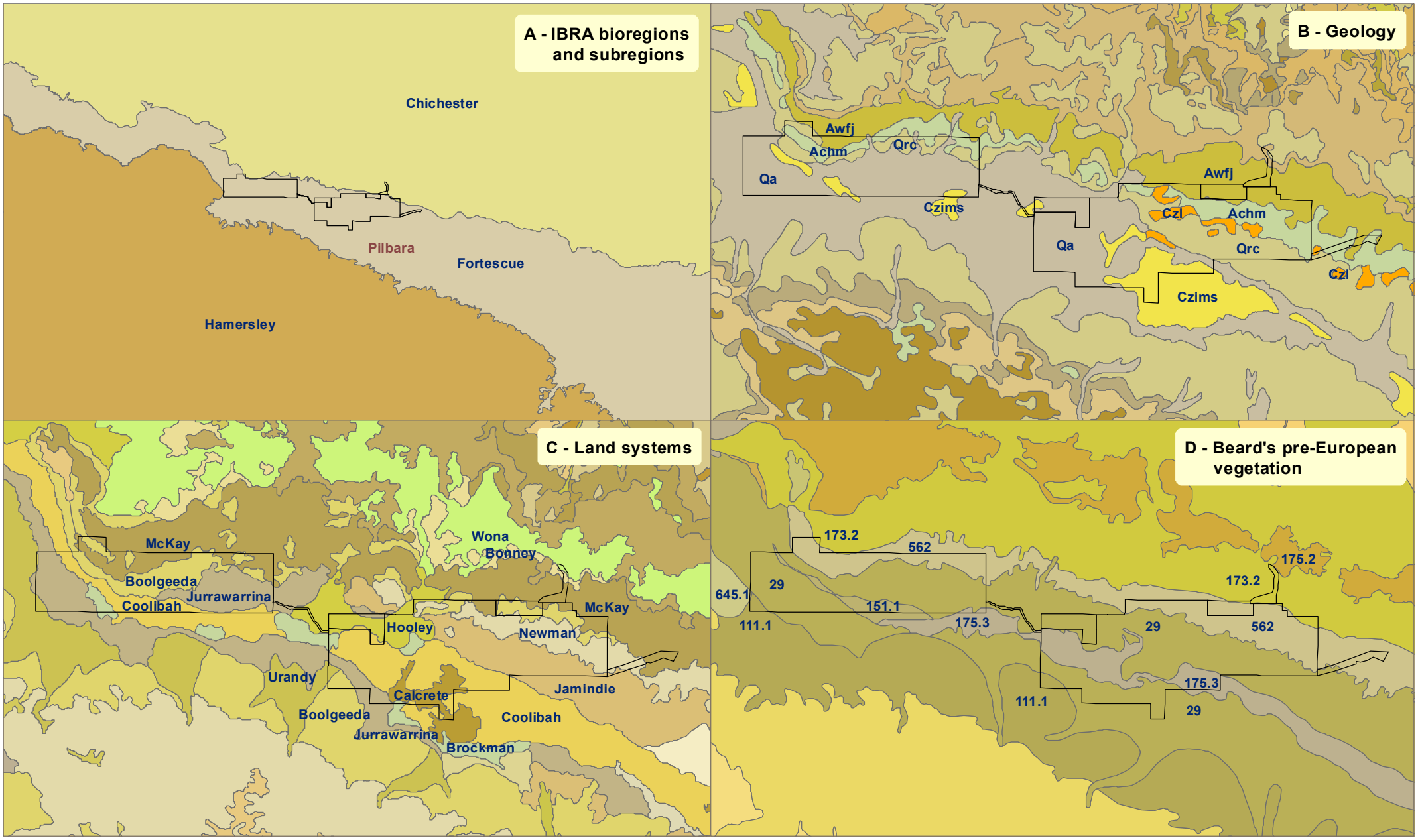
Map: 2 **Version:** 2

Prepared for: JBSG

Drawn by: RH

Date: 17/08/2022

Project: 2204 **Size:** A4



Mine and Borefield Study Area

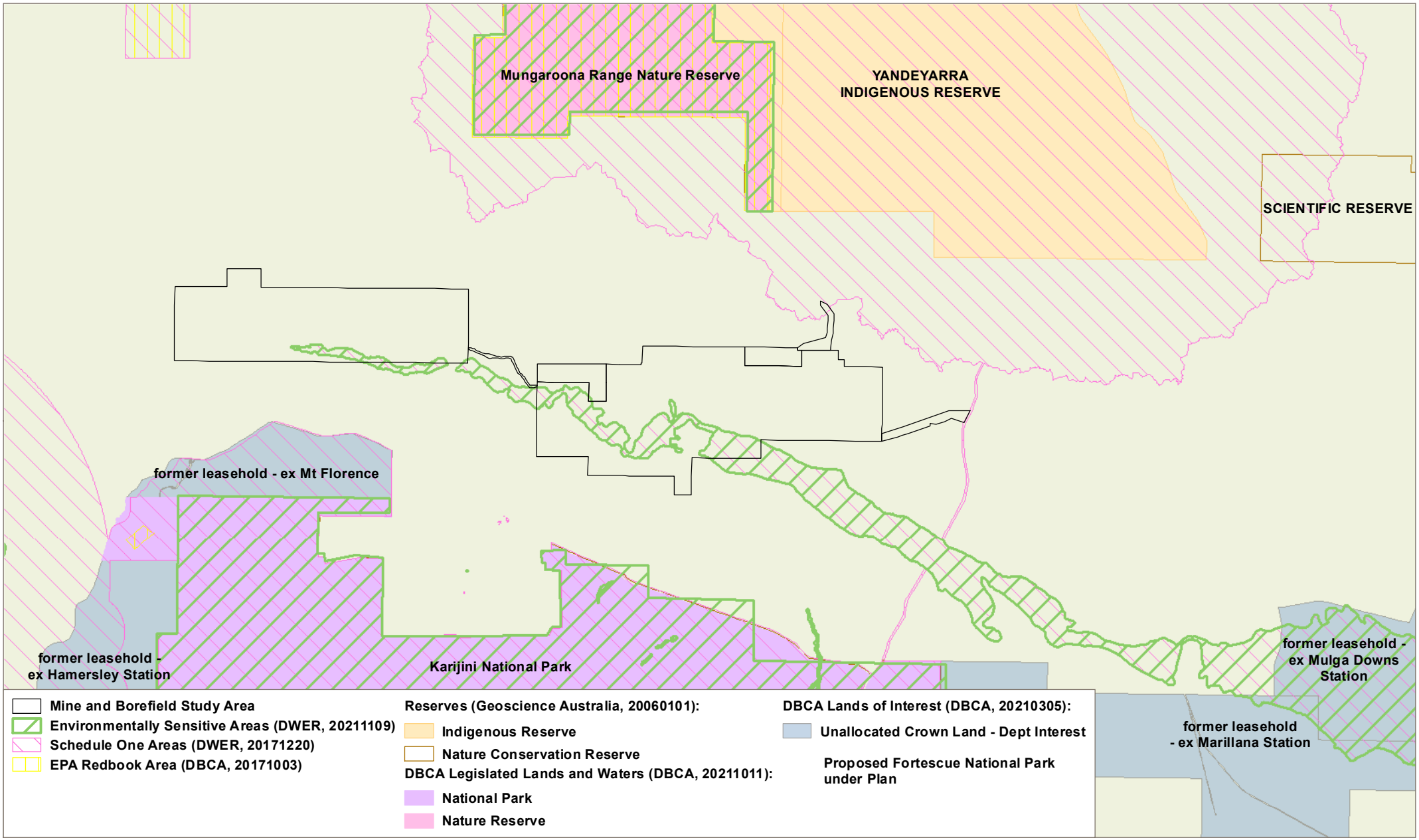
IBRA Bioregions and Subregions, Geology, Land Systems and Beard's Pre-European Vegetation (Vegetation System Associations)

maia

N

Datum: GDA 1994, MGA 50

Map: 3	**Version:** 1
Prepared for: JBSG	
Drawn by: RH	
Date: 10/05/2022	
Project: 2204	**Size:** A4





Protected and Significant Areas

N

0 10

Kilometres

Datum: GDA 1994, MGA 50

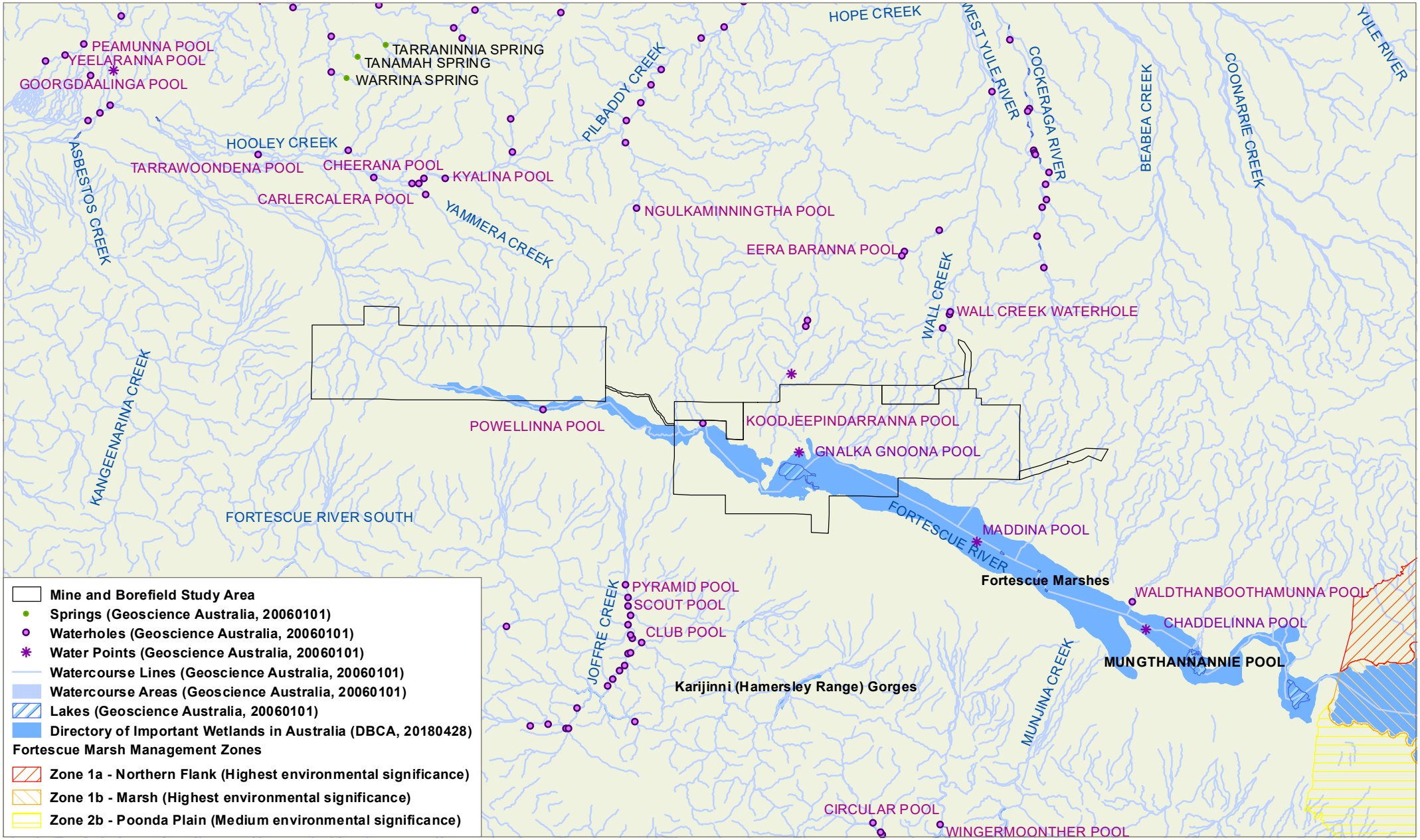
Map: 4 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4





Watercourses and Wetlands

N

0 10

Kilometres

Datum: GDA 1994, MGA 50

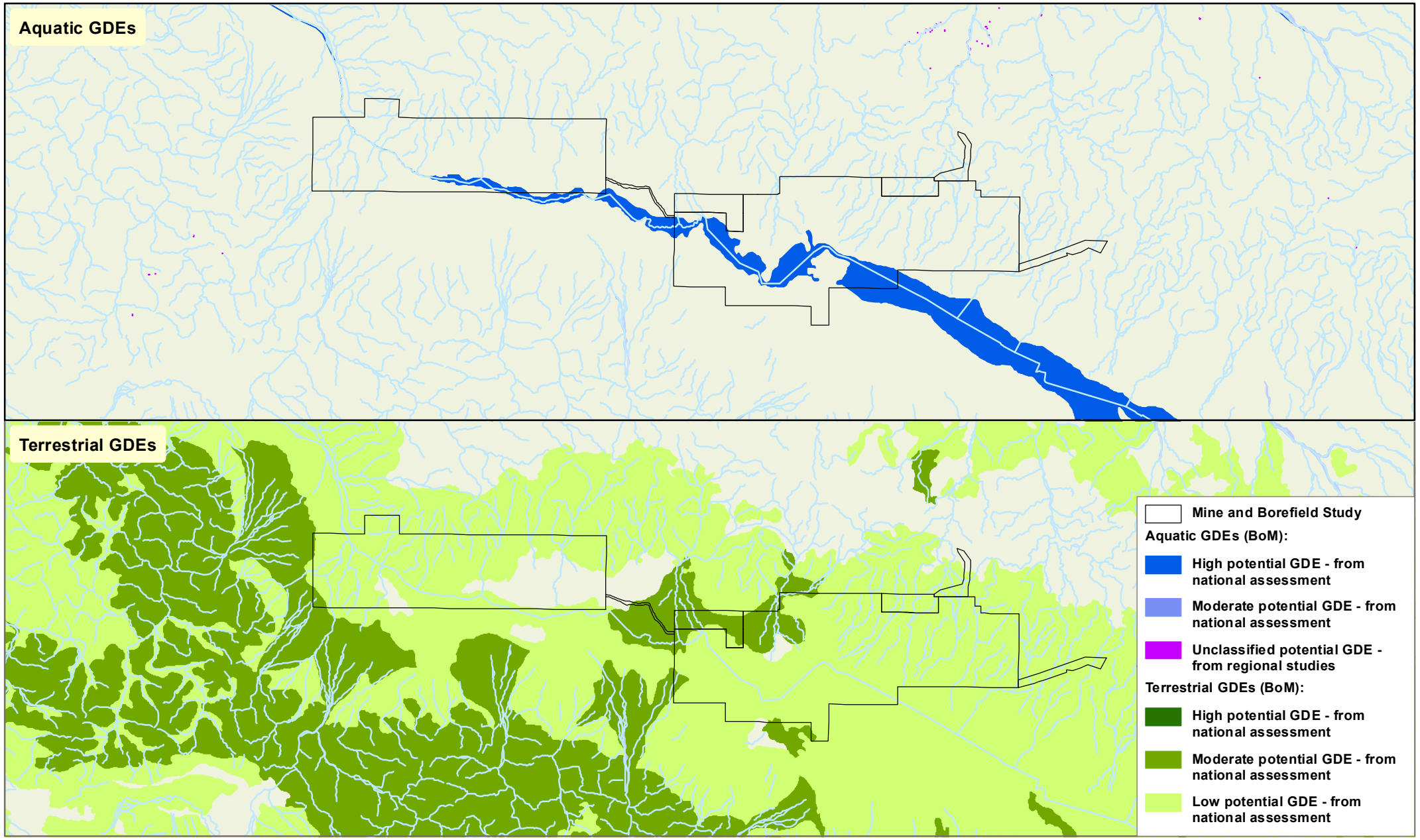
Map: 5 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4





Aquatic and Terrestrial Groundwater Dependent Ecosystems

maia

N

0 10

Kilometres

Datum: GDA94, MGA 50

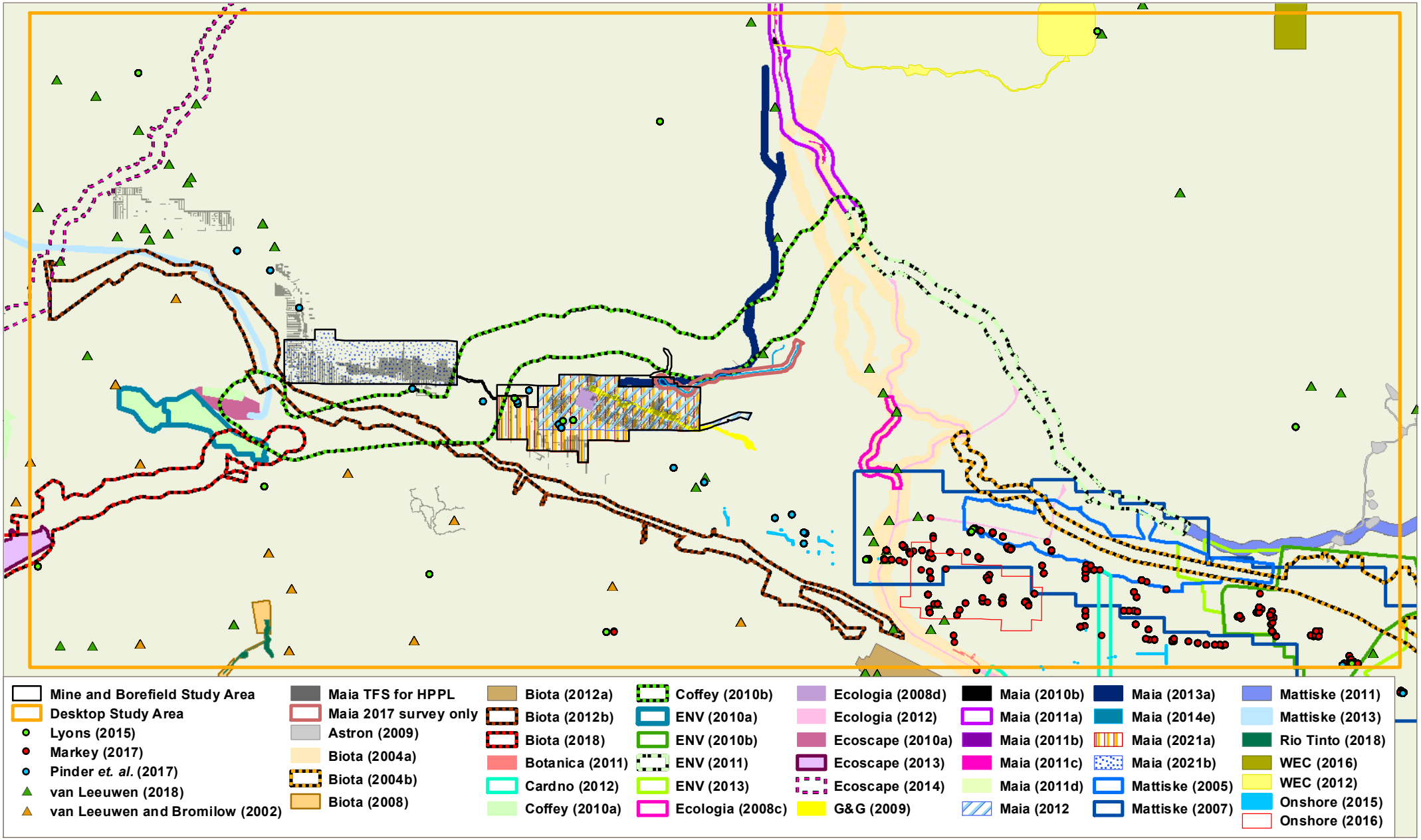
Map: 6 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4



Location Map



Previous Biological Surveys within the Desktop Study Area

N

0 17.5

Kilometres

Datum: GDA 1994, MGA 50

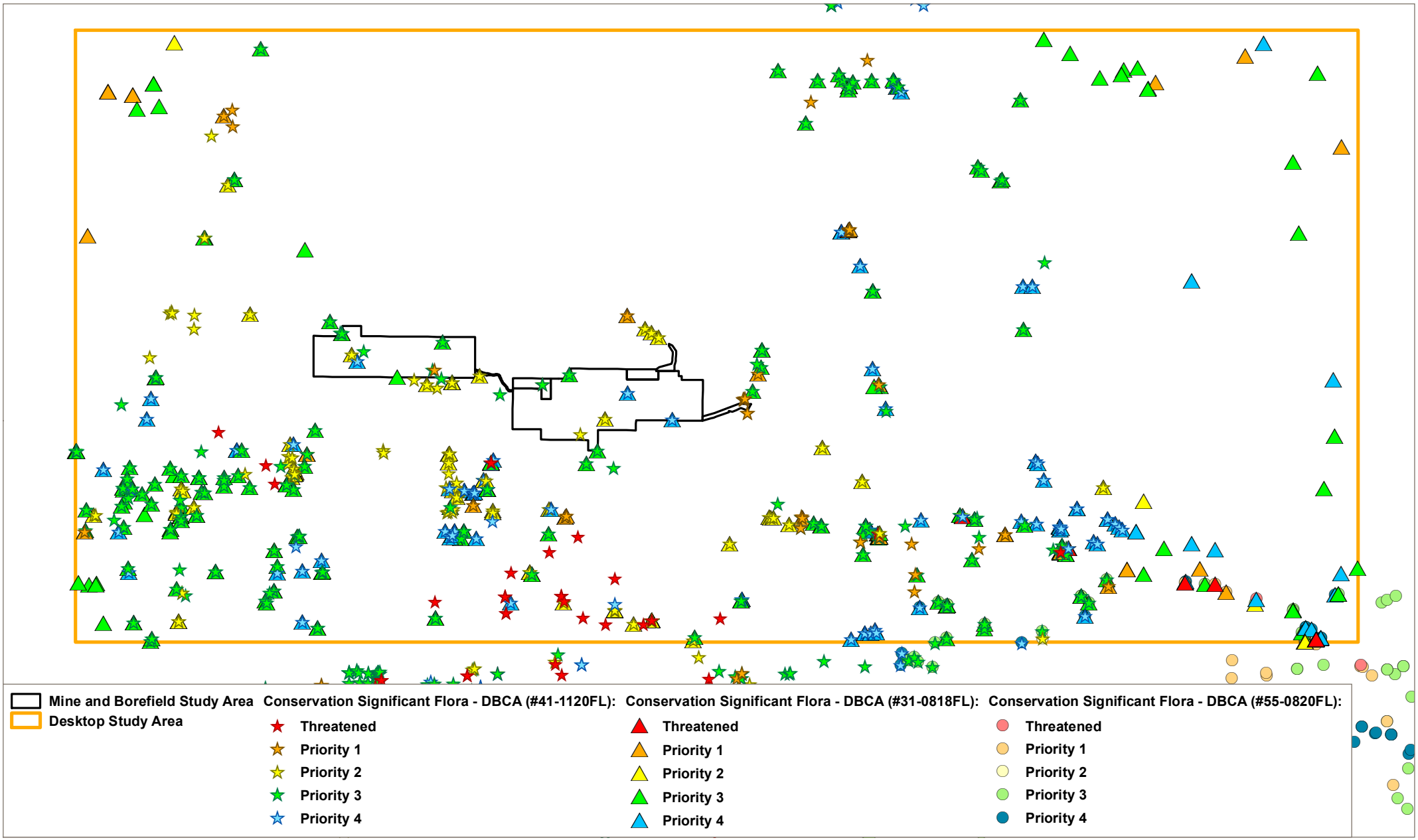
Map: 7 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4





Conservation Significant Flora - DBCA Searches (#41-1120FL, #31-0818FL and #55-0820FL)

maia

N

0 20

Kilometres

Datum: GDA 1994, MGA 50

Map: 8 **Version:** 2

Prepared for: JBSG

Drawn by: RH

Date: 29/06/2022

Project: 2204 **Size:** A4

Mine and Borefield Study Area

DBCA (31-0818FL and 41-1120FL)

Triodia basitricha (P3)

Maia (Surveys for HPPL)

Josephinia sp. Woodstock (A.A. Mitchell PRP 989) (P1)

Teucrium pilbaranum (P2)

Euphorbia australis var. *glabra* (P3)

Glycine falcata (P3)

Goodenia sp. East Pilbara (A.A. Mitchell PRP 727) (P3)

Rostellularia adscendens var. *latifolia* (P3)

Themeda sp. Hamersley Station (M.E. Trudgen 11431) (P3)

Bulbostylis burbidgeae - atypical form (?P4)

Goodenia nuda (P4)

Bulbostylis sp. (TOI)

Location Map

Karatha

Newman

Wiluna

Geraldton

Kalgoorlie

Perth

Previously known conservation significant flora recorded in the Mine and Borefield Study Area

maia

N

0 2.75

Kilometres

Datum: GDA 1994, MGA 50

Map: 9 **Version:** 5

Prepared for: JBSG

Drawn by: RH

Date: 17/08/2022

Project: 2204 **Size:** A3

Mine and Borefield Study Area

Maia (Surveys for HPPL)

- *Calotis squamigera* (P1)
- *Helichrysum oligochaetum* (P1)
- *Triodia veniciae* (P1)
- *Teucrium pilbaranum* (P2)
- *Eragrostis crateriformis* (P3)
- *Eragrostis* sp. Erect spikelets (P.K. Latz 2122) (P3)
- *Euphorbia australis* var. *glabra* (P3)
- *Rostellularia adscendens* ?var. *latifolia* (?P3)
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3)
- *Bulbostylis burbidgeae* (P4)
- *Goodenia nuda* (P4)
- *Hibiscus* sp. Mulga Downs (TOI)

***ecologia* (2008a):**

- *Goodenia nuda* (P4)

Lyons (2015):

- *Helichrysum oligochaetum* (P1)
- *Iotasperma sessilifolium* (P3)
- *Rhodanthe ascendens* (P1)

Location Map



Previously known conservation significant flora recorded in the Mine and Borefield Study Area

N

0 3

Kilometres

Datum: GDA 1994, MGA 50

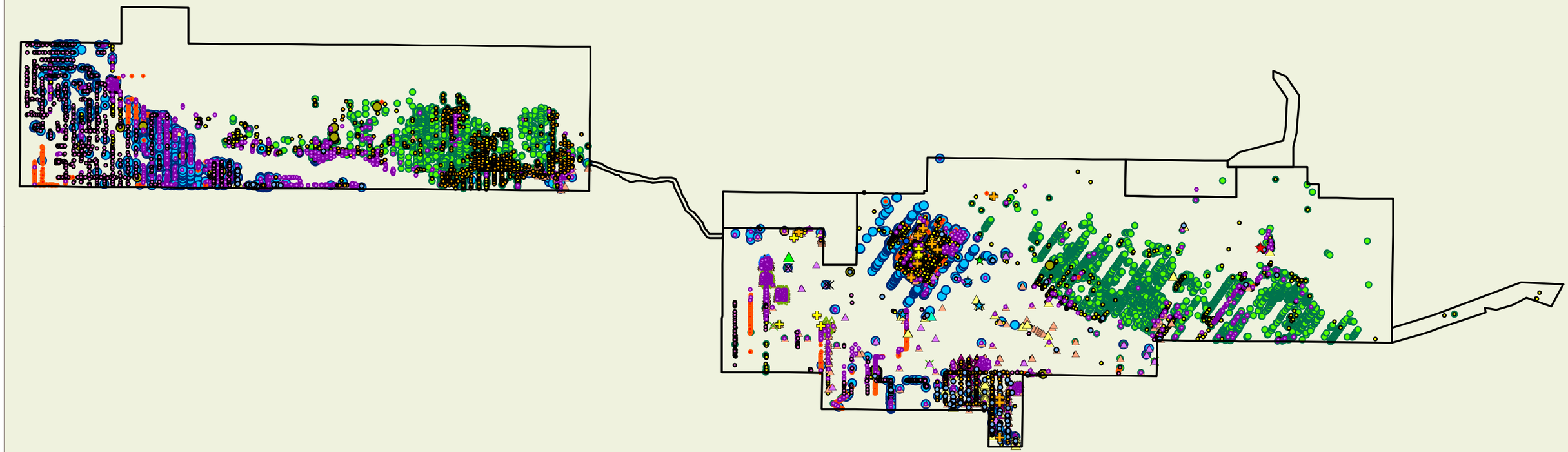
Map: 10 **Version:** 5

Prepared for: JBSG

Drawn by: RH

Date: 17/08/2022

Project: 2204 **Size:** A3



Mine and Borefield Study Area

Weeds (Maia Surveys for HPPL):

- *Aerva javanica*
- *Bidens bipinnata*
- *Cenchrus ciliaris*
- *Cenchrus ciliaris* and *Cenchrus setiger*
- *Cenchrus setiger*
- *Cenchrus* spp.
- *Chloris virgata*
- *Citrullus amarus*
- *Citrullus colocynthis*
- *Cynodon dactylon*
- *Echinochloa colona*
- *Echinochloa microstachya*
- *Flaveria trinervia*
- *Malvastrum americanum*
- *Malvastrum americanum* and *Setaria verticillata*
- *Malvastrum americanum* and *Cenchrus ciliaris*
- *Malvastrum americanum* and *Cenchrus setiger*
- *Malvastrum americanum*, *Setaria verticillata* and *Cenchrus ciliaris*
- *Medicago polymorpha*
- *Portulaca pilosa*
- *Rumex vesicarius*
- *Setaria verticillata*
- *Solanum nigrum*
- *Sonchus oleraceus*
- *Tribulus terrestris*
- *Vachellia farnesiana*

Location Map



Previously recorded weeds in the Mine and Borefield Study Area - all species

maia

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 11 **Version:** 4

Prepared for: JBSG

Drawn by: RH

Date: 6/09/2022

Project: 2204 **Size:** A3

Mine and Borefield Study Area

Weeds (Maia Surveys for HPPL):

- *Cenchrus ciliaris*
- *Cenchrus ciliaris* and *Cenchrus setiger*
- *Cenchrus setiger*
- *Cenchrus* spp.

Location Map



Previously recorded weeds in the Mine and Borefield Study Area - *Cenchrus* species

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 12 **Version:** 4

Prepared for: JBSG

Drawn by: RH

Date: 6/09/2022

Project: 2204 **Size:** A3

Mine and Borefield Study Area

Weeds (Maia Surveys for HPPL):

- *Malvastrum americanum*
- *Malvastrum americanum* and *Setaria verticillata*
- *Malvastrum americanum* and *Cenchrus ciliaris*
- *Malvastrum americanum* and *Cenchrus setiger*
- *Malvastrum americanum*, *Setaria verticillata* and *Cenchrus ciliaris*

Location Map



Previously recorded weeds in the Mine and Borefield Study Area - *Malvastrum americanum* and *M. americanum* with *Setaria* verticillata and *Cenchrus* species

maia

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 13 **Version:** 4

Prepared for: JBSG

Drawn by: RH

Date: 6/09/2022

Project: 2204 **Size:** A3

Mine and Borefield Study Area

Weeds (Maia Surveys for HPPL):

- *Bidens bipinnata*
- *Vachellia farnesiana*

Location Map



Previously recorded weeds in the Mine and Borefield Study Area - *Bidens bipinnata* and *Vachellia farnesiana*

maia

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 14 **Version:** 4

Prepared for: JBSG

Drawn by: RH

Date: 6/09/2022

Project: 2204 **Size:** A3

Mine and Borefield Study Area

Weeds (Maia Surveys for HPPL):

- *Aerva javanica*
- *Chloris virgata*
- *Citrullus amarus*
- *Citrullus colocynthis*
- *Cynodon dactylon*
- *Echinochloa colona*
- *Echinochloa microstachya*
- *Flaveria trinervia*
- *Medicago polymorpha*
- *Portulaca pilosa*
- *Rumex vesicarius*
- *Setaria verticillata*
- *Solanum nigrum*
- *Sonchus oleraceus*
- *Tribulus terrestris*

Location Map



Previously recorded weeds in the Mine and Borefield Study Area - all other species

maia

N

0 7.5

Kilometres

Datum: GDA 1994, MGA 50

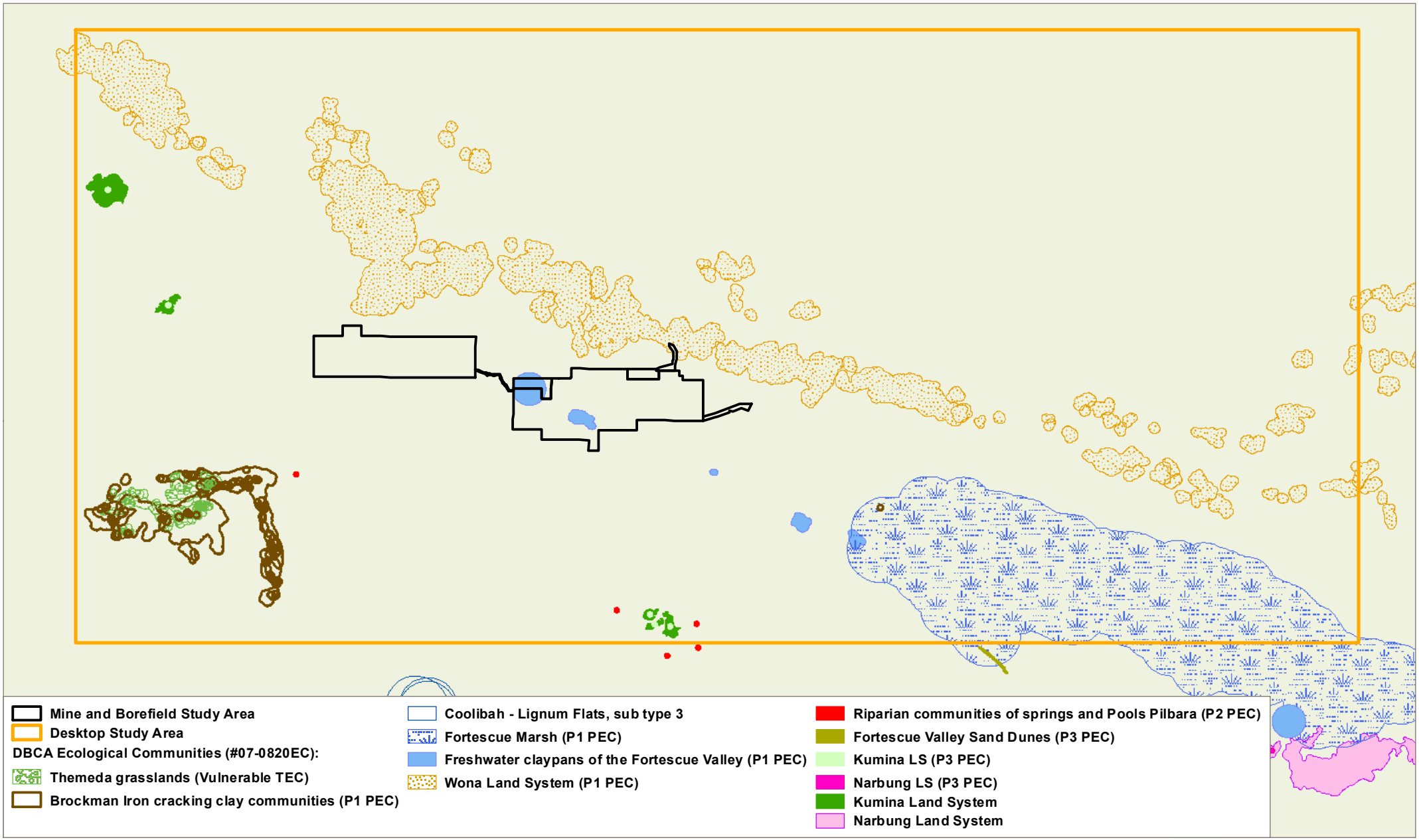
Map: 15 **Version:** 4

Prepared for: JBSG

Drawn by: RH

Date: 6/09/2022

Project: 2204 **Size:** A3





Significant Ecological Communities (DBCA Search #07-0820EC)

N

0 20

Kilometres

Datum: GDA 1994, MGA 50

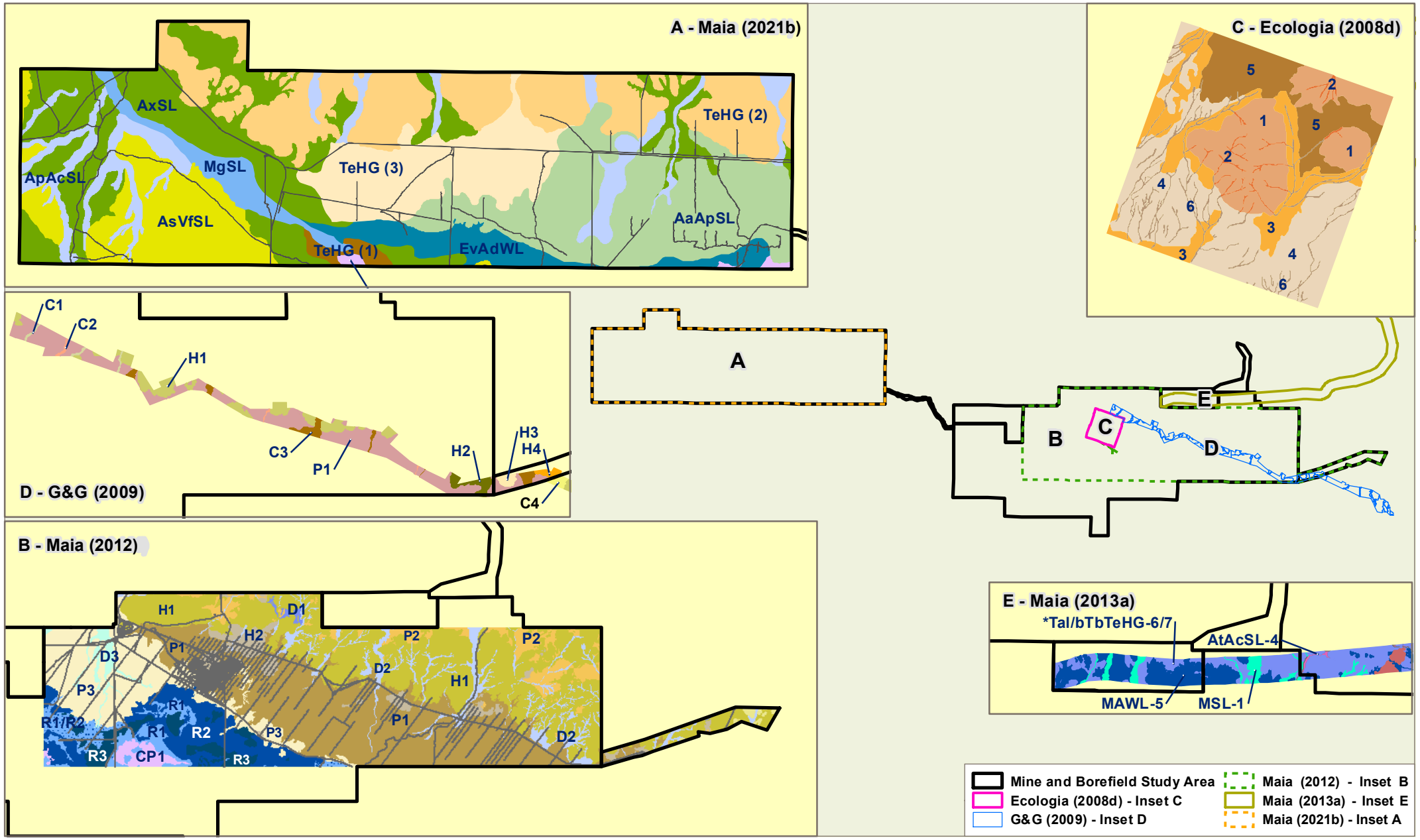
Map: 16 **Version:** 1

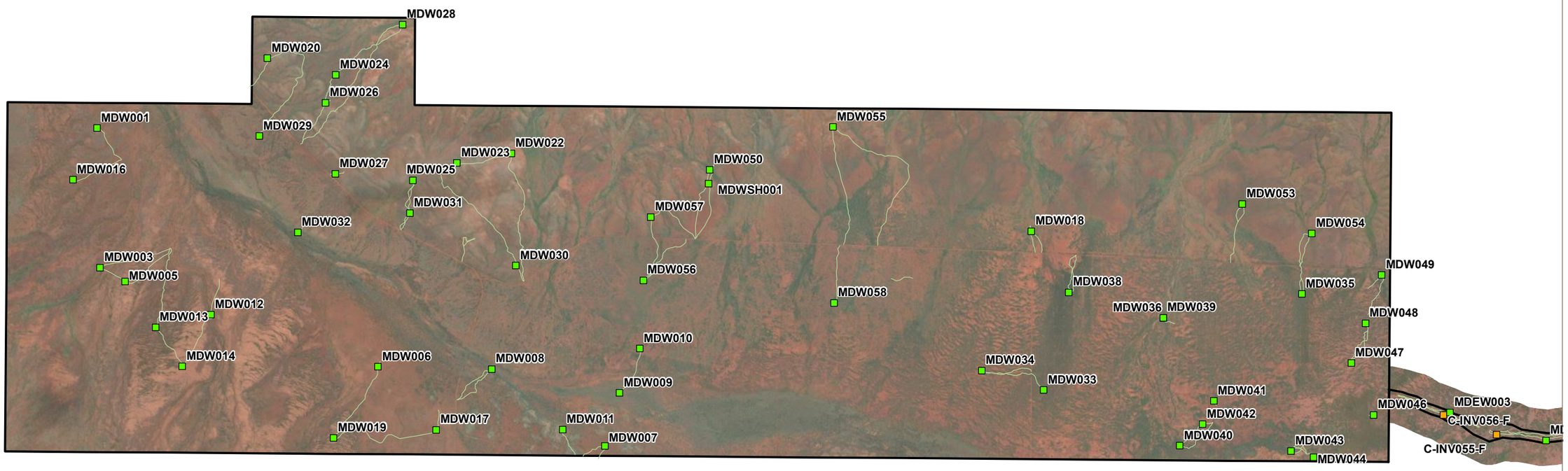
Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4


A - Maia (2021b)
AxSL
MgSL
ApAcSL
AsVfSL
TeHG (3)
TeHG (2)
TeHG (1)
EvAdWL
AaApSL
C - Ecologia (2008d)
5
2
1
5
2
1
4
6
3
3
4
6
C1
C2
H1
C3
P1
H2
H3
H4
C4
D - G&G (2009)
A
B
C
D
E
B - Maia (2012)
H1
D1
H2
P1
D3
P2
P2
D2
H1
P3
R1
R1/R2
R1
R2
P3
P1
D2
R3
CP1
R3
E - Maia (2013a)
*Tal/bTbTeHG-6/7
AtAcSL-4
MAWL-5
MSL-1
Mine and Borefield Study Area
Ecologia (2008d) - Inset C
G&G (2009) - Inset D
Maia (2012) - Inset B
Maia (2013a) - Inset E
Maia (2021b) - Inset A
Location Map
Karatha
Newman
Wiluna
Geraldton
Kalgoorlie
Perth
Previous Vegetation Mapping in the Mine and Borefield Study Area
maia
N
0
10
Kilometres
Datum: GDA 1994, MGA 50
Map: 17 Version: 1
Prepared for: JBSG
Drawn by: RH
Date: 10/05/2022
Project: 2204 Size: A4



Quadrats

- Coffey
- Maia

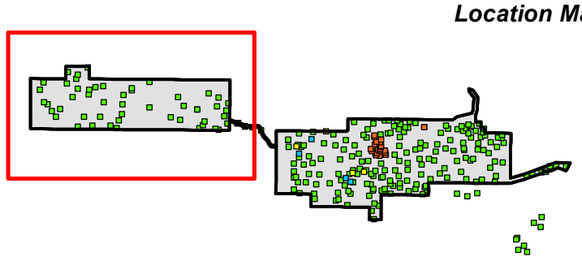
Traverses

- Traverses March 2021

Study Area

- Mine and borefield study area (MBSA)

Location Map



Location Map



Quadrats and Traverses

N

0 — 4

Kilometres

Datum: GDA 1994, MGA 50

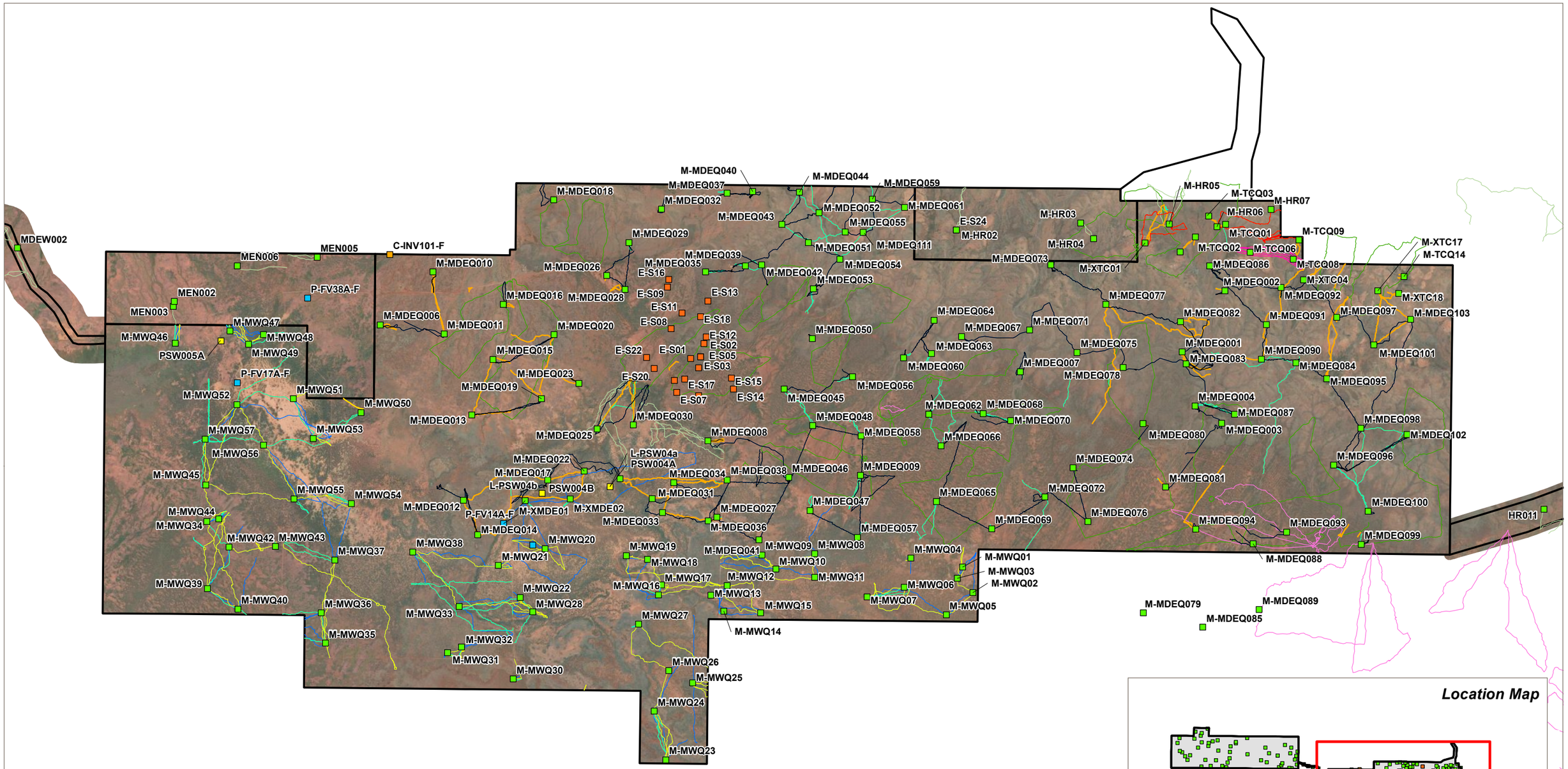
Map: 18 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Quadrats

- Coffey
- Ecologia
- Lyons
- Maia
- Pinder

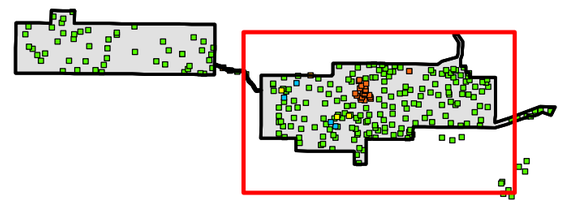
Traverses

- Traverses - 2012f
- Traverses 2013a
- Traverses 2014e
- Traverses May 2019
- Traverses August 2019
- Traverses September 2019
- Traverses May 2020
- Traverses August - September 2020
- Traverses July 2021
- Traverses March 2022
- Traverses May 2022

Study Area

- Mine and borefield study area (MBSA)

Location Map



Location Map



Quadrats and Traverses

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

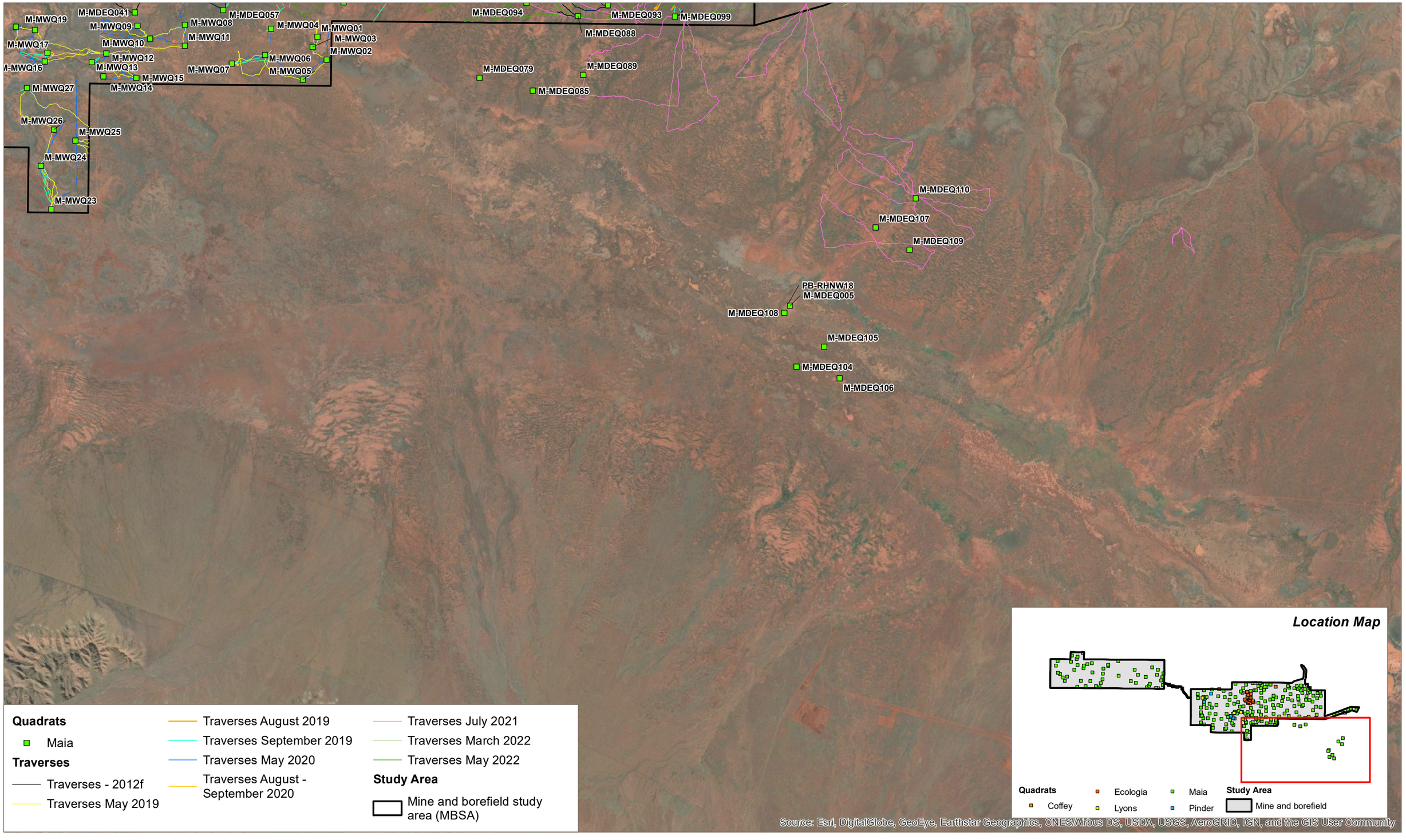
Map: 19 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Location Map

- Karratha
- Newman
- Wiluna
- Geraldton
- Kalgoorlie
- Perth

Quadrats and Traverses

maia

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

Map: 20 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Significant Flora Recorded

- *Euphorbia australis* var. *glabra*, P3
- *Glycine falcata*, P3
- *Goodenia nuda*, P4
- *Teucrium* pilbaranum, P2
- *Triodia basitricha*, P3

Study Area

Mine and borefield study area (MBSA)

Location Map

Karratha
Newman
Wiluna
Geraldton
Kalgoorlie
Perth

Conservation Significant Flora Species

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

Map: 21 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3

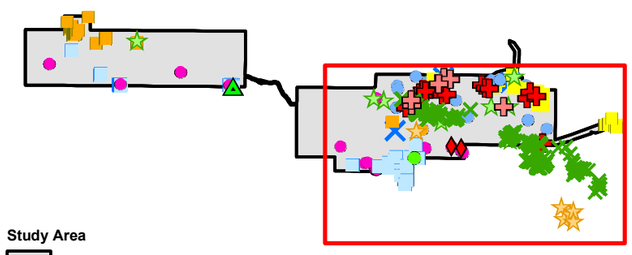
Significant Flora Recorded

- *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), P3
- *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), P3
- *Euphorbia australis* var. *glabra*, P3
- *Goodenia* ? *lyrata*, P3
- *Goodenia nuda*, P4
- *Helichrysum oligochaetum*, P1
- *Hibiscus* sp. Mulga Downs, TOI
- *Rhynchosia bungarensis*, P4
- *Rostellularia adscendens* ?var. *latifolia*, P3
- *Santalum spicatum*, TOI
- *Seringia* ? *exastia*, T
- *Seringia exastia*, T
- *Teucrium pilbaranum*, P2
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), P3
- *Triodia veniciae*, P1

Study Area

Mine and borefield study area (MBSA)

Location Map



Study Area

Mine and borefield

Location Map



Conservation Significant Flora Species

maia

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

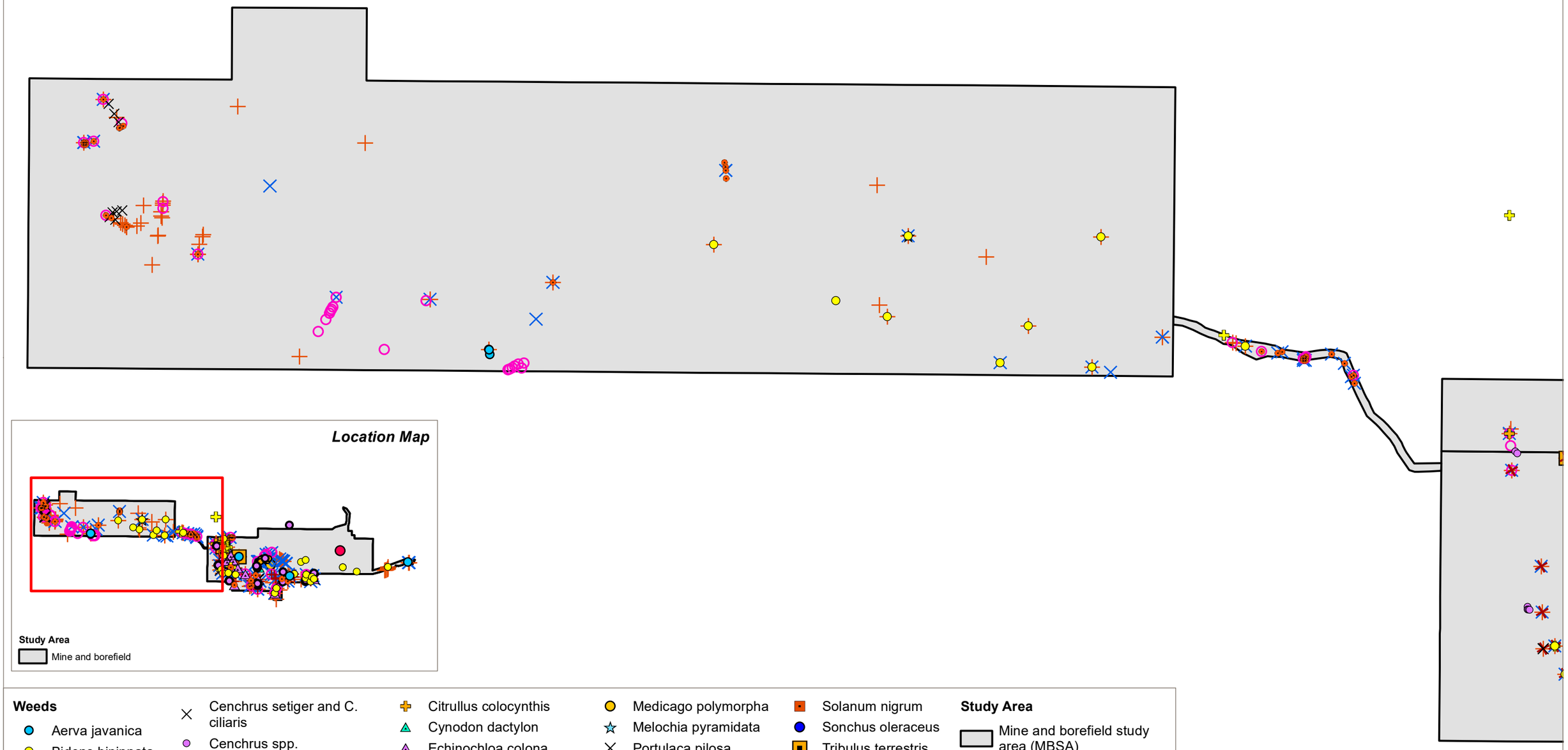
Map: 22 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Weeds

- Aerva javanica
- Bidens bipinnata
- Cenchrus ciliaris
- Cenchrus setiger
- Cenchrus setiger and C. ciliaris
- Cenchrus spp.
- Cenchrus ciliaris/Cenchr... setiger
- Citrullus amarus
- Citrullus colocynthis
- Cynodon dactylon
- Echinochloa colona
- Flaveria trinervia
- Malvastrum americanum
- Medicago polymorpha
- Melochia pyramidata
- Portulaca pilosa
- Rumex vesicarius
- Setaria verticillata
- Solanum nigrum
- Sonchus oleraceus
- Tribulus terrestris
- Vachellia farnesiana

Study Area

- Mine and borefield study area (MBSA)



Weeds Recorded

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

Map: 23 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3

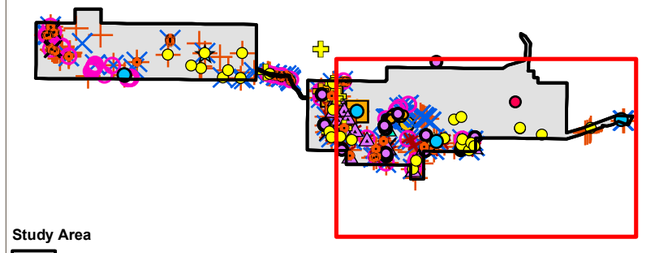
Weeds

- Aerva javanica
- Bidens bipinnata
- Cenchrus ciliaris
- Cenchrus setiger
- Cenchrus spp.
- Cenchrus ciliaris/Cenchr... setiger
- Citrullus amarus
- Cynodon dactylon
- Echinochloa colona
- Flaveria trinervia
- Malvastrum americanum
- Medicago polymorpha
- Portulaca pilosa
- Rumex vesicarius
- Setaria verticillata
- Solanum nigrum
- Sonchus oleraceus
- Tribulus terrestris
- Vachellia farnesiana

Study Area

- Mine and borefield study area (MBSA)

Location Map



Location Map



Weeds Recorded

maia

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

Map: 24 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3

Vegetation Mapping

AaAxSL: Tall Sparse Shrubland of *Acacia aneura* (alliance) and *A. xiphophylla* with a Low Sparse Shrubland of *Eremophila cuneifolia* and a Sparse Hummock Grassland of *Triodia epactia* and/or *T. basedowii*

AdEvWL: Low Open Woodland to Low Woodland of *Acacia distans* and *Eucalyptus victrix* sometimes with a Tall Sparse Shrubland of *Acacia stenophylla* or *A. tetragonophylla* and a Shrubland to a Sparse Shrubland of *Duma florulenta*.

ASL (1): Tall Sparse to Open mixed Shrubland mainly of *Acacia synchronicia*, *A. tetragonophylla*, *A. xiphophylla* with a mixed Sparse Chenopod Shrubland mainly of *Sclerolaena densiflora*, *S. cuneata* and *S. costata* and Isolated mixed Tussock Grasses mainly of *Sporobolus australasicus, Enneapogon polyphyllus* and *Dactyloctenium radulans*.

ASL (2): Mixed Tall *Acacia* Shrubland mainly of *Acacia tumida var. pilbarensis,A. pyrifolia* and *A. maitlandii* with a Sparse Tussock Grassland of *Themeda triandra* and Low Isolated Trees of *Corymbia hamersleyana* and / or *Eucalyptus victrix*

AWL (1): Low Woodland / Tall Shrubland to Low Isolated Trees / Shrubs of *Acacia aneura*(complex) with a mixed Low Sparse Shrubland mainly of *Dodonaea petiolaris, Eremophila forrestii* and *Abutilon otocarpum* and Isolated Low Trees of *A. pruinocarpa*.

AWL (2): Low Woodland / Tall Shrubland to Low Isolated Trees / Tall Shrubs of *Acacia aneura* (complex) A. synchronicia and *A. tetragonophylla* with a mixed Low Sparse Shrubland mainly of *Solanum lasiophyllum*, *Abutilon otocarpum* and *Sida platycalyx* and a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of *Sporobolus australasicus, Enneapogon cylindricus* and Aristida contorta.

AWL (3): Low Woodland of *Acacia aneura*(complex) mainly *Acacia aptaneura, A. aneura* and *A. incurvaneura* with a mixed Tall Shrubland mainly of *A. synchronicia*, *A. tetragonophylla* and Hakea lorea subsp. lorea with a Sparse Tussock Grassland to Isolated Tussock Grasses mainly of *Sporobolus australasicus, Enneapogon cylindricus* and *Aristida contorta*.

AxAsSL: Tall Sparse Shrubland of *Acacia xiphophylla* and / or *A. synchronicia* with a mixed Sparse Chenopod Shrubland mainly of *Sclerolaena cuneata, S. bicornis, S. cornishiana* and a Sparse Tussock Grassland of *Eragrostis xerophila*.

BpoFL: Claypans mostly bare of vegetation but with scattered *Bergia perennis subsp. obtusifolia* and mixed tussock grasses mainly of *Eriachne benthamii* and *Sporobolus mitchellii*.

Cleared

EfEbTG: Tussock Grassland of Eriachne flaccida and E. benthamii with Isolated Trees of Eucalyptus victrix.

EvWL: Low Open Woodland of *Eucalyptus victrix* and +/- *Acacia distans* with a Tussock Grassland of Eulalia aurea, *Eriachne benthamii* and *E. flaccida* and an Open Shrubland of *Melaleuca glomerata*.

MSL (1): Sparse to Open mixed Shrubland mainly of *Melaleuca glomerata, Acacia tetragonophylla* and *A. synchronicia* with a mixed Tussock grassland mainly of *Eragrostis pergracilis, Eriachne benthamii* and **Cenchrus setiger* or occasionally with a Hummock Grassland of *Triodia epactia* and Low Isolated Trees of *Eucalyptus victrix*.

MSL (2): Sparse to Open mixed Tall Shrubland mainly of *Acacia synchronicia*, *A. tetragonophylla*, and *Melaleuca glomerata* over a mixed Low Shrubland mainly of *Indigofera monophylla, Solanum lasiophyllum* and *Stemodia grossa* and either a Sparse Tussock grassland of *Eragrostis desertorum* or a Hummock Grassland of *Triodia epactia*.

MTG (1): Mixed Tussock Grassland mainly of *Eragrostis xerophila*, *Eulalia aurea* and **Cenchrus setiger* with a mixed Tall Sparse Shrubland mainly of *Acacia coriacea* subsp. pendens, *A. tetragonophylla* and *A. synchronicia* with a Low mixed Sparse Shrubland mainly of *Pluchea rubelliflora, Pterocaulon sphacelatum* and *Salsola australis*.

MTG (2): Sparse to Open mixed Tussock Grassland mainly of *Eriachne benthamii*, *Aristida latifolia* and **Cenchrus setiger* with a Sparse mixed Shrubland mainly of *Acacia synchronicia*, *A. tetragonophylla*, A. distans with Low Isolated Trees of *Eucalyptus victrix*.

MTG (3): Sparse to Open mixed Tussock Grassland mainly of *Eragrostis xerophylla*, *Eriachne benthamii*, and *Astrebla lappacea* with a mixed Forbland, mainly of *Stemodia kingii, Operculina aequisepala* and *Cullen cinereum* with Isolated shrubs of *Acacia synchronicia* or *Vachellia farnesiana*.

Mosaic of AdEvWL / BpoFL

THG (1): Mixed Hummock Grassland mainly of *Triodia basedowii*, *Triodia brizoides* and *T. vanleeuwenii* with a Tall Sparse Shrubland of mixed *Acacia* species mainly *Acacia atkinsiana*, *A. maitlandii*, *A. ancistrocarpa* with Low Isolated Trees of *Eucalyptus leucophloia* subsp. *leucophloia* +/- *Corymbia hamersleyana*.

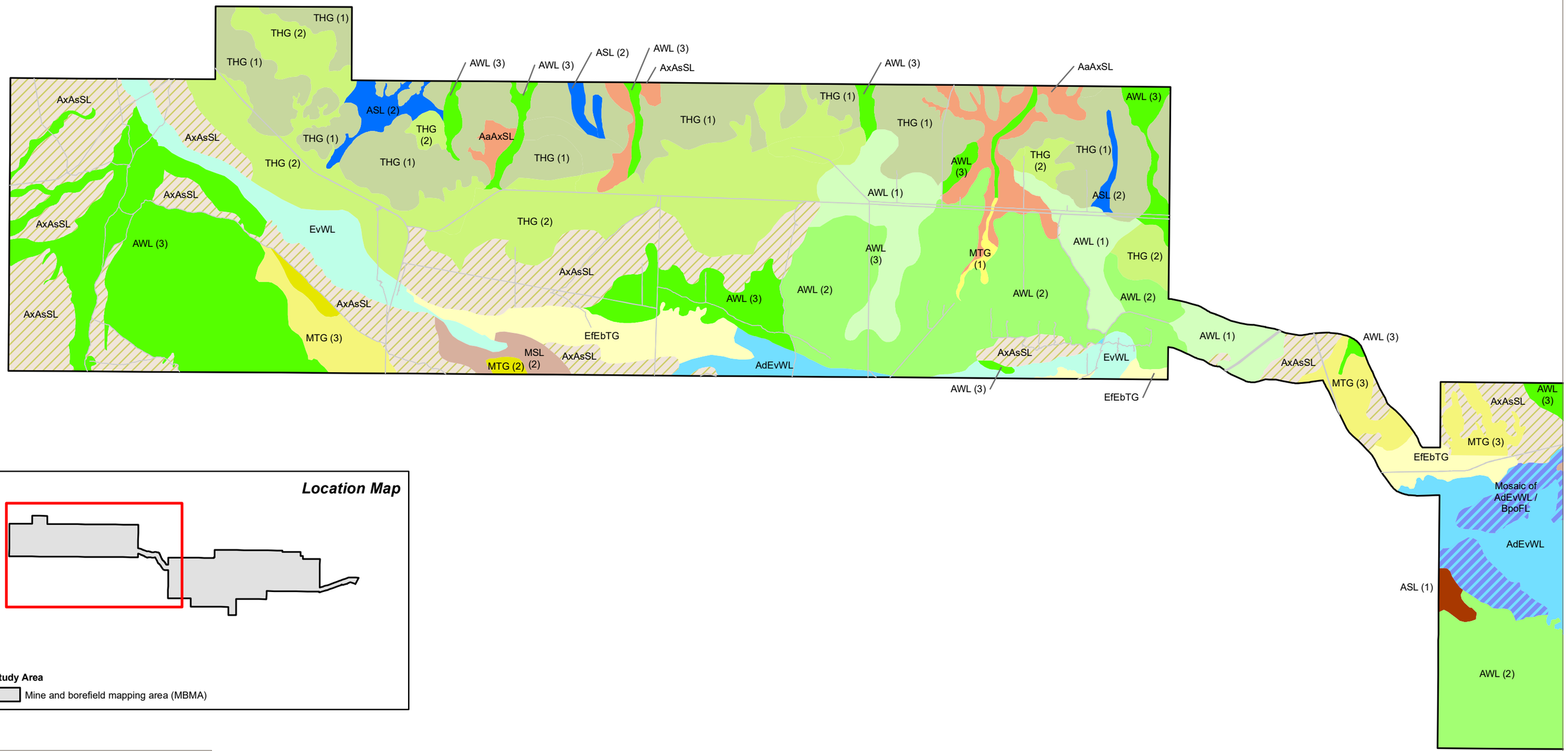
THG (2): Mixed Hummock Grassland mainly of *Triodia basedowii*, *T. epactia* and *T. vanleeuwenii* with a Sparse mixed Shrubland mainly of *Acacia aneura*, *A. aptaneura* and *A. atkinsiana* and Isolated Low Trees of *A. pruinocarpa* and / or *Eucalyptus leucophloia subsp. Leucophloia*.

TvHG: Hummock Grassland of *Triodia veniciae* with Isolated Shrubs of *Acacia marramamba* and *A. atkinsiana*.

Maia Vegetation Types Legend

maia

Map: 25 **Version:** 1
Prepared for: JBSG
Drawn by: RH
Date: 25/06/2022
Project: Mulga **Size:** A4



Location Map

Study Area

Mine and borefield mapping area (MBMA)

Study Area

Mine and borefield mapping area (MBMA)

Location Map



Vegetation Types

maia

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

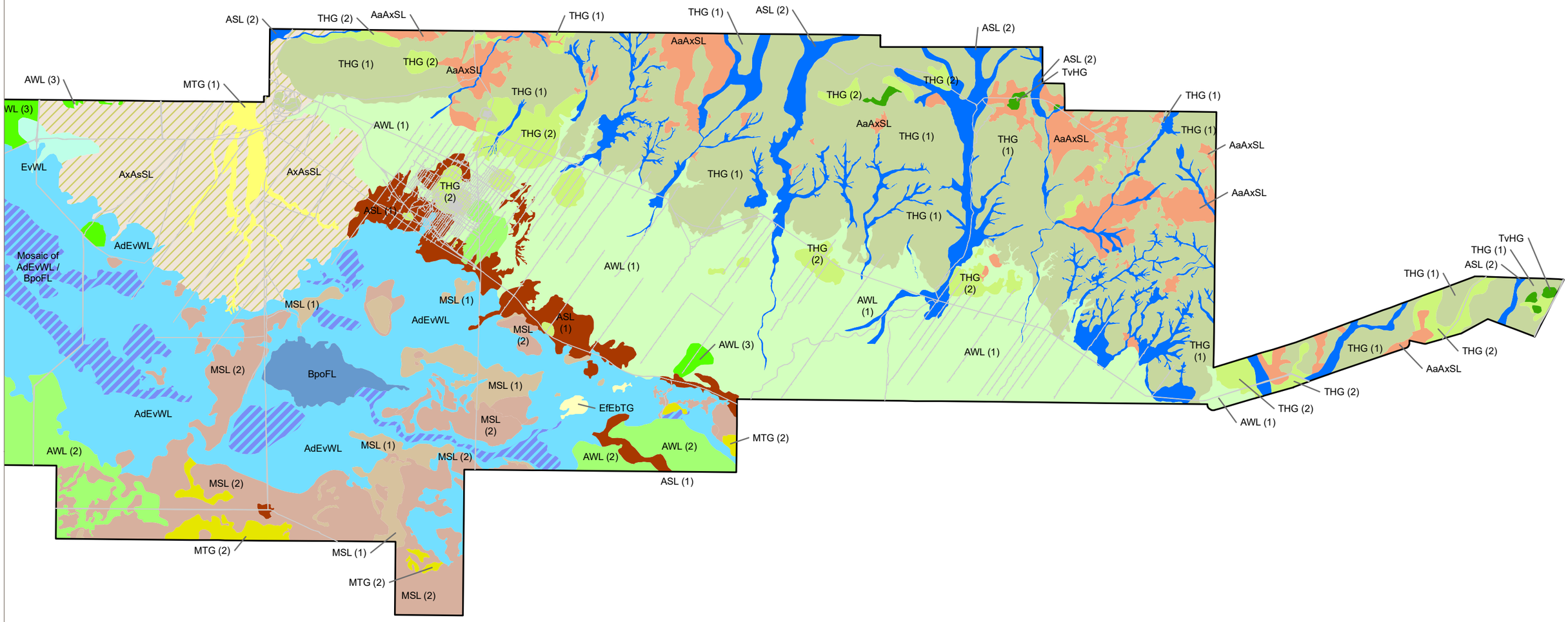
Map: 26 **Version:** 1

Prepared for: JBSG

Drawn by: RH

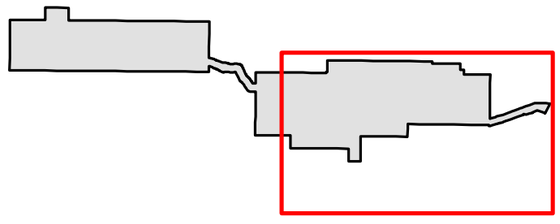
Date: 25/06/2022

Project: Mulga **Size:** A3



Mine and borefield mapping area (MBMA)

Location Map



Mine and borefield mapping area (MBMA)

Location Map



Vegetation Types

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

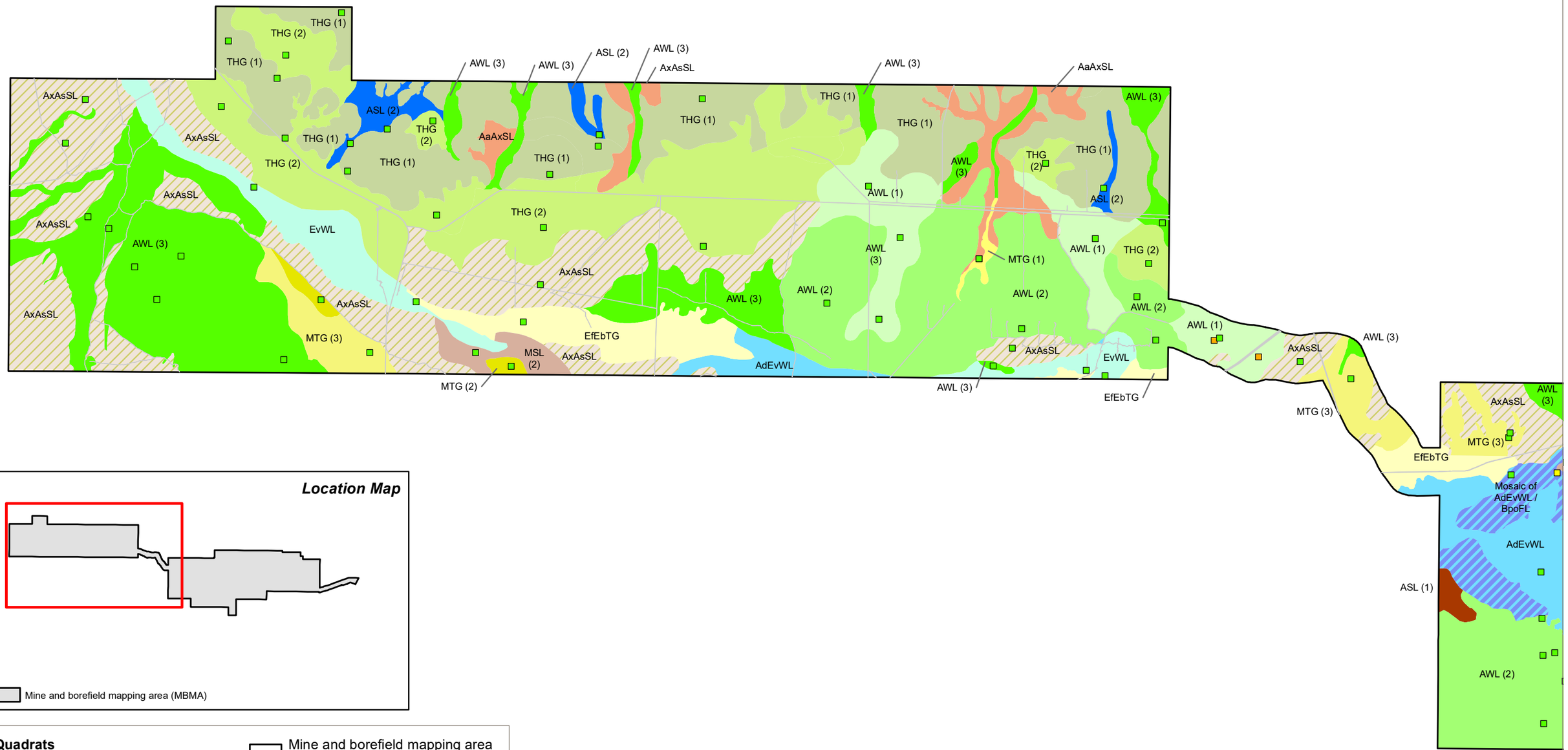
Map: 27 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Location Map

Mine and borefield mapping area (MBMA)

Quadrats

- Coffey (2010b)
- Lyons (2015)
- Maia (2012, 2019, 2020, 2022)

Mine and borefield mapping area (MBMA)

Location Map



Vegetation Types and Quadrats

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

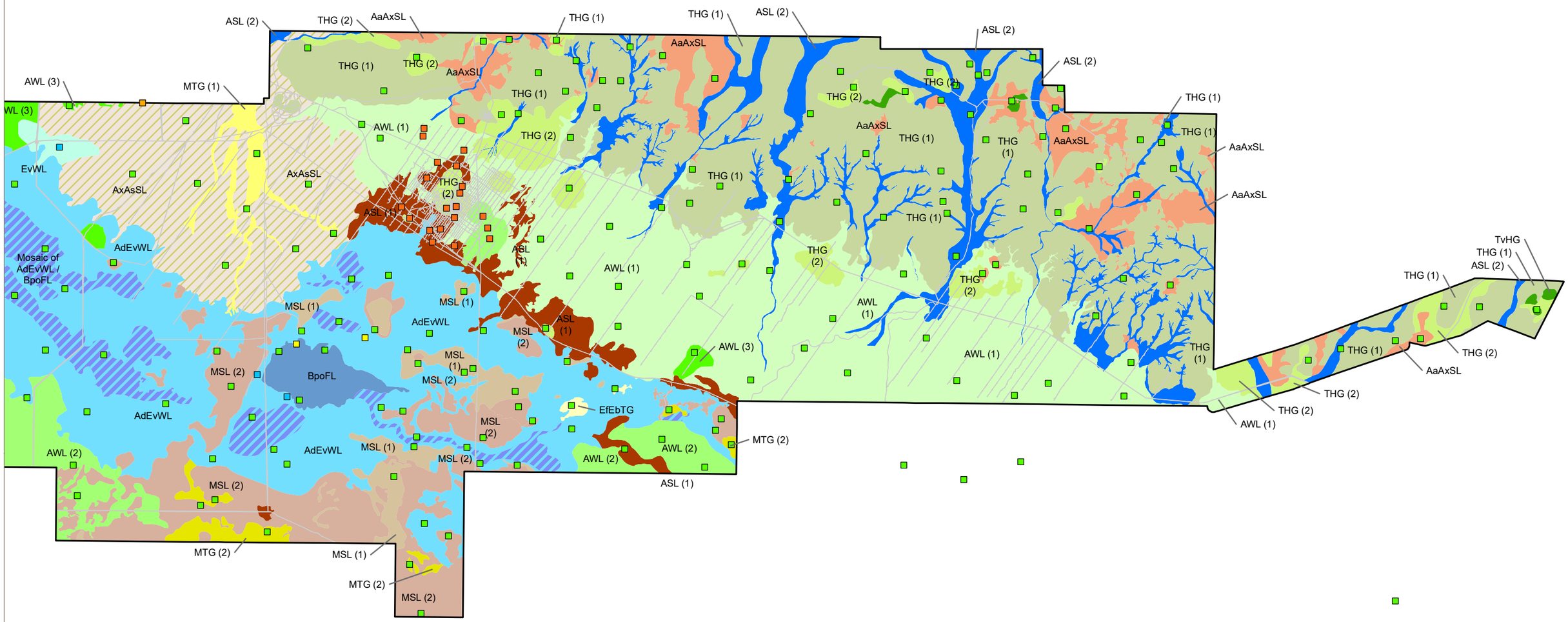
Map: 28 **Version:** 1

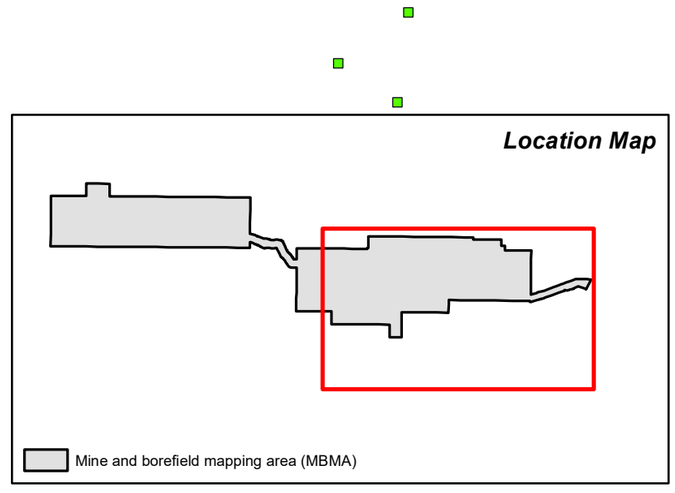
Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3





Quadrats

- Coffey (2010b)
- Ecologia (2008d)
- Lyons (2015)
- Maia (2012, 2019, 2020, 2022)
- Pinder et al (2017)

Mine and borefield mapping area (MBMA)



Vegetation Types and Quadrats

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

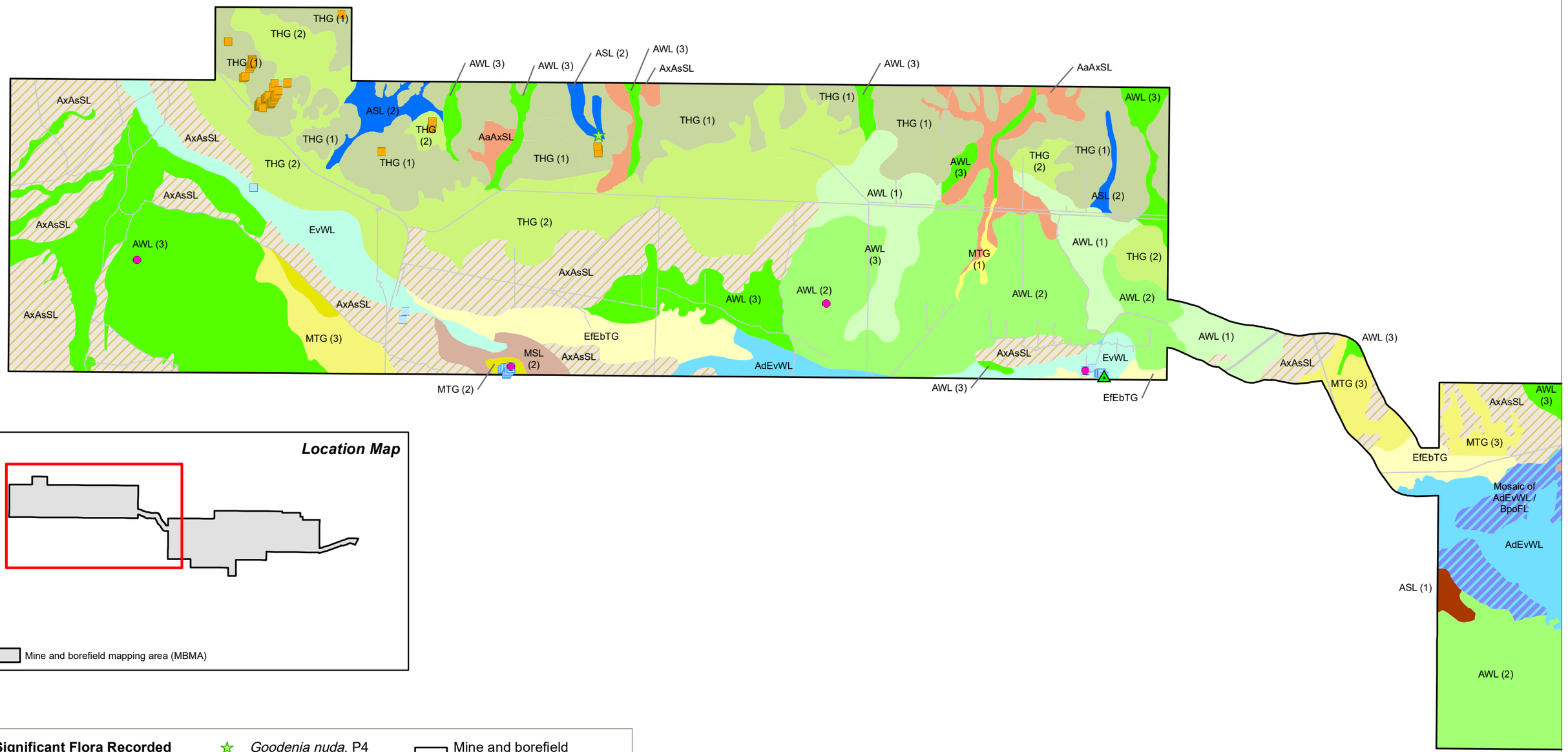
Map: 29 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Location Map

Mine and borefield mapping area (MBMA)

Significant Flora Recorded

- *Euphorbia australis* var. *glabra*, P3
- *Glycine falcata*, P3
- *Goodenia nuda*, P4
- *Teucrium pilbaranum*, P2
- *Triodia basitricha*, P3

Mine and borefield mapping area (MBMA)

Location Map



Vegetation Types
Conservation Significant Flora

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

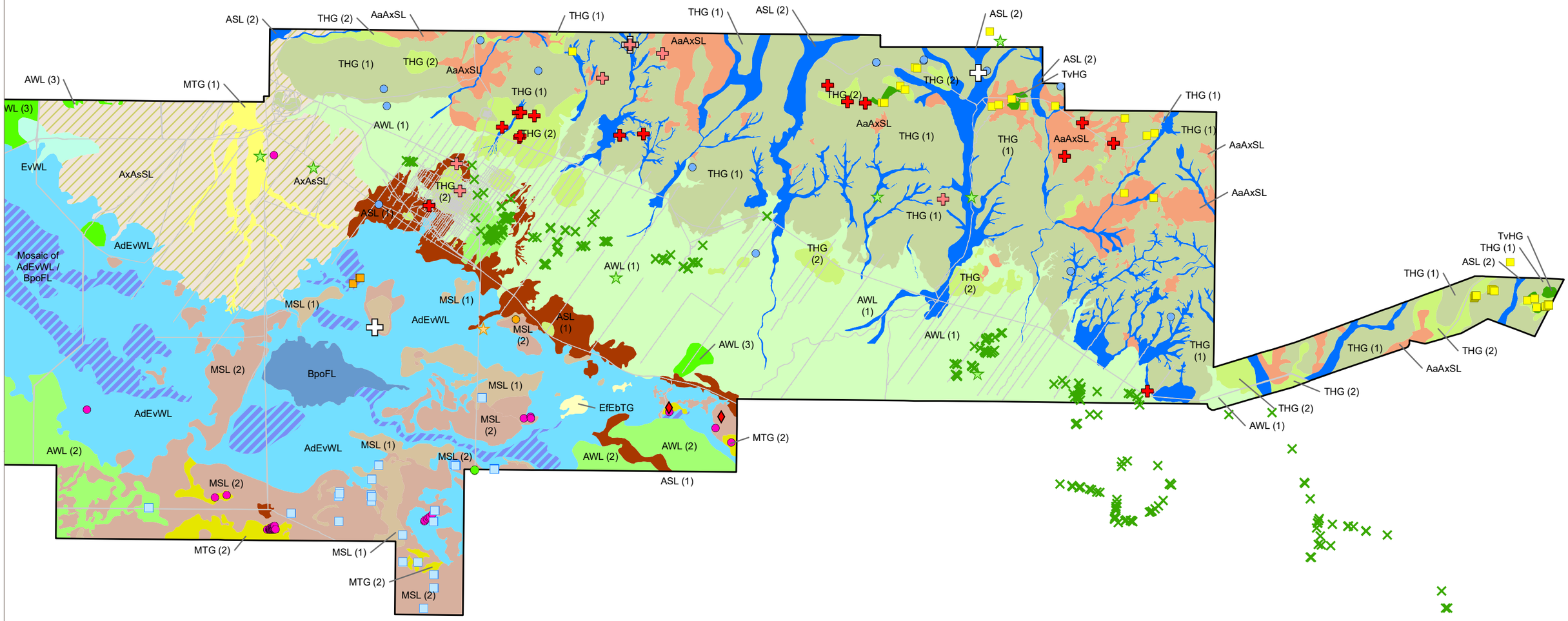
Map: 30 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3

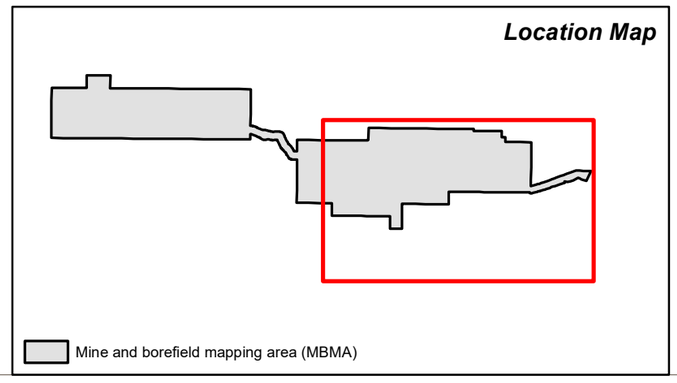


Significant Flora Recorded

- *Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479), P3
- *Eragrostis* sp. Erect spikelets (P.K. Latz 2122), P3
- *Euphorbia australis* var. *glabra*, P3
- *Goodenia* ? *lyrata*, P3
- *Goodenia nuda*, P4
- *Helichrysum oligochaetum*, P1
- *Hibiscus* sp. Mulga Downs, TOI
- *Rhynchosia bungarensis*, P4
- *Rostellularia adscendens* ? var. *latifolia*, P3
- *Santalum spicatum*, TOI
- *Seringia* ? *exastia*, T
- *Seringia exastia*, T
- *Teucrium pilbaranum*, P2
- *Themeda* sp. Hamersley Station (M.E. Trudgen 11431), P3
- *Triodia veniciae*, P1

Mine and borefield mapping area (MBMA)

Location Map



Location Map



Vegetation Types
Conservation Significant Flora

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

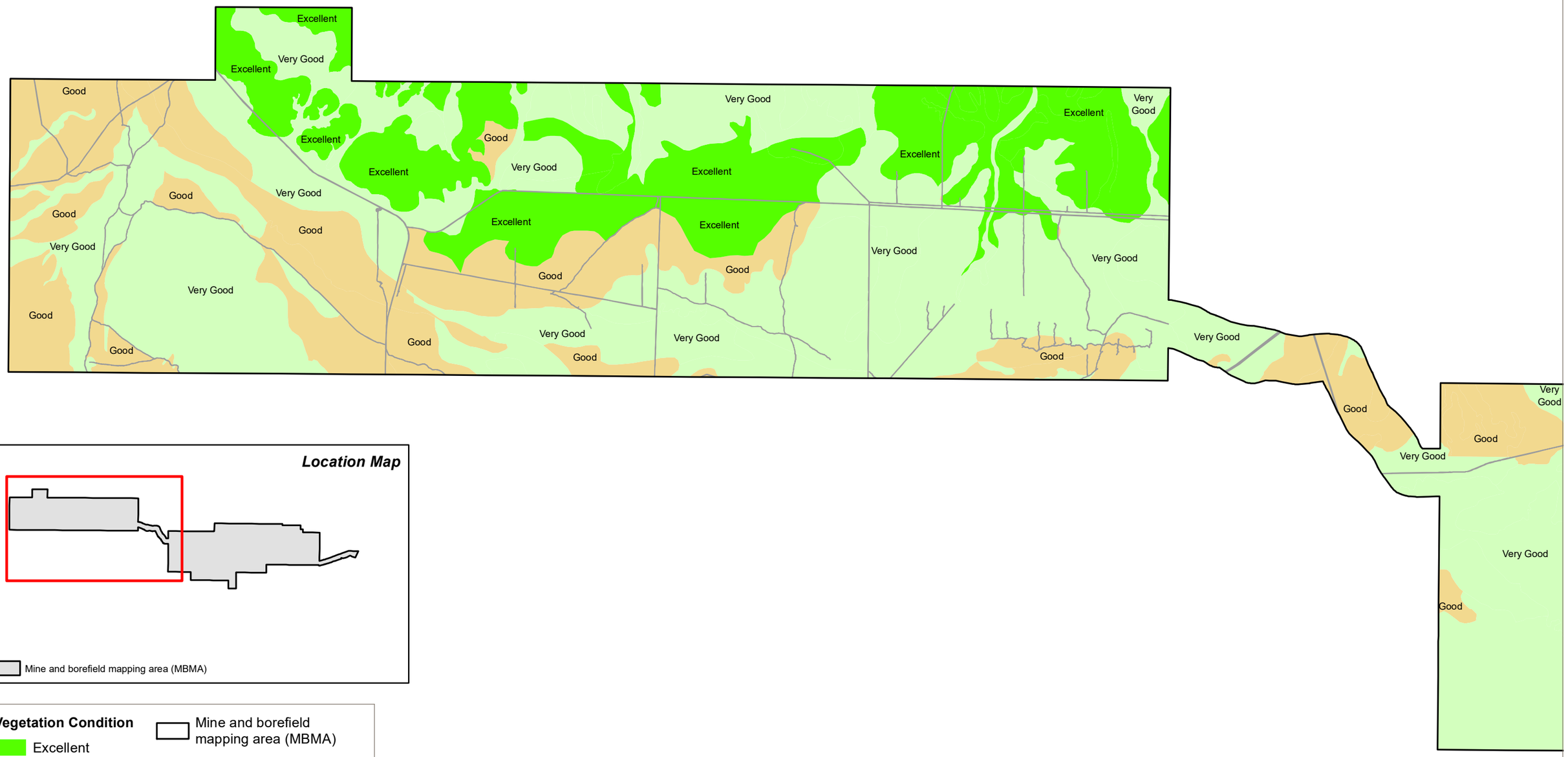
Map: 31 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3



Location Map

Karratha
Newman
Wiluna
Geraldton
Kalgoorlie
Perth

Vegetation Condition

maia

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

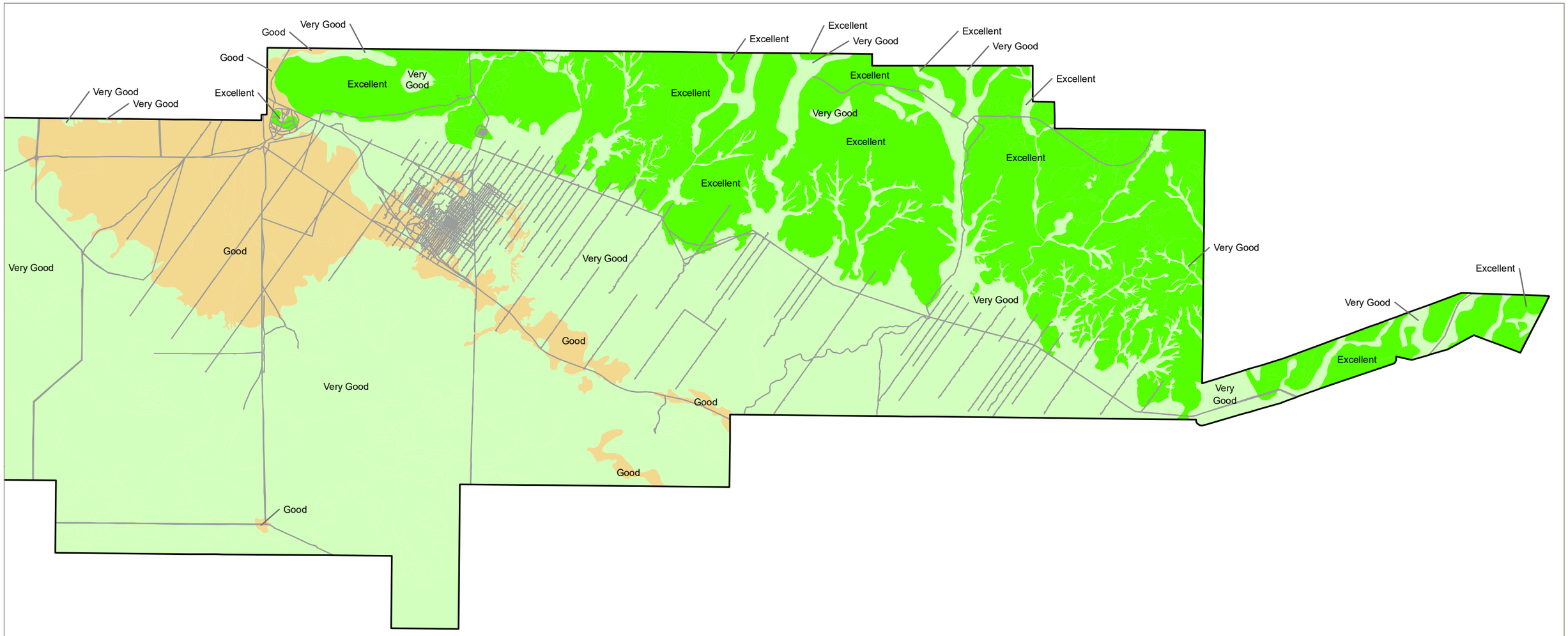
Map: 32 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3

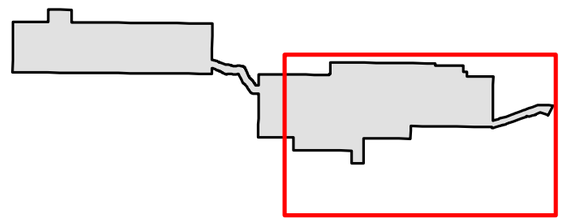


Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded

Mine and borefield mapping area (MBMA)

Location Map



Mine and borefield mapping area (MBMA)

Location Map



Vegetation Condition

N

0 4

Kilometres

Datum: GDA 1994, MGA 50

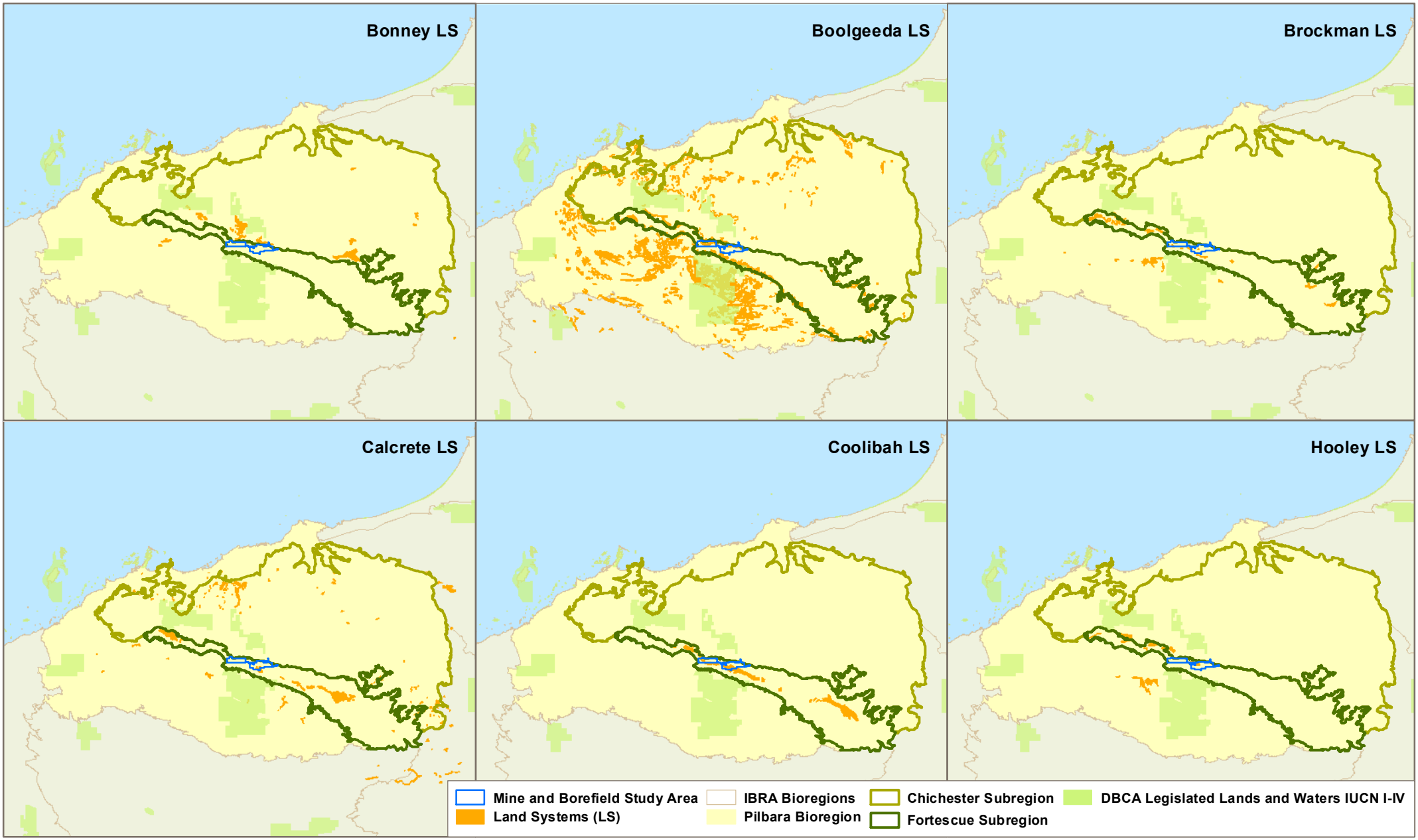
Map: 33 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 25/06/2022

Project: Mulga **Size:** A3





Distribution of Land Systems (Pre-European Extent) in the Pilbara Bioregion

maia

N

0 17.5

Kilometres

Datum: GDA 1994, MGA 50

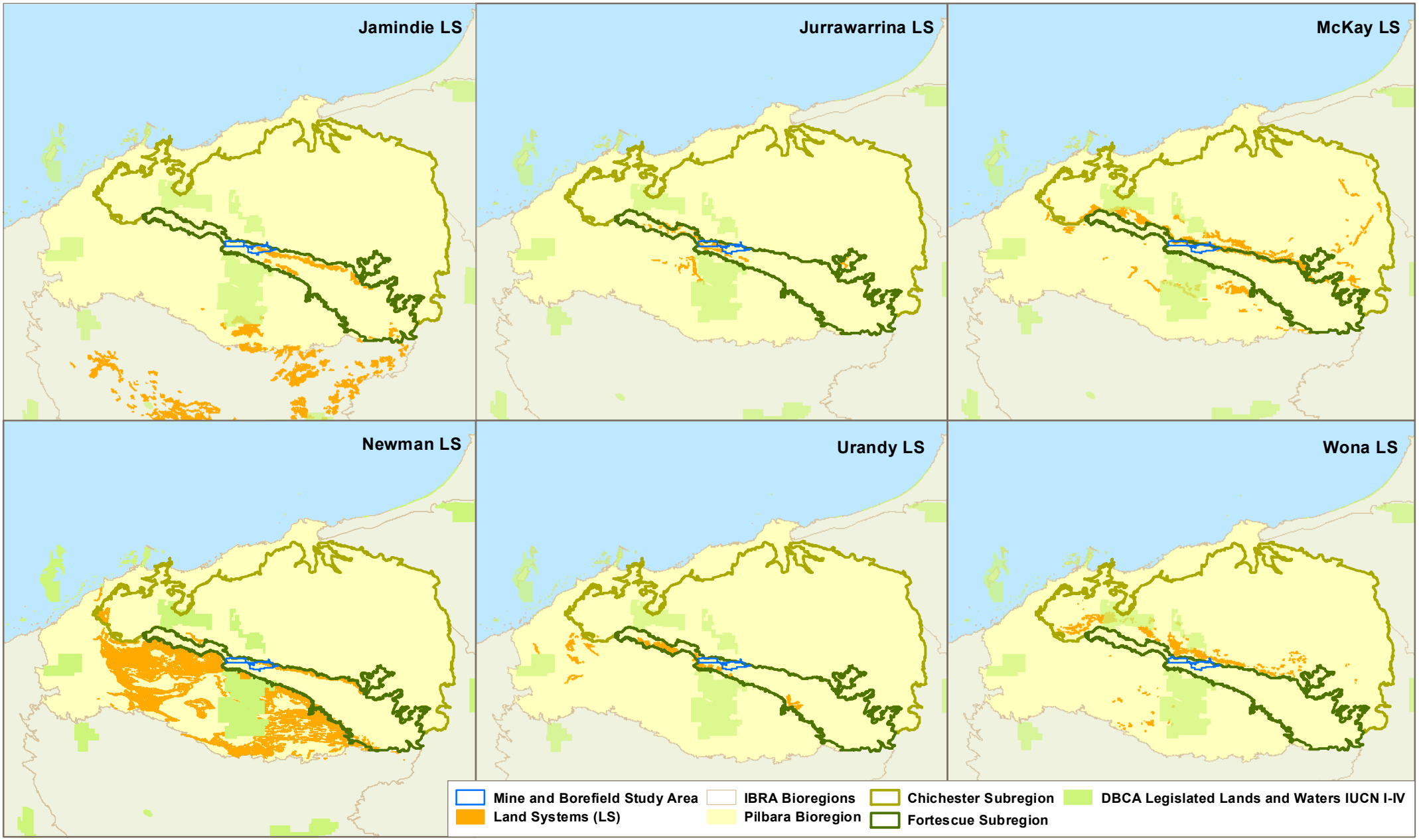
Map: 34 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4





Distribution of Land Systems (Pre-European Extent) in the Pilbara Bioregion

maia

N

0 17.5

Kilometres

Datum: GDA 1994, MGA 50

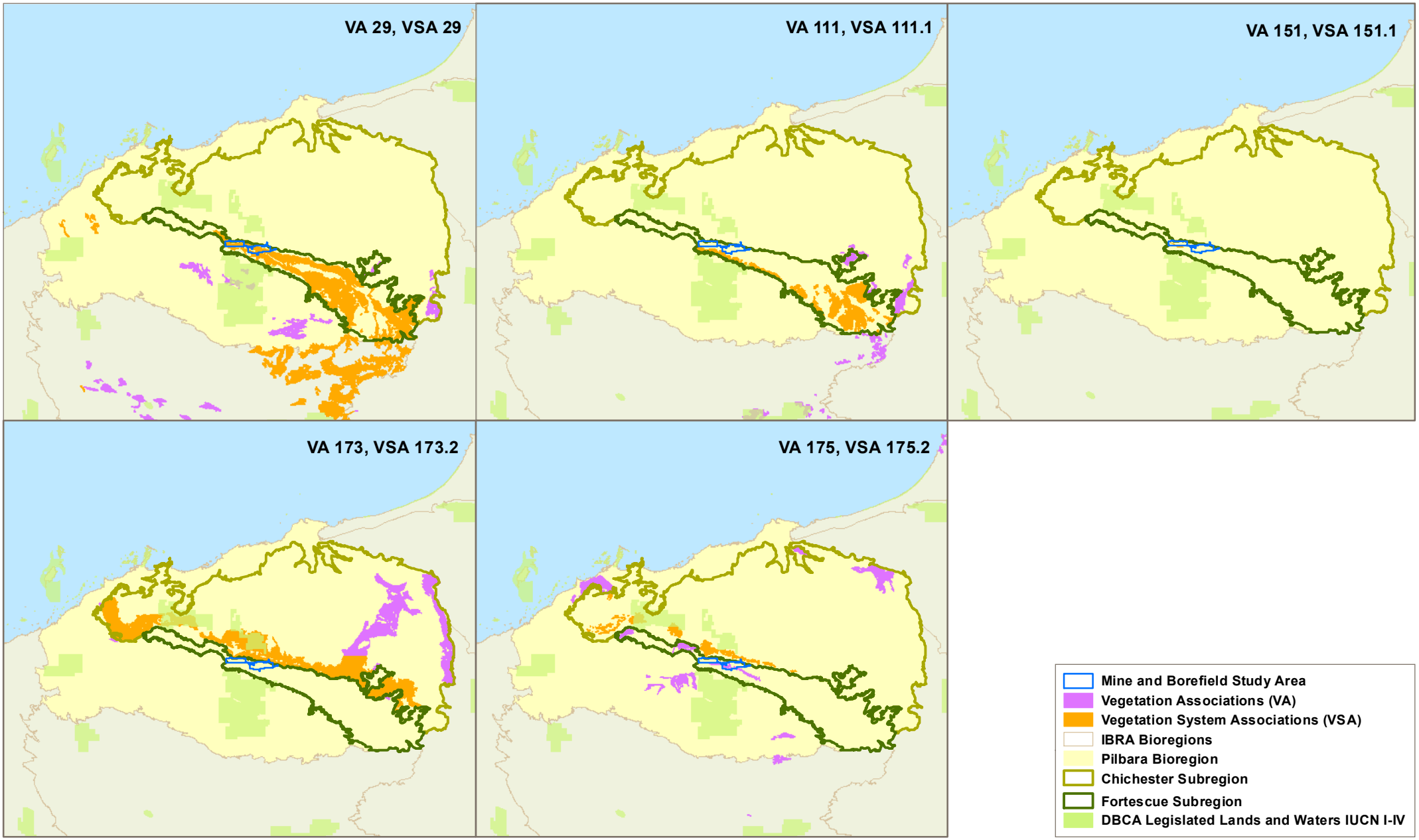
Map: 35 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4





Distribution of Vegetation Associations and Vegetation System Associations (Pre-European Extent) in the Pilbara Bioregion

maia

N

0 17.5

Kilometres

Datum: GDA 1994, MGA 50

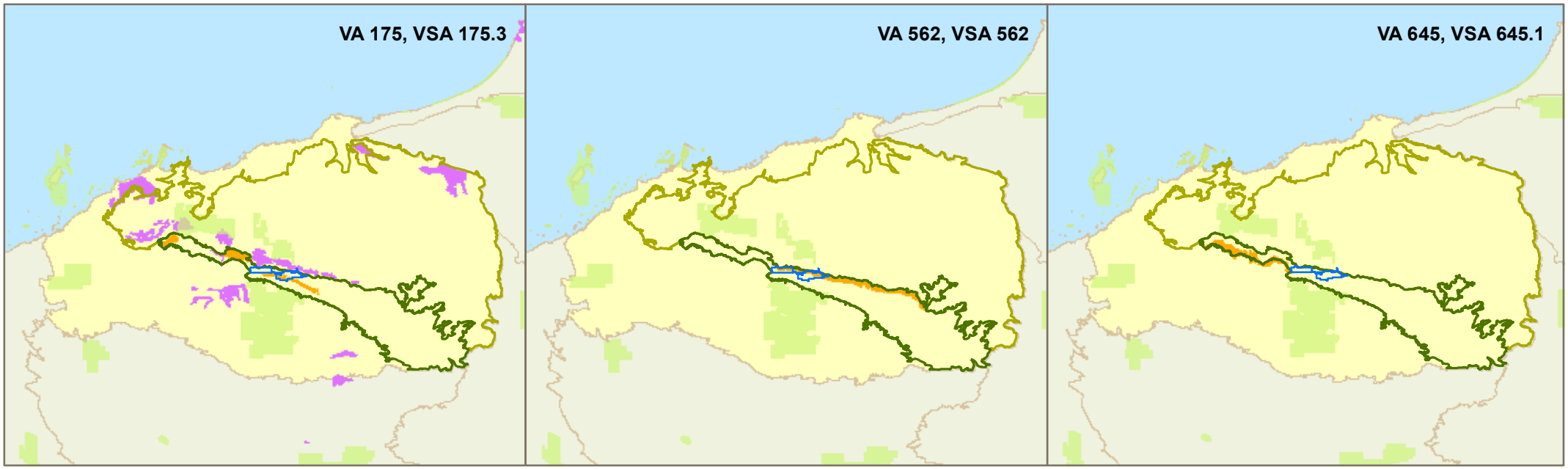
Map: 36 **Version:** 1

Prepared for: JBSG

Drawn by: RH

Date: 10/05/2022

Project: 2204 **Size:** A4



Mine and Borefield Study Area
Vegetation Associations (VA)
Vegetation System Associations (VSA)
IBRA Bioregions
Pilbara Bioregion
Chichester Subregion
Fortescue Subregion
DBCA Legislated Lands and Waters IUCN I-IV



Distribution of Vegetation Associations and Vegetation System Associations (Pre-European Extent) in the Pilbara Bioregion

maia

N

0 17.5

Kilometres

Datum: GDA 1994, MGA 50

Map: 37 **Version:** 1
Prepared for: JBSG
Drawn by: RH
Date: 10/05/2022
Project: 2204 **Size:** A4

APPENDIX 1: CONSERVATION SIGNIFICANCE

Threatened Flora

Some flora species can be protected by Australian Government legislation (*Environment Protection and Biodiversity Conservation Act 1999*, EPBC Act) or by WA legislation (*Biodiversity Conservation Act 2016*, BC Act) (DCCEEW, 2022a; GoWA, 2016).

Some flora species are protected by Australian Government legislation (EPBC Act) based on the perceived levels of threat to the species population at a national level. Threatened fauna and flora may be listed under Section 178 of the EPBC Act in one of six conservation categories: extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (DCCEEW, 2022a). An EPBC Act list of threatened flora can be found on the DCCEEW website (DCCEEW, 2022b).

The *Biodiversity Conservation Act 2016* (BC Act) provides for the listing of threatened native plants (flora), threatened native animals (fauna) and threatened ecological communities that need protection as critically endangered, endangered or vulnerable species or ecological communities because they are under identifiable threat of extinction (species) or collapse (ecological communities). The BC Act provides a statutory basis for the listing of threatened species, specially protected species, threatened ecological communities, critical habitat and key threatening processes (DBCA, 2022b). The most recent threatened flora list was issued in the WA Government Gazette in September 2018 (GoWA, 2018a) and they are included in DBCA's most recent threatened and priority flora list (DBCA, 2022f).

Priority Flora

Possible threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Flora List under Priorities (P) 1, 2, 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. 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 list for other than taxonomic reasons, are placed in Priority 4 and require regular monitoring (DBCA, 2019). The most recent priority flora list was issued in June 2022 (DBCA, 2022f).

Threatened Ecological Communities

Some ecological communities are protected by Australian Government legislation (the EPBC Act) based on the perceived levels of threat to the community or species population at a national level. They are listed as threatened ecological communities – TECs – and can be listed as critically endangered, endangered or vulnerable: the communities are listed by state on the DCCEEW website (DCCEEW, 2022c and 2022d).

In WA, the BC Act provides for the statutory listing of TECs by the Minister. The legislation also describes statutory processes for preparing recovery plans for TECs, the registration of their critical habitat, and penalties for unauthorised modification of TECs. These TECs are listed as presumed totally destroyed, critically endangered, endangered or vulnerable (DBCA, 2022c; Department of Environment and Conservation (DEC), 2013). The most recent list was issued in June 2018 (DBCA, 2018c).

Priority Ecological Communities

Ecological communities with insufficient information available to be considered a TEC, or which are rare but not currently threatened are placed on a priority list and are referred to as priority ecological communities (PECs; DBCA, 2022c). Definitions and criteria for PECs can be found on the DBCA's website (DEC, 2013). The most recent list of PECs was published on 1 June 2022 (DBCA, 2022d).

APPENDIX 2: WEED LISTS AND DECLARED PESTS

Weeds of National Interest

A number of lists of weeds of national interest are currently recognised. A number of lists and strategies have been created that identify plants of particular concern or plants that have been through an assessment process (weedsAUSTRALIA, 2022). Weeds lists include - Weeds of National Significance (WoNS), Species Targeted for Biological Control, Species permitted entry into Australia, Priority list of exotic weeds, National Environmental Alert List, Sleeper Weeds, Species targeted for eradication and State and territory noxious weed lists (weedsAUSTRALIA, 2022).

Declared Pests

To protect WA agriculture DPIRD regulates harmful plants under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD, 2022). Under the Biosecurity and Agriculture Management Regulations 2013, declared pests can be assigned to one of three control categories and these are explained in **Table A2.1**.

Table A2.1: Control categories for declared pests (DPIRD, 2022)

Category (C)	Definition
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.

Department of Biodiversity, Conservation and Attractions Weed Prioritisation Process

The DBCA prioritises 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, 2022e).

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, 2022e). Most recent species-led ecological impact and invasiveness ranking summary results are available for the different government regions in WA.

APPENDIX 3: DATABASE AND LITERATURE SEARCH RESULTS

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Table A3.1: Surveys within the Desktop Study Area

Column 1	2	3	4	5	6		7	8		9		10	
Ref	Survey area	Month and year of survey	Survey type	Area (ha)	Sites (unless stated all are quadrats)		No. Taxa	Number of weed species		Number of CSF species		Veg types # only	
					Survey Area	DSA		Survey Area	DSA	Survey Area	DSA	Survey Area	DSA
Astron (2009)	BC Iron Nullagine	May, June, July, August and September 2008	Level 2	5,302	71	Not available	462	15	10	5	4	VT 59	N/A
Biota (2004a)	FMG Stage A Rail Corridor	March and April 2004	Level 2 - single phase (data includes previous surveys within the survey area boundary)	129,482	97	76	762	11	9	7	6	VT 122	VT 51 and 24 mosaics
Biota (2004b)	FMG Stage B Rail Corridor	June and October 2004	Level 2 - single phase (data includes previous surveys within the survey area boundary)	88,894	206	47	599	11	9	3	2	VT 81	VT 21 and 2 mosaics
Biota (2008)	Rio Tinto Marandoo Mine Phase 2	March and May 2007, April 2008	Level 2 - single phase	8,718	47	5	537	18	8	5	0	VT 27	VT 13 and one mosaic
Biota (2012a)	Rio Tinto Koodaideri Study Area	July 2010, March and May 2011	Level 2 - two phase	11,991	62	7	384	11	5	2	4	VSA 25	VSA 13
Biota (2012b)	Rio Tinto Koodaideri Western Rail Corridor	July 2011, March and April 2012, May 2012	Level 2 - two phase	38,627	191	191	469	10	10	3	3	VU 45	
Biota (2018)	FMG Eliwana Project	April, July, August, September 2017	Level 2 - two phase	134,177	554 quadrats and 143 relevés	127 quadrats and 22 relevés	596 (2017 survey) 768 (Eliwana study area)	25	13	35	17	VT 99	VT 30
Botanica (2011)	Brockman Resources Marillana airstrip	September 2011	Level 2 - single phase	10	13	11	75	1	1	0	0	VC 4	
Cardno (2012)	FMG Nyidinghu Study	March, April, July 2011	Level 2 - two phase	121,732	282	29	392	10	3	4	1	VC 22	VC 7

Column 1	2	3	4	5	6		7	8		9		10	
Ref	Survey area	Month and year of survey	Survey type	Area (ha)	Sites (unless stated all are quadrats)		No. Taxa	Number of weed species		Number of CSF species		Veg types # only	
					Survey Area	DSA		Survey Area	DSA	Survey Area	DSA	Survey Area	DSA
Coffey (2010a)	FMG Investigator (directly adjacent to tenement R47/12), Valley of the Queens, Firetail, Trinity, Valley of the Kings, Zion, Serenity Valley and Mt Sheila West	April and May 2008	Level 2, one phase	21,076	272 quadrats and 44 relevés	131	467	11	11	5	3	VT 224	VT 141
Coffey (2010b)	FMG Solomon Rail Project	May and June 2008, October and November 2009	Level 2, two phases	1,040	104	104	388	11	11	2	2	VT 53	
Coffey (2010c)	FMG Solomon Project - regional area	April, May, August and September 2008	Level 2 - two phase	68	152	17	326	5	2	3	2	FU 39	
ecologia (2008a)	HPPL Mulga Downs East	August & September 2007	TFS	Unknown	Not applicable		211	4	4	1	1	6 main & 9 subunits	
ecologia (2008b)	HPPL Mulga Downs East	June 2008	TFS	30	Not applicable		58	0	0	0	0	4 broad	
Ecologia (2008c)	BHP Chichester Deviation L45/147	October 2007 & May 2008	Level 2 - two phase	2,449	47	47	306	5	5	1	1	9 main & 10 subunits	
ecologia (2008d)	HPPL Murrays Hill	June 2008	Level 2 - single phase	900	24	24	139	7	7	0	0	6 main & 3 subunits	
ecologia (2012)	Brockman Resources Rail	May, June, August 2010, August 2012	Level 2 - two phase	7,886	220	214	549	2	2	7	7	VC 39	VC 38
Ecoscape (2010a)	FMG Firetail Mining Area	2008 (Coffey), March and May 2010 (Ecoscape)	Level 2 - two phase	2,667	55	55	207	2	2	2	2	VT 7 and one mosaic	
Ecoscape (2010b)	FMG Solomon Project Airstrip	May 2010	Level 1, one phase	1,540	26	26	93	2	2	0	0	VT 8	
Ecoscape (2010c)	FMG Solomon Project Rail Camp 1G	May 2010	Level 1, one phase	409	5	5	46	2	2	0	0	VT 3	
Ecoscape (2010d)	FMG Solomon Project rail re-alignment	May 2010	Level 1, one phase	2,491	13	13	77	1	1	0	0	VT 11 and one mosaic	
Ecoscape (2013)	FMG Mt Macleod West	July 2011	Level 1, one phase	3,807	46 relevés from this survey and 12 quadrats from	21 relevés from this survey and 2 quadrats from	232	3	3	4	2	VT 14 and one mosaic	VT 11 and one mosaic

Column 1	2	3	4	5	6		7	8		9		10	
Ref	Survey area	Month and year of survey	Survey type	Area (ha)	Sites (unless stated all are quadrats)		No. Taxa	Number of weed species		Number of CSF species		Veg types # only	
					Survey Area	DSA		Survey Area	DSA	Survey Area	DSA	Survey Area	DSA
					previous survey	previous survey							
Ecoscape (2014)	Rutila Resources Railway Corridor	May, July, August 2014	Level 2 - single phase and reconnaissance	69,070	156	49	474	14	8	10	4	VT 58	VT 25
ENV (2010a)	FMG Kings Study Area	April and May 2008 (Coffey), April 2010 (ENV)	Level 2 - two phase	10,645	187	187	365	7	7	4	4	VT 29, FU 47	
ENV (2010b)	FMG Christmas Creek	July and August 2010	Level 2 - two phase	49,353	21	15	73	17	17	9	6	VT 17	
ENV (2011)	RHI Rail - chainage 179 km to 262 km	April 2011	TFS	17,763	Not applicable		Not assessed	4	4	2	2	Not listed	
ENV (2013)	FMG Christmas Creek Life of Mine	April and May 2011, April, May and June 2012 and May 2013	Level 2 - single phase (data includes previous surveys within the survey area boundary)	70,144	124 quadrats and 54 relevés	91 quadrats and 47 relevés	485	17	17	12	6	VT 13 and two mosaics, VA 11	
FMG (2015)	Solomon Iron Ore Project – Sustaining production, public environmental review	Numerous	Numerous botanical surveys; all survey reports not publicly available	Flora and vegetation report not available				5	-	7, but 1 does not occur in Pilbara	-	26 VC in Area 2	
G&G (2009)	HPPL Murrays Hill transport corridor	August	Level 2 - single phase	1,997	22	22	157	3	3	1	1	3 main & 8 subunits	
Lyons (2015)	Wetlands of the Pilbara region	Autumn and Spring 2004-2006	Level 2 - single phase	2	103 (200m²)	14	455	28	14	16	5	G 8	G 5
Maia (2010): Maia database	HPPL Coondiner, Round Hill, Kalgan, Mulga Downs East, Roy Hill South, Marillana, Ethel Creek	July 2010	TFS	280	Not applicable		195	6	6	3	0	VU 11	VU 3
	RHI Rail - camps 1a, 1b, 2 and 3. Camp 3 is within desktop study area.	August 2010	TFS	203	Not applicable		106	1	1	1	0	VU 11	VU 3
Maia (2011a)	RHI Rail Corridor - Abydos to Woodstock section	December 2011, March and April 2011	Level 1 flora and vegetation and reconnaissance	18,745	128 quadrats and 11 relevés	62 quadrats and 4 relevés	398	8	6	8	2	VA 21	VA 16

Column 1	2	3	4	5	6		7	8		9		10	
Ref	Survey area	Month and year of survey	Survey type	Area (ha)	Sites (unless stated all are quadrats)		No. Taxa	Number of weed species		Number of CSF species		Veg types # only	
					Survey Area	DSA		Survey Area	DSA	Survey Area	DSA	Survey Area	DSA
Maia (2011b and c)	RHI Rail - chainage 2 km to 148 km access and borrow pit areas and alignment track	July 2011	TFS	495	Not applicable		182	3	0	2	0	VA 23	
	RHI Rail - chainage 9 km to 170 km - Whim Creek intersection, water bore areas, access and borrow pit areas, alignment track and Coonarie Bridge investigation areas	July 2011	TFS	427	Not applicable		188	4	4	2	1	VA 22	
Maia (2011d)	RHI Rail - chainage 41 km to 94.5 km - alignment track and bridge investigation areas	May 2011	TFS	332	Not applicable		93	6	2	4	0	VA 5 (bridge investigation areas only)	
Maia (during 2012): Maia database	HPPL Mulga Downs East	January 2012	TFS	557	Not applicable		165	6	6	0	0	VA 13	
	HPPL Mulga Downs East	February 2012	TFS	137	Not applicable		144	2	2	2	2	VA 7	
	HPPL Mulga Downs West	February and April 2012	TFS	95	Not applicable		180	5	5	1	1	VA 7	
	HPPL Mulga Downs East Landfill Area	May 2012	TFS	34	Not applicable		39	0	0	0	0	VA 1	
	HPPL Mulga Downs East	May 2012	TFS	406	Not applicable		216	6	6	0	0	VA 14	
Maia (2012)	HPPL Mulga Downs East	June, July and August 2012	Level 2 - single phase	22,018	115	115	397	12	12	4	4	VA 13 and one mosaic	
Maia (2013a)	HPPL Mulga Downs Transport Corridor	August 2012	Level 2 - single phase	8,811	79	79	342	8	8	1	1	VA 16	VA 1
Maia (2013b)	HPPL Mulga Downs East	August 2013	TFS	207	Not applicable		Not assessed	6	6	1	1	VA 4	
Maia (during 2014): Maia database	HPPL Juna Downs, Mulga Downs East, Mulga Downs West and Corboy	March and May 2014	TFS	188	Not applicable		306	7	7	4	4	VA12	VA8
	HPPL Drillers Ridge	November 2013	TFS	358	Not applicable		132	1	1	6	6	VA 7	
Maia (2014a)	HPPL Mulga Downs Airstrip	August 2014	TFS	11	Not applicable		Not assessed	0	0	0	0	VA 2	
Maia (2014b)	HPPL Mulga Downs East and Malay Well	November 2014	TFS	200	Not applicable		145	6	6	0	0	VA 7	
Maia (2014c)	HPPL Mulga Downs Transport Corridor Options K and J	August 2014	Reconnaissance flora and vegetation survey and TFS	392	Not applicable		216	6	6	3	3	VA12	

Column 1	2	3	4	5	6		7	8		9		10	
Ref	Survey area	Month and year of survey	Survey type	Area (ha)	Sites (unless stated all are quadrats)		No. Taxa	Number of weed species		Number of CSF species		Veg types # only	
					Survey Area	DSA		Survey Area	DSA	Survey Area	DSA	Survey Area	DSA
Maia (during 2015): Maia database	HPPL Round Hill South, Kalgan, Mulga Downs West and Corboy	August 2015	TFS	255	Not applicable		303	8	8	5	3	VA 14	VA 7
Maia (2017): Maia database	HPPL Malay Well, Mulga Downs East and Boundary Bore	May 2017	TFS	270	Not applicable		243	12	12	2	2	VA 17	VA 14
Maia (2018): Maia database	HPPL Malay Well, Mulga Downs East and West	May 2018	TFS	562	Not applicable		229	9	9	4	4	VA 14	
	HPPL Corboy, Malay Well, Mulga Downs East and West	July 2018	TFS	633	Not applicable		300	10	10	6	6	VA 16	
Maia (2019)	HPPL MEIOP Proposed Monitoring Bores	October and November 2018	TFS	5	Not applicable		76	4	4	1	1	VT 2	
Maia (during 2019): Maia database	HPPL Corboy, Mount Florance, Malay Well, Mulga Downs East and West	October and November 2018	TFS	438	Not applicable		230	8	8	6	6	VT 17	
	HPPL Corboy	February 2019	TFS	243	Not applicable		134	5	5	3	3	VT 9	
	HPPL Mulga Downs West	March 2019	TFS	468	Not applicable		158	7	7	2	2	VT 10	
	HPPL Mulga Downs West and Mount Florance	June 2019	TFS	629	Not applicable		230	10	10	5	5	VT 18	
Maia (2020): Maia database	HPPL Corboy and Mulga Downs West	February 2020	TFS	515	Not applicable		190	8	8	7	7	VT 9	
Markey (2017)	Fortescue Marsh	July to September 2013, June to September 2014	Level 2 - two phase	32	128	99	352	16	13	13	12	VC 21	VC 20
Mattiske (2005)	FMG Cloudbreak and White Knight	October and November 2004, May 2005	Level 2 - two phase	55,387	56	56	234	4	4	4	4	PC 18	
Mattiske (2007)	FMG near Fortescue Marshes	September 2006	Level 1	185,000	52	Not known	92	4	4	3	3	VC 29	VC 25
Mattiske (2013)	Fortescue River Gas Pipeline	October 2013	Level 1	13,338	238	20	353	10	3	1	0	VC 30	VC 9
Onshore (2015)	BHP Fortescue Marsh Tenements	May, 2015	TFS	Not stated	Not applicable		Not stated	Not included		-	5	Not included	
Onshore (2016)	BHP Fortescue Valley Tenement	October, 2016	Level 2 – single phase	22,179	0	70	299	-	9	-	9	-	VA-16

Column 1	2	3	4	5	6		7	8		9		10	
Ref	Survey area	Month and year of survey	Survey type	Area (ha)	Sites (unless stated all are quadrats)		No. Taxa	Number of weed species		Number of CSF species		Veg types # only	
					Survey Area	DSA		Survey Area	DSA	Survey Area	DSA	Survey Area	DSA
Pinder *et al.* (2017)	Wetlands of the Fortescue Valley	July and August 2015, March, July and August 2016	Level 2 – single phase	1	51 (200m²)	25	284	14	11	10	7	G 12	G 9
Rio Tinto (2018)	HI Southern Fortescue Borefield	March 2018	Level 1	751	26 relevés	24 relevés	245	14	14	3	3	VU 12	VU 11
van Leeuwen (2018)	Pilbara Biological Survey – Plants	April, May, Auust and September 2004, July and August 2005, February – June, August and September 2006	Level 2	106	422	45	1,203	41	6	47	6	N/A	N/A
van Leeuwen and Bromilow (2002)	Botanical Survey of the Hamersley Uplands	Not available	Level 2	376	80	13	376	4	1	0	0	N/A	N/A
WEC (2012)	Atlas Mt Webber	July and August 2010, April 2012	Level 2 – two phase	10,763	122+	93+	354	8	8	7	2	VC 16	VC 16
WEC (2016)	Atlas Corunna Downs	March, April and May 2014, May 2016	Level 2 – two phase	25,949	357	37	413	18	4	11	2	VT 15	VT 10

Note: column 1 – Ref = reference; column 2 – BHP = BHP Billiton, FMG = Fortescue Metals Group, HI = Hamersley Iron, HPPL = Hancock Prospecting Pty Ltd, RHI = Roy Hill Infrastructure; column 4 – TFS = targeted flora survey; columns 6, 8, 9, 10 – DSA = Desktop Study Area; column 9 – CSF = conservation significant flora; column 10 – FU = floristic units, G = group, PC = plant community, VA = vegetation association, VC = vegetation community, VSA = vegetation sub-association, VT = vegetation type, VU = vegetation unit. Rows highlighted orange indicate level 2 HPPL surveys carried out previously in the MBSA.

Table A3.2: Significant vegetation types –collated from reports on surveys in the Desktop Study Area (only those with significant types listed)

Column 1	2	3
Reference	Survey Area	Significant Veg types
Astron (2009)	BC Iron Nullagine	59 vegetation types mapped in the project area. One vegetation type (PC1b) is located on cracking clays and is part of the Wona Land System PEC. This vegetation type occurs in the desktop study area.
Biota (2004a)	FMG Stage A Rail Corridor	40 vegetation types along the entire rail corridor. 8 vegetation types (Cx4, Cx5, Fa2, Fa3, Fa4, Fa7, Fx3 and Fx9) have high conservation significance incide the desktop study area.
Biota (2004b)	FMG Stage B Rail Corridor	One vegetation type was considered to be of very high conservation significance. This does not occur in the desktop study area. Seven vegetation types were high and one of these (Fa13) occurs in the desktop study area. Twenty vegetation types were moderate-high and seven of these occur in the desktop study area (Ch30, Fc8, Fa1a, Fa11, Fc9, Fc10, Fc12, Fx1).
Biota (2008)	Rio Tinto Marandoo Mine Phase 2	No high conservation significant communities in survey area and desktop study area. 11 vegetation units are considered to be of moderate conservation significance, 5 occur in the desktop study area (units 1a, 1a, 1c, 2e, 4a, 4f) and represent mulga habitats and small representation in the survey area.
Biota (2012a)	Rio Tinto Koodaideri Study Area	Koodaideri Spring mosaic was considered to be moderate to high but not recorded in desktop study area. None in the desktop study area.
Biota (2012b)	Rio Tinto Koodaideri Western Rail Corridor	Three ecosystems at risk occur in the survey area - 'Grove/inter-grove Mulga communities' (vegetation units (P11, P13, and P19), 'Valley floor mulga' (units P2, P9, P11, P12, P13, P14) and 'All major ephemeral water courses' (units D17 and D18)
Biota (2018)	FMG Eliwana Project	25 vegetation types mapped over the Eliwana study area Within desktop study area - one vegetation unit (PANdTHs) within the Themeda grasslands TEC, two vegetation units (VfASl and AanVfTHt) equivalent to the Brockman Iron cracking clay communities PEC, two riparian vegetation units considered to be GDV (EcAcEUaTe and EcApyTErCYa) and two potential GDV units (AcBTe and EvAtuApyTErTHt), two mulga vegetation units (AanCHf and AanAalmCc).

Column 1	2	3
Reference	Survey Area	Significant Veg types
Botanica (2011)	Brockman Resources Marillana airstrip	None of the vegetation communities are similar to known TECs and PECs. The area occurs within the Fortescue Marsh and Fortescue Valley Sand Dunes PECs.
Cardno (2012)	FMG Nyidinghu Study	Seven vegetation communities, one representing the Fortescue Valley sand dunes PEC (vegetation community SsTs) and six Mulga communities (AaAsCc, AaAsTp, AaAsEs, AaAtCc, AaEfTp, AaPsCf). Two Mulga communities occur within the desktop study area (vegetation communities AaAsEs and AaAtCc).
Coffey (2010a)	FMG Investigator (directly adjacent to tenement R47/12), Valley of the Queens, Firetail, Trinity, Valley of the Kings, Zion, Serenity Valley and Mt Sheila West	Mulga communities, two at Valley of Queens and 12 within Investigator
Coffey (2010b)	FMG Solomon Rail Project	Priority 3(iii) priority ecological community - “Plant assemblages of the Wona Land System.” - occurs in the survey area Six mulga vegetation types
ecologia (2008c)	BHP Chichester Deviation L45/147	Priority 3(iii) priority ecological community - “Plant assemblages of the Wona Land System.” - occurs in the survey area
ecologia (2012)	Brockman Resources Rail	2 high vegetation communities (d1 and r6) and 5 moderate to high conservation significant vegetation communities
Ecoscape (2010a)	FMG Firetail Mining Area	CfLO, AaS, PlGwTOS, ChEgLOW all have restricted distribution in the study area
Ecoscape (2010b)	FMG Solomon Project Airstrip	Two mulga communities AaLW and AaTOS display affinities with the 'Valley floor mulga' and 'Lower-slope mulga' ecosystems at risk.
Ecoscape (2010d)	FMG Solomon Project rail re-alignment	Two vegetation types (PoaTG and EsppArspTG) are similar to 'Perennial grassland communities in the Fortescue Valley' ecosystem at risk and three mulga vegetation types (AaLWApAvTOS, AaLWTeHG ad EvAaW) are similar to 'Grove-intergrove mulga communities at the southern end of the northern apron of the Hamersley Ranges' ecosystem at risk.
Ecoscape (2013)	FMG Mt Macleod West	The 'Brockman Iron cracking clay communities of the Hamersley' PEC is mapped as vegetation type Ap and occurs within the desktop study area. Vegetation types EvEb and AcEa (both occur in the desktop study area) are considered to be potential GDEs.

Column 1	2	3
Reference	Survey Area	Significant Veg types
Ecoscape (2014)	Rutila Resources Railway Corridor	EvApTe, EvCb, EvMgEb, EvMlCv and MaMgCv represent a GDE and AiTe(3), AiTw(3) and MaMgCv have an association with a poorly represented pre-European vegetation association.
ENV (2010a)	FMG Kings Study Area	Floristic units 175, 199, 281, 283, 285, 290, 312 have only been recorded in the study area. Another unit was new to the statistical analysis dataset and no other known representation outside the study area.
ENV (2010b)	FMG Christmas Creek	Six vegetation types (22, 26, 31, 32, 34 and 35) are locally significant and are associated with Fortescue Marsh PEC. Three vegetation types (2, 4 and 10) are associated with locally significant Mulga and sheet flow. Eight vegetation types (1, 13, 22, 26, 31, 32, 34 and 35) with potentially varying degrees of groundwater dependence.
ENV (2013)	FMG Christmas Creek Life of Mine	Nine vegetation associations represent the Fortescue Marshes PEC (VA1-VA9); all nine occur in the desktop study area. Five vegetation types have (co)dominant mulga (VT2, VT3, VT4, VT10.1, VT10.2) and all occur in the desktop study area also.
ENV (2016)	Fortescue Valley Tenement	Eleven of the 16 vegetation associations mapped are affiliated with the Fortescue Marsh PEC. Three of the vegetation associations were equivalent to Valley Floor Mulga (an ecosystem at risk).
FMG (2015)	Solomon Iron Ore Project PER	CddAdTw was indicated as regionally significant; however, it does not occur in Area 2. AaVfTH1 and EllHcTw1 were indicated as locally significant; however, they do not occur in Area 2. Partially sheet flow dependent vegetation communities occurring in Area 2 were: AaElCf, AaElfTe, AalmTe, AaPlAc, AaPsCf, AaSfAl, AaSvCc and all except AaPsCf occur in Area 2. Groundwater dependent ecosystems and potential groundwater dependent ecosystems were indicated: groundwater dependent – EcApCa, EcAcEu, EcEvAcTw, EcMaMlCv; potential groundwater dependent – EvAcCc, EvAcEa, EvAtpTe, EvVfCc. Two of the potentially groundwater dependent communities were mapped in Area 2 – EvAcCc and EvAcEa.
Lyons (2015)	Wetlands of the Pilbara region	Freshwater claypans of the Fortescue Valley PEC, Fortescue Marshes PEC plus others
Maia (2011a)	RHI Rail Corridor - Abydos to Woodstock section	D2 is considered to be of high conservation significance and is mapped in the desktop study area. Three other vegetation associations and two mosaics (G1, G2, G3, G1/G2, G1/G4) are considered to be of high significance but are not mapped in the desktop study area.
Maia (2012a)	HPPL Mulga Downs East	Nine vegetation associations (D1, D2, P1, P2, R1, R2, R1/R2, R3, CP1) were considered to be locally conservation significant.

Column 1	2	3
Reference	Survey Area	Significant Veg types
		One of the vegetation associations mapped is probably the 'Priority 1' ecological community 'Freshwater claypans of the Fortescue Valley' – CP1. Two associations (R1, R2 and a mosaic of the two) resemble the Coolibah-lignum flats: *Eucalyptus victrix* over *Muehlenbeckia* community' PEC. Some of one of the buffers around the 'Four plant assemblages of the Wona Land System' PEC lies over the Survey Area.
Maia (2013a)	HPPL Mulga Downs Transport Corridor	One vegetation association was considered to be of ?High conservation significance and six as High (?MTG1-15, AcMlSL-3, AtAcSL-4, MAS/WL-5, TaeHG-12, MTG1-15, MTG2-15 respectively). One vegetation association mapped in the Survey Area (MTG1/2-15) resembles one of the P3 subunits of the 'Four plant assemblages of the Wona Land System' Priority Ecological Community (PEC), the 'Mitchell grass plains (Astrebla spp.) on gilgai' sub-unit.
Maia (2013b)	HPPL Mulga Downs East	None of the vegetation communities similar to known TECs and PECs. The survey area occurs within the Fortescue Marsh and Fortescue Valley Sand Dunes PECs.
Maia (2014a)	HPPL Mulga Downs Airstrip	The entire Survey Area lies within the boundaries of a section of the 'Four plant assemblages of the Wona Land System' priority ecological community (PEC). The vegetation associations noted in the Survey Area are similar to one of the two Priority 3(iii) grassland subtypes of this PEC – Mitchell grass plains (*Astrebla* spp.) on gilgai. The two VA match 2 VSA (MTG1-15 and MGT2-15) from Maia (2013a) and were considered to be of high conservation significance.
Maia (2014c)	HPPL Mulga Downs Transport Corridor Options K and J	The descriptions for two of the vegetation associations recorded in the Survey Area (8 and 9) match the descriptions for the grassland and shrubland components of a vegetation association (MTG1/2-15) mapped in an earlier HPPL transport corridor. The association was mapped as two subassociations, MTG1-15 and MTG2-15. MTG1-15 resembles the description for the Priority 3 PEC 'Mitchell grass plains (*Astrebla* spp.) on gilgai with little to no shrub layer', which is a sub-unit of the 'Four Plant Assemblages of the Wona Land system' priority ecological community (PEC). MTG2-15 has the same tussock grass species but also has an Acacia xiphophylla and/or A. glaucocaesia shrub layer. Vegetation associations 8 and 9 were noted only in habitats of the Wona LS PEC. As a result, they are also considered to have high conservation significance. One of the vegetation associations recorded in the area (11) is restricted to low rolling shale hills. Because of its restricted distribution and the two different *Triodia* taxa, this association has been given a preliminary high conservation significance rating.

Column 1	2	3
Reference	Survey Area	Significant Veg types
Maia (2019a)	HPPL MEIOP Proposed Monitoring Bores	The vegetation description for one of the monitoring bores is similar to the description for the vegetation of the 'Freshwater claypans of the Fortescue Valley' P1 PEC because of the presence of the tussock grass species *Eriachne benthamii* and the tree species *Eucalyptus victrix*. However, the polygon surveyed around this bore is not in a clay pan but in an area where water pools in small, isolated patches. These areas are fringed by tussock grasses; however, *Chrysopogon fallax* is a co-dominant tussock grass species and therefore the habitat and the vegetation at the bore is not the same as the description for the PEC.
Markey (2017)	Fortescue Marsh	Fortescue Marshes PEC.
Mattiske (2005)	FMG Cloudbreak and White Knight	Four plant communities (11, 12, 13, 14) are locally significant and are within the fringes of the Fortescue Marsh. Two mulga communities (4 and 5) are locally significant.
Mattiske (2007)	FMG near Fortescue Marshes	Fortescue Marshes PEC.
Mattiske (2013)	Fortescue River Gas Pipeline	One PEC (mapped as vegetation community FL15) was inferred to occur within the survey area - 'Four plant assemblages of the Wona Land System' PEC. None within desktop study area.
Onshore (2016)	Fortescue Valley Tenement	Eleven of the vegetation associations were affiliated with the Fortescue Marsh (Marsh Land System) Priority 1 PEC. Three of the vegetation associations support mulga vegetation on stony plains and claypans and are equivalent to an ecosystem considered at risk by DBCA – Valley Floor Mulga.
Pinder *et al.* (2017)	Wetlands of the Fortescue Valley	Fortescue Marshes PEC.
Rio Tinto (2018)	HI Southern Fortescue Borefield	The vegetation units P3 and P5 are representative of 'valley floor mulga', an Ecosystem at Risk. Both occur within the desktop study area.
van Leeuwen (2018)	Pilbara Biological Survey – Plants	Not available
van Leeuwen and Bromilow (2002)	Botanical Survey of Hamersley Uplands	Not available

Column 1	2	3
Reference	Survey Area	Significant Veg types
WEC (2012)	Atlas Mt Webber	Not available
WEC (2016)	Atlas Corunna Downs	Fifteen vegetation types were mapped within the project. Eight of these vegetation types are locally significant due to their limited extent in the project area (vegetation types 1, 2, 3, 4, 6, 7, 8, 15). Four of these are regionally significant due to their potentially restricted distribution in the wider region (vegetation types 3, 6, 7, 8). Vegetation types 7 and 8 occur in the desktop study area are locally and regionally significant.

Note: column 2 – BHP = BHP Billiton, FMG = Fortescue Metals Group, HI = Hamersley Iron, HPPL = Hancock Prospecting Pty Ltd, RHI = Roy Hill Infrastructure.

Table A3.3: Conservation significant flora collated from database and literature search results

Note: P1-P4 = Priority 1 to Priority 4 flora species. Cells highlighted orange in columns 1 and 2 indicate species with records in the MBSA. Columns coloured dark grey = no CSF data. This table does not include information for *Seringia exastia*, as it was not a threatened species when the searches were originally carried out and many of the earlier surveys; however, it has been recorded in the MBSA and it is discussed in the relevant section/s of this report. FMG (2015) also noted *Eremophila lanata* (P3) as having been recorded in Area 2; however, this species does not occur in the Pilbara, and it is not listed below.

Species	Rank	NM	TPFL	WAHERB	Extra CSF, other sources
		DBCA (2007-)			
Acacia cyperophylla var. *omearana*	P1	•		•	
Acacia fecunda	P1	•		•	
Barbula ehrenbergii	P1	•	•	•	
Calotis squamigera	P1	•	•	•	
Cochlospermum macnamarae	P1	•		•	
Dipteracanthus chichesterensis	P1	•		•	
Helichrysum oligochaetum	P1	•	•	•	
Hibiscus sp. Mt Brockman (E. Thoma ET 1354)	P1	•		•	
Josephinia sp. Woodstock (A.A. Mitchell PRP 989)	P1			•	
Lindernia sp. Pilbara (M.N. Lyons & L. Lewis FV 1069)	P1	•			
Myriocephalus scalpellus	P1	•		•	
Rhodanthe ascendens	P1	•			
Samolus sp. Fortescue Marsh (A. Markey & R. Coppen FM 9702)	P1	•		•	
Sida sp. Hamersley Range (K. Newbey 10692)	P1				Biota 2012a
Synostemon hamersleyensis	P1			•	
Tecticornia globulifera	P1	•	•	•	
Tecticornia sp. Christmas Creek (K.A. Shepherd & T. Colmer et al. KS 1063)	P1	•		•	
Triodia sp. Karijini (S. van Leeuwen 4111)	P1	•		•	
Triodia veniciae	P1			•	
Vittadinia sp. Coondewanna Flats (S. van Leeuwen 4684)	P1			•	
Whiteochloa capillipes	P1				Biota 2018
Adiantum capillus-veneris	P2	•		•	
Aristida lazaridis	P2	•		•	

Species	Rank	NM	TPFL	WAHERB	Extra CSF, other sources
		DBCA (2007-)			
Arthropodium vanleeuwenii (formerly *Arthropodium* sp. Ironstone (J. Bull & J. Waters ONS PJ 36.01)	P2			•	
Cladium procerum	P2	•		•	
Dicladanthera glabra	P2	•	•	•	
Eremophila pusilliflora	P2	•		•	
Euphorbia inappendiculata var. *inappendiculata*	P2	•		•	
Euphorbia inappendiculata var. *queenslandica*	P2	•		•	
Gompholobium karijini	P2	•		•	
Isotropis parviflora	P2	•		•	
Indigofera ixocarpa	P2			•	
Ipomoea racemigera	P2		•	•	
Kohautia australiensis	P2			•	
Oxalis sp. Pilbara (M.E. Trudgen 12725)	P2			•	
Paspalidium retiglume	P2	•		•	
Pentalepis trichodesmoides subsp. *hispida*	P2	•		•	
Scaevola sp. Hamersley Range basalts (S. van Leeuwen 3675)	P2	•	•	•	
Tetratheca fordiana	P2			•	
Teucrium pilbaranum	P2	•		•	
Abutilon sp. Pritzelianum (S. van Leeuwen 5095)	P3	•		•	
Acacia daweana	P3		•	•	
Acacia effusa	P3		•	•	
Acacia levata	P3	•	•	•	
Acacia subtiliformis	P3		•	•	
Amaranthus centralis	P3			•	
Ampelopteris prolifera	P3	•		•	
Aristida jerichoensis var. *subspinulifera / Aristida jerichoensis* ? var. *subspinulifera*	P3	•		•	
Astrebla lappacea	P3	•	•	•	
Atriplex flabelliformis	P3	•		•	
Dampiera anonyma	P3	•	•	•	
Dampiera metallorum	P3	•	•	•	

Species	Rank	NM	TPFL	WAHERB	Extra CSF, other sources
		DBCA (2007-)			
Dolichocarpa sp. Hamersley Station (A.A. Mitchell PRP 1479)	P3	•		•	
Dysphania congestiflora	P3	•		•	
Elatine macrocalyx	P3	•			
Eleocharis papillosa	P3	•		•	
Eragrostis crateriformis	P3	•		•	
Eragrostis sp. Erect spikelets (P.K. Latz 2122)	P3	•		•	
Eragrostis surreyana	P3	•		•	
Eremophila magnifica subsp. *velutina*	P3	•	•	•	
Eremophila naaykensii (formerly *Eremophila* sp. Hamersley Range (K. Walker KW 136)	P3			•	
Eremophila spongiocarpa	P3	•	•	•	
Eucalyptus rowleyi	P3			•	
Euphorbia australis var. *glabra*	P3	•	•	•	
Euphorbia stevenii	P3	•		•	
Euploca mutica (formerly *Heliotropium muticum*)	P3	•		•	
Fimbristylis sieberiana	P3	•	•	•	
Geijera salicifolia	P3			•	
Glycine falcata	P3	•	•	•	
Gomphrena leptophylla	P3	•		•	
Goodenia ? lyrata	P3			•	
Goodenia sp. East Pilbara (A.A. Mitchell PRP 727)	P3	•	•	•	
Grevillea saxicola	P3				Biota 2018
Gymnanthera cunninghamii	P3	•		•	
Heliotropium murinum	P3	•		•	
Indigofera gilesii	P3	•	•	•	
Indigofera rivularis (formerly *Indigofera* sp. Bungaroo Creek (S. van Leeuwen 4301)	P3				Biota 2018
Iotasperma sessilifolium	P3	•		•	
Nicotiana umbratica	P3	•		•	
Olearia mucronata	P3	•		•	

Species	Rank	NM	TPFL	WAHERB	Extra CSF, other sources
		DBCA (2007-)			
Phragmites karka	P3				Lyons 2015
Phyllanthus hebecarpus	P3	•		•	
Polymeria distigma	P3	•		•	
Ptilotus subspinescens	P3	•		•	
Rhagodia sp. Hamersley (M. Trudgen 17794)	P3	•		•	
Rostellularia adscendens var. *latifolia / Rostellularia adscendens* ? var. *latifolia*	P3	•		•	
Rothia indica subsp. *australis*	P3	•		•	
Sida sp. Barlee Range (S. van Leeuwen 1642)	P3			•	
Solanum albostellatum	P3	•		•	
Solanum sp. Red Hill (S. van Leeuwen et al. PBS 5415)	P3	•		•	
Stackhousia clementii	P3	•		•	
Stylidium weeliwolli	P3	•	•	•	
Swainsona thompsoniana	P3	•		•	
Tecticornia medusa	P3	•		•	
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	P3	•		•	
Triodia basitricha	P3	•		•	
Triodia pisoliticola	P3	•		•	
Triodia sp. Mt Ella (M.E. Trudgen 12739)	P3			•	
Xanthoparmelia nashii	P3			•	
Acacia bromilowiana	P4	•	•	•	
Bulbostylis burbidgeae / Bulbostylis burbidgeae atypical form	P4	•	•	•	
Eremophila magnifica subsp. *magnifica*	P4	•		•	
Eremophila youngii subsp. *lepidota*	P4	•		•	
Goodenia nuda	P4	•	•	•	
Lepidium catapycnon	P4	•	•	•	
Ptilotus mollis	P4	•		•	
Ptilotus trichocephalus	P4	•		•	
Rhynchosia bungarensis	P4	•		•	

Table A3.4: Weeds – list collated from database and literature search results

Note: WoNS = Weed of National Significance, DPP = Declared Pest Plant, EW = environmental weed; H = high, M = moderate/medium, L = low, U = unknown, R = rapid, S = slow. Cells coloured orange in columns 1 and 2 indicate species with records in the MBSA – before the surveys carried out for the current report.

Species	Common name	Rank	DPaW (2014)		NM	Extra weed species, source/s as cited
			Ecological impact	Invasiveness	DBCA (2007-)	
Parkinsonia aculeata	Parkinsonia	WoNS, DPP	H		•	
Prosopis glandulosa	Mesquite	WoNS, DPP	H			ENV, 2013
Argemone mexicana	Mexican Prickly Poppy	DPP	Not rated			ENV, 2013
Aerva javanica	Kapok Bush	EW	H	R	•	
Alternanthera pungens	Khaki Weed	EW	L	S	•	
Amaranthus viridis	Green Amaranth	EW	L	S	•	
Argemone ochroleuca	Mexican Poppy	EW	U	R	•	
Asphodelus fistulosus	Onion Weed	EW	U	R	•	
Bidens bipinnata	Bipinnate Beggar's Tick	EW	U	R	•	
Bidens pilosa	Cobbler's Pegs	EW	U	R		ENV, 2010b
Bidens subalternans var. *simulans*	-	EW	Not rated		•	
Calotropis procera	Rubber Tree	EW	Alert Weed			WEC, 2016
Catharanthus roseus	Madagascar Periwinkle	EW	U	U	•	
Cenchrus ciliaris	Buffel Grass	EW	H	R	•	
Cenchrus echinatus	Burrgrass	EW	M	R	•	
Cenchrus setiger	Birdwood Grass	EW	H	R	•	
Chloris barbata	Purpletop Chloris	EW	H	R	•	
Chloris virgata	Feathertop Rhodes Grass	EW	H	R	•	
Citrullus amarus	Pie Melon	EW	U	M	•	
Citrullus colocynthis	Colocynth	EW	U	M	•	
Clitoria ternatea	Butterfly Pea	EW	Alert Weed		•	
Crotalaria juncea	Sunnhemp	EW	Not rated		•	
Cynodon dactylon	Couch	EW	H	R	•	
Cyperus hamulosus	-	EW	Not rated			Pinder et al., 2017

Species	Common name	Rank	DPaW (2014)		NM	Extra weed species, source/s as cited
			Ecological impact	Invasiveness	DBCA (2007-)	
Datura leichhardtii subsp. *leichhardtii*	Native Thornapple	EW	U	U	•	
Digitaria ciliaris	Summer Grass	EW	L	S		Biota, 2018
Diplachne fusca subsp. *uninervia*	-	EW	Not rated		•	
Distimake dissectus var. *dissectus*	-	EW	H	R	•	
Echinochloa colona	Awnless Barnyard Grass	EW	H	R	•	
Echinochloa microstachya	Prickly Barnyard Grass	EW	Not rated		•	
Eragrostis minor	Smaller Stinkgrass	EW	Not rated			Astron, 2009; Coffey, 2010b
Erigeron bonariensis (formerly *Conyza bonariensis*)	Flaxleaf Fleabane	EW	Not rated		•	
Flaveria trinervia	Speedy Weed	EW	Not rated		•	
Gnaphalium polycaulon	Indian Cudweed	EW	Not rated			Lyons, 2015
Gomphrena celosioides	Gomphrena Weed	EW	L	U	•	
Lysimachia arvensis	Pimpernel	EW	Not rated		•	
Malvastrum americanum	Spiked Malvastrum	EW	H	R	•	
Medicago polymorpha	Burr Medic	EW	L	M		Maia, 2012
Panicum miliaceum^	Millet Panic	EW	Not rated			Maia database
Paspalum urvillei	Vasey Grass	EW	Not rated		•	
Portulaca oleracea^^	Purslane	EW	U	U		Maia database
Portulaca pilosa	Djanggara	EW	Not rated		•	
Rumex vesicarius	Ruby Dock	EW	H	R		Biota 2012b, 2018; Ecoscape 2013 , 2014; ENV 2010b, 2011, 2013; Rio 2018
Setaria verticillata	Whorled Pigeon Grass	EW	H	R	•	
Sigesbeckia orientalis	Indian Weed	EW	U	R	•	
Solanum nigrum	Black Berry Nightshade	EW	L	R	•	
Sonchus oleraceus	Common Sowthistle	EW	L	R	•	
Sonchus sp. indet. ^^^	-	EW	Not rated			Pinder et al., 2017
Trianthema portulacastrum	Giant Pigweed	EW	Not rated		•	

Species	Common name	Rank	DPaW (2014)		NM	Extra weed species, source/s as cited
			Ecological impact	Invasiveness	DBCA (2007-)	
Tribulus terrestris	Caltrop	EW	U	M	•	
Tridax procumbens	Tridax	EW	Not rated		•	
Vachellia farnesiana	Mimosa Bush	EW	H	R	•	

Note: ^ This species is a large range extension (>800 km) and was either misidentified or was brought to the area by livestock trucked to the area. ^^ This species has a mixed naturalised status, as it is native in part of range and naturalised elsewhere (WAH 1998-); it is not shown on **Map 11.** ^^^This is likely a weed *Sonchus* species, however, one native *Sonchus* (*S. hydrophilus*) has records to the south and east of the MBSA.

Table A3.5: Vegetation associations and system associations of the MBSA

Vegetation association (system association / s)	Area/s mapped in	Subregion/s	Description
29 (29)	1, 2, 3, 4, 5	Fortescue	Sparse low woodland; mulga, discontinuous in scattered groups
111 (111.1)	1, 2	Fortescue	Hummock grasslands, shrub steppe; *Eucalyptus gamophylla* over hard spinifex
151 (151.1)	2	Fortescue	Riverine sedgeland/grassland with trees
173 (173.2)	1, 2, 6, 7	Chichester	Hummock grasslands, shrub steppe; kanji over soft spinifex & *Triodia wiseana* on basalt
175 (175.2)	7	Chichester	Grasslands, short bunch-grass savanna
175 (175.3)	1, 2, 4, 5	Fortescue	Short bunch grassland - savanna/grass plain (Pilbara)
562 (562)	1, 2, 3, 6, 7	Chichester & Fortescue	Mosaic: Low woodland; mulga in valleys / Hummock grasslands, open low tree-steppe; snappy gum over *Triodia wiseana*
645 (645.1)	2	Hamersley	Shrub - steppe

Table A3.6: Vegetation associations and system associations – pre-European, current, remaining extents and pProtection

Vegetation Association (VA)/ System Association (VSA)	Pilbara Bioregion	Chichester Subregion	Fortescue Subregion	Hamersley Subregion	Shire of Ashburton
Vegetation associations (VA)					
Pre-European extent (ha)					
29	1,133,219.76	Not in MBSA (NIMBSA)	893,394.62	NIMBSA	274,442.50
111	550,286.99	NIMBSA	454,784.97	855.56	66,773.93
151	2,446.05	NIMBSA	2,446.05	NIMBSA	2,446.05
173	1,752,520.89	1,744,029.51	NIMBSA	NIMBSA	571,286.73
175	507,860.16	230,987.86	69,513.33	NIMBSA	267,900.95
562	103,606.82	3,883.61	99,723.21	NIMBSA	65,072.40
645	84,670.25	NIMBSA	68,375.48	16,294.77	84,670.25
Current extent (ha)					
29	1,131,712.01	NIMBSA	893,221.87	NIMBSA	273,138.45
111	550,232.45	NIMBSA	454,730.43	855.56	66,719.39
151	2,446.05	NIMBSA	2,446.05	NIMBSA	2,446.05
173	1,747,677.63	1,739,189.58	NIMBSA	NIMBSA	570,210.90
175	507,466.80	230,952.43	69,479.26	NIMBSA	267,555.16
562	103,606.82	3,883.61	99,723.21	NIMBSA	65,072.40
645	84,658.03	NIMBSA	68,371.79	16,286.24	84,658.03
Remaining (%)					
29	99.87	NIMBSA	99.98	NIMBSA	99.52
111	99.99	NIMBSA	99.99	100	99.92
151	100	NIMBSA	100	NIMBSA	100
173	99.72	99.72	NIMBSA	NIMBSA	99.81
175	99.92	99.98	99.95	NIMBSA	99.87
562	100	100	100	NIMBSA	100
645	99.99	NIMBSA	99.99	99.95	99.99
Current extent of VA protected (IUCN 1-4) for conservation (proportion of pre-European extent) (%)					
29	1.91	NIMBSA	0.26	NIMBSA	7.87
111	1.29	NIMBSA	1.51	23.6	10.61
151	0	NIMBSA	0	NIMBSA	0
173	7.49	7.52	NIMBSA	NIMBSA	22.97
175	4.37	9.61	0	NIMBSA	8.29
562	0	0	0	NIMBSA	0
645	0	NIMBSA	0	0	0

VA / VSA	Pilbara Bioregion	Chichester Subregion	Fortescue Subregion	Hamersley Subregion	Shire of Ashburton
Vegetation system associations (VSA)					
Pre-European extent (ha)					
29	903,050.65	Not in MBSA (NIMBSA)	872,802.85	NIMBSA	203,180.77
111.1	430,960.63	NIMBSA	430,134.57	792.63	66,685.88
151.1	2,446.05	NIMBSA	2,446.05	NIMBSA	2,446.05
173.2	1,125,813.10	1,122,547.28	NIMBSA	NIMBSA	569,440.02
175.2	139,664.18	139,662.49	NIMBSA	NIMBSA	133,524.65
175.3	68,175.03	NIMBSA	67,282.96	NIMBSA	68,175.03
562	103,606.82	3,883.61	99,723.21	NIMBSA	65,072.40
645.1	84,670.25	NIMBSA	68,375.48	16,294.77	84,670.25
Current extent (ha)					
29	902,864.44	NIMBSA	872,633.65	NIMBSA	203,180.77
111.1	430,906.09	NIMBSA	430,080.03	792.63	66,631.34
151.1	2,446.05	NIMBSA	2,446.05	NIMBSA	2,446.05
173.2	1,124,734.22	1,121,471.73	NIMBSA	NIMBSA	568,364.19
175.2	139,642.69	139,641.00	NIMBSA	NIMBSA	133,503.17
175.3	68,175.03	NIMBSA	67,282.96	NIMBSA	68,175.03
562	103,606.82	3,883.61	99,723.21	NIMBSA	65,072.40
645.1	84,658.03	NIMBSA	68,371.79	16,286.24	84,658.03
Remaining (%)					
29	99.98	NIMBSA	99.98	NIMBSA	100
111.1	99.99	NIMBSA	99.99	100	99.92
151.1	100	NIMBSA	100	NIMBSA	100
173.2	99.90	99.90	NIMBSA	NIMBSA	99.81
175.2	99.98	99.98	NIMBSA	NIMBSA	99.98
175.3	100	NIMBSA	100	NIMBSA	100
562	100	100	100	NIMBSA	100
645.1	99.99	NIMBSA	99.99	99.95	99.99
Current extent of VSA protected (IUCN 1-4) for conservation (proportion of pre-European extent) (%)					
29	0.26	NIMBSA	0.26	NIMBSA	1.29
111.1	1.63	NIMBSA	1.59	18.86	10.52
151.1	0	NIMBSA	0	NIMBSA	0
173.2	11.66	11.69	NIMBSA	NIMBSA	23.04
175.2	15.89	15.89	NIMBSA	NIMBSA	16.62
175.3	0	NIMBSA	0	NIMBSA	0
562	0	0	0	NIMBSA	0
645.1	0	NIMBSA	0	0	0

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APPENDIX 4: VEGETATION CONDITION

Table A4.1: Vegetation condition scale (EPA, 2016b)

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

APPENDIX 5: NATIONAL VEGETATION INFORMATION SYSTEM VEGETATION CLASSIFICATION

Table A5.1: Height classes defined for the NVIS

Height		Growth Form				
Height Classes	Height Range (m)	Tree, vine (M & U), palm (single-stemmed)	Shrub, Heath Shrub, Chenopod Shrub, Ferns, Samphire Shrub, Cycad, Tree-Fern, Grass-Tree, Palm (multi-stemmed)	Tree Mallee, Mallee Shrub	Tussock Grasses, Sedges, Rushes and Forbs	Bryophyte, Lichen, Seagrass, Aquatic
8	**>30**	tall	NA	NA	NA	NA
7	**10-30**	mid	NA	tall	NA	NA
6	**<10**	low	NA	mid	NA	NA
5	**<3**	NA	NA	low	NA	NA
4	**>2**	NA	tall	NA	tall	NA
3	**1-2**	NA	mid	NA	tall	NA
2	**0.5-1**	NA	low	NA	mid	Tall
1	**<0.5**	NA	low	NA	low	low

Table A5.2: NVIS growth forms and descriptions

Code	Growth Form	Description
T	Tree	Woody plants, more than 2m tall with a single stem or branches well above the base.
M	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
S	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.
Y	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).
Z	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
C	Chenopod Shrub	Single or multi-stemmed, semi-succulent shrub of the family Chenopodiaceae exhibiting drought and salt tolerance.
U	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*.
G	Tussock Grass	Forms discrete but open tussocks usually with distinct individual shoots, or if not, then forming a hummock. These are common agricultural grasses.
H	Hummock Grass	Coarse xeromorphic grass with a mound-like form often dead in the middle; genera are *Triodia* and *Plectrachne*.
W	Other Grass	Member of the family Poaceae, but having neither a distinctive tussock nor hummock appearance. Examples include stoloniferous species such as *Cynodon dactylon*
V	Sedge	Herbaceous, usually perennial erect plant generally with a tufted habit and of the families Cyperaceae (true sedges) or Restionaceae (node sedges).
R	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).

Code	Growth Form	Description
F	Forb	Herbaceous or slightly woody, annual or sometimes perennial plant (usually a dicotyledon).
D	Tree Fern	Characterised by large and usually branched leaves (fronds), arborescent and terrestrial; spores in sporangia on the leaves
E	Fern	Ferns and fern allies, except tree-fern, above. Characterised by large and usually branched leaves (fronds), herbaceous and terrestrial to aquatic; spores in sporangia on the leaves.
B	Bryophyte	Mosses and Liverworts. Mosses are small plants usually with a slender leafbearing stem with no true vascular tissue. Liverworts are often moss-like in appearance or consisting of a flat, ribbon-like green thallus.
N	Lichen	Composite plant consisting of a fungus living symbiotically with algae; without true roots, stems or leaves.
K	Epiphyte	Epiphytes, mistletoes and parasites. Plant with roots attached to the aerial portions of other plants. Can often be another growth form, such as fern or forb.
L	Vine	Climbing, twining, winding or sprawling plants usually with a woody stem.
P	Palm	Palms and other arborescent monocotyledons. Members of the Arecaceae family or the genus Pandanus. (Pandanus is often multi-stemmed).
X	Grass-tree	Australian grass trees. Members of the Xanthorrhoeaceae family
A	Cycad	Members of the families Cycadaceae and Zamiaceae.

Table A5.3: NVIS structural formation terminology (excluding fern, bryophyte, lichen, vine, and aquatic plants)

Growth Form	Height (m)	Foliage Cover (%)					
		>70	30-70	10-30	<10	≈0	0-5
Tree, palm	**<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, cycad, grass-tree, tree-fern	**<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
Other grass	**<0.5,>0.5**	Closed grassland	Grassland	Open grassland	Sparse grassland	Isolated grasses	Isolated clumps of grasses

Growth Form	Height (m)	Foliage Cover (%)					
		>70	**30-70**	**10-30**	**<10**	**≈0**	**0-5**
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: for these tables NVIS Technical Working Group (2017).

APPENDIX 6: QUADRATS - CODE AND COORDINATES AND TIMING OF SURVEYS

These tables include only Maia and *ecologia* quadrats. *ecologia*'s are prefixed with an E and most of Maia's with an M. Most of Maia's quadrats are also coded by area i.e., M-MW = Maia-Mulga Well, M-MDE and M-XMDE= Maia-Mulga Downs East (in and out of the MBSA), M-TC and M-XTX = Maia-Transport Corridor (in and out of the corridor) (2017 and 2019), and M-HR = Maia-Transport Corridor (2013 (sites 05, 06 & 07)). Almost all of these quadrats are in Area 1; however, M-HR02, 03 and 04 are in Area 6 (they were outside the MSA in Maia 2021a, but they are now within the MBSA). Quadrats assessed in 2022 are also prefixed with an M for Maia, and they are coded as follows: M-MDEW = Maia Mulga Downs East West corridor (Area 4), M-MEN = Maia Mulga East North (Area 5), M-HR (sites 11, 13, 15, 17 & 19) and M-MDHR = Maia Haul Road/Mulga Downs Haul Road (Area 3) and M-MDW = Maia Mulga Downs West (Area 2). ~ indicates site that was a relevé rather than quadrat.

Table A6.1: Quadrat Locations (GDA94, MGA50)

Quadrat	Survey Area	Easting (mE)	Northing (mN)	Quadrat	Survey Area	Easting (mE)	Northing (mN)
Quadrats assessed pre-2022							
M-HR02	A1: Mulga East (L45/380) (part of)	662695	7556020	M-MDEQ046	A1: Mulga East (R47/12)	658414	7549711
M-HR03	A1: Mulga East (L45/380) (part of)	665871	7556197	M-MDEQ047	A1: Mulga East (R47/12)	658957	7548869
M-HR04	A1: Mulga East (L45/380) (part of)	666196	7555803	M-MDEQ048	A1: Mulga East (R47/12)	659029	7551031
M-HR05	A1: Mulga East (L45/380) (part of)	668127	7556173	M-MDEQ050	A1: Mulga East (R47/12)	659013	7553250
M-HR06	A1: Mulga East (L45/380) (part of)	669351	7556107	M-MDEQ051	A1: Mulga East (R47/12)	658919	7555699
M-HR07	A1: Mulga East (L45/380) (part of)	670726	7556545	M-MDEQ052	A1: Mulga East (R47/12)	659190	7556465
M-MDEQ001	A1: Mulga East (R47/12)	668458	7552912	M-MDEQ053	A1: Mulga East (R47/12)	659045	7554527
M-MDEQ002	A1: Mulga East (R47/12)	669547	7554472	M-MDEQ054	A1: Mulga East (R47/12)	659716	7555281
M-MDEQ003	A1: Mulga East (R47/12)	669464	7551094	M-MDEQ055	A1: Mulga East (R47/12)	659857	7555971
M-MDEQ004	A1: Mulga East (R47/12)	668787	7551535	M-MDEQ056	A1: Mulga East (R47/12)	660038	7552282
M-MDEQ005	A1: Mulga East (R47/12)	676310	7539773	M-MDEQ057	A1: Mulga East (R47/12)	660171	7548184
M-MDEQ006	A1: Mulga East (R47/12)	647981	7553603	M-MDEQ058	A1: Mulga East (R47/12)	660257	7550772
M-MDEQ007	A1: Mulga East (R47/12)	664325	7552403	M-MDEQ059	A1: Mulga East (R47/12)	660549	7556812
M-MDEQ008	A1: Mulga East (R47/12)	656348	7550643	M-MDEQ060	A1: Mulga East (R47/12)	661347	7552762
M-MDEQ009	A1: Mulga East (R47/12)	660243	7549765	M-MDEQ061	A1: Mulga East (R47/12)	661372	7556594
M-MDEQ010	A1: Mulga East (R47/12)	649326	7554953	M-MDEQ062	A1: Mulga East (R47/12)	661987	7551324
M-MDEQ011	A1: Mulga East (R47/12)	649617	7553369	M-MDEQ063	A1: Mulga East (R47/12)	662059	7552872

Quadrat	Survey Area	Easting (mE)	Northing (mN)	Quadrat	Survey Area	Easting (mE)	Northing (mN)
M-MDEQ012	A1: Mulga East (R47/12)	650108	7549133	M-MDEQ064	A1: Mulga East (R47/12)	662125	7553721
M-MDEQ013	A1: Mulga East (R47/12)	650322	7551307	M-MDEQ065	A1: Mulga East (R47/12)	662180	7549098
M-MDEQ014	A1: Mulga East (R47/12)	650470	7548247	M-MDEQ066	A1: Mulga East (R47/12)	662301	7550520
M-MDEQ015	A1: Mulga East (R47/12)	650866	7552722	M-MDEQ067	A1: Mulga East (R47/12)	662823	7553305
M-MDEQ016	A1: Mulga East (R47/12)	651121	7554123	M-MDEQ068	A1: Mulga East (R47/12)	663379	7551341
M-MDEQ017	A1: Mulga East (R47/12)	652257	7549644	M-MDEQ069	A1: Mulga East (R47/12)	663599	7548405
M-MDEQ018	A1: Mulga East (R47/12)	652408	7556793	M-MDEQ070	A1: Mulga East (R47/12)	664084	7551164
M-MDEQ019	A1: Mulga East (R47/12)	652102	7551718	M-MDEQ071	A1: Mulga East (R47/12)	664559	7553470
M-MDEQ020	A1: Mulga East (R47/12)	652423	7553355	M-MDEQ072	A1: Mulga East (R47/12)	664955	7549211
M-MDEQ022	A1: Mulga East (R47/12)	653189	7549878	M-MDEQ073	A1: Mulga East (R47/12)	665105	7555131
M-MDEQ023	A1: Mulga East (R47/12)	653059	7552110	M-MDEQ074	A1: Mulga East (R47/12)	665671	7549957
M-MDEQ024	A1: Mulga East (R47/12)	654101	7549678	M-MDEQ075	A1: Mulga East (R47/12)	665777	7552896
M-MDEQ025	A1: Mulga East (R47/12)	653518	7550952	M-MDEQ076	A1: Mulga East (R47/12)	666051	7548587
M-MDEQ026	A1: Mulga East (R47/12)	653766	7554860	M-MDEQ077	A1: Mulga East (R47/12)	666509	7554122
M-MDEQ027	A1: Mulga East (R47/12)	656580	7548694	M-MDEQ078	A1: Mulga East (R47/12)	666955	7552517
M-MDEQ028	A1: Mulga East (R47/12)	654231	7554509	M-MDEQ079	A1: Mulga East (R47/12)	667467	7546260
M-MDEQ029	A1: Mulga East (R47/12)	654332	7555703	M-MDEQ080	A1: Mulga East (R47/12)	667461	7551082
M-MDEQ030	A1: Mulga East (R47/12)	654443	7551050	M-MDEQ081	A1: Mulga East (R47/12)	668037	7549465
M-MDEQ031	A1: Mulga East (R47/12)	654927	7549171	M-MDEQ082	A1: Mulga East (R47/12)	668414	7553681
M-MDEQ032	A1: Mulga East (R47/12)	655160	7556556	M-MDEQ083	A1: Mulga East (R47/12)	668563	7552612
M-MDEQ033	A1: Mulga East (R47/12)	655189	7548819	M-MDEQ084	A1: Mulga East (R47/12)	671364	7552634
M-MDEQ034	A1: Mulga East (R47/12)	655477	7549582	M-MDEQ085	A1: Mulga East (R47/12)	668985	7545895
M-MDEQ035	A1: Mulga East (R47/12)	656288	7554955	M-MDEQ086	A1: Mulga East (R47/12)	669158	7555108
M-MDEQ036	A1: Mulga East (R47/12)	656356	7548602	M-MDEQ087	A1: Mulga East (R47/12)	669793	7551321
M-MDEQ037	A1: Mulga East (R47/12)	656842	7556960	M-MDEQ088	A1: Mulga East (R47/12)	670267	7548016
M-MDEQ038	A1: Mulga East (R47/12)	656841	7549650	M-MDEQ089	A1: Mulga East (R47/12)	670422	7546342
M-MDEQ039	A1: Mulga East (R47/12)	657303	7555109	M-MDEQ090	A1: Mulga East (R47/12)	670481	7552726
M-MDEQ040	A1: Mulga East (R47/12)	657496	7557004	M-MDEQ091	A1: Mulga East (R47/12)	670605	7553606
M-MDEQ041	A1: Mulga East (R47/12)	657650	7548122	M-MDEQ092	A1: Mulga East (R47/12)	670985	7554559

Quadrat	Survey Area	Easting (mE)	Northing (mN)	Quadrat	Survey Area	Easting (mE)	Northing (mN)
M-MDEQ042	A1: Mulga East (R47/12)	657724	7555130	M-MDEQ093	A1: Mulga East (R47/12)	671123	7548319
M-MDEQ043	A1: Mulga East (R47/12)	658234	7556163	M-MDEQ094	A1: Mulga East (R47/12)	668806	7548390
M-MDEQ044	A1: Mulga East (R47/12)	658686	7556986	M-MDEQ095	A1: Mulga East (R47/12)	672149	7552227
M-MDEQ045	A1: Mulga East (R47/12)	658295	7551964	M-MDEQ096	A1: Mulga East (R47/12)	672325	7550026
M-MDEQ097	A1: Mulga East (R47/12)	672406	7553792	M-MWQ37	A1: Mulga Well (E47/2117)	646822	7547605
M-MDEQ098	A1: Mulga East (R47/12)	673019	7550971	M-MWQ38	A1: Mulga Well (E47/2117)	648814	7547805
M-MDEQ099	A1: Mulga East (R47/12)	673030	7548004	M-MWQ39	A1: Mulga Well (E47/2117)	643573	7546873
M-MDEQ100	A1: Mulga East (R47/12)	673211	7548846	M-MWQ40	A1: Mulga Well (E47/2117)	644346	7546353
M-MDEQ101	A1: Mulga East (R47/12)	673354	7553090	M-MWQ42	A1: Mulga Well (E47/2117)	644120	7547933
M-MDEQ102	A1: Mulga East (R47/12)	674198	7550802	M-MWQ43	A1: Mulga Well (E47/2117)	645306	7547955
M-MDEQ103	A1: Mulga East (R47/12)	674289	7553744	M-MWQ44	A1: Mulga Well (E47/2117)	643859	7548658
M-MDEQ104	A1: Mulga East (R47/12)	676490	7538038	M-MWQ45	A1: Mulga Well (E47/2117)	643530	7549523
M-MDEQ105	A1: Mulga East (R47/12)	677278	7538604	M-MWQ46	A1: Mulga Well (E47/2117)	642751	7553136
M-MDEQ106	A1: Mulga East (R47/12)	677724	7537700	M-MWQ47	A1: Mulga Well (E47/2117)	644146	7553447
M-MDEQ107	A1: Mulga East (R47/12)	678746	7541997	M-MWQ48	A1: Mulga Well (E47/2117)	645000	7553354
M-MDEQ108	A1: Mulga East (R47/12)	676149	7539568	M-MWQ49	A1: Mulga Well (E47/2117)	644621	7553110
M-MDEQ109	A1: Mulga East (R47/12)	679712	7541360	M-MWQ50	A1: Mulga Well (E47/2117)	647494	7551367
M-MDEQ110	A1: Mulga East (R47/12)	679891	7542823	M-MWQ51	A1: Mulga Well (E47/2117)	645764	7551720
M-MDEQ111	A1: Mulga East (R47/12)	660315	7555962	M-MWQ52	A1: Mulga Well (E47/2117)	644325	7551570
M-MWQ01	A1: Mulga Well (E47/2117)	662856	7547424	M-MWQ53	A1: Mulga Well (E47/2117)	646270	7550707
M-MWQ02	A1: Mulga Well (E47/2117)	663112	7546772	M-MWQ54	A1: Mulga Well (E47/2117)	647245	7549042
M-MWQ03	A1: Mulga Well (E47/2117)	662715	7547140	M-MWQ55	A1: Mulga Well (E47/2117)	645778	7549164
M-MWQ04	A1: Mulga Well (E47/2117)	661534	7547653	M-MWQ56	A1: Mulga Well (E47/2117)	645000	7550539
M-MWQ05	A1: Mulga Well (E47/2117)	662437	7546204	M-MWQ57	A1: Mulga Well (E47/2117)	643510	7550691
M-MWQ06	A1: Mulga Well (E47/2117)	661358	7546909	M-TCQ01	A1: Mulga East (L45/380) (part of)	669570	7556166
M-MWQ07	A1: Mulga Well (E47/2117)	660414	7546661	M-TCQ02	A1: Mulga East (L45/380) (part of)	668795	7555843
M-MWQ08	A1: Mulga Well (E47/2117)	659074	7547766	M-TCQ03	A1: Mulga East (L45/380) (part of)	669139	7556380
M-MWQ09	A1: Mulga Well (E47/2117)	657728	7547734	M-TCQ04	A1: Mulga East (L45/380) (part of)	668408	7555467
M-MWQ10	A1: Mulga Well (E47/2117)	658084	7547373	M-TCQ06	A1: Mulga East (L45/380) (part of)	670197	7555453

Quadrat	Survey Area	Easting (mE)	Northing (mN)	Quadrat	Survey Area	Easting (mE)	Northing (mN)
M-MWQ11	A1: Mulga Well (E47/2117)	659078	7547168	M-TCQ08	A1: Mulga East (L45/380) (part of)	671297	7555274
M-MWQ12	A1: Mulga Well (E47/2117)	656837	7546954	M-TCQ09	A1: Mulga East (L45/380) (part of)	671436	7555768
M-MWQ13	A1: Mulga Well (E47/2117)	656426	7546709	M-TCQ14	A1: Mulga East (L45/380) (part of)	674127	7554839
M-MWQ14	A1: Mulga Well (E47/2117)	656756	7546302	M-XMDE01	A1: Mulga East (R47/12)	651681	7549125
M-MWQ15	A1: Mulga Well (E47/2117)	657694	7546258	M-XMDE02	A1: Mulga East (R47/12)	652837	7549159
M-MWQ16	A1: Mulga Well (E47/2117)	655088	7546718	M-XTC01	A1: Mulga East (L45/380) (part of)	667508	7555692
M-MWQ17	A1: Mulga Well (E47/2117)	655160	7546969	M-XTC04	A1: Mulga East (L45/380) (part of)	671556	7554751
M-MWQ18	A1: Mulga Well (E47/2117)	654810	7547619	M-XTC17	A1: Mulga East (L45/380) (part of)	673451	7554472
M-MWQ19	A1: Mulga Well (E47/2117)	654264	7547716	M-XTC18	A1: Mulga East (L45/380) (part of)	673985	7554405
M-MWQ20	A1: Mulga Well (E47/2117)	652192	7547897	E-S01	A1: Mulga East (R47/12)	655912	7552745
M-MWQ21	A1: Mulga Well (E47/2117)	651000	7547469	E-S02	A1: Mulga East (R47/12)	656249	7553122
M-MWQ22	A1: Mulga Well (E47/2117)	651552	7546651	E-S03	A1: Mulga East (R47/12)	656160	7552784
M-MWQ23	A1: Mulga Well (E47/2117)	655270	7542510	E-S04	A1: Mulga East (R47/12)	656838	7552541
M-MWQ24	A1: Mulga Well (E47/2117)	654980	7543748	E-S05	A1: Mulga East (R47/12)	656160	7552784
M-MWQ25	A1: Mulga Well (E47/2117)	655960	7544468	E-S06	A1: Mulga East (R47/12)	656116	7551796
M-MWQ26	A1: Mulga Well (E47/2117)	655352	7544783	E-S07	A1: Mulga East (R47/12)	655556	7551884
M-MWQ27	A1: Mulga Well (E47/2117)	654578	7545969	E-S08	A1: Mulga East (R47/12)	655408	7553507
M-MWQ28	A1: Mulga Well (E47/2117)	651878	7546280	E-S09	A1: Mulga East (R47/12)	655320	7554567
M-MWQ30	A1: Mulga Well (E47/2117)	651379	7544573	E-S11	A1: Mulga East (R47/12)	655685	7553907
M-MWQ31	A1: Mulga Well (E47/2117)	649698	7545240	E-S12	A1: Mulga East (R47/12)	656306	7553292
M-MWQ32	A1: Mulga Well (E47/2117)	650056	7545383	E-S13	A1: Mulga East (R47/12)	656351	7554206
M-MWQ33	A1: Mulga Well (E47/2117)	650002	7546420	E-S14	A1: Mulga East (R47/12)	657005	7551970
M-MWQ34	A1: Mulga Well (E47/2117)	643555	7548591	E-S15	A1: Mulga East (R47/12)	656954	7552246
M-MWQ35	A1: Mulga Well (E47/2117)	646582	7545487	E-S16	A1: Mulga East (R47/12)	655348	7554757
M-MWQ36	A1: Mulga Well (E47/2117)	646479	7546257	E-S17	A1: Mulga East (R47/12)	655759	7552222
E-S18	A1: Mulga East (R47/12)	656162	7553814	E-S21	A1: Mulga East (R47/12)	655492	7552185
E-S19	A1: Mulga East (R47/12)	656115	7552507	E-S22	A1: Mulga East (R47/12)	654779	7552774
E-S20	A1: Mulga East (R47/12)	654979	7552487	E-S24	A1: Mulga East (R47/12)	654779	7552774

Quadrat	Survey Area	Easting (mE)	Northing (mN)	Quadrat	Survey Area	Easting (mE)	Northing (mN)
Quadrats assessed in 2022							
M-MDEW001	A4: Mulga West to Mulga East linking corridor	637434	7555992	M-HR011	A3: Hester Peak South-east (L45/316)	677694	7548904
M-MDEW002	A4: Mulga West to Mulga East linking corridor	638718	7555562	M-HR013	A3: Hester Peak South-east (L45/316)	678512	7549195
M-MDEW003	A4: Mulga West to Mulga East linking corridor	635406	7556580	M-HR015	A3: Hester Peak South-east (L45/316)	679891	7549396
M-MEN002	A5: Two Mile Well (E47/4264)	642727	7554199	M-HR017	A3: Hester Peak South-east (L45/316)	680527	7549449
M-MEN003	A5: Two Mile Well (E47/4264)	642696	7554075	M-HR019	A3: Hester Peak South-east (L45/316)	681120	7550267
M-MEN005	A5: Two Mile Well (E47/4264)	646374	7555331	M-MDHREK001	A3: Hester Peak South-east (L45/316)	682017	7550254
M-MEN006	A5: Two Mile Well (E47/4264)	644334	7555109	M-MDHRSH001	A3: Hester Peak South-east (L45/316)	683462	7550182
M-MDW001	A2: Mulga West (E47/1315-I)	606812	7562591	M-MDW030	A2: Mulga West (E47/1315-I)	615663	7559683
M-MDW003	A2: Mulga West (E47/1315-I)	606878	7559639	M-MDW031	A2: Mulga West (E47/1315-I)	613424	7560790
M-MDW005	A2: Mulga West (E47/1315-I)	607403	7559345	M-MDW032	A2: Mulga West (E47/1315-I)	611057	7560385
M-MDW006	A2: Mulga West (E47/1315-I)	612750	7557546	M-MDW033	A2: Mulga West (E47/1315-I)	626818	7557057
M-MDW007	A2: Mulga West (E47/1315-I)	617542	7555871	M-MDW034	A2: Mulga West (E47/1315-I)	625509	7557466
M-MDW008	A2: Mulga West (E47/1315-I)	615151	7557497	M-MDW035	A2: Mulga West (E47/1315-I)	632274	7559086
M-MDW009	A2: Mulga West (E47/1315-I)	617853	7556992	M-MDW036	A2: Mulga West (E47/1315-I)	629342	7558579
M-MDW010	A2: Mulga West (E47/1315-I)	618283	7557930	M-MDW038	A2: Mulga West (E47/1315-I)	627348	7559118
M-MDW011	A2: Mulga West (E47/1315-I)	616651	7556220	M-MDW039	A2: Mulga West (E47/1315-I)	629342	7558579
M-MDW012	A2: Mulga West (E47/1315-I)	609219	7558647	M-MDW040	A2: Mulga West (E47/1315-I)	629694	7555877
M-MDW013	A2: Mulga West (E47/1315-I)	608050	7558376	M-MDW041	A2: Mulga West (E47/1315-I)	630413	7556824
M-MDW014	A2: Mulga West (E47/1315-I)	608614	7557555	M-MDW042	A2: Mulga West (E47/1315-I)	630177	7556332
M-MDW016	A2: Mulga West (E47/1315-I)	606305	7561497	M-MDW043	A2: Mulga West (E47/1315-I)	632046	7555767
M-MDW017	A2: Mulga West (E47/1315-I)	613982	7556215	M-MDW044	A2: Mulga West (E47/1315-I)	632520	7555638
M-MDW018	A2: Mulga West (E47/1315-I)	626556	7560412	M-MDW046	A2: Mulga West (E47/1315-I)	633791	7556528
M-MDW019	A2: Mulga West (E47/1315-I)	611813	7556044	M-MDW047	A2: Mulga West (E47/1315-I)	633318	7557626
M-MDW020	A2: Mulga West (E47/1315-I)	610415	7564066	M-MDW048	A2: Mulga West (E47/1315-I)	633618	7558466

Quadrat	Survey Area	Easting (mE)	Northing (mN)	Quadrat	Survey Area	Easting (mE)	Northing (mN)
M-MDW021	A2: Mulga West (E47/1315-I)	611160	7564146	M-MDW049	A2: Mulga West (E47/1315-I)	633961	7559485
M-MDW022	A2: Mulga West (E47/1315-I)	615568	7562050	M-MDW050	A2: Mulga West (E47/1315-I)	619762	7561705
M-MDW023	A2: Mulga West (E47/1315-I)	614419	7561853	M-MDW053	A2: Mulga West (E47/1315-I)	631016	7560985
M-MDW024	A2: Mulga West (E47/1315-I)	611859	7563714	M-MDW054	A2: Mulga West (E47/1315-I)	632485	7560359
M-MDW025	A2: Mulga West (E47/1315-I)	613490	7561488	M-MDW055	A2: Mulga West (E47/1315-I)	622364	7562614
M-MDW026	A2: Mulga West (E47/1315-I)	611643	7563125	M-MDW056	A2: Mulga West (E47/1315-I)	618358	7559373
M-MDW027	A2: Mulga West (E47/1315-I)	611850	7561622	M-MDW057	A2: Mulga West (E47/1315-I)	618517	7560710
M-MDW028	A2: Mulga West (E47/1315-I)	613272	7564776	M-MDW058	A2: Mulga West (E47/1315-I)	622388	7558897
M-MDW029	A2: Mulga West (E47/1315-I)	610240	7562420	M-MDWSH001	A2: Mulga West (E47/1315-I)	619735	7561418

Table A6.2: Quadrats and assessments

Note: columns 3 to 7 (A to E) indicate the different assessment events; as the first assessment for each area / survey is not on the same date, A, B, C, D and E are used to indicate assessments rather than specific dates: see **Table 6.1** for season, month and year when different assessments were carried out.

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga East (R47/12)	M-MDEQ001	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ002	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ003	✓					1
A1: Mulga East (R47/12)	M-MDEQ004	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ005	✓					1
A1: Mulga East (R47/12)	M-MDEQ006	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ007	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ008	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ009	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ010	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ011	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ012	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ013	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ014	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ015	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ016	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ017	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ018	✓					1
A1: Mulga East (R47/12)	M-MDEQ019	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ020	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ022	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ023	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ024	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ025	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ026	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ027	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ028	✓	✓				2

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga East (R47/12)	M-MDEQ029	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ030	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ031	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ032	✓					1
A1: Mulga East (R47/12)	M-MDEQ033	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ034	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ035	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ036	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ037	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ038	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ039	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ040	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ041	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ042	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ043	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ044	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ045	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ046	✓					1
A1: Mulga East (R47/12)	M-MDEQ047	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ048	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ050	✓					1
A1: Mulga East (R47/12)	M-MDEQ051	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ052	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ053	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ054	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ055	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ056	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ057	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ058	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ059	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ060	✓	✓				2

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga East (R47/12)	M-MDEQ061	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ062	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ063	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ064	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ065	✓					1
A1: Mulga East (R47/12)	M-MDEQ066	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ067	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ068	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ069	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ070	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ071	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ072	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ073	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ074	✓					1
A1: Mulga East (R47/12)	M-MDEQ075	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ076	✓					1
A1: Mulga East (R47/12)	M-MDEQ077	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ078	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ079	✓					1
A1: Mulga East (R47/12)	M-MDEQ080	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ081	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ082	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ083	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ084	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ085	✓					1
A1: Mulga East (R47/12)	M-MDEQ086	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ087	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ088	✓					1
A1: Mulga East (R47/12)	M-MDEQ089	✓					1
A1: Mulga East (R47/12)	M-MDEQ090	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ091	✓	✓				2

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga East (R47/12)	M-MDEQ092	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ093	✓					1
A1: Mulga East (R47/12)	M-MDEQ094	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ095	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ096	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ097	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ098	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ099	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ100	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ101	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ102	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ103	✓	✓				2
A1: Mulga East (R47/12)	M-MDEQ104	✓					1
A1: Mulga East (R47/12)	M-MDEQ105	✓					1
A1: Mulga East (R47/12)	M-MDEQ106	✓					1
A1: Mulga East (R47/12)	M-MDEQ107	✓					1
A1: Mulga East (R47/12)	M-MDEQ108	✓					1
A1: Mulga East (R47/12)	M-MDEQ109	✓					1
A1: Mulga East (R47/12)	M-MDEQ110	✓					1
A1: Mulga East (R47/12)	M-MDEQ111	✓	✓				2
A1: Mulga East (R47/12)	M-XMDE01		✓	✓			2
A1: Mulga East (R47/12)	M-XMDE02		✓	✓			2
A1: Mulga Well (E47/2117)	M-MWQQ01	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ02	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ03	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ04	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ05	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ06	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ07	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ08	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ09	✓	✓	✓			3

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga Well (E47/2117)	M-MWQQ10	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ11	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ12	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ13	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ14	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ15	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ16	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ17	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ18	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ19	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ20	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ21	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ22	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ23	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ24	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ25	✓	✓				2
A1: Mulga Well (E47/2117)	M-MWQQ26	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ27	✓	✓				2
A1: Mulga Well (E47/2117)	M-MWQQ28	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ30	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ31	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ32	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ33	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ34	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ35	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ36	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ37	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ38	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ39	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ40	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ42	✓	✓	✓			3

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga Well (E47/2117)	M-MWQQ43	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ44	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ45	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ46	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ47	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ48	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ49	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ50	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ51	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ52	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ53	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ54	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ55	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ56	✓	✓	✓			3
A1: Mulga Well (E47/2117)	M-MWQQ57	✓	✓	✓			3
A1: Mulga East (L45/380) (part of)	M-HR02	✓				✓	2
A1: Mulga East (L45/380) (part of)	M-HR03	✓				✓	2
A1: Mulga East (L45/380) (part of)	M-HR04	✓				✓	2
A1: Mulga East (L45/380) (part of)	M-HR05	✓					1
A1: Mulga East (L45/380) (part of)	M-HR06	✓					1
A1: Mulga East (L45/380) (part of)	M-HR07	✓					1
A1: Mulga East (L45/380) (part of)	M-TCQ01			✓	✓		2
A1: Mulga East (L45/380) (part of)	M-TCQ02		✓	✓			2
A1: Mulga East (L45/380) (part of)	M-TCQ03			✓	✓		2
A1: Mulga East (L45/380) (part of)	M-TCQ04		✓	✓			2
A1: Mulga East (L45/380) (part of)	M-TCQ06		✓	✓			2
A1: Mulga East (L45/380) (part of)	M-TCQ08		✓	✓			2
A1: Mulga East (L45/380) (part of)	M-TCQ09			✓	✓		2
A1: Mulga East (L45/380) (part of)	M-TCQ14		✓	✓			2
A1: Mulga East (L45/380) (part of)	M-XTC01			✓			1
A1: Mulga East (L45/380) (part of)	M-XTC04			✓			1

Survey area	Quadrat	A	B	C	D	E	Total assessments
A1: Mulga East (L45/380) (part of)	M-XTC17			✓			1
A1: Mulga East (L45/380) (part of)	M-XTC18			✓			1
A3: Hester Peal South-east (L45/316)	M-HR011	✓				✓	2
A3: Hester Peal South-east (L45/316)	M-HR013	✓				✓	2
A3: Hester Peal South-east (L45/316)	M-HR015	✓				✓	2
A3: Hester Peal South-east (L45/316)	M-HR017	✓				✓	2
A3: Hester Peal South-east (L45/316)	M-HR019	✓				✓	2
A3: Hester Peal South-east (L45/316)	M-MDHREK001					✓	1
A3: Hester Peal South-east (L45/316)	M-MDHRSH001					✓	1
A5: Two Mile Well (E47/4264)	M-MEN002					✓	1
A5: Two Mile Well (E47/4264)	M-MEN003					✓	1
A5: Two Mile Well (E47/4264)	M-MEN005					✓	1
A5: Two Mile Well (E47/4264)	M-MEN006					✓	1
A4: Mulga West to Mulga East linking corridor	M-MDEW001					✓	1
A4: Mulga West to Mulga East linking corridor	M-MDEW002					✓	1
A4: Mulga West to Mulga East linking corridor	M-MDEW003					✓	1
A2: Mulga West (E47/1315-I)	M-MDW001					✓	1
A2: Mulga West (E47/1315-I)	M-MDW003					✓	1
A2: Mulga West (E47/1315-I)	M-MDW005					✓	1
A2: Mulga West (E47/1315-I)	M-MDW006					✓	1
A2: Mulga West (E47/1315-I)	M-MDW007					✓	1
A2: Mulga West (E47/1315-I)	M-MDW008					✓	1
A2: Mulga West (E47/1315-I)	M-MDW009					✓	1
A2: Mulga West (E47/1315-I)	M-MDW010					✓	1
A2: Mulga West (E47/1315-I)	M-MDW011					✓	1
A2: Mulga West (E47/1315-I)	M-MDW012					✓	1
A2: Mulga West (E47/1315-I)	M-MDW013					✓	1
A2: Mulga West (E47/1315-I)	M-MDW014					✓	1
A2: Mulga West (E47/1315-I)	M-MDW016					✓	1
A2: Mulga West (E47/1315-I)	M-MDW017					✓	1
A2: Mulga West (E47/1315-I)	M-MDW018					✓	1

Survey area	Quadrat	A	B	C	D	E	Total assessments
A2: Mulga West (E47/1315-I)	M-MDW019					✓	1
A2: Mulga West (E47/1315-I)	M-MDW020					✓	1
A2: Mulga West (E47/1315-I)	M-MDW021					✓	1
A2: Mulga West (E47/1315-I)	M-MDW022					✓	1
A2: Mulga West (E47/1315-I)	M-MDW023					✓	1
A2: Mulga West (E47/1315-I)	M-MDW024					✓	1
A2: Mulga West (E47/1315-I)	M-MDW025					✓	1
A2: Mulga West (E47/1315-I)	M-MDW026					✓	1
A2: Mulga West (E47/1315-I)	M-MDW027					✓	1
A2: Mulga West (E47/1315-I)	M-MDW028					✓	1
A2: Mulga West (E47/1315-I)	M-MDW029					✓	1
A2: Mulga West (E47/1315-I)	M-MDW030					✓	1
A2: Mulga West (E47/1315-I)	M-MDW031					✓	1
A2: Mulga West (E47/1315-I)	M-MDW032					✓	1
A2: Mulga West (E47/1315-I)	M-MDW033					✓	1
A2: Mulga West (E47/1315-I)	M-MDW034					✓	1
A2: Mulga West (E47/1315-I)	M-MDW035					✓	1
A2: Mulga West (E47/1315-I)	M-MDW036					✓	1
A2: Mulga West (E47/1315-I)	M-MDW038					✓	1
A2: Mulga West (E47/1315-I)	M-MDW039					✓	1
A2: Mulga West (E47/1315-I)	M-MDW040					✓	1
A2: Mulga West (E47/1315-I)	M-MDW041					✓	1
A2: Mulga West (E47/1315-I)	M-MDW042					✓	1
A2: Mulga West (E47/1315-I)	M-MDW043					✓	1
A2: Mulga West (E47/1315-I)	M-MDW044					✓	1
A2: Mulga West (E47/1315-I)	M-MDW046					✓	1
A2: Mulga West (E47/1315-I)	M-MDW047					✓	1
A2: Mulga West (E47/1315-I)	M-MDW048					✓	1
A2: Mulga West (E47/1315-I)	M-MDW049					✓	1
A2: Mulga West (E47/1315-I)	M-MDW050					✓	1
A2: Mulga West (E47/1315-I)	M-MDW053					✓	1

Survey area	Quadrat	A	B	C	D	E	Total assessments
A2: Mulga West (E47/1315-I)	M-MDW054					✓	1
A2: Mulga West (E47/1315-I)	M-MDW055					✓	1
A2: Mulga West (E47/1315-I)	M-MDW056					✓	1
A2: Mulga West (E47/1315-I)	M-MDW057					✓	1
A2: Mulga West (E47/1315-I)	M-MDW058					✓	1
A2: Mulga West (E47/1315-I)	M-MDWSH001					✓	1

APPENDIX 7: SPECIES LIST

Notes regarding this table: bold and T = Threatened species; bold and P1 – P4 = Priority One to Priority Four; bold and * = environmental weed; bold and REx = range extension; bold and REnd = endemic to the Pilbara region, bold and TOI = taxon of interest. Fl = flowering material, Fr = fruiting material, Opp Coll = opportunistic collection, TFS = targeted flora survey. Nomenclature based on current Western Australian Herbarium terminology and confirmed on Florabase (WAH, 1998 -). Flowering and fruiting information collated from across all surveys.

Table A7.1: Vascular flora list

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Acanthaceae	*Dicladanthera forrestii*	Fl			•			•	•			
Acanthaceae	*Dipteracanthus australasicus*		•									
Acanthaceae	*Dipteracanthus australasicus* subsp. *australasicus*	Fl	•		•			•	•	•		
Acanthaceae	*Rostellularia adscendens*		•									
Acanthaceae	***Rostellularia adscendens* ?var. *latifolia* (potential P3 and REnd)**	FlFr	•		•							
Acanthaceae	***Rostellularia adscendens* var. *latifolia* (P3) (REnd)**				•							
Acanthaceae	*Rostellularia adscendens* var. *clementii*	FlFr	•	•	•	•					•	
Aizoaceae	*Trianthema cusackianum*	Fr	•									
Aizoaceae	*Trianthema glossostigmum*	Fl	•	•	•	•		•				
Aizoaceae	*Trianthema pilosum*		•									
Aizoaceae	*Trianthema triquetrum*	FlFr	•	•	•	•				•		
Amaranthaceae	*Achyranthes aspera*	FlFr	•		•	•						
Amaranthaceae	***Aerva javanica****	FlFr	•	•	•							
Amaranthaceae	*Alternanthera angustifolia*										•	
Amaranthaceae	*Alternanthera denticulata*										•	
Amaranthaceae	*Alternanthera nana*	FlFr	•		•							
Amaranthaceae	*Alternanthera nodiflora*	FlFr	•	•	•	•					•	
Amaranthaceae	*Amaranthus* aff. *interruptus* (MET 16,114)							•				
Amaranthaceae	*Amaranthus cuspidifolius*	FlFr	•		•							
Amaranthaceae	*Amaranthus induratus*	Fl			•							
Amaranthaceae	*Amaranthus undulatus*	FlFr	•		•							
Amaranthaceae	*Gomphrena affinis* subsp. *pilbarensis*	FlFr	•		•	•				•		
Amaranthaceae	*Gomphrena canescens*	Fl	•	•	•	•	•					

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Amaranthaceae	*Gomphrena canescens* subsp. *canescens*	Fl	•									
Amaranthaceae	*Gomphrena cunninghamii*	FlFr	•		•			•	•			
Amaranthaceae	*Gomphrena kanisii*	Fl	•		•			•				
Amaranthaceae	*Ptilotus aervoides*	Fl	•		•							
Amaranthaceae	*Ptilotus astrolasius*	FlFr	•		•			•				
Amaranthaceae	*Ptilotus axillaris*	Fl	•									
Amaranthaceae	*Ptilotus calostachyus*	FlFr	•		•	•		•				
Amaranthaceae	*Ptilotus carinatus*							•				
Amaranthaceae	*Ptilotus clementii*	FlFr	•	•	•			•				
Amaranthaceae	*Ptilotus exaltatus*	FlFr	•		•	•		•		•		
Amaranthaceae	*Ptilotus fusiformis*	FlFr	•		•			•				
Amaranthaceae	*Ptilotus gaudichaudii*	FlFr	•		•							
Amaranthaceae	*Ptilotus gomphrenoides*	FlFr	•	•	•			•			•	
Amaranthaceae	*Ptilotus helipteroides*	Fl	•		•			•				
Amaranthaceae	*Ptilotus incanus*	Fr	•									
Amaranthaceae	*Ptilotus obovatus*	FlFr	•		•			•				
Amaranthaceae	*Ptilotus obovatus* var. *obovatus*		•		•							
Amaranthaceae	*Ptilotus polystachyus*	FlFr	•		•			•				
Amaranthaceae	*Ptilotus roei*	Fl	•		•							
Amaranthaceae	*Ptilotus rotundifolius*	Fl	•		•			•				
Amaranthaceae	*Ptilotus schwartzii*		•									
Amaranthaceae	*Ptilotus* sp. indet.		•									
Amaranthaceae	*Ptilotus xerophilus*	Fl	•	•								
Apocynaceae	*Cynanchum floribundum*		•									
Apocynaceae	*Cynanchum viminale* subsp. *australe*		•		•							
Apocynaceae	*Leichhardtia australis*				•							
Apocynaceae	*Vincetoxicum lineare*	Fr	•					•				

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Araliaceae	*Trachymene oleracea*	Fl			•							
Araliaceae	*Trachymene oleracea* subsp. *oleracea*	FlFr	•					•	•			
Asteraceae	***Bidens bipinnata****	FlFr	•	•	•	•		•		•		
Asteraceae	*Blumea tenella*	Fl	•	•	•	•						
Asteraceae	*Calocephalus knappii*	Fl		•								
Asteraceae	*Calocephalus pilbarensis*				•							
Asteraceae	*Calocephalus* sp. indet.		•									
Asteraceae	*Calotis hispidula*	Fl		•								
Asteraceae	*Calotis multicaulis*	Fl		•	•							
Asteraceae	*Calotis plumulifera*	FlFr	•	•	•							
Asteraceae	*Calotis porphyroglossa*				•						•	
Asteraceae	***Calotis squamigera* (P1) (REnd)**	Fl		•	•							
Asteraceae	*Centipeda crateriformis* subsp. *crateriformis*		•									
Asteraceae	*Centipeda minima*	FlFr	•		•						•	
Asteraceae	*Centipeda minima* subsp. *macrocephala*	FlFr	•	•	•							
Asteraceae	*Centipeda minima* subsp. *minima*					•						
Asteraceae	*Chrysocephalum apiculatum*	Fl	•	•								
Asteraceae	*Chrysocephalum gilesii*	Fl			•							
Asteraceae	***Flaveria trinervia****	FlFr	•	•	•							
Asteraceae	***Helichrysum oligochaetum* (P1)**	**Fl**		•	•						•	
Asteraceae	***Iotasperma sessilifolium* (P3)**										•	
Asteraceae	*Minuria integerrima*	Fl	•	•								
Asteraceae	*Myriocephalus rudallii*										•	
Asteraceae	***Olearia muelleri* (REx)**		•									
Asteraceae	*Olearia* sp. indet.				•							
Asteraceae	*Olearia stuartii*	Fl	•									

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Asteraceae	*Peripleura* ? *arida*		•									
Asteraceae	*Peripleura arida*	FlFr		•	•							
Asteraceae	*Pluchea dentex*	FlFr	•		•				•			
Asteraceae	*Pluchea dunlopii*	Fl	•		•							
Asteraceae	*Pluchea ferdinandi-muelleri*	FlFr	•		•							
Asteraceae	*Pluchea rubelliflora*	Fl	•	•	•							
Asteraceae	*Pluchea tetranthera*	FlFr	•		•							
Asteraceae	*Pseudognaphalium luteoalbum*										•	
Asteraceae	*Pterocaulon* ? *sphacelatum*		•									
Asteraceae	*Pterocaulon serrulatum* var. *velutinum*	Fl	•									
Asteraceae	*Pterocaulon* sp. indet.		•									
Asteraceae	*Pterocaulon sphacelatum*	FlFr	•	•	•	•			•			
Asteraceae	*Pterocaulon sphaeranthoides*	FlFr	•		•			•		•		
Asteraceae	***Rhodanthe adscendens* (P1)**											•
Asteraceae	*Rhodanthe floribunda*	Fl			•							
Asteraceae	*Rutidosis helichrysoides*				•			•				
Asteraceae	*Rutidosis helichrysoides* subsp. *helichrysoides*	FlFr	•	•	•							
Asteraceae	***Sonchus oleraceus****	Fl	•									
Asteraceae	*Streptoglossa* ? *odora*		•									
Asteraceae	*Streptoglossa adscendens*	Fl			•							
Asteraceae	*Streptoglossa bubakii*	FlFr	•		•							
Asteraceae	*Streptoglossa decurrens*	FlFr	•	•	•			•	•			
Asteraceae	*Streptoglossa liatroides*	Fl	•									
Asteraceae	*Streptoglossa macrocephala*	Fl	•		•							
Asteraceae	*Streptoglossa odora*	FlFr	•		•							
Asteraceae	*Streptoglossa* sp. indet.		•									

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Asteraceae	*Streptoglossa tenuiflora*	FlFr	•	•	•							
Asteraceae	*Vittadinia eremaea*	FlFr	•		•							
Asteraceae	***Vittadinia sulcata* (REx)**	Fl			•							
Boraginaceae	*Ehretia saligna*		•									
Boraginaceae	*Ehretia saligna* var. *saligna*		•	•	•	•						
Boraginaceae	*Euploca* sp. indet.		•									
Boraginaceae	*Euploca chrysocarpa*	FlFr	•	•								
Boraginaceae	*Euploca heterantha*	Fl	•		•							
Boraginaceae	*Euploca ovalifolia*	FlFr	•	•	•						•	•
Boraginaceae	*Euploca pachyphylla*	Fl			•							
Boraginaceae	*Euploca tanythrix*	Fr	•									
Boraginaceae	*Euploca tenuifolia*	Fr	•									
Boraginaceae	*Trichodesma zeylanicum*	Fl	•		•							
Boraginaceae	*Trichodesma zeylanicum* var. *zeylanicum*	Fl	•		•			•				
Brassicaceae	*Lepidium echinatum*	FlFr	•		•							
Brassicaceae	*Lepidium phlebopetalum*	FlFr	•	•								
Brassicaceae	*Stenopetalum nutans*		•									
Campanulaceae	*Wahlenbergia queenslandica*	Fl	•									
Campanulaceae	*Wahlenbergia* sp. indet.		•									
Campanulaceae	*Wahlenbergia tumidifructa*	Fl	•	•	•							
Capparaceae	*Capparis lasiantha*	Fl	•	•	•			•	•			
Capparaceae	*Capparis umbonata*	Fr	•	•	•							
Caryophyllaceae	*Polycarpaea corymbosa*	FlFr	•		•							
Caryophyllaceae	*Polycarpaea corymbosa* var. *corymbosa*	Fl	•		•							
Caryophyllaceae	*Polycarpaea holtzei*	Fl	•		•			•				
Caryophyllaceae	*Polycarpaea longiflora*	FlFr	•		•			•				
Celastraceae	*Stackhousia intermedia*	Fl	•					•				

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Celastraceae	*Stackhousia* sp. indet.		•									
Chenopodiaceae	*Atriplex amnicola*	FlFr	•	•	•							
Chenopodiaceae	*Atriplex bunburyana*	FlFr	•		•							
Chenopodiaceae	*Atriplex* sp. indet.		•		•							
Chenopodiaceae	*Dysphania kalpari*	FlFr	•		•			•				
Chenopodiaceae	*Dysphania melanocarpa*	*Fr*	•									
Chenopodiaceae	*Dysphania rhadinostachya*	Fl			•							
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*	FlFr	•	•	•			•				
Chenopodiaceae	*Dysphania sphaerosperma*	FlFr	•									
Chenopodiaceae	*Enchylaena tomentosa*	Fr			•							
Chenopodiaceae	*Enchylaena tomentosa* var. *tomentosa*	FlFr	•		•							
Chenopodiaceae	*Maireana* ? *planifolia*		•									
Chenopodiaceae	*Maireana* ? *villosa*		•									
Chenopodiaceae	***Maireana aphylla* (Rex)**	Fr	•									
Chenopodiaceae	*Maireana planifolia*	Fr	•		•							
Chenopodiaceae	*Maireana thesioides*	Fl	•		•							
Chenopodiaceae	*Maireana tomentosa* subsp. *tomentosa*	Fr	•		•							
Chenopodiaceae	*Maireana triptera*	FlFr	•	•		•						
Chenopodiaceae	*Maireana villosa*	Fr	•		•	•						
Chenopodiaceae	*Rhagodia eremaea*	FlFr	•	•	•	•		•	•	•		
Chenopodiaceae	*Salsola australis*	FlFr	•		•	•		•	•	•		
Chenopodiaceae	*Sclerolaena* ? *cornishiana*		•									
Chenopodiaceae	*Sclerolaena bicornis*	Fr	•	•	•					•		
Chenopodiaceae	*Sclerolaena cornishiana*	FlFr	•	•	•	•		•		•		
Chenopodiaceae	*Sclerolaena costata*	Fr	•		•	•				•		
Chenopodiaceae	*Sclerolaena cuneata*	Fr	•		•	•						

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Chenopodiaceae	*Sclerolaena densiflora*	FlFr	•		•	•						
Chenopodiaceae	*Sclerolaena eriacantha*	Fr	•		•							
Chenopodiaceae	*Sclerolaena* sp. indet.				•							
Chenopodiaceae	*Sclerolaena tetragona*	FlFr	•		•							
Chenopodiaceae	*Tecticornia indica*				•							
Chenopodiaceae	*Tecticornia indica* subsp. *leiostachya*	Fl			•							
Chenopodiaceae	*Tecticornia verrucosa*	FlFr	•		•						•	
Cleomaceae	*Areocleome oxalidea*	FlFr	•		•							
Cleomaceae	*Arivela viscosa*	FlFr	•		•			•		•	•	
Commelinaceae	*Commelina ensifolia*	FlFr	•		•	•						
Convolvulaceae	*Bonamia erecta*	FlFr	•		•	•						
Convolvulaceae	*Bonamia media*							•				
Convolvulaceae	*Bonamia pilbarensis*	FlFr	•	•								
Convolvulaceae	*Bonamia rosea*	Fl	•					•				
Convolvulaceae	*Bonamia* sp. indet.				•							
Convolvulaceae	*Convolvulus clementii*	FlFr	•		•							
Convolvulaceae	*Duperreya commixta*	Fl	•	•	•	•		•		•		
Convolvulaceae	*Evolvulus alsinoides*		•									
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*	Fl	•									
Convolvulaceae	*Evolvulus alsinoides* var. *villosicalyx*	FlFr	•		•	•		•	•			
Convolvulaceae	*Ipomoea coptica*	Fl	•									
Convolvulaceae	*Ipomoea diamantinensis*										•	
Convolvulaceae	*Ipomoea lonchophylla*	FlFr	•		•							
Convolvulaceae	*Ipomoea muelleri*	FlFr	•		•			•				
Convolvulaceae	*Ipomoea polymorpha*										•	
Convolvulaceae	*Operculina aequisepala*	FlFr	•		•			•				
Convolvulaceae	*Polymeria ambigua*	Fl	•		•							

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Convolvulaceae	*Polymeria calycina*		•									
Cucurbitaceae	*Austrobryonia pilbarensis*		•									
Cucurbitaceae	***Citrullus amarus****	FlFr	•	•	•							
Cucurbitaceae	***Citrullus colocynthis****		•		•							
Cucurbitaceae	*Cucumis argenteus*	FlFr	•		•							
Cucurbitaceae	*Cucumis melo*	FlFr	•		•					•		
Cucurbitaceae	*Cucumis variabilis*	Fr	•		•	•		•				
Cyperaceae	*Abildgaardia oxystachya* **(REx)**	Fr		•								
Cyperaceae	*Bulbostylis barbata*	Fr	•		•			•			•	
Cyperaceae	***Bulbostylis burbidgeae*** **(atypical form) (P4)**	Fl			•							
Cyperaceae	***Bulbostylis burbidgeae*** **(P4)**				•							
Cyperaceae	*Bulbostylis turbinata*	Fr	•	•								
Cyperaceae	*Cyperus ? rigidellus*		•									
Cyperaceae	*Cyperus bifax*	Fr	•									
Cyperaceae	*Cyperus cunninghamii* subsp. *cunninghamii*		•									
Cyperaceae	*Cyperus difformis*	FlFr	•		•						•	
Cyperaceae	*Cyperus hesperius*	Fl			•							
Cyperaceae	*Cyperus iria*	FlFr	•	•								
Cyperaceae	*Cyperus ixiocarpus*	Fl	•	•					•			
Cyperaceae	*Cyperus macrostachyos*										•	
Cyperaceae	*Cyperus pulchellus*	Fl			•							
Cyperaceae	*Cyperus pygmaeus*	Fr	•								•	
Cyperaceae	*Cyperus squarrosus*	FlFr	•	•							•	
Cyperaceae	*Cyperus vaginatus*	FlFr			•							
Cyperaceae	*Eleocharis pallens*	Fr	•	•	•						•	•
Cyperaceae	*Eleocharis* sp. indet.	Fl	•	•								

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Cyperaceae	*Fimbristylis dichotoma*	Fr	•		•			•				
Cyperaceae	*Fimbristylis microcarya*	Fr	•									
Cyperaceae	*Fimbristylis simulans*	FlFr	•		•			•				
Cyperaceae	*Isolepis congrua*		•									
Cyperaceae	*Schoenoplectiella dissachantha*	FlFr	•	•								•
Droseraceae	*Drosera finlaysoniana*	Fl	•	•								
Elatinaceae	*Bergia ammannioides*	Fl	•	•								
Elatinaceae	*Bergia pedicellaris*	FlFr	•									
Elatinaceae	*Bergia perennis*										•	
Elatinaceae	*Bergia perennis* subsp. *exigua*	Fl			•							
Elatinaceae	*Bergia perennis* subsp. *obtusifolia*	FlFr	•	•						•		•
Elatinaceae	*Bergia perennis* subsp. *perennis*	Fl			•							
Elatinaceae	*Bergia trimera*	Fl	•	•								
Euphorbiaceae	*Euphorbia* aff. *australis*								•			
Euphorbiaceae	*Euphorbia* aff. *drummondii* (M87)							•				
Euphorbiaceae	*Euphorbia australis*	FlFr	•		•							
Euphorbiaceae	***Euphorbia australis* var. *glabra* (P3 and REnd)**	FlFr	•	•	•							
Euphorbiaceae	*Euphorbia australis* var. *hispidula*	Fl	•									
Euphorbiaceae	*Euphorbia australis* var. *subtomentosa*	FlFr	•		•							
Euphorbiaceae	*Euphorbia biconvexa*	FlFr	•		•							
Euphorbiaceae	*Euphorbia boophthona*	FlFr	•	•	•			•				
Euphorbiaceae	*Euphorbia coghlanii*	FlFr	•		•			•				
Euphorbiaceae	*Euphorbia drummondii*	Fl	•		•							
Euphorbiaceae	*Euphorbia* sp. (site 1089)							•				
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*	FlFr	•	•	•							
Euphorbiaceae	*Euphorbia vaccaria* var. *vaccaria*	FlFr	•		•							

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Fabaceae	*Desmodiopsis campylocaulon*				•							
Fabaceae	*Acacia* ? *aptaneura*		•									
Fabaceae	*Acacia* ? *aptaneura* x *pteraneura*		•									
Fabaceae	*Acacia* ? *incurvaneura*		•									
Fabaceae	*Acacia* ? *ligulata*		•									
Fabaceae	*Acacia acradenia*	FlFr	•		•							
Fabaceae	*Acacia adoxa* var. *adoxa*	FlFr	•	•	•			•				
Fabaceae	*Acacia adsurgens*	FlFr	•	•								
Fabaceae	*Acacia* aff. *stowardii* (linear form)							•				
Fabaceae	*Acacia ampliceps*	Fl			•							
Fabaceae	*Acacia ampliceps* × *sclerosperma* subsp. *sclerosperma*		•									
Fabaceae	*Acacia ancistrocarpa*	Fr	•		•	•	•	•				
Fabaceae	*Acacia aneura*	FlFr	•	•	•	•		•	•			
Fabaceae	*Acacia aneura* type A	Fr	•									
Fabaceae	*Acacia aneura* x *craspedocarpa*				•							
Fabaceae	*Acacia aptaneura*	FlFr	•	•	•		•	•		•		
Fabaceae	*Acacia aptaneura* x *pteraneura*		•									
Fabaceae	*Acacia arida*	FlFr	•		•			•				
Fabaceae	*Acacia atkinsiana*	Fl	•		•	•		•	•			
Fabaceae	*Acacia ayersiana*		•		•			•				
Fabaceae	*Acacia balsamea*				•							
Fabaceae	*Acacia bivenosa*	FlFr	•	•	•			•				
Fabaceae	*Acacia catenulata* subsp. *occidentalis*							•				
Fabaceae	*Acacia citrinoviridis*	Fr	•		•			•				
Fabaceae	*Acacia colei* var. *colei*				•							
Fabaceae	*Acacia coriacea* subsp. *pendens*	FlFr	•	•	•							

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Fabaceae	*Acacia dictyophleba*		•									
Fabaceae	*Acacia distans*	FlFr	•	•	•				•		•	•
Fabaceae	***Acacia doreta* (REx)**	Fl	•		•							
Fabaceae	*Acacia hilliana*	FlFr	•		•							
Fabaceae	*Acacia inaequilatera*	FlFr	•		•			•				
Fabaceae	*Acacia incurvaneura*		•	•	•		•					
Fabaceae	*Acacia kempeana*	Fl			•							
Fabaceae	*Acacia ligulata*	Fr	•									
Fabaceae	*Acacia macraneura*	Fr	•		•							
Fabaceae	*Acacia maitlandii*	FlFr	•		•	•		•	•			
Fabaceae	*Acacia marramamba*	FlFr	•	•	•			•				
Fabaceae	*Acacia minyura*					•						
Fabaceae	*Acacia monticola*	FlFr	•	•	•	•		•	•			
Fabaceae	*Acacia pachyacra*		•									
Fabaceae	*Acacia paraneura*				•							
Fabaceae	*Acacia pruinocarpa*		•		•	•		•	•			
Fabaceae	*Acacia pteraneura*	Fr	•				•	•				
Fabaceae	*Acacia pyrifolia*	Fr	•		•			•				
Fabaceae	*Acacia pyrifolia* var. *morrisonii*	FlFr	•		•	•			•			
Fabaceae	*Acacia pyrifolia* var. *pyrifolia*	FlFr	•				•					
Fabaceae	*Acacia rhodophloia*	Fl	•		•							
Fabaceae	*Acacia sclerosperma* subsp. *sclerosperma*	FlFr	•		•							
Fabaceae	*Acacia sericophylla*	Fl			•							
Fabaceae	*Acacia sibirica*	Fl			•	•		•	•			
Fabaceae	*Acacia* sp. indet 1				•							
Fabaceae	*Acacia* sp. indet 2				•							
Fabaceae	*Acacia* sp. indet. 3		•									

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Fabaceae	*Acacia spondylophylla*	FlFr	•		•			•				
Fabaceae	*Acacia stenophylla*	Fl	•	•	•						•	
Fabaceae	*Acacia synchronicia*	FlFr	•		•	•		•		•		
Fabaceae	*Acacia tenuissima*	Fr	•	•	•	•		•				
Fabaceae	*Acacia tetragonophylla*	FlFr	•		•	•		•	•	•	•	
Fabaceae	*Acacia trachycarpa*	FlFr		•	•							
Fabaceae	*Acacia trachycarpa* x *tumida* var. *pilbarensis*		•									
Fabaceae	*Acacia trudgeniana*		•		•			•				
Fabaceae	*Acacia tumida* var. *pilbarensis*	FlFr	•		•			•	•			
Fabaceae	*Acacia victoriae*	FlFr	•		•							
Fabaceae	*Acacia victoriae* subsp. *victoriae*	Fr		•								
Fabaceae	*Acacia xiphophylla*	FlFr	•		•	•		•		•		
Fabaceae	*Aeschynomene indica*	FlFr	•		•						•	
Fabaceae	*Alysicarpus muelleri*	FlFr	•	•	•							
Fabaceae	*Crotalaria dissitiflora* subsp. *benthamiana*	Fl			•					•		
Fabaceae	*Crotalaria medicaginea*							•				
Fabaceae	*Crotalaria medicaginea* var. *neglecta*	FlFr	•		•							
Fabaceae	*Cullen* aff. *lachnostachys* (M.E. Trudgen 15,073)							•				
Fabaceae	*Cullen cinereum*	FlFr	•	•	•			•				
Fabaceae	*Cullen graveolens*	FlFr	•		•							
Fabaceae	*Cullen lachnostachys*		•									
Fabaceae	*Cullen leucanthum*	Fl	•									
Fabaceae	*Cullen leucochaites*	Fl		•								
Fabaceae	*Cullen martinii*							•				
Fabaceae	*Gastrolobium grandiflorum*	Fl	•									

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Fabaceae	*Glycine canescens*		•					•				
Fabaceae	***Glycine falcata* (P3)**		•									
Fabaceae	*Gompholobium oreophilum*	Fl	•	•	•			•				
Fabaceae	*Indigofera linifolia*	**FlFr**	•		•							
Fabaceae	*Indigofera linnaei*	Fr	•		•							
Fabaceae	*Indigofera monophylla*	FlFr	•		•	•		•	•			
Fabaceae	*Isotropis atropurpurea*	FlFr	•	•	•			•				
Fabaceae	*Kennedia prorepens*		•									
Fabaceae	*Lotus australis*	Fl	•	•	•							
Fabaceae	*Lotus cruentus*		•									
Fabaceae	***Medicago polymorpha****	Fl	•	•								
Fabaceae	*Neptunia dimorphantha*	Fr	•		•						•	
Fabaceae	*Petalostylis labicheoides*	FlFr	•		•			•				
Fabaceae	*Rhynchosia australis*									•		
Fabaceae	***Rhynchosia bungarensis* (P4)**	Fl	•									
Fabaceae	*Rhynchosia minima*	FlFr	•	•	•			•	•		•	•
Fabaceae	*Senna artemisioides* subsp. aff. *oligophylla* (thinly sericeous)							•				
Fabaceae	*Senna artemisioides* subsp. *filifolia*		•		•							
Fabaceae	*Senna artemisioides* subsp. *helmsii*	FlFr	•	•	•	•		•				
Fabaceae	*Senna artemisioides* subsp. *helmsii* x *oligophylla*		•		•							
Fabaceae	*Senna artemisioides* subsp. *helmsii* x subsp. *oligophylla*		•									
Fabaceae	*Senna artemisioides* subsp. *oligophylla*	FlFr	•	•	•	•		•	•	•		
Fabaceae	*Senna artemisioides* subsp. *oligophylla* x *helmsii*	Fl			•							
Fabaceae	*Senna artemisioides* subsp. x *artemisioides*		•		•							

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Fabaceae	*Senna ferraria*		•									
Fabaceae	*Senna glaucifolia*	Fr	•		•	•						
Fabaceae	*Senna glutinosa* subsp. *chatelainiana*		•			•						
Fabaceae	*Senna glutinosa* subsp. *glutinosa*	FlFr	•		•	•		•		•		
Fabaceae	*Senna glutinosa* subsp. *luerssenii*		•									
Fabaceae	*Senna glutinosa* subsp. *luerssenii* x *pruinosa*		•									
Fabaceae	*Senna glutinosa* subsp. *pruinosa*	FlFr	•		•	•		•				
Fabaceae	*Senna glutinosa* subsp. x *luerssenii*	FlFr	•		•	•		•	•			
Fabaceae	*Senna notabilis*	FlFr	•		•			•		•		
Fabaceae	*Senna sericea*	Fl	•	•								
Fabaceae	*Senna symonii*	FlFr	•		•							
Fabaceae	*Senna venusta*	FlFr			•							
Fabaceae	*Sesbania cannabina*	FlFr	•		•							
Fabaceae	*Swainsona forrestii*	FlFr	•		•							
Fabaceae	*Swainsona kingii*	FlFr	•		•							
Fabaceae	*Swainsona stenodonta*	FlFr						•				
Fabaceae	*Swainsona tanamiensis*	Fr	•									
Fabaceae	*Tephrosia densa*	FlFr	•		•							
Fabaceae	*Tephrosia oxalidea*	Fr	•	•								
Fabaceae	*Tephrosia rosea* var. *clementii*	FlFr	•	•					•			
Fabaceae	*Tephrosia rosea* var. Fortescue creeks (M.I.H. Brooker 2186)	Fl	•					•				
Fabaceae	*Tephrosia* sp. Bungaroo Creek (M.E. Trudgen 11601)	Fl		•	•			•				
Fabaceae	*Tephrosia* sp. clay soils (S. van Leeuwen et al. PBS 0273)	FlFr	•		•							
Fabaceae	*Tephrosia* sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)	Fl	•									

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Fabaceae	*Tephrosia supina*		•		•							
Fabaceae	***Vachellia farnesiana****	FlFr	•	•	•	•					•	
Fabaceae	*Vigna lanceolata* var. *lanceolata*	Fl	•									
Fabaceae	*Vigna* sp. Hamersley Clay (A.A. Mitchell PRP 113)				•							
Gentianaceae	*Schenkia australis*	Fl	•	•								
Goodeniaceae	*Dampiera candicans*	FlFr	•		•			•				
Goodeniaceae	***Goodenia* ? *lyrata* (potential P3)**	Fl	•									
Goodeniaceae	*Goodenia* ? *microptera*				•							
Goodeniaceae	***Goodenia* aff. *muelleriana* (TOI)**	Fl	•									
Goodeniaceae	*Goodenia connata*	Fl	•		•			•				
Goodeniaceae	*Goodenia cusackiana*	FlFr	•	•	•			•				
Goodeniaceae	*Goodenia forrestii*	Fl	•	•	•			•				
Goodeniaceae	*Goodenia lamprosperma*	FlFr	•	•	•							•
Goodeniaceae	*Goodenia microptera*	FlFr	•	•	•			•				
Goodeniaceae	*Goodenia muelleriana*	FlFr	•		•							
Goodeniaceae	***Goodenia nuda* (P4)**	FlFr	•	•	•			•				
Goodeniaceae	***Goodenia occidentalis* (Rex)**	FlFr			•							
Goodeniaceae	*Goodenia pascua*	FlFr	•	•	•						•	
Goodeniaceae	*Goodenia prostrata*	FlFr	•		•			•				
Goodeniaceae	***Goodenia* sp. East Pilbara (A.A. Mitchell PRP 727) (P3)**	Fl			•							
Goodeniaceae	*Goodenia* sp. indet. 1		•									
Goodeniaceae	*Goodenia* sp. indet. 2				•							
Goodeniaceae	*Goodenia stellata*								•			
Goodeniaceae	*Goodenia stobbsiana*	FlFr	•		•	•		•	•			
Goodeniaceae	*Goodenia triodiophila*	FlFr	•		•			•				
Goodeniaceae	*Scaevola* aff. *browniana*							•				

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Goodeniaceae	*Scaevola amblyanthera* var. *amblyanthera*				•							
Goodeniaceae	*Scaevola amblyanthera* var. *centralis*		•		•							
Goodeniaceae	*Scaevola browniana* subsp. *browniana*	Fl		•								
Goodeniaceae	*Scaevola parvifolia* subsp. *pilbarae*	FlFr	•	•								
Goodeniaceae	*Scaevola spinescens*	FlFr	•		•	•		•				
Gyrostemonaceae	*Codonocarpus cotinifolius*	Fr	•		•			•				
Haloragaceae	*Haloragis gossei*		•		•							
Haloragaceae	*Haloragis gossei* var. *gossei*	Fr	•	•	•	•		•				
Haloragaceae	*Haloragis* sp. indet.		•									
Haloragaceae	*Haloragis trigonocarpa*	FlFr	•	•	•							
Lamiaceae	*Basilicum polystachyon*	Fr	•	•	•							
Lamiaceae	*Clerodendrum floribundum* var. *angustifolium*	FlFr	•	•	•							
Lamiaceae	*Clerodendrum floribundum* var. *ovatum*	FlFr			•							
Lamiaceae	***Teucrium pilbaranum* (P2 and REnd)**	FlFr	•	•	•							
Lamiaceae	*Teucrium racemosum*	FlFr	•	•	•						•	
Lamiaceae	*Teucrium teucriiflorum*				•							
Lauraceae	*Cassytha capillaris*		•					•				
Loranthaceae	*Amyema hilliana*	Fl	•	•		•						
Loranthaceae	*Amyema miquelii*			•								
Loranthaceae	*Amyema preissii*	FlFr		•	•							
Loranthaceae	*Lysiana casuarinae*	Fr	•									
Lythraceae	*Ammannia multiflora*	FlFr	•		•							
Malvaceae	*Abutilon* ? *leucopetalum*		•									
Malvaceae	*Abutilon* aff. *lepidum*							•				
Malvaceae	*Abutilon amplum*	FlFr	•		•							
Malvaceae	*Abutilon cryptopetalum*	FlFr	•		•							

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Malvaceae	*Abutilon cunninghamii*	FlFr	•		•							
Malvaceae	*Abutilon fraseri*	FlFr			•	•		•				
Malvaceae	*Abutilon fraseri* subsp. *fraseri*	Fr	•		•					•		
Malvaceae	*Abutilon lepidum*	FlFr	•	•	•	•		•				
Malvaceae	*Abutilon macrum*	FlFr	•		•	•		•				
Malvaceae	*Abutilon malvifolium*	Fr	•									
Malvaceae	*Abutilon otocarpum*	FlFr	•	•	•	•		•				
Malvaceae	*Abutilon oxycarpum*	FlFr			•							
Malvaceae	*Abutilon oxycarpum* subsp. Prostrate (A.A. Mitchell PRP 1266)	Fl			•							
Malvaceae	*Abutilon* sp. Dioicum (A.A. Mitchell PRP 1618)		•		•							
Malvaceae	*Abutilon* sp. indet.		•									
Malvaceae	*Abutilon* sp. Pilbara (W.R. Barker 2025)	FlFr	•	•								
Malvaceae	*Androcalva luteiflora*	FlFr	•									
Malvaceae	***Corchorus incanus* subsp. *lithophilus* (REnd)**	Fl	•		•							
Malvaceae	*Corchorus laniflorus*	Fl		•	•							
Malvaceae	*Corchorus lasiocarpus*	FlFr			•							
Malvaceae	*Corchorus lasiocarpus* subsp. *lasiocarpus*	FlFr	•		•	•		•				
Malvaceae	*Corchorus lasiocarpus* subsp. *parvus*	FlFr	•		•							
Malvaceae	*Corchorus parviflorus*		•									
Malvaceae	*Corchorus sidoides*		•									
Malvaceae	*Corchorus sidoides* subsp. *sidoides*	FlFr	•		•							
Malvaceae	*Corchorus* sp. Hamersley Range hilltops (S. van Leeuwen 3826)	FlFr	•									
Malvaceae	*Corchorus tectus*	FlFr	•		•							
Malvaceae	*Corchorus tridens*	FlFr	•		•							
Malvaceae	*Corchorus trilocularis*	Fr	•	•							•	

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Malvaceae	*Gossypium australe*	FlFr	•		•			•				
Malvaceae	*Gossypium robinsonii*	FlFr	•	•	•			•				
Malvaceae	*Hibiscus* aff. *coatesii*							•				
Malvaceae	*Hibiscus* aff. *sturtii* (Site B9)							•				
Malvaceae	*Hibiscus austrinus* var. *austrinus*		•									
Malvaceae	*Hibiscus brachychlaenus*	Fl	•									
Malvaceae	*Hibiscus brachysiphonius*	FlFr	•		•							
Malvaceae	*Hibiscus burtonii*	FlFr	•		•	•		•				
Malvaceae	*Hibiscus coatesii*	FlFr	•	•	•	•			•			
Malvaceae	*Hibiscus leptocladus*					•			•			
Malvaceae	*Hibiscus* sp. Gardneri (A.L. Payne PRP 1435)	Fl			•			•				
Malvaceae	*Hibiscus* sp. indet.	Fl	•		•							
Malvaceae	***Hibiscus* sp. Mulga Downs (TOI)**	**FlFr**	•		•							
Malvaceae	*Hibiscus sturtii*	FlFr	•		•							
Malvaceae	*Hibiscus sturtii* var. *campylochlamys*	FlFr	•	•	•			•				
Malvaceae	*Hibiscus sturtii* var. *campylochlamys/platychlamys*		•									
Malvaceae	*Hibiscus sturtii* var. *platychlamys*	FlFr	•			•			•			
Malvaceae	*Hibiscus sturtii* var. *truncatus*	Fr			•							
Malvaceae	***Malvastrum americanum****	FlFr	•	•	•	•		•		•	•	
Malvaceae	*Melhania oblongifolia*	FlFr	•	•	•		•					
Malvaceae	***Melochia pyramidata****		•									
Malvaceae	***Seringia exastia* (T) / *Seringia ? exastia* (?T)**	Fl	•	•	•	•						
Malvaceae	*Seringia nephrosperma*	FlFr	•	•	•	•		•				
Malvaceae	*Sida* ? sp. Articulation below (A.A. Mitchell PRP 1605)		•									
Malvaceae	*Sida* ? sp. Excedentifolia (J.L. Egan 1925)	Fr	•									

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Malvaceae	*Sida* aff. *cardiophylla* (site 1086)							•				
Malvaceae	*Sida* aff. *fibulifera*		•									
Malvaceae	*Sida* aff. *fibulifera* (FMG 125-20)							•				
Malvaceae	*Sida arenicola*	FlFr	•		•	•		•				
Malvaceae	*Sida cardiophylla*		•					•			•	
Malvaceae	*Sida clementii*	Fl	•									
Malvaceae	*Sida echinocarpa*	FlFr	•	•	•							
Malvaceae	*Sida ectogama*	FlFr			•							
Malvaceae	*Sida fibulifera*	FlFr	•		•	•				•		
Malvaceae	*Sida platycalyx*	FlFr	•		•	•		•				
Malvaceae	*Sida rohlenae* subsp. *rohlenae*	FlFr	•		•							
Malvaceae	*Sida* sp. (inadequate material)		•									
Malvaceae	*Sida* sp. Articulation below (A.A. Mitchell PRP 1605)	FlFr	•	•	•			•				
Malvaceae	*Sida* sp. dark green fruits (S. van Leeuwen 2260)	FlFr	•		•	•		•	•			
Malvaceae	*Sida* sp. Excedentifolia (J.L. Egan 1925)	FlFr	•		•							
Malvaceae	*Sida* sp. Golden calyces glabrous (H.N. Foote 32)	Fr	•									
Malvaceae	*Sida* sp. indet. 1		•									
Malvaceae	*Sida* sp. indet. 2		•									
Malvaceae	*Sida* sp. L (A.M. Ashby 4202)	FlFr	•	•	•	•				•		
Malvaceae	*Sida* sp. Pilbara (A.A. Mitchell PRP 1543)	FlFr	•		•			•				
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)	FlFr	•		•			•	•			
Malvaceae	*Sida* sp. Supplejack Station (T.S. Henshall 2345)	FlFr	•		•							
Malvaceae	*Sida spinosa*		•								•	•
Malvaceae	*Triumfetta chaetocarpa*	FlFr	•	•	•			•				

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Malvaceae	*Triumfetta clementii*	FlFr	•	•	•			•				
Malvaceae	*Triumfetta maconochieana*	FlFr	•									
Malvaceae	*Waltheria indica*	FlFr	•		•			•	•			
Marsileaceae	*Marsilea hirsuta*	FlFr	•		•			•				
Molluginaceae	*Glinus lotoides*	FlFr	•	•	•						•	
Molluginaceae	*Trigastrotheca molluginea*	FlFr	•	•	•			•				
Moraceae	*Ficus brachypoda*	Fr	•	•	•							
Myrtaceae	*Calytrix carinata*		•		•	•		•				
Myrtaceae	*Corymbia* ? *ferriticola*				•							
Myrtaceae	*Corymbia ? hamersleyana*		•		•							
Myrtaceae	*Corymbia aspera*		•									
Myrtaceae	*Corymbia candida* subsp. *candida*	Fr	•	•								
Myrtaceae	*Corymbia deserticola*	Fr	•		•							
Myrtaceae	*Corymbia deserticola* subsp. *deserticola*	Fr	•	•	•	•		•				
Myrtaceae	*Corymbia ferriticola*				•	•						
Myrtaceae	*Corymbia hamersleyana*	FlFr	•	•	•	•		•				
Myrtaceae	*Corymbia* sp. indet.		•									
Myrtaceae	*Eucalyptus ? camaldulensis* subsp. *refulgens*		•									
Myrtaceae	*Eucalyptus ? leucophloia*		•									
Myrtaceae	*Eucalyptus* ?*tephrodes*	Fr			•							
Myrtaceae	*Eucalyptus* ?*victrix*								•			
Myrtaceae	*Eucalyptus gamophylla*	Fr	•		•	•		•				
Myrtaceae	*Eucalyptus leucophloia*								•			
Myrtaceae	*Eucalyptus leucophloia* subsp. *leucophloia*	FlFr	•	•	•	•		•				
Myrtaceae	*Eucalyptus pilbarensis*				•							
Myrtaceae	*Eucalyptus socialis* subsp. *eucentrica*	FlFr			•							

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Myrtaceae	*Eucalyptus victrix*	Fr	•	•	•			•			•	•
Myrtaceae	*Eucalyptus xerothermica*	Fr	•		•							
Myrtaceae	*Melaleuca glomerata*	Fr	•	•	•						•	
Myrtaceae	*Melaleuca lasiandra*	Fr		•								
Myrtaceae	*Melaleuca linophylla*	Fr	•	•	•							
Nyctaginaceae	*Boerhavia burbidgeana*	FlFr			•						•	
Nyctaginaceae	*Boerhavia coccinea*	FlFr	•		•					•		
Nyctaginaceae	*Boerhavia gardneri*	FlFr	•									
Nyctaginaceae	*Boerhavia repleta*	Fl			•							
Oleaceae	*Jasminum didymum*		•									
Oleaceae	*Jasminum didymum* subsp. *lineare*	FlFr	•	•	•			•				
Onagraceae	*Ludwigia perennis*	Fr	•									
Orobanchaceae	*Striga curviflora*		•									
Orobanchaceae	*Striga squamigera*	FlFr	•		•							
Pedaliaceae	*Josephinia eugeniae*	FlFr	•	•	•	•						
Pedaliaceae	***Josephinia* sp. Woodstock (A.A. Mitchell PRP 989) (P1)**				•							
Phrymaceae	*Mimulus gracilis*	FlFr	•		•						•	
Phrymaceae	*Peplidium aithocheilum*	FlFr	•		•							
Phrymaceae	*Peplidium muelleri*	FlFr	•		•							
Phrymaceae	*Peplidium* sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)							•			•	
Phyllanthaceae	*Dendrophyllanthus erwinii*				•				•			
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*		•									
Phyllanthaceae	*Nellica maderaspatensis*	FlFr	•								•	
Phyllanthaceae	*Notoleptopus decaisnei*	Fr	•									
Phyllanthaceae	*Notoleptopus decaisnei* var. Orbicularis (A.B. Craig 428)	Fr	•									

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Pittosporaceae	*Pittosporum angustifolium*	Fr			•							
Plantaginaceae	*Stemodia grossa*	FlFr	•		•		•	•				
Plantaginaceae	*Stemodia kingii*	Fr	•		•							
Plantaginaceae	***Stemodia linophylla* (REx)**	Fl		•	•							
Plantaginaceae	*Stemodia viscosa*	Fl	•	•	•	•		•				
Poaceae	*Acrachne racemosa*	Fr	•	•								
Poaceae	*Amphipogon caricinus*		•									
Poaceae	*Amphipogon sericeus*	FlFr	•		•	•		•				
Poaceae	***Aristida* ? *jerichoensis* var. *subspinulifera* (potential P3)**		•									
Poaceae	***Aristida anthoxanthoides* (REx)**	Fl			•							
Poaceae	*Aristida burbidgeae*	Fl	•									
Poaceae	*Aristida contorta*	FlFr	•		•	•		•		•		
Poaceae	*Aristida holathera* var. *holathera*	FlFr	•		•			•				
Poaceae	*Aristida hygrometrica*	Fr			•							
Poaceae	*Aristida inaequiglumis*	FlFr	•		•	•						
Poaceae	*Aristida ingrata*							•				
Poaceae	***Aristida jerichoensis* var. *subspinulifera* (P3)**	Fr	•									
Poaceae	*Aristida latifolia*	FlFr	•		•	•				•		
Poaceae	*Aristida obscura*	FlFr	•	•	•			•				
Poaceae	*Aristida pruinosa*	FlFr	•		•							
Poaceae	*Aristida* sp. indet.	FlFr	•									
Poaceae	*Astrebla elymoides*		•		•							
Poaceae	*Astrebla pectinata*	Fr	•		•							
Poaceae	*Astrebla* sp. indet.			•								
Poaceae	*Bothriochloa bladhii* subsp. *bladhii*		•									
Poaceae	***Cenchrus ciliaris****	Fr	•	•	•	•		•		•	•	

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Poaceae	***Cenchrus setiger****	FlFr	•	•	•	•					•	
Poaceae	*Chloris pectinata*	Fr	•		•	•				•		
Poaceae	*Chloris pumilio*									•		
Poaceae	***Chloris virgata****	Fr			•							
Poaceae	*Chrysopogon fallax*	FlFr	•		•	•		•				
Poaceae	*Cymbopogon ambiguus*	FlFr	•	•	•	•		•				
Poaceae	*Cymbopogon obtectus*	Fl	•		•							
Poaceae	*Cymbopogon procerus*	Fl			•							
Poaceae	*Cynodon convergens*	Fr	•									
Poaceae	***Cynodon dactylon****		•									
Poaceae	*Cynodon prostratus*	FlFr	•		•							
Poaceae	*Dactyloctenium radulans*	Fr	•		•	•				•		
Poaceae	*Dichanthium sericeum* subsp. *humilius*	Fr	•		•			•	•		•	
Poaceae	*Dichanthium sericeum* subsp. *polystachyum*				•						•	
Poaceae	*Dichanthium sericeum* subsp. *sericeum*		•									
Poaceae	*Digitaria brownii*	Fr	•		•							
Poaceae	*Digitaria ctenantha*	FlFr			•			•				
Poaceae	*Diplachne fusca*	Fr	•		•							
Poaceae	*Diplachne fusca* subsp. *muelleri*	Fr	•								•	
Poaceae	***Echinochloa colona****	FlFr	•		•	•					•	
Poaceae	***Echinochloa microstachya****										•	
Poaceae	*Elytrophorus spicatus*	FlFr	•		•							
Poaceae	*Enneapogon caerulescens*	FlFr	•	•	•			•		•		
Poaceae	*Enneapogon cylindricus*	FlFr	•									
Poaceae	*Enneapogon intermedius*	FlFr	•									
Poaceae	*Enneapogon lindleyanus*	FlFr	•									

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Poaceae	*Enneapogon polyphyllus*	FlFr	•	•	•	•		•	•	•		
Poaceae	*Enneapogon robustissimus*	Fr	•		•							
Poaceae	*Enteropogon ramosus*	Fr	•		•							
Poaceae	*Eragrostis ? cumingii*		•									
Poaceae	*Eragrostis ? xerophila*		•									
Poaceae	***Eragrostis crateriformis* (P3)**	Fr			•							
Poaceae	*Eragrostis cumingii*	FlFr	•		•		•	•				
Poaceae	*Eragrostis desertorum*	FlFr	•	•	•							
Poaceae	*Eragrostis dielsii*	FlFr	•	•	•						•	
Poaceae	*Eragrostis eriopoda*	FlFr	•		•							
Poaceae	*Eragrostis exigua*	FlFr	•	•	•							
Poaceae	*Eragrostis falcata*	Fr	•									
Poaceae	*Eragrostis leptocarpa*	FlFr	•	•	•							
Poaceae	*Eragrostis pergracilis*	FlFr	•	•	•			•				
Poaceae	*Eragrostis setifolia*	FlFr	•	•	•					•	•	
Poaceae	***Eragrostis* sp. Erect spikelets (P.K. Latz 2122) (P3)**	Fr			•							
Poaceae	*Eragrostis* sp. indet.				•							
Poaceae	*Eragrostis speciosa*	Fr			•							
Poaceae	*Eragrostis tenellula*	FlFr	•	•	•	•					•	
Poaceae	*Eragrostis xerophila*	FlFr	•		•	•				•		
Poaceae	*Eriachne aristidea*	FlFr	•	•	•			•	•			
Poaceae	*Eriachne benthamii*	FlFr	•	•	•			•	•			
Poaceae	*Eriachne benthamii / flaccida*									•		
Poaceae	*Eriachne ciliata*		•									
Poaceae	*Eriachne flaccida*	FlFr	•	•							•	
Poaceae	*Eriachne gardneri*	Fl	•									

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Poaceae	*Eriachne helmsii*	Fl	•		•							
Poaceae	*Eriachne lanata*	Fr	•		•	•		•				
Poaceae	*Eriachne mucronata*	FlFr	•		•	•		•	•			
Poaceae	*Eriachne obtusa*	FlFr	•		•							
Poaceae	*Eriachne pulchella* subsp. *dominii*	FlFr	•		•							
Poaceae	*Eriachne pulchella* subsp. *pulchella*	Fr	•		•			•				
Poaceae	*Eriachne* sp. indet. 1				•							
Poaceae	*Eriachne* sp. indet. 2				•							
Poaceae	*Eriachne* sp. indet. 3	Fr	•									
Poaceae	*Eriachne tenuiculmis*		•									
Poaceae	*Eriochloa pseudoacrotricha*	FlFr	•	•								
Poaceae	*Eulalia aurea*	FlFr	•	•	•	•		•				
Poaceae	*Iseilema eremaeum*	Fr	•					•				
Poaceae	*Iseilema membranaceum*	Fr	•									
Poaceae	*Iseilema vaginiflorum*	Fr	•		•						•	
Poaceae	*Panicum australiense*		•									
Poaceae	*Panicum decompositum*	FlFr	•		•							
Poaceae	*Panicum effusum*							•				
Poaceae	*Panicum laevinode*	FlFr	•								•	
Poaceae	***Panicum miliaceum****	Fl			•							
Poaceae	*Paraneurachne muelleri*	FlFr	•	•	•	•		•	•			
Poaceae	*Paspalidium basicladum*	FlFr	•	•	•	•			•			
Poaceae	*Paspalidium clementii*	FlFr	•		•							
Poaceae	*Paspalidium jubiflorum*	Fr	•								•	
Poaceae	*Paspalidium rarum*	Fr	•		•							
Poaceae	*Perotis rara*	FlFr	•		•	•		•		•		
Poaceae	*Schizachyrium fragile*	Fl	•		•			•				

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Poaceae	*Setaria dielsii*	Fr	•	•	•							
Poaceae	***Setaria verticillata****	FlFr	•	•	•	•		•				
Poaceae	*Sorghum plumosum*	Fr	•									
Poaceae	*Sporobolus actinocladus*	Fl	•									
Poaceae	*Sporobolus australasicus*	FlFr	•		•	•		•	•	•		
Poaceae	*Sporobolus mitchellii*	Fl	•	•							•	•
Poaceae	*Themeda* ? *triandra*				•							
Poaceae	***Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3)**	Fr			•							
Poaceae	*Themeda* sp. indet.	Fr			•							
Poaceae	*Themeda triandra*	FlFr	•	•	•	•		•				
Poaceae	*Tragus australianus*		•									
Poaceae	*Triodia* ? *lanigera*				•							
Poaceae	*Triodia* ? *pungens*				•							
Poaceae	*Triodia angusta*	Fr	•									
Poaceae	*Triodia basedowii*	Fr	•		•							
Poaceae	***Triodia basitricha* (P3)**	Fr	•	•								
Poaceae	*Triodia brizoides*	FlFr	•	•	•							
Poaceae	*Triodia epactia*	FlFr	•	•	•			•				
Poaceae	*Triodia lanigera*	FlFr	•		•	•			•			
Poaceae	*Triodia longiceps*	FlFr	•		•							
Poaceae	*Triodia pungens*	Fl	•		•	•		•				
Poaceae	*Triodia vanleeuwenii*	*Fr*	•									
Poaceae	***Triodia veniciae* (P1) (REnd)**	FlFr	•	•	•							
Poaceae	*Triodia wiseana*	FlFr	•	•	•							
Poaceae	*Tripogonella loliiformis*	Fl	•									
Poaceae	*Urochloa occidentalis* var. *ciliata*					•						

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Poaceae	*Urochloa occidentalis* var. *occidentalis*	Fr	•		•							
Polygalaceae	*Polygala glaucifolia*		•									
Polygalaceae	*Polygala isingii*	Fl	•		•							
Polygonaceae	*Duma florulenta*	Fl	•	•	•						•	•
Polygonaceae	***Rumex vesicarius****	Fl	•									
Portulacaceae	*Calandrinia ptychosperma*	FlFr			•							
Portulacaceae	*Calandrinia pumila*	Fl	•									
Portulacaceae	*Portulaca conspicua*	Fr			•							
Portulacaceae	*Portulaca cyclophylla*	Fl			•							
Portulacaceae	*Portulaca decipiens*	Fr	•									
Portulacaceae	*Portulaca intraterranea*										•	
Portulacaceae	*Portulaca oleracea*	FlFr	•		•		•	•		•		
Portulacaceae	***Portulaca pilosa****	FlFr	•									
Proteaceae	*Grevillea ? stenobotrya*		•									
Proteaceae	*Grevillea berryana*	FlFr	•		•	•		•				
Proteaceae	*Grevillea pyramidalis* subsp. *leucadendron*	FlFr	•		•			•				
Proteaceae	*Grevillea striata*		•		•							
Proteaceae	*Grevillea wickhamii*	Fr	•		•							
Proteaceae	*Grevillea wickhamii* subsp. *aprica*	FlFr	•		•							
Proteaceae	*Grevillea wickhamii* subsp. *hispidula*	Fl	•			•		•	•			
Proteaceae	*Hakea chordophylla*	FlFr	•		•	•		•				
Proteaceae	*Hakea lorea*	*Fr*			•							
Proteaceae	*Hakea lorea* subsp. *lorea*	FlFr	•		•	•		•	•			
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*		•		•	•		•				
Rubiaceae	*Dolichocarpa crouchiana*	FlFr	•		•			•				
Rubiaceae	***Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3 and REnd)**	FlFr	•	•	•							

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Rubiaceae	*Psydrax latifolia*	Fl	•		•	•		•	•			
Rubiaceae	*Psydrax rigidula*	Fr	•		•							
Rubiaceae	*Psydrax suaveolens*		•		•	•		•				
Rubiaceae	*Scleromitrion galioides*	Fr	•									
Rubiaceae	*Spermacoce brachystema*	FlFr	•		•				•			
Rubiaceae	*Synaptantha tillaeacea* var. *tillaeacea*	FlFr	•									
Santalaceae	*Anthobolus leptomerioides*		•		•	•		•				
Santalaceae	*Exocarpos sparteus*	Fr	•	•	•							
Santalaceae	*Santalum lanceolatum*	FlFr	•	•	•	•		•	•			
Santalaceae	***Santalum spicatum* (TOI)**	Fl	•		•							
Sapindaceae	*Atalaya hemiglauca*	Fr	•		•			•	•			
Sapindaceae	*Dodonaea coriacea*	FlFr	•		•	•		•				
Sapindaceae	*Dodonaea pachyneura*	Fr	•		•							
Sapindaceae	*Dodonaea petiolaris*	FlFr	•	•	•	•			•			
Sapindaceae	*Dodonaea viscosa*							•				
Sapindaceae	*Dodonaea viscosa* subsp. *viscosa*	Fr			•							
Scrophulariaceae	*Eremophila cuneifolia*	FlFr	•	•	•	•		•				
Scrophulariaceae	*Eremophila forrestii*				•							
Scrophulariaceae	*Eremophila forrestii* subsp. *forrestii*	FlFr	•	•	•	•		•	•			
Scrophulariaceae	*Eremophila forrestii* subsp. *hastieana*	Fl	•									
Scrophulariaceae	*Eremophila lanceolata*	FlFr	•	•	•			•				
Scrophulariaceae	*Eremophila latrobei*							•				
Scrophulariaceae	*Eremophila latrobei* subsp. *filiformis*	FlFr	•	•	•	•		•	•			
Scrophulariaceae	*Eremophila latrobei* subsp. *glabra*							•				
Scrophulariaceae	*Eremophila longifolia*	FlFr	•	•	•	•		•		•		
Scrophulariaceae	*Eremophila maculata*	Fl		•								
Scrophulariaceae	*Eremophila maculata* subsp. *brevifolia*	Fr	•		•							

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Solanaceae	*Nicotiana benthamiana*	Fl	•	•		•						
Solanaceae	*Nicotiana heterantha*		•									
Solanaceae	*Nicotiana* sp. indet.		•		•							
Solanaceae	*Nicotiana obliqua*	Fl	•	•	•							
Solanaceae	*Nicotiana occidentalis*	FlFr	•									
Solanaceae	*Nicotiana rosulata*	Fl	•	•	•							
Solanaceae	*Solanum cleistogamum*	FlFr	•		•	•						
Solanaceae	*Solanum diversiflorum*	FlFr	•		•			•				
Solanaceae	*Solanum elatius*		•									
Solanaceae	*Solanum lasiophyllum*	FlFr	•	•	•	•		•		•		
Solanaceae	*Solanum morrisonii*	FlFr	•		•							
Solanaceae	***Solanum nigrum****	FlFr	•	•								
Solanaceae	*Solanum phlomoides*	FlFr	•		•		•	•				
Solanaceae	*Solanum* sp. indet.		•									
Solanaceae	*Solanum sturtianum*	Fr	•		•							
Sterculiaceae	*Melotia pyramidata*		•									
Surianaceae	*Stylobasium spathulatum*			•	•							
Thymelaeaceae	*Pimelea ammocharis*		•									
Violaceae	*Afrohybanthus aurantiacus*	FlFr	•		•	•		•				
Zygophyllaceae	***Roepera iodocarpa* (REx)**	*Fr*			•							
Zygophyllaceae	*Tribulus astrocarpus*	FlFr	•		•							
Zygophyllaceae	*Tribulus cistoides*	FlFr			•							
Zygophyllaceae	*Tribulus hirsutus*	Fr	•									
Zygophyllaceae	*Tribulus macrocarpus*	FlFr	•		•							
Zygophyllaceae	*Tribulus platypterus*	FlFr			•			•				
Zygophyllaceae	*Tribulus* sp. indet.		•									
Zygophyllaceae	*Tribulus suberosus*	Fr	•		•		•	•				

Family	Taxa List	FlFr	Quadrats Maia Detailed Surveys	Opp Coll Maia Detailed Surveys	TFS Maia Surveys	Quadrats *ecologia* (2008d)	Opp Coll *ecologia* (2008d)	TFS *ecologia* (2008a)	TFS *ecologia* (2008b)	Quadrats Coffey (2010b)	Quadrats Pinder et. al. (2017)	Sites Lyons (2015)
Zygophyllaceae	***Tribulus terrestris****	Fr	•		•							

Table A7.2: Similar or taxonomically uncertain taxa

Similar or taxonomically uncertain taxa that were excluded / included in the counts and the species accumulation curve analyses	
Similar taxa	
Abutilon fraseri	*Abutilon fraseri* subsp. *fraseri*
Acacia pyrifolia	*Acacia pyrifolia* var. *morrisonii*
Bergia perennis	*Bergia perennis* subsp. *obtusifolia*
Centipeda minima	*Centipeda minima* subsp. *minima*
Corymbia deserticola	*Corymbia deserticola* subsp. *deserticola*
Cucumis argenteus *Cucumis variabilis*	*Cucumis argenteus / variabilis*
Cynanchum viminale	*Cynanchum viminale subsp. australe*
Diplachne fusca	*Diplachne fusca subsp. muelleri*
Dipteracanthus australasicus	*Dipteracanthus australasicus* subsp. *australasicus*
Ehretia saligna	*Ehretia saligna* var. *saligna*
Eremophila forrestii *Eremophila forrestii* subsp. *hastieana*	*Eremophila forrestii* subsp. *forrestii / hastiena*
Eriachne mucronata *Eriachne gardneri*	*Eriachne mucronata / gardneri*
Evolvulus alsinoides *Evolvulus alsinoides* var. *villosicalyx* *Evolvulus alsinoides* var. *decumbens*	*Evolvulus alsinoides* var. *villosicalyx / decumbens*
Grevillea wickhamii *Grevillea wickhamii* subsp. *aprica* *Grevillea wickhamii* subsp. *hispidula*	*Grevillea wickhamii* subsp. *aprica / hispidula*
Haloragis gossei	*Haloragis gossei* var. *gossei*
Hibiscus sturtii *Hibiscus sturtii* var. *platychlamys* *Hibiscus sturtii* var. *campylochlamys*	*Hibiscus sturtii* var. *campylochlamys / platychlamys*
Notoleptopus decaisnei	*Notoleptopus decaisnei* var. Orbicularis (A.B. Craig 428)
Pluchea dentex *Pluchea dunlopii*	*Pluchea dunlopii / dentex*
Polycarpaea corymbosa	*Polycarpaea corymbosa* var. *corymbosa*
Ptilotus obovatus var. *obovatus*	*Ptilotus obovatus*
Rostellularia adscendens	*Rostellularia adscendens* var. *clementii*
Current taxonomic uncertainty	
Abutilon sp. indet.	*Abutilon otocarpum*
Acacia ? *aptaneura*	*Acacia aptaneura*

Similar or taxonomically uncertain taxa that were excluded / included in the counts and the species accumulation curve analyses	
Acacia ? *aptaneura* x *pteraneura*	*Acacia aptaneura* x *pteraneura*
Acacia ? *incurvaneura*	*Acacia incurvaneura*
Acacia ? *ligulata*	*Acacia ligulata*
Acacia sp. indet. 2 and 3	Likely to be one of the many other Acacia species recorded
Aristida ? *jerichoensis* var. *subspinulifera*	*Aristida jerichoensis* var. *subspinulifera* (P3)
Corymbia ? ferriticola	*Corymbia ferriticola*
Corymbia ? *hamersleyana* *Corymbia* sp. indet.	*Corymbia hamersleyana*
Eragrostis ? *cumingii* *Eragrostis* sp. Indet	*Eragrostis cumingii*
Eragrostis ? *xerophila*	*Eragrostis xerophila*
Eriachne sp. indet. 1, 2 and 3	*Eriachne mucronata / gardneri*
Eucalyptus ?leucophloia	*Eucalyptus leucophloia* subsp. *leucophloia*
Goodenia aff. *muelleriana*	*Goodenia muelleriana* (TOI)
Goodenia sp. indet. 1 & 2	*Goodenia pascua*
Hibiscus sp. indet.	*Hibiscus burtonii*
Maireana ? *planifolia*	*Maireana planifolia*
Maireana ? *villosa*	*Maireana villosa*
Nicotiana sp. indet.	*Nicotiana occidentalis*
Peripleura ? *arida*	*Peripleura arida*
Pterocaulon sp. indet. *Pterocaulon* ? *sphacelatum*	*Pterocaulon sphacelatum*
Ptilotus sp. indet.	*Ptilotus gaudichaudii*
*Rostellularia adscendens ?*var. *latifolia*	*Rostellularia adscendens* var. *latifolia*
Sclerolaena ? *cornishiana*	*Sclerolaena cornishiana*
Sida ? sp. Articulation below (A.A. Mitchell PRP 1605)	*Sida* sp. Articulation below (A.A. Mitchell PRP 1605)
Sida ? sp. Excedentifolia (J.L. Egan 1925)	*Sida* sp. Excedentifolia (J.L. Egan 1925)
Sida sp. indet. 1 *Sida* sp. indet. 2 *Sida* sp. inadequate *Sida* aff. *fibulifera* & *Sida* aff. fibulifera (FMG 125-20)	*Sida fibulifera*
Solanum sp. indet.	*Solanum lasiophyllum*
Streptoglossa ? *odora*	*Streptoglossa odora*
Streptoglossa sp. indet.	*Streptoglossa decurrens*
Themeda ? triandra	*Themeda triandra*
Triodia ? lanigera	*Triodia lanigera*
Triodia ? pungens	*Triodia pungens*

Table A7.3: Queried taxa that were included in the species counts and SPAC

Seventeen other taxa included in counts
Abutilon ? leucopetalum, Acacia sp. indet. 1*, Aristida* sp. indet., *Astrebla* sp. indet., *Atriplex* sp. indet.*, Calocephalus* sp. indet.*, Cyperus* ?*rigidellus, Eleocharis* sp. indet.*, Euploca* sp. indet.*, Goodenia* ?*lyrata* (potential P3)*, Grevillea ? stenobotrya, Haloragis* sp. indet.*, Olearia* sp. indet., *Stackhousia* sp. indet.*, Themeda* sp. indet.*, Tribulus* sp. indet., *Wahlenbergia* sp. indet..

APPENDIX 8: CONSERVATION SIGNIFICANT FLORA PHOTOGRAPHS

Table A8.1: Confirmed conservation significant flora species recorded in the MBSA

Seringia exastia (Threatened) (Biota, 2018 and DEC, 2010)	
	
Calotis squamigera (P1) (PlantNet, 2022 (left) Northern Territory Government, 2022 (right)	
	
Helichrysum oligochaetum (P1) (Maia)	
	

Josephinia sp. Woodstock (P1)
No photographs available

Rhodanthe ascendens (P1) (Atlas of Living Australia, 2022)
 Photograph of pressed specimen, Royal Botanic Gardens, Victoria

Triodia veniciae (P1) (Maia)	
	

Teucrium pilbaranum (P2) (Maia)	
	
***Aristida jerichoensis* var. *subspinulifera* (P3) (Maia, pressed specimen)**	
	
***Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3) (Maia)**	
	

Eragrostis crateriformis (P3) (pressed specimen)	
	
***Eragrostis* sp. Erect spikelets (P.K. Latz 2122) (P3)**	
No photographs available	
***Euphorbia australis* var. *glabra* (P3) (Maia)**	
	

Glycine falcata (P3) (Maia)	
	
***Goodenia* sp. East Pilbara (P3) (Florabase, 2022)**	
	Photography by M.Maier. 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 Monday, 27 June 2022.
***Iotasperma sessilifolium* (P3) (Atlas of Living Australia, 2022)**	
	Photograph of pressed specimen, Royal Botanic Gardens, Victoria

Rostellularia adscendens var. *latifolia* (P3) (Maia)	
	Photography by E. Wajon. 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 Monday, 28 June 2022.
***Themeda* sp. Hamersley Station (M.E. Trudgen 11431) (P3) (Maia)**	
	
***Triodia basitricha* (P3) (Maia)**	
	

Bulbostylis burbidgeae (atypical form) (P4) (Maia)	
	
***Goodenia nuda* (P4) (Maia)**	
	
***Rhynchosia bungarensis* (P4) (Maia)**	
	

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APPENDIX 9: STATISTICAL ANALYSIS INPUTS AND OUTPUTS

Notes regarding **Table A9.1**:bold font and T = Threatened species; bold font and P1 – P4 = Priority One to Priority Four; bold font and * = environmental weed; bold font and REx = range extension; bold font and REn = endemic to the Pilbara subregion;bold font and TOI = taxon of interest. Nomenclature based on current Western Australian Herbarium terminology and confirmed on Florabase (WAH, 1998 -). Only species recorded at quadrats were used to produce this table.

Table A9.1: Species by vegetation type matrix (quadrat data only)

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Abutilon amplum				■	■								■					■	
Abutilon cryptopetalum		■				■									■				
Abutilon cunninghamii				■	■		■	■									■	■	
Abutilon fraseri subsp. *fraseri*		■	■		■	■	■						■					■	
Abutilon lepidum		■		■	■	■					■	■	■		■		■	■	
Abutilon otocarpum						■									■				
Acacia ampliceps × sclerosperma subsp. *sclerosperma*													■						
Acacia ampliceps																		■	
Acacia aneura type A				■															
Acacia aneura var. *aneura*			■		■	■												■	
Acacia aptaneura	■	■		■	■	■	■	■				■	■				■	■	
Acacia aptaneura x pteraneura		■				■							■						
Acacia arida				■										■			■	■	
Acacia atkinsiana	■		■	■	■												■	■	
Acacia ayersiana		■		■							■	■						■	
Acacia bivenosa		■		■								■	■				■	■	■
Acacia citrinoviridis							■												
Acacia coriacea subsp. *pendens*				■					■					■					
Acacia dictyophleba																		■	
Acacia distans		■		■	■	■			■	■	■	■	■		■		■	■	
Acacia hilliana																	■	■	
Acacia inaequilatera																	■	■	
Acacia incurvaneura	■				■	■	■				■	■	■				■	■	
Acacia ligulata					■								■						
Acacia macraneura	■							■											
Acacia maitlandii				■													■	■	
Acacia marramamba				■													■	■	■
Acacia minyura			■		■	■												■	
Acacia monticola	■			■													■	■	
Acacia pachyacra																	■	■	
Acacia pruinocarpa	■			■	■	■	■						■				■	■	■
Acacia pteraneura				■	■	■							■				■	■	
Acacia pyrifolia var. *morrisonii*				■	■	■								■			■	■	
Acacia pyrifolia var. *pyrifolia*				■													■		
Acacia rhodophloia																	■	■	■
Acacia sclerosperma subsp. *sclerosperma*		■						■				■	■	■	■				
Acacia sibilans																		■	
Acacia sibirica																		■	
Acacia sp. indet. 1						■							■						
***Acacia doreta* (REx)**																	■	■	
Acacia spondylophylla				■													■	■	
Acacia stenophylla		■							■				■						
Acacia synchronicia	■	■	■		■	■	■	■	■		■	■	■	■	■	■	■	■	
Acacia tenuissima	■			■													■	■	
Acacia tetragonophylla	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Acacia trachycarpa x tumida var. pilbarensis																			
Acacia trudgeniana																			
Acacia tumida var. *pilbarensis*																			
Acacia victoriae																			
Acacia xiphophylla																			
Achyranthes aspera																			
Acrachne racemosa																			
Aerva javanica*																			
Aeschynomene indica																			
Afrohybanthus aurantiacus																			
Alternanthera angustifolia																			
Alternanthera denticulata																			
Alternanthera nana																			
Alternanthera nodiflora																			
Alysicarpus muelleri																			
Amaranthus cuspidifolius																			
Amaranthus undulatus																			
Ammannia multiflora																			
Amphipogon caricinus																			
Amphipogon sericeus																			
Amyema hilliana																			
Androcalva luteiflora																			
Anthobolus leptomerioides																			
Areocleome oxalidea																			
Aristida burbidgeae																			
Aristida contorta																			
Aristida holathera var. *holathera*																			
Aristida holathera var. *latifolia*																			
Aristida inaequiglumis																			
***Aristida jerichoensis* var. *subspinulifera* (P3)**																			
Aristida latifolia																			
Aristida obscura																			
Aristida pruinosa																			
Aristida sp. indet.																			
Arivela viscosa																			
Astrebla elymoides																			
Astrebla pectinata																			
Atalaya hemiglauca																			
Atriplex amnicola																			
Atriplex bunburyana																			
Atriplex sp. indet.																			
Austrobryonia pilbarensis																			
Basilicum polystachyon																			
Bergia ammannioides																			
Bergia pedicellaris																			
Bergia perennis subsp. *obtusifolia*																			
Bergia trimera																			
Bidens bipinnata*																			

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Blumea tenella					■	■							■	■					
Boerhavia coccinea		■		■	■	■	■	■					■	■	■	■			
Boerhavia burbidgeana									■										
Boerhavia gardneri					■	■		■							■	■		■	
Bonamia erecta / rosea				■													■	■	
Bonamia pilbarensis							■							■	■		■	■	
Bonamia sp. Dampier (A.A. Mitchell PRP 217)																	■		
Bothriochloa bladhii subsp. *bladhii*														■					
Bulbostylis barbata	■	■		■	■	■	■				■						■	■	■
Bulbostylis turbinata		■		■	■							■					■	■	
Calandrinia pumila					■														
Calocephalus sp. indet.		■													■				
Calotis plumulifera		■			■							■	■						
Calotis porphyroglossa											■								
Calytrix carinata																	■	■	
Capparis lasiantha	■			■									■				■		
Capparis umbonata	■				■												■		
Cassytha capillaris	■																	■	
Cenchrus ciliaris*		■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	
Cenchrus setiger*		■			■	■	■	■		■	■	■	■	■	■	■			
Centipeda crateriformis subsp. *crateriformis*								■											
Centipeda minima subsp. *macrocephala*		■			■				■	■		■	■	■					
Centipeda minima subsp. *minima*		■			■				■	■	■								
Cheilanthes sieberi subsp. *sieberi*	■			■	■	■	■											■	
Chloris pectinata		■	■		■	■			■			■	■		■				
Chloris pumilio						■													
Chrysocephalum apiculatum				■	■							■	■						
Chrysopogon fallax		■		■	■	■	■	■				■	■	■	■		■	■	
Citrullus amarus*		■			■	■	■									■			
Citrullus colocynthis*																■			
Clerodendrum floribundum var. *angustifolium*																		■	
Codonocarpus cotinifolius												■	■				■	■	
Commelina ensifolia					■	■	■								■				
Convolvulus clementii		■				■									■	■			
***Corchorus incanus* subsp. *lithophilus* (REnd)**				■													■	■	
Corchorus lasiocarpus subsp. *lasiocarpus / parvus*	■			■	■		■	■					■	■			■	■	
Corchorus lasiocarpus subsp. *parvus*					■		■						■				■		
Corchorus parviflorus				■															
Corchorus sidoides				■													■		
Corchorus sidoides subsp. *sidoides*		■		■	■					■							■	■	
Corchorus sp. Hamersley Range hilltops (S. van Leeuwen 3826)																	■	■	
Corchorus tectus													■	■	■			■	
Corchorus tridens							■	■							■				
Corchorus trilocularis		■		■							■		■		■				
Corymbia aspera				■															
Corymbia candida subsp. *candida*					■													■	
Corymbia deserticola subsp. *deserticola*				■	■	■											■	■	

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Corymbia ferriticola					■														
Corymbia hamersleyana	■			■	■												■	■	
Crotalaria dissitiflora subsp. *benthamiana*								■											
Crotalaria medicaginea var. *neglecta*				■										■		■			
Cucumis argenteus / variabilis	■	■		■	■	■	■			■	■	■	■	■	■		■	■	
Cucumis melo	■	■		■	■		■	■				■	■	■	■			■	
Cullen cinereum		■								■		■			■	■			
Cullen graveolens		■																	
Cullen lachnostachys				■													■		
Cullen leucanthum							■												
Cymbopogon ambiguus	■			■	■	■								■			■	■	
Cymbopogon obtectus				■													■		
Cynanchum australe	■																		
Cynanchum floribundum														■					
Cynanchum viminale subsp. *australe*	■																		
Cynodon convergens				■				■	■				■		■				
Cynodon dactylon*									■										
Cynodon prostratus	■						■	■		■									
Cyperus ? rigidellus									■										
Cyperus bifax		■							■										
Cyperus cunninghamii subsp. *cunninghamii*														■					
Cyperus difformis		■							■	■									
Cyperus iria		■			■				■										
Cyperus ixiocarpus				■															
Cyperus macrostachyos									■										
Cyperus pygmaeus		■							■										
Cyperus squarrosus											■	■							
Dactyloctenium radulans		■	■		■	■		■					■		■	■			
Dampiera candicans																	■		
Dichanthium sericeum subsp. *humilius*											■				■	■			
Dichanthium sericeum subsp. *polystachyum*											■								
Dichanthium sericeum subsp. *sericeum*				■															
Digitaria brownii				■		■							■	■					
Diplachne fusca subsp. *muelleri*		■							■				■						
Dipteracanthus australasicus subsp. *australasicus*				■	■	■		■					■						
Dodonaea coriacea	■			■													■	■	
Dodonaea pachyneura				■															
Dodonaea petiolaris	■	■	■	■	■	■	■	■									■	■	
Dolichocarpa crouchiana																	■		
***Dolichocarpa* sp. Hamersley Station (A.A. Mitchell PRP 1479) (P3 and REnd)**																	■		
Drosera finlaysoniana												■	■						
Duma florulenta		■							■		■	■	■		■				
Duperreya commixta	■	■	■	■	■	■					■		■	■	■		■	■	
Dysphania kalpari	■	■		■	■	■												■	
Dysphania melanocarpa				■		■									■		■		
Dysphania rhadinostachya subsp. *rhadinostachya*	■	■		■	■		■	■						■			■	■	
Dysphania sphaerosperma												■	■						

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Echinochloa colona*		■			■	■			■	■	■		■		■				
Echinochloa microstachya*									■										
Ehretia saligna var. *saligna*				■								■	■		■			■	
Eleocharis pallens		■							■		■								
Eleocharis sp. indet.		■																	
Elytrophorus spicatus		■		■															
Enchylaena tomentosa var. *tomentosa*	■	■		■	■	■	■	■					■		■				
Enneapogon caerulescens		■		■		■		■					■			■	■	■	
Enneapogon cylindricus	■	■			■	■							■				■	■	
Enneapogon intermedius				■															
Enneapogon lindleyanus		■		■								■	■						
Enneapogon polyphyllus	■	■	■	■	■	■	■	■		■			■				■	■	
Enneapogon robustissimus		■											■						
Enteropogon ramosus		■				■		■				■							
Eragrostis cumingii	■	■		■	■	■			■			■					■		
Eragrostis desertorum		■				■					■	■	■		■				
Eragrostis dielsii		■						■	■		■	■	■						
Eragrostis eriopoda												■							
Eragrostis exigua		■			■	■			■	■		■							
Eragrostis falcata		■											■		■				
Eragrostis leptocarpa		■			■				■			■							
Eragrostis pergracilis		■			■	■	■	■	■	■		■	■						
Eragrostis setifolia		■				■					■		■		■				
Eragrostis tenax		■							■										
Eragrostis tenellula	■	■		■	■	■		■	■	■		■	■	■			■	■	
Eragrostis xerophila		■			■	■	■	■		■			■	■		■			
Eremophila cuneifolia	■		■		■		■	■					■					■	
Eremophila forrestii subsp. *forrestii / hastieana*	■			■	■	■	■	■									■	■	
Eremophila lanceolata					■	■					■								
Eremophila latrobei subsp. *filiformis*	■			■	■	■	■	■										■	
Eremophila longifolia	■	■	■	■	■	■	■	■		■	■	■	■	■	■		■	■	
Eremophila maculata subsp. *brevifolia*								■					■						
Eriachne aristidea	■			■	■												■		
Eriachne benthamii / flaccida		■		■	■	■		■	■	■	■	■	■		■	■			
Eriachne ciliata					■												■		
Eriachne flaccida											■								
Eriachne helmsii	■			■	■														
Eriachne lanata				■													■	■	
Eriachne mucronata / gardneri	■			■	■	■	■	■					■	■			■	■	■
Eriachne obtusa						■											■		
Eriachne pulchella subsp. *dominii*	■			■	■		■										■	■	
Eriachne pulchella subsp. *pulchella*	■			■	■												■	■	■
Eriachne tenuiculmis				■															
Eriochloa pseudoacrotricha		■							■										
Eucalyptus camaldulensis subsp. *refulgens*																		■	
Eucalyptus gamophylla				■													■	■	
Eucalyptus leucophloia subsp. *leucophloia*	■		■	■		■											■	■	
Eucalyptus victrix		■		■		■			■	■	■	■	■	■	■				

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Eucalyptus xerothermica				■															
Eulalia aurea		■		■	■	■	■		■	■	■	■	■	■	■			■	
Euphorbia australis	■			■	■		■					■		■			■	■	
***Euphorbia australis* var. *glabra* (P3 and REnd)**		■			■	■					■		■		■				
Euphorbia australis var. *hispidula*				■			■											■	
Euphorbia australis var. *subtomentosa*		■								■		■	■		■				
Euphorbia biconvexa		■		■	■	■	■				■	■	■	■	■	■	■	■	
Euphorbia boophthona				■			■				■	■							
Euphorbia coghlanii		■		■			■						■						
Euphorbia drummondii															■				
Euphorbia tannensis subsp. *eremophila*				■	■								■						
Euphorbia vaccaria var. *vaccaria*		■																	
Evolvulus alsinoides var. villosicalyx / decumbens	■	■		■	■	■	■				■	■	■		■		■	■	
Exocarpos sparteus				■	■													■	
Ficus brachypoda				■															
Fimbristylis dichotoma																	■		
Fimbristylis microcarya		■							■										
Fimbristylis simulans																	■		
Flaveria trinervia*					■							■	■	■					
Flueggea virosa subsp. *melanthesoides*				■															
Gastrolobium grandiflorum				■															
Glinus lotoides		■							■			■	■						
Glycine canescens		■											■		■				
***Glycine falcata* (P3)**											■								
Gompholobium oreophilum				■													■	■	
Gomphrena affinis subsp. *pilbarensis*		■			■	■		■		■			■		■				
Gomphrena canescens			■		■														
Gomphrena canescens subsp. *canescens*	■	■		■	■	■	■	■					■	■			■	■	
Gomphrena cunninghamii	■	■		■	■	■		■							■		■	■	
Gomphrena kanisii				■	■	■	■			■	■				■	■	■	■	
Goodenia connata																	■		
Goodenia cusackiana	■			■													■		
Goodenia forrestii				■				■											
Goodenia lamprosperma		■		■										■					
***Goodenia ? lyrata* (potential P3)**		■								■		■							
Goodenia microptera	■			■	■												■	■	
Goodenia muelleriana								■		■									
***Goodenia nuda* (P4)**				■	■									■					
Goodenia pascua		■		■	■				■		■	■							
Goodenia prostrata					■		■												
Goodenia stobbsiana	■			■													■	■	
Goodenia triodiophila				■	■												■	■	
Gossypium australe		■		■	■	■							■				■	■	
Gossypium robinsonii				■			■										■		
Grevillea ? stenobotrya							■												
Grevillea berryana	■				■	■	■										■	■	
Grevillea pyramidalis subsp. *leucadendron*																	■	■	
Grevillea striata												■							

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Grevillea wickhamii subsp. *aprica / hispidula*				■	■												■	■	
Hakea chordophylla						■						■					■	■	
Hakea lorea subsp. *lorea / suberea*		■		■	■	■	■					■	■	■	■		■	■	
Haloragis gossei var. *gossei*		■			■				■						■				
Haloragis sp. indet.												■	■						
Haloragis trigonocarpa												■	■						
***Helichrysum oligochaetum* (P1)**											■								
Heliotropium chrysocarpum												■					■		
Heliotropium heteranthum					■													■	
Heliotropium ovalifolium		■							■		■	■	■						
Heliotropium sp. indet.					■														
Heliotropium tanythrix															■				
Heliotropium tenuifolium												■							
Hibiscus austrinus var. *austrinus*																		■	
Hibiscus brachychlaenus				■															
Hibiscus brachysiphonius																■			
Hibiscus burtonii	■	■	■	■	■	■	■							■			■	■	
Hibiscus coatesii	■				■								■				■	■	
Hibiscus leptocladus						■													
***Hibiscus* sp. Mulga Downs (TOI)**					■														
Hibiscus sturtii var. *campylochlamys / platychlamys*		■		■	■		■	■				■	■				■	■	
Indigofera linifolia		■										■	■		■				
Indigofera monophylla	■			■	■	■	■					■	■				■	■	
Indigofera sessiliflora					■														
***Iotasperma sessilifolium* (P3)**											■								
Ipomoea coptica							■	■								■			
Ipomoea diamantinensis									■										
Ipomoea lonchophylla		■									■					■			
Ipomoea muelleri		■		■	■	■	■	■				■	■	■	■	■			
Ipomoea polymorpha									■										
Iseilema eremaeum		■													■				
Iseilema membranaceum					■	■	■												
Iseilema vaginiflorum	■			■							■								
Isolepis congrua		■																	
Isotropis atropurpurea				■														■	
Jasminum didymum subsp. *lineare*				■													■	■	
Josephinia eugeniae					■	■	■												
Kennedia prorepens		■													■				
Lepidium echinatum					■														
Lepidium phlebopetalum	■							■											
Lotus australis													■						
Lotus cruentus		■																	
Ludwigia perennis		■							■										
Lysiana casuarinae													■						
***Maireana aphylla* (REx)**					■			■											
Maireana georgei	■																		
Maireana planifolia		■			■														
Maireana sp.						■													

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Maireana thesioides					■														
Maireana tomentosa subsp. *tomentosa*	■																		
Maireana triptera	■		■																
Maireana villosa	■	■	■		■	■	■	■							■			■	
Malvastrum americanum*		■	■	■	■	■	■	■		■	■	■	■	■	■	■			
Marsilea hirsuta		■			■					■		■				■			
Medicago polymorpha*									■			■	■						
Melaleuca glomerata		■								■	■	■	■	■					
Melaleuca linophylla				■															
Melhania oblongifolia		■		■	■								■		■				
Melochia pyramidata*					■														
Mimulus gracilis		■							■		■								
Minuria integerrima				■	■			■											
Myriocephalus rudallii									■										
Neptunia dimorphantha		■				■		■			■		■		■	■			
Nicotiana benthamiana				■	■														
Nicotiana heterantha				■															
Nicotiana occidentalis subsp. *obliqua*		■			■					■		■			■				
Nicotiana occidentalis subsp. *occidentalis*		■				■													
Nicotiana rosulata subsp. *rosulata*		■							■			■	■						
Notoleptopus decaisnei var. Orbicularis (A.B. Craig 428)		■			■								■						
***Olearia muelleri* (REx)**		■																	
Olearia stuartii				■															
Operculina aequisepala		■								■	■				■	■			
Panicum australiense				■													■		
Panicum decompositum		■		■											■				
Panicum laevinode		■		■					■		■		■				■		
Paraneurachne muelleri	■			■	■								■				■	■	
Paspalidium basicladum	■	■			■	■						■					■	■	
Paspalidium clementii						■											■	■	
Paspalidium jubiflorum		■									■								
Paspalidium rarum		■		■	■	■							■				■		
Peplidium aithocheilum		■							■	■		■							
Peplidium muelleri					■														
Peplidium sp. C Evol. Fl. Fauna Arid Aust. (N.T. Burbidge & A. Kanis 8158)									■										
Peripleura ? arida		■																	
Perotis rara				■	■	■													
Petalostylis labicheoides				■										■			■	■	
Phyllanthus maderaspatensis		■		■					■		■	■	■		■				
Pimelea ammocharis										■									
Pluchea dunlopii / dentex		■		■	■					■		■	■	■					
Pluchea ferdinandi-muelleri												■	■						
Pluchea rubelliflora	■				■				■	■		■	■	■					
Pluchea tetranthera	■	■			■				■	■		■	■	■				■	
Polycarpaea corymbosa var. *corymbosa*	■	■		■	■	■	■										■	■	
Polycarpaea holtzei	■			■	■												■	■	■

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Polycarpaea longiflora				■	■	■											■		
Polygala glaucifolia																	■		
Polygala isingii					■														
Polymeria ambigua				■										■					
Polymeria calycina				■															
Portulaca decipiens					■														
Portulaca intraterranea									■										
Portulaca oleracea	■	■		■	■	■	■	■	■			■	■	■	■			■	
Portulaca pilosa*		■				■													
Pseudognaphalium luteoalbum									■										
Psydrax latifolia	■			■	■	■	■	■					■				■	■	
Psydrax rigidula	■			■	■								■						
Psydrax suaveolens	■				■	■	■										■	■	
Pterocaulon serrulatum var. *velutinum*		■		■														■	
Pterocaulon sphacelatum	■	■		■	■	■		■		■		■	■	■	■		■	■	
Pterocaulon sphaeranthoides					■	■						■	■						
Ptilotus aervoides		■			■														
Ptilotus astrolasius				■	■												■	■	
Ptilotus axillaris	■																■		
Ptilotus calostachyus	■	■		■	■	■											■	■	
Ptilotus clementii					■	■						■	■				■		
Ptilotus exaltatus	■	■	■	■	■	■	■	■	■	■		■	■	■	■		■	■	
Ptilotus fusiformis		■		■	■							■					■		
Ptilotus gaudichaudii		■				■													
Ptilotus gomphrenoides		■				■	■	■			■	■			■	■			
Ptilotus helipteroides		■		■		■							■				■		
Ptilotus incanus							■												
Ptilotus nobilis	■			■													■	■	
Ptilotus obovatus	■	■		■	■	■	■					■	■	■			■	■	
Ptilotus polystachyus		■		■													■	■	
Ptilotus roei					■														
Ptilotus rotundifolius	■				■												■		
Ptilotus schwartzii		■																	
Ptilotus xerophilus															■				
Rhagodia eremaea		■	■	■	■			■	■			■			■			■	
Rhynchosia australis						■													
***Rhynchosia bungarensis* (P4)**				■															
Rhynchosia minima		■		■	■	■		■		■	■		■	■	■				
Rostellularia adscendens var. *clementii*					■	■	■	■		■	■	■	■	■	■	■			
***Rostellularia adscendens* var. *latifolia* (P3 and REnd)**					■								■		■				
Rumex vesicarius*				■															
Rutidosis helichrysoides subsp. *helichrysoides*				■	■														
Salsola australis	■	■	■	■	■	■		■					■	■				■	
Santalum lanceolatum	■			■	■	■						■	■		■				
***Santalum spicatum* (TOI)**				■									■						
Scaevola amblyanthera var. *centralis*					■							■	■				■		
Scaevola parvifolia subsp. *pilbarae*				■													■	■	

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Scaevola spinescens																			
Schenkia australis																			
Schizachyrium fragile																			
Schoenoplectiella dissachantha																			
Sclerolaena bicornis																			
Sclerolaena cornishiana																			
Sclerolaena costata																			
Sclerolaena cuneata																			
Sclerolaena densiflora																			
Sclerolaena eriacantha																			
Sclerolaena tetragona																			
Scleromitrion galioides																			
Senna artemisioides subsp. *artemisioides*																			
Senna artemisioides subsp. *filifolia*																			
Senna artemisioides subsp. *helmsii*																			
Senna artemisioides subsp. *helmsii x oligophylla*																			
Senna artemisioides subsp. *helmsii x subsp. oligophylla*																			
Senna artemisioides subsp. *oligophylla*																			
Senna artemisioides subsp. *x artemisioides*																			
Senna ferraria																			
Senna glaucifolia																			
Senna glutinosa subsp. *chatelainiana*																			
Senna glutinosa subsp. *glutinosa*																			
Senna glutinosa subsp. *glutinosa x luerssenii*																			
Senna glutinosa subsp. *luerssenii x pruinosa*																			
Senna glutinosa subsp. *luerssenii*																			
Senna glutinosa subsp. *pruinosa*																			
Senna glutinosa subsp. *x luerssenii*																			
Senna notabilis																			
Senna sericea																			
Senna symonii																			
***Seringia exastia* (T)**																			
Seringia elliptica																			
Seringia nephrosperma																			
Sesbania cannabina																			
Setaria dielsii																			
Setaria verticillata*																			
Sida arenicola																			
Sida cardiophylla																			
Sida clementii																			
Sida echinocarpa																			
Sida fibulifera																			
Sida platycalyx																			
Sida rohlenae subsp. *rohlenae*																			
Sida sp. Articulation below (A.A. Mitchell PRP 1605)																			
Sida sp. dark green fruits (S. van Leeuwen 2260)																			
Sida sp. Excedentifolia (J.L. Egan 1925)																			

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Sida sp. Golden calyces glabrous (H.N. Foote 32)				■															
Sida sp. L (A.M. Ashby 4202)				■	■	■	■				■		■					■	
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	■			■	■												■	■	
Sida sp. spiciform panicles (E. Leyland s.n. 14/8/90)		■		■															
Sida sp. Supplejack Station (T.S. Henshall 2345)		■		■	■	■	■	■			■					■		■	
Sida spinosa		■						■	■		■								
Solanum cleistogamum	■	■		■	■	■		■					■	■	■		■	■	
Solanum diversiflorum	■			■				■									■	■	
Solanum elatius		■											■					■	
Solanum lasiophyllum	■	■	■	■	■	■	■					■	■		■		■	■	
Solanum morrisonii		■					■												
Solanum nigrum*		■																	
Solanum phlomoides					■		■								■		■		
Solanum sturtianum												■							
Sonchus oleraceus*													■						
Sorghum plumosum														■					
Spermacoce brachystema				■	■	■	■			■			■						
Sporobolus actinocladus				■	■														
Sporobolus australasicus	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	
Sporobolus mitchellii		■							■										
Stackhousia intermedia																			■
Stackhousia sp. indet.																	■		
Stemodia grossa	■				■			■				■	■	■			■	■	
Stemodia kingii		■			■	■	■	■							■	■			
Stemodia viscosa		■		■	■														
Stenopetalum nutans					■														
Streptoglossa bubakii		■							■				■		■		■		
Streptoglossa decurrens		■		■	■								■	■	■		■	■	
Streptoglossa liatroides				■	■							■							
Streptoglossa macrocephala													■						
Streptoglossa odora		■											■						
Streptoglossa tenuiflora				■						■		■							
Striga curviflora							■												
Striga squamigera						■													
Swainsona forrestii												■							
Swainsona kingii												■	■						
Swainsona tanamiensis		■											■						
Synaptantha tillaeacea var. *tillaeacea*		■										■							
Tecticornia verrucosa									■										
Tephrosia densa				■	■														
Tephrosia rosea var. *clementii*					■									■					
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)					■														
Tephrosia sp. Cathedral Gorge (F.H. Mollemans 2420)																	■		
Tephrosia sp. clay soils (S. van Leeuwen et al. PBS 0273)																	■		
Tephrosia sp. NW Eremaean (S. van Leeuwen et al. PBS 0356)																	■	■	

Species	*AaAx*SL	*AdEv*WL	ASL (1)	ASL (2)	AWL (1)	AWL (2)	AWL (3)	*AxAs*SL	*Bpo*FL	*EfEb*TG	*Ev*WL	MSL (1)	MSL (2)	MTG (1)	MTG (2)	MTG (3)	THG (1)	THG (2)	*Tv*HG
Tephrosia supina				■		■							■				■		
***Teucrium pilbaranum* (P2 and REnd)**											■	■			■				
Teucrium racemosum		■							■		■								
Themeda triandra	■			■	■								■				■	■	
Trachymene oleracea subsp. *oleracea*				■													■	■	
Tragus australianus				■															
Trianthema cusackianum								■											
Trianthema glossostigmum	■	■	■	■	■			■	■								■	■	
Trianthema pilosum									■										
Trianthema triquetrum		■	■		■	■	■	■	■				■		■				
Tribulus astrocarpus						■													
Tribulus hirsutus						■							■						
Tribulus macrocarpus					■	■													
Tribulus sp. indet.							■												
Tribulus suberosus	■			■													■	■	
Tribulus terrestris*													■						
Trichodesma zeylanicum var. *zeylanicum*	■	■		■	■	■							■				■		
Trigastrotheca molluginea	■			■	■									■	■		■		
Triodia angusta														■				■	
Triodia basedowii	■		■	■	■												■	■	■
***Triodia basitricha* (P3)**																	■	■	
Triodia brizoides	■			■													■	■	
Triodia epactia	■			■	■	■		■				■	■	■			■	■	
Triodia lanigera	■																■	■	
Triodia longiceps	■												■	■					
Triodia pungens				■	■												■	■	
Triodia vanleeuwenii	■				■												■	■	
***Triodia veniciae* (P1 and REnd)**																		■	■
Triodia wiseana													■				■		
Tripogonella loliiformis					■														
Triumfetta chaetocarpa																	■		
Triumfetta clementii				■	■										■			■	
Triumfetta maconochieana																	■		
Urochloa occidentalis var. *ciliata*						■													
Urochloa occidentalis var. *occidentalis*		■											■		■				
Vachellia farnesiana*		■			■		■	■			■	■	■	■	■	■			
Vigna lanceolata var. *lanceolata*											■								
Vincetoxicum lineare	■			■		■							■				■	■	
Vittadinia eremaea													■						
Wahlenbergia queenslandica													■						
Wahlenbergia sp. indet.		■																	■
Wahlenbergia tumidifructa		■			■					■		■	■	■					
Waltheria indica				■															

Table A9.2: Vegetation type by quadrat matrix

VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA
AaAxSL	M-HR017	In	ASL (2)	C-SUP15-F	Out	AWL (2)	C-INV051-F	Out	BpoFl	L-PSW04b	In	MSL (1)	B-KOE20-F	Out	THG (1)	C-INV007-F	Out	THG (2)	C-INV013-F	Out
AaAxSL	M-HR02	In	ASL (2)	M-HR013	In	AWL (2)	C-INV063-F	Out	BpoFL	M-MDEQ022	In	MSL (1)	M-MDEQ008	In	THG (1)	C-INV041-F	Out	THG (2)	C-INV015-F	Out
AaAxSL	M-MDEQ003	In	ASL (2)	M-HR06	In	AWL (2)	C-SUP21-F	Out	BpoFL	M-MDEQ025	In	MSL (1)	M-MDEQ027	In	THG (1)	C-INV044-F	Out	THG (2)	C-INV019a-F	Out
AaAxSL	M-MDEQ035	In	ASL (2)	M-MDEQ004	In	AWL (2)	E-S04	In	BpoFL	M-MWQ20	In	MSL (1)	M-MDEQ031	In	THG (1)	C-INV046-F	Out	THG (2)	C-INV020-F	Out
AaAxSL	M-MDEQ073	In	ASL (2)	M-MDEQ007	In	AWL (2)	E-S12	In	BpoFL	M-MWQ51	In	MSL (1)	M-MDEQ033	In	THG (1)	C-INV047-F	Out	THG (2)	C-INV053-F	Out
AaAxSL	M-MDEQ087	In	ASL (2)	M-MDEQ040	In	AWL (2)	E-S14	In	BpoFL	M-XMDE01	In	MSL (1)	M-MDEQ036	In	THG (1)	C-INV100-F	Out	THG (2)	C-INV061-F	Out
AaAxSL	M-MDEQ095	In	ASL (2)	M-MDEQ042	In	AWL (2)	E-S15	In	BpoFL	M-XMDE02	In	MSL (1)	M-MDEQ041	In	THG (1)	M-HR011	In	THG (2)	C-INV066-F	Out
AaAxSL	M-MDEQ101	In	ASL (2)	M-MDEQ052	In	AWL (2)	E-S16	In	BpoFL	P-FV08A-F	Out	MSL (1)	M-MDEQ047	In	THG (1)	M-HR015	In	THG (2)	E-S02	In
AaAxSL	M-MDEQ102	In	ASL (2)	M-MDEQ059	In	AWL (2)	E-S24	In	BpoFL	P-FV14A-F	In	MSL (1)	M-MDEQ104	In	THG (1)	M-HR019	In	THG (2)	E-S03	In
AaAxSL	M-TCQ04	In	ASL (2)	M-MDEQ060	In	AWL (2)	MDW034	In	BpoFL	P-FV17A-F	In	MSL (1)	M-MDEQ106	In	THG (1)	M-HR03	In	THG (2)	E-S06	In
AaAxSL	M-XTC04	In	ASL (2)	M-MDEQ071	In	AWL (2)	MDW041	In	BpoFL	P-FV19A-F	In	MSL (1)	M-MWQ15	In	THG (1)	M-HR07	In	THG (2)	E-S09	In
AdEvWL	L-PSW04a	In	ASL (2)	M-MDEQ078	In	AWL (2)	MDW047	In	EfEbTG	C-SUP23-F	Out	MSL (1)	M-MWQ23	In	THG (1)	M-MDEQ001	In	THG (2)	E-S13	In
AdEvWL	L-PSW05a	In	ASL (2)	M-MDEQ083	In	AWL (2)	M-MWQ05	In	EfEbTG	C-SUP24-F	Out	MSL (1)	PB-RHNE15	Out	THG (1)	M-MDEQ002	In	THG (2)	E-S19	In
AdEvWL	M-MDEQ017	In	ASL (2)	M-MDEQ086	In	AWL (2)	M-MWQ06	In	EfEbTG	C-SUP26-F	Out	MSL (1)	PB-RHNW04	Out	THG (1)	M-MDEQ018	In	THG (2)	E-S20	In
AdEvWL	M-MDEQ030	In	ASL (2)	M-MDEQ092	In	AWL (2)	M-MWQ34	In	EfEbTG	M-MDEQ005	In	MSL (2)	M-MDEQ012	In	THG (1)	M-MDEQ029	In	THG (2)	M-HR04	In
AdEvWL	M-MDEQ034	In	ASL (2)	MDW025	In	AWL (2)	M-MWQ35	In	EfEbTG	M-MDEQ057	In	MSL (2)	M-MDEQ014	In	THG (1)	M-MDEQ043	In	THG (2)	M-MDEQ032	In
AdEvWL	M-MDEQ038	In	ASL (2)	MDW050	In	AWL (2)	M-MWQ36	In	EfEbTG	M-MDEQ105	In	MSL (2)	M-MDEQ024	In	THG (1)	M-MDEQ044	In	THG (2)	M-MDEQ037	In
AdEvWL	M-MWQ02	In	ASL (2)	MDW054	In	AWL (2)	M-MWQ39	In	EfEbTG	M-MDEQ108	In	MSL (2)	MDW011	In	THG (1)	M-MDEQ051	In	THG (2)	M-MDEQ039	In
AdEvWL	M-MWQ11	In	ASL (2)	M-TCQ02	In	AWL (2)	M-MWQ40	In	EfEbTG	MDW008	In	MSL (2)	M-MWQ01	In	THG (1)	M-MDEQ053	In	THG (2)	M-MDEQ046	In
AdEvWL	M-MWQ13	In	ASL (2)	M-TCQ14	In	AWL (2)	M-MWQ42	In	EfEbTG	MDW009	In	MSL (2)	M-MWQ03	In	THG (1)	M-MDEQ054	In	THG (2)	M-MDEQ050	In
AdEvWL	M-MWQ14	In	ASL (2)	PB-RHNC13	Out	AWL (2)	M-MWQ44	In	EfEbTG	M-MWQ08	In	MSL (2)	M-MWQ09	In	THG (1)	M-MDEQ055	In	THG (2)	M-MDEQ068	In
AdEvWL	M-MWQ16	In	ASL (2)	PB-RHNW03	Out	AWL (3)	C-INV016-F	Out	EfEbTG	PB-PE17	Out	MSL (2)	M-MWQ10	In	THG (1)	M-MDEQ061	In	THG (2)	M-MDEQ097	In
AdEvWL	M-MWQ17	In	AWL (1)	C-INV018-F	Out	AWL (3)	C-INV031-F	Out	EfEbTG	PB-RHNW18	Out	MSL (2)	M-MWQ12	In	THG (1)	M-MDEQ063	In	THG (2)	M-MDEQ100	In
AdEvWL	M-MWQ19	In	AWL (1)	E-S05	In	AWL (3)	C-INV032-F	Out	EfEbTG	P-FV02A-F	Out	MSL (2)	M-MWQ18	In	THG (1)	M-MDEQ064	In	THG (2)	MDW022	In
AdEvWL	M-MWQ21	In	AWL (1)	E-S11	In	AWL (3)	M-MDEQ020	In	EfEbTG	P-FV03A-F	Out	MSL (2)	M-MWQ25	In	THG (1)	M-MDEQ067	In	THG (2)	MDW024	In
AdEvWL	M-MWQ22	In	AWL (1)	E-S17	In	AWL (3)	M-MDEQ065	In	EfEbTG	P-FV09A-F	Out	MSL (2)	M-MWQ27	In	THG (1)	M-MDEQ075	In	THG (2)	MDW026	In
AdEvWL	M-MWQ26	In	AWL (1)	E-S22	In	AWL (3)	MDW003	In	EfEbTG	P-FV13A-F	Out	MSL (2)	M-MWQ31	In	THG (1)	M-MDEQ077	In	THG (2)	MDW027	In
AdEvWL	M-MWQ28	In	AWL (1)	M-HR05	In	AWL (3)	MDW005	In	EfEbTG	P-FV15A-F	Out	MSL (2)	M-MWQ47	In	THG (1)	M-MDEQ082	In	THG (2)	MDW029	In
AdEvWL	M-MWQ33	In	AWL (1)	M-MDEQ009	In	AWL (3)	MDW012	In	EfEbTG	P-FV16A-F	Out	MSL (2)	M-MWQ50	In	THG (1)	M-MDEQ084	In	THG (2)	MDW030	In
AdEvWL	M-MWQ37	In	AWL (1)	M-MDEQ026	In	AWL (3)	MDW013	In	EfEbTG	P-FV39A-F	Out	MTG (1)	C-INV012-F	Out	THG (1)	M-MDEQ090	In	THG (2)	MDW036	In

VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA	VT	Quadrat	In or out of MBSA
AdEvWL	M-MWQ38	In	AWL (1)	M-MDEQ028	In	AWL (3)	MDW014	In	EvWL	MDW032	In	MTG (1)	C-INV065-F	Out	THG (1)	M-MDEQ091	In	THG (2)	MDW048	In
AdEvWL	M-MWQ43	In	AWL (1)	M-MDEQ045	In	AWL (3)	MDW019	In	EvWL	MDW043	In	MTG (1)	C-SUP30-F	Out	THG (1)	M-MDEQ096	In	THG (2)	MDW049	In
AdEvWL	M-MWQ45	In	AWL (1)	M-MDEQ048	In	AWL (3)	MDW040	In	EvWL	MDW044	In	MTG (1)	M-MDEQ015	In	THG (1)	M-MDEQ098	In	THG (2)	MDW053	In
AdEvWL	M-MWQ46	In	AWL (1)	M-MDEQ056	In	AWL (3)	MEN005	In	EvWL	P-FV38A-F	In	MTG (1)	M-MDEQ016	In	THG (1)	M-MDEQ103	In	THG (2)	MDW056	In
AdEvWL	M-MWQ48	In	AWL (1)	M-MDEQ058	In	AWL (3)	MEN006	In	EvWL	P-FV39B-F	Out	MTG (1)	MDW039	In	THG (1)	M-MDEQ111	In	THG (2)	MDW058	In
AdEvWL	M-MWQ49	In	AWL (1)	M-MDEQ062	In	AxAsSL	C-INV019-F	Out	EvWL	P-FV41A-F	Out	MTG (2)	MDW006	In	THG (1)	MDHREK001	In	THG (2)	MDW021	In
AdEvWL	M-MWQ52	In	AWL (1)	M-MDEQ066	In	AxAsSL	C-INV101-F	In	EvWL	P-FV46A-F	Out	MTG (2)	MDW007	In	THG (1)	MDW020	In	THG (2)	M-XTC01	In
AdEvWL	M-MWQ53	In	AWL (1)	M-MDEQ069	In	AxAsSL	C-SUP22-F	Out	EvWL	P-FV47A-F	Out	MTG (2)	M-MWQ04	In	THG (1)	MDW023	In	THG (2)	PB-PE06	Out
AdEvWL	M-MWQ54	In	AWL (1)	M-MDEQ070	In	AxAsSL	C-SUP25-F	Out	EvWL	P-P40A-F	Out	MTG (2)	M-MWQ24	In	THG (1)	MDW028	In	TvHG	MDHRSH001	In
AdEvWL	M-MWQ55	In	AWL (1)	M-MDEQ072	In	AxAsSL	C-SUP27-F	Out				MTG (2)	M-MWQ30	In	THG (1)	MDW031	In	TvHG	M-TCQ06	In
AdEvWL	M-MWQ56	In	AWL (1)	M-MDEQ074	In	AxAsSL	C-SUP29-F	Out				MTG (2)	M-MWQ32	In	THG (1)	MDW055	In	TvHG	M-TCQ08	In
AdEvWL	M-MWQ57	In	AWL (1)	M-MDEQ076	In	AxAsSL	M-MDEQ006	In				MTG (3)	MDEW002	In	THG (1)	MDW057	In	NA	C-INV055-F	In
ASL (1)	B-KOE22-F	Out	AWL (1)	M-MDEQ079	In	AxAsSL	M-MDEQ010	In				MTG (3)	MDW017	In	THG (1)	MDWSH001	In	NA	C-INV056-F	In
ASL (1)	E-S01	In	AWL (1)	M-MDEQ080	In	AxAsSL	M-MDEQ011	In				MTG (3)	MEN003	In	THG (1)	M-TCQ01	In	NA	M-MDW046	In
ASL (1)	E-S07	In	AWL (1)	M-MDEQ081	In	AxAsSL	M-MDEQ013	In				MTG (3)	PB-PE01	Out	THG (1)	M-TCQ03	In	These two sites did not group with any others; however, surrounded by AWL (2)		
ASL (1)	E-S08	In	AWL (1)	M-MDEQ085	In	AxAsSL	M-MDEQ019	In				MTG (3)	PB-PE03	Out	THG (1)	M-TCQ09	In			
ASL (1)	E-S18	In	AWL (1)	M-MDEQ088	In	AxAsSL	M-MDEQ023	In							THG (1)	M-XTC17	In	This site was treated as a relevé		
ASL (1)	E-S21	In	AWL (1)	M-MDEQ089	In	AxAsSL	MDEW001	In							THG (1)	M-XTC18	In			
ASL (1)	PB-RHNE02	Out	AWL (1)	M-MDEQ093	In	AxAsSL	MDW001	In									343 quadrats lying within (279) or outside (64) of the MBSA grouped in distinct vegetation types in the pattern analysis. Two others lying inside the MBSA did not group with other quadrats in particular vegetation types, and one of the inside quadrats was treated as a releve for similar reasons. A total of 282 quadrats have been assessed within the MBSA.		
ASL (1)	PB-RHNE04	Out	AWL (1)	M-MDEQ094	In	AxAsSL	MDW010	In												
ASL (1)	PB-RHNE14	Out	AWL (1)	M-MDEQ099	In	AxAsSL	MDW016	In												
ASL (1)	PB-RHNE17	Out	AWL (1)	M-MDEQ107	In	AxAsSL	MDW042	In												
ASL (1)	PB-RHNW15	Out	AWL (1)	M-MDEQ109	In	AxAsSL	MEN002	In												
			AWL (1)	M-MDEQ110	In	AxAsSL	M-MWQ07	In												
			AWL (1)	MDEW003	In	AxAsSL	PB-PE05	Out												
			AWL (1)	MDW018	In	AxAsSL	PB-RHNW05	Out												
			AWL (1)	MDW033	In	AxAsSL	PB-RHNW06	Out												
			AWL (1)	MDW035	In															
			AWL (1)	MDW038	In															

Figure A9.1: Pattern analysis dendrogram – all sites

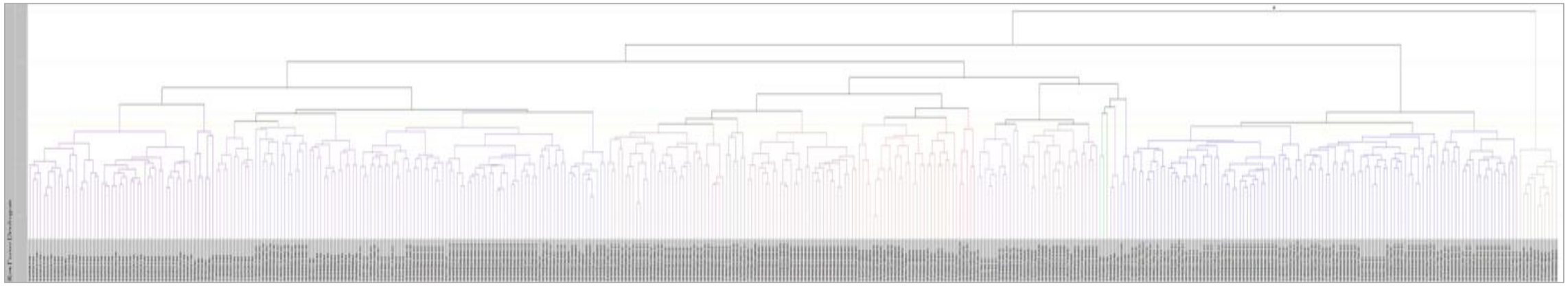


Figure A9.2: Pattern analysis dendrogram – all sites enlarged (left to right)

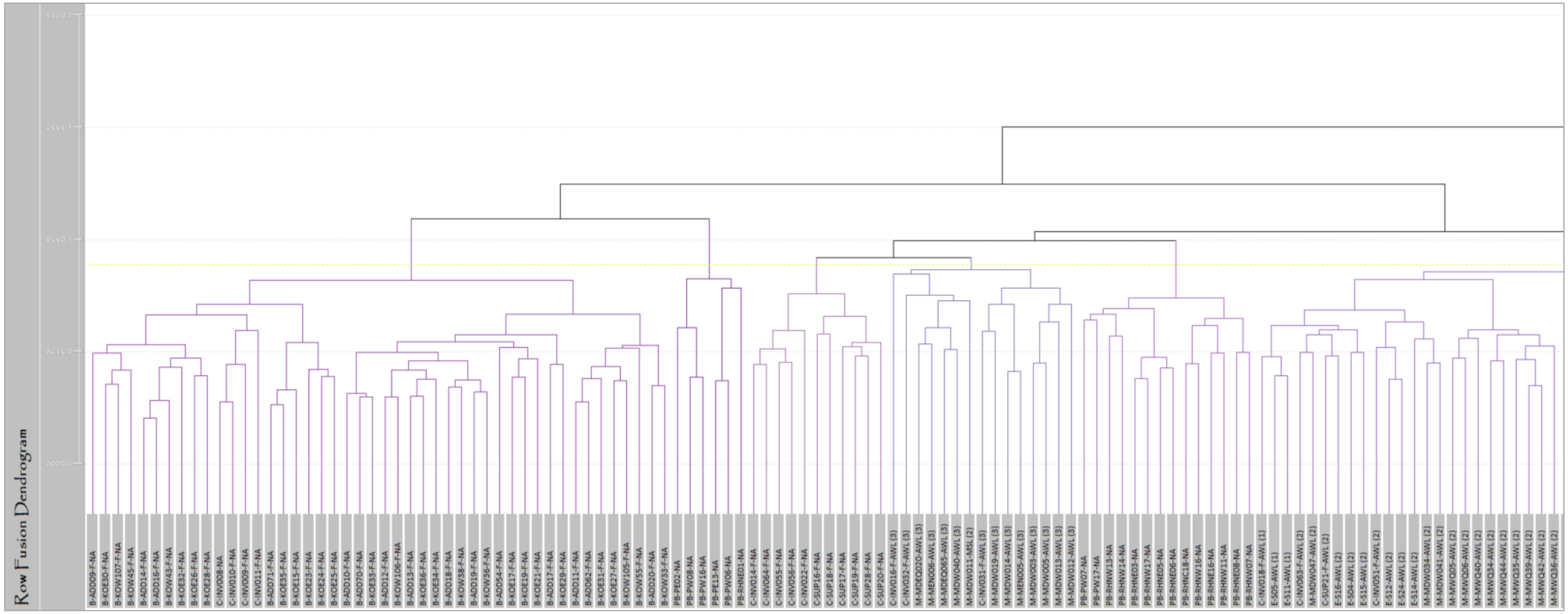


Figure A9.2: Continued

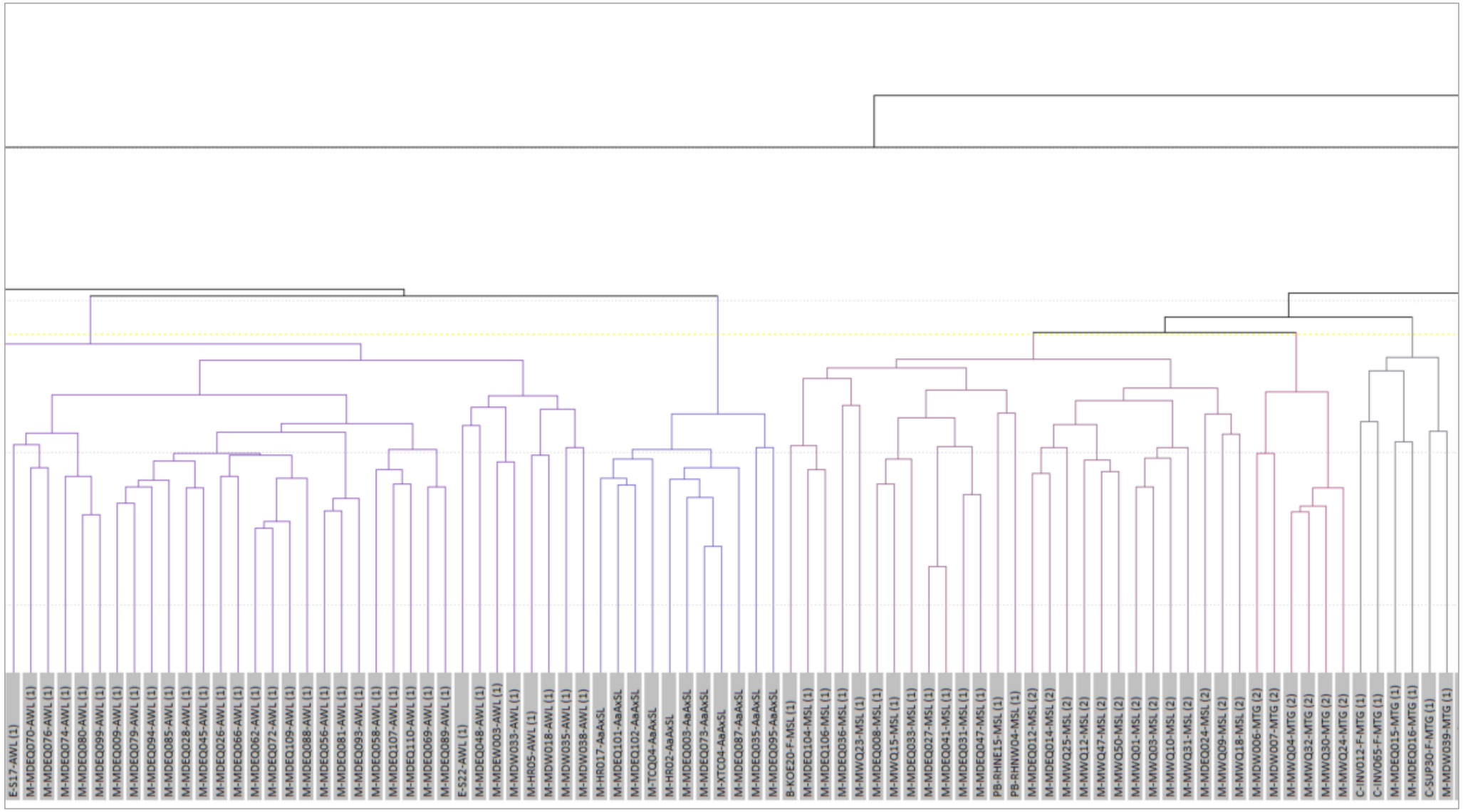


Figure A9.2: Continued

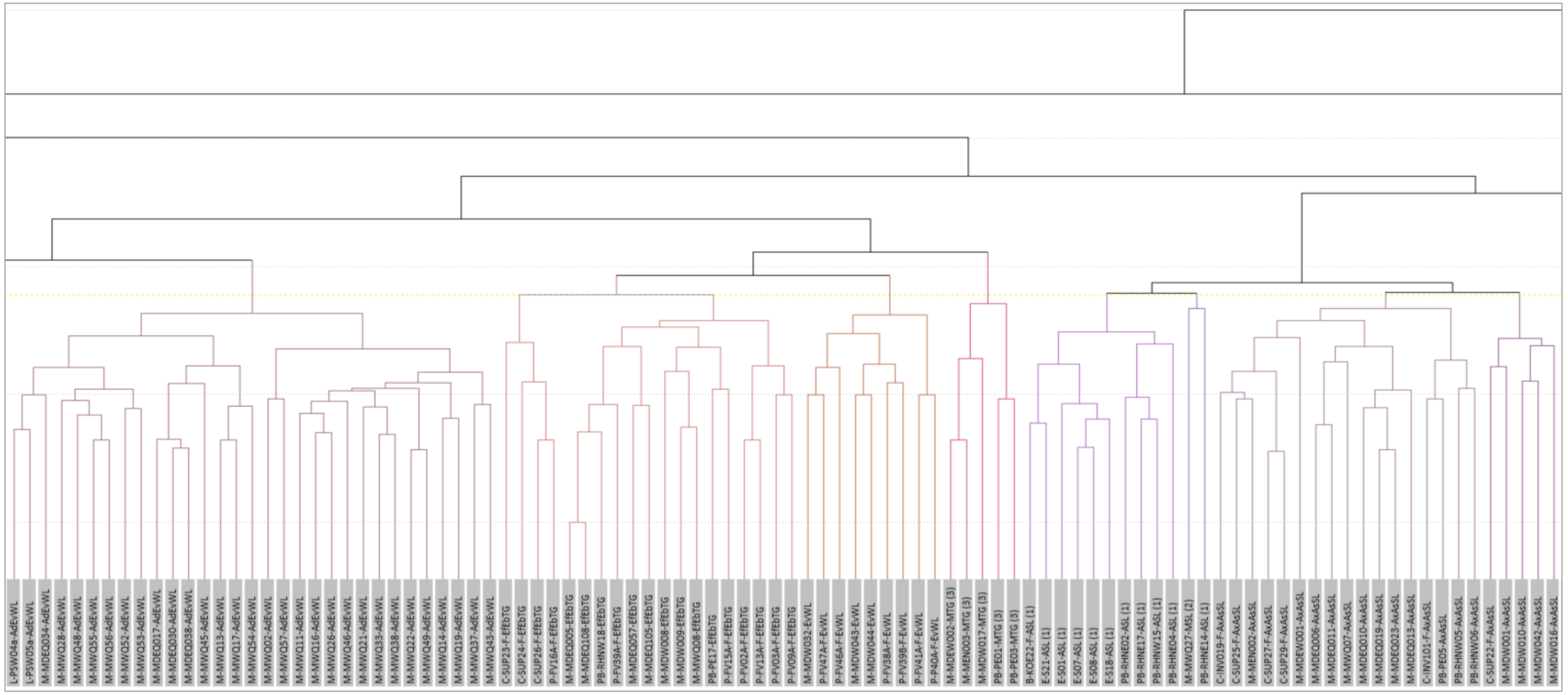


Figure A9.2: Continued

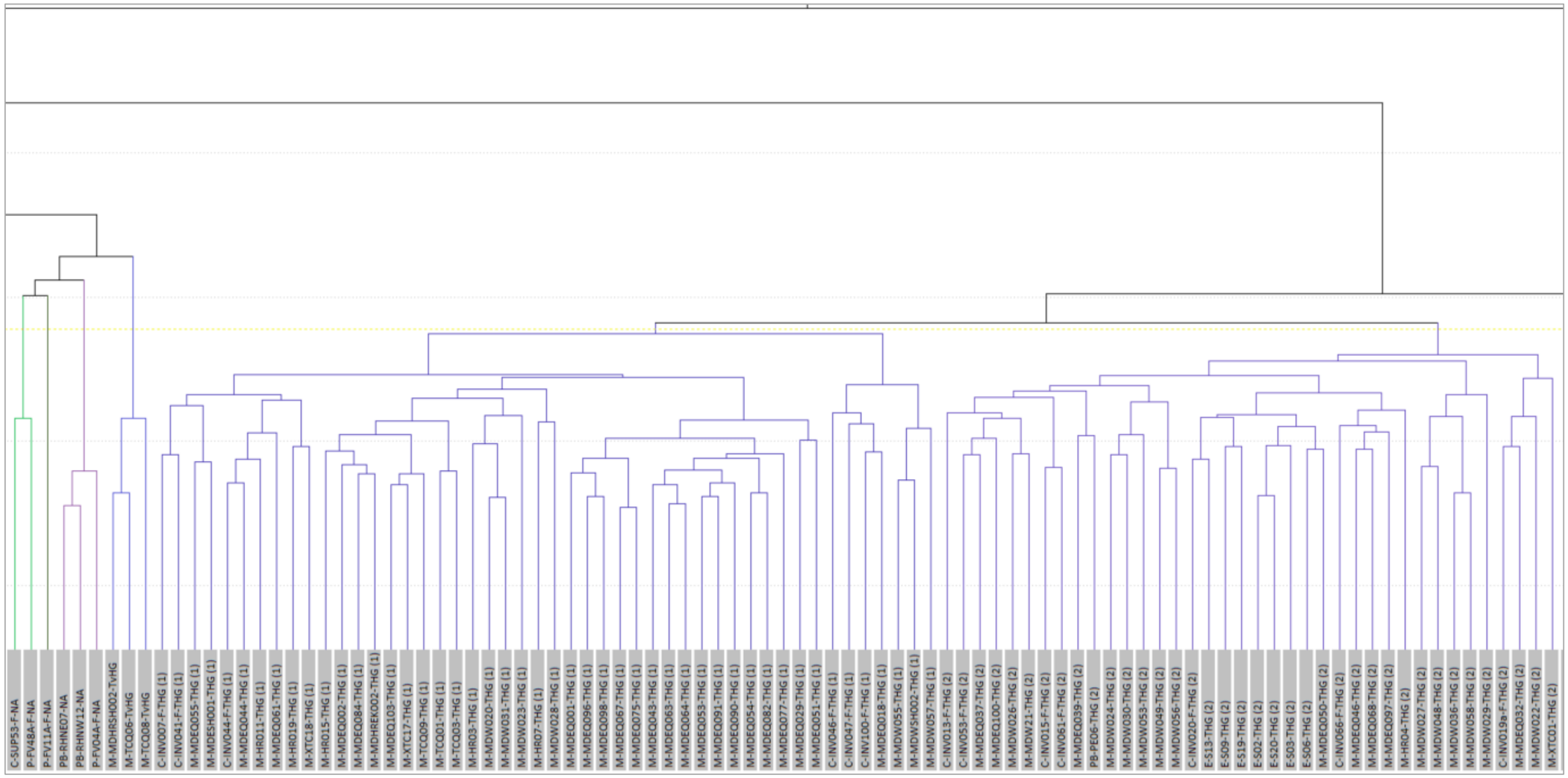


Figure A9.2: Continued

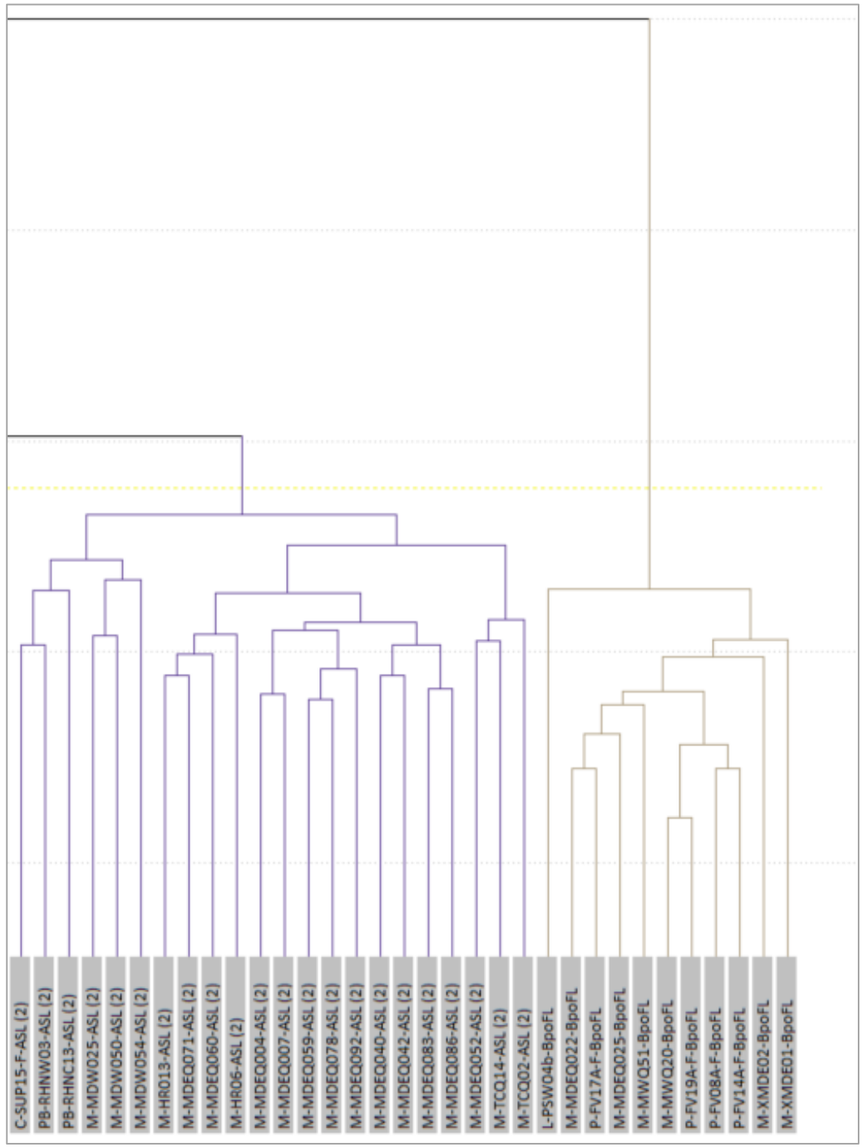


Figure A9.3: Pattern analysis dendrogram - groups

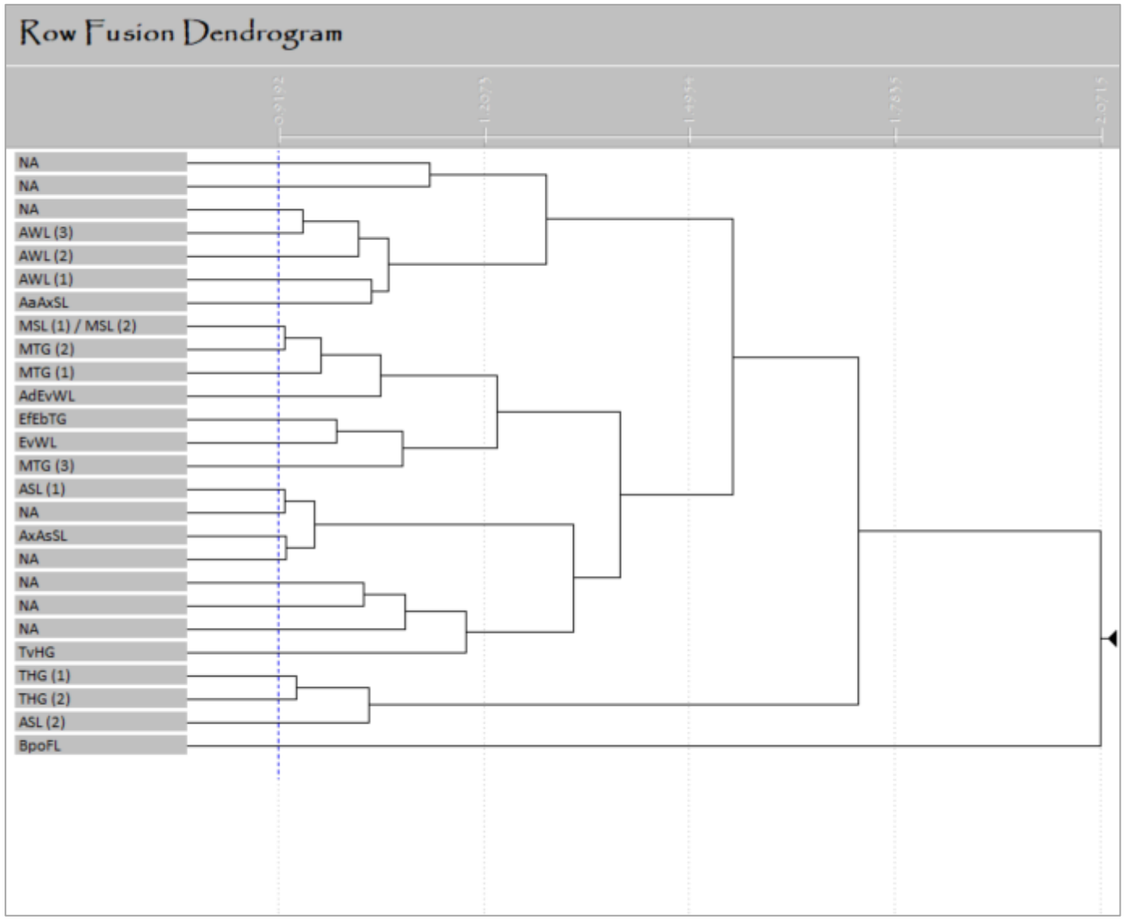


Figure A9.4: PATN pattern analysis recipe

```
Recipe of analysis to be performed on    at  06:48:33, June 20, 2022

Analysis based on rows -

    Association Measure: Bray Curtis

    Classification Strategy: Agglomerative Hierarchical Fusion

        Technique: Flexible UPGMA

        Beta: -0.1000

        Number of groups to produce: 26

    Ordination Method: SSH

        CutOff = 0.900

        3 Dimensions

        Number of random starts: 10

        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: 19
```

Table A9.3: Indicator species analysis (quadrats used in pattern analysis)

Note: Indicator values are shown only for taxa which were significant at p<0.05 (Monte Carlo Permutation Tests). Re p values in column 2: orange shade = p<0.05>0.01, light yellow shade = p<0.01>0.001. Green, orange, dark blue and light blue shading in columns 3 to 21 indicates which are very high, high, moderate, low or poor indicator species. P1 = Priority 1 species and REnd = regional endemic species.

Species	p value	Group / Observed Indicator Value																			Indicator Level
		AWL-3	AWL-2	AWL-1	AaAxSL	MSL-1	MSL-2	MTG-2	MTG-1	AdEvWL	EfEbTG	EvWL	MTG-3	ASL-1	AxAsSL	TvHG	THG-1	THG-2	ASL-2	BpoFL	
		None																			None
Psydrax latifolia	0.001		25.2																		Poor
Dodonaea petiolaris	0.030		18.9																		Poor
Spermacoce brachystema	0.003			32.8																	Low
Pterocaulon sphacelatum	0.009			17.9																	Poor
Cheilanthes sieberi subsp. *sieberi*	0.013			17.5																	Poor
Sida sp. dark green fruits (S. van Leeuwen 2260)	0.002				52.8																Moderate
Eremophila latrobei subsp. *filiformis*	0.001				35.8																Low
Eremophila cuneifolia	0.003				34.6																Low
Hibiscus coatesii	0.005				40.1																Low
Ptilotus obovatus	0.001				22.2																Poor
Triodia basedowii	0.005				27.5																Poor
Senna glutinosa subsp. *chatelainiana*	0.032				25.4																Poor
Psydrax suaveolens	0.044				13.6																Poor
Psydrax rigidula	0.046				21.3																Poor
						None															None
Streptoglossa odora	0.020						32.8														Low
Eremophila longifolia	0.001						15.2														Poor
Melaleuca glomerata	0.012						21.4														Poor
Eragrostis desertorum	0.021						26.8														Poor
Abutilon fraseri	0.040						14														Poor
Acacia sclerosperma subsp. *sclerosperma*	0.040						20.1														Poor
Scaevola spinescens	0.044						15.6														Poor
Abutilon malvifolium	0.001							60.8													Moderate
Cullen cinereum	0.002							41.7													Low
Panicum decompositum	0.006							31.1													Low
Rhynchosia minima	0.003							24.1													Poor
Acacia victoriae	0.011							19.4													Poor
Sida fibulifera	0.028							13.3													Poor
Achyranthes aspera	0.001								47.2												Low
Triodia angusta	0.012								30.9												Low
Afrohybanthus aurantiacus	0.009								22.3												Poor
Goodenia lamprosperma	0.012								25												Poor
Alternanthera nana	0.025								17.9												Poor
Tephrosia rosea var. Fortescue creeks (M.I.H. Brooker 2186)	0.037								23.6												Poor
Acacia arida	0.050								19.9												Poor
Acacia distans	0.001									31.4											Low
Duma florulenta	0.001									40.9											Low
Eucalyptus victrix	0.024									16.5											Poor
Heliotropium ovalifolium	0.026									17.7											Poor
Eriachne benthamii / flaccida	0.045										17.6										Poor

Species	p value	Group / Observed Indicator Value																		Indicator Level
		AWL-3	AWL-2	AWL-1	AaAxSL	MSL-1	MSL-2	MTG-2	MTG-1	AdEvWL	EfEbTG	EvWL	MTG-3	ASL-1	AxAsSL	TvHG	THG-1	THG-2	ASL-2	BpoFL	
Teucrium racemosum	0.004											32.9									Low
Eragrostis setifolia	0.014											20.5									Poor
Panicum laevinode	0.024											25.2									Poor
Cyperus bifax	0.033											25.8									Poor
Paspalidium jubiflorum	0.033											24									Poor
Sida spinosa	0.049											22.1									Poor
Astrebla lappacea	0.007												40								Low
Hibiscus brachysiphonius	0.011												35.9								Low
Neptunia dimorphantha	0.008												24.9								Poor
Stemodia kingii	0.008												24.5								Poor
Sida sp. Supplejack Station (T.S. Henshall 2345)	0.018												23.1								Poor
Sida rohlenae subsp. *rohlenae*	0.024												18								Poor
Sclerolaena cuneata	0.002													38.7							Low
Sclerolaena densiflora	0.015													27.9							Poor
Sclerolaena bicornis	0.014														31.8						Low
Acacia xiphophylla	0.015														25.9						Poor
Enchylaena tomentosa var. *tomentosa*	0.022														18.4						Poor
***Triodia veniciae* (P1 and REnd)**	0.001															97.4					High
Acacia marramamba	0.002															38.4					Low
Acacia pruinocarpa	0.001															15.6					Poor
Acacia rhodophloia	0.010															29.2					Poor
Eucalyptus leucophloia subsp. *leucophloia*	0.001																30.7				Low
Acacia adoxa var. *adoxa*	0.006																33.9				Low
Indigofera monophylla	0.001																15.6				Poor
Ptilotus calostachyus	0.001																28.3				Poor
Goodenia stobbsiana	0.005																28.5				Poor
Sida sp. Pilbara (A.A. Mitchell PRP 1543)	0.008																28				Poor
Triodia brizoides	0.014																22.1				Poor
Dampiera candicans	0.028																21.4				Poor
Amphipogon sericeus	0.033																18.5				Poor
Grevillea wickhamii subsp. *aprica / hispidula*	0.040																12.1				Poor
Corchorus lasiocarpus subsp. *lasiocarpus / parvus*	0.041																14.7				Poor
Acacia atkinsiana	0.001																	25.3			Poor
Triodia epactia	0.001																	14.8			Poor
Senna glutinosa subsp. *glutinosa*	0.031																	14.9			Poor
Seringia nephrosperma	0.039																	14.5			Poor
Acacia maitlandii	0.001																		31.9		Low
Acacia tumida var. *pilbarensis*	0.003																		39.2		Low
Tephrosia densa	0.006																		38.2		Low
Themeda triandra	0.011																		27.7		Poor
Petalostylis labicheoides	0.013																		24		Poor
Acacia pyrifolia	0.021																		21.8		Poor
Bonamia erecta / rosea	0.021																		18.3		Poor
Hibiscus sturtii var. *campylochlamys/platychlamys*	0.049																		11.5		Poor

Species	p value	Group / Observed Indicator Value																		Indicator Level
		AWL-3	AWL-2	AWL-1	AaAxSL	MSL-1	MSL-2	MTG-2	MTG-1	AdEvWL	EfEbTG	EvWL	MTG-3	ASL-1	AxAsSL	TvHG	THG-1	THG-2	ASL-2	BpoFL	
Tecticornia verrucosa	0.001																			85.9	High
Sporobolus mitchellii	0.003																			54.4	Moderate
Bergia perennis subsp. *obtusifolia*	0.001																			44.2	Low
Acacia stenophylla	0.003																			42.4	Low
Eleocharis pallens	0.020																			24.5	Poor

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APPENDIX 10: QUADRAT DATA

Quadrat data is provided as a separate, **Appendix 10** document.

APPENDIX 11: SPECIES BY VEGETATION TYPE AND SITE MATRIX

Species by vegetation type and site matrix is provided as a separate, **Appendix 11** document.