Western Botanical

Flora and Vegetation of the Mount Mason Study Area, Mt Mason DSO Haematite Project, December 2021

Prepared for: Juno Minerals Pty Ltd

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Executive Summary

Juno Minerals Pty Ltd (Juno) hold the Mount Mason DSO Hematite Project, located approximately 12km NW of the Mount Ida magnetite project, 96 km south-west of Leonora and 90 km north-west of Menzies, Western Australia. The project also includes planned development of a rail siding at Yunndaga Siding, south of the Menzies townsite. Flora and Vegetation of the Yunndaga Study Area is reported separately in Western Botanical 2021b.

The Mount Mason and Yunndaga Siding project received development approval by the Department of Mining and Petroleum Resources in July 2014. Jupiter Mines Pty Ltd was granted a Clearing Permit (CP) 5765/2 on 24/9/2015 with an expiry date of 30/11/2018. The tenements were subsequently transferred to Juno Minerals Pty Ltd. Given the former CP has expired, a new Clearing Permit meeting the current Department of Mines, Industry Regulation and Safety (DMIRS) regulations and Environmental Protection Authority (EPA, 2016) Guidance is required.

In order to further the project, Juno engaged Western Botanical to review the existing information on the flora and vegetation of the Mt Mason and Yunndaga Study Areas, identify any gaps that may exist, and to develop and implement a works program to address the gaps, meeting the current EPA Guidance requirements.

Previous works presented in P.G. Armstrong & Associates (2008) and Native Vegetation Solutions (2012 and 2013) were used in supporting the previous Mining Approval. These works were limited to Disturbance Footprints and Targeted Surveys for Priority Flora recognised at that time had not been implemented.

The current works included a desktop review and identified a range of significant flora known within and nearby both Study Areas (Western Botanical 2021a). The review identified some gaps that were required to bring the assessments for the project into compliance with EPA Guidance 2016 requirements (Western Botanical 2021b), primarily extending the Study Area to include a 500m buffer around planned infrastructure and conducting targeted surveys for Significant Flora.

Current studies at the Mount Mason Study Area represent multiple levels of assessment, conducted over the period April to October 2021, consisting of:

- A detailed survey with quadrats and traverses over the Orebody, waste rock landform and ROM pad area, Camp Cassini site as well as the northern section of the proposed mine access road north of the Camp Cassini site.
- A targeted survey on the proposed road alignment between the proposed mine site and the proposed Explosives Magazine.
- A reconnaissance level survey on the proposed mine access road alignment from the Camp Cassini site to the Menzies – Sandstone Road with a section of this intensively assessed in a Targeted Survey for Priority Flora (*Jacksonia lanicarpa* P1).

The Mount Mason Study Area supports eighteen vegetation associations at NVIS Level 5 Association level of detail. These include three Mulga (commonly *Acacia incurvaneura, A. mulganeura*) dominated communities associated with the banded ironstone formation range; an *Acacia effusifolia* community on aeolian sandplain; an *Acacia cockertoniana* dominated community on lateritic duricrust rises, an Acacia sibirica community on rises of weathered basalt and associated carbonates; an *Acacia quadrimarginea* community with Thryptomene costata shrubs on exfoliating granite slopes, a *Casuarina pauper* community on weathered basalt and associated carbonates, five eucalypt dominated communities, and two low shrublands, one dominated by *Hibbertia* and *Calytrix* shrubs associated with lateritised duricrust and granite platforms and one dominated by halophytic *Frankenia* shrubs on saline kaolinitic plains below breakaways. Relatively minor proportions of each of these communities are represented within the proposed Mt Mason development envelope.

The Mount Mason Study Area supports eight Significant Species including six Priority Flora and three Species of Interest (SOI). These are:

Priority 1 Flora

- *Jacksonia lanicarpa* P1 is known from a hardpan plain in the proposed mine access road alignment 17.4 km south of the proposed mine site.

Priority 3 Flora

- *Calytrix hislopii* P3 plants present populations on low lateritic duricrust rises which all lie outside areas of proposed development in the region between the orebody area and the Camp Cassini site.

- *Calotis sp. Perrinvale* (R.J. Cranfield 7096) P3 is known from two sites, point records, on the central banded iron formation ridge within the orebody area.

- *Drosera eremaea* P3 populations, inclusive of *Drosera* aff. *eremaea* for purposes of this discussion, are occasional on banded ironstone and common on exfoliating granite landforms within and outside of the proposed disturbance footprints as well as near the Mt Magnet townsite.

- *Menkea draboides* P3 is known in small numbers on exfoliating granite landforms outside the proposed disturbance footprint near the Camp Cassini site.

- *Philotheca coateana* P3 occurs in a large population on sandplain and lies outside area of proposed development, west of the Camp Cassini site.

Species of Interest, not of conservation concern:

- *Eucalyptus* aff. *lesouefii* (G. & S. Cockerton WB40262)
- *Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683)
- *Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281)

The Mount Mason Study Area has relatively simple flora with moderate diversity for the region and reflecting that of similar landforms in the region. Vegetation is in Pristine Condition outside areas of previous direct disturbance. Excluding tracks and rehabilitated drill pads, the entire Study Area would be considered in Excellent Condition. Rehabilitation of previous exploration areas has progressed well.

The northern portion of the Mount Mason Study Area, inclusive of the orebody area and part of the proposed mine access road, lies within the Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority 1 Priority Ecological Community, which has a total area of 14,607.17 ha. The Mt Mason proposal impacts 75.14 ha of this PEC, representing 0.51% of the total area.

Only minor weeds were noted within the Mt Mason Study Area and are not of concern. However, the Declared Pest and Weed of National Significance *Opuntia* sp. (Prickly Pear) was casually observed at the turnoff into the Mt Mason Study Area off the Mt Ida Road. This should be addressed in development of that access road.

The Mount Mason project has nil impacts to *Calytrix hislopii* P3, *Philotheca coateana* P3 and *Menkea draboides* P3 populations. However, a caveat on *Menkea draboides* P3 is acknowledged as individuals may occur within the proposed Camp Cassini expansion area.

Minor impacts to the following are known:

- *Jacksonia lanicarpa* P1: 3 plants of the minimum of 427 plants that can be enumerated in the 8 populations known to date lie within the current road alignment approximately 17.4 km south of the proposed minesite. Impacts to this species can be avoided altogether if the proposed mine access road is realigned 50m to the east at this point.
- *Calotis* sp. Perrinvale (R.J. Cranfield 7096) P3 is present in two small locations of this small annual are within the proposed Mt Mason orebody area and can not be avoided. An estimated 20 plants may occur here. *Calotis* sp. Perrinvale is known from 21 populations regionally and is likely under-surveyed at all sites, potential impacts represent 8.7% of the known regionally occurring populations and 100% of the local population known to date.

Moderate Impacts to *Drosera eremaea* P3 (inclusive of *Drosera* aff. *eremaea*) are unavoidable. The project currently impacts 4,804 plants of *Drosera eremaea* at the orebody, waste rock landform, ROM and infrastructure areas as well as at the Camp Cassini site. This represents an impact to 12.5% of known regional populations and 16.0% of the known regionally quantified

numbers of this species. However, the species is regarded as likely being far more abundant where it occurs than current information indicates. The works commissioned by Juno Minerals has led to a re-evaluation of the taxonomic status of *Drosera eremaea* with the species now being recognised as far more abundant and widespread than previously understood. This has led to a review of the Conservation Status of the species by the DBCA's Species and Communities Branch (Cathy Bourke pers. comm.). The Priority Status of *Drosera eremaea* was revised downwards from P1 to P3 on 25th November 2021 by DBCA following incorporation of numerous specimens collected during these studies at WAHERB. Further downward-review may occur based on a widening known distribution of the species.

1. Introduction

Juno Minerals Pty Ltd (Juno) hold the Mount Mason DSO Hematite Project, located approximately 12km NW of the Mount Ida magnetite project, 96 km south-west of Leonora and 90 km north-west of Menzies, Western Australia. The project also includes planned development of a rail siding at Yunndaga Siding, at the Menzies townsite. The project lies near the south-western margin of the Eastern Murchison (MUR01) biogeographic subregion which is dominated by Mulga woodlands on stony hills and hardpan plains, *Acacia* shrublands on yellow sandplains, Spinifex hummocked grasslands on orange sandplains and Chenopod plains on saline margins of salt lakes.

The Mount Mason and Yunndaga Siding project received development approval by the Department of Mining and Petroleum Resources in July 2014. Jupiter Mines Pty Ltd was granted a Clearing Permit (CP) 5765/2 on 24/9/2015 with an expiry date of 30/11/2018. The tenements were subsequently transferred to Juno Minerals Pty Ltd. Given the former CP has expired, a new Clearing Permit meeting the current Department of Mines, Industry Regulation and Safety (DMIRS) regulations and Environmental Protection Authority (EPA, 2016) Guidance is required.

In order to further the project, Juno engaged Western Botanical to review the existing information on the flora and vegetation of the Mt Mason and Yunndaga Study Areas, identify any gaps that may exist and to develop and implement a works program to address the gaps, meeting the current EPA Guidance requirements.

This report deals exclusively with the Mt Mason DSO Haematite project Study Area at Mt Mason. The Yunndaga Siding area is reported separately in Western Botanical 2021b). A reconnoitre survey of the Mount Mason Study Area was implemented in mid-April 20201 where previous consultant's reports and mapping were referred to in reviewing the flora, vegetation and significant flora of the Study Areas. This review identified the following matters:

- The previous flora and vegetation assessments at both sites were limited to the proposed disturbance footprints at both sites with minimal (approximately 100m) buffers around planned development.

- Previous Detailed level survey vegetation mapping and flora assessments at Mount Mason were reasonably accurate, however, previous Reconnoitre level survey for the Yunndaga Siding site was inaccurate.

- Neither dataset was compliant with current EPA Guidance requirements, specifically requiring (i) a minimum 500m buffer around infrastructure, (ii) adequate quadrat representation to validate vegetation mapping, and (iii) targeted surveys for conservation-significant flora.

- Minor amendments to flora nomenclature and conservation status updates were required.

- While records of a few Priority Flora had been reported, Targeted Surveys within and adjacent to the Mount Mason Study Area for conservation-listed significant species had not been implemented. Targeted Survey within the former limited Yunndaga Siding Study Area had been conducted.

- No Threatened Flora were known, nor were expected, within or nearby the two Study Areas.

1.1. Previous Surveys of the Mount Mason Study Area

The following reports assessing the flora and vegetation of tenements now held by Juno Minerals at Mt Mason were reviewed in the course of the desktop assessment.

- P.G. Armstrong & Associates (2008) *Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project May-Sept 2007.* Consultant's report to Jupiter Mines Ltd and Hardrock Mining.

- Native Vegetation Solutions (2012) *Level 2 Flora and Vegetation Survey*. Consultant's report to Jupiter Mines Ltd.

- Native Vegetation Solutions (2013) *Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Proposed mine access road (M29/414, M29/408, G29/22, G29/23, L29/79, L29/100).* Consultant's report to Jupiter Mines Ltd.

- Western Botanical (2021a). *Desktop Review of Flora and Vegetation, Mt Mason Project in the Mt Ida Area, January 2021.* Consultant's report prepared for Jupiter Mines Pty Ltd. Report Reference WB945 v.31.

- Western Botanical (2021b) *Post Field Survey Memo Report and Gap Analysis, Mt Mason Project, May 2021.* Consultant's report prepared for Jupiter Mines Pty Ltd. Report Reference WB954.

- Western Botanical (2021c) *Final Report, Review of Flora and Vegetation of the Mount Mason and Yunndaga Study Areas, July 2021.* Consultant's report to Juno Minerals Pty Ltd.

In order to gain some contextual information, three reports dealing with the flora and vegetation of adjacent Banded Ironstone Formation (BIF) ranges west and north-west of the Study Area were reviewed (Western Botanical 2010, 2011a, 2011b). Additional information on *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) P1 was taken from Western Botanical 2019.

1.2. Current Survey

The current study incorporates a targeted survey for *Drosera eremaea* which was listed as Priority 1 at the time of surveys at Mt Mason and Mt Magnet as well as a Detailed Survey of the

Mt Mason Study Area. Vegetation mapping was extended to the limits of the 500m buffer now applied at both Study Areas. These surveys bring the current works in line with EPA Guidance (2016) requirements.

1.3. Physical Environment

1.3.1. Climate

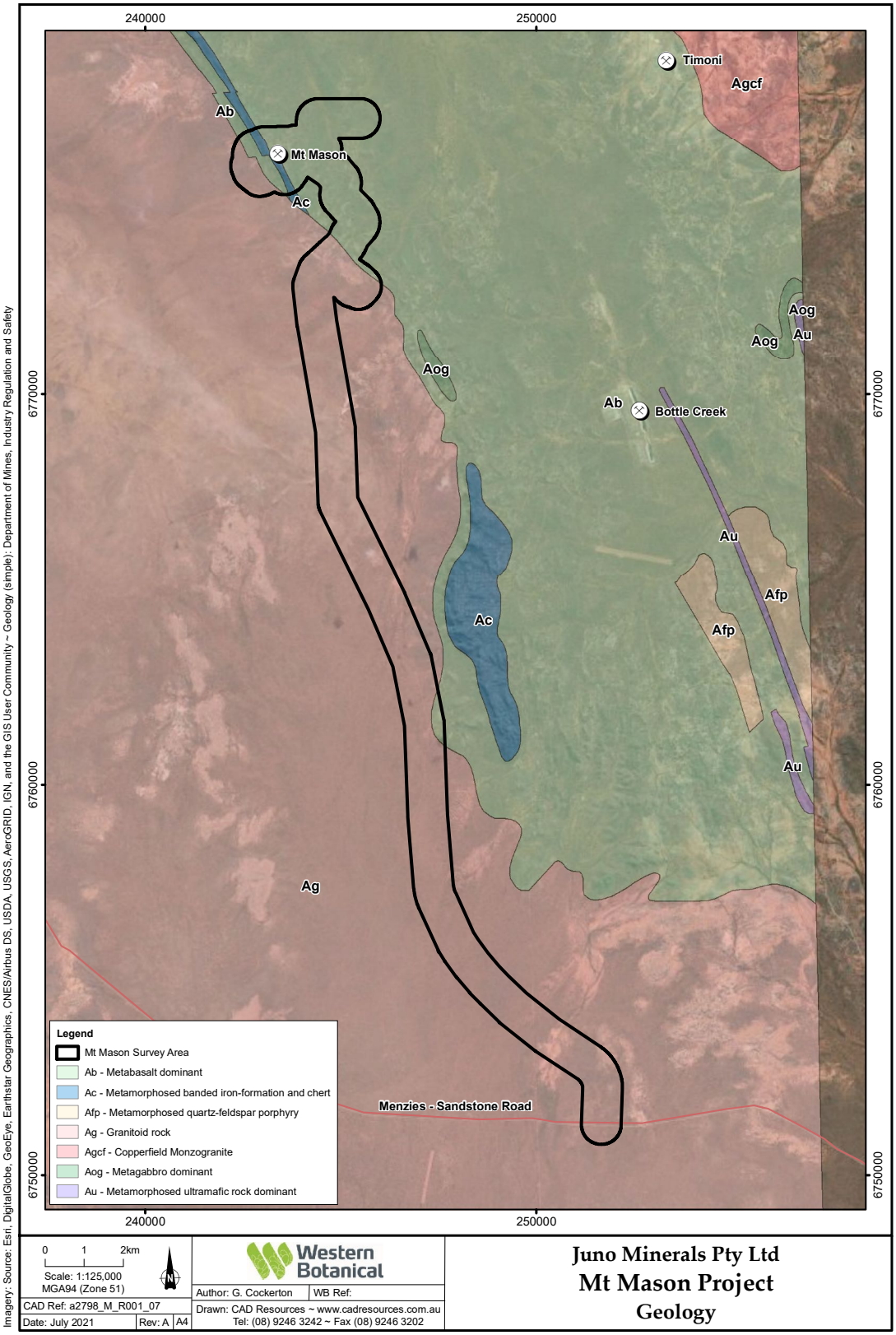
Long term climatological information is presented in Native Vegetation Solutions (2013) and is not reproduced here.

Rainfall prior to the April 2021 Reconnaissance Survey included a 35mm in one day in mid February 2021 from a decaying tropical low. Monthly totals of 3.4mm in January, 60.2mm in February, 39.6mm in March and 7.2mm to mid April 2021 were recorded at Walling Rock (BOM Station 12318) (Bureau of Meteorology). The response in vegetation observed in the April 2021 Reconnaissance Survey was that vegetation had been sustained over summer as foliage was healthy and leaves extended (plants not aestivating) but that insufficient rainfall had occurred to stimulate germination of annuals except in low lying moisture gaining sites with clayey soils and few species were in flower.

1.3.2. Geology

Geology of the Mount Mason Study Area is relatively simple with the orebody area laying within Metamorphosed banded iron formation and chert strike aligned NNW-SSE with metabasalt dominating on the eastern side of the BIF ridge and granites on the western side, Figure 1.

Figure 1. Geology of the Mt Mason Study Area



1.4. Biological Environment

1.4.1. Interim Biogeographic Regionalisation of Australia

The setting of the Study Area within the IBRA regions is presented Native Vegetation Solutions (2012 and 2013) and is not reproduced here.

1.4.2. Land Systems

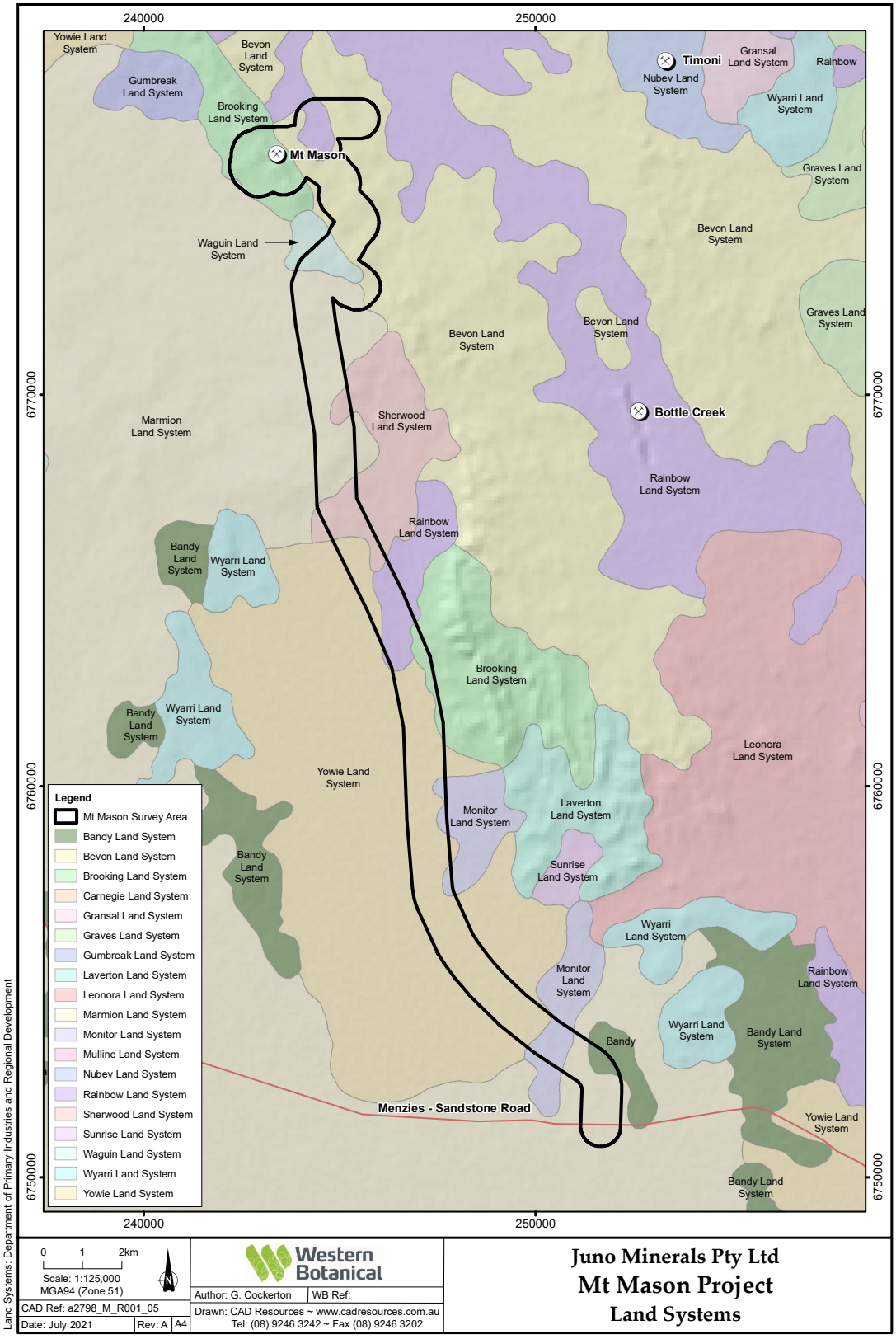
Land Systems of the Mt Mason Study Area are presented in Table 1.

Table 1. Land Systems of the Mt Mason Study Area

Land System Name	Characteristics
Rainbow	Hardpan plains supporting Mulga on alluvial plains subject to sheet flow; frequently with fine ironstone gravel mantles, and sparse, generally narrow and unincised concentrated drainage tracts.
Bevon	Irregular low hills supporting Mulga and Low shrubs on ?Tertiary limonite, minor Archaean greenstone and banded iron formation, extensive Quaternary colluvium and restricted areas of Quaternary alluvium and eluvium.
Brooking	Mulga shrublands, occasional minor halophytic shrublands on Archaean banded iron formation, locally quartzite, slate, shale and greywacke, with Quaternary colluvium and minor alluvium.
Waguin	*Acacia* shrublands and minor halophytic shrublands on very low breakaways (relief usually less than 4 m) with short footslopes above erosional plains and minor alluvial plains. This system usually occurs within large areas of sandplain, often occurring in parallel series.
Marmion	Gently undulating sandplains with mixed shrublands and hummock grasslands on Gently undulating sandplains with surface drainage features confined to areas fringing occasional exposures of granite.
Sherwood	Mulga shrublands, occasional minor halophytic shrublands on low breakaways (5 to 20 m relief), with pallid zone upper footslopes, depositional lower footslopes; extensive, level to gently undulating plains with pebble mantles; and lower alluvial plains and drainage floors receiving concentrated £low. Occasional low hills and tors.

Land System Name	Characteristics
Yowie	Mulga and Bowgada shrublands and patchy wanderrie grasslands on Quaternary sand and minor cemented alluvium.

Figure 2. Land Systems of the Mount Mason Study Area



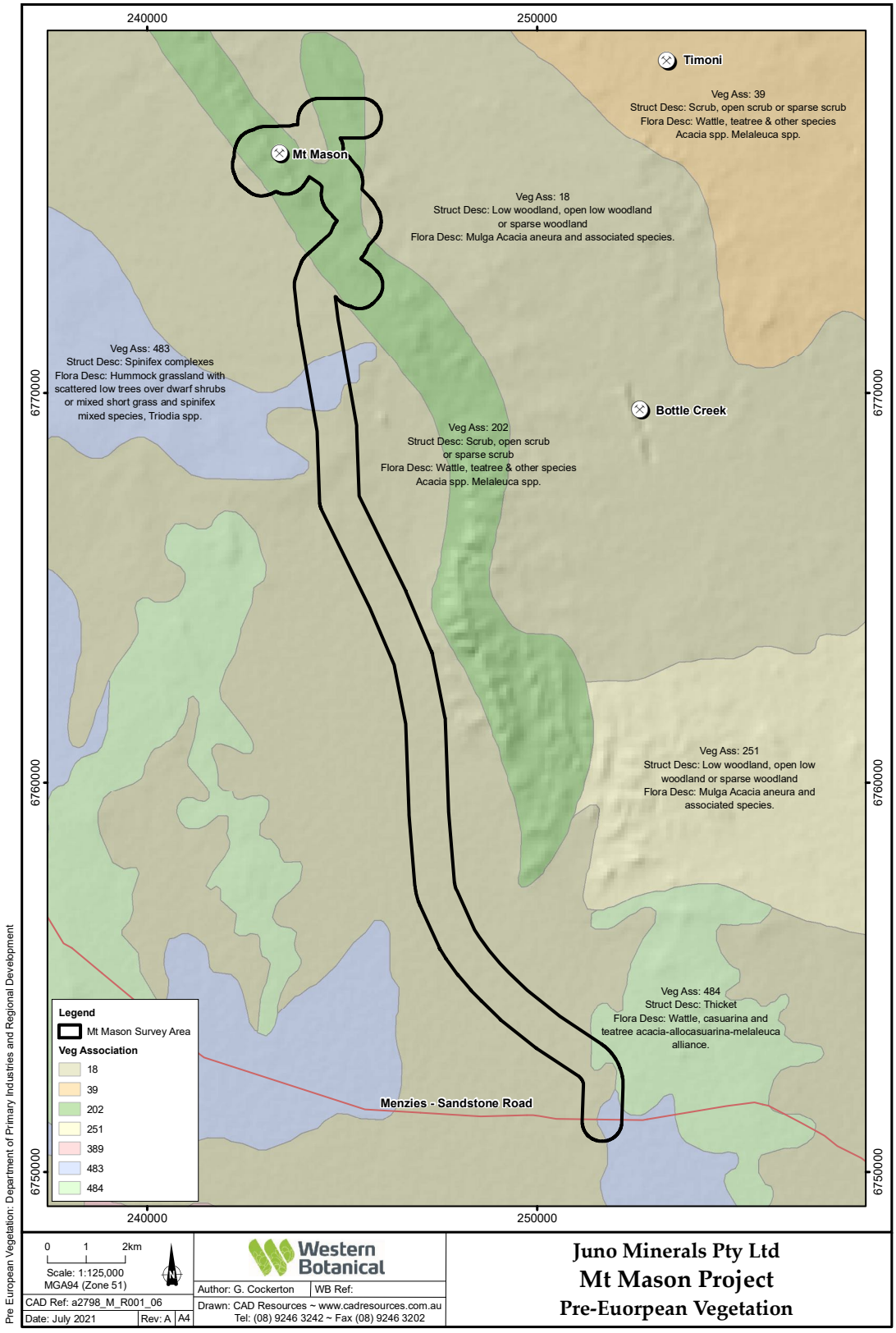
1.4.3. Pre-European Vegetation

The setting of the Study Area within Beard's Pre-European vegetation mapping is presented in Figure 3. The Mt Mason DSO project Study Area intersects four of Beard's Pre-European Vegetation Associations, Table 2.

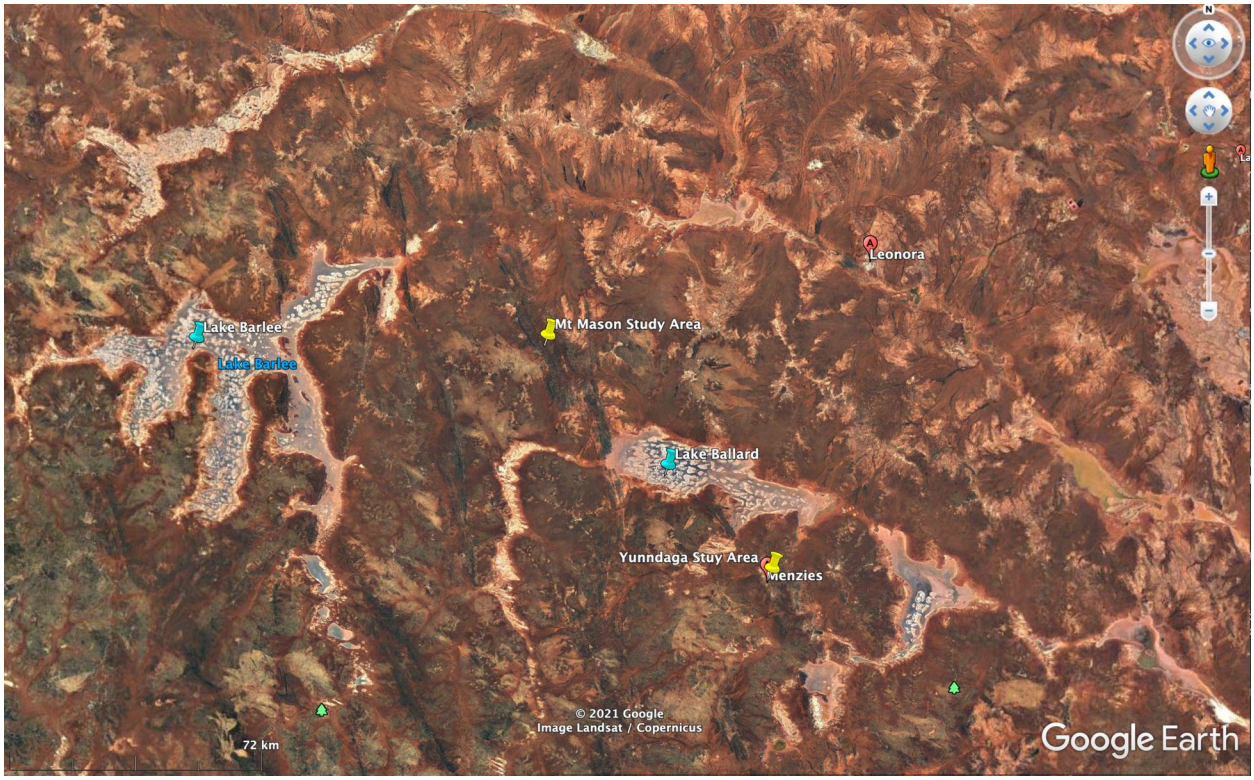
Table 2. Beard Pre-European Vegetation Intersected by the Mt Mason Study Area

Association #	Description	Regions within the Mt Mason Study Area
202	Wattle, Teatree open scrub or sparse scrub, flora includes Wattle, Teatree and other species, *Acacia* spp., *Melaleuca* spp.	Dominating the orebody, infrastructure areas and the northern part of the proposed mine access road.
18	Low woodland, open low woodland or sparse woodland. Flora includes Mulga, *Acacia* aneura and associated species.	Minor occurrence within the buffer of the orebody and infrastructure areas; Extensive within the proposed mine access road.
483	Spinifex complexes. Flora includes scattered low trees over dwarf shrubs or mixed short grass and spinifex mixed species, *Triodia* spp.	Two small in areas within the Study area, (a) intersects the proposed mine access road alignment it's the northern section just south of the Camp Cassini, and (b) southern tip of the proposed mine access road alignment at the Menzies – Sandstone Rd.
484	Thicket. Flora includes Wattle, *Casuarina* and Teatree, *Acacia – Allocasuarina – Melaleuca.*	Fringing the eastern portion of the southern end of the proposed mine access road alignment.

Figure 3. Pre-European Vegetation of the Mt Mason Study Area



1.5. Site location map



The location of the Study Area is presented in greater detail in Figure 5.

2. Methods

2.1. Desktop Assessment

This report incorporates the findings of a Desktop Assessment undertaken prior to the field work of April 2021, as reported in Western Botanical (2021a).

A query of the Department of Biodiversity, Conservation and Attractions' (DBCA's) Threatened and Priority Flora (TPFL) and WA Herbarium (WAHERB) databases (15-1120FL) and the Threatened and Priority Ecological Communities (TEC/PEC) databases (41-1020EC) was undertaken and the results analysed for likelihood of occurrence of conservation significant flora species within the Study Area.

The Department of Agriculture, Water and Environment's Protected Matters Search Tool was used to identify any Federally listed species or Threatened Ecological Communities within or nearby the Study Area.

Reports by previous Consultants addressing the Study Area and consulted in this Desktop Assessment are summarised in Table 3.

Table 3. Previous Consultant's Reports Reviewed, Mount Mason Study Area

Reference	Brief Description
P.G. Armstrong & Associates (2008) Vegetation Survey and Rare Flora Search of the Mt Mason and Mt Ida Exploration Project May-Sept 2007. Consultant's report to Jupiter Mines Ltd and Hardrock Mining.	Level 1 Reconnaissance and Targeted Survey of Orebody Area
Native Vegetation Solutions (2012) Level 2 Flora and Vegetation Survey. Consultant's report to Jupiter Mines Ltd.	Level 2 Detailed Survey of Orebody Areas (lacking Targeted Survey component)
Native Vegetation Solutions (2013) Level 1 Flora and Vegetation Survey of the Proposed Mount Mason Proposed mine access road (M29/414, M29/408, G29/22, G29/23, L29/79, L29/100). Consultant's report to Jupiter Mines Ltd.	Level 1 Targeted Survey of Proposed mine access road from Orebody Areas to Menzies

Relevant reports prepared by Western Botanical on adjacent BIF ranges, (Western Botanical 2010, 2011a, 2011b) and a project near Leonora (Western Botanical 2019) were reviewed and information added to that presented in the DBCA databases.

2.2. Field Survey

Studies at the Mount Mason Study Area represent multiple levels of assessment:

- A detailed survey with quadrats and traverses has been completed over the Orebody, waste rock landform and ROM pad area, Camp Cassini site as well as the northern section of the proposed mine access road north of the Camp Cassini site.

- A targeted survey has been implemented on the road alignment between the proposed mine site and the proposed Explosives magazine.

- A reconnaissance level survey has been undertaken on the proposed mine access road alignment from the Camp Cassini site to the Menzies – Sandstone Road with a section of this intensively assessed in a Targeted Survey for Priority Flora (*Jacksonia lanicarpa* P1).

The current assessments were undertaken in the following survey events during 2021:

- A Reconnaissance field survey was undertaken by two botanist and one field assistant over the period 14th to 22nd April 2021. Survey involved utilising vegetation mapping prepared by previous consultants which were either validated or amended in the field. Vegetation mapping was extended beyond previous mapping limits, to a buffer of 500m around all planned infrastructure at Mount Mason and the proposed mine access road to the Menzies – Sandstone Road. Not all areas within the expanded buffer were able to be assessed in the timeframe available.

    - Vegetation was assessed on foot at sites representative of homogeneous reflectance as shown on (i) laminated colour satellite imagery field maps at 1:10,000 scale and (ii) on Google Earth imagery on laptops. Field maps were annotated with vegetation types and boundaries drawn where this could be done reasonably confidently.

    - Vegetation descriptions inclusive of species present, landform, soil and any significant flora were documented at representative sites.

    - All flora encountered was recorded and reference specimens of most species were taken for compilation of a field herbarium, future reference and to meet licence conditions.

- A field survey assessing the numbers and distribution of *Drosera eremaea*, listed at that time as P1, (inclusive of *Drosera* aff. *eremaea*) was implemented over a six day period in early (3rd to 8th) August 2021 while the species was in flower. Populations of *Drosera eremaea* were estimated and mapped and around 60 specimens were collected for vouchering at the WA Herbarium. At minimum, one specimen was taken from every population encountered. During the first day of this survey, populations of *Drosera eremaea* near Mt Magnet, inclusive of the TYPE locality for this species, were also surveyed with specimens taken and population numbers assessed.

- A field survey establishing quadrats for a Detailed Survey, as well as recording species in traverses within the Study Area between the Orebody and Infrastructure Area and the Camp Cassini site, was implemented over an 11 day period, 10th to 20th August 2021. Some additional records of *Drosera eremaea* were also made and additional specimens

collected for verification. At minimum, one specimen was taken from every population encountered.

- In response to a request from the WA Herbarium, collections of fruits and seeds of *Drosera eremaea* from both the Mt Magnet and Mt Mason populations were collected over a four day period from 1st to 4th October 2021.

- A targeted survey for *Calotis* sp. Perrinvale (R.J. Cranfield 706) P3, installation of additional quadrats and re-collection of other taxa including *Calytrix hislopii* P3 to confirm initial identifications.

2.3. Floristic Analysis

- Statistical analyses were conducted following the final field assessment and the identification of all collected specimens. Flora data from all 34 quadrat sites were analysed to investigate floristic similarity amongst sites, groupings of sites, and to assess relationships amongst groupings.

- Percent Foliar Coverage (PFC) scores of each species recorded ere used to incorporate dominance of key species within vegetation groupings. To optimise interpretive output, PFCs were standardised to cover scores, scaled from 0-5. Species recorded outside quadrats were excluded from the final analysis, as were dead plants of species recorded within the quadrats. The effects of excluding singleton sample sites, or sites with fewer than three replicates were examined during initial runs– the results guiding later iterations of the analysis.

- Analysis of flora data was conducted using PATN v3.12 statistical package software (Belbin 2010). Association (Bray and Curtis), Classification (Flexible UPGMA Agglomerative Hierarchical Fusion), and Ordination (Semi-Strong Hybrid) components of PATN were utilised in the analysis; primarily producing a dendrogram of site similarity/dissimilarity with suggested Vegetation Association groupings provided by PATN.

2.4. Flora Specimen Identification

Specimens of flora were confirmed using resources at Western Botanical, the WA Herbarium's Reference Herbarium and Research Collection where required, and on-line resources. Where full identification could not be achieved, specimens were marked for recollection in subsequent surveys as possible.

2.5. Significant Flora

Specimens of significant flora were added to the Western Botanical Specimen Database and have been prepared for vouchering at the WA Herbarium (WAHERB). A total of forty six specimens

of *Drosera eremaea* (inclusive of *Drosera* aff. *eremaea*) have been vouchered at the WA Herbarium following this study. These are comprised of (i) thirty five specimens from within and near by the Mt Mason Study Area, (ii) seven specimens from three populations near Mt Magnet and Paynes Find, and (iii) three specimens from the Die Hardy Range. Flowering and fruiting material was vouchered from each of the major centres of investigation. These are all available on the Florabase website.

2.6. Weeds

Weed species were recorded in a similar fashion to native flora and specimens retained for verification of identification and vouchering at the WA Herbarium as required.

2.7. Vegetation Condition

Vegetation Condition was scored utilising the Vegetation Condition Scale presented in EPA Guidance (2016), Appendix 1.

3. Results and Discussion

3.1. Results of the Desktop Assessment – adapted from Western Botanical (2021a)

3.1.1. Flora and Vegetation

The flora of the tenements reflects that of the interzone between the eastern Murchison Biogeographic region and that of the north-eastern Coolgardie biogeographic region. The vegetation the flora of the BIF range, inclusive of the proposed orebody area, is dominated by Mulga (*Acacia incurvaneura* predominantly), *Acacia quadrimarginea* (Granite Mulga), *Acacia cockertoniana* as small to medium trees over *Thryptomene decussata*, *Prostanthera althoferi* subsp. *althoferi, Hibbertia arcuata, Olearia humilis* and *Eremophila latrobei* subsp. *latrobei* and *E. clarkei or E. forrestii* subsp. *forrestii* in the mid-shrub stratum. Sandplains support *Acacia effusifolia* shrublands with a shrubby understorey of *Philotheca* and *Rinzia* species and occasional emergent eucalypt mallees in a mature state and a wide range of relatively short-lived shrubs in a recent post-fire state.

Only one significant range extension was recorded by Native Vegetation Solutions (2012), a *Hysterobaeckea longipes,* and its occurrence within the Study Area represents a disjunct occurrence from the main range of the species which occurs near Perenjori. The identification of the specimen (PERTH 08423490, P. Knapton 47), is accurate (Barbara Rye, pers. comm.), however, an error in plotting the location of this species is suspected as the species has not been confirmed in this survey and is not further discussed.

3.1.2. Conservation-Significant Flora

The review of publicly available DBCA databases (15-1120FL) returned sixty one species with conservation significance with records in a 20km radius of a centroid within the Study Area, Table 5 and Figure 4. Within this, ten Priority 1, 11 Priority 2, 27 Priority 3 and nine Priority 4 species were returned. The list also returned four species listed as Threatened Flora in Western Australia. No Federally EPBC Listed Threatened Flora are known within or in the immediate vicinity of the Study Area.

Of the four Threatened Flora species returned:

- *Eucalyptus crucis* subsp. *crucis* is a granite rock endemic and is known from several populations considerably south of the Study Area and is considered unlikely to occur within the Study Area.
- *Myriophyllum lapidicola* is an aquatic annual herb known from granite outcrops in the eastern Avon Wheatbelt and is unlikely to occur in the Study Area.
- *Ricinocarpos brevis* is a Banded Ironstone Formation (BIF) endemic known within reasonable proximity to the Study Area with populations at the Windarling Range, Johnson

Range and Perrinvale Station. This species and suitable potential habitat has been extensively surveyed in the region by Western Botanical and is therefore considered unlikely to occur within the Study Area.

Of the 57 Priority Flora returned:

Twenty-six Priority Flora species are considered Unlikely to occur within the Study Area due to either (i) their known ranges being at considerable distance from the Study Area, and/or (ii) the habitats which they occupy are considered unlikely to occur within the Study Area. These species can be discounted from further consideration.

- Of these, two are DBCA database errors:
    - *Acacia effusa* P3 has a Pilbara distribution. The one point on ex-Cashmere Downs (PERTH 07737742), is likely either a taxonomic or data entry error at WAHERB and has since been reviewed (B. Maslin pers. comm.).
    - *Eremophila dendritica* P2 has a western Nullarbor distribution and its inclusion in the database search results is in error and has since been reviewed by WAHERB.
- Twenty-nine Priority Flora species are considered as Possibly occurring within the Study Area, either due to (i) close proximity of known populations to the Study Area and/or (ii) habitats supporting the species are known to, or are likely to, occur within the Study Area.
    - Of these, the newly recognised *Hibiscus* sp. Perrinvale Station (J. Warden & E. Ager WB 10581) P1 is likely to occur on the upper to lower slopes of the BIF ranges and associated duricrust outcrops within the Study Area. Given its discovery in the region in 2019 by Western Botanical, it is unlikely to have been surveyed in previous botanical assessments within tenements. It is a cryptic species and is difficult to assess in seasons outside those with favourable rainfall.
- Seven Priority species have records plotted within or nearby tenements: *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) P3, *Calytrix hislopii* P3, *Chrysocephalum apiculatum* subsp. *norsemanense* P3, *Drosera eremaea* P3, *Philotheca deserti* subsp. *brevifolia* P3 and *Pterostylis virens* P3. Of these:
    - *Chrysocephalum apiculatum* subsp. *norsemanense* P3 and *Philotheca deserti* subsp. *brevifolia* P3 are species found on gravely sandplains with *Acacia effusifolia* shrublands and *Triodia* hummocked grassland (Spinifex). Both species are fire responsive, being particularly abundant after fire and numbers diminish as vegetation matures.
        - The location of *Chrysocephalum apiculatum* subsp. *norsemanense* P3 may not be accurately plotted within the Study Area and the species was not found during the 2021 surveys.
        - The record of *Philotheca deserti* subsp. *brevifolia*, similarly may not be plotted accurately and the species was not recorded in the 2021 surveys.

A similar species, *Philotheca coateana* P3, was recorded on sandplain supporting *Acacia effusifolia*, outside the proposed Development Envelope west of the Camp Cassini site.

- *Calytrix hislopii* P3 is known from one small population on low lateritic duricrust hills north-east of the Mt Mason Study Area, outside proposed the Development Footprint. It may occur within the Study Area.

- Regionally, *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) P3 is found in non-saline red-brown loamy to clayey soils, often under *Eucalyptus ravida*, *E. salubris* (Gimlet) or *E. salmonophloia* (Salmon Gum) trees in winter wet depressions. At Mt Mason, a point plotted by PG Armstrong & Associates (PGA54) was not re-confirmed in the Spring 2021 surveys. This record occurs on a west facing upper slope of the BIF range under the shade of *Acacia quadrimarginea* and *Melaleuca leiocarpa* tall shrubs.

- The small perennial geophyte *Drosera eremaea*, formerly P1 and now listed as P3, (inclusive of *Drosera macrantha* subsp. *eremaea* and *Drosera* aff. *eremaea*) was reported from multiple locations within and nearby the Mt Mason Study Area:

  - Records on mid slopes of BIF ranges;

  - Records on lateritic duricrust low hills within and outside the Mt Mason Study Area;

  - Records on exfoliating granite outcrops and granitoid sheets with shallow sandy soils; and

  - Note that The TYPE population and additional populations occur on exfoliating granite landforms near Mt Magnet.

- The small perennial geophyte *Pterostylis virens* P3 is associated with shallow sandy deposits on and around granite outcrops outside the Mt Mason Study Area. Locations of these are plotted using GPS and are likely accurate.

A correlation of Priority Flora records plotted with the Mt Mason Tenements in presented in Table 4 and an assessment of the likelihood of Conservation-Significant Flora occurring within the Study Areas is presented in Table 5.

Table 4. Correlation of Priority Flora and Occurrences Within Tenements

Taxon	Cons_Code	Presence within Tenements	Comment
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3	Plotted on L29/100	Positional error suspected
Calotis sp. Perrinvale Station (R.J. Cranfield 7096) (Record PGA54)	P3	Plotted on M29/408	Likely accurate
Calytrix hislopii	P3	Present on G29/023	Present outside proposed disturbance envelopes
Chrysocephalum apiculatum subsp. *norsemanense*	P3	Plotted on L29/079	Positional error suspected
Drosera eremaea	P3	Present on M 29/408, L29/100, G29/023	Within and adjacent to disturbance footprints
Philotheca deserti subsp. *brevifolia* (not confirmed in 2021 surveys)	P3	Not recorded in 2021	Reported outside proposed disturbance envelopes
Pterostylis virens	P3	Present on L29/078	Outside proposed disturbance envelopes

Distributions of Priority Flora known within and adjacent to the Study Area are presented in Figure 4, Figure 5 and Figure 9.

Table 5. Desktop Analysis of Likelihood of Conservation Significant Flora Occurring within the Study Area

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Acacia effusa	P3		1		Ironstone Hills	Unlikely	Acacia effusa P3 has a Pilbara distribution. The one point on ex-Cashmere Downs (PERTH 07737742), is likely either a taxonomic or data entry error at WAHERB and is being reviewed (B. Maslin pers. comm.).
Acacia subrigida	P2		1		Sandplains	Possible	Widespread, poorly collected
Aluta teres	P1	1	1		Sandplains	Possible	Known nearby Study Area, Cashmere Downs, Bulga Downs, Ida Valley, dependant on suitable habitat
Banksia arborea	P4	1	1		Ironstone Hills	Not present	Known from BIF ranges west of tenements, different vegetation association to that within Study Area
Beyeria lapidicola	P1	1	1		Ironstone Hills	Unlikely	Known nearby Study Area, Mount Richardson, dependant on suitable habitat
Calandrinia kalanniensis	P2		1		Granite outcrops	Unlikely	Main distribution significantly south-west of Study Area
Calandrinia quartzitica	P1		1		Quartz outcrops	Possible	Known from quartz outcrops near slat lakes east of Study Area
Calandrinia sp. Menzies (F. Hort et al. FH 4100)	P3		1		Red loamy plains	Possible	Known nearby Study Area, dependant on suitable habitat
Calotis sp. Perrinvale Station (R.J. Cranfield 7096)	P3		1		Red loamy plains	Possible	Plotted on L 29/100 though positional error suspected, species not confirmed in 2021 surveys
Calytrix hislopii	P3		1		Lateritic breakaways, low hills and associated drainage areas	Possible	Known from north of tenements
Calytrix praecipua	P3		1		Archaean granite breakaways	Unlikely	Main distribution significantly east and north of Study Area

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Chrysocephalum apiculatum subsp. *norsemanense*	P3		1		Sandplains	Plotted within tenements	Present on L 29/079 though positional error suspected
*Drosera eremaea (*incl. *Drosera aff. eremaea)*	P3 (downgraded from P1 25/11/2021)		1		Granite outcrops, BIF ranges	Present within Study Area	Present on M 29/408, within orebody and adjacent to proposed mine access road areas
Eremophila dendritica	P2	1			Stony plains	Unlikely	Database positional error
Eremophila mirabilis	P2	1	1		Archaean granite breakaways	Unlikely	Main distribution significantly east of Study Area
Eremophila veronica	P3		1		Lateritic breakaways	Unlikely	Main distribution significantly south of Study Area
Eucalyptus crucis subsp. *crucis*	T		1		Granite outcrops	Unlikely	Well surveyed, granite rock endemic, main distribution significantly south of Study Area
Eucalyptus educta	P2		1		Granite outcrops	Possible	Main distribution significantly south-west of Study Area
Eucalyptus formanii	P4	1	1		Sandplains	Possible	Main distribution west of the Study Area
Eucalyptus jutsonii subsp. *jutsonii*	P4		1		Sandplains and sand dunes	Unlikely	Main distribution significantly south-east of Study Area
Euryomyrtus recurva	P3	1	1		Sandplains, gravely soils	Unlikely	Main distribution significantly west of Study Area
Eutaxia nanophylla	P3		1		Red loamy plains	Unlikely	Main distribution significantly south of Study Area
Eutaxia rubricarina	P3		1		Red loamy plains	Unlikely	Main distribution significantly south-west of Study Area
Goodenia berringbinensis	P4		1		Red loamy plains, water courses	Possible	Main distribution significantly north-west of Study Area
Grevillea erectiloba	P4	1	1		Red loamy plains	Possible	Main distribution significantly south-west of Study Area, positional error of record near Menzies is highly likely
Grevillea georgeana	P3	1	1		Ironstone Hills, laterite gravel rises	Possible	Main distribution significantly south-west of Study Area
Grevillea inconspicua	P4		1		Red loams over subcropping greenstone	Possible	Main distribution significantly north-east of Study Area

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Grevillea secunda	P4		1		Sandplains and sand dunes	Possible	Main distribution significantly south-east of Study Area
Grevillea sp. Yerilgee Hills (T. Laslett TL 025)	P1		1		Sandplains	Unlikely	Main distribution significantly south of Study Area
Grevillea subterlineata	P3		1		Gravely sand	Unlikely	Highly disjunct distribution, significantly south and north-west of the Study Area
Hemigenia exilis	P4	1	1		Duricrust outcrops	Possible	Main distribution north-west of the Study Area
Hibbertia lepidocalyx subsp. *tuberculata*	P3	1	1		Ironstone Hills	Unlikely	Main distribution significantly south of Study Area
Hibiscus krichauffianus	P3		1		Red loamy plains, stony hills	Possible	Widely distributed, poorly collected
Hibiscus sp. Perrinvale Station (J. Warden & E. Ager WB 10581)	P3		1	1	Ironstone Hills	Possible	Widely distributed, poorly collected, a BIF and duricrust remnant Endemic
Homalocalyx grandiflorus	P3		1		Sandplains	Possible	Main distribution significantly south of Study Area
Hyalosperma stoveae	P2		1		Sandplains	Possible	Main distribution significantly west of Study Area
Hysterobaeckea ochropetala subsp. *cometes*	P3		1		Sandplains	Unlikely	Main distribution significantly south of Study Area, positional error of record near Menzies is highly likely
Jacksonia lanicarpa	P1	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
Labichea eremaea	P3	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
Malleostemon sp. Adelong (G.J. Keighery 11825)	P2		1		Sandplains and sand dunes	Possible	Known nearby Study Area, dependent on suitable habitat
Menkea draboides	P3		1		Red sand, loam, granite rocks	Possible	Known nearby Study Area, dependent on suitable habitat
Micromyrtus serrulata	P3	1	1		Sandy clayey soils over granite	Possible	Known nearby Study Area, dependent on suitable habitat

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Mirbelia ferricola	P3	1	1		Ironstone Hills	Possible	Main distribution significantly south of Study Area
Myriophyllum lapidicola	T	1			Granite outcrops	Unlikely	An annual growing in rock pools on granite outcrops
Newcastelia insignis	P2		1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat. positional error of record near Menzies is highly likely
Notisia intonsa	P3		1		Red clay, winter wet depressions	Possible	Main distribution significantly south of Study Area, dependent on suitable habitat
Phebalium sp. Yerilgee Sandplain (J. Jackson 223)	P2		1		Sandplains	Unlikely	Main distribution significantly south of Study Area
Philotheca coateana	P3	1	1		Sandplains	Possible	Present on L 29/079, outside proposed disturbance envelopes
Philotheca deserti subsp. *brevifolia*	P3	1	1		Sandplains	Possible	Known nearby Study Area, dependent on suitable habitat
Phyllanthus baeckeoides	P3	1	1		Drainage lines associated with BIF Ranges	Possible	Known in region nearby Study Area, dependent on suitable habitat
Pterostylis elegantissima	P1		1		Winter wet clay soil	Unlikely	Known distribution significantly south-east of Study Area
Pterostylis virens	P3		1		Granite outcrops	Known within tenements, outside Study Area	Present on L 29/078, outside proposed disturbance envelopes
Pterostylis xerampelina	P1		1		Granite outcrops	Unlikely	Main distribution significantly south of Study Area, dependent on suitable habitat
Ricinocarpos brevis	T	1	1		Ironstone Hills	Unlikely	Has been extensively surveyed
Seringia exastia	T*		1		Sandplains	Probable	Known nearby, Listed as Threatened due to technicality, abundant and widespread species
Tecticornia mellarium	P1		1		Salt lake margins	Possible	Suitable habitat may be present on L29/081
Thryptomene eremaea	P2		1		Sandplains	Unlikely	Main distribution significantly south-east of Study Area, dependent on suitable habitat, positional error of record near Menzies is highly likely.

Taxon	Cons_Code	TPFL	WAHERB	WB	Habitat	Likelihood	Comment
Thryptomene sp. Leinster (B.J. Lepschi & L.A. Craven 4362)	P3		1		Archaean granite breakaways	Unlikely	Main distribution significantly east of Study Area, close to Thryptomene decussata
Thysanotus brachyantherus	P2		1		Limestone	Unlikely	Main distribution significantly south of Study Area
Thysanotus sp. Ennuin (N. Gibson & M. Lyons 2665)	P1		1		Loamy soils, winter wet depressions	Unlikely	Main distribution significantly south-west of Study Area
Wurmbea murchisoniana	P4		1		Granite rocks, wet depressions	Unlikely	Widespread, poorly collected, main distribution significantly west of Study Area

Figure 4. Species With Conservation Significance Returned in DBCA Database Query 15-1120FL.

a2798_M_R001_01 DBCA Pri Flora Regional

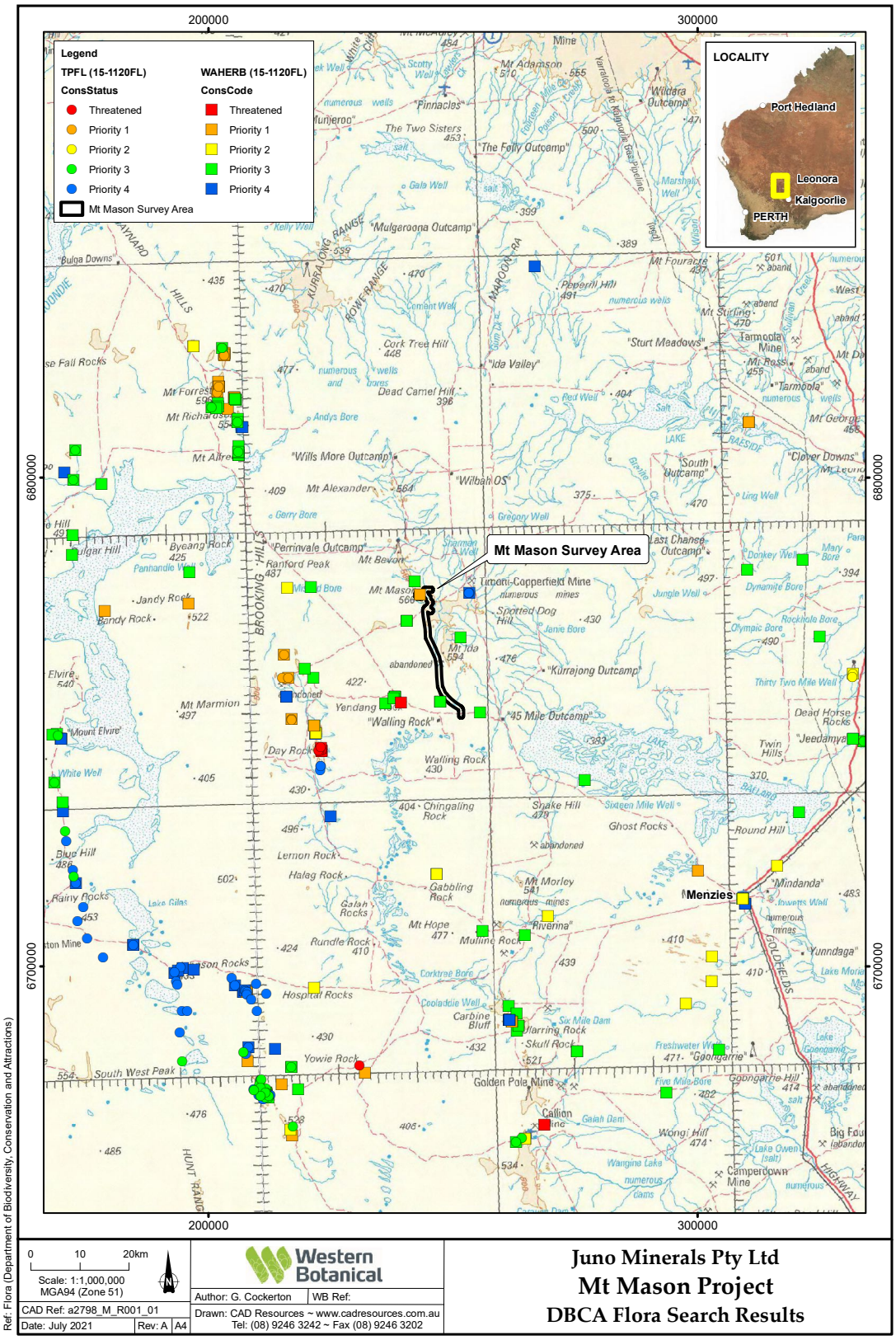
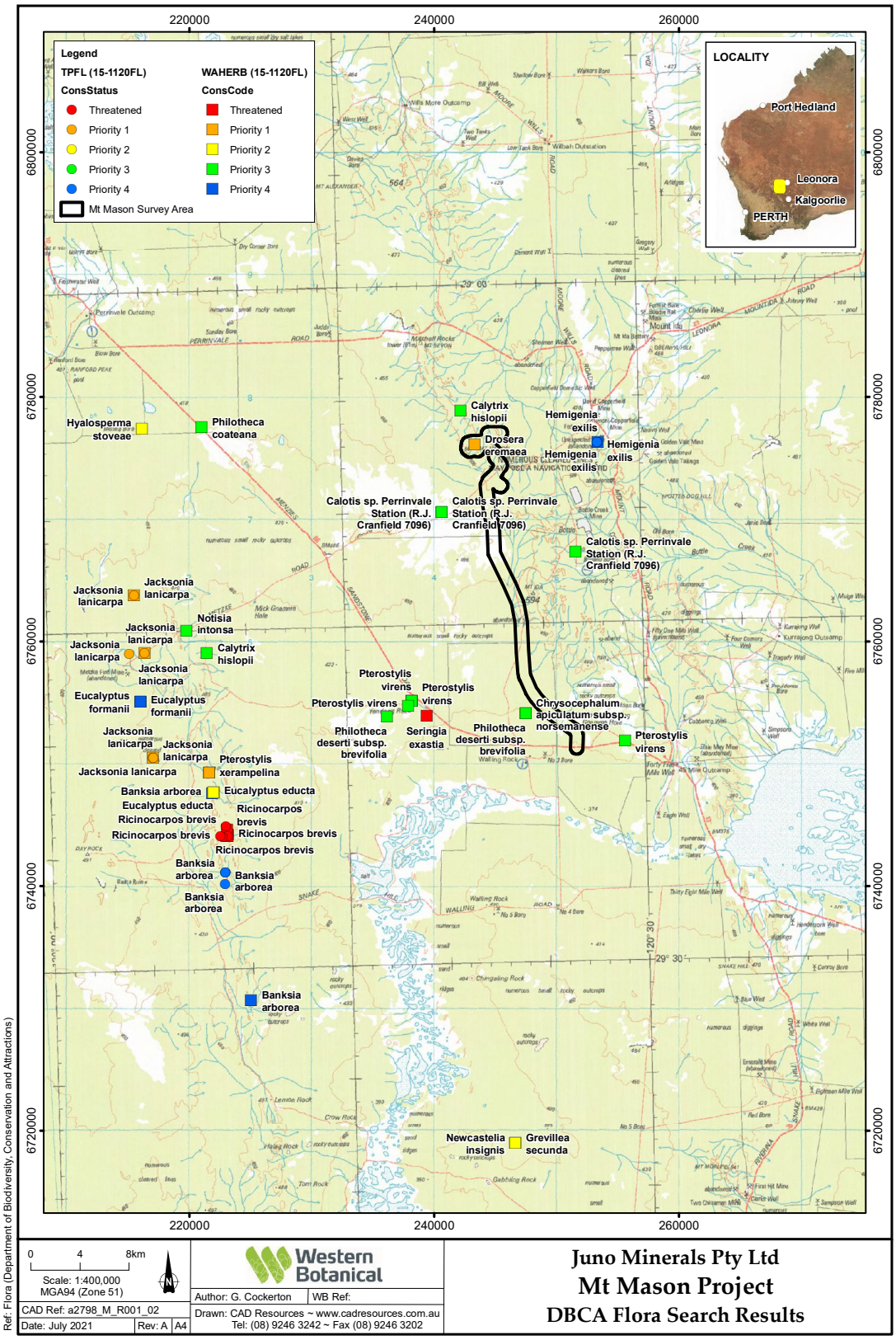


Figure 5. Known Species With Conservation Significance Within and in Close Proximity to the Mount Mason Study Area

a2798_M_R001_02 DBCA Pri Flora Mt Mason



A review of relevant Western Botanical reports for sites with similar landforms and geology to those of the Study Area within a 100km radius of the Study Area was also undertaken, Figure 6, Table 3. Western Botanical reports for the Brooking Hills (Western Botanical 2010), Mt Richardson (Western Botanical 2011a) and Churchill Polygon (Western Botanical 2011b) were reviewed. Species with conservation significance reported within WB reports or subsequently recognised at each Adjacent Study Site are presented in Table 7.

Figure 6. Adjacent Study Sites Assessed by Western Botanical

Table 6. Relevant WB Adjacent Study Site Reports Reviewed

Site	Distance and Direction from Study Area	Landforms, Geology	Indicative Coordinate		
Brooking Hills	55 km NW	BIF, debris slopes, outwash plains	51J	208100	6788700
Churchill Polygon	55km WNW	BIF, debris slopes, outwash plains, drainage systems	50J	782000	6780000
Mt Richardson	74km NW	BIF, debris slopes, outwash plains, sandplains	50J	790000	6816000

Table 7. Conservation-Significant Species Correlation within Western Botanical Adjacent Study Sites

	Brooking Hills	Churchill Polygon	Mt Richardson
Aluta teres P1		Present	
Beyeria lapidicola P1			Present
Calytrix creswellii P3			Present
Calytrix verruculosa P3			Present
Hibiscus sp. Perrinvale Station P1[1]		Present	
Philotheca coateana P3		Present	
Phyllanthus baeckeoides P3			Present
Drosera sp. in *the D. macrantha*[2] *– D. eremaea* complex	Present		Present

While species with conservation significance recorded at these sites are useful in developing a regional context for some species, the sites covered by Western Botanical previous surveys do not overlap the current Study Area and are at somewhat (55 to 74 km) disjunct. No species with Conservation Significance were confirmed at the Brooking Hills. The Churchill Polygon supports three Priority species and Mt Richardson supports four taxa with conservation significance. There is no overlap in the Priority species present at the two sites.

Drosera sp. in the *macrantha – D. eremaea* complex (noted then as *Drosera macrantha* subsp. *macrantha*) were recorded at the Brooking Hills and Mt Richardson sites. These may represent *Drosera eremaea*.

[1] *Hibiscus* sp. Perrinvale was recognised after the WB report was produced.
[2] Reported as *Drosera macrantha* subsp. *macrantha*

At Mt Richardson, *Calytrix uncinata* recorded (Western Botanical 2011a) and reported as Priority 4 has subsequently been removed from the Priority Flora list and *Calytrix* sp. Triangles (J. Warden & E. Ager WB19712) reported was subsequently identified as *Calytrix erosipetala* which has also recently been removed from the Priority Flora list.

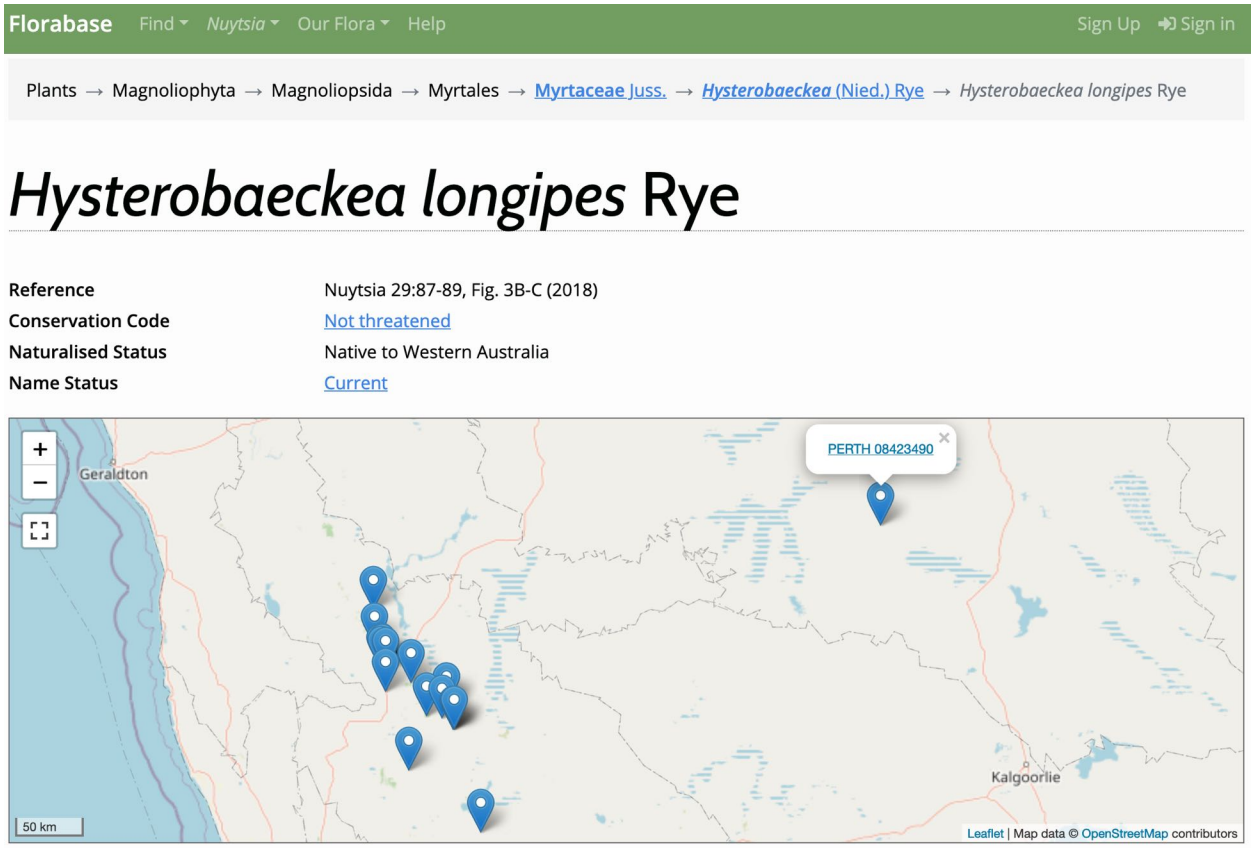
At the Churchill Polygon, *Hibiscus* sp. Perrinvale Station was recognised as a new species following surveys east of Leonora (Western Botanical, 2019) and was listed as Priority 1 by DBCA in 2019. This species is not known at Mt Mason.

3.1.3. Disjunct Occurrences and Range Extensions

No significant range extensions were reported in previous consultant's reports.

One species, reported in Native Vegetation Solutions (2013) as *Baeckea* sp. Wubin, now *Hysterobaeckea longipes*, represents a disjunct occurrence of this species, some 375 km east of its known range in the northern Avon Wheatbelt west of Mongers Lake, north of Wubin, Figure 7. While no voucher from the Mt Mason project area is reported, a specimen of the species from within the proposed mine access road alignment is vouchered (PERTH 8423490, P. Knapton 47, 9/4/2018). The identification of this specimen has been reviewed and is not in doubt (Dr. Barbara Rye, pers. comm.). However, the location information is queried as the associated species noted with the specimen do not occur within the Mt Mason Study Area. It is suggested that the location notes accompanying the specimen and the coordinate given are inaccurate, Figure 7.

Figure 7. *Hysterobaeckea longipes* records in WA



3.1.4. Species Not Fully Identified

Previous reports on flora and vegetation of tenements held by Jupiter Mines also reported the following species which have not been fully identified, Table 8. While these have not been fully identified due to unavailability of suitable material following survey, the majority of these may not represent species with conservation significance, however, some require review.

Table 8. Species Previously Reported but Not Fully Identified

Species	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Native Vegetation Solutions (2013)	Issue
Corchorus sp.	1			No Corchorus in this region, specimen not vouchered at WAHERB
Liliaceae sp.	1			Not vouchered at WAHERB
Poaceae (Poa) sp. PA07/506	1			Not vouchered at WAHERB
Drosera sp. (P.G. Armstrong 07/545)	1			Specimen at WAHERB (PERTH 07801823) Now considered *Drosera eremaea* P3
Apocynaceae sp.		1		Not vouchered at WAHERB
Corchorus sp.		1		No Corchorus known in the region. Not vouchered at WAHERB
Eucalyptus sp. (sterile)		1		Not vouchered at WAHERB
Podolepis sp. (ATQ14-6)			1	Not vouchered at WAHERB
Eucalyptus sp. (sterile)			1	Not vouchered at WAHERB
Goodenia sp.			1	Not vouchered at WAHERB
Myrtaceae sp. #3 (ATQ120-7)			1	Not vouchered at WAHERB
Unknown sp. (unknown family).			1	Not vouchered at WAHERB
Haloragis sp.			1	Not vouchered at WAHERB
Eucalyptus sp.			1	Not vouchered at WAHERB
Alectryon oleifolius			1	Not vouchered at WAHERB, NO SUBSP noted, likely subsp. canescens
Frankenia sp.			1	Not vouchered at WAHERB
Sclerolaena sp.			1	Not vouchered at WAHERB
Psydrax sp.,			1	Not vouchered at WAHERB
Calandrinia sp.			1	Not vouchered at WAHERB
Sida sp.			1	Not vouchered at WAHERB
Hibiscus sp.			1	Not vouchered at WAHERB

3.1.5. Possible Mis-identifications of Flora

Four species previously reported represent possibly mis-identifications of flora, Table 9. None of these have conservation significance.

Table 9. Potential Misidentifications of Flora within Previous Consultants' Reports

Species Reported	Likely Correct Corrected Identification	P.G. Armstrong & Associates (2008)	Native Vegetation Solutions (2012)	Native Vegetation Solutions (2013)
Acacia ramulosa	*Acacia cockertoniana* (BIF endemic)	1		
Minuria cunninghamii	*Olearia humilis* (Occurs on BIF and Laterite)	1		
Eucalyptus lesouefii	*Eucalyptus* aff. *lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) – newly recognised species, widespread	1		1
Eucalyptus salubris	*Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683).	1		1

The possible misidentification of *Acacia cockertoniana* and *Olearia humilis* in P.G. Armstrong & Associates (2008) is corrected in Native Vegetation Solutions (2012). *Eucalyptus* aff. *lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) is a recently recognized species (mid 2020) which is widespread in the northern portion of the range of *E. lesouefii* (Malcolm French, pers. comm.) and not considered to warrant conservation listing. *Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683) is a newly recognised species allied to *E. salubris* and is widespread south-west of Menzies to near Forrestania (Malcolm French, pers. comm.).

3.1.6. Declared Pests

No species listed as Declared Pests in Western Australia have been reported within or adjacent to the Mt Mason Study Area. However, a population of *Opuntia* sp. (Prickly Pear) is known at the turnoff into the Mt Mason project off the Leonora Road at the abandoned Mt Ida minesite. This site lies outside the current Study Area and has not been addressed. This weed species should be addressed in any development proposal incorporating upgrading the road into the Mt Mason area from the Leonora Road.

3.1.7. Weeds of National Significance (WONS)

As noted above, a population of *Opuntia* sp. (Prickly Pear) is known at the turnoff into the Mt Mason project off the Mt Ida Road at the abandoned Mt Ida minesite. This site lies outside the current Study Area and has not been addressed. *Opuntia* species (Prickly Pears) are listed as

Weeds of National Significance (WONS). The *Opuntia* sp. cacti should be addressed in any development proposal incorporating upgrading the road into the Mt Mason area from the Leonora Road.

3.1.8. Threatened and Priority Ecological Communities

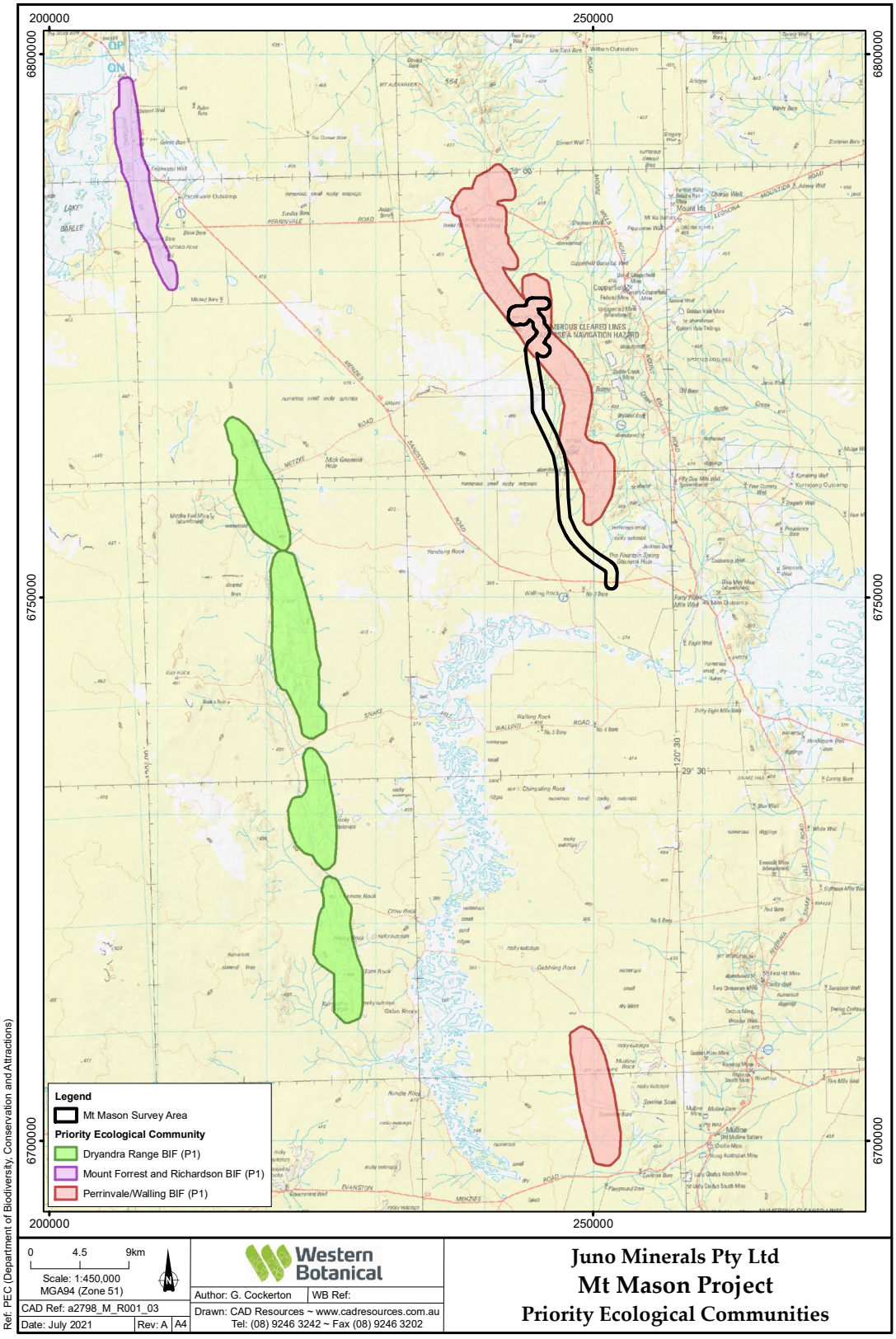
No Federally or State Listed Threatened Ecological Communities were identified within the Study Area.

The orebody areas and northern parts of the proposed mine access road and the camp area all lie within the 14,607.17 ha Perrinvale/Walling vegetation assemblages (banded ironstone formation) Priority 1 Priority Ecological Community. Tenements held by Juno Minerals are located within the central and southern parts of this PEC, Figure 8.

It is expected, upon evaluation, that some vegetation associations of the Study Area may be regionally restricted, particularly those associated with the geology of the BIF ranges and associated laterite-capped low hills and the erosion products from these ranges. These will most likely be widespread within similar landforms in the Mt Mason / Mt Ida area.

It is not expected that vegetation associations associated with (i) Archaean granite breakaways, (ii) aeolian sandplains or (iii) broad drainage tracts would be considered to fall within the definition of the PEC.

Figure 8. Priority Ecological Communities of the Region



3.2. Results of the Field Survey

3.2.1. Landforms

The Mt Mason Study Area includes the following landforms.

- Low banded ironstone formation (haematite) hills (two to three parallel series) of moderate relief, estimated at 20 to 75m above the surrounding plains, with moderate outcrop and small areas of tallus slopes;
- Colluvial slopes with laterite gravel, angular BIF colluvium and minor outcrop;
- Lower slopes with lateritic gravely and sandy lateritic gravely textures, colluvium and alluvium;
- Small, disjunct low rises of weathered ferruginous duricrust;
- Subcropping weathered, fractured basalt and gabbro with associated calcrete concretion;
- Aeolian yellow sandplain west of the orebody area;
- Aeolian orange sandplain on top of weathered Archaean granite plateaux;
- Minor occurrences of weathered Archaean granite plateaux, low breakaway cliffs of 2 to 5m relief, kaolinitic footslopes and associated saline plains with coarse silty sand soils; and
- Narrow to broad drainage lines, extensive alluvial floodplains and areas subject to sheet flow, often with a mantle of shallow red silty sand.

3.2.2. Vegetation Mapping

Field survey at Mt Mason to date has recognised eighteen vegetation associations at the NVIS Level V *Association* where three dominant species in each stratum is used to define vegetation associations. Of these:

- Ten are *Acacia* Woodlands, ranging from tops of BIF ridges to low lying drainage tracts;
- One is a *Casuarina* Woodland on outcropping calcrete over basalt;
- Five are eucalypt woodlands with either calcrete influenced soils or on clay;
- One represents a low shrubland with emergent *Acacia* over *Calytrix erosipetala* or *C. desolata* and *Hibbertia arcuata* shrubs on lateritic duricrust outcrops.
- One represents a saline flat supporting *Frankenia setosa* low shrubs below an Archaean granite breakaway.

These are summarised in Table 10.

Table 10. Vegetation Associations of the Mount Mason Study Area

Influencing Geology / Soil	Structural Formation	Vegetation Association Code	Vegetation Association Name
Banded Ironstone outcrop and subcrop	Acacia (Mulga) Woodlands	A1	*Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura* (narrow phyllode form) Woodland over *Thryptomene decussata*, *Prostanthera althoferi* subsp. *althoferi*, *Hibbertia arcuata, Olearia humilis* Shrubland on BIF outcrop and upper slopes
Lateritised Duricrust, minor Banded Ironstone	Acacia (Mulga) Woodlands	A2	*Acacia incurvaneura* and *Acacia quadrimarginea, Acacia cockertoniana* over *Philotheca brucei, Hibbertia* arcuata, Pros*tanthera althoferi* subsp. *althoferi* and *Dodonaea rigida* on BIF outcrop and upper slopes
Colluvial sandy BIF and laterite gravel	Acacia (Mulga) Woodlands	A3	*Acacia incurvaneura, A mulganeura, A. caesaneura* over *Eremophila forrestii* subsp. *forrestii* on sandy gravely mid to lower slopes
Weathered basalt, calcrete	Acacia (Mulga, Acacia sibirica) woodlands	A4	*Acacia sibirica* Woodland over *Dodonaea lobulata, Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) on weathered basalt and calcrete
Aeolian Sandplain over gravel	Acacia (Mulga) Woodlands	A5	*Acacia effusifolia* with emergent *Eucalyptus leptopoda*, *E. ewartiana* Mallees on orange-brown sandplain
Exfoliating granite outcrop and subcrop	Acacia (Mulga) Woodlands	A6	*Thryptomene costata* Shrubland with emergent *Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa, A. cockertoniana* small trees on granite sheets and exfoliating outcrop
Archaean granite breakaway plateaux	Acacia (Mulga) Woodlands	A7	*Acacia cockertoniana, A. quadrimarginea, A. ramulosa* subsp. *ramulosa, Calytrix erosipetala, Hibbertia arcuata, Ptilotus obovatus* (typical goldfields form) on lateritic duricrust hills and outcrops
Aeolian sandplain over laterite gravel	Acacia (Mulga) Woodlands	A8	*Callitris columellaris, Acacia ramulosa* subsp. *ramulosa, Eucalyptus leptopoda* mallee on orange-brown sandplain
Hardpan plain, sheet wash,	Acacia (Mulga) Woodlands	A9	*Acacia incurvaneura, A. ramulosa* subsp. *ramulosa, A. tetragonophylla, A.* mulganeura over *Ptilotus obovatus* (typical Goldfields form) on hardpan plains, colluvium and alluvium
Drainage focus, hardpan and clay soil	Acacia (Mulga) Woodlands	A10	Drainage line Mulga Shrublands
Weathered basalt, calcrete	Casuarina pauper woodland	C1	*Casuarina pauper* Woodland over *Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) Shrubland on weathered basalt and abundant calcrete
Weathered basalt, calcrete	Eucalypt woodlands	E1	*Eucalyptus* aff. *lesouefii* Woodland over *Eremophila pantonii* Shrubland on weathered basalt and abundant calcrete
Drainage focus, clay soil	Eucalypt woodlands	E2	*Eucalyptus* aff. *salubris* woodland on red-brown clay, alluvium
Colluvial plains, sandy clay soils	Eucalypt woodlands	E3	*Eucalyptus oleosa* emergent over *Acacia incurvaneura* and *Acacia cockertoniana* Woodland
Colluvial plains, sandy clay soils	Eucalypt woodlands	E4	*Eucalyptus oleosa, Acacia caesaneura* over *Acacia ramulosa* subsp. *ramulosa* over *Eremophila forrestii* subsp. *forrestii*, on shallow sandy profiles over hardpan plains, colluvium and alluvium
Sandy clay soils	Eucalypt woodlands	E5	*Eucalyptus horistes* over *Acacia ramulosa*, *A. hemiteles, Senna artemisioides* subsp. *filifolia* on sandy clay

Influencing Geology / Soil	Structural Formation	Vegetation Association Code	Vegetation Association Name
Lateritised duricrust, minor BIF and quartz outcrop	Low Shrublands with emergent Acacia, Allocasuarina	S1	*Hibbertia arcuata*, occasionally with *Calytrix* spp. Shrubland with emergent *Acacia cockertoniana, A. quadrimarginea, Allocasuarina acutivalvis* subsp. *acutivalvis* tall shrubs on lateritic duricrust outcrop
Saline plains, kaolinitic sandy clay	Low Shrublands with Emergent Acacia, Allocasuarina	S2	*Frankenia* Shrubland on saline stony plain with kaolinitic soil

Descriptions of these communities are presented in Appendix 4 and the communities are depicted on the Vegetation Maps presented in Appendix 2.

3.3. Flora

The cumulative species list for the Mt Mason Study Area stands at 252 species inclusive of 48 families, 124 genera and 252 taxa. A systematic Species List for the Mt Mason Study Area as recorded in the 2021 field surveys is presented in Appendix 3 and a Species Vs Quadrats table is presented in Appendix 8. Of the total species list, 222 have been fully identified leaving 30 specimens not fully identified to species level (noted as "Indet."). The specimens not fully identified in this study include a range of annual herbs in the families Asteraceae and Goodeniaceae (*Goodenia* spp.) and Montiaceae (*Calandrinia* spp.) which were collected during the early August field surveys and these lacked sufficient characters to be able to fully identify material. An effort was made in the mid October Targeted Survey to re-collect these specimens, however, the dry seasonal conditions prevailing at that time meant annuals were not able to be recognised. One specimen of a perennial shrub resembling *Rhagodia eremaea* was also not able to be verified. *Rhagodia* are notoriously difficult to differentiate and the genus is undergoing taxonomic review. These specimens are largely an artefact of the time of field survey and prevailing seasonal conditions. They do not resemble any known Significant Flora of the region and are not considered to warrant further consideration.

The majority of the flora represents species that are well known and widespread in the region and are not considered significant species. Fourteen well known species which are none the less not formally described are also present within the Study Area. These are listed in Appendix 3 as "Undescribed" and are not discussed further.

Two widely distributed and regionally abundant but novel *Eucalyptus* species have been confirmed within the Study Area. These are listed in Appendix 3 as "*Eucalyptus* aff. *lesouefii* (G. & S. Cockerton WB40262)" and "*Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683)". Both have been confirmed by eucalypt specialist Malcolm French and are discussed in Appendix 7. Both are widespread in the southern part of the eastern Murchison and central Coolgardie biogeographic regions respectively and are the subject of further taxonomic studies by Malcolm French, Dean Nicole and the WA Herbarium (M. French pers. comm.).

A third novel species, *Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281), is abundant on calcareous souls within the Mt Mason Study Area and also more widely in the region eastwards to Laverton. It lies within the *Ptilotus obovatus* complex and is under review by Kevin Thiele at the WA Herbarium. It is not regarded as warranting conservation listing.

These are briefly discussed under Significant Flora.

3.3.1. Significant Flora

Significant Flora of the Study Area include conservation listed species, potentially novel taxa, records representing significant range extensions. Six Priority Flora and three Species of Interest are known within the Study Area.

Priority 1 Flora

- *Jacksonia lanicarpa* P1 is known from hardpan plains in the proposed mine access road alignment 17.4 km south of the proposed mine site and can be avoided with adequate buffer.

Priority 3 Flora

- *Calytrix hislopii* P3 are present populations on low lateritic duricrust rises which all lie outside areas of proposed development in the region between the orebody area and the Camp Cassini site.

- A large *Philotheca coateana* P3 population occurs on sandplain west of the Camp Cassini site and lies outside the area of the proposed Development Envelope.

- *Calotis sp. Perrinvale* (R.J. Cranfield 7096) P3 is known from two sites, point records, on the central banded iron formation ridge within the orebody area.

- *Drosera eremaea* P3 populations, inclusive of *Drosera* aff. *eremaea* for purposes of this discussion, are infrequent on banded ironstone and abundant on exfoliating granite landforms within and outside of the proposed disturbance footprints as well as near the Mt Magnet townsite.

- *Menkea draboides* P3 is known in small numbers on exfoliating granite landforms from outside the proposed disturbance footprint near the Camp Cassini site.

Species of Interest

- *Eucalyptus* aff. *lesouefii* (G. & S. Cockerton WB40262)

- *Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683)

- *Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281)

Locations of the Priority Flora species are presented in Figure 9.

Maps of the Priority Flora recorded during the current survey are presented in the discussion of each species and their locations are presented in the IBSA data associated with this project. Locations of Species of Interest are not depicted specifically as they are widespread within the vegetation communities that each of these species define. Their distribution within the Study Area is shown in the Vegetation Maps presented in Appendix 2.

Of these six species, *Drosera eremaea* P3 was particularly abundant where recorded. The detailed and extensive surveys of *Drosera eremaea* implemented by Juno have resulted in a re-evaluation of this species and its allies by Skye Coffey, WA Herbarium, resulting in the numbers and distribution of *Drosera eremaea* being far greater than previously known. Consequently, a re-evaluation of the Conservation Status of this species was undertaken by DBCA in November 2021 resulting in the species be re-evaluated as meeting the criteria for Priority 3 status on 25th November 2021 (C. Bourke pers. comm.).

Hibiscus sp. Perrinvale Station (P1) identified in the Desktop Study was not observed within the Study Area during the 2021 field surveys.

Figure 9. Overview of Locations of Significant Flora within and Adjacent to the Mt Mason Study Area.

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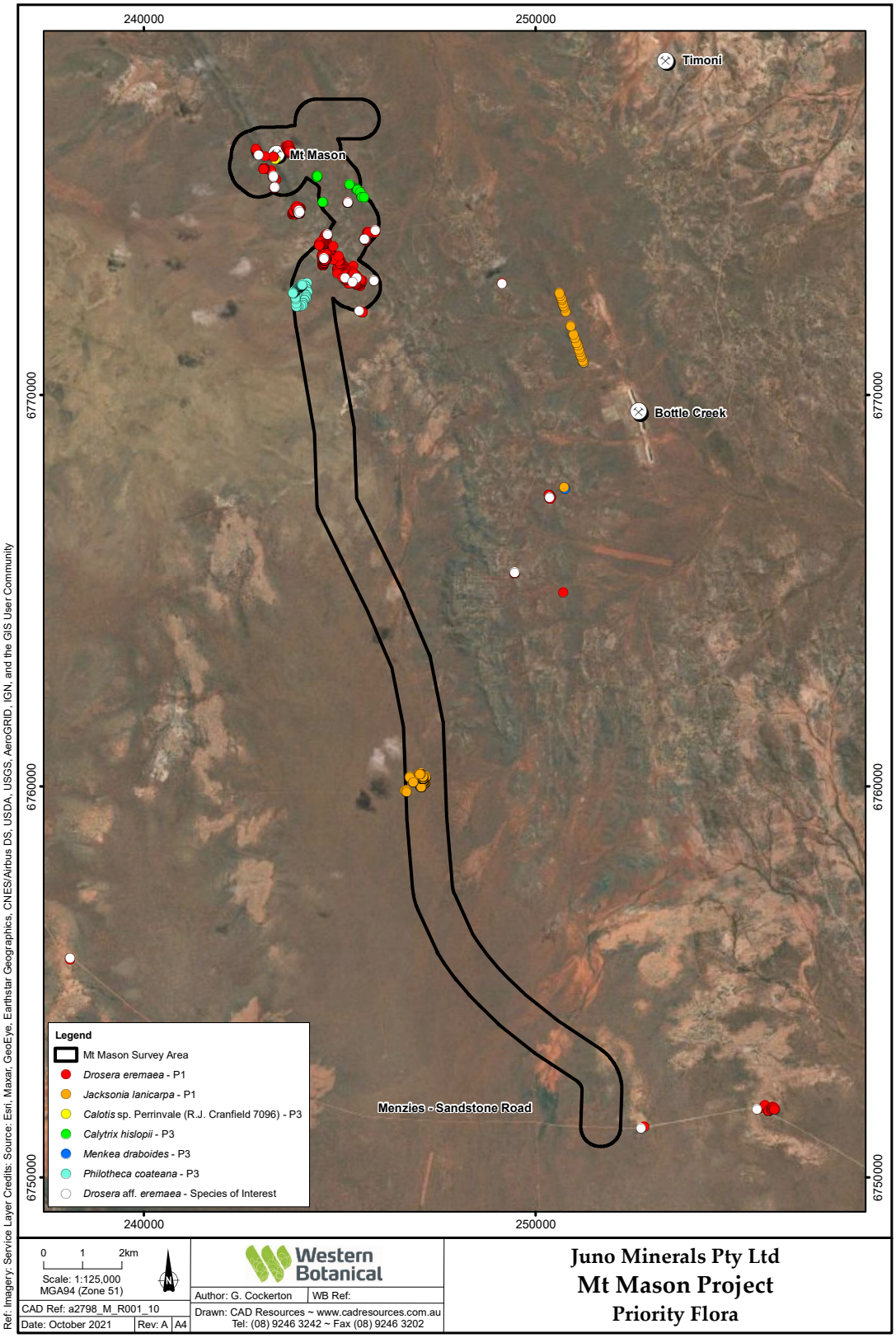


3.3.2. Weeds

Minor occurrences of minor weed species were recorded at the Mt Mason Study Area. These were limited to two minor weed species *Cleretum papulosum* and *Mesembryanthemum nodiflorum* (Slender Iceplant) and both were observed in small populations of a few plants on the BIF range within the A1 vegetation association. Both are widespread and now considered naturalised in southern Western Australia and neither are listed as weeds of National Significance (WONS). These are not discussed further.

3.3.3. Vegetation Condition

Vegetation Condition excluding areas that have been previously cleared for Pastoral management and or mining exploration are considered to be in Pristine Condition and displaying normal characteristics for the prevailing seasonal conditions. While not specifically assessed, areas previously cleared for exploration have been rehabilitated and casual observations indicated excellent recruitment of a wide range of local native species of representing all strata of the surrounding vegetation. Inclusive of tracks and rehabilitated drill pads, the entire Study Area would be considered in Excellent Condition.

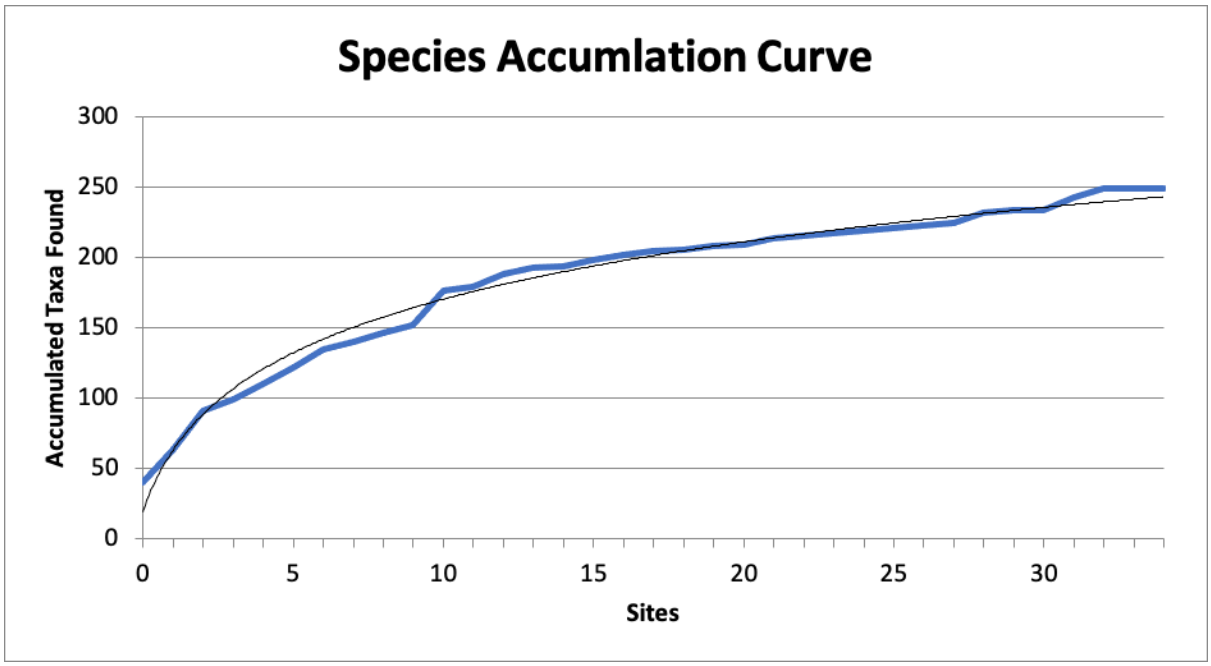
3.4. Survey Effort

The northern part of the Mt Mason Study area, inclusive of the orebody and infrastructure areas inclusive of the Camp Cassini site, have been assessed utilising quadrats, traverses and relevés. The region incorporating the proposed explosives magazine and the majority of the proposed access road have been assessed at a reconnaissance level utilising traverses and relevés. The population of *Jacksonia lanicarpa* adjacent to the proposed access road alignment was assessed in detailed in a Targeted Survey. Quadrat locations are presented in Appendix 5 while tracks are presented in Appendix 6.

3.5. Statistical Analysis of Vegetation Associations

Of the 249 taxa included in the analysis, 209 (84%) were recorded within quadrat sites. The species accumulation curve commences at 40 to include taxa encountered opportunistically (i.e., at relevé sites and in traverses), Figure 10. The curve displays a near-asymptotic progression, demonstrating that the survey effort was likely adequate in capturing *most* of the taxa present within the Study Area.

Figure 10. Species – Area Curve for the Mt Mason Study Area

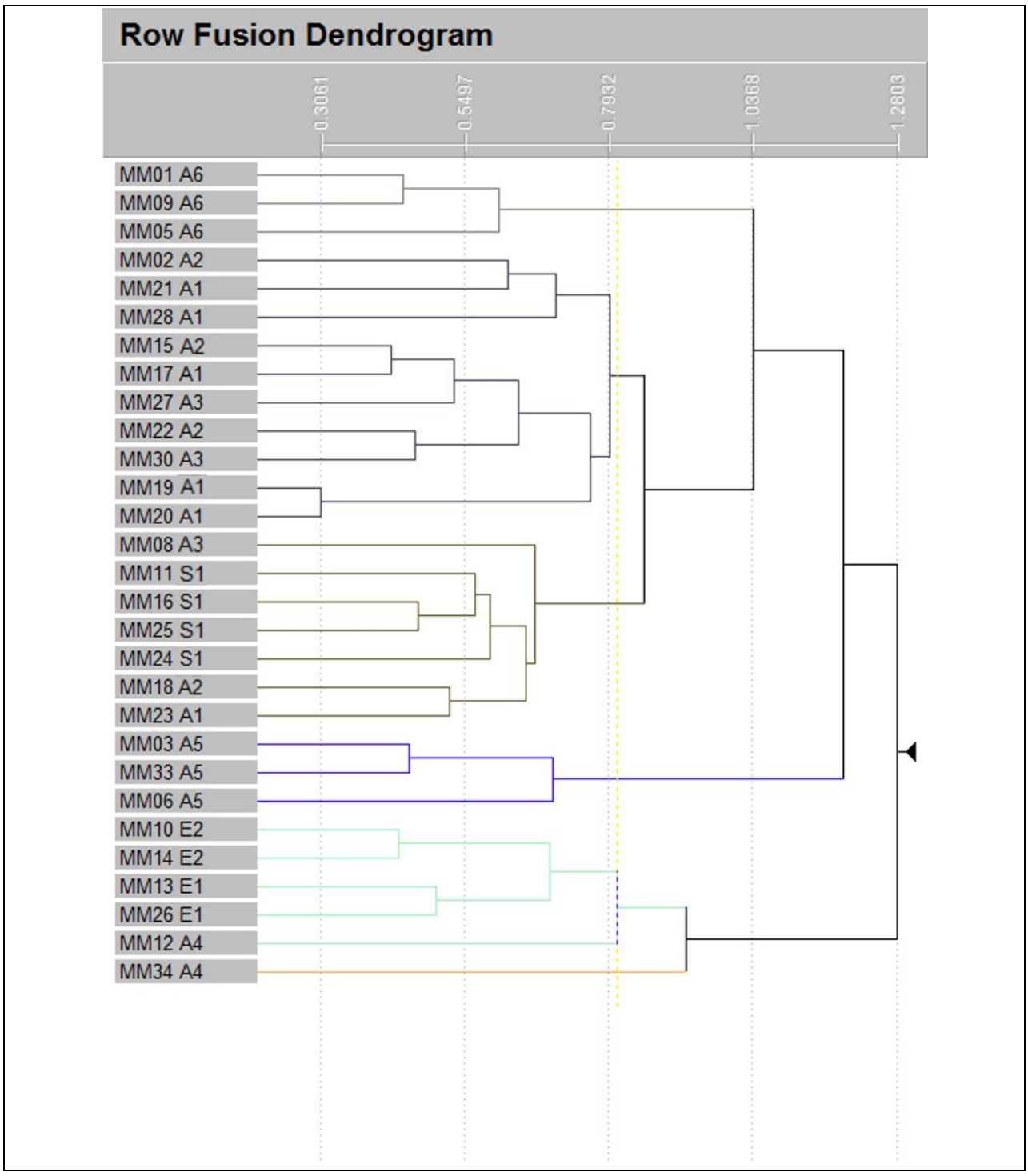


The final PATN analysis, Figure 11, incorporated a total of 29 quadrat sites. Singleton sites Q04 – *Eucalyptus oleosa* Woodlands (E4); Q07 – Mulga Woodland with *Acacia ramulosa* var. *ramulosa* (A9); Q29 – *Acacia burkittii* Shrubland; Q31 – *Frankenia* Shrubland (S3) and Q32 – *Acacia cockertoniana* - *Calytrix desolata* Shrubland (A7) were removed from the analysis to reduce bias. Non-metric multidimensional scaling (NMDS) analysis performed for 171 species from 29 sites found a stable 3-dimensional solution, generating an ordination stress value of 0.1666. This value is slightly higher than the preferred threshold of 0.15, however, the option of reducing non-discriminatory (less important) species from the analysis to reduce the final stress value was discounted, in order to preserve the original dataset and retain species important in determining finer-scale floristic units.

The PATN generated dendrogram, Figure 11, illustrates five major branches, closely corresponding to landforms encountered within the Study Area. These include; i) granite sheets supporting *Thryptomene* shrublands (A6); ii) BIF ridges supporting various Mulga woodlands (including A1, A2 & A3); iii) lateritic duricrust outcrops supporting *Casuarina*/*Acacia* spp. shrublands (S1); iv) sandplains supporting *Acacia effusifolia* shrublands (A5); v) weathered basalt supporting *Acacia sibirica* woodlands (A4), or Eucalypt woodlands (E1 & E2) in areas of deeper sand/ exposed calcrete. Statistical analyses were only conducted for Vegetation Associations with sufficient replicate sites (i.e., two or more).

The A1, A2 and A3 sites, collectively the A group (i.e., Mulga Woodlands on BIF ridges) were very closely related. All were dominated by *Acacia incurvaneura*, with varying understories related to their location and aspect of the ridges. While discrete groupings are not illustrated within the dendrogram, these groups are should still be considered as distinct Vegetation Associations.

Figure 11. PATN Generated Dendrogram of Vegetation Units, Mt Mason Study Area



Outlier sites Q08 (A2) and Q23 (A1) appear to be more closely related to the S1 group, due to these sites containing relatively higher levels of *Acacia cockertonii* and *Philotheca brucei* subsp. *brucei.* This is most likely explained by their location in the landscape; Q23 being positioned on a markedly lower BIF ridge to the west of the major BIFs within the study area and Q08 being positioned to the south.

The dendrogram also strongly supports the S1 (*Allocasuarina acutivalvis – Acacia* spp. Shrubland on lateritic duricrust), A5 (*Acacia effusifolia* Shrubland) and A6 (*Thryptomene costata* Shrubland)

Vegetation Associations. The E1 (*Eucalyptus* aff. *lesouefii* Woodland) and E2 (*Eucalyptus* aff. *salubris* Woodland) Vegetation Associations are also supported by the dendrogram, however, both require additional quadrat sites.

The A4 sites are not closely related. Further quadrating is required for these sites, as well as others containing fewer than three quadrat sites.

A table of analysis notes is presented in Table 11.

Table 11. Key Discussion Points of Statistical Analysis

Veg Code	Analysis comments	# Quadrats
A1	Strong group determined by the dominance of *Acacia incurvaneura.* Sites intermingled with A2 and A3 sites to form a broader group encompassing all Mulga woodland on BIF ridges. Two outliers (Q08 and Q23) more closely related to the S1 association due to high levels of *Acacia cockertonii* and *Philotheca brucei.*	6
A2	Perfect group; sites interspersed within the major A group encompassing all Mulga woodland on BIF ridges.	3
A3	Moderate group determined by the dominance of *Acacia incurvaneura over Eremophila forrestii* subsp. *forrestii* & *Prostanthera althoferi* subsp. *althoferi*. Sites fall within the major A dendrogram grouping. Insufficient number of quadrats established.	3
A4	Weak group. Sites not closely related (i.e., joined beyond threshold). Insufficient number of sites. Q34 does not contain *Acacia sibirica.*	2
A5	Perfect group determined by the dominance of *Acacia effusifolia.*	3
A6	Perfect group determined by the dominance of *Acacia quadrimarginea* and *Thryptomene costata*.	3
E1	Good group. Determined by dominance of *Eucalyptus lesouefii.* Insufficient number of quadrat sites.	2
E2	Good group. Determined by dominance of *Eucalyptus salubris*. Insufficient number of quadrat sites.	2
S1	Perfect group; determined by the dominance of *Acacia cockertoniana* & *Acacia incurvaneura* over *Philotheca brucei* subsp. *brucei*.	4

3.6. Impact Assessment, Significant Flora

An assessment of potential impacts on Significant Flora is presented in Table 12.

This shows that the Mount Mason project has:

Nil impacts on:

Calytrix hislopii P3;

Philotheca coateana P3; and

Menkea draboides P3.

However, a caveat on *Menkea draboides* P3 is acknowledged and individuals may occur within the proposed Camp Cassini expansion area, Appendix 7.

Minor impacts to

Jacksonia lanicarpa P1:

3 plants of the local population of 207 plants within the proposed mine access road alignment, or

3 of the minimum of 427 plants that can be enumerated in the 8 populations known to date.

Impacts to this species can be avoided altogether if the proposed mine access road is realigned 50m to the east at abut 17.4 km south of the Mt Mason orebody area.

Calotis sp. Perrinvale (R.J. Cranfield 7096) P3:

Two small locations of this small annual are within the proposed Mt Mason orebody area and can not be avoided. An estimated 20 plants may occur here. *Calotis* sp. Perrinvale is known from 21 populations regionally and is likely under-surveyed at all sites. Potential impacts represent 8.7% of the known regionally occurring populations and 100% of the local population known to date.

Moderate Impacts to:

Drosera eremaea P3 (inclusive of *Drosera* aff. *eremaea*):

The project currently impacts 4,804 plants of *Drosera eremaea* at the orebody, waste rock landform, ROM and infrastructure areas as well as at the Camp Cassini site. This represents an impact to 12.5% of regionally known number of populations and 16.0% of the regionally known numbers of this species. However,

the species is regarded as likely being far more abundant at all sites where it occurs than current information indicates.

The works commissioned by Juno Minerals has led to a re-evaluation of the taxonomic status of *Drosera eremaea* with the species now being recognised as far more abundant and widespread than previously understood.

This has led to a review of the Conservation Status of the species by the DBCA's Species and Communities Branch and listing of the species as Priority 3 in November 2021 (Cathy Bourke pers. comm.). This may be further downgraded in future as the species is found to be more abundant where it has been recorded.

Table 12. Impacts to Significant Flora

Species sorted in order of decreasing Conservation Status and then alphabetically:

	Regional					Number of plants / populations known at Mt Mason, Outside Development Envelope				Impacts to known plants / populations at Mt Mason, Within Development Envelope			
Taxon	# Populations Florabase	# Additional Populations WB records	Total # Populations	Min. # Plants	% of Plants	# Populations	Min. # Plants	% of Known Populations	% of All Known Plants	# Sub-Populations	# Plants	% of Known Populations	% of All Known Plants
Jacksonia lanicarpa P1	6	2	8	427	100%	1	407	12.5%	95%	1	3	12.5%	0.7%
Calytrix hislopii P3	8	3	11	137	100%	3	121	27.3%	88%	0	0	0.0%	0.0%
Calotis sp. Perrinvale (R.J. Cranfield 7096) P3	21	2	23	n/a	100%	0	n/a	0	0.0%	2	20	8.7%	n/a
Drosera eremaea P3	32	0	32	30,038	100%	8	18,265	25.0%	61%	4	4,804	12.5%	16.0%
Menkea draboides P3	9	3	12	n/a	100%	3	50	25.0%	n/a	0	0	0.0%	0.0%
Philotheca coateana P3	12	1	13	1,068	100%	1	500	7.7%	47%	0	0	0.0%	0.0%

4. Assessment Against the 10 Clearing Principles

Principle (a) – Native vegetation should not be cleared if it comprises a high level of biological diversity.

The Mt Mason Study Area is known to support 250 native species and two minor weeds. It comprises 18 vegetation associations over an approximately 26 km north-south alignment and includes banded ironstone outcrop, colluvial slopes, Lateritised duricrust and outcropping basalt undulating landscapes, aeolian sandplains and depositional hardpan plains. The species richness of each community ranges from 8 to 35 species per vegetation association with a mean of 22.14 and a Std Dev of 6.62. This is considered within the expected range for projects of similar magnitude in a similar region in the southern Murchison biogeographic region.

The Project is not at variance with this principle.

Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

While the Study Area has habitat value for fauna endemic to the area, the area of impact is relatively small in relation to the overall area of the adjoining similar habitats in the area.

The Project is not at variance with this principle.

Principle (c) – Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

No Threatened (Rare) Flora were observed or are expected to occur within the Study Area. While Priority Flora are known, development of the project will not result in any significant increase in the threat level to any of these species.

The Project is not at variance with this principle.

Principle (d) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community.

No Threatened Ecological Communities are known within or adjacent to the Study Area. The Study Area does intersect the 14,429.24 ha "Perrinvale/Walling vegetation complexes (banded ironstone formation)" Priority 1 PEC with 75.14 ha of the PEC as currently mapped falling within the Development Envelope, representing 0.51% of the PEC.

The Project is not at variance with this principle.

Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

The study Area lies within a large area of uncleared vegetation that is subject to Pastoral activities and small, disjunct mining operations.

The Project is not at variance with this principle.

Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

No wetlands or watercourses are associated with either Study Area. The proposed access road does traverse an area of Mulga Woodland on hardpan plain subject to sheet wash. Management of drainage in this region to maintain ecological flows following heavy rainfall can be engineered.

The Project is not at variance with this principle.

Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

The Development Envelope is relatively small and abut extensive uncleared vegetation. If developed with care, development of the proposal should not cause or exacerbate land degradation outside areas of direct clearing.

The Project is not at variance with this principle.

Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

No Conservation Reserves are located immediately adjacent to either Study Area.

The Project is not at variance with this principle.

Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

The Development Envelope is relatively small and abuts extensive uncleared vegetation. If developed with care, development of the proposal should not cause deterioration in the quality of surface or underground water.

The Project is not at variance with this principle.

Principle (j) – Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

The Development Envelope is relatively small and abuts extensive uncleared vegetation. If developed with care, development of the proposal should not cause, or exacerbate, the incidence of flooding.

The Project is not at variance with this principle.

5. Limitations

Limitation	Discussion
Available sources of contextual information	Reasonable contextual information was available for the Mount Mason Study Area. Previous Consultant's reports and publicly available data was useful in preparing for field operations in 2021. This is not a Limitation for the proposal
The Scope of the survey	The current surveys included reconnoitre, gap analysis, vegetation mapping, quadrats and a Targeted Flora survey within the infrastructure areas and the northern part of the proposed mine access road. The southern part of the proposed mine access road has only been assessed in a Reconnaissance survey to date with on section having been assessed in a Targeted Survey for *Jacksonia lanicarpa* P1. The level of survey in the southern part of the proposed mine access road is a Limitation for the proposal.
Proportion of flora collected and identified	Perennial flora of the Mount Mason has been reasonably well addressed in current surveys. The overall species list stands at 252 species which is reasonably representative of that expected in similar landforms in this region. Thirty specimens remain not fully identified, primarily as the material collected in the early August 2021 surveys was immature and not in flower. None of the specimens resemble any Significant Species known in the region.
Completeness and further work which may be needed	While previous botanical assessments have been conducted at Mt Mason, the areas assessed do not comply with EPA Guidance 2016 requirements throughout the Study Area. The following are still required to meet Guidance 2016: • Establishment of additional quadrats for adequate representation, replication and subsequent statistical analysis of data. • Finalisation of flora collections and identifications of some species within the Study Area and Development Envelopes. This is a minor Limitation for the proposal.
Mapping reliability	Vegetation mapping has been completed in the field to NVIS Level 5 *'Association'* using 1:10,000 aerial photography and the descriptions and boundaries of communities are considered sufficiently accurate to define the Vegetation Associations of the Study Area. However, the proposed mine access road alignment south of the Camp Cassini site has largely been assessed in a Reconnoitre level of survey. A targeted survey was undertaken at the site where *Jacksonia lanicarpa* was recorded. Mapping reliability would be increased within the southern portion of the mine access road following a detailed survey. This is a minor Limitation for the proposal.
Timing: weather, season	The Autumn 2021 surveys at Mount Mason Study Area was undertaken under dry seasonal conditions. This allowed most perennial species to be accurately identified confidently.

Limitation	Discussion
	Subsequent additional surveys in Spring 2021 allowed for a collection of a broad range of annuals, and was specifically timed to target *Drosera eremaea* in flower, and later in fruit. The timing of subsequent field survey in October 2021 was too late to allow for effective survey for *Calotis* sp. Perrinvale Station P3. This is a minor Limitation for the proposal.
Disturbances	Disturbances at Mount Mason were limited to previously rehabilitated exploration areas and to currently serviceable tracks. This is not a Limitation for the proposal.
Intensity	While vegetation mapping within the Mount Mason Study Area inclusive of a 500m buffer around planned Development Envelopes has been implemented at adequate intensity to define communities and map boundaries. The establishment of representative quadrats has not been implemented at adequate intensity to comply with EPA Guidance (2016) requirements. This is a Limitation for the proposal
Resources	Other than the level of survey undertaken within the southern section of the proposed mine access road alignment, adequate resources (field survey time) were available for the Autumn 2021 assessment at the Mount Mason Study Area. This is a Limitation for the proposal
Access	Access within the Mount Mason orebody and infrastructure areas was readily available. Access within the proposed mine access road was limited and allowed only limited access to the central and southern portions. However, both these regions have relatively uniform vegetation communities as demonstrated on aerial photography and satellite imagery of the area and the limited access here is not considered a material limitation to the vegetation mapping of these areas. This is not a Limitation for the proposal.
Experience levels	Geoff Cockerton, Principal Botanist, has 30 years' experience in assessment of flora and vegetation in the Murchison biogeographic region of Western Australia, and specifically over 16 years assessing the flora and vegetation of the Banded Ironstone formation ranges of the Yilgarn region. Jonathan Warden, Senior Botanist, has 13 years experience in assessing flora and vegetation of similar landscape to those at Mount Mason and Yunndaga Siding. Jason Paterson has 2 years experience in flora survey and has worked on several projects in the Menzies region in this timeframe. Steven Cockerton has assisted flora surveys for 7 years. Experience levels of Senior Botanists is not considered a limitation for this project.

6. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Flora Taking (Biological Assessment) Licence No. – FB62000046	**1**	**1**	**1**	**1**
Jason Paterson B.Sc. Hons (Environmental Science) Flora Taking (Biological Assessment) Licence No. – FB62000299	**1**	**1**		**1**
Steven Cockerton Flora Taking (Biological Assessment) Licence No. –FB62000300	**1**			
Jonathan Warden Flora Taking (Biological Assessment) Licence No. – FB6200044		**1**		
Dr. Margaret Collins		**1**		

7. Acknowledgements

- Dr Barbara Rye, WA Herbarium, for review of specimen of *Hysterobaeckea longipes* reportedly collected near Mt Mason.

- Dr. Kevin Thiele, WA Herbarium, for comment on the *Ptilotus obovatus* complex.

- Mr Frank Obbens is thanked for his review of *Calandrinia* specimens collected at Mt Mason.

- Mr. Malcolm French is thanked for his comments on *Eucalyptus aff. lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) and *Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683).

- Skye Coffey, WA Herbarium, for review of the taxonomy of *Drosera eremaea*, *D*. aff. *eremaea, D. macrantha* and related groups leading to a re-evaluation of the known distribution of *Drosera eremaea* in Western Australia.

- Catherine Bourke, DBCA, Species and Communities Branch, for the re-evaluation of the Conservation Status of *Drosera eremaea*.

8. Bibliography

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Appendix 1. EPA Vegetation Condition Scale

Table 2: Vegetation Condition Scale (adapted from Keighery 1994 and Trudgen 1988)

Vegetation Condition	South West and Interzone Botanical Provinces	Eremaean and Northern Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.	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	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	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	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.	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	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

10 **Technical Guidance** – Flora and Vegetation Surveys for Environmental Impact Assessment

Appendix 2. Vegetation Map for the Mount Mason Study Area

Legend

	Influencing Geology / Soil
Acacia (Mulga) Woodlands	
A1 - Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura (narrow phyllode form) Woodland over Thryptomene decussata, Prostanthera althoferi subsp. althoferi, Hibbertia arcuata, Olearia humilis Shrubland on BIF outcrop and upper slopes	Banded Ironstone outcrop and subcrop
A2 - Acacia incurvaneura and Acacia quadrimarginea, Acacia cockertoniana over Philotheca brucei, Hibbertia arcuata, Prostanthera althoferi subsp. althoferi and Dodonaea rigida on BIF outcrop and upper slopes	Lateritized Duricrust, minor Banded Ironstone
A3 - Acacia incurvaneura, A mulganeura, A. caesaneura over Eremophila forrestii subsp. forrestii on sandy gravely mid to lower slopes	Colluvial sandy BIF and laterite gravel
A5 - Acacia effusifolia with emergent Eucalyptus leptopoda, E. ewartiana Mallees on orange-brown sandplain	Aeolian Sandplain over gravel
A5 (Recent Fire)	
A6 - Thryptomene costata, T. decussata Shrubland with emergent Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa, A. cockertoniana small trees on granite sheets and exfoliating outcrop	Exfoliating granite outcrop and subcrop
A7 - Acacia cockertoniana, A. quadrimarginea, A. ramulosa subsp. ramulosa, Calytrix desolata, Hibbertia arcuata, Ptilotus obovatus (typical goldfields form) on Archaean granite plateaux and footslopes	Archaean granite breakaway plateaux
A8 - Callitris columellaris, Acacia ramulosa subsp. ramulosa, Eucalyptus leptopoda mallee on orange-brown sandplain	Aeolian sandplain over latere gravel
A9 - Acacia incurvaneura, A. ramulosa subsp. ramulosa, A. tetragonophylla, A. mulganeura over Ptilotus obovatus (typical Goldfields form) on hardpan plains, colluvium and alluvium	Hardpan plain, sheet wash, drainage areas
A10 - Drainage line Mulga Shrublands	Drainage focus, hardpan and clay soil
Acacia sibirica woodlands (was Acacia (Mulga) Woodlands)	
A4 - Acacia sibirica Woodland over Dodonaea lobulata, Ptilotus obovatus (Upright form, G Cockerton et. al. 15206) on weathered basalt and calcrete	Weathered basalt, calcrete
Casuarina woodland	
C1 - Casuarina pauper Woodland over Ptilotus obovatus (Upright form, G Cockerton et. al. 15206) Shrubland on weatehred basalt and abundant calcrete	Weathered basalt, calcrete
Eucalypt woodlands	
E1 - Eucalyptus lesouefii Woodland over Eremophila pantonii Shrubland on weatehred basalt and abundant calcrete	Weathered basalt, calcrete
E2 - Eucalyptus salubris woodland on red-brown clay, alluvium	Drainage focus, clay soil
E3 - Eucalyptus oleosa emergent over Acacia incurvaneura and Acacia cockertoniana Woodland	Colluvial plains, sandy clay soils
E4 - Eucalyptus oleosa, Acacia caesaneura over Acacia ramulosa subsp. ramulosa over Eremophila forrestii subsp. forrestii, on shallow snady profiles over hardpan plains, colluvium and alluvium	Colluvial plains, sandy clay soils
E5 - Eucalyptus sp. (mallee) over Acacia ramulosa, A. hemiteles, Senna artemisioides subsp. filifolia on sandy clay	Sandy clay soils
Low Shrublands with Emergent Acacia, Allocasuarina	
S1 - Hibbertia arcuata, occasional Calytrix spp. Shrubland with emergent Acacia cockertoniana, A. quadrimarginea, Allocasuarina acutivalvis tall shrubs on lateritic duricrust outcrop	Lateritised duricrust, minor BIF and quartz outcrop
S2 - Frankenia Shrubland on saline stony plain with kaolinitic soil	Saline plains, kaolinitic sandy clay
Other	
D - Disturbed	

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Western Botanical
Author: G. Cockerton | WB Ref:
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202

Juptier Mines Limited
Mt Mason Survey
Vegetation Legend

243000 244000 245000 246000

6777000

6776000

A4 A4 C1 S1 A4 E1 A4 A10 A2 A2 A2 A2 A2 A2 A4 A2 E1 A1 A4 S1 A4 E1 E3 A3 A1 A1 A1 S1 E1 S1 A1 A2 A2 S1 A1 S1 A1 A5 A3 A2 E1 A1 S1 A9 S1 E1 S1 S1 A2 S1

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Survey Area
- Vegetation Boundary
- *Drosera eremaea* - P1
- *Calotis* sp. Perrinvale (R.J. Cranfield 7096) - P3
- *Calytrix hislopii* - P3
- *Drosera* aff. *eremaea* - Species of Interest

Sheet Layout

N

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Scale: 1:10,000
MGA94 (Zone 50)

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Vegetation - Sheet 1 of 13

243000 244000 245000

6776000

6775000

A1 A2 A3 A4 A5 A5 (Recent Fire) A9 A10 C1 E1 E2 E3 S1

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Survey Area
- Vegetation Boundary
- *Drosera eremaea* - P1
- *Calotis* sp. Perrinvale (R.J. Cranfield 7096) - P3
- *Calytrix hislopii* - P3
- *Drosera* aff. *eremaea* - Species of Interest

Sheet Layout

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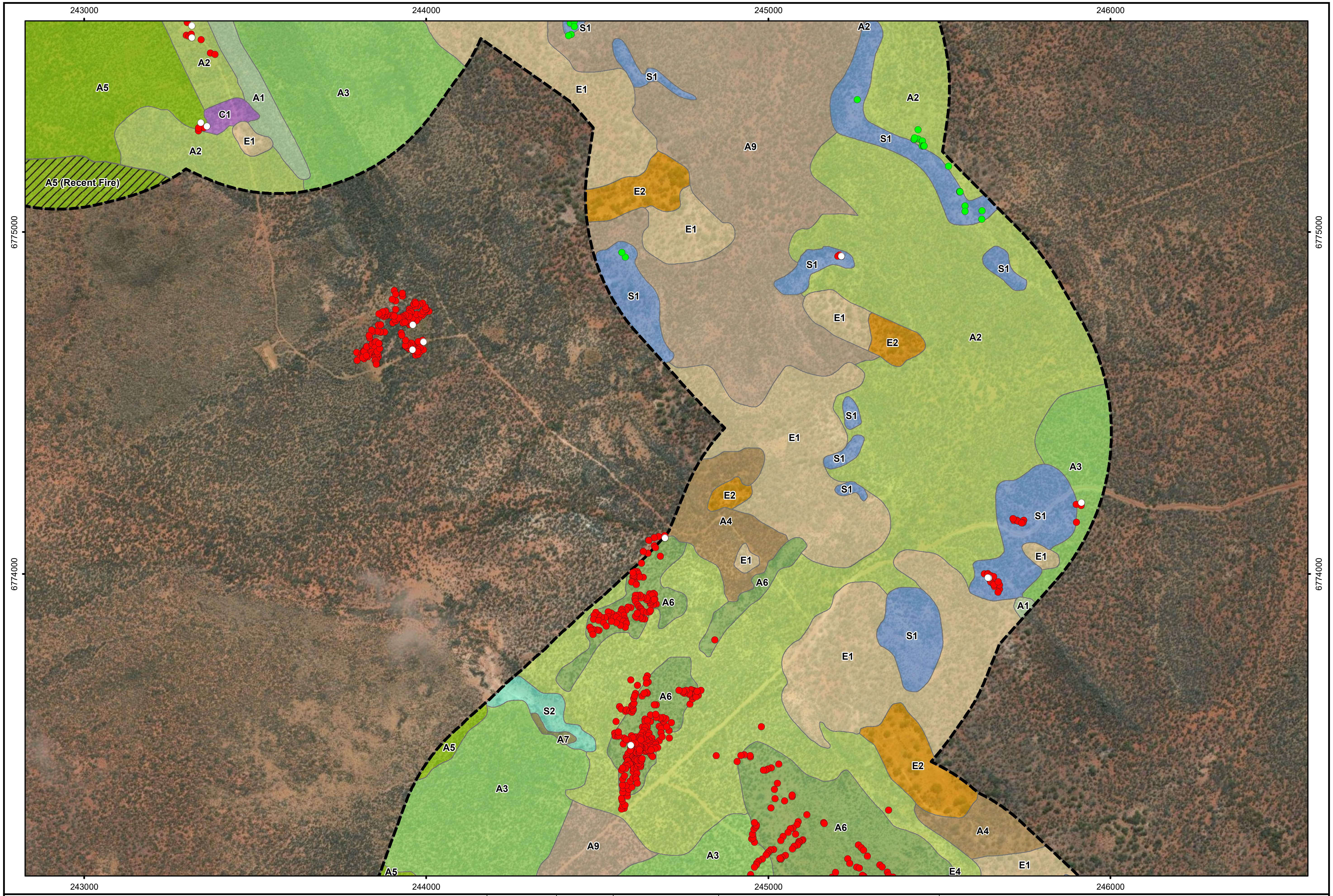
Vegetation - Sheet 2 of 13



Legend

- Survey Area
- Vegetation Boundary
- *Drosera eremaea* - P1
- *Calytrix hislopii* - P3
- *Drosera* aff. *eremaea* - Species of Interest

Sheet Layout

Scale: 1:10,000
MGA94 (Zone 50)

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Vegetation - Sheet 3 of 13

243000 244000 245000 246000

6773000 6772000 6771000

A2 A2 E2 A4 A6 A9 E1 S1 E2 A3 A5 E4 A8 A5 (Recent Fire) A6 A8 A5 (Recent Fire) A8 A5 (Recent Fire) A5

Legend

- Survey Area
- Vegetation Boundary
- *Drosera eremaea* - P1
- *Menkea draboides* - P3
- *Philotheca coateana* - P3
- *Drosera* aff. *eremaea* - Species of Interest

Sheet Layout

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Vegetation - Sheet 4 of 13

243000 244000 245000 246000

6770000

6769000

A5

A7

243000 244000 245000 246000

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Vegetation Boundary

Sheet Layout

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Scale: 1:10,000
MGA94 (Zone 50)

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Vegetation - Sheet 5 of 13

244000 245000 246000 247000

6768000 6767000 6766000

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Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Vegetation Boundary

Sheet Layout

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MGA94 (Zone 50)

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Vegetation - Sheet 6 of 13

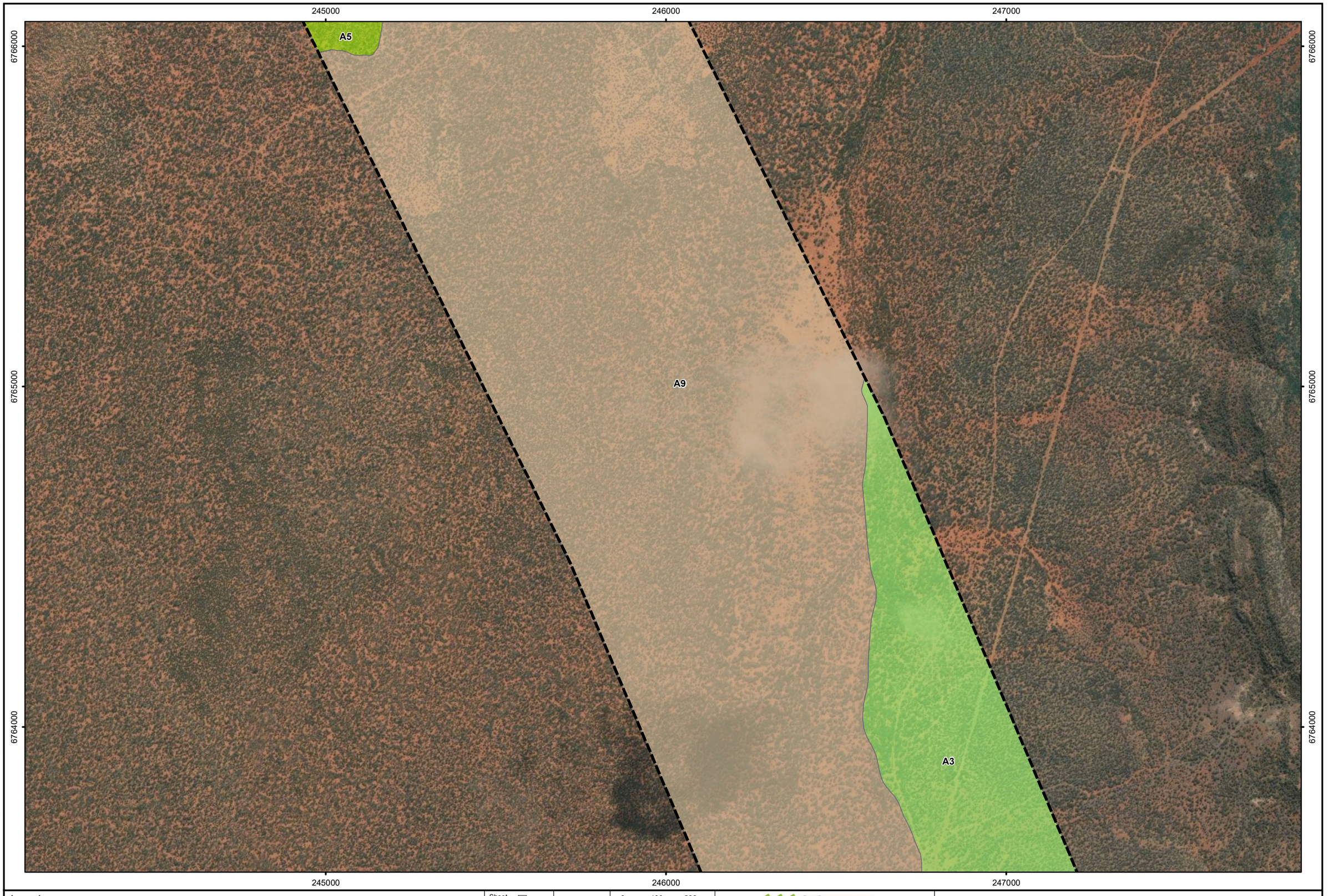

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Survey Area
- Vegetation Boundary

Sheet Layout

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Vegetation - Sheet 7 of 13

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Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Vegetation Boundary

Sheet Layout

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Vegetation - Sheet 8 of 13

246000 247000 248000 249000

6761000

6760000

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A3

A9

A9

A9

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Survey Area
- Vegetation Boundary
- *Jacksonia lanicarpa* - P1

Sheet Layout

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Vegetation - Sheet 9 of 13

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A10

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend
- Survey Area
- Vegetation Boundary

Sheet Layout

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Scale: 1:10,000
MGA94 (Zone 50)

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Vegetation - Sheet 10 of 13

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Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

Survey Area

Vegetation Boundary

Sheet Layout

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Scale: 1:10,000
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Mt Mason Survey
Vegetation - Sheet 11 of 13

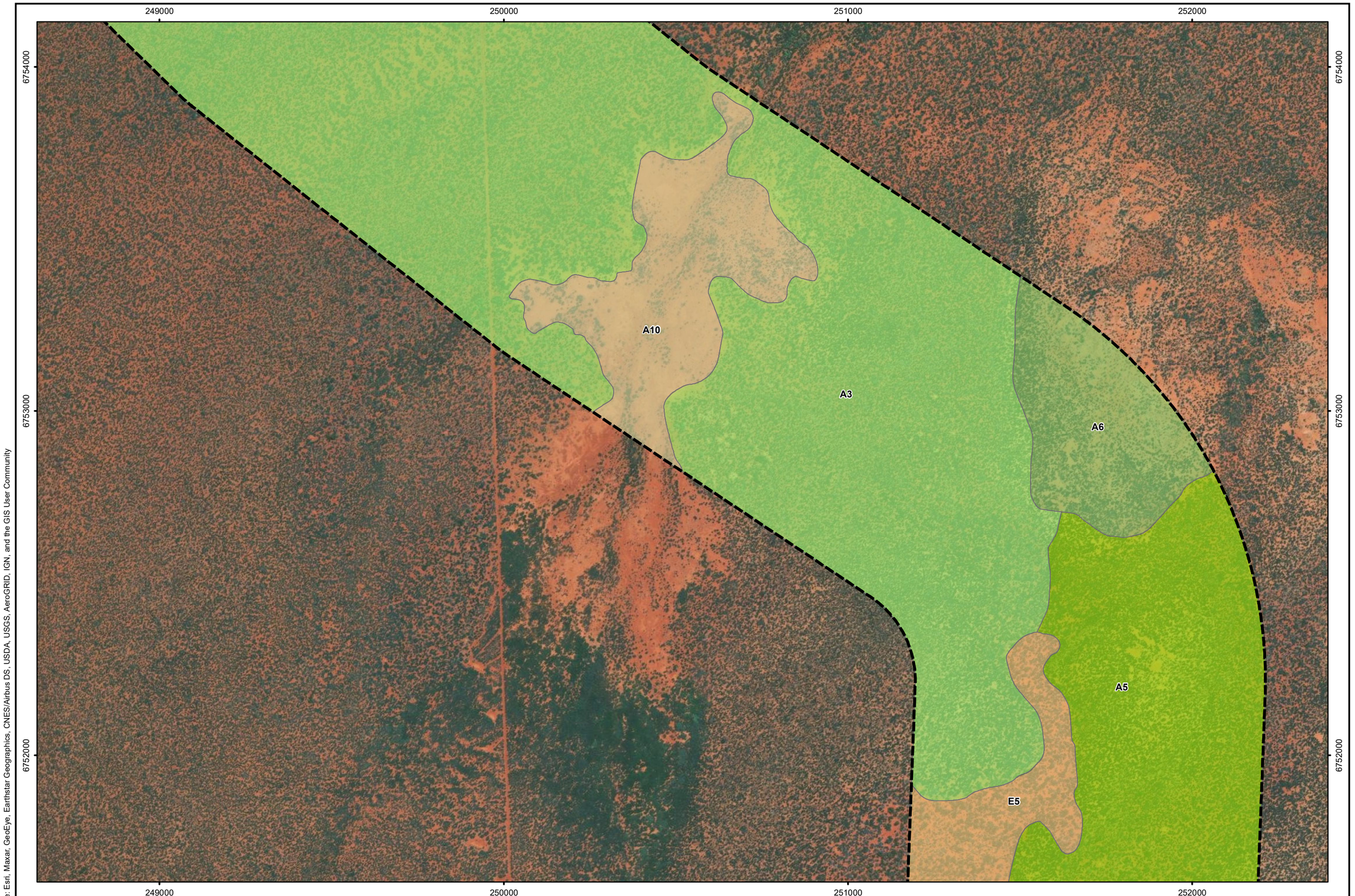

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Survey Area
- Vegetation Boundary

Sheet Layout

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Scale: 1:10,000
MGA94 (Zone 50)

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Mt Mason Survey
Vegetation - Sheet 12 of 13

Image Source: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Survey Area
- Vegetation Boundary
- *Drosera eremaea* - P1
- *Drosera* aff. *eremaea* - Species of Interest

Sheet Layout

0 100 200m

Scale: 1:10,000
MGA94 (Zone 50)

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Mt Mason Survey
Vegetation - Sheet 13 of 13

Appendix 3. Systematic Species List for the Mount Mason Study Area

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Aizoaceae	MM21-4	Cleretum papulosum * (Weed)	Weed	
Aizoaceae	wp 287/662	Gunniopsis septifraga (taxon under review)		Taxon under review
Aizoaceae	n/c	Mesembryanthemum nodiflorum (Slender Iceplant) *	Weed	
Amaranthaceae		Ptilotus aervoides		
Amaranthaceae	MM10-10	Ptilotus carlsonii		
Amaranthaceae	MM10-11	Ptilotus exaltatus		
Amaranthaceae	MM4-1	Ptilotus obovatus (goldfields form)		
Amaranthaceae	numerous	Ptilotus obovatus (upright form, G. Cockerton & G. O'Keefe 12281)		
Amaranthaceae	MM9-6	Ptilotus sp. Indet (glabrous, juvenile plant)		Indet
Anthericaceae	MM2-7	Thysanotus manglesianus		
Apiaceae	MM12-5	Daucus glochidiatus		
Apiaceae	MM28-17	Trachymene ornata		
Apocynaceae	n/c	Alyxia buxifolia		
Apocynaceae	n/c	Vincetoxicum lineare		
Asclepiadaceae	MM2-5	Leichardtia australis		
Asparagaceae	MM1-2	Arthropodium dyeri		
Asteraceae	MM25-7	?Gilruthia osbornei		Indet
Asteraceae	MM10-15	Brachyscome ciliaris		
Asteraceae	M22-2	Brachyscome perpusilla		
Asteraceae	MM32-3	Calocephalus multiflorus		
Asteraceae	MM28-16	Calotis hispidula		
Asteraceae		Calotis sp. Perrinvale Station (R. J. Cranfield 7096)	P3	Undescribed
Asteraceae	n/c	Cephalipterum drummondii		
Asteraceae		Chrysocephalum puteale		
Asteraceae	MM23-5	Chthonocephalus pseudevax		
Asteraceae		Erymophyllum ramosum		
Asteraceae	MM20-4	Gilbertia tenuifolia		
Asteraceae	MM5-7	Gnephosis sp. Indet (WB40685) vesicular hairs on stems		Indet
Asteraceae	MM11-4	Goodenia sp Indet. (WB40681)		Indet
Asteraceae		Helipterum craspedioides		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Asteraceae	MM1-13	Hyalosperma demissum		
Asteraceae	MM12-3	Indet (immature plant)		Indet
Asteraceae	MM12-10	Isoetopsis graminifolia		
Asteraceae	MM2-25	Lawrencella rosea		
Asteraceae	MM25-9	Lemooria burkittii		
Asteraceae	MM7-3	Olearia humilis		
Asteraceae	MM13-3	Olearia muelleri		
Asteraceae	MM6-7	Olearia pimeleoides		
Asteraceae	MM1-4	Panaetia lessonii		
Asteraceae	MM9-7	Pogonolepis ?muelleriana		Indet
Asteraceae	MM2-3 (or 2-30)	Rhodanthe battii		
Asteraceae	MM11-3	Rhodanthe laevis		
Asteraceae	downslope of MM10	Rhodanthe stricta		
Asteraceae	WP236/662	Schoenia filifolia subsp filifolia		
Asteraceae	MM28-18	Senecio glossanthus		
Asteraceae	MM5-3	Siemssenia capillaris		
Asteraceae	wp264 near Quad 10	Streptoglossa adscendens		
Asteraceae	MM2-27	Waitzia acuminata		
Brassicaceae	MM5-10	Cuphonotus andraeanus		
Brassicaceae	MM2-30	Lepidium oxytrichum		
Brassicaceae	MM10-13	Lepidium phlebopetalum		
Brassicaceae	MM21-9	Menkea australis		
Brassicaceae	wp 113/662; wp 254/662; MM5-17	Menkea draboides	P3	
Brassicaceae	MM1-5	Stenopetalum anfractum		
Brassicaceae	MM23-3	Stenopetalum filifolium		
Campanulaceae	MM28-14	Isotoma petraea		
Campanulaceae	MM28-20	Wahlenbergia tumidifructa		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Caryophyllaceae	MM15-2	Goodenia sp. Indet (WB40681) corolla ?yellow, glandular and simple hairs		Indet
Caryophyllaceae	MM5-9	Goodenia sp. Indet, (WB40682) white simple hairs		Indet
Casuarinaceae	n/c	Allocasuarina acutivalvis subsp. acutivalvis		
Chenopodiaceae	MM10-6	Atriplex bunburyana		
Chenopodiaceae	MM28-2	Chenopodium melanocarpum		
Chenopodiaceae	MM21-12	Dysphania saxatilis		
Chenopodiaceae		Enchylaena lanata		
Chenopodiaceae	MM31-3	Eriochiton sclerolaenoides		
Chenopodiaceae		Maireana carnosa		
Chenopodiaceae	MM10-4	Maireana georgei		
Chenopodiaceae		Maireana sedifolia		
Chenopodiaceae	MM10-2	Maireana tomentosa var. tomentosa		
Chenopodiaceae	MM4-3	Maireana trichoptera		
Chenopodiaceae		Rhagodia aff. eremaea		
Chenopodiaceae		Rhagodia drummondii		
Chenopodiaceae	n/c	Salsola australis		
Chenopodiaceae	n/c	Sclerolaena diacantha		
Chenopodiaceae	MM26-1	Sclerolaena drummondii		
Chenopodiaceae	MM14-3	Sclerolaena eriacantha		
Colchicaceae	MM5-15	Wurmbea ?tenella (sterile seedling)		
Colchicaceae	Wp227/662	Wurmbea densiflora		
Colchicaceae	MM1-3	Wurmbea tenella		
Crassulaceae	MM13	Crassula colorata var acuminata		
Crassulaceae	MM32-2	Crassula sp. hairy		Indet
Crassulaceae	MM2-28	Crassula tetramera		
Cupressaceae	n/c	Callitris glaucophylla		
Cyperaceae	MM8-2	Schoenus nanus		
Dilleniaceae	MM2-19	Hibbertia arcuata		
Droseraceae	MM5-1, 9-9, 16-6, 18-1, 25-6	Drosera eremaea	P3 (revised from P1 on 25th Nov 2021)	
Euphorbiaceae	wp233/662	Euphorbia boophthona		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Euphorbiaceae	n/c	Euphorbia drummondii		
Euphorbiaceae	n/c	Phyllanthus erwinii		
Fabaceae	n/c	Acacia aneura sens. str.		
Fabaceae	n/c	Acacia burkittii		
Fabaceae	MM2-14	Acacia caesaneura (broad phyllode variant)		
Fabaceae	MM2-15	Acacia caesaneura (narrow phyllode variant)		
Fabaceae	n/c	Acacia caesaneura sp. (juvenile)		
Fabaceae	n/c	Acacia cockertoniana		
Fabaceae	n/c	Acacia colletioides		
Fabaceae	n/c	Acacia craspedocarpa		
Fabaceae	MM3-5	Acacia effusifolia		
Fabaceae	MM13-2	Acacia erinacea		
Fabaceae	MM2-17	Acacia incurvaneura		
Fabaceae	n/c	Acacia kempeana		
Fabaceae	MM27-2	Acacia mulganeura		
Fabaceae	n/c	Acacia quadrimarginea		
Fabaceae	MM2-21	Acacia ramulosa subsp. ramulosa		
Fabaceae	MM5-11	Acacia resinosa		
Fabaceae	n/c	Acacia rhodophloia		
Fabaceae	n/c	Acacia sibirica		
Fabaceae	n/c	Acacia tetragonophylla		
Fabaceae		Jacksonia lanicarpa	P1	
Fabaceae	MM19-8	Mirbelia microphylla		
Fabaceae	MM3-7	Senna artemisioides subsp. artemisioides		
Fabaceae	MM4-2	Senna artemisioides subsp. filifolia		
Fabaceae	n/c	Senna artemisioides subsp. sturtii		
Fabaceae	numerous	Senna manicula		
Fabaceae	n/c	Senna sp. Meekatharra (E. Bailley 1-26)		Undescribed
Fabaceae	MM13	Swainsona gracilis		
Frankeniaceae	MM31-2	Frankenia setosa		
Geraniaceae	MM28-8	Erodium crinitum		
Geraniaceae	MM1-16	Erodium cygnorum		
Goodeniaceae	n/c	Brunonia australis		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Goodeniaceae	MM11-2	Goodenia ?capillosa		Indet
Goodeniaceae	MM2-2	Goodenia ?havilandii		Indet
Goodeniaceae	MM8-3	Goodenia ?occidentalis		Indet
Goodeniaceae	MM15-1	Goodenia capillosa		
Goodeniaceae	MM29-2	Goodenia cycnopotamica		
Goodeniaceae	MM1-1	Goodenia havilandii		
Goodeniaceae	MM11-1	Goodenia occidentalis		
Goodeniaceae	MM9-8	Goodenia rosea		
Goodeniaceae	MM3-3	Goodenia sp Indet., immature, buds, rosette of dentate leaves, axils woolly hairy		Indet
Goodeniaceae	MM27-5	Goodenia sp. small yellow flowers, single indusium		Indet
Goodeniaceae	MM2-1	Probably a Goodenia sp.		Indet
Goodeniaceae	MM13-1	Scaevola spinescens (broad leaf no spines)		Undescribed
Goodeniaceae		Scaevola spinescens (broad leaf with spines)		Undescribed
Goodeniaceae		Scaevola spinescens (narrow leaf spiny form)		Undescribed
Haloragaceae	MM28-10	Gonocarpus nodulosus		
Haloragaceae	MM3-2	Haloragis odontocarpa		
Haloragaceae	MM2-4	Haloragis trigonocarpa		
Hemerocallidaceae	MM9-3	? Caesia sp. #110		Indet
Hemerocallidaceae	MM15-5	? Caesia sp. #160		Indet
Hemerocallidaceae	MM7-4	Dianella revoluta var. divaricata		
Lamiaceae	MM19-7	Hemigenia sp. Yalgoo (A.M. Ashby 2624)		Undescribed
Lamiaceae	MM6-2	Microcorys sp. Mt Gibson (S. Patrick 2098)		Undescribed
Lamiaceae	MM2-13, MM19-9	Prostanthera althoferi subsp. althoferi		
Lamiaceae	MM6-1	Prostanthera prostantheroides		
Lamiaceae	n/c	Teucrium teucriflora		
Loranthaceae		Amyema banksii (parasitic on Grevillea nematophylla)		
Loranthaceae		Amyema benthamii (parasitic on Brachychiton gregorii)		
Loranthaceae		Amyema miquelii (parasitic on Eucalyptus oleosa)		
Lythraceae	MM16-2	Ammannia multiflora		
Malvaceae	MM12-4	Abutilon otocarpum subsp. prostratum		
Malvaceae	M2-18	Brachychiton gregorii		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Malvaceae	MM3-1	Seringia velutina		
Malvaceae	n/c	Sida ectogama		
Malvaceae	n/c	Sida sp. dark green fruits (S. Van Leeuwin 2260)		Undescribed
Malvaceae	MM28-25	Sida sp. excedentifolia (J.L. Egan 1925)		Undescribed
Malvaceae	MM19-4, MM21-7	Sida sp. golden calyces glabrous (H.N. Foote 32)		Undescribed
Montiaceae	MM1-15	Calandrinia creethiae		
Montiaceae	MM1-10	Calandrinia eremaea (dull seeded variant)		Undescribed
Montiaceae	MM1-11	Calandrinia monosperma		
Montiaceae	wp 431/662	Calandrinia sp. INDET.		Indet
Montiaceae	MM31-7	Calandrinia sp. INDET.		Indet
Montiaceae	MM32-6	Calandrinia sp. INDET. 1 cm tall		Indet
Montiaceae	MM32-4	Calandrinia sp. INDET. 4cm tall		Indet
Montiaceae		Portulaca intraterranea		
Myrtaceae		Aluta aspera subsp. aspera		
Myrtaceae	wp281/662	Calytrix desolata		
Myrtaceae	MM24-2	Calytrix erosipetala		
Myrtaceae		Calytrix hislopii	P3	
Myrtaceae		Eucalyptus aff. lesouefii (G & S Cockerton WB40262)		sp. nov.
Myrtaceae		Eucalyptus aff. salubris glaucous branchlets (G & S Cockerton WB40683)		sp. nov.
Myrtaceae		Eucalyptus ewartiana		
Myrtaceae		Eucalyptus horistes		
Myrtaceae		Eucalyptus leptopoda subsp. elevata		
Myrtaceae	MM17-4	Eucalyptus leptopoda subsp. leptopoda		
Myrtaceae		Eucalyptus oleosa		
Myrtaceae	wp271/662	Eucalyptus yilgarnensis		
Myrtaceae	MM6-6	Euryomyrtus patrickiae		
Myrtaceae	MM3-6	Melaleuca hamata		
Myrtaceae		Melaleuca leiocarpa		
Myrtaceae	wp129/662	Micromyrtus clavata		
Myrtaceae	MM6-5	Micromyrtus flaviflora		
Myrtaceae	MM21-13	Myrtaceae sp. 21-13 ?Calytrix		Indet

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Myrtaceae	M2-22	Thryptomene costata		
Myrtaceae		Thryptomene decussata		
Myrtaceae	wp 454/662	Verticordia interioris		
Ophioglossaceae	MM1-19	Ophioglossum lusitanicum		
Orchidaceae	WP160/662	Pterostylis setulosa		
Pittosporaceae		Bursaria occidentalis		
Plantaginaceae	MM10-9	Plantago debilis		
Poaceae	n/c	Amphipogon caricinus		
Poaceae	MM1-7	Aristida contorta		
Poaceae	MM10-1	Austrostipa ?nitida		Indet
Poaceae	MM12-1	Austrostipa ?trichophylla		Indet
Poaceae		Austrostipa elegantissima		
Poaceae	MM2-9	Austrostipa sp. (sterile young plant)		
Poaceae	MM28-7	Austrostipa trichophylla		
Poaceae	MM12-8	Enneapogon caerulescens		
Poaceae	n/c	Eragrostis eriopoda		
Poaceae	MM13	Eriachne ?ovata		Indet
Poaceae		Eriachne mucronata Desert form glabrous (WB40048)		
Poaceae	MM1-6	Eriachne pulchella subsp pulchella		
Poaceae	n/c	Monachather paradoxus		
Poaceae		Neurachne minor		
Poaceae	MM28-9	Paspalidium clementii		
Poaceae	MM31-5	Rytidosperma sp. MM31-5		Indet
Poaceae		Triodia ?rigidissima		Indet
Poaceae	MM1-8	Tripogonella loliiformis		
Proteaceae	MM6-9	Grevillea extorris		
Proteaceae	MM6-8	Grevillea juncifolia		
Proteaceae		Grevillea nematophylla		
Proteaceae	n/c	Hakea recurva subsp. recurva		
Pteridaceae	MM2-6	Cheilanthes distans		
Pteridaceae	MM1-17	Cheilanthes sieberi subsp. sieberi		
Pteridaceae	MM28-19	Cheilanthes sieberi subsp. sieberi		
Rhamnaceae	wp228/662	Cryptandra connata		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Rubiaceae		Hakea lorea subsp. lorea		
Rubiaceae		Psydrax latifolia		
Rubiaceae	MM2-12	Psydrax suaveolens		
Rutaceae	MM6-10	Phebalium filifolium		
Rutaceae	MM2-11	Philotheca brucei subsp. brucei		
Rutaceae	MM6-3	Philotheca coateana	P3	
Rutaceae	MM6-4	Philotheca tomentella		
Santalaceae		Santalum spicatum		
Sapindaceae		Dodonaea lobulata		
Sapindaceae	MM21-6	Dodonaea petiolaris		
Sapindaceae	MM2-10	Dodonaea rigida		
Sapindaceae	MM24-3	Dodonaea viscosa subsp. mucronata		
Scrophulariaceae		Eremophila clarkei (broad leaf form)		
Scrophulariaceae	MM2-20	Eremophila forrestii subsp. forrestii		
Scrophulariaceae	MM26-2	Eremophila glabra subsp. Kalgoorlie (A.P.Brown pers. comm.)		
Scrophulariaceae	MM2-23	Eremophila latrobei subsp. glabra		
Scrophulariaceae	MM7-2	Eremophila latrobei subsp. latrobei		
Scrophulariaceae	MM7-1	Eremophila latrobei subsp. tuberculate leaves (A. Markey & S. Dillon 5841)		
Scrophulariaceae		Eremophila longifolia (green leaf form)		
Scrophulariaceae	MM16-3	Eremophila metallicorum		
Scrophulariaceae		Eremophila oldfieldii subsp. angustifolia		
Scrophulariaceae		Eremophila oppositifolia subsp. angustifolia		
Scrophulariaceae	MM10-5	Eremophila pantonii		
Scrophulariaceae		Eremophila platycalyx subsp. granites (DJ Edinger & G Marsh DJE4788)		
Solanaceae	MM28-6	Nicotiana ?clavicola		Indet
Solanaceae	WP264/662	Nicotiana occidentalis subsp obliqua		Indet
Solanaceae	MM5-8	Nicotiana sp. (juvenile)		Indet
Solanaceae		Nicotiana sp. (seedling)		
Solanaceae		Solanum cleistogamum		
Solanaceae	M22-1	Solanum ferocissimum		
Solanaceae		Solanum lasiophyllum		
Stylidiaceae	MM24-1	Stylidium longibracteatum		

Family	Collection Number	Taxon	Conservation Status	Taxonomic Status
Thymelaeaceae	MM1-21	Pimelea spiculigera subsp. thesioides		
Urticaceae	MM12-2	Parietaria cardiostegia		
Zygophyllaceae	MM10-7	Roepera kochii		
Zygophyllaceae	MM10-8	Roepera ovata		
Zygophyllaceae		Tribulus astrocarpus		

Appendix 4. Vegetation Descriptions – Mt Mason Study Area

Overview of the Mt Mason Range, western slope, a small, subdued BIF range with minor outcrop.

Vegetation Associations of the Mount Mason Study Area

Influencing Geology / Soil	Structural Formation	Vegetation Assoc. Code	Vegetation Association Name
Banded Ironstone outcrop and subcrop	Acacia (Mulga) Woodlands	A1	*Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura* (narrow phyllode form) Woodland over *Thryptomene decussata*, *Prostanthera althoferi* subsp. *althoferi*, *Hibbertia arcuata, Olearia humilis* Shrubland on BIF outcrop and upper slopes.
Lateritised Duricrust, minor Banded Ironstone	Acacia (Mulga) Woodlands	A2	*Acacia incurvaneura* and *Acacia quadrimarginea, Acacia cockertoniana* over *Philotheca brucei, Hibbertia* arcuata, Prost*anthera althoferi* subsp. *althoferi* and *Dodonaea rigida* on BIF outcrop and upper slopes.
Colluvial sandy BIF and laterite gravel	Acacia (Mulga) Woodlands	A3	*Acacia incurvaneura, A mulganeura, A. caesaneura* over *Eremophila forrestii* subsp. *forrestii* on sandy gravely mid to lower slopes.
Weathered basalt, calcrete	Acacia (Mulga, Acacia sibirica) Woodlands	A4	*Acacia sibirica* Woodland over *Dodonaea lobulata, Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) on weathered basalt and calcrete.
Aeolian Sandplain over gravel	Acacia (Mulga) Woodlands	A5	*Acacia effusifolia* with emergent *Eucalyptus leptopoda*, *E. ewartiana* Mallees on orange-brown sandplain.
Exfoliating granite outcrop and subcrop	Acacia (Mulga) Woodlands	A6	*Thryptomene costata* Shrubland with emergent *Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa, A. cockertoniana* small trees on granite sheets and exfoliating outcrop with *Drosera eremaea* P3.
Archaean granite breakaway plateaux	Acacia (Mulga) Woodlands	A7	*Acacia cockertoniana, A. quadrimarginea, A. ramulosa* subsp. *ramulosa, Calytrix erosipetala, Hibbertia arcuata, Ptilotus obovatus* (typical Goldfields form) on lateritic duricrust hills and outcrops.
Aeolian sandplain over laterite gravel	Acacia (Mulga) Woodlands	A8	*Callitris columellaris, Acacia ramulosa* subsp. *ramulosa, Eucalyptus leptopoda* mallee on orange-brown sandplain.
Hardpan plain, sheet wash,	Acacia (Mulga) Woodlands	A9	*Acacia incurvaneura, A. ramulosa* subsp. *ramulosa, A. tetragonophylla, A.* mulganeura over *Ptilotus obovatus* (typical Goldfields form) on hardpan plains, colluvium and alluvium.
Drainage focus, hardpan and clay soil	Acacia (Mulga) Woodlands	A10	Drainage line Mulga Shrublands.
Weathered basalt, calcrete	Casuarina pauper Woodland	C1	*Casuarina pauper* Woodland over *Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) Shrubland on weathered basalt and abundant calcrete.
Weathered basalt, calcrete	Eucalypt Woodlands	E1	*Eucalyptus* aff. *lesouefii* (G & S Cockerton WB40262) Woodland over *Eremophila pantonii* and (Upright form, G Cockerton et. al. 15206) Shrubland on weathered basalt and abundant calcrete.
Drainage focus, clay soil	Eucalypt Woodlands	E2	*Eucalyptus* aff. *salubris* glaucous branchlets (G & S Cockerton WB40683) Woodland over *Atriplex bunburyana*, *Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) and occasional *Eremophila pantonii* Shrubland on red-brown clay, alluvium.
Colluvial plains, sandy clay soils	Eucalypt Woodlands	E3	*Eucalyptus oleosa* emergent over *Acacia incurvaneura* and *Acacia cockertoniana* Woodland.
Colluvial plains, sandy clay soils	Eucalypt Woodlands	E4	*Eucalyptus oleosa, Acacia caesaneura* over *Acacia ramulosa* subsp. *ramulosa* over *Eremophila forrestii* subsp. *forrestii*, on shallow sandy profiles over hardpan plains, colluvium and alluvium
Sandy clay soils	Eucalypt Woodlands	E5	*Eucalyptus horistes* over *Acacia ramulosa*, *A. hemiteles, Senna artemisioides* subsp. *filifolia* on sandy clay.
Lateritised duricrust, minor BIF and quartz outcrop	Low Shrublands with emergent Acacia, Allocasuarina	S1	*Hibbertia arcuata*, occasionally with *Calytrix desolata* or *C. erosipetala* or *C. hislopii* P3 Shrubland with emergent *Acacia cockertoniana, A. quadrimarginea, Allocasuarina acutivalvis* subsp. *acutivalvis* tall shrubs on lateritic duricrust outcrop.
Saline plains, kaolinitic sandy clay	Low Shrublands with Emergent Acacia, Allocasuarina	S2	*Frankenia setosa* Shrubland on saline stony plain with kaolinitic soil.

Landform and Surface Geology: Banded Ironstone Ridges, Hill Tops and Upper Slopes

A1	Shrublands or Woodlands of *Acacia quadrimarginea, A. incurvaneura, A. mulganeura, A. caesaneura* (narrow phyllode form) 3 to 6m, PFC 10 to 30%; over Shrubland of *Thryptomene decussata*, *Prostanthera althoferi* subsp. *althoferi*, *Hibbertia arcuata, Olearia humilis* 0.5 to 2m, PFC 5 to 20% on BIF outcrop and upper slopes. Species richness 16 to 34 species, dependant on annuals.

Quadrat MM17
IMGP6890

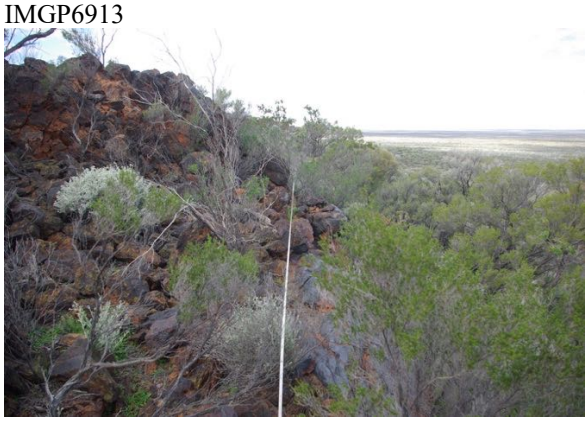
Quadrat MM20
IMGP6895

Quadrat MM21
IMGP6896

Summit of the main BIF range in the orebody area, dense *Acacia incurvaneura* and *Acacia cockertoniana* Shrubland

Quadrat MM23
IMGP6902

Quadrat MM28
IMGP6913



West facing BIF ridge in the Mt Mason orebody area

Landform and Surface Geology: Low Banded Ironstone Formation Hills

A2	Tall Shrublands to Woodlands of *Acacia incurvaneura* and *Acacia quadrimarginea, Acacia cockertoniana* 2 to 7m, PFC 5 to 50% over Shrublands of *Philotheca brucei, Hibbertia* arcuata, *Prostanthera althoferi* subsp. *althoferi* and *Dodonaea rigida* 0.5 to 1.5m, PFC 5 to 25% on BIF outcrop and upper slopes. These sites tend to be either on minor ridge tops, west facing larger BIF slopes or in broad valleys between BIF ridges. Species richness of 17 to 35 species, depending on seasonality and presence of annuals. May support small populations of *Drosera eremaea* P3 and *Calotis* sp. Perrinvale Station (R. J. Cranfield 7096) P3 in sheltered positions on the upper slopes.

Quadrat MM2
IMGP6810

Mulga, *Acacia quadrimarginea* over *Philotheca brucei* subsp. *brucei, Hibbertia arcuata, Prostanthera althoferi* subsp. *althoferi, Dodonaea rigida*

Quadrat MM22
IMGP6900

Acacia incurvaneura over *Philotheca brucei* subsp. *brucei* in abroad valley between BIF ridges

Quadrat MM18
IMGP6891

Mulga, *Acacia quadrimarginea* and *Acacia cockertoniana* over *Calytrix desolata, Philotheca brucei* subsp. *brucei* and some *Allocasuarina acutivalvis*

Landform and Surface Geology: Colluvial sandy BIF and laterite gravel

A3	Tall Shrublands to Woodlands of *Acacia incurvaneura, A mulganeura, A. caesaneura* 3 to 6m, PFC 5 to 15% over Shrublands of *Eremophila forrestii* subsp. *forrestii and Prostanthera althoferi* subsp. *althoferi* 0.5 to 1.5m, PFC 15 to 25% on sandy gravely mid to lower slopes. Commonly encountered at Mt Mason and elsewhere in the region, this community is found on deep sandy lateritic and BIF gravel soil profiles. A relatively uniform community with 18 to 19 species recorded, including annuals.

Quadrat MM15
IMGP6875

Mulga over *Eremophila forrestii* subsp. *forrestii*

Quadrat MM30
IMGP6923

Mulga and *Acacia ramulosa* subsp. *ramulosa* over *Eremophila forrestii* subsp. *forrestii*

Quadrat MM27
IMGP6910

Mulga over *Eremophila forrestii* subsp. *forrestii* and *Prostanthera althoferi* subsp. *althoferi*

Landform and Surface Geology: Weathered Basalt Rises with Associated Calcrete

A4	Open Woodlands or Shrublands of *Acacia sibirica* over *Dodonaea lobulata, Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) Shrubs on weathered basalt and associated calcrete. Species richness of 8 to 24 species, depending on seasonality and presence of annuals.

Quadrat MM34
IMG_1949 2

Acacia sibirica trees to 6m with a variable and open understorey including *Dodonaea lobulata*, *Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206). Tabular BIF rubble overlaying weathered basalt and calcrete matrix.

Quadrat MM12
IMGP6869

Acacia sibirica Shrubland, mid-slope stony surface with calcrete platform below the surface and surface lag gravel of BIF and some quartz rocks. *Acacia sibirica* trees to 6m with *Dodonaea lobulata*, *Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206).

Landform and Surface Geology: Aeolian Sandplain over Laterite Gravel

A5	*Acacia effusifolia* with emergent *Eucalyptus leptopoda*, *E. ewartiana* Mallees on orange-brown sandplain, may support *Philotheca coateana* P3 (outside proposed development footprint. A variable species richness of 11 to 24 species was recorded, depending on fire age and maturity of vegetation.

Quadrat MM3
IMGP6812

Post fire regenerating *Acacia effusifolia* Shrubland

Quadrat MM33
IMG_1927

Mallees emergent above regenerating post-fire *Acacia effusifolia* shrubs, very little understorey present on sandy gravely soil.

Quadrat MM6
IMGP6826

Long unburnt *Acacia effusifolia* Shrubland with occasional emergent mallees, this community supports *Philotheca coateana* P3. This site was around double the species richness of more recently burnt vegetation with a similar dominant upper stratum.

Landform and Surface Geology: Exfoliating Granite Outcrop and Subcrop

A6	*Thryptomene costata* 1.2 to 1.8m, PFC 10 to 15% Shrubland with emergent *Acacia quadrimarginea, Acacia ramulosa subsp. ramulosa, A. cockertoniana* small trees to 4m, PFC < 5% on exfoliating granite sheets and outcrop. Species richness of 24 to 35 species including annuals. *Drosera eremaea* P3 is commonly noted in this community where it is abundant. Occasional occurrences of *Menkea draboides* P3 were also recorded within this community.

Quadrat MM1
IMGP6809

Granitic plain near the Camp Cassini site, dominated by *Thryptomene costata* Shrubs and occasional emergent *Acacia quadrimarginea* and *A. cockertoniana* small trees to 4m many *Drosera eremaea* P3 commonly noted in this community in August 2021.

Quadrat MM5
IMG6814

Small granitic plains and gentle slopes supporting *Acacia quadrimarginea, A. cockertoniana* and *Thryptomene costata* Shrublands with occasional *Drosera eremaea* P3.

Quadrat MM9
IMGP6846

Open *Thryptomene costata* Shrubland with *Drosera eremaea* P3 perennial geophytic herbs in the foreground with a Mulga lined drainage line at rear.

Landform and Surface Geology: Archaean Granite Breakaway Plateaux

A7	*Acacia cockertoniana, A. quadrimarginea, A. ramulosa* subsp. *ramulosa* taller shrubs to 2.5m, PF C< 5% over *Calytrix erosipetala, Hibbertia arcuata, Ptilotus obovatus* (typical goldfields form) low shrubs to 0.6m, PFC 5 to 10% on Archaean granite breakaway plateaux. Species richness 21 species including annuals.

IMG_1922

Low Archaean granite breakaway with *Acacia cockertoniana, Dodonaea viscosa* subsp. *mucronata* and *Ptilotus obovatus* (typical goldfields form). The edges of the Breakaway and associated footslope were not included in the quadrat.
Note: the S2 Saline *Frankenia* Shrubland community lies immediately downslope.

Quadrat MM32
IMG_1925

Archaean granite breakaway plateaux with scattered *Acacia cockertoniana* and *Calytrix erosipetala* shrubs

Landform and Surface Geology: Aeolian sandplain over laterite gravel

A8	*Callitris columellaris, Acacia ramulosa* subsp. *ramulosa, Eucalyptus leptopoda* mallee on orange-brown sandplain. No quadrats were installed in this community. It only occurs within the haul road alignment at Mt Mason.

No Quadrat or Releve IMGP  This community has strong affinities with the A5 *Acacia effusifolia* dominated Shrublands on yellow to orange sand over laterite gravel, however, differs in the common occurrence of emergent *Callitris columellaris*.	

Landform and Surface Geology: Hardpan Plain, Sheet Wash Areas

A9	Scattered, often groved clumps of *Acacia incurvaneura, A. ramulosa* subsp. *ramulosa, A. tetragonophylla, A.* mulganeura to 6m, PFC 1 to 2% on hardpan plains, up to 80% in groves; over *Ptilotus obovatus* (typical Goldfields form) 0.4m, PFC 2%. Soil has a high clay content, is hard setting colluvium and alluvium.

Releve only IMG_1983	Releve only IMG_0457
	
Open hardpan plain, subject to sheet flow.	Grove of Mulga within the hardpan plain.

Landform and Surface Geology: Drainage Focus, Hardpan and Clay Soil

A10	Drainage line Mulga Shrublands reflect the adjacent vegetation in most cases but may have a denser tree and shrub canopy. They are narrow and are mostly not incised, indicating minor flows. There are no permanent pools within the Mt Mason Study Area.

Releve Only IMG_0354  Minor drainage lines in Mulga communities with shrubs and trees reflecting the adjacent communities.	

Landform and Surface Geology: Weathered Basalt, Calcrete

C1	*Casuarina pauper* 6 to 8m, PFC 5 to 10% Woodland over *Ptilotus obovatus* (Upright form, G Cockerton et. al. 15206) to 1.2m Shrubland on weathered basalt and abundant calcrete.

Releve only IMGP  Open Woodlands of *Casuarina pauper* are small in area and uncommon in the Mt Mason Study Area, but are more common adjacent to the Mt Ida – Leonora Road east of the Study Area.	

E1	*Eucalyptus* aff. *lesouefii* (G & S Cockerton WB40262) 8 to 10m, PFC 16 to 18% Woodland over *Eremophila pantonii* 1.5 to 2m and *Ptilotus obovatus* (upright form G Cockerton et al 15206) 1.2m Shrubland PFC 3 to 10% on weathered basalt and abundant calcrete. A widespread and common vegetation association at Mt Mason and in the Mt Ida region. Species richness 17 to 20 species including annuals.

Quadrat MM13 IMGP6870  A common Woodland of the Mt Mason Study Area, *Eucalyptus* aff. *lesouefii* (G & S Cockerton WB40262) Woodland over *Eremophila pantonii* and *Ptilotus obovatus* (upright form G Cockerton et al 15206) Shrubland on weathered basalt and abundant calcrete.	Quadrat MM26 IMGP6908  *Eucalyptus* aff. lesouefii (G & S Cockerton WB40262) over *Eremophila pantonii* and *Ptilotus obovatus* (upright form G Cockerton et al 15206).

Landform and Surface Geology: Drainage focus, clay soil

E2	*Eucalyptus* aff. *salubris* Woodland to 40% PFC on red-brown clay, alluvium. The open small shrub stratum supports *Atriplex bunburyana, Ptilotus obovatus* (upright form G Cockerton et al 15206) and occasional *Eremophila pantonii* with *Roepera kochii* a common annual. Total species richness 23 to 29 species, including annuals.

Quadrat MM10 IMGP6847  Very open Gimlet (*Eucalyptus* aff. *salubris* glaucous branchlets (G & S Cockerton WB40683) Woodland over *Ptilotus obovatus* (upright form G Cockerton et al 15206), *Atriplex bunburyana* shrubs to 1m with occasional *Eremophila pantonii* shrubs to 1.8m, PFC 3 to 5% and Roepera kochii herbs.	Quadrat MM14 IMGP6873  *Eucalyptus* aff. *salubris* glaucous branchlets (G & S Cockerton WB40683) over *Eremophila pantonii* to 1.8m PFC 15% and *Ptilotus obovatus* (upright form G Cockerton et al 15206) to 1.2m, PFC 5.5%.

Landform and Surface Geology: Colluvial plains, sandy clay soils

E3	*Eucalyptus oleosa* emergent over *Acacia incurvaneura* and *Acacia cockertoniana* Woodland occurs south of the Mt Mason Camp Cassini site and lies outside the proposed development footprint.

No Relevés, quadrats or images

E4	*Eucalyptus oleosa, Acacia caesaneura* over *Acacia ramulosa* subsp. *ramulosa* over *Eremophila forrestii* subsp. *forrestii*, on shallow sandy profiles over hardpan plains, colluvium and alluvium. Total species richness 20, including annuals.

Quadrat MM14 IMGP6813  *Eucalyptus oleosa* and *Acacia caesaneura* Woodland over *Acacia ramulosa* and *Eremophila forrestii* subsp. *forrestii*	

Landform and Surface Soil: Sandy Clay Soils

E5	*Eucalyptus horistes* mallee Woodland to 8m, PFC 10% over *Acacia ramulosa*, *A. hemiteles, Senna artemisioides* subsp. *filifolia* Medium shrubs to 1.8m, PFC 15 to 20% on sandy clay soils. Area may be subject to sheetwash. This community occurs at the southern end of the proposed haul road alignment and extends southwards across the Menzies – Sandstone Road.

Releve only IMG_1978 	

Landform and Surface Geology: Lateritised duricrust, minor BIF and quartz outcrop

S1	Open low Shrublands of *Hibbertia arcuata*, occasionally with *Calytrix desolata* or *Calytrix erosipetala* or *Calytrix hislopii* P3 (outside disturbance footprint) to 0.8m, PFC 3 to 10% Shrubland with emergent *Acacia cockertoniana, A. quadrimarginea, Allocasuarina acutivalvis* subsp. *acutivalvis* tall shrubs to 3m, PFC 5 to 31% on lateritic duricrust outcrops. Species richness 19 to 30 species including annuals. Interestingly, there is no overlap in distribution of the *Calytrix* species at these sites, only one species is present in the understorey at any given site but all three are present at Mt Mason.

Quadrat MM11 IMGP6867  *Acacia cockertoniana* over *Philotheca brucei*, *Hibbertia arcuata* and *Olearia humilis*	Quadrat MM16 IMGP6878  Mulga (*Acacia incurvaneura, A. quadrimarginea*) and *Acacia cockertoniana* over *Calytrix desolata* and *Philotheca brucei*
Quadrat MM24 IMG_1350  *Allocasuarina acutivalvis* and *Acacia cockertoniana* over *Calytrix desolata* and *Philotheca brucei* subsp. *brucei.*	Quadrat MM25 IMGP6907  *Acacia cockertoniana* over *Thryptomene decussata* and *Calytrix erosipetala* Shrubland.

See over…

No Quadrat IMG_1919  *Calytrix hislopii* dominated S1 Shrubland	

Landform and Surface Geology: Saline plains, kaolinitic sandy clay

S2	*Frankenia setosa* 0.4m, PFC 10% Shrubland with annual *Gunniopsis septifraga* PFC 7% annual herbs on saline stony plains with kaolinitic soil, below Archaean granite breakaways. Species richness 24 species including annuals.

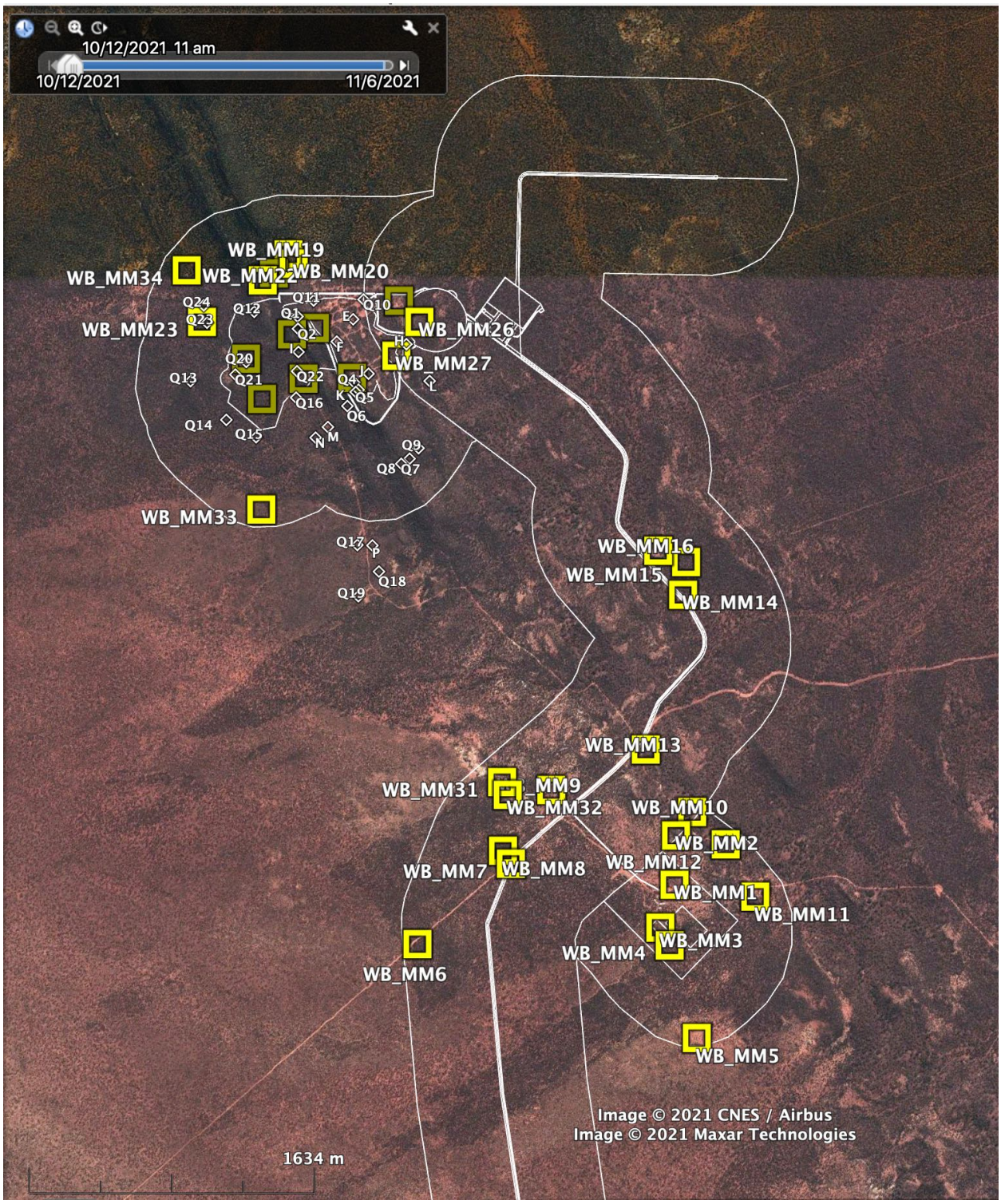
Quadrat MM31 IMG_1921  Low Shrublands of *Frankenia setosa*. on saline clay plains with stony mantles are uncommon and small in area at Mt Mason. These are present immediately adjacent to and below low granite breakaways.	

Appendix 5. Quadrat Locations

Western Botanical 2021 Quadrat Locations, GDA94 Datum

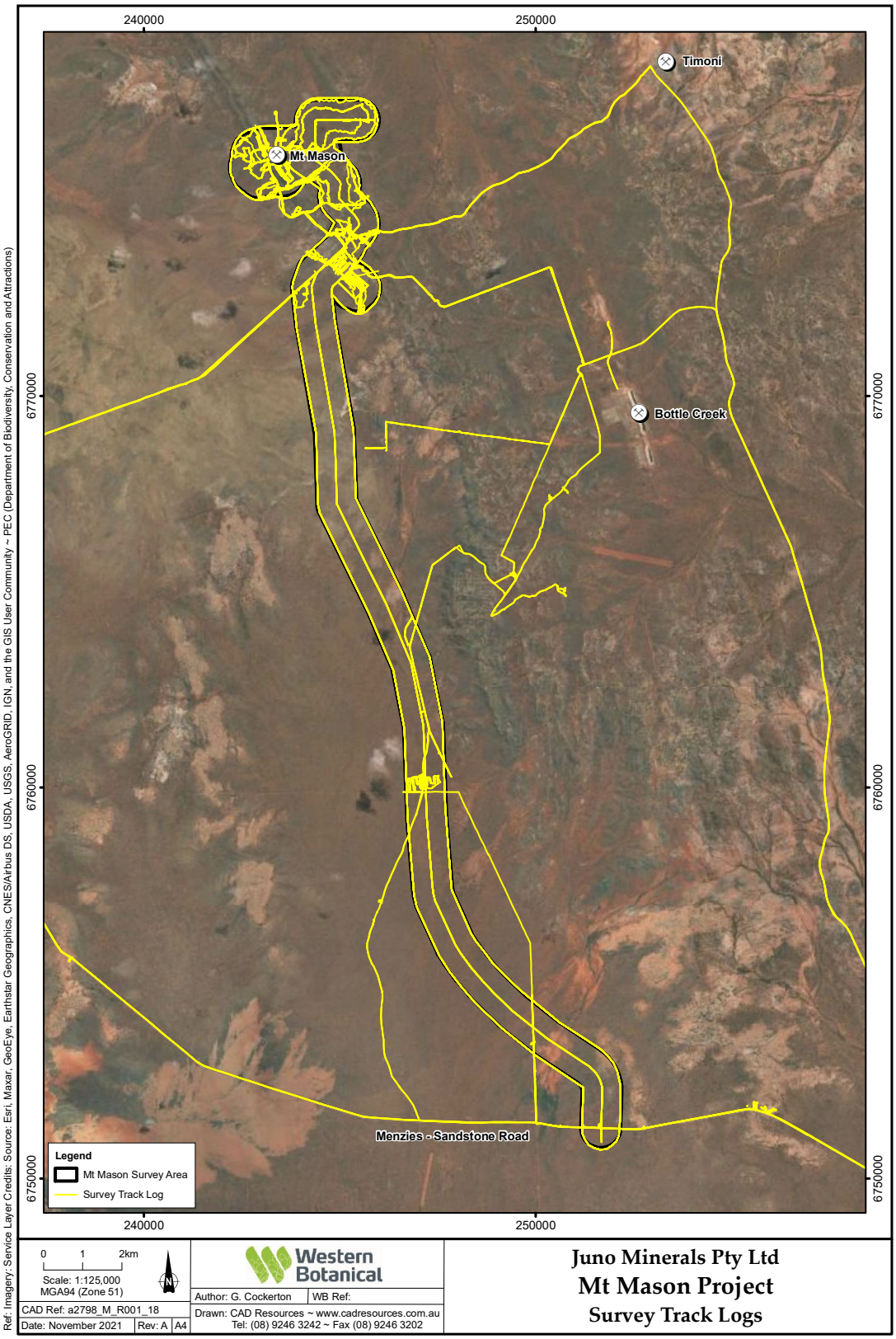
WB Quadrat Number	Zone	Zone	Easting	Northing
WB_MM1	51	J	245350	6773028
WB_MM2	51	J	245352	6773309
WB_MM3	51	J	245274	6772782
WB_MM4	51	J	245330	6772682
WB_MM5	51	J	245497	6772158
WB_MM6	51	J	243885	6772657
WB_MM7	51	J	244410	6773127
WB_MM8	51	J	244363	6773200
WB_MM9	51	J	244632	6773552
WB_MM10	51	J	245442	6773445
WB_MM11	51	J	245814	6772971
WB_MM12	51	J	245638	6773265
WB_MM13	51	J	245168	6773795
WB_MM14	51	J	245362	6774681
WB_MM15	51	J	245375	6774868
WB_MM16	51	J	245214	6774929
WB_MM17	51	J	243219	6776154
WB_MM18	51	J	243088	6776115
WB_MM19	51	J	243058	6776570
WB_MM20	51	J	243089	6776518
WB_MM21	51	J	242977	6776460
WB_MM22	51	J	242914	6776419
WB_MM23	51	J	242571	6776174
WB_MM24	51	J	242828	6775970
WB_MM25	51	J	243697	6776320
WB_MM26	51	J	243817	6776202
WB_MM27	51	J	243689	6776006
WB_MM28	51	J	243438	6775874
WB_MM29	51	J	243160	6775864
WB_MM30	51	J	242925	6775743
WB_MM31	51	J	244349	6773591
WB_MM32	51	J	244383	6773519
WB_MM33	51	J	242935	6775113
WB_MM34	51	J	242477	6776466

See Figure on following page



Western Botanical quadrats denoted with yellow squares, previous consultant's quadrats identified with smaller white triangles.

Appendix 6. Survey Effort – Tracks Logs


240000
250000
6770000
6760000
6750000
Timoni
Mt Mason
Bottle Creek
Menzies - Sandstone Road
Legend
Mt Mason Survey Area
Survey Track Log
Ref: Imagery: Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community ~ PEC (Department of Biodiversity, Conservation and Attractions)
0 1 2km
Scale: 1:125,000
MGA94 (Zone 51)
N
Western Botanical
Author: G. Cockerton
WB Ref:
CAD Ref: a2798_M_R001_18
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax (08) 9246 3202
Date: November 2021
Rev: A
A4
Juno Minerals Pty Ltd
Mt Mason Project
Survey Track Logs

Appendix 7. Significant Species Information

Priority 1 Flora

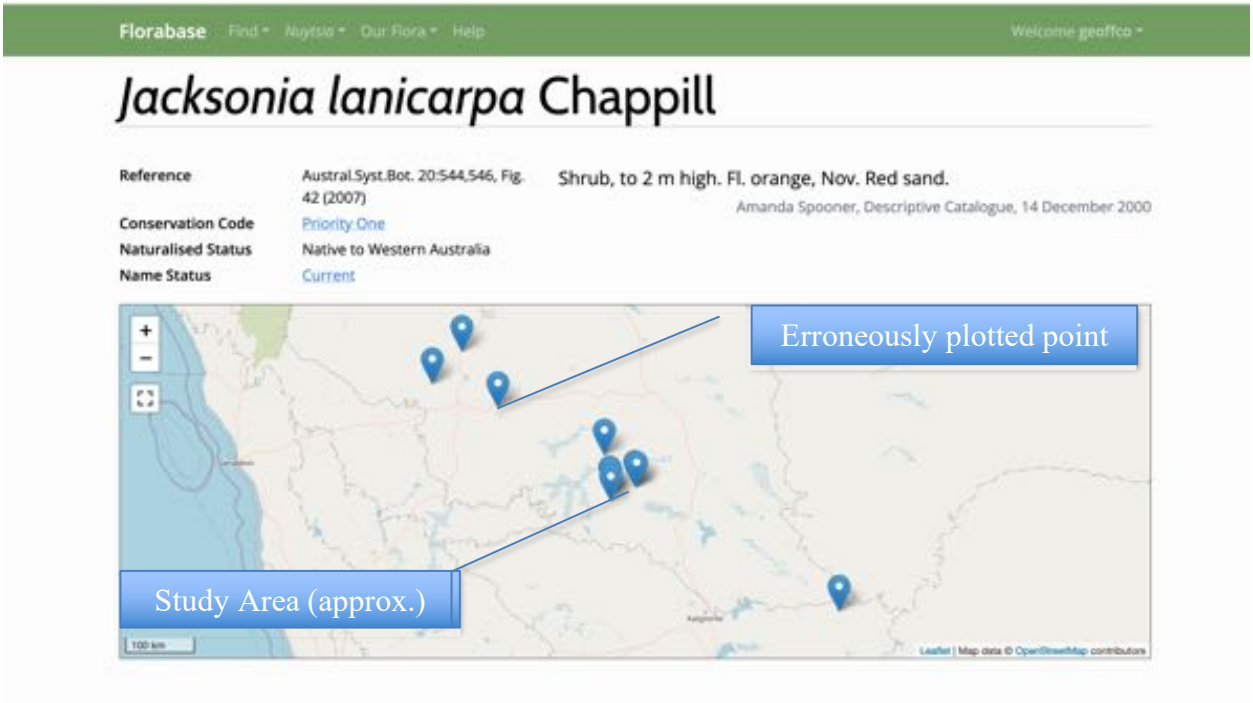
Jacksonia lanicarpa P1

Jacksonia lanicarpa P1 is a stiff, upright yellowish-brown shrub to 2m high with yellow flowers in Spring following adequate rainfall. It is known from hardpan wash plains in the proposed mine access road alignment 17.4 km south of the proposed mine site and can be avoided with adequate buffer. Current infrastructure plans indicate 3 plants lie within the proposed clearing envelope, however, the proposed mine access road here can be diverted eastwards by 50m to avoid this population with adequate buffer.

Plate 1. *Jacksonia lanicarpa* shrub within the current proposed mine access road alignment.

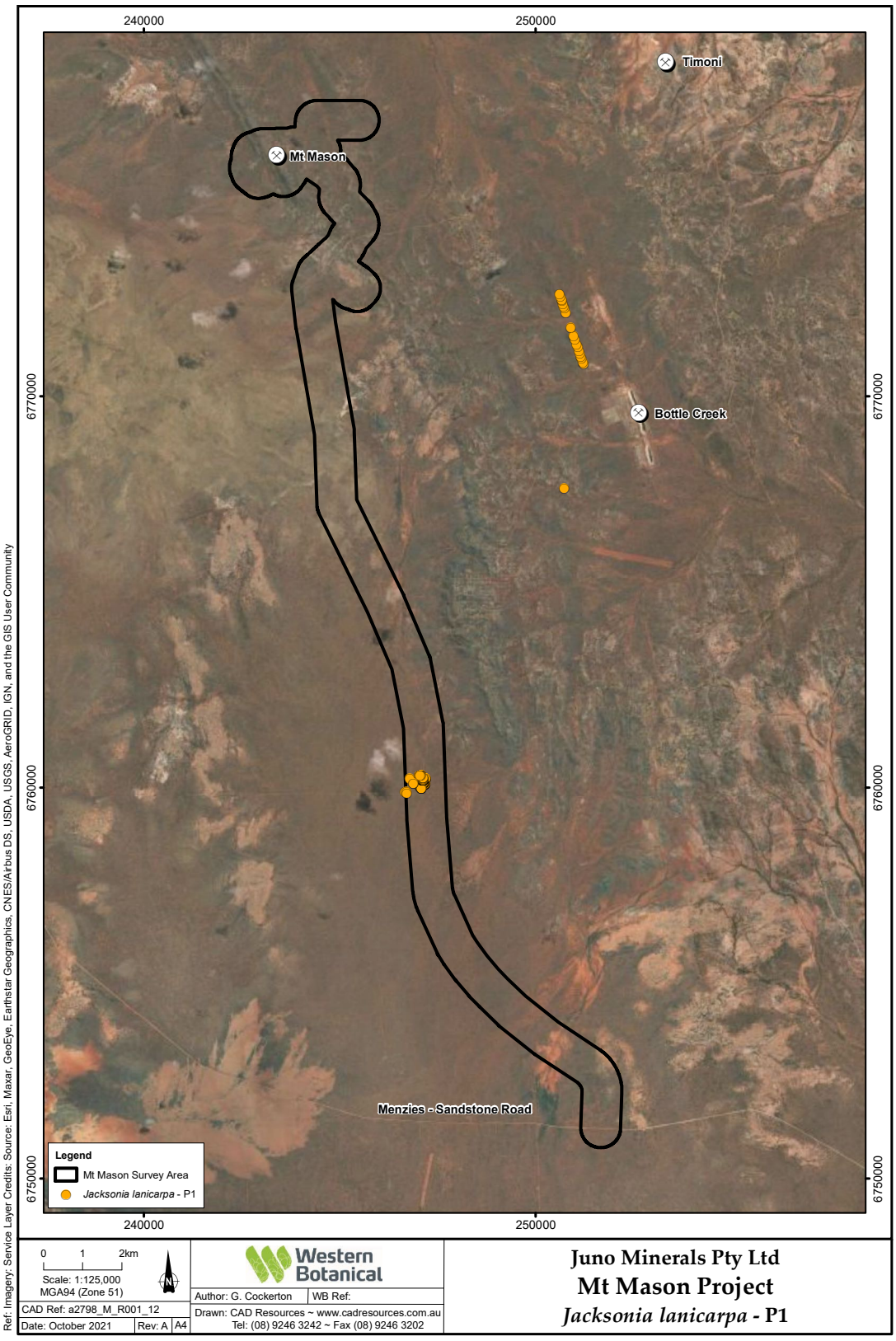
Jacksonia lanicarpa was previously known from 6 populations. One of the seven records on the Florabase map, that collected by K. Ashby 1/12/1996 (PERTH 04663551), is incorrectly plotted south-east of Mt Magnet. The point should be at about the same location as the record by the author (Landcare Services, PERTH 07278969), west of Mt Magnet on the Dalgaranga Road (K. Ashby pers. comm., Nov 2021), Figure 12. WAHERB has been advised of this issue through the ALA portal.

Figure 12. Distribution of *Jacksonia lanicarpa* in Western Australia (Florabase)



During the current surveys, three new populations of *Jacksonia lanicarpa* were recorded near Mt Mason and Mt Ida. Two of these are substantial: (i) 210 plants accurately counted and plotted within the Mt Mason Study Area, adjacent to the proposed mine access road alignment approximately 17.4 km south of the orebody area; and (ii) an estimated 200 (minimum) plants north of the Bottle Creek abandoned minesite, east of the Mt Mason Study Area. A third small population SW of the Bottle Creek minesite was not counted. These populations are depicted in Figure 13.

Figure 13. Distribution of *Jacksonia lanicarpa* near the Mt Mason Study Area



Priority 3 Flora

Calytrix hislopii P3

Calytrix hislopii P3 is present in small scattered populations on low lateritic duricrust rises which all lie outside areas of proposed development in the region between the orebody area and the Camp Cassini site. It is a low lignotuberous shrub to 0.6m high x 1 m wide with yellow flowers in October and is associated with *Acacia cockertoniana* and *A. quadrimarginea,* Plate 2 and Plate 3.

Calytrix hislopii is known from eight populations in WA, within a 400 km radius of the Mt Mason site, Figure 14. Within the Mt Mason Study Area it is known from three slightly disjunct sub-populations outside the proposed disturbance envelope for the Proposed mine access road south of the proposed mine area.

Figure 14. Distribution of *Calytrix hislopii* in Western Australia (Florabase).

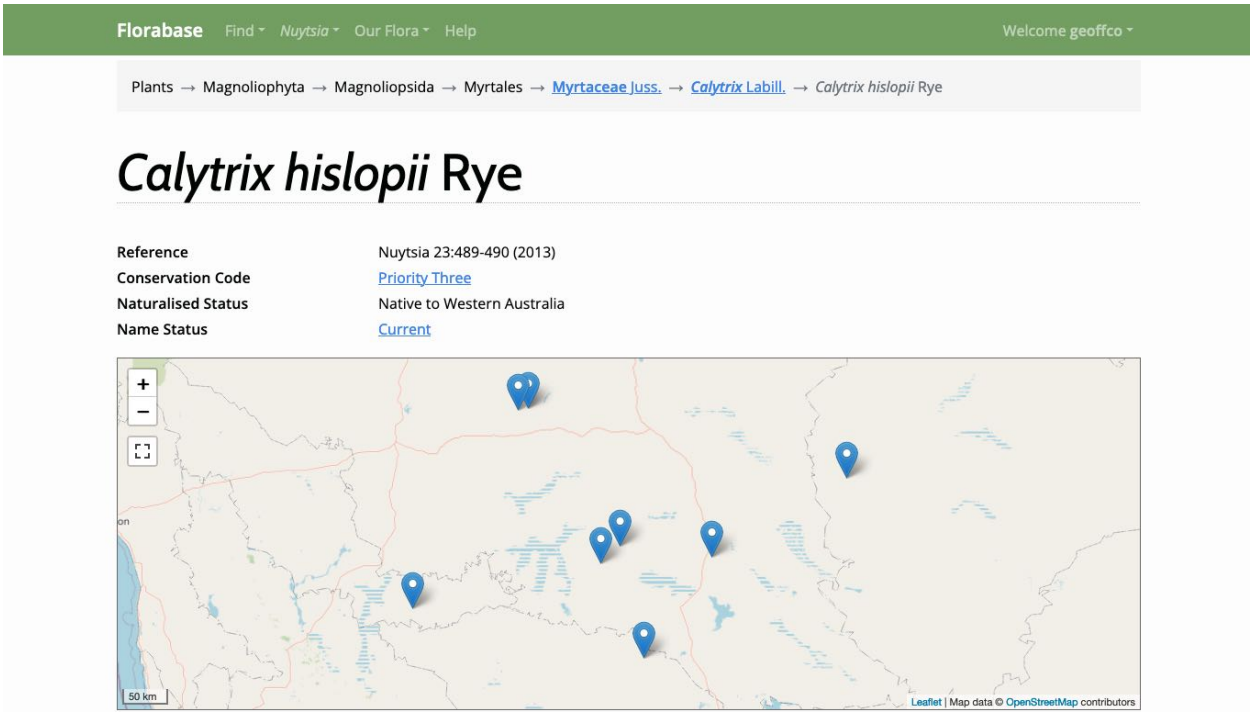


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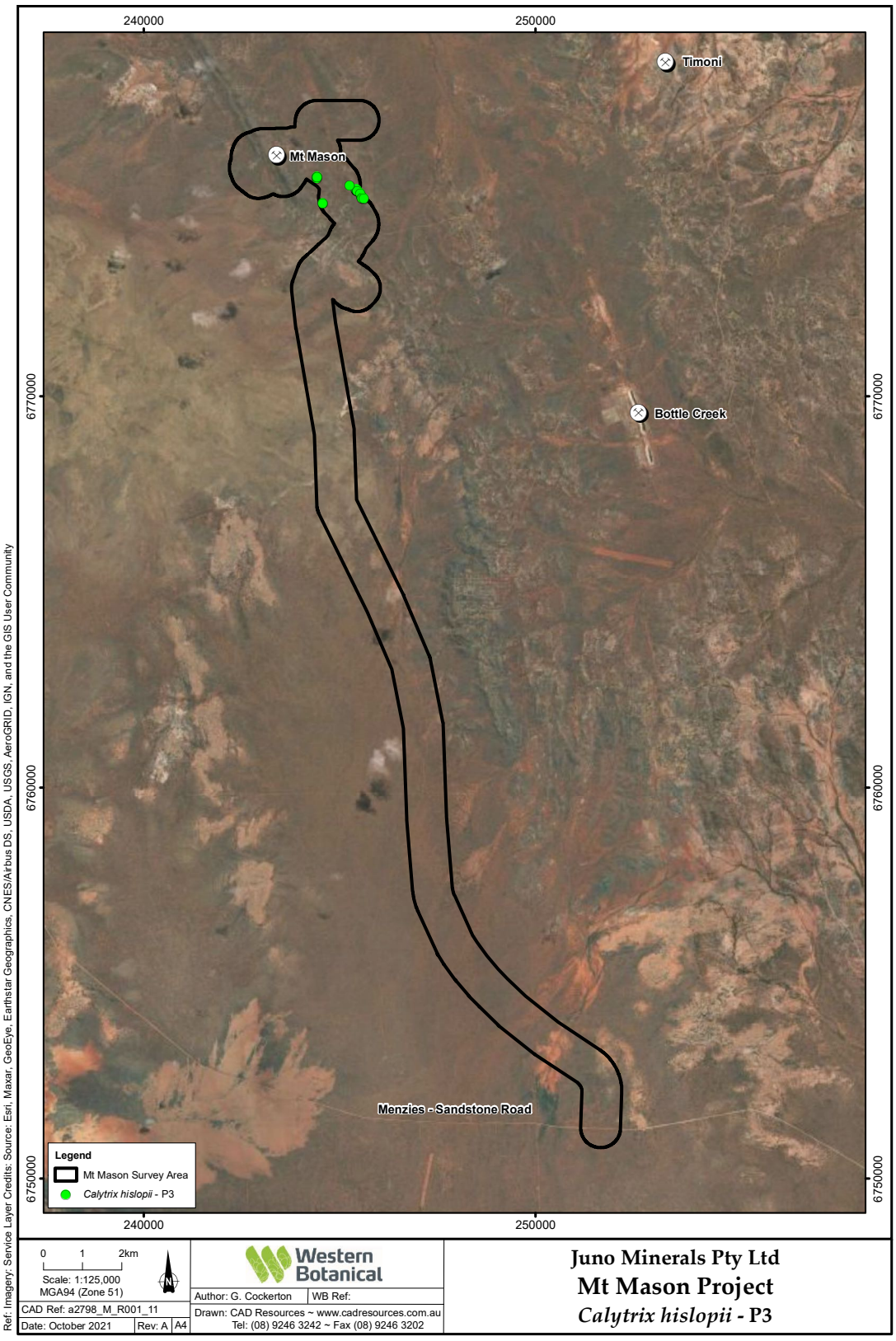
Plate 2. *Calytrix hislopii* habitat and shrubs in foreground

Plate 3. *Calytrix hislopii* flowers and foliage

Figure 15. Distribution of *Calytrix hislopii* at the Mason Study Area



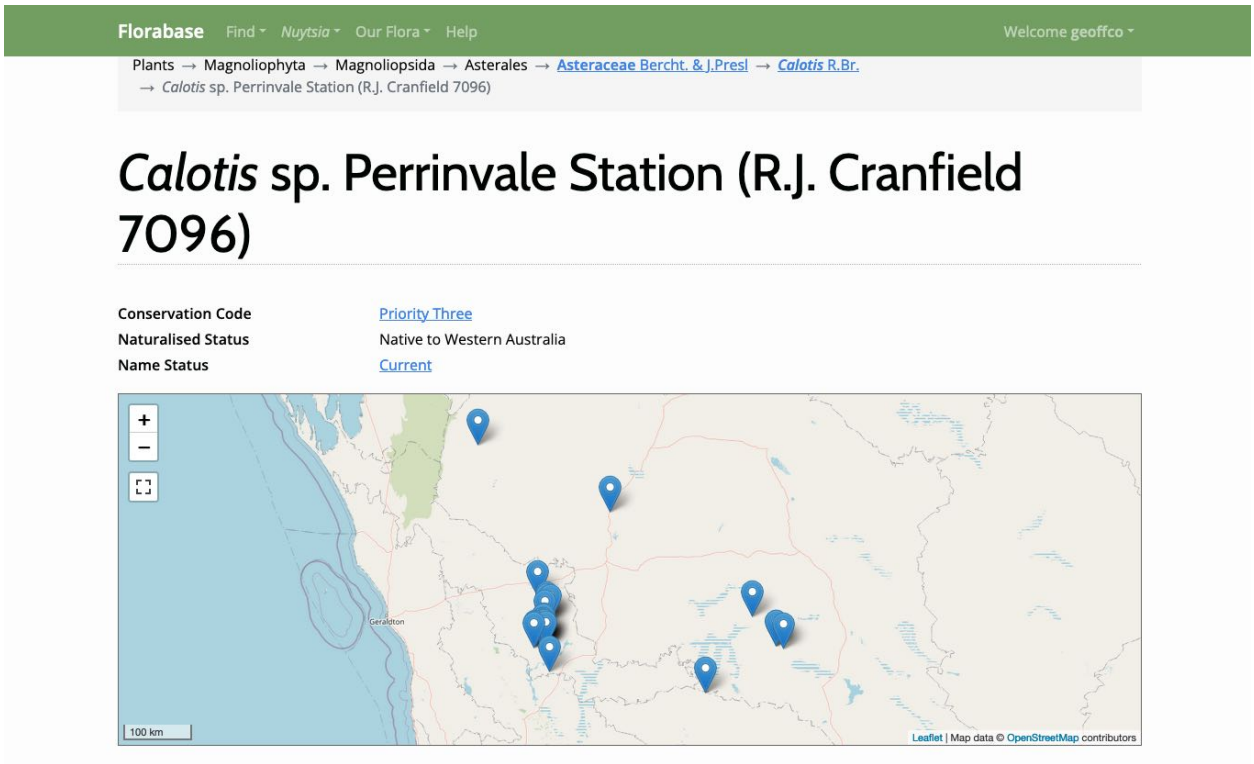
Calotis sp. Perrinvale (R.J. Cranfield 7096) P3

Calotis sp. Perrinvale (R.J. Cranfield 7096) P3 is a diminutive annual herb with prickly fruits. It is a very difficult species to assess as it is present for a very short window in Spring and resembles many other annuals in the area. It is likely under-surveyed at Mt Mason and other sites where it has been recorded.

It is known from two sites, point records, on the central banded iron formation ridge within the orebody area, where it grows under *Acacia incurvaneura* and *A. quadrimarginea* small trees on the west facing upper slope, Figure 9. Populations recorded by P.G. Armstrong (2007) and Western Botanical is this study were not enumerated at either site, however, a conservative 10 plants has been estimated at each site for purposes of this report.

Calotis sp. Perrinvale Station is known from 23 populations, broadly distributed from the Mt Mason area westwards to a series of points south-west of Mt Magnet with one record east of Shark Bay, Figure 16.

Figure 16. Distribution of *Calotis sp. Perrinvale* (R.J. Cranfield 7096) in Western Australia (Florabase)



The unavoidable impacts to *Calotis* sp. Perrinvale Station at Mt Mason will impact one population of the 23 known, representing 8.7% of the known populations.

Drosera eremaea P3

Drosera eremaea P3 populations, inclusive of *Drosera* aff. *eremaea* for purposes of this discussion, are abundant on banded ironstone and exfoliating granite landforms within and outside of the proposed disturbance footprints as well as near the Mt Magnet townsite.

Prior to this study, only 17 specimens were recognised as representing *Drosera eremaea,* hence the former listing under the Priority 1 status. A total of forty six specimens of *Drosera eremaea* (inclusive of *Drosera* aff. *eremaea*) have been vouchered at the WA Herbarium following this study. These are comprised of (i) thirty five specimens from within and near by the Mt Mason Study Area, (ii) seven specimens from three populations near Mt Magnet and Paynes Find, and (iii) three specimens from the Die Hardy Range. Flowering and fruiting material was vouchered from each of the major centres of investigation at Mt Magnet and Mt Mason. These are all available on the Florabase website.

Skye Coffey, WA Herbarium, has since undertaken an extensive and thorough review of *Drosera eremaea* and its allies in the period August to October 2021, resulting in a revision of the taxonomic determinations on this difficult group, Figure 17. There are now 134 records of *Drosera eremaea* and *D*. aff. *eremaea* recognised on Florabase with a distribution from near Leonora to west of Mt Magnet with an outlier NE of Binnu, Figure 19. An email from DBCA's Catherine Bourke confirming the revision of the Conservation Status of *Drosera eremaea* to Priority 3 is presented in Figure 18.

During these field studies, *Drosera eremaea* was observed to be associated with shallow soils and stony landscapes as follows:

- Shallow soil pockets on and at the base of moderate to large sized exfoliating granite outcrops at "The Granites", some 6 km north of Mt Magnet supporting *Acacia umbraculiformis* and/or *A. quadrimarginea* and *Dodonaea peteolaris.*

- Gently inclined (3 degrees) exfoliating granite sheets at the Mt Mason Study Area and on similar landforms outside the Mt Mason Study Area but adjacent to the Menzies – Sandstone Road, associated with *Acacia quadrimarginea, Thryptomene costata, Hibbertia arcuata, Olearia humilis, Prostanthera althoferi* subsp. *althoferi*; and at the TYPE locality some 26.4 directly south of Mt Magnet associated with *Acacia quadrimarginea, A. incurvaneura, A. ramulosa subsp. ramulosa*, *Eremophila punicea* and *E. forrestii* subsp. *forrestii* with wide range of annuals.

- Shallow soil pockets associated with banded ironstone ranges at Mt Mason and the Die Hardy Range, often is shaded locations (Mt Mason) with Acacia quadrimarginea, Acacia incurvaneura, A. cockertoniana; or on south facing slopes (Die Hardy Range), associated with *Allocasuarina dielsiana, Allocasuarina acutivalvis*, *Acacia* sp. Mt Jackson (B. Ryan 176).

- Shallow soils below low lateritic duricrust rises / hills at Mt Mason, associated with *Acacia incurvaneura, A. cockertoniana*, *Philotheca brucei* subsp. *brucei*, *Prostanthera althoferi* subsp. althoferi and *Hibbertia arcuata*.

It is considered by the author that *Drosera eremaea* is likely abundant but suffers from being notable in the field during a very short period, when plants are in flower, in early to mid August and only following suitable winter rainfall. It is therefore considered poorly surveyed and rarely correctly identified. The numbers provided in Table 13 are reasonably accurate representations of most sites where it was encountered in the current surveys. It is considered to be similarly abundant at other sites where most WAHERB records are not quantified.

Drosera eremaea is abundant and widespread on exfoliating granite sheets in the Mt Mason and Mt Magnet Areas with populations exceeding 5,000 individuals per site where the size of the appropriate habitat allows. It has a perennial tuber and sets seeds which means that mature, flowering plants are often surrounded by younger immature (not flowering) plants and populations are therefore considered to be stable and long lived. Smaller populations are observed on the BIF ridge within the Mt Mason orebody area, numbering from a dozen or so plants to several hundred plants.

While based on the current assessment, the project impacts 16% of the known numbers of *Drosera eremaea*, this assessment is based on limited information on population numbers gathered during the August 2021 surveys. The recent review of taxonomy of *Drosera eremaea* by Sky Coffey has vastly increased the known range of the species and it is considered highly likely that the species is significantly more abundant than current data indicates. It is therefore also considered that the overall impact on the numbers of individuals of the species is far less than current limited data indicates.

Populations of *Drosera eremaea* in the region included in this study are depicted in Figure 20 while those at and near Mt Mason are depicted in Figure 21.

Table 13. Abundance of *Drosera eremaea*

Location	# Plants Counted in This Study	Percentage of Plants Known	Comment
Total *Drosera eremaea* mapped in this study	30,038	100%	Considered an accurate number for those within the Mt Mason Study Area, considered an under-estimate for populations at Mt Magnet and Die Hardy Range
Mt Mason, within Study Area	6,933	23%	Reasonably accurately mapped
Mt Mason, Within Proposed Disturbance Footprint	4,840	16%	Reasonably accurately mapped
Outside Mt Mason Study Area	18,265	61%	Reasonably accurately counted but only represents a partial survey of suitable habitats in the region.

Location	# Plants Counted in This Study	Percentage of Plants Known	Comment
Mt Magnet Populations	11,468	38%	The TYPE population 26.4 km south of Mt Magnet is significantly under-estimated. The population at "The Granites", 6 km north of Mt Magnet is reasonably accurately counted, but only represents a partial survey of suitable habitats in this area.
Die Hardy Range Population	472	2%	Significantly under-estimated, population is in the thousands at this site.

Figure 17. Letter from WA Herbarium on the revision of *Drosera eremaea*.

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Your ref: [Recipient REF here]
Our ref: [Our REF here]
Enquiries: S.C. Coffey
Phone: n/a
Email: skye.coffey@dbca.wa.gov.au

To Whom it may concern

Review of *Drosera eremaea* & *D.* aff. *eremaea*

I have examined the flowering & fruiting tuberous *Drosera* specimens from the *D. macrantha* complex that were recently submitted for identification by Geoff Cockerton of Western Botanical. These were collected from the Mount Magnet & Mount Mason areas. I identified all specimens that included the diagnostic basal parts & seed (i.e. the presence of a basal leaf rosette and adventitious stolons. Nail-like seed) as *Drosera eremaea* . In addition, after further research I now consider it very likely that those specimens lacking basal parts, that I had originally referred to *D.* aff. *eremaea*, also represent *D. eremaea s. str.*

Drosera eremaea was first recognised as distinct in 1992 under the name *D. macrantha* subsp. *eremaea* and because of an apparent paucity of collections it had been assessed as Priority One. In his Carnivorous Plants of Australia (2013) Allen Lowrie made a number of changes to the taxonomy of the *D. macrantha* complex, including the elevation of subsp. *eremaea* to species level. Following that publication, I took the opportunity to examine Perth's entire holding of *D. macrantha s. lat.* This led to a realisation that the species was significantly more common than had been hitherto understood and in fact was quite widely distributed in the Murchison and Yalgoo bioregions.

Somewhat disjunctly to the west of plants that are clearly referrable to *D. eremaea* there occurs a very similar morphotype which is also locally common and widespread. It differs from typical *D. eremaea* in apparently always lacking the basal leaf rosette and adventitious stolons. The taxonomic status of this entity requires further research, and it is currently referred to at the W.A. Herbarium as *D.* aff. *eremaea*.

It is now clear that even excluding the populations of *D.* aff. *eremaea* the conservation status of *D. eremaea* needs to be reviewed.

Yours sincerely

S.C. Coffey
Loans & Accessioning Officer/Curation Technician – Specialist for Droseraceae
Western Australian Herbarium

10th November 2021

Biodiversity and Conservation Science
Department of Biodiversity, Conservation and Attractions
Locked Bag 104, Bentley Delivery Centre WA 6983
Website: dbca.wa.gov.au/science

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Figure 18. Email confirming re-evaluation of Priority Status of *Drosera eremaea* P3

From: **Catherine Bourke** catherine.bourke@dbca.wa.gov.au
Subject: Drosera eremea
Date: 24 November 2021 at 7:57 am
To: geoff.cockerton geoff.cockerton@westernbotanical.com.au

CB

Hi Geoff

Sorry I missed your call yesterday. As of tomorrow, Drosera eremea will show as P3 on florabase. Based on the confirmed specimens, it still meets P3, however this may change in future if the taxonomy is further resolved

Catherine Bourke
Senior Biodiversity Conservation Officer
Species and Communities Program| Biodiversity and Conservation Science
Department of Biodiversity, Conservation and Attractions
Locked Bag 104 Bentley Delivery Centre WA 6983
Phone: (08) 9219 8760| Email:Catherine.Bourke@dbca.wa.gov.au

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Figure 19. Distribution of *Drosera eremaea* (inclusive of *D.* aff. *eremaea*) in Western Australia (Florabase) as at 11 Nov 2021.

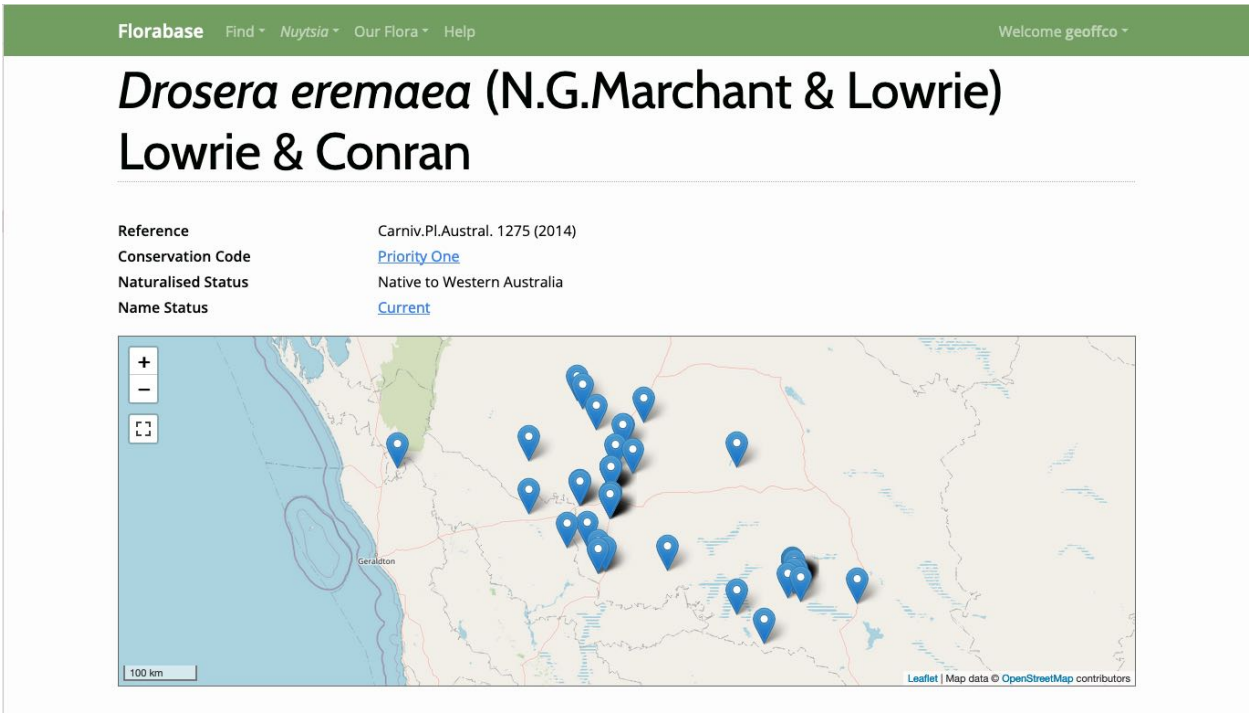

Plate 4. Typical habitat of a large population of *Drosera eremaea* at Mt Mason, with *Thryptomene costata* medium shrub cover.

Plate 5. *Drosera eremaea* plant

Plate 6. *Drosera eremaea* flower, these produce a sweet vanilla-honey fragrance from mid morning to late afternoon.

Plate 7. *Drosera eremaea* foliage showing the glandular hairs on the leaves which trap insects

Figure 20. Regional Populations of *Drosera eremaea* in this Study

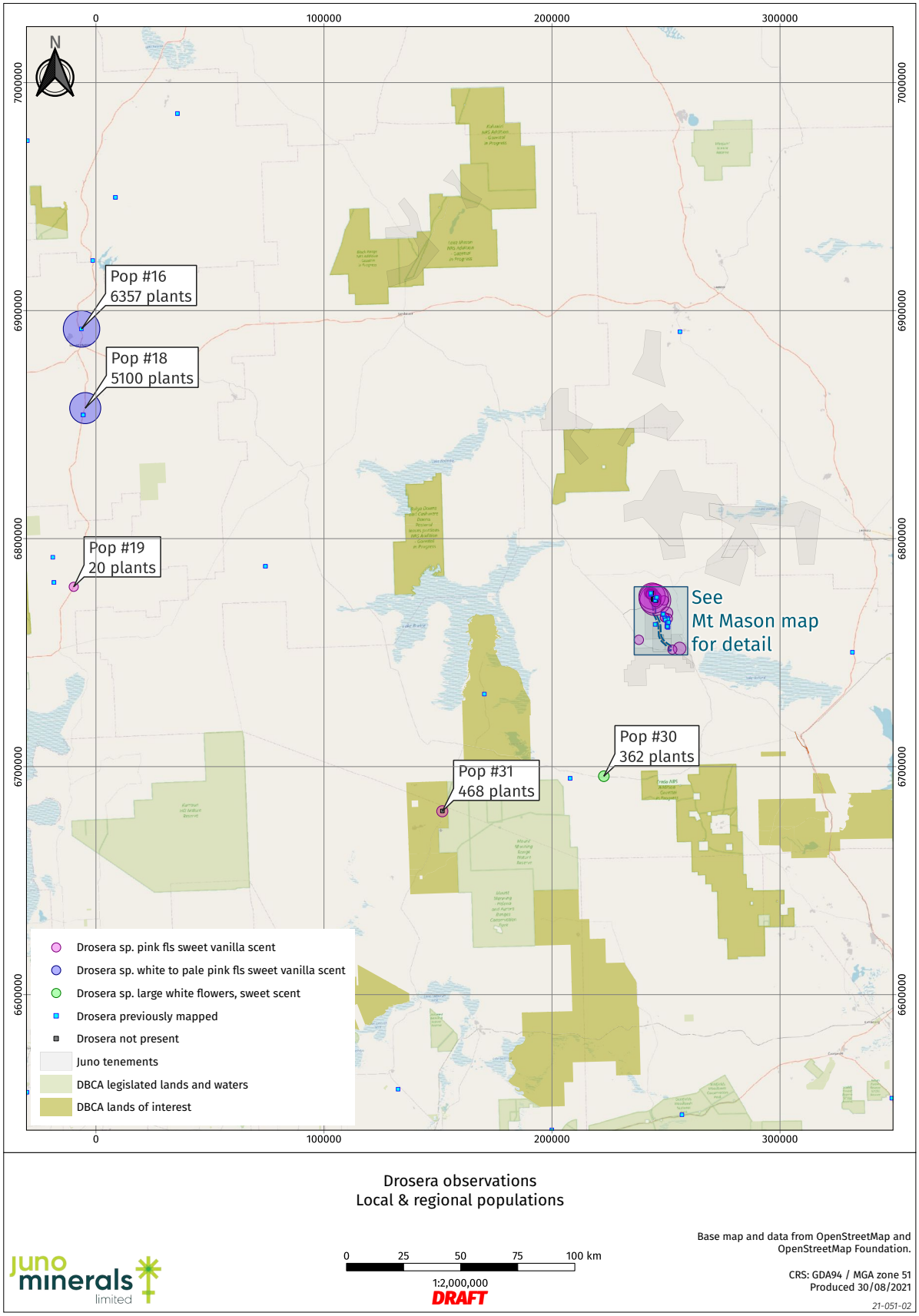

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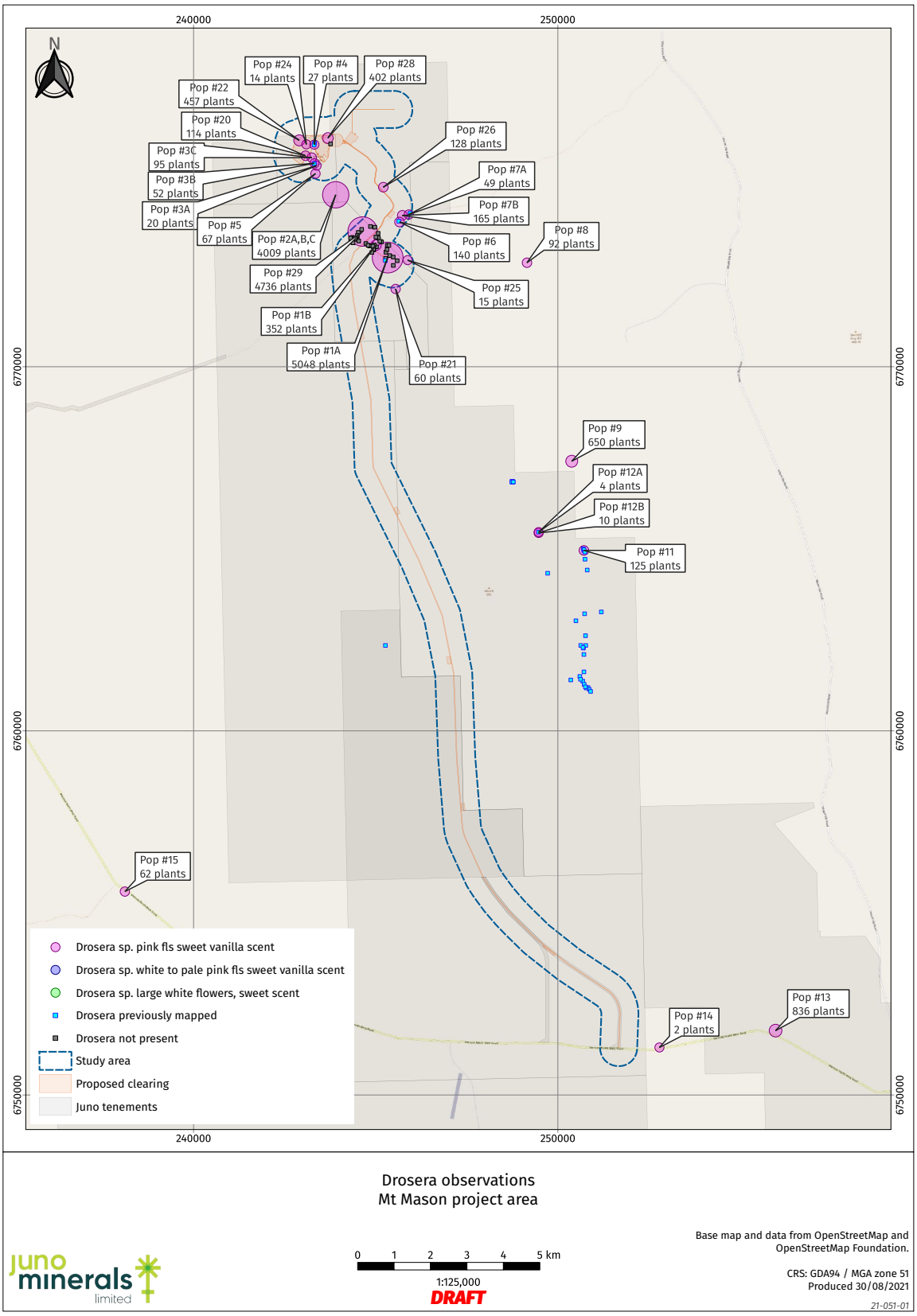
Figure 21. Populations of *Drosera eremaea* at the Mt Mason Study Area Observed in This Study

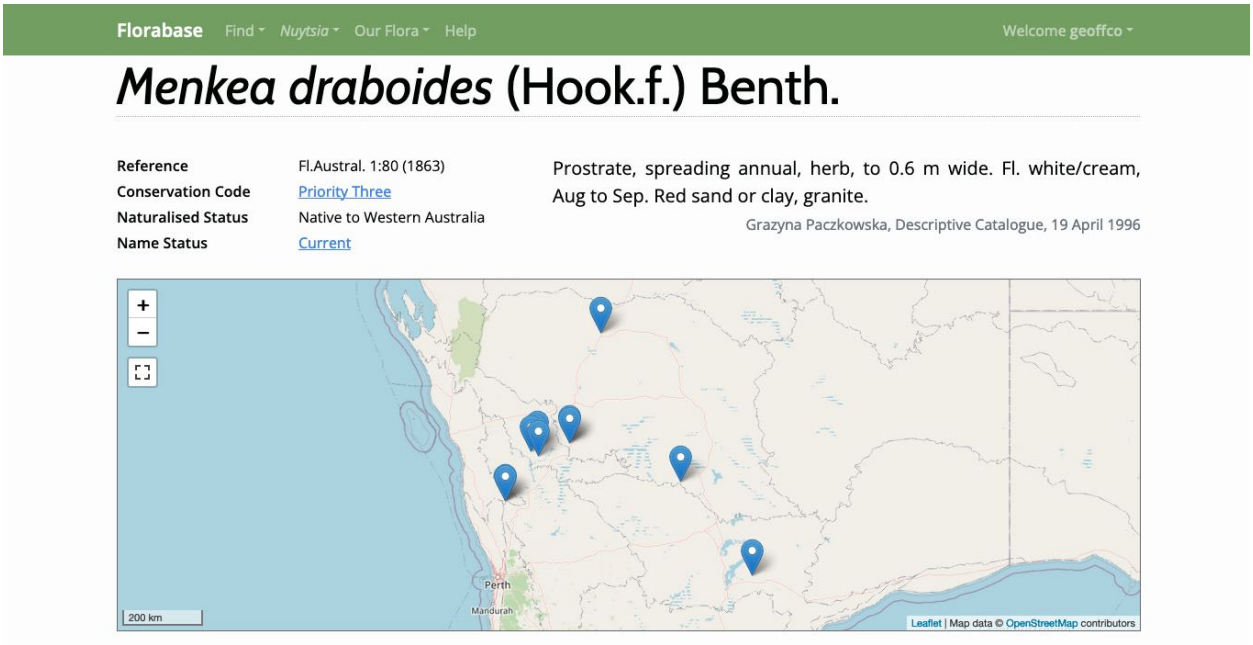


Western Botanical

Menkea draboides P3

Menkea draboides P3 is a small succulent yellowish herb known in small numbers on exfoliating granite landforms from outside the proposed disturbance footprint near the Camp Cassini site. Regionally it is known from 9 populations in Western Australia, Figure 22.

Figure 22. Distribution of *Menkea draboides* in Western Australia (Florabase)



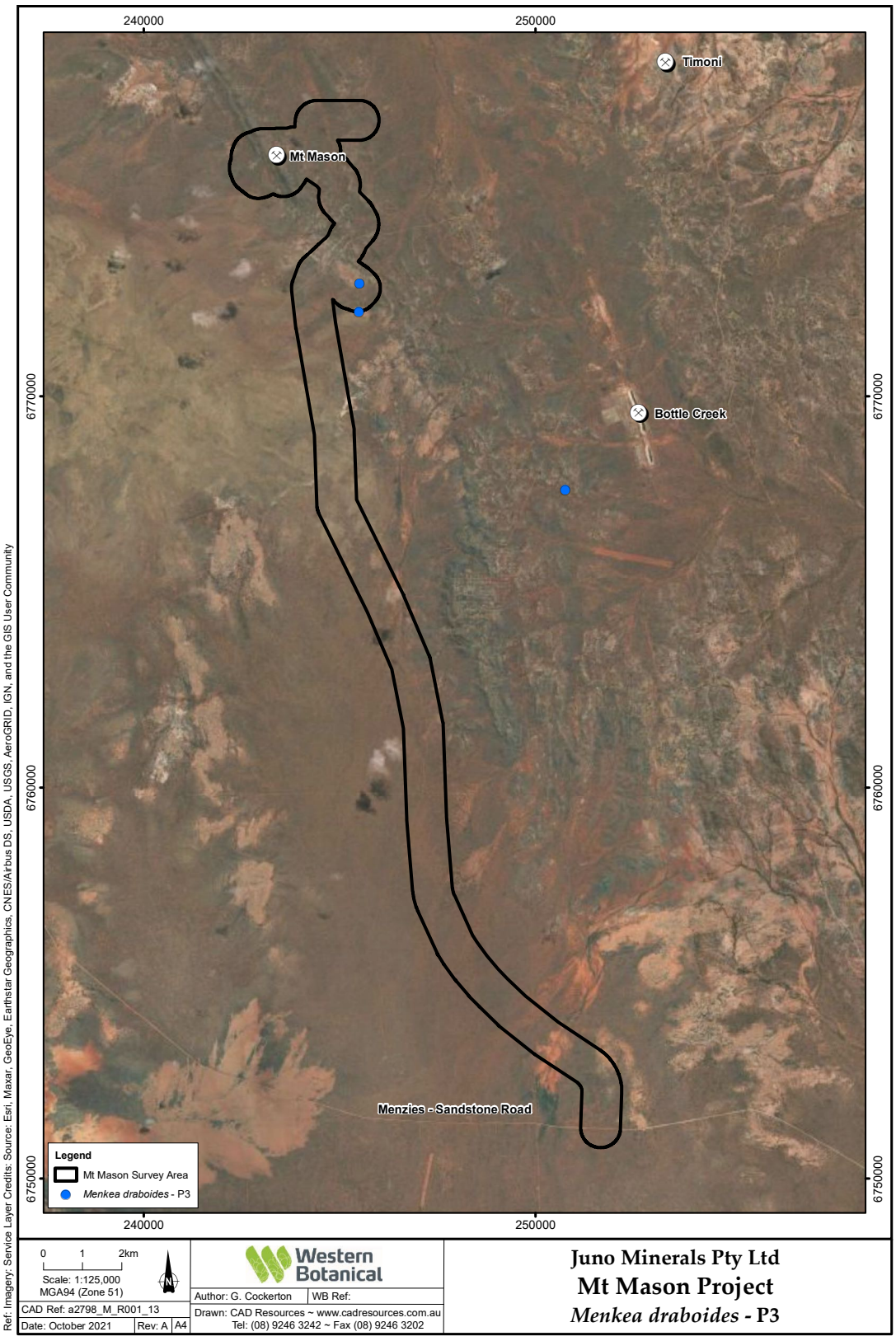
Three populations of *Menkea draboides* were recorded during the field studies in August 2021 near Mt Mason. It was associated with (i) open *Acacia cockertoniana, A. quadrimarginea* small trees and *Thryptomene costata* shrublands on gently inclined granite sheet at Mt Mason near the Camp Cassini site, and (ii) on a low lateritic platform west of the Bottle Creek minesite.

Menkea draboides is a small (5 cm diameter) annual herb with small white flowers, Plate 8, that would readily be overlooked in field survey. It is likely more common in the habitats that support the species. It grows with *Drosera eremaea* on granitoid landscapes at Mt Mason and likely shares this habitat more widely.

While no individuals of *Menkea draboides* were observed within the proposed camp expansion area at Mt Mason (should the camp expansion proceed), its presence in that footprint can not be discounted entirely. This is due to (i) the difficulty in observing the species, (ii) that the identity of the species was not recognised until after the optimal observation period in the August field survey, and (iii) the species could not be re-located in October 2021 due to dry seasonal conditions at that time.

Plate 8. *Menkea draboides* plants and flowers, west of the Bottle Creek minesite.

Plate 9. *Menkea draboides* populations at Mt Mason



Philotheca coateana P3

A large *Philotheca coateana* P3 population occurs on sandplain west of the Camp Cassini site and lies outside area of the proposed Development Envelope. It is a low shrub to 0.7m with pink and white flowers in August to September, Plate 10 and Plate 11. The population is large in area and is conservatively estimated at supporting a minimum of 500 plants. It occurs with a similar species, *Philotheca tomentella*, making identification of the species difficult without flowers.

It is known from 12 populations in W.A. with only two of the WAHERB records having any estimated of population size (1068 estimated), Figure 23.

Figure 23. Distribution of *Philotheca coateana* in Western Australia (Florabase)

The population of *Philotheca coateana* at Mt Mason west of the proposed Development Envelope is presented in Figure 9.

Plate 10. *Philotheca coateana* habitat and shrubs in centre-ground west of the proposed Development Envelope at Mt Mason.

Plate 11. *Philotheca coateana* stem showing leaves, buds and flowers

Species of Interest

Eucalyptus aff. lesouefii (G. & S. Cockerton WB40262)

Eucalyptus aff. *lesouefii* (G. & S. Cockerton WB40262) is a tree to 10 m with dark grey to black persistent rough bark to 2.5m high, pale grey stems and dull blue-green (pruinose) leaves, Plate 12 and Plate 13. It has the typical *Eucalyptus lesouefii* buds and fruits, however, differs from the typical species in retaining the pruinose foliage in the adult tree.

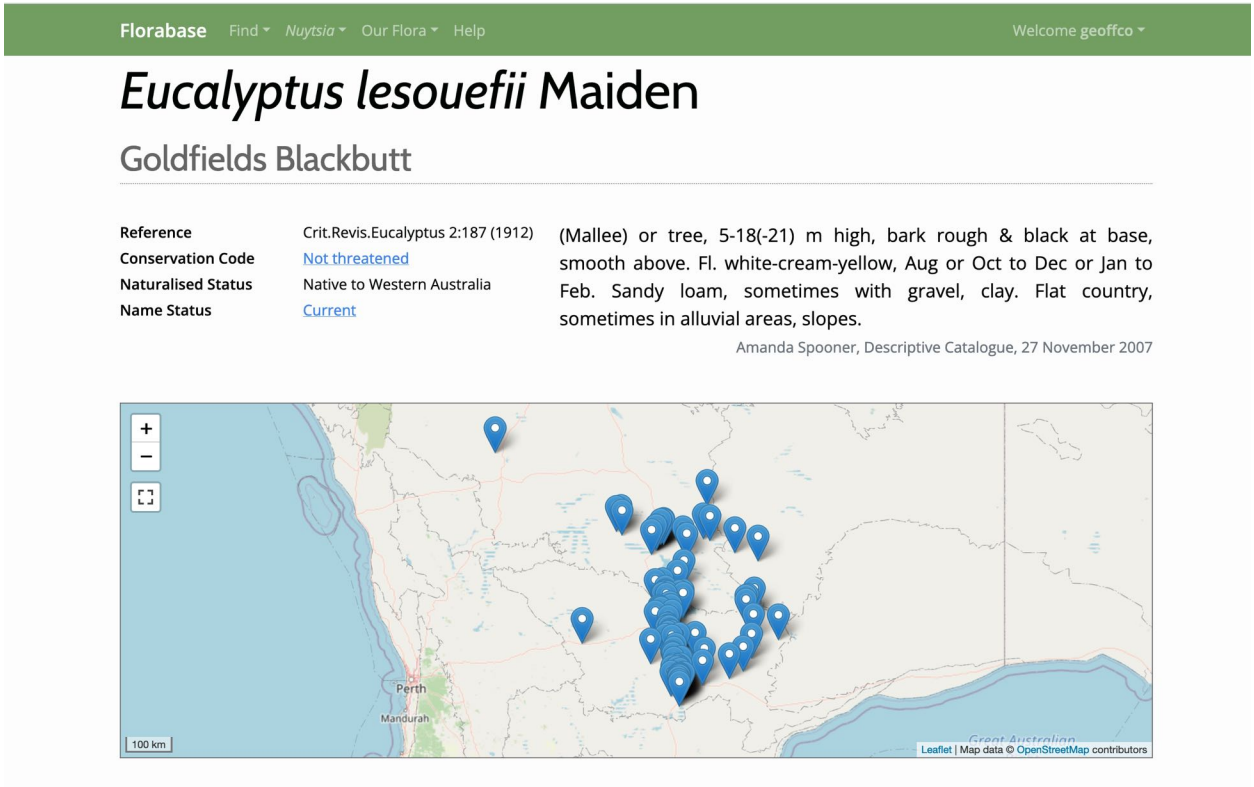
While a new species and not yet formally recognised by the WA Herbarium, it is widely known in the northern region of the known distribution of *Eucalyptus lesouefii*, with the records approximately north of Kalgoorlie representing this new species and those south of Kalgoorlie representing the typical species, Figure 24.

Plate 12. *Eucalyptus* aff. *lesouefii* tree at Mt Mason.

Eucalyptus aff. *lesouefii* (G. & S. Cockerton WB40262) is associated with *Eremophila pantonii* and *Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281) on carbonate soils associated with weathered basalt outcrops throughout its range and these species define that vegetation association at Mt Mason. This species is widespread and not of conservation concern.

Plate 13. ***Leaves and fruits of Eucalyptus*** **aff.** ***lesouefii*** **at Mt Mason.**

Figure 24. ***Eucalyptus lesouefii*** **sens. lat. distribution in Western Australia (Florabase)**



Eucalyptus aff. salubris glaucous branchlets (G. & S. Cockerton WB40683)

Eucalyptus aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683) is a newly recognised species with strong affinities to *Eucalyptus salubris*, Gimlet, but differs in having glaucous (white waxy covered) branchlets on young sapling trees. Young regrowth trees adjacent to the access track into the Mt Mason Study Area from the Mt Ida Road demonstrate this feature, leading us to believe the *Eucalyptus salubris* at Mt Mason represent this new species at Mt Mason.

Plate 14. Young regrowth trees of *Eucalyptus* aff. *salubris* glaucous branchlets adjacent to the access track into the Mt Mason Study Area from the Mt Ida Road

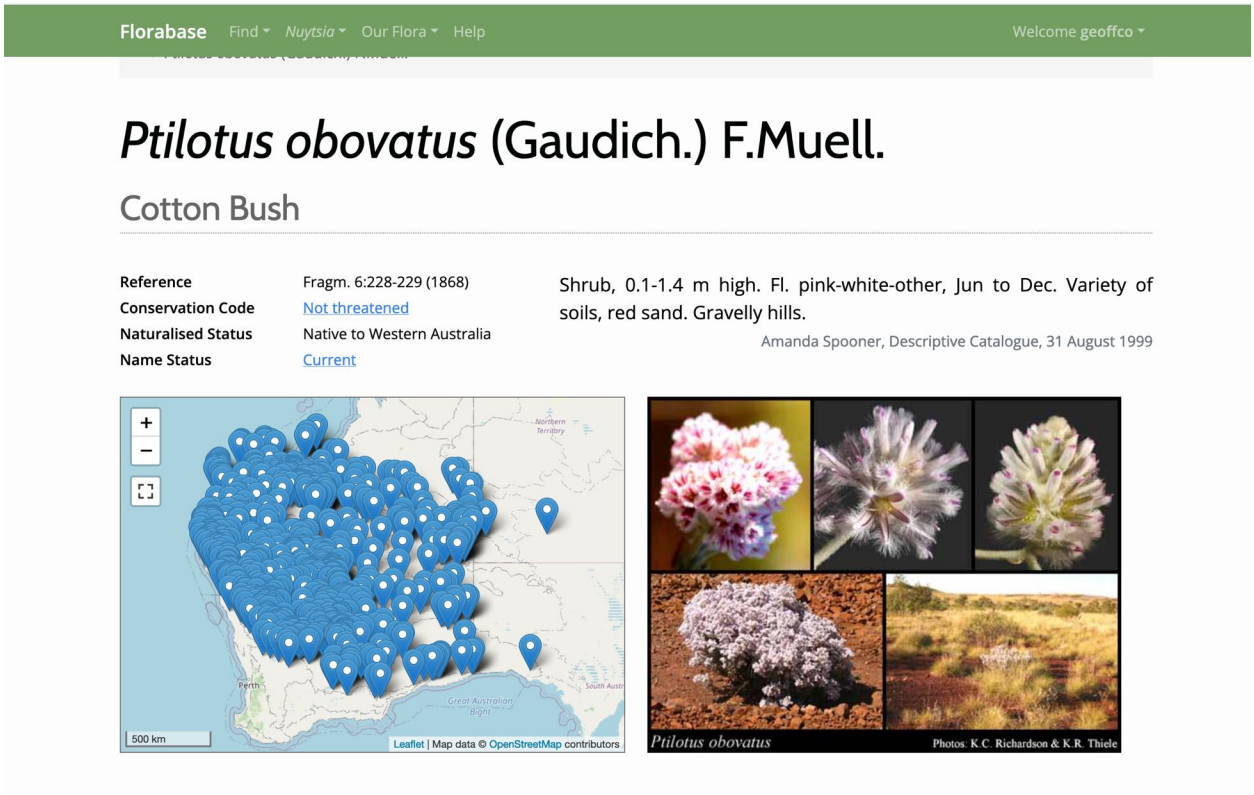
Plate 15. Glaucous branchlets of *Eucalyptus* aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683)

Eucalyptus aff. *salubris* glaucous branchlets (G. & S. Cockerton WB40683) is widespread in the central Coolgardie biogeographic region and its presence at Mt Mason represents the north-easterly extent of its known distribution (Malcolm French, pers. comm.). This species was first recognised near Marvel Lock by the author in 2021 and has since been found to be widespread and abundant where it occurs. This species is widespread and not of conservation concern.

Ptilotus obovatus upright form (G. Cockerton & G. O'Keefe 12281)

Ptilotus obovatus upright form (G. Cockerton & G. O'Keefe 12281) is an upright shrub to 1.5m tall and is always associated with carbonate rich soils and outcropping basalt rocks in the region between Laverton, Wiluna and Mt Mason. It lies within the *Ptilotus obovatus* complex which is known throughout the central and southern parts of Western Australia, Figure 25.

Figure 25. Distribution of *Ptilotus obovatus* in Western Australia



Ptilotus obovatus upright form (G. Cockerton & G. O'Keefe 12281) differs from the typical form of the species in the taller and more upright growth habit, small and fewer flowers in the flowering head and in a slightly later flowering period to the typical species. It is not yet recognised formally by the WA Herbarium, however, some movement in reviewing the diverse group of related species may be undertaken in the near future (Dr. Kevin Thiele, pers. comm.). This species is widespread and not of conservation concern.

Appendix 8. Mt Mason, Species Vs Quadrats Table

Date		15/8/21	16/8/21	16/8/21	16/8/21	18/8/21	12/8/21	15/8/21	16/8/21	18/8/21	18/8/21	15/8/21	14/8/21	11/10/21	13/8/21	13/8/21	11/10/21	12/8/21	13/8/21	14/8/21	18/8/21	13/8/21	13/8/21	14/8/21	17/8/21	14/8/21	15/8/21	13/8/21	14/8/21	15/8/21	17/8/21	17/8/21	11/10/21	16/8/21	11/10/21
Quadrat #		MM17	MM20	MM21	MM23	MM28	MM2	MM18	MM22	MM27	MM30	MM15	MM12	MM34	MM3	MM6	MM33	MM1	MM5	MM9	MM29	MM8	MM7	MM13	MM26	MM10	MM14	MM4	MM11	MM16	MM24	MM25	MM32	MM19	MM31
Taxon	**CONS STATUS**																																	
Cleretum papulosum * (Weed)	Weed			0.5		+																										out		
Mesembryanthemum nodiflorum (Slender Iceplant)	Weed																												out					
Gunniopsis septifraga (taxon under review)																																		7
Ptilotus carlsonii																									+	+								
Ptilotus exaltatus																									+	+								
Ptilotus obovatus (goldfields form)						7			0.25				1.5						out		+					0.25		0.1						+
Ptilotus sp. Indet (glabrous, juvenile plant)																				+														
Ptilotus obovatus (upright form, G. Cockerton & G. O'Keefe 12281)					0.25								+	0.25									+	1	4	5	5.5							
Ptilotus aervoides																																		
Thysanotus manglesianus		+		+			+					+						+		+														
Daucus glochidiatus													+																					
Trachymene ornata						0.25	+		+	+	+	+						+		+		+						+	+		+			
Vincetoxicum lineare		+																																
Alyxia buxifolia																																		out
Leichardtia australis		+			+	+	+		+		+		+			+							+					+			out			
Arthropodium dyeri																		+																
Rhodanthe stricta																										out								
Brachyscome perpusilla									+																									
Hyalosperma demissum																		+	+															
Panaetia lessonii								+										+														out		
Brachyscome ciliaris						+																				+								
Rhodanthe laevis																		+											+					
Goodenia sp Indet. (WB40681)																													+					
Isoetopsis graminifolia													out																					
Indet (immature plant)													+																					
Olearia muelleri																								3	out									
Lawrencella rosea		+					out	+																				+	+		+			
Waitzia acuminata		+					out		+	+	+	+										out						+						
Rhodanthe battii				+		+	+																											
Gilbertia tenuifolia			+																															
Chthonocephalus pseudevax					+													+																
?Gilruthia osbornei																						+						+			+			
Lemooria burkittii					+													+				+									+			
Calotis hispidula				+	+	+	out		out				+												out									+
Senecio glossanthus						+							+													out								
Calocephalus multiflorus																																out		
Siemssenia capillaris																		+																
Gnephosis sp. Indet (WB40685) vesicular hairs on stems																		+																
Olearia pimeleoides																out																		
Olearia humilis		3	0.25	1.75				1		0.5		2										out	+					+	+	out				
Pogonolepis ?muelleriana																				+														
Cephalipterum drummondii					+																	+												
Schoenia filifolia subsp filifolia																																		
Streptoglossa adscendens																		+								out								
Helipterum craspedioides		+		+		+	out		+		+																							
Calotis sp. Perrinvale Station (R. J. Cranfield 7096)	P3																																	
Chrysocephalum puteale																																		
Erymophyllum ramosum																																		+
Stenopetalum anfractum																		+	+	+		+				+								
Lepidium phlebopetalum																										+								
Lepidium oxytrichum				out		+	out																											
Menkea australis				out															+															
Stenopetalum filifolium				out	+																+											+		
Cuphonotus andraeanus																			+			+												
Menkea draboides	P3																		+															
Isotoma petraea						+																												
Wahlenbergia tumidifructa						+																												
Goodenia sp. Indet (WB40681) corolla ?yellow, glandular and simple hairs		+	0.5	+					+	+		+																		+			+	
Goodenia sp. Indet, (WB40682) white simple hairs																			+															
Allocasuarina acutivalvis subsp. acutivalvis								0.75																						5				
Casuarina pauper																																		
Maireana tomentosa var. tomentosa																										+								+
Maireana georgei													+													+	+							0.25
Atriplex bunburyana													1													2	0.25							
Sclerolaena eriacantha																											+							+
Dysphania saxatilis				out		+																										out		
Sclerolaena drummondii																								out										+
Chenopodium melanocarpum						+																												
Eriochiton sclerolaenoides																																		+
Maireana trichoptera													+										out		+	+	out							
Salsola australis																							+		+									
Sclerolaena diacantha																							+		1	+								
Enchylaena lanata																									+									out
Maireana carnosa																																		+
Maireana sedifolia																									+	0.25								
Rhagodia aff. eremaea																																		
Rhagodia drummondii																																		
Wurmbea tenella																	+																	
Wurmbea ?tenella (sterile seedling)																																		
Wurmbea densiflora																			+											out	+			
Crassula colorata var acuminata				+									+																+					
Crassula tetramera						+	out												+															
Crassula sp. hairy																																out		
Callitris collumellaris																out											0.12							
Schoenus nanus																						+							+		+			
Hibbertia arcuata		2.5	12				5	out		0.5		0.5				out	0.25						out					7	0.5	0.2		0.25	12	
Drosera eremaea	P3							+										0.25	+	0.25									+		+			
Euphorbia drummondii													+													+								
Euphorbia boophthona																																		
Phyllanthus erwinii																																		
Swainsona gracilis																																		
Acacia erinacea																								4										
Mirbelia microphylla																																	3	
Acacia caesaneura (broad phyllode variant)				9			3									out						8				6.25			out		0.1		
Acacia caesaneura (narrow phyllode variant)					6		8.5	6		out	4			6									20			4								
Acacia incurvaneura		18	8	20	8	3.5	2	6	60	7.5	22	15								0.25			15.5					+	9	1	2.5		8	
Acacia ramulosa subsp. ramulosa					3		1				10			2							8.5		1			1.5								
Acacia mulganeura										20						4	out																out	
Acacia effusifolia															65	40	40																	
Senna artemisioides subsp. artemisioides															out																			
Senna artemisioides subsp. filifolia					1								0.25			out								out			1	0.25						
Acacia resinosa																		10																
Acacia quadrimarginea		3.5		9		3.5	2.25	2						2				0.75	5	4.25	5.5							2	3			out		
Acacia cockertoniana		out			4.5			3		3	out	15					out					17	5					31.5	8.5	10	5.5	3		1

Date		15/8/21	16/8/21	16/8/21	16/8/21	18/8/21	12/8/21	15/8/21	16/8/21	18/8/21	18/8/21	15/8/21	14/8/21	11/10/21	13/8/21	13/8/21	11/10/21	12/8/21	13/8/21	14/8/21	18/8/21	13/8/21	13/8/21	14/8/21	17/8/21	14/8/21	15/8/21	13/8/21	14/8/21	15/8/21	17/8/21	17/8/21	11/10/21	16/8/21	11/10/21
Quadrat #		MM17	MM20	MM21	MM23	MM28	MM2	MM18	MM22	MM27	MM30	MM15	MM12	MM34	MM3	MM6	MM33	MM1	MM5	MM9	MM29	MM8	MM7	MM13	MM26	MM10	MM14	MM4	MM11	MM16	MM24	MM25	MM32	MM19	MM31
Acacia tetragonophylla									out		0.25		out	1						+	2	0.25	1.5		0.25		0.5	out							
Acacia burkittii																					18													
Acacia caesaneura sp. (juvenile)																				+														
Acacia sibirica													32												0.5		0.5								
Senna artemisioides subsp. sturtii																												out						
Senna sp. Meekatharra (E. Bailley 1-26)																																		
Acacia aneura sens. str.																																		1
Acacia colletioides																																		
Acacia craspedocarpa																																		
Acacia kempeana																																		
Acacia rhodophloia																																		
Jacksonia lanicarpa	P1																																	
Senna manicula														0.25							3													
Frankenia setosa																																		10
Erodium cygnorum				0.5	+		+		0.25		+	+	+					+	+		+	+	+		out			+						
Erodium crinitum						0.25																												
Goodenia havilandii																			0.5	1							+			+		+		
Goodenia occidentalis			+	+					+	+															out				+		+		+	
Goodenia ?capillosa																													+					
Scaevola spinescens (broad leaf no spines)																								0.5										
Goodenia capillosa		+	+		+						+	+																	+		+		+	
Probably a Goodenia sp.							+																											
Goodenia ?havilandii							+												+															
Goodenia sp. small yellow flowers, single indusium										out																								
Goodenia cycnopotamica					+								+					+			+					+							
Goodenia sp Indet., immature, buds, rosette of dentate leaves, axils woolly hairy															+																			
Goodenia ?occidentalis		+						+														+												
Goodenia rosea																				out														
Brunonia australis			+													+																+		+	
Scaevola spinescens (narrow leaf spiny form)		out			1				2		2		out	0.5							1	3.5	0.5		0.1			0.75							
Scaevola spinescens (broad leaf with spines)																										out								
Haloragis trigonocarpa							+						+								+				out	+								
Gonocarpus nodulosus						+																										+		
Haloragis odontocarpa			+							+					+	+																	0.75	
? Caesia sp. #160												+																						
Dianella revoluta var. divaricata							0.25												+				+					+		+				
? Caesia sp. #110					+															+														
Hemigenia sp. Yalgoo (A.M. Ashby 2624)																	out																2	
Prostanthera althoferi subsp. althoferi		0.5	20	1			6			10	0.5	4																	+		+		7	
Prostanthera prostantheroides																4																		
Microcorys sp. Mt Gibson (S. Patrick 2098)																0.75																		
Teucrium teuciflora																							+					0.25						
Amyema banksii (on Grevillela nematophylla)																																		
Amyema benthamii (on Brachychiton gregorii)																																		
Amyema miquelii (on Eucalyptus oleosa)																																		
Ammannia multiflora																														out				
Brachychiton gregorii							1								out		out	out		out			out						+		out			
Abutilon otocarpum subsp. prostratum				out									+																					
Sida sp. golden calyces glabrous (H.N. Foote 32)			+	0.25		+	+								+																		+	
Sida sp. excedentifolia (J.L. Egan 1925)						0.5				+																						+		
Seringia velutina															0.25																				
Sida ectogama				+																		out	25					out						
Sida sp. dark green fruits (S. Van Leeuwin 2260)							+		+		+								+		+							+		+		out		
Calandrinia eremaea (dull seeded variant)				+		0.5	+						+						+	+	+	+	+			out		+			out		+		out
Calandrinia monosperma																			+																
Calandrinia creethiae																			+	0.25															
Calandrinia sp. INDET.																																			+
Calandrinia sp. INDET. 4cm tall																																	out		
Calandrinia sp. INDET. 1 cm tall																																	out		
Calandrinia sp. INDET.																																			
Portulaca intraterranea																																			
Thryptomene costata							1											20		21													+		
Eucalyptus leptopoda subsp. leptopoda		out	out							out							out																out		
Myrtaceae sp. 21-13 ?Calytrix				out	+																														
Calytrix erosipetala					+	+		5.5											0.5										6.5	6	+				
Melaleuca hamata															0.25																				
Micromyrtus flaviflora																8																		
Euryomyrtus patrickiae																4	out																out	5	
Verticordia interioris																																			
Micromyrtus clavata																																			
Eucalyptus vilgamensis					out																														
Calytrix desolata																																	5		
Thryptomene decussata		7.5		4.5	6	28.5		1																							4		1	
Eucalyptus ewartiana												3.5					2																		
Eucalyptus aff. Iesouefii (G & S Cockerton WB40262)	SOI																							18	16	+				0.5					
Eucalyptus aff. salubris glaucous branchlets (G & S Cockerton WB40683)	SOI																									5	38								
Aluta aspera subsp. aspera																																	out		
Calytrix hislopii	P3																																		
Eucalyptus horistes																																			
Eucalyptus leptopoda subsp. elevata															out	2																			
Eucalyptus oleosa										out						out												25						
Melaleuca leiocarpa																0.75																		
Ophioglossum lusitanicum																		+	+	+														
Pterostylis setulosa																																			
Bursaria occidentalis																																			
Plantago debilis																										+								
Eriachne pulchella subsp pulchella			+															+	+											+	+		+	
Aristida contorta																		+	+	+														
Tripogonella loliiformis																		+	+	+									+			out		
Austrostipa ?nitida																								+	+	+	+							
Austrostipa ?trichophylla						+							+								+													+
Enneapogon caerulescens													+													+								
Eriachne ?ovata																																			
Austrostipa sp. (sterile young plant)							+																												
Austrostipa trichophylla						+																													
Paspalidium clementii						+																													
Rytidosperma sp. MM31-5																																			+
Monachather paradoxus			+							+					+																			
Amphipogon caricinus																													+						
Eragrostis eriopoda																											+			out					
Triodia ?rigidissima																																			
Eriachne mucronata Desert form glabrous (WB40048)																																			
Austrostipa elegantissima																																			
Neurachne minor																																			
Grevillea juncifolia																out																		
Grevillea extorris																out													1.75					
Hakea recurva subsp. recurva																															+				
Grevillea nematophylla																																			

Date		15/8/21	16/8/21	16/8/21	16/8/21	18/8/21	12/8/21	15/8/21	16/8/21	18/8/21	18/8/21	15/8/21	14/8/21	11/10/21	13/8/21	13/8/21	11/10/21	12/8/21	13/8/21	14/8/21	18/8/21	13/8/21	13/8/21	14/8/21	17/8/21	14/8/21	15/8/21	13/8/21	14/8/21	15/8/21	17/8/21	17/8/21	11/10/21	16/8/21	11/10/21
Quadrat #		MM17	MM20	MM21	MM23	MM28	MM2	MM18	MM22	MM27	MM30	MM15	MM12	MM34	MM3	MM6	MM33	MM1	MM5	MM9	MM29	MM8	MM7	MM13	MM26	MM10	MM14	MM4	MM11	MM16	MM24	MM25	MM32	MM19	MM31
Cheilanthes sieberi subsp. sieberi		0.25		0.25	2	0.5	1	0.5	0.5		0.25	out						3	2.5	3		+	6						+	+		1	out	out	
Cheilanthes distans						+	0.5																											
Cheilanthes sieberi subsp. sieberi																																		
Cryptandra connata																																		
Psydrax suaveolens			+				+									+			0.25				+					0.5	+					
Hakea lorea subsp. lorea																																		
Psydrax latifolia																																		
Philotheca brucei subsp. brucei		0.5		3	6.5		12	7	18		0.5	0.5								out		9							7	3	2.5	3	0.25		
Phebalium filifolium																out																		
Philotheca coateana	P3															1																		
Philotheca tomentella																1.75																		
Santalum spicatum																					0.5			0.25			0.5						out		
Dodonaea rigida					out		3					out					out		out										out	1		0.25			
Dodonaea petiolaris				5.25																														
Dodonaea viscosa subsp. mucronata						4.5																								0.25		+		out
Dodonaea lobulata													5								15			0.5	1.25		out							0.75
Eremophila pantonii													out											8	0.25	1	15								
Eremophila metallicorum																			0.25				out							0.5					
Eremophila forrestii subsp. forrestii		20	0.5				0.25			8	25	16			0.25	8.5	0.25		0.25	0.25		+	+					30							
Eremophila latrobei subsp. glabra							1.5												out															
Eremophila glabra subsp. Kalgoorlie (A.P.Brown pers. comm.)																									out									
Eremophila latrobei subsp. tuberculate leaves (A. Markey & S. Dillon 5841)																					+	0.25	+					0.25	0.25	0.25	0.15			
Eremophila latrobei subsp. latrobei		3		17	0.75	1		2	1.5	out										0.5	0.25	0.75	0.25						0.25	0.1	0.75		out		
Eremophila oldfieldii subsp. angustifolia					1.5								1	1							7	0.5		out	1		0.5							out
Eremophila clarkei (broad leaf form)					out			+			0.25	0.25										+												
Eremophila longifolia (green leaf form)																																		
Eremophila platycalyx subsp. granites (DJ Edinger & G Marsh DJE4788)																																		
Eremophila oppositifolia subsp. angustifolia																								+										1
Solanum ferocissimum									+		+																							
Nicotiana ?clavicola						+																												
Nicotiana sp. (juvenile)																																		
Nicotiana occidentalis subsp obliqua																																		
Solanum lasiophyllum						+												+	+			+		+										
Nicotiana sp. (seedling)																			+															
Solanum cleistogamum																																		
Stylidium longibracteatum																														+		0.1		
Pimelea spiculigera subsp. thesioides																		out	out															
Parietaria cardiostegia						+							+																					
Roepera kochii													2								+			+	out	0.25	+							
Roepera ovata																								0.25	0.25	0.5	+							+
Tribulus astrocarpus																																		
Species Richness		**22**	**16**	**28**	**27**	**34**	**35**	**17**	**18**	**19**	**19**	**18**	**29**	**8**	**11**	**24**	**11**	**24**	**35**	**25**	**19**	**25**	**21**	**17**	**21**	**29**	**23**	**20**	**19**	**30**	**16**	**30**	**21**	**18**	**24**

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