
FLORA & VEGETATION ASSESSMENT

MT CATTLIN PROJECT EXTENSION

Prepared By



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LIST OF ABBREVIATIONS

ANOSIM:	Analysis of similarity
BAM Act:	<i>Biosecurity and Agriculture Management Act 2007 (WA)</i>
BC Act:	<i>Biodiversity Conservation Act 2016 (WA)</i>
BOM:	Bureau of Meteorology
CLUSTER:	Hierarchical clustering
DBCA	Department of Biodiversity, Conservation and Attractions
DotEE:	Department of the Environment and Energy
DPIRD	Department of Primary Industries and Regional Development
EP Act:	<i>Environmental Protection Act 1986 (WA)</i>
EPA:	Environmental Protection Authority
EPBC Act:	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
IBRA:	Interim Biogeographical Regionalisation for Australia
Mattiske Consulting:	Mattiske Consulting Pty Ltd
PEC:	Priority ecological community
PRIMER:	Plymouth Routines in Multivariate Ecological Research
SIMPER:	Similarity percentages
SIMPROF:	Similarity profile
TEC:	Threatened ecological community
WAH:	Western Australian Herbarium (PERTH)
WC Act:	<i>Wildlife Conservation Act 1950 (WA)</i>
WONS	<i>Weeds of National Significance</i>

EXECUTIVE SUMMARY

Mattiske Consulting Pty Ltd was commissioned in March 2018 by Galaxy Lithium Australia to undertake a Reconnaissance flora and vegetation survey of the Mt Cattlin Project Extension. The Mt Cattlin Project represents a proposed area in which the current Spodumene mining operations may extend. A targeted field assessment of the flora and vegetation of the Mt Cattlin Project Extension within tenement M74/244 was undertaken by four botanists from Mattiske Consulting Pty Ltd, between the 16th and 19th of April, 2018, in accordance with methods outlined in *Technical Guidance – Flora and vegetation surveys for environmental impact assessment*. There were three previous flora and vegetation surveys conducted in the Ravensthorpe Spodumene Project, with some overlap of the current survey area.

A total of 49 quadrats were selected in which flora and vegetation was described and sampled systematically. A total of 123 vascular plant taxa, representative of 67 genera and 33 families, were recorded within the Mt Cattlin Project Extension. The majority of taxa recorded were representative of the Myrtaceae (30 taxa), Fabaceae (19 taxa) and Chenopodiaceae (17 taxa) families. The majority of the taxa recorded were widespread both locally and more broadly within the associated biogeographical subregion.

No threatened flora species pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act 1999* and as listed by the Department of Biodiversity, Conservation and Attractions, or pursuant to section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* or listed by the Department of the Environment and Energy, were recorded within the Mt Cattlin Project Extension. One priority flora species, *Acacia bifaria* (P3), as listed by the Department of Biodiversity, Conservation and Attractions, was recorded within the Mt Cattlin Project Extension. In addition, one potential priority flora species, *?Guichenotia anota* (P1), was recorded, however was unable to be confirmed due to lack of fertile material. Populations of *Acacia bifaria* (P3) were common throughout the area, and were present in all vegetation communities, with the exception of W4. Although a large number of individuals were present within the Mt Cattlin Project, potentially representing an important local population of this species, there are records within Overshot Hill Nature Reserve, Fitzgerald River National Park and many of the remnant vegetation patches surrounding Ravensthorpe.

A total of seven introduced (weed) species were recorded within the Mt Cattlin Project Extension. One of these, **Asparagus asparagoides* was a declared pest organisms pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (the remaining five are permitted under section 11 of the *Biosecurity and Agriculture Management Act 2007*). Two species recorded, **Asparagus asparagoides* and **Lycium ferocissimum*, were listed as Weeds of National Significance. Seventeen of the 49 survey quadrats contained **Asparagus asparagoides* or **Lycium ferocissimum*. **Asparagus asparagoides* was recorded in fifteen survey quadrats and **Lycium ferocissimum* was recorded in seven quadrats.

Based on statistical analysis of species composition data, seven vegetation communities were defined and mapped across the Mt Cattlin Project, with six of these communities present in the Mt Cattlin Project Extension. Overall, the vegetation communities mapped and species recorded in the Mt Cattlin Project Extension were consistent with the historical mapping of Beard and the more recent localised surveys. The majority of the Mt Cattlin Project Extension is situated on brown clay-loam slopes supporting *Eucalyptus* mid mallee woodlands, dominated by *Eucalyptus myriadena* subsp. *myriadena*, *Eucalyptus oleosa* subsp. *corvina* and *Eucalyptus extensa*, over shrublands dominated by fabaceous and chenopod species, and grasses. These woodlands are dissected by creeks, associated with shrublands dominated by *Melaleuca* spp., over *Tecticornia ?pergranulata* subsp. *pergranulata* and *Salicornia quinqueflora* subsp. *quinqueflora*. In addition, shrublands dominated by *Acacia sulcata* var. *platyphylla* and *Melaleuca* spp., over *Lepidosperma* spp., were present on red-brown clay-loam soils on rocky slopes within the area. None of the vegetation communities described within the Mt Cattlin Project Extension resembled any Threatened Ecological Communities or Priority Ecological Communities recorded in the vicinity of the area. The eucalypt woodlands and species present are well represented both at the local and regional scale. Consequently, mine development would result in a minimal impact on the vegetation values of the area.

1. INTRODUCTION

In March 2018, Matiske Consulting Pty Ltd (Matiske Consulting) was commissioned by Galaxy Lithium Australia to undertake a Reconnaissance flora and vegetation survey of an extension to the Mt Cattlin Project. Galaxy Lithium Australia currently mine pegmatite ore at the Ravensthorpe Spodumene Project, which is processed into lithium concentrate. Galaxy Lithium Australia proposes to expand mining operations from the Ravensthorpe Spodumene Project into the adjacent Mt Cattlin Project. There have been two previous flora and vegetation surveys conducted in the Ravensthorpe Spodumene Project, within the vicinity of the Mt Cattlin Project Extension. ENV Australia (ENV) conducted a flora and fauna survey in April 2008 (ENV 2008) and in October 2008 Botanica Consulting conducted a flora and vegetation survey (Botanica Consulting 2008). Furthermore, in December 2017, Matiske Consulting conducted a flora and vegetation survey of a section of the Mt Cattlin Project, south of the current survey area (Matiske Consulting 2018).

1.1. Location and Scope of Project

The Mt Cattlin Project is located approximately 1 km north of Ravensthorpe on mining lease M74/244 (Figure 1). The Mt Cattlin Project is located adjacent to the current Ravensthorpe Spodumene operations. Overshot Hill Nature Reserve is located approximately 2 km to the north-west of the project area.

The scope of the current survey was to undertake a Reconnaissance flora and vegetation survey of the Mt Cattlin Project Extension.

1.2. Environmental Legislation and Guidelines

The following key Commonwealth (federal) legislation relevant to this survey is the:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

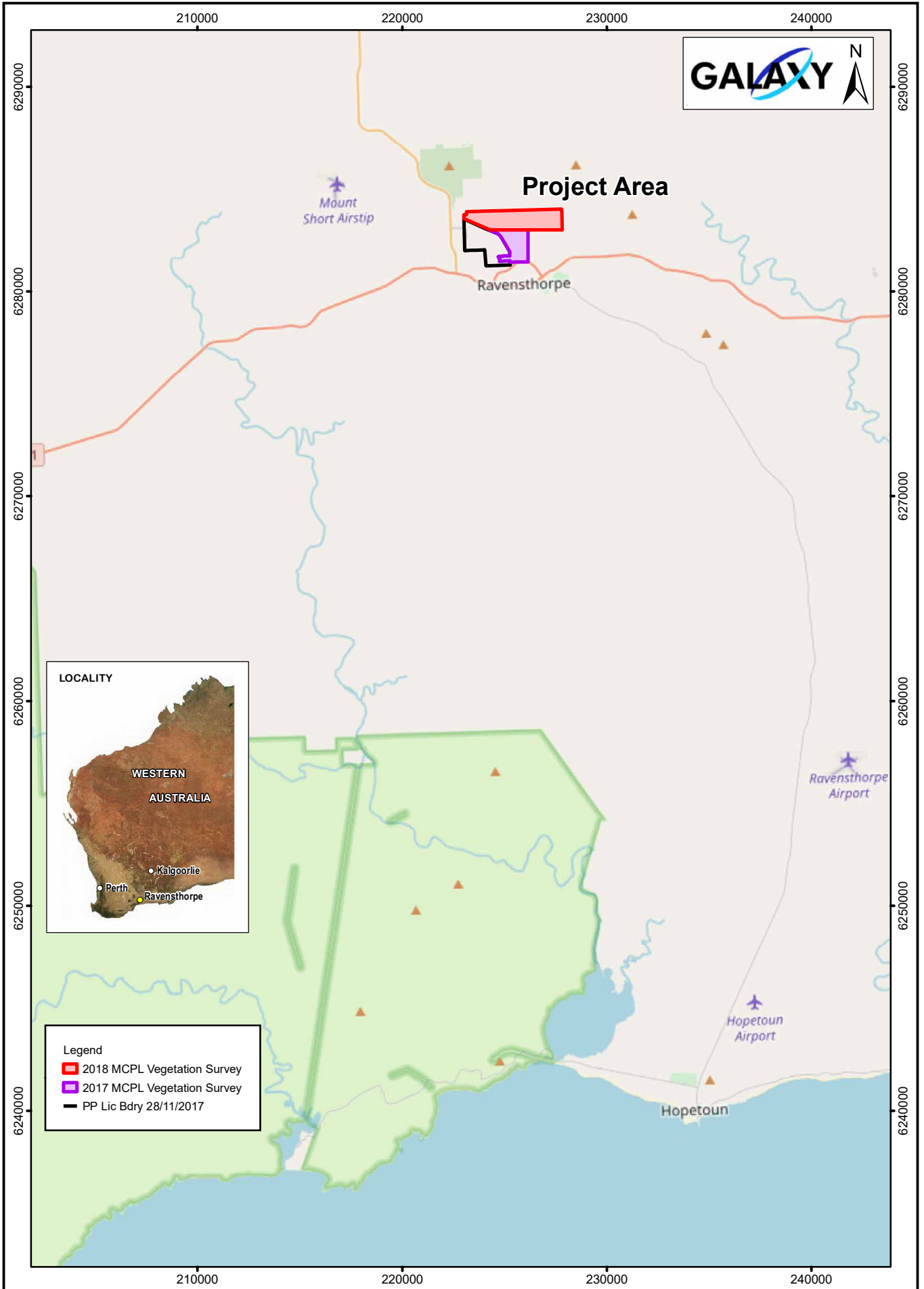
The following key Western Australian (state) legislation relevant to this survey include the:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act);
- *Environmental Protection Act 1986* (EP Act); and
- *Wildlife Conservation Act 1999* (WC Act).

Furthermore, key Western Australian guidelines relevant to this survey are the:

- *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority [EPA] 2016a); and
- *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b).

Definitions of flora and vegetation terminology commonly used throughout this report are provided in Appendix A1-4.



Source Topography: Geoscience Australia

0 6,000 m
 Scale: 1:250,000
 MGA94 (Zone 51)
 CAD Ref: a2587_f12_01
 Date: August 2018

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Galaxy Resources - Mt Cattlin Project
Locality

Figure:
1

2. BACKGROUND

2.1. Regional Context

The proposed Mt Cattlin Project Extension lies within the Eyre Botanical District, which is situated in the Esperance Plains Region (Beard 1990). More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the Mt Cattlin Project Extension being situated within the Fitzgerald (ESP01) subregion of the Esperance Plains bioregion (Department of the Environment and Energy [DotEE] 2018a).

2.2. Climate

Beard (1990) described the climate of the Mt Cattlin Project Extension as warm Mediterranean, with winter precipitation ranging from 500-700 mm per annum and 5-6 dry months (Beard 1990). Ravensthorpe is the closest active Bureau of Meteorology (BOM) weather station to the Mt Cattlin Project Extension. Rainfall and temperature data from Ravensthorpe (BOM 2018) is illustrated in Figure 2. In the 12 months prior to the survey, the temperatures in the area did not deviate greatly from the long-term averages. From April 2017 to March 2018 the area received a total of 354.7 mm of rainfall which was lower than the long-term average of 432.1 mm per year. Three of the four months prior to the survey received approximately half of the long-term average rainfall (Figure 2). However, February received higher than average rainfall (Figure 2).

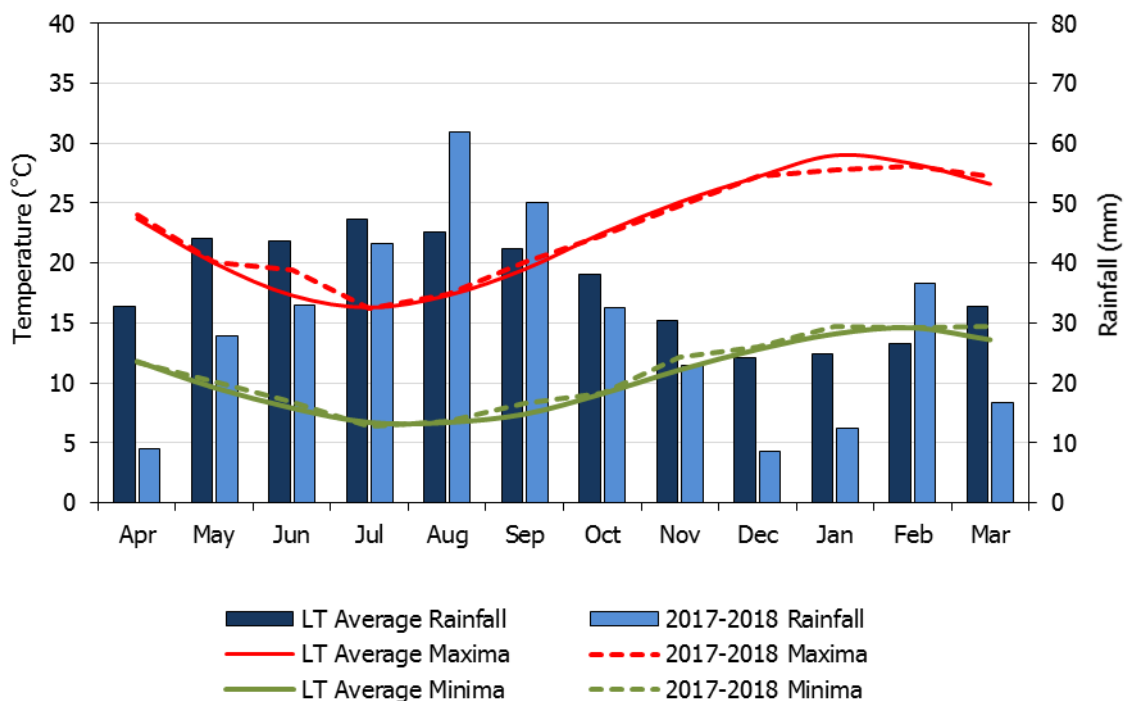


Figure 2: Rainfall and temperature data for Ravensthorpe

Note: Long-term (LT) average monthly rainfall (1901-2018) and temperature (1962-2018) data, together with monthly rainfall and temperature data for the period of April 2017 to March 2018 (BOM 2018).

2.3. Geology, Soils and Topography

Beard (1990) described the underlying geology of the Eyre Botanical District as mainly Eocene sediments with outcrops of granites and quartzites. Topographically the district is a plain with a little-dissected prior land surface rising gently from near sea level to a height of 200 m, broken by quartzite ranges and granite domes (Beard 1990). The soils are described as sandy overlying clay or ironstone gravels (Beard 1990).

The ESP1 subregion has variable relief, comprising subdued relief on the sandplains of the coastal region, punctuated with metamorphosed granite and quartzite ranges both inland and on the coastal plain. It lies mainly on the Bremer Sedimentary Basin with some sections within the Albany-Fraser Orogen of the Yilgarn Craton. It has extensive western plains over Eocene marine sediment basement with small areas of Gneiss outcropping. Archaean greenstones – sand sheets with varying levels of lateritisation with gravel soils also occurs. The region is dominated by duplex soils and deep and shallow sands on the plains and dissected areas and by shallow sandy soils on the mountain ranges (Comer *et al.* 2001).

2.4. Regional Vegetation

2.4.1. Botanical District

The Mt Cattlin Project Extension is situated within the Eyre Botanical District of the Esperance Plains Region. The vegetation of this district is predominantly scrub-heath and mallee-heath on sandplain with *Eucalyptus pleurocarpa* as a characteristic species. Mallee (*Eucalyptus redunca*, *Eucalyptus incrassata*) occupies valleys incised in the plain (Beard 1990).

2.4.2. Vegetation Systems

Beard (1973), in his 1:250,000 mapping series described the vegetation of the Ravensthorpe Area, which encompasses the Mt Cattlin Project Extension in its western extent. Within the Ravensthorpe Area, Beard (1973) described a range of vegetation systems. A vegetation system consists of a particular series of plant communities recurring in a catenary sequence or mosaic pattern linked to topographic, pedological and/or geological features. The Mt Cattlin Project Extension is situated within Beard's Ravensthorpe System. The Ravensthorpe vegetation system is associated with greenstone outcropping around the township and vegetation included thickets, mallee and sclerophyll woodlands or low forest, and patches of mallee-heath south-west of Mt. Desmond on a remnant of plateau surface. The vegetation described by Beard (1973) in the Ravensthorpe System is set out below.

Thicket: Dominated by low mallees *Eucalyptus preissiana* and *E. lehmannii*, with *Banksia heliantha*. Other associated species include other mallees, *Banksia lemmaniana*, *Allocasuarina campestris*, *Calothamnus ?pinifolius*, *Melaleuca uncinata*, *Grevillea patentiloba* subsp. *platypoda* and *Eucalyptus desmondensis*.

Mallee: Mallee on the pediments of ranges and on a stretch of low hilly country south of Ravensthorpe. *Eucalyptus* species in this association include *Eucalyptus gardneri*, *E. loxophleba*, *E. uncinata*, *E. flocktoniae*, *E. conglobata*, *E. spathulata*, *E. platypus*, *E. annulata* and *E. stoatei*. Other species associated with the vegetation type are *Hakea laurina*, *Banksia lemmaniana* and *Melaleuca uncinata*.

Sclerophyll Woodland: The woodlands occupy broad valleys with deep soil. In more sandy soils *Eucalyptus loxophleba* and *E. salmonophloia* occur and watercourses are dominated by *E. occidentalis*, with *E. annulata* associated locally.

2.4.3. IBRA Biogeographical Sub-regions

More recently, the Interim Biogeographic Regionalisation for Australia (IBRA) delineated 85 bioregions across Australia, based on a range of biotic and abiotic factors, including climate, vegetation, fauna, geology and landform (Thackway and Cresswell 1995; DotEE 2018a). IBRA Version 7 refined the original 85 bioregions and 403 subregions described in IBRA 6.1, by expanding the number of regions to 89 and the number of subregions to 419. The subregions represent more localised and homogenous geomorphological units in each bioregion. IBRA7 includes four new oceanic bioregions, and seven new subregions in the oceanic bioregions and six new subregions in South Australia (DotEE 2018a).

The Mt Cattlin Project Extension is situated within the Fitzgerald subregion of the Esperance Plains region. Comer *et al.* (2001) described the Fitzgerald subregion as having vegetation types that are diverse, often cryptic and significantly endemically localised in nature. The subregion is characterised by myrtaceous and proteaceous scrub and mallee heaths on sandplain overlying Eocene sediments (rich in endemics), Eucalypt woodlands occurring in gullies and alluvial foot-slopes, and more cryptic vegetation communities comprising of herbfields and heaths (rich in endemics) on abrupt granite tors and quartzite ranges that rise from the plain and the greenstone heath and shrublands. The Fitzgerald subregion is dominated by a diverse array of Eucalypts including: coastal dune woodlands of *Eucalyptus utilis* and *E. cornuta*, coastal shrublands and heathlands dominated by *Agonis flexuosa*, *Eucalyptus angulosa* and *E. notactites*, mallee shrubland and heath (rich in endemics) dominated by *Eucalyptus captiosa*, *E. decipiens* subsp. *chalara* and subsp. *adesmophloia*, *E. falcata*, *E. flocktoniae*, *E. lehmannii*, *E. phaenophylla*, *E. pleurocarpa*, *E. sporadica*, *E. tetraptera*, *E. thamnoides* and *E. uncinata*; mallet and moort woodlands on gravel rises, clay sheets and colluvial slopes and greenstone (rich in endemics) *Eucalyptus astringens* subsp. *redacta*, *E. cernua*, *E. clivicola*, *E. megacornuta*, *E. platypus* subsp. *platypus*, and *E. praetermissa* are typical dominants of these woodlands; Yate and York Gum (in the Pallinup system) woodlands on alluvials, Jarrah/Marri woodlands in the west and Goldfields woodland and mallee systems mixing with south coast and wheatbelt taxa on Greenstone in the east with *Eucalyptus annulata*, *E. brachycalyx*, *E. cernua*, *E. desmondensis*, *E. gardneri* subsp. *ravensthorpensis*, *E. occidentalis*, *E. oleosa* subsp. *corvina*, and *E. salmonophloia* (Comer *et al.* 2001).

2.4.4. Pre-European Vegetation

The pre-European vegetation dataset, prepared through the National Land and Water Resources Audit, describes vegetation in relation to natural resource boundaries commonly used for environmental reporting (Shepherd *et al.* 2002). The pre-European vegetation dataset builds on the earlier vegetation studies by Beard (1973, 1990) vegetation maps. The pre-European vegetation dataset was developed by G R Beeston and A J M Hopkins, based on 1: 250,000 scale mapping. A total of 819 vegetation types were recognised in Western Australia, ranging from tall forests, through to a wide variety of forests and woodlands, shrublands and grasslands, mostly with an overstorey of trees. The identification of the original pre-European and current extent of each of the vegetation types assist in providing baselines for managing issues such as land clearing. The Intensive land-use zone, in which the Mt Cattlin Project Extension lies within, has been extensively cleared for intensive agricultural activities and only patches of the original vegetation remain (Shepherd *et al.* 2002).

In more recent years Shepherd *et al.* (2001) delineated a series of vegetation maps based primarily in this region on the previous work of Beard (1973) and the merged work was published in 2013 (Beard *et al.* 2013). The area of pre-European vegetation associations intersecting the Mt Cattlin Project Extension are set out in Table 1, and are based on the 2016 Statewide Vegetation Statistics (Government of Western Australia 2016).

Table 1: Extent of pre-European vegetation associations intersecting the Mt Cattlin Project Extension, Statewide and within the Fitzgerald Subregion

VEGETATION ASSOCIATION	STATEWIDE			FITZGERALD SUBREGION		
	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	PERCENT REMAINING (%)	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	PERCENT REMAINING (%)
352 - Medium woodland; York gum	724,272.97	142,751.37	19.71	22,816.85	6,566.34	28.78
934 - Shrublands; mallee scrub (<i>Eucalyptus nutans</i>)	9,282.37	4,243.66	45.72	8,320.47	3,863.24	46.43

2.5. Previous Surveys

Three previous flora surveys have been carried out in the vicinity of the Mt Cattlin Project Extension, with ENV conducting a flora and fauna survey in April 2008 (ENV 2008), Botanica Consulting conducting a flora and vegetation survey in October 2008 (Botanica Consulting 2008) and Mattiske Consulting conducting a flora and vegetation survey in December 2017 (Mattiske Consulting 2018). Botanica Consulting identified a total of 12 vegetation units in the wider area, whilst ENV identified a total of 15 vegetation units, and Mattiske Consulting identified seven vegetation units. All previously identified vegetation units comprised predominantly of open woodlands containing various *Eucalyptus* species. The ENV and previous Mattiske Consulting surveys lie to the south of the current extension, and whilst they are adjacent to the area, they do not overlap (ENV 2008; Mattiske Consulting 2018). However, the northern section of the survey conducted by Botanica Consulting in October 2008 encompasses the Mt Cattlin Project Extension (Botanica Consulting 2008). Results from these previous surveys are discussed in the relevant sections within the current desktop assessment results (Section 5).

3. OBJECTIVES

The objective of this survey was to undertake a flora and vegetation assessment of the Mt Cattlin Project Extension, including:

- Undertake a desktop study of the flora and vegetation of the Mt Cattlin Project Extension, with an emphasis on threatened and priority flora, and Threatened and Priority Ecological Communities (TECs and PECs);
- Review the previous literature of the Mt Cattlin Project Extension survey area;
- Undertake a Reconnaissance flora and vegetation survey of the Mt Cattlin Project Extension, and collect and identify the vascular plant species present;
- Review the conservation status of the vascular plant species recorded by reference to current literature and listings by the Department of Biodiversity, Conservation and Attractions (DBCA) and plant collections held at the Western Australian State Herbarium (WAH), and listed by the DotEE under the EPBC Act;
- Define and map the vegetation communities in the Mt Cattlin Project Extension;
- Define and map the location of any threatened and priority flora located within the Mt Cattlin Project Extension;
- Define any management issues related to flora and vegetation values; and
- Prepare a report summarising the findings.

4. METHODS

4.1. Desktop Assessment

A desktop assessment was conducted using FloraBase (WAH 1998-), NatureMap (DPaW 2007-) and the EPBC Act Protected Matters (DotEE 2018b) databases, to identify the possible occurrence of threatened and priority flora and TECs and PECs within the Mt Cattlin Project Extension. The NatureMap search parameters used were a 10 km radius 'by circle' at 33° 33' 42" S, 120° 01' 47" E. The EPBC Act Protected Matters Search Tool (DotEE 2018b) was also centred on the aforementioned co-ordinates.

In addition, historical documentation and vegetation mapping of the region, principally that of CAR Reserve Analysis Statewide Vegetation Statistics (Government of Western Australia 2016), Beard (1973; 1990), ENV (2008), Botanica Consulting (2008) and Mattiske Consulting (2018) were reviewed. These documents provided extensive resource material for the floristics and vegetation of the Mt Cattlin Project Extension.

4.2. Field Survey

A field assessment of the flora and vegetation of the Mt Cattlin Project Extension within tenement M74/244 was undertaken by four botanists from Mattiske Consulting, between the 16th and 19th of April, 2018, in accordance with methods outlined in *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b). All botanists held valid collection licences to collect flora for scientific purposes, issued under the WC Act.

The geographic co-ordinates defining the Mt Cattlin Project Extension were supplied by Galaxy Lithium Australia. Aerial photographic maps of the proposed Mt Cattlin Project Extension were prepared and supplied by CAD Resources. Survey quadrats for the Mt Cattlin Project Extension were selected using aerial photographic maps and field observations. A total of 49 survey quadrats were selected to sample all vegetation types, with replication, within the Mt Cattlin Project Extension. Survey quadrats consisted of un-marked 20 x 20 metre quadrats. The locations of all survey quadrats established within the Mt Cattlin Project Extension are set out in Appendix B.

Flora and vegetation were described and sampled systematically at each survey quadrat, and additional opportunistic collections were undertaken wherever previously unrecorded plants were observed. At each quadrat the following floristic and environmental parameters were recorded:

- GPS location (GDA94 datum, zone 51H);
- Local site topography;
- Soil type and colour;
- Outcropping rocks and their type;
- Percentage litter cover and percentage bare ground;
- Approximate time since fire;
- Vegetation condition (based on Keighery 1994); and
- For each vascular plant species, the average height and the percentage cover (of both alive and dead material) over the survey quadrat.

All plant specimens collected during the field surveys were dried and processed in accordance with the requirements of the WAH. The plant species were identified based on taxonomic literature and through comparison with pressed specimens housed at the WAH. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH (1998-).

4.3. Survey Timing

According to Table 3 in the *Technical guidance – Flora and vegetation surveys for environmental impact assessment* (EPA 2016b), the primary survey timing for the South – West Botanical Province is spring (September-November). As the current survey was conducted in April, it falls outside of this period. As a result, many plants were not flowering, limiting the number of confirmed species identifications. Furthermore, potential annual species were likely under represented. Not only does this affect the completeness of the species list, but also creates limitations in statistical analysis.

4.4. Analysis of Quadrat Data

A species accumulation curve, based on accumulated species versus quadrats surveyed was prepared to provide an indication of the level of adequacy of the survey effort (*EstimateS* – Colwell 2006). As the number of survey quadrats increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence based coverage estimator of species richness (Chao 2004). When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

Plymouth Routines in Multivariate Ecological Research v6 (PRIMER) statistical analysis software was used to analyse species-by-quadrat data and discriminate survey quadrats on the basis of their species composition (Clarke and Gorley 2006). Species-by-quadrat data from 76 quadrats was analysed, including 27 quadrats from the Matiske Consulting 2017 survey and 49 quadrats from the Matiske Consulting 2018 survey. To down-weight the relative contributions of quantitatively dominant species, a fourth root transformation was applied to the data set. Introduced species, annual species and singletons (species recorded at a single quadrat and not forming a dominant structural component) were excluded from the data set prior to analysis. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including Similarity Profile (SIMPROF), Hierarchical Clustering (CLUSTER), Similarity Percentages (SIMPER) and Analysis of Similarity (ANOSIM). Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities.

4.5. Vegetation Descriptions

Vegetation descriptions were based on Alpin's (1979) modification of the vegetation classification system of Specht (1970), to align with the National Vegetation Information System (NVIS) (see Appendix A5). Vegetation communities were described at the association level of the NVIS classification framework, as defined by the Executive Steering Committee for Australian Vegetation Information (2003). Vegetation condition of each of the mapping sites was assessed as per the criteria developed by Keighery (1994) (see Appendix A6).

4.6. Survey Limitations

A general assessment was made of the current survey against a range of factors that may have limited the outcomes and conclusions of this report (Table 2). Based on this assessment, the present survey has not been subject to constraints which would affect the thoroughness of the survey, and the conclusions which have been formed.

Table 2: Potential limitations affecting the conclusions made in this report

POTENTIAL SURVEY LIMITATION	IMPACT ON CURRENT SURVEY
Availability of contextual information at a regional and local scale	Not a limitation: Reference resources such as Beard’s mapping and historical survey data in the vicinity of the survey area (consultant’s reports), together with online flora and vegetation information, has provided an appropriate level of information for the current survey.
Competency/experience of team carrying out survey; experience in the bioregion surveyed	Not a limitation: The two botanists leading teams had extensive experience working in a range of botanical districts across the state. The majority of the plants observed in the field were collected for formal identification and were compared with specimens at the Western Australian State Herbarium where required.
Proportion of flora collected and identification issues	Minor Constraint: Based on the survey quadrat data, it was estimated that approximately 78.51 % of the potential flora species that may be present were recorded (refer to Section 6.1 of this report). Of the 123 species recorded within the Mt Cattlin Project Extension, 37 species (30.08 %) were unable to be confidently identified to species level due to the absence of sufficient taxonomic characters to enable accurate identification. Not only does this affect the completeness of the species list, but also creates limitations in statistical analysis. As a result, majority of vegetation quadrats were statistically dissimilar to quadrats surveyed in December 2017, and previously defined vegetation communities.
Effort and extent of survey	Not a limitation: The intensity of the survey effort of the Mt Cattlin Project Extension was considered to be sufficient. Resources, in terms of equipment, support and personnel were good.
Access restrictions within survey area	Not a limitation: Vehicle access to the Mt Cattlin Project Extension and foot traverses were sufficient to allow access to the entirety of the survey area.
Survey timing, rainfall, season of survey	Potential limitation: The EPA (2016b) recommends that flora and vegetation surveys in the South – West Botanical Province be conducted in Spring (September-November). The current survey was conducted in April, outside of this period. Rainfall in the month preceding the survey was below average (Figure 2). Not only does this affect the completeness of the species list, but also creates limitations in statistical analysis. As a result of 30.08 % of all plants unable to be identified to species level, majority of vegetation quadrats were statistically dissimilar to quadrats surveyed in December 2017 and previously defined vegetation communities.
Disturbances (fire/flood/clearing)	Not a limitation: The Mt Cattlin Project Extension exhibits moderate levels of disturbance from historical agricultural and mining activities.
Data and statistical analysis	Potential limitation: Due to the survey timing and resulting identification issues, the majority of survey quadrats were statistically dissimilar to previously delineated vegetation communities. Therefore, the majority of survey quadrats were assigned to previously defined vegetation communities based on site data, and the presence of select indicator species.

5. DESKTOP ASSESSMENT RESULTS

5.1. Potential Flora

A total of 947 vascular plant taxa, representative of 306 genera and 92 families, have the potential to occur within the Mt Cattlin Project Extension (DPaW 2007-). The most commonly represented families were the Myrtaceae (165 taxa), Fabaceae (138 taxa) and Proteaceae (88 taxa). The most commonly represented genera were *Eucalyptus* (75 taxa), *Acacia* (60 taxa) and *Melaleuca* (34 taxa).

A total of 124 vascular plant taxa, representative of 76 genera and 40 families, were recorded by Botanica Consulting (2008) and a total of 95 vascular plant taxa, representative of 45 genera and 29 families, were recorded by ENV (2008), in previous surveys of areas including, and adjacent to, the Mt Cattlin Project Extension (Botanica Consulting 2008; ENV 2008). The December 2017 survey, conducted by Mattiske Consulting within the Mt Cattlin Project adjacent to the current extension, recorded a total of 138 vascular plant taxa, representative of 85 genera and 35 families (Mattiske Consulting 2018). Species lists from these previous surveys are presented in Appendix C.

5.1.1. Potential Threatened and Priority Flora

Five threatened flora species, *Acacia rhamphophylla*, *Conostylis lepidospermoides*, *Daviesia megacalyx*, *Eucalyptus purpurata* and *Eucalyptus steedmanii*, pursuant to subsection (2) of section 23F of the WC Act and as listed by the DBCA (2018a) have the possibility of occurring in the Mt Cattlin Project Extension. At a Federal level, *Acacia rhamphophylla*, *Conostylis lepidospermoides* and *Daviesia megacalyx* are listed as Endangered and *Eucalyptus steedmanii* is listed as Vulnerable, pursuant to section 179 of the EPBC Act or listed by the DotEE (2018c).

A total of 56 priority flora species as listed by WAH have the potential to occur within the Mt Cattlin Project Extension, comprising of 18 Priority 1, two Priority 2, 19 Priority 3 and 17 Priority 4 species (WAH 1998-).

An assessment of the likelihood of recording any of the listed threatened and priority taxa within the Mt Cattlin Project Extension, based on factors including known soil type, topography and distribution, is set out in Appendix D. Based on this assessment, one taxa – *Acacia bifaria* (P3) – was ranked as being highly likely to be recorded as it has been recorded within the vicinity of the Mt Cattlin Project Extension in previous surveys by both ENV (2008), Botanica Consulting (2008) and Mattiske Consulting (2018). Twenty-seven taxa were ranked with a medium likelihood of being recorded in the survey area and the remaining 33 taxa were ranked with a low likelihood of being recorded in the survey area (Appendix D). Botanica Consulting (2008) previously identified *Lepidosperma ?diurnum* and *Eucalyptus proxima*, which have since been delisted and are no longer considered conservation significant species.

5.1.2. Potential Introduced (Weed) Species and Declared Pest (Plant) Organisms

A total of 67 introduced (weed) species have the potential to occur within the Mt Cattlin Project Extension (DPaW 2007-). Four of these species, **Asparagus asparagoides*, **Gomphocarpus fruticosus*, **Ornithogalum umbellatum* and **Rhaponticum repens*, are declared pest organisms pursuant to section 22 of the BAM Act (Department of Primary Industries and Regional Development [DPIRD] 2018). **Asparagus asparagoides* is also listed as a Weed of National Significance (WONS; DotEE 2018e).

In previous surveys of the Mt Cattlin Project Extension and adjacent areas, Botanica Consulting recorded 22 weed species, of which two, **Asparagus asparagoides* and **Moraea flaccida*, were declared pest species, and two, **Asparagus asparagoides* and **Lycium ferocissimum* were WONS (Botanica Consulting 2008; DotEE 2018e; DPIRD 2018). Although Botanica Consulting also identified **Carthamus lanatus*, it is now listed as permitted. ENV recorded seven weed species including **Asparagus asparagoides* and **Lycium ferocissimum*, and an additional declared pest organism, **Gomphocarpus fruticosus* (DotEE 2018e; DPIRD 2018; ENV 2008). During the December 2017 survey conducted by Mattiske Consulting,

31 weed species were recorded, including **Asparagus asparagoides*, **Lycium ferocissimum* and **Gomphocarpus fruticosus* (Mattiske Consulting 2018; DotEE 2018e; DPIRD 2018).

**Asparagus asparagoides* and **Moraea flaccida* have a declared pest organism category of exempt, requiring no permit of conditions for keeping, however they may be regulated by other legislation. **Gomphocarpus fruticosus* has a declared pest organism category of C3 – management for the Shire of Ravensthorpe (DPIRD 2018). A declared pest category of C3 requires the land owner or occupier to undertake control measures (see Appendix A3 for further information). **Ornithogalum umbellatum* and **Rhaponticum repens* have a declared pest organism category of C1 – exclusion for the whole state. A declared pest category of C1 requires the land owner or occupier to undertake control measures (Appendix A3).

5.2. Potential Threatened and Priority Ecological Communities

No TECs or PECs were identified as occurring in the vicinity of the Mt Cattlin Project Extension in either of the previous surveys (Botanica Consulting 2008; ENV 2008). One TEC (*Proteaceae Dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia*), pursuant to Schedule 1 of the WC Act and as listed by the DBCA (2018b), was recorded within a 10 km buffer of the Mt Cattlin Project Extension. This TEC is listed as Vulnerable pursuant to the EPBC Act and as listed by the Department of the Environment and Energy (DotEE 2018d). Although recorded within the vicinity of the survey area, it does not intersect with the Mt Cattlin Project Extension and this vegetation type, associated with the Central Barren Ranges, eastern Stirling Range and Russel Range, is not expected to occur within the survey area. Components of this TEC are also listed as PECs (ranging from priority 1 through priority 4) by the DBCA (2017b).

No PECs as listed by the DBCA (2017b) currently intersect the Mt Cattlin Project Extension. However, in addition to the TEC (and its associated PECs listed above) there is currently one additional priority 3(iii) PEC, as listed by the DBCA (2017b), that occurs 4.5 km to the north-east of the Mt Cattlin Project Extension. The priority 3(iii) *Heath on Komatiite of the Ravensthorpe area* community is described as dense heath on alkaline red clay over komatiite (ultra-mafic rock) and associated carbonates. The vegetation is described as very open tree mallee over heath B in Hale Bopp orebody area with dominant species including *Beyeria cockertonii* (T), *Acacia ophiolithica*, *Hakea verrucosa*, *Grevillea fastigiata* (P4), *Melaleuca ulicoides*, *Allocasuarina hystricosa* (P3), *Verticordia oxylepis*, *Grevillea oligantha*, *Hybanthus floribundus*, *Pomaderris brevifolia*, *Pultenaea wudjariensis* (P1), *Melaleuca pomphostoma*, *Nematolepis phebaloides*, *Philotheca gardneri* subsp. *gardneri*, *Gyrostemon sessilis*, *Calothamnus quadrifidus*, *Calytrix tetragona*, *Halgania anagaloides*, *Coleanthera myrtoides*. The current survey area is not expected to impact any of these PECs.

5.3. Other Matters

In addition to the items reviewed in the preceding paragraphs of this desktop assessment (sections 5.1 and 5.2), the EPBC Act Protected Matters Report (DotEE 2018b) reveals that within 10 km of the Mt Cattlin Project Extension, the following applies:

World Heritage Properties	none
National Heritage Places	none
Wetlands of International Importance	none
Commonwealth Heritage Places	none
Critical Habitats	none
Commonwealth Terrestrial Reserves	none
Regional Forest Agreements	none
Nationally Important Wetlands	none

6. FIELD SURVEY RESULTS

6.1. Flora

A total of 123 vascular plant taxa, representative of 67 genera and 33 families, were recorded within the Mt Cattlin Project Extension. The majority of taxa recorded were representative of the Myrtaceae (30 taxa), Fabaceae (19 taxa) and Chenopodiaceae (17 taxa) families. The taxa recorded during the survey are set out in Appendix C. A list of plant taxa recorded at each survey quadrat within the Mt Cattlin Project Extension is set out in Appendix E. Five annual plant species were recorded during the survey of the Mt Cattlin Project Extension, representing 4.10 % of all taxa recorded. Of the five annual species, only two were native species. A number of plant species could not be identified accurately to species level due to the absence of sufficient taxonomic characters to enable accurate identification.

A species accumulation curve was used to evaluate the sampling adequacy and is presented in Figure 3. The incidence based coverage estimator (ICE) of species richness was 165.58. Based on this value and the total of 123 species recorded (in vegetation mapping sites *only*), approximately 78.51 % of the flora species potentially present within the Mt Cattlin Project Extension were recorded.

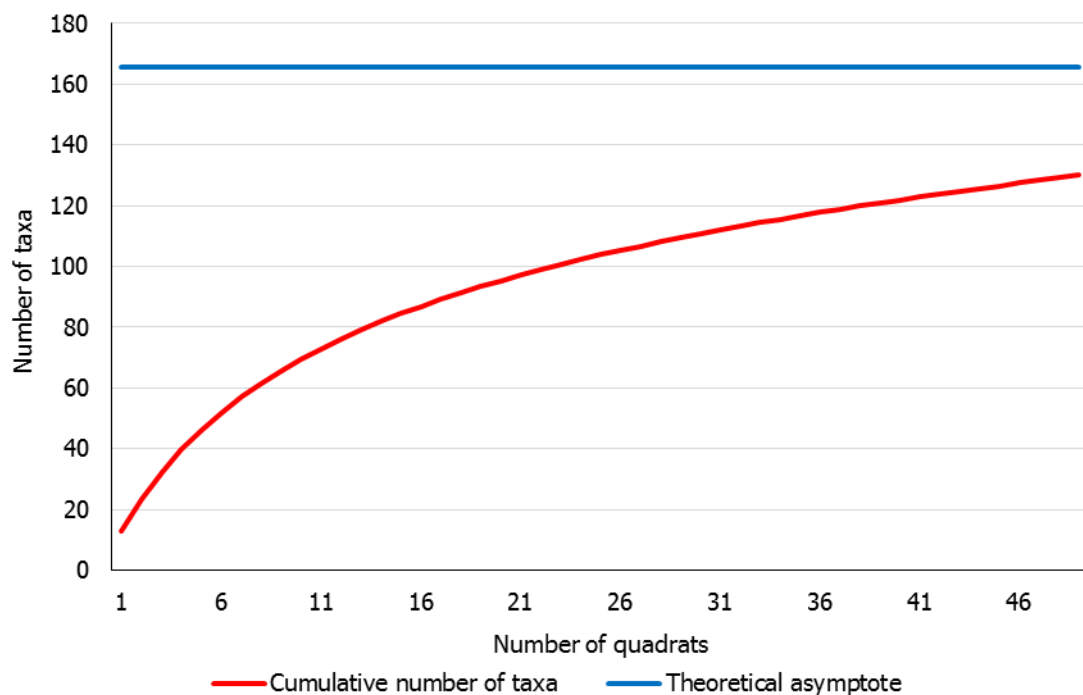


Figure 3: Average randomised species accumulation curve

6.1.1. Threatened and Priority Flora

No threatened flora species pursuant to subsection (2) of section 23F of the WC Act and as listed by the DBCA (2018a), or pursuant to section 179 of the EPBC Act or listed by the DotEE (2018c), were recorded within the Mt Cattlin Project Extension.

One priority flora species, *Acacia bifaria* (P3), as listed by the DBCA (2018a), was recorded within the Mt Cattlin Project Extension. In addition, one potential priority flora species, *?Guichenotia anota* (P1), was recorded, however was unable to be confirmed due to lack of fertile material. The geographic locations and number of plants recorded are presented in Appendix F. The locations of *Acacia bifaria* (P3) and *?Guichenotia anota* (P1) recorded during the survey of the Mt Cattlin Project Extension are also presented in Figure 4. A brief description of these species is provided below:

- **PRIORITY 3:**

***Acacia bifaria* – FABACEAE** – Prostrate or semi-prostrate, commonly domed shrub, growing from 30 – 60 (occasionally 80) cm high and 2 m wide. Yellow flowers from August to October or occasionally to December. Occurring on clay, rocky loam, sandy soils on undulating plains, roadsides, low-lying areas. WAH houses 33 specimens of *Acacia bifaria* from areas around the Shire of Ravensthorpe and the Shire of Jerramungup, with majority of specimens being collected within 10 km of Ravensthorpe (WAH 1998-).

- **PRIORITY 1:**

?*Guichenotia anota* (P1) – MALVACEAE – Shrub, growing from 0.3 – 1 m high. Pink-purple flowers from November to December. Occurring on sandy, loamy gravel soils on undulating land. WAH houses 20 specimens of *Guichenotia anota* from areas around the Shire of Ravensthorpe, with majority of specimens being collected within 15 km of Ravensthorpe (WAH 1998-).

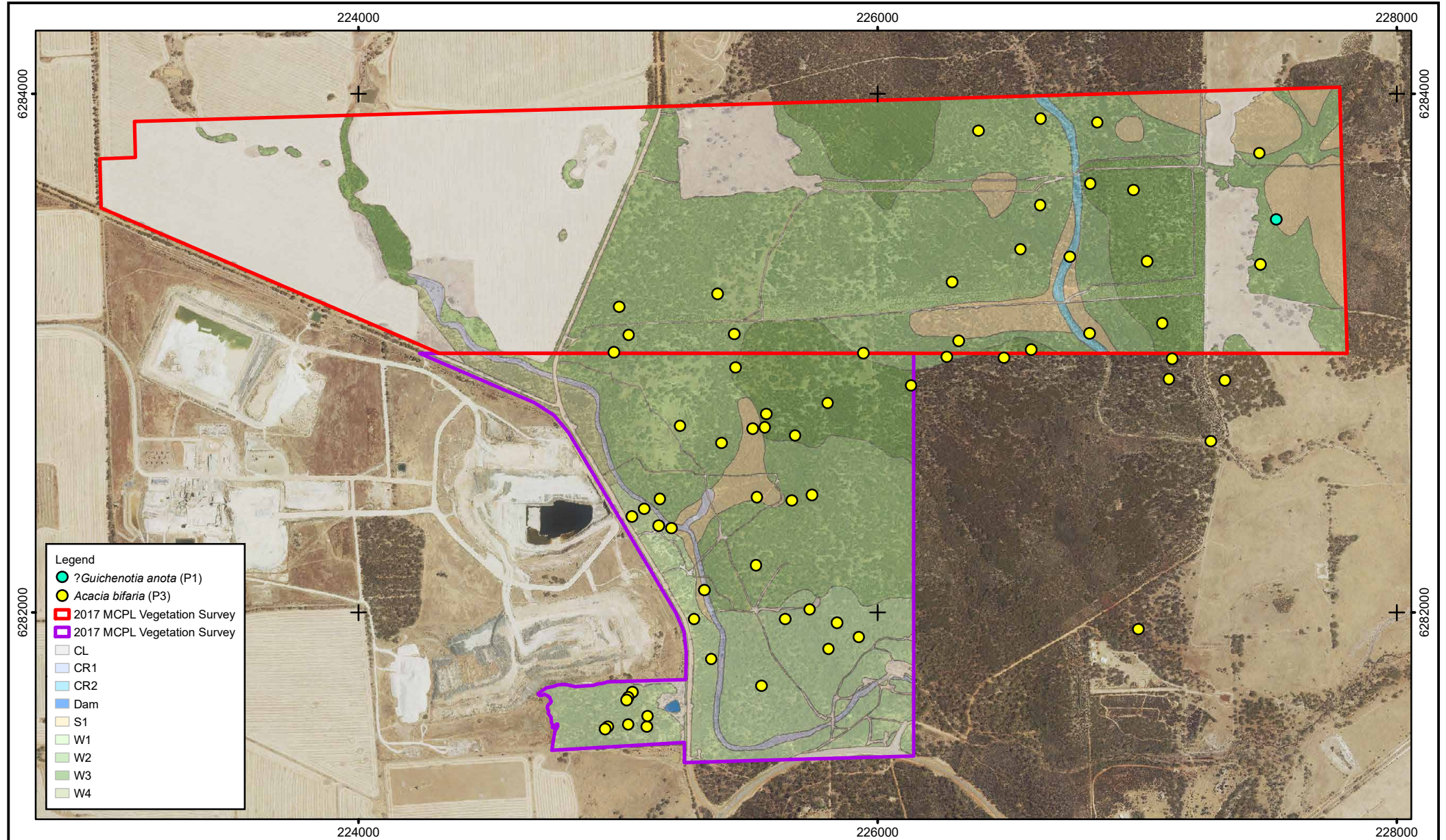
6.1.2. Flora Range Extensions

One species recorded at the Mt Cattlin Project Extension represented extensions to their current known distributions. *Eucalyptus spathulata* subsp. *spathulata*, represents a range extension of approximately 80 km to the east of its current known distribution (WAH 1998-). In this report, 50 km has been used as a basis to determine an extension to the currently known range for a species.

6.1.3. Introduced (Weed) Species and Declared Pest (Plant) Organisms

A total of seven introduced (weed) species were recorded within the Mt Cattlin Project Extension, these were: **Asparagus asparagoides*, **Asphodelus fistulosus*, **Chenopodium glaucum*, **Lycium ferocissimum*, **Marrubium vulgare*, **Solanum nigrum* and **Trifolium* sp. (see Appendix C). One of these, **Asparagus asparagoides*, was a declared pest organisms pursuant to section 22 of the BAM Act, the remaining six are permitted under section 11 of the BAM Act (DPIRD 2018). **Asparagus asparagoides* has a declared pest organism category of exempt, requiring no permit of conditions for keeping (DPIRD 2018). Two species recorded, **Asparagus asparagoides* and **Lycium ferocissimum*, were listed as WONS (DotEE 2018e). All of the weeds recorded were listed in the South Coast impact and invasiveness ratings (DPaW 2013). Three, **Asparagus asparagoides*, **Lycium ferocissimum* and **Marrubium vulgare* were listed as having high ecological impacts with rapid invasiveness. The remaining four were listed as having unknown ecological impacts, with **Asphodelus fistulosus*, **Chenopodium glaucum* and **Trifolium* sp. having moderate invasiveness, and **Solanum nigrum* having rapid invasiveness (DPaW 2013).

Seventeen of the 49 survey quadrats contained **Asparagus asparagoides* or **Lycium ferocissimum*. Five quadrats, MC030, MC032, MC044, MC062 and MC071, contained both **Asparagus asparagoides* and **Lycium ferocissimum*. **Asparagus asparagoides* was recorded in fifteen quadrats and **Lycium ferocissimum* in seven (Appendix E).



Notes:



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Galaxy Resources - Mt Cattlin Project
Priority Species

Figure:
4

6.2. Vegetation

6.2.1. Statistical Analysis

SIMPROF analysis identified ten significantly associated groups of quadrats ($P_i = 3.08$; $p < 0.001$), from the 76 quadrats analysed (including 27 quadrats from the 2017 survey and 49 quadrats from the 2018 survey). Where appropriate, larger groupings were split into multiple vegetation units and smaller groupings were combined based on factors including species composition and site descriptions. Seven significantly dissimilar vegetation communities were delineated within the Mt Cattlin Project (Global $R = 0.598$; $p < 0.001$). The dendrogram representing the results of the cluster analysis, and the corresponding seven vegetation communities is illustrated in Figure 5. Of these seven vegetation communities, six were represented in the current survey of the Mt Cattlin Project Extension.

6.2.2. Vegetation Communities

Based on statistical analysis (Section 6.2.1.), seven vegetation communities were defined and mapped across the Mt Cattlin Project, with six of these vegetation communities mapped across the Mt Cattlin Project Extension. In addition to the statistical analysis, survey quadrat physical data and aerial photographic maps were used to delineate the boundaries of the vegetation communities in the Mt Cattlin Project Extension. The vegetation mapped is presented in Figure 6. A list of species recorded within each vegetation community during the Mattiske Consulting 2018 survey is set out in Appendix G. Vegetation community descriptions, topographic and edaphic information and representative photos are shown in Appendix H. A summary of the vegetation communities is presented below.

- W1:** *Eucalyptus* spp. mid mallee woodland dominated by *Eucalyptus myriadena* subsp. *myriadena* over *Templetonia retusa*, *Rhagodia crassifolia* and *Dodonaea ptarmicaefolia* mid sparse shrubland over *Austrostipa puberula*, *Austrostipa elegantissima* and *Rytidosperma caespitosum* isolated grasses on brown clay-loam soils on slopes. *Note: W1 was not present in the Mt Cattlin Project Extension
- W2:** *Eucalyptus oleosa* subsp. *corvina* and *Eucalyptus extensa* mid mallee woodland over *Senna artemisioides* mid sparse shrubland over *Acacia erinacea*, *Rhagodia crassifolia* and *Sclerolaena diacantha* low sparse shrubland on brown clay-loam soils on slopes.
- W3:** *Eucalyptus myriadena* subsp. *myriadena* and *Eucalyptus oleosa* subsp. *corvina* mid mallee woodland over *Acacia bifaria* (P3), *Acacia erinacea* and *Senna artemisioides* low sparse shrubland over *Austrostipa puberula* isolated grasses on brown clay-loam soils on slopes.
- W4:** Mixed *Eucalyptus* spp. mid mallee woodland over *Rhagodia crassifolia*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena uniflora* low sparse shrubland over *Austrostipa exilis*, *Austrostipa* sp. and *Rytidosperma caespitosum* low sparse grassland on brown clay-loam soils on slopes.
- S1:** *Acacia sulcata* var. *platyphylla*, *Santalum murrayanum* and *Melaleuca* spp. mid open shrubland over *Dodonaea caespitosa*, *Astroloma* sp. and *Hibbertia* sp. low sparse shrubland over *Lepidosperma diurnum* and *Neurachne alopecuroidea* isolated clumps of sedges and grasses on red-brown clay loam soils on rocky slopes adjacent to creeklines and drainage lines.
- CR1:** *Dodonaea ptarmicaefolia*, *Melaleuca cuticularis* and *Melaleuca elliptica* mid sparse shrubland over *Tecticornia ?pergranulata* subsp. *pergranulata* low sparse chenopod shrubland, with occasional emergent *Eucalyptus occidentalis*, on red-brown clay-loam soils on creeklines. *Note: CR1 was present in the Mt Cattlin Project Extension, however no survey quadrats were placed within this vegetation community in the current assessment.
- CR2:** *Melaleuca cuticularis* and *Santalum murrayanum* mid sparse shrubland over *Acacia bifaria* (P3) low sparse shrubland over *Salicornia quinqueflora* subsp. *quinqueflora* low sparse chenopod shrubland, on brown clay-loam soils on rocky drainage lines.

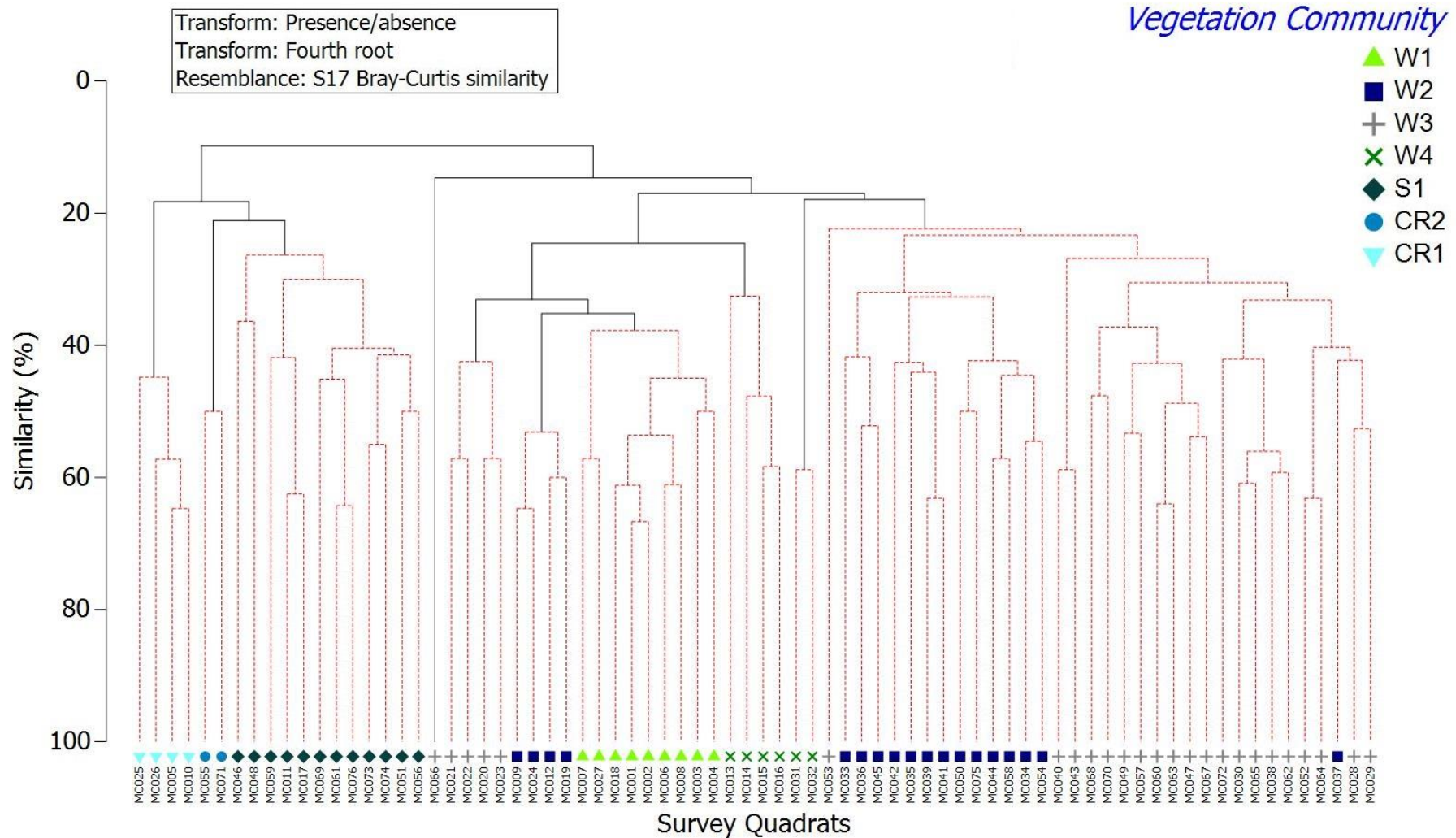
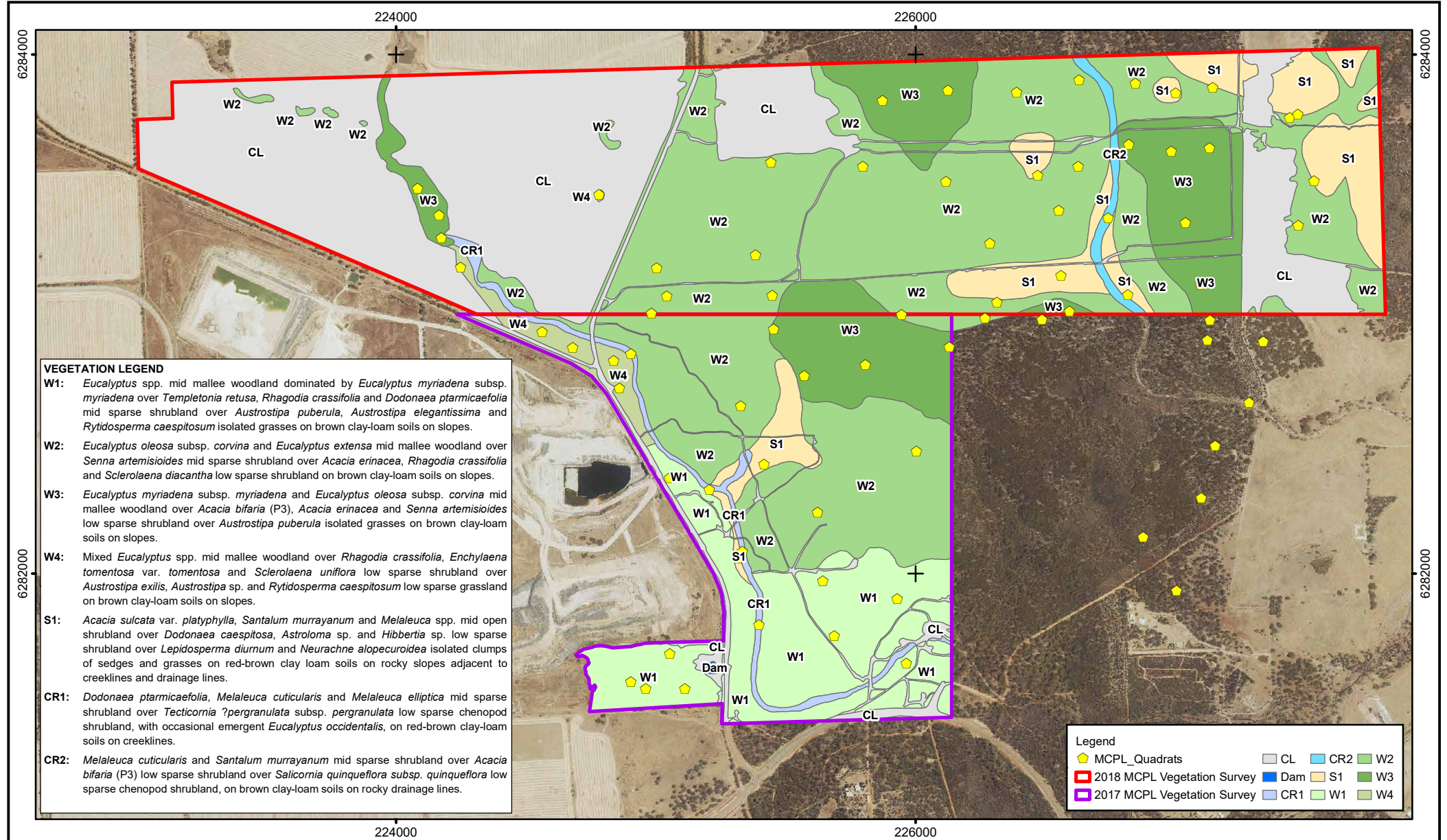


Figure 5: Dendrogram of the 76 survey quadrats established across the Mt Cattlin Project Extension



VEGETATION LEGEND

W1: *Eucalyptus* spp. mid mallee woodland dominated by *Eucalyptus myriadena* subsp. *myriadena* over *Templetonia retusa*, *Rhagodia crassifolia* and *Dodonaea ptermiceaefolia* mid sparse shrubland over *Austrostipa puberula*, *Austrostipa elegantissima* and *Rytidosperma caespitosum* isolated grasses on brown clay-loam soils on slopes.

W2: *Eucalyptus oleosa* subsp. *corvina* and *Eucalyptus extensa* mid mallee woodland over *Senna artemisioides* mid sparse shrubland over *Acacia erinacea*, *Rhagodia crassifolia* and *Sclerolaena diacantha* low sparse shrubland on brown clay-loam soils on slopes.

W3: *Eucalyptus myriadena* subsp. *myriadena* and *Eucalyptus oleosa* subsp. *corvina* mid mallee woodland over *Acacia bifaria* (P3), *Acacia erinacea* and *Senna artemisioides* low sparse shrubland over *Austrostipa puberula* isolated grasses on brown clay-loam soils on slopes.

W4: Mixed *Eucalyptus* spp. mid mallee woodland over *Rhagodia crassifolia*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena uniflora* low sparse shrubland over *Austrostipa exilis*, *Austrostipa* sp. and *Rytidosperma caespitosum* low sparse grassland on brown clay-loam soils on slopes.

S1: *Acacia sulcata* var. *platyphylla*, *Santalum murrayanum* and *Melaleuca* spp. mid open shrubland over *Dodonaea caespitosa*, *Astroloma* sp. and *Hibbertia* sp. low sparse shrubland over *Lepidosperma diurnum* and *Neurachne alopecuroidea* isolated clumps of sedges and grasses on red-brown clay loam soils on rocky slopes adjacent to creeklines and drainage lines.

CR1: *Dodonaea ptermiceaefolia*, *Melaleuca cuticularis* and *Melaleuca elliptica* mid sparse shrubland over *Tecticornia ?pergranulata* subsp. *pergranulata* low sparse chenopod shrubland, with occasional emergent *Eucalyptus occidentalis*, on red-brown clay-loam soils on creeklines.

CR2: *Melaleuca cuticularis* and *Santalum murrayanum* mid sparse shrubland over *Acacia bifaria* (P3) low sparse shrubland over *Salicornia quinqueflora* subsp. *quinqueflora* low sparse chenopod shrubland, on brown clay-loam soils on rocky drainage lines.

Legend

	MCPL_Quadrats		CL		W2
	2018 MCPL Vegetation Survey		Dam		S1
	2017 MCPL Vegetation Survey		CR1		W1
			W3		W4

6.2.3. Threatened and Priority Ecological Communities

No TECs, pursuant to Schedule 1 of the WC Act and as listed by the DBCA (2018b) were recorded within the Mt Cattlin Project Extension. No PECs as listed by the DBCA (2017b) were recorded within the Mt Cattlin Project Extension.

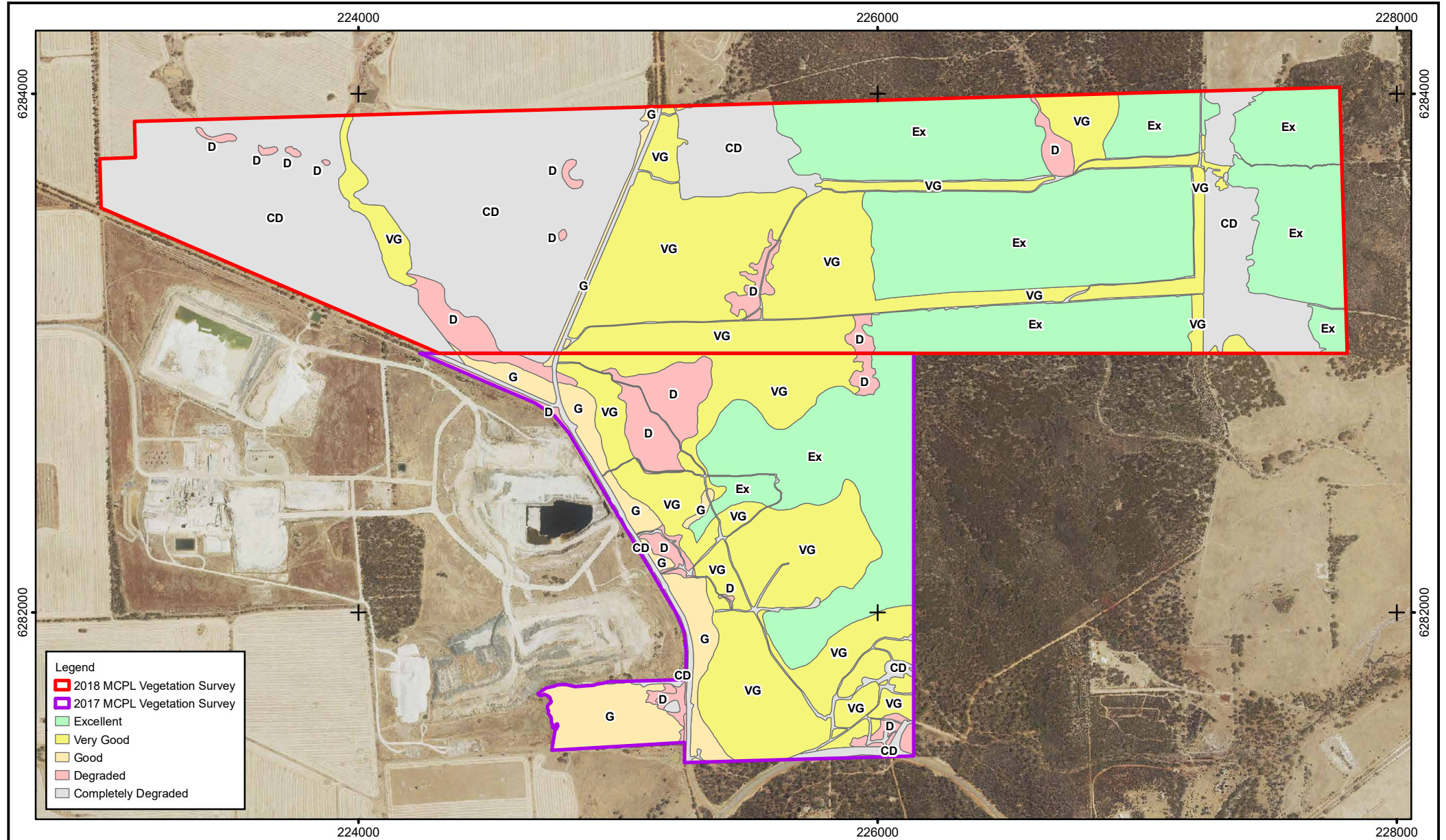
6.2.4. Vegetation Condition

The condition of the vegetation within the Mt Cattlin Project Extension ranged from excellent to completely degraded. Large areas of pastoral land were considered to be completely degraded, however the majority of the remaining vegetation was in excellent condition, according to the Keighery scale (Keighery 1994; Appendix A5). Figure 7 shows the vegetation condition of the Mt Cattlin Project Extension. Within the Mt Cattlin Project Extension these areas can be delineated as follows:

- Excellent:** Areas in the eastern section of the Mt Cattlin Project Extension, very little disturbance and very small populations of weeds. No declared pest organisms or WONS present.
- Very Good:** Areas in the eastern section of the Mt Cattlin Project Extension, areas dissected by some small tracks and areas of previous clearing. Areas with more aggressive weeds present.
- Good:** Areas adjacent to roads (Old Newdegate Rd, Floater Rd), typically 10 to 100 m from road edge.
- Degraded:** Old tracks. Areas of high activity and disturbance. Small remnant patches of trees surrounded by pasture or clearing.
- Completely Degraded:** Roads and tracks, old mining operations, dams, pasture.

Table 3: Condition rating of areas within the Mt Cattlin Project Extension

CONDITION	AREA WITHIN THE MT CATTLIN PROJECT EXTENSION
Excellent	146.20 ha
Very Good	91.28 ha
Good	1.53 ha
Degraded	10.97 ha
Completely Degraded	170.06 ha



Legend

- ▭ 2018 MCPL Vegetation Survey
- ▭ 2017 MCPL Vegetation Survey
- ▭ Excellent
- ▭ Very Good
- ▭ Good
- ▭ Degraded
- ▭ Completely Degraded

Notes:

Client:



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Galaxy Resources - Mt Cattlin Project
Vegetation Condition

Figure:

7

6.2.5. Clearing Principles

The ten clearing principles in relation to the impacts on flora and vegetation by the proposed clearing within the Mt Cattlin Project Extension are summarised in Table 4.

Table 4: Assessment of the proposal against the ten clearing principles

Note: Adapted from Schedule 5 of the EP Act.

PRINCIPLE	ASSESSMENT
A	<p><i>Native vegetation should not be cleared if it comprises a high level of biological diversity.</i></p> <p>Proposal is not at variance to this principle - A total of 123 vascular plant taxa, representative of 67 genera and 33 families, were recorded within the Mt Cattlin Project area. The majority of taxa recorded were representative of the Myrtaceae (30 taxa), Fabaceae (19 taxa) and Chenopodiaceae (17 taxa) families. Overall, the vegetation communities mapped and species recorded in the Mt Cattlin Project Extension were consistent with the historical mapping of Beard (1973; 1990) and the more recent localised surveys (Botanica Consulting 2008; ENV 2008; Mattiske Consulting 2018). Comparison of aerial photography of the survey area and surrounding areas suggests that the area under application is typical of the vegetation throughout the region.</p>
B	<p><i>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.</i></p> <p>Proposal was not assessed against this principle - Fauna specialist should be consulted with reference to this principle.</p>
C	<p><i>Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.</i></p> <p>Proposal is not at variance to this principle - No threatened flora species pursuant to subsection (2) of section 23F of the WC Act and as listed by the DBCA (2018a), or pursuant to section 179 of the EPBC Act or listed by the DotEE (2018c), were recorded within the Mt Cattlin Project Extension.</p>
D	<p><i>Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of a threatened ecological community.</i></p> <p>Proposal is not at variance to this principle - No TECs, pursuant to Schedule 1 of the WC Act and as listed by the DBCA (2018b) were recorded within the Mt Cattlin Project Extension.</p>
E	<p><i>Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.</i></p> <p>Proposal is not at variance to this principle - The area under application is not considered significant as a stand of remnant native vegetation. Although much of the area was in excellent condition, large areas of completely degraded pastoral land existed within the Mt Cattlin Project Extension. Overall, the vegetation communities mapped and species recorded in the Mt Cattlin Project Extension were considered typical of vegetation throughout the region and represented in larger stands of remnant vegetation in proximity to the Mt Cattlin Project Extension.</p>
F	<p><i>Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.</i></p> <p>Proposal may be at variance to this principle – The Mt Cattlin Project Extension is dissected by a creek, which is not of National or International significance.</p>

Table 4: Assessment of the proposal against the ten clearing principles**Note:** Adapted from Schedule 5 of the EP Act.

PRINCIPLE	ASSESSMENT
G	<p><i>Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.</i></p> <p>Proposal is not at variance to this principle - The proposed area of disturbance ranges from Degraded to Excellent condition (Keighery 1994). The area under application is part of an area where current and historical mining and agricultural activities have already degraded areas of land. The proposed clearing is not extensive in a local or regional context and is unlikely to cause appreciable land degradation.</p>
H	<p><i>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.</i></p> <p>Proposal is not at variance to this principle – Overshot Hill Nature Reserve is located approximately 2 km to the north-west of the Mt Cattlin Project. Pasture exists between the project area and the Overshot Hill Nature Reserve. No impacts on the environmental values of the Overshot Hill Nature Reserve should occur as a result of clearing in the area under application.</p>
I	<p><i>Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface and underground water.</i></p> <p>Proposal was not assessed against this principle - The assessment of the hydrological values associated with surface and underground water were not undertaken or requested.</p>
J	<p><i>Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.</i></p> <p>Proposal was not assessed against this principle - The assessment of the hydrological values associated with the incidence or intensity of flooding were not undertaken or requested.</p>

7. DISCUSSION AND CONCLUSIONS

A total of 123 vascular plant taxa, representative of 67 genera and 33 families, were recorded within the Mt Cattlin Project Extension. The majority of taxa recorded were representative of the Myrtaceae (30 taxa), Fabaceae (19 taxa) and Chenopodiaceae (17 taxa) families. The majority of the taxa recorded were widespread both locally and more broadly within the associated biogeographical subregion.

Acacia bifaria (P3) was widespread throughout the Mt Cattlin Project and has been recorded in all previous surveys in the area (Botanica Consulting 2008; ENV 2008; Mattiske Consulting 2018). *Acacia bifaria* (P3) were present in all vegetation communities, with the exception of W4. Although large numbers of individuals were present within the Mt Cattlin Project, potentially representing an important local population of this species, there are records within Overshot Hill Nature Reserve, Fitzgerald River National Park and many of the remnant vegetation patches surrounding Ravensthorpe. In addition, one potential priority flora species, ?*Guichenotia anota* (P1), was recorded, however was unable to be confirmed due to lack of fertile material. With an additional 27 taxa identified as having a medium likelihood of being recorded in the survey area, it is possible that additional threatened and priority taxa may occur in the Mt Cattlin Project Extension which were not identified during the current survey due to the survey being conducted outside of the flowering period of majority of the taxa.

A total of seven introduced (weed) species were recorded within the Mt Cattlin Project Extension. One of these, *Asparagus asparagoides* was a declared pest organisms pursuant to section 22 of the BAM Act (the remaining 29 are permitted under section 11 of the BAM Act). Two species recorded, *Asparagus asparagoides* and *Lycium ferocissimum*, were listed as WONS. Seventeen of the 49 survey quadrats contained WONS, *Asparagus asparagoides* or *Lycium ferocissimum*. Five quadrats, MC030, MC032, MC044, MC062 and MC071, contained both *Asparagus asparagoides* and *Lycium ferocissimum*. *Asparagus asparagoides* was recorded in fifteen quadrats and *Lycium ferocissimum* in seven (Appendix E). As such, these species present a management issue associated with possible spread during disturbance to the Mt Cattlin Project Extension.

No TECs, pursuant to Schedule 1 of the *Wildlife Conservation Act 1950* and as listed by the DBCA (2018b), or PECs as listed by the DBCA (2017b), were recorded within the Mt Cattlin Project Extension. One TEC (*Proteaceae Dominated Kwongan Shrublands of the Southeast Coastal Floristic Province of Western Australia*) and its associated PECs were recorded within a 10 km buffer of the Mt Cattlin Project Extension. However, due to the dominance of proteaceous species and its association with the Central Barren Ranges, eastern Stirling Range and Russel Range, vegetation communities described in the Mt Cattlin Project Extension did not resemble the TEC or its associated PECs. In addition to the TEC (and its associated PECs listed above) there is currently one additional priority 3(iii) PEC, as listed by the DBCA (2017b), that occurs 4.5 km to the north-east of the Mt Cattlin Project Extension. The priority 3(iii) *Heath on Komatiite of the Ravensthorpe* area community has different species composition to that of the Mt Cattlin Project Extension, with only three species, *Calothamnus quadrifidus*, *Hakea verrucosa* and *Hybanthus floribundus*, associated with this PEC recorded in the Mt Cattlin Project Extension. As such, no vegetation communities within the Mt Cattlin Project Extension resembled this PEC.

The vegetation of the Mt Cattlin Project Extension ranged from excellent to completely degraded. Large areas of pastoral land were considered to be completely degraded, however the majority of the remaining vegetation was in excellent condition, according to the Keighery scale (Keighery 1994; Appendix A5).

Seven vegetation communities were delineated and mapped across the Mt Cattlin Project, with six of these communities present in the Mt Cattlin Project Extension. There was a high proportion of species that were unable to be confidently identified to species level as a result of the survey being conducted in April, and an absence of sufficient taxonomic characters to enable accurate identification. Due to these factors there were some limitations in statistical analysis, as majority of vegetation quadrats were statistically dissimilar to quadrats surveyed in December 2017 and previously defined vegetation communities. Therefore, the majority of survey quadrats were assigned to previously defined vegetation communities based on site

data, and the presence of select indicator species. Overall, the vegetation communities mapped and species recorded in the Mt Cattlin Project Extension were consistent with the historical mapping of Beard (1973; 1990) and the more recent localised surveys (Botanica Consulting 2008; ENV 2008; Mattiske Consulting 2018). The majority of the Mt Cattlin Project Extension is situated on brown clay-loam slopes supporting *Eucalyptus* mid mallee woodlands, dominated by *Eucalyptus myriadena* subsp. *myriadena*, *Eucalyptus oleosa* subsp. *corvina* and *Eucalyptus extensa*, over mid sparse shrublands, dominated by fabaceous and chenopod species, over low sparse grasslands, dominated by *Austrostipa* spp. These mallee woodlands are dissected by creeks, associated with a shrublands dominated by *Melaleuca* spp., over *Tecticornia ?pergranulata* subsp. *pergranulata* and *Salicornia quinqueflora* subsp. *quinqueflora*. In addition, shrublands dominated by *Acacia sulcata* var. *platyphylla* and *Melaleuca* spp., over isolated clumps of *Lepidosperma* spp., were present on red-brown clay loam soils on rocky slopes. The eucalypt woodlands and species present are well represented both at the local and regional scale (Beard 1973; Beard 1990; Botanica Consulting 2008; ENV 2008; Mattiske Consulting 2018). Consequently, mine development would result in a minimal impact on the vegetation values of the area.

8. ACKNOWLEDGEMENTS

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9. PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

NAME	POSITION	PROJECT INVOLVEMENT	FLORA COLLECTION PERMITS
Dr EM Mattiske	Managing Director & Principal Ecologist	Planning, managing, reporting	N/A
Ms C Reynolds	Experienced Botanist	Data analysis, reporting	N/A
Mr B Ellery	Experienced Botanist	Planning, fieldwork, plant identification	SL012282
Ms M van Wees	Experienced Botanist	Fieldwork	SL012357
Ms R Kerr	Botanist	Fieldwork	SL012287
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APPENDIX A1: THREATENED AND PRIORITY FLORA DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), **threatened flora** are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened flora species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	Extinct	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	Extinct in the Wild	Species which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	Critically Endangered	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	Endangered	Species which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	Vulnerable	Species which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	Conservation Dependent	Species which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

The *Wildlife Conservation Act 1950* (WC Act) provides for (amongst other things) the protection of flora likely to become extinct or rare or otherwise in need of special protection in Western Australia under section 23F. **Threatened** (or **rare**) **flora** are listed in the *Wildlife Conservation (Rare Flora) Notice 2016* (under section 23F(2) of the WC Act; Department of Biodiversity, Conservation and Attractions 2017a) and are categorised under Schedules 1-4 as critically endangered, endangered, vulnerable or extinct, respectively. Threatened flora are defined as "likely to become extinct or is rare, or otherwise in need of special protection", pursuant to section 23F(2) of the WC Act. Threatened species are categorised as critically endangered, endangered, vulnerable and presumed extinct (Table A1.2).

Table A1.2 State definition of threatened flora species

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2017a).

CODE	CATEGORY	DEFINITION
CR	Critically endangered	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the <i>Wildlife Conservation (Rare Flora) Notice 2016</i>).
EN	Endangered	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the <i>Wildlife Conservation (Rare Flora) Notice 2016</i>).
VU	Vulnerable	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2016</i>).
EX	Presumed extinct species	Species that have been adequately searched for and there is no reasonable doubt that the last individual has died (listed under Schedule 4 of the <i>Wildlife Conservation (Rare Flora) Notice 2016</i>).

Priority flora species are defined as “possibly threatened species that do not meet the survey criteria, or are otherwise data deficient; or are adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list for other than taxonomic reasons” (Department of Biodiversity, Conservation and Attractions 2017a). **Priority species are not afforded any protection under state or federal legislation**, however are considered significant under the Environmental Protection Authority’s *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority flora into four categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority flora species

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2017a).

CODE	CATEGORY	DEFINITION
P1	Priority 1: Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	Priority 2: Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	Priority 3: Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	Priority 4: Rare, Near Threatened, and other species in need of monitoring	<p>a) Rare - Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>b) Near Threatened - Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>c) Other - Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

APPENDIX A2: THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, **threatened ecological communities** are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

CATEGORY	DEFINITION
Critically Endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

Currently there is no Western Australian legislation covering the conservation of state listed **threatened ecological communities** (TECs), however, a non-statutory process is in place, whereby the Department of Biodiversity, Conservation and Attractions have been identifying and informally listing TECs since 1994. Some of these TECs are endorsed by the Federal Minister as threatened, and some of these are also listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
PD	Presumed Totally Destroyed	An ecological community will be listed as PD if there are no recent records of the community being extant and either of the following applies: <ol style="list-style-type: none"> 1. Records within the last 50 years have not been confirmed despite thorough searches or known likely habitats; or 2. All occurrences recorded within the last 50 years have since been destroyed.
CR	Critically Endangered	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one or more of the following criteria: <ol style="list-style-type: none"> 1. The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; 2. The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or 3. The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	Endangered	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet any one or more of the following criteria: <ol style="list-style-type: none"> 1. The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; 2. The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or 3. The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	Vulnerable	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one or more of the following criteria: <ol style="list-style-type: none"> 1. The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; 2. The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or 3. The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the Department of Biodiversity, Conservation and Attractions. Similarly to priority flora, PECs are not afforded legislative protection, however are considered significant under the Environmental Protection Authority's (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from Department of Environment and Conservation (2013).

CODE	CATEGORY	DEFINITION
P1	Priority 1 (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	Priority 2 (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	Priority 3 (Poorly known ecological communities)	<ol style="list-style-type: none"> 1. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation; 2. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or 3. Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Priority 4 (Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring)	<ol style="list-style-type: none"> 1. Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. 2. Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. 3. Communities that have been removed from the list of threatened communities during the past five years.
P5	Priority 5 (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A3: CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

Section 22 of Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act) makes provision for a plant taxon to be listed as a declared pest organism in respect to parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Primary Industries and Regional Development 2017).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

CONTROL CATEGORY	CONTROL MEASURES
<p style="text-align: center;">C1 (Exclusion)</p> <p>'(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented.'</p> <p>Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.</p>	<p>In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.</p>
<p style="text-align: center;">C2 (Eradication)</p> <p>'(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible.'</p> <p>Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.</p>	<p>In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.</p>
<p style="text-align: center;">C3 (Management)</p> <p>'(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to:</p> <p>(i) alleviate the harmful impact of the declared pest in the area; or</p> <p>(ii) reduce the number or distribution of the declared pest in the area; or</p> <p>(iii) prevent or contain the spread of the declared pest in the area.'</p> <p>Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.</p>	<p>In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to:</p> <p>(a) alleviate the harmful impact of the declared pest in the area for which it is declared; or</p> <p>(b) reduce the number or distribution of the declared pest in the area for which it is declared; or</p> <p>(c) prevent or contain the spread of the declared pest in the area for which it is declared.</p>

APPENDIX A4: OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

APPENDIX A5: NVIS STRUCTURAL FORMATION TERMINOLOGY

Note: Adapted from ESCAVI (2003).

COVER CHARACTERISTICS							
Foliage cover*	70-100	30-70	10-30	<10	≈0	0-5	unknown
Crown cover**	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
% cover***	>80	50-80	20-50	0.25-20	<0.25	0-5	unknown
Cover code	d	c	i	r	bi	bc	unknown

GROWTH FORM	HEIGHT RANGES (m)	STRUCTURAL FORMATION CLASSES						
tree, palm	<10, 10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	trees
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	mallee trees
shrub, cycad, grass-tree, tree-fern	<1, 1-2, >2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrubs
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrubs
heath shrub	<1, 1-2, >2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrubs
chenopod shrub	<1, 1-2, >2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrubs
samphire shrub	<0.5, >0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrubs
hummock grass	<2, >2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grasses
tussock grass	<0.5, >0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grassland	isolated clumps of tussock grasses	tussock grasses
other grass	<0.5, >0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grasses
sedge	<0.5, >0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedges
rush	<0.5, >0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rushes
forb	<0.5, >0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forbs
fern	<1, 1-2, >2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	ferns
bryophyte	<0.5	closed bryophyteland	bryophyteland	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophytes
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichens
vine	<10, 10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vines
aquatic	0-0.5, <1	closed aquatic bed	aquatic bed	open aquatic bed	sparse aquatics	isolated aquatics	isolated clumps of aquatics	aquatics
seagrass	0-0.5, <1	closed seagrass bed	seagrass bed	open seagrass bed	sparse seagrasses	isolated seagrasses	isolated clumps of seagrasses	seagrasses

APPENDIX A.6: DEFINITION OF VEGETATION CONDITION SCALE FOR THE SOUTH WEST AND INTERZONE BOTANICAL PROVINCES

Vegetation condition ratings relate to vegetation structure, level of disturbance at each structural layer and the ability of the vegetation unit to regenerate (Table A5.1). Vegetation condition provides complementary information for assessing the significance of potential impacts.

Table A6.1 Definition of vegetation condition categories

Note: Adapted from Keighery (1994).

CATEGORY	DEFINITION
Pristine	Pristine or nearly so, no obvious sign 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.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
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 or shrubs.

**APPENDIX B: GEOGRAPHIC LOCATIONS OF SURVEY QUADRATS IN THE
MT CATTLIN PROJECT EXTENSION**

QUADRAT	LOCATION (GDA94 Z51H)	
	EASTING (mE)	NORTHING (mN)
MC028	224082	6283483
MC029	224165	6283382
MC030	224175	6283294
MC031	224248	6283180
MC032	224781	6283460
MC033	225004	6283177
MC034	225042	6283069
MC035	225184	6283785
MC036	225384	6283228
MC037	225444	6283585
MC038	225449	6283072
MC039	225798	6283568
MC040	225874	6283823
MC041	225946	6282999
MC042	226117	6283510
MC043	226126	6283863
MC044	226267	6282985
MC045	226287	6283273
MC046	226313	6283047
MC047	226390	6283855
MC048	226470	6283535
MC049	226487	6282980
MC050	226552	6283398
MC051	226560	6283150
MC052	226593	6283013
MC053	226627	6283570
MC054	226630	6283904
MC055	226742	6283370
MC056	226818	6283076
MC057	226821	6283652
MC058	226847	6283888
MC059	226877	6282142
MC060	226986	6283627
MC061	227003	6283852
MC062	227006	6281935
MC063	227039	6283353
MC064	227099	6283115
MC065	227100	6282293
MC066	227124	6282900
MC067	227133	6283640
MC068	227135	6282977
MC069	227145	6283872
MC070	227155	6282493
MC071	227285	6282659
MC072	227339	6282894
MC073	227440	6283758
MC074	227472	6283769
MC075	227475	6283341
MC076	227536	6283514

APPENDIX C: VASCULAR PLANT SPECIES RECORDED FROM SURVEYS WITHIN THE MT CATTLIN PROJECT

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2017a, WAH 1998-); ENV (2008); Botanica (Botanica Consulting 2008); MCPL 2017 (Mattiske Consulting 2018); MCPL 2018 - current survey conducted by Mattiske Consulting Pty Ltd

FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018
PTERIDACEAE	<i>Cheilanthes sieberi</i>		X		
CUPRESSACEAE	<i>Callitris drummondii</i>	X			X
POACEAE	* <i>Aira elegantissima</i>			X	
	<i>Amphipogon amphipogonoides</i>		X		
	<i>Amphipogon ?turbinatus</i>		X		
	<i>Austrostipa acrociliata</i>			X	
	<i>Austrostipa elegantissima</i>			X	
	<i>Austrostipa eremophila</i>	X			
	<i>Austrostipa exilis</i>	X		X	
	<i>Austrostipa puberula</i>			X	
	<i>Austrostipa scabra</i>			X	
	<i>Austrostipa</i> sp.		X	X	X
	* <i>Avena fatua</i>	X			
	* <i>Avena</i> sp.			X	
	* <i>Bromus rubens</i>	X			
	<i>Chloris truncata</i>			X	
	* <i>Ehrharta longiflora</i>			X	
	* <i>Hordeum hystrix</i>			X	
	* <i>Hordeum leporinum</i>	X			
	* <i>Lolium rigidum</i>			X	
	<i>Neurachne alopecuroidea</i>			X	X
	* <i>Parapholis incurva</i>			X	
	* <i>Phalaris minor</i>	X			
	* <i>Polypogon monspeliensis</i>			X	
	<i>Rytidosperma caespitosum</i>		X	X	
	<i>Rytidosperma setaceum</i>	X			
	* <i>Vulpia bromoides</i>			X	
	Poaceae sp.		X	X	X
CYPERACEAE	<i>Gahnia ancistrophylla</i>			X	X
	<i>Lepidosperma diurnum</i>			X	X
	<i>Lepidosperma</i> aff. <i>diurnum</i>	X	X		
	<i>Lepidosperma ?fimbriatum</i>			X	
	<i>Lepidosperma humile</i>			X	X
	<i>Lepidosperma</i> aff. <i>pruinatum</i>	X			
	<i>Lepidosperma</i> sp. Halleys		X		
	<i>Lepidosperma</i> sp.			X	X
	? <i>Schoenus</i> sp.		X		
	Cyperaceae sp.				X
JUNCACEAE	<i>Juncus aridicola</i>		X		
ASPARAGACEAE	* <i>Asparagus asparagoides</i>	X	X	X	X
	<i>Dichopogon fimbriatus</i>			X	
	<i>Thysanotus patersonii</i>	X			
	Asparagaceae sp.		X		

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FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018
CHENOPODIACEAE (continued)	<i>Rhagodia preissii</i> subsp. <i>preissii</i>	X		X	X
	<i>Rhagodia</i> sp.				X
	<i>Salicornia quinqueflora</i>		X		
	<i>Salicornia quinqueflora</i> subsp. <i>quinqueflora</i>				X
	<i>Salsola australis</i>				X
	<i>Sclerolaena bicornis</i>	X			
	<i>Sclerolaena diacantha</i>	X			X
	<i>Sclerolaena uniflora</i>	X		X	X
	<i>Tecticornia lepidosperma</i>				X
	<i>Tecticornia pergranulata</i>	X			
	<i>Tecticornia</i> ? <i>pergranulata</i> subsp. <i>pergranulata</i>			X	
	<i>Tecticornia</i> sp.				X
	<i>Threlkeldia diffusa</i>			X	
	Chenopodiaceae sp.			X	X
	AMARANTHACEAE	<i>Ptilotus holosericeus</i>		X	
<i>Ptilotus manglesii</i>				X	
<i>Ptilotus spathulatus</i>		X		X	
<i>Ptilotus</i> sp.					X
AIZOACEAE	* <i>Carpobrotus edulis</i>		X		
	<i>Carpobrotus modestus</i>	X			
	<i>Carpobrotus</i> sp.			X	X
	* <i>Mesembryanthemum nodiflorum</i>			X	
CARYOPHYLLACEAE	* <i>Petrorhagia dubia</i>			X	
	<i>Spergularia marina</i>			X	
LAURACEAE	<i>Cassytha glabella</i>			X	
	<i>Cassytha</i> ? <i>melantha</i>			X	
	<i>Cassytha</i> sp.		X		X
PAPAVERACEAE	* <i>Papaver hybridum</i>	X			
BRASSICACEAE	* <i>Carrichtera annua</i>	X			
	* <i>Diplotaxis muralis</i>		X		
	* <i>Raphanus raphanistrum</i>	X			
	* <i>Rapistrum rugosum</i>	X			
	* <i>Sisymbrium irio</i>	X			
CRASSULACEAE	<i>Crassula</i> ? <i>decumbens</i> var. <i>decumbens</i>			X	
PITTOSPORACEAE	? <i>Billardiera coriacea</i>		X		
	Pittosporaceae sp.			X	
ROSACEAE	* <i>Prunus dulcis</i>	X			
FABACEAE	<i>Acacia bifaria</i> (P3)	X	X	X	X
	<i>Acacia binata</i>	X			X

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FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018	
FABACEAE (continued)	<i>Acacia chrysell</i>	x	x			
	<i>Acacia ?chrysell</i>				x	
	<i>Acacia cyclops</i>		x	x	x	
	<i>Acacia erinacea</i>	x	x	x	x	
	<i>Acacia fragilis</i>	x				
	<i>Acacia lachnophylla</i>	x			x	x
	<i>Acacia ?lachnophylla</i>			x		
	<i>Acacia microbotrya</i>				x	
	<i>Acacia pusilla</i>				x	
	<i>Acacia redolens</i>	x	x	x	x	x
	<i>Acacia saligna</i>	x	x			x
	<i>Acacia ?saligna</i>					x
	<i>Acacia saligna</i> subsp. <i>lindleyi</i> ms				x	
	<i>Acacia sulcata</i>			x		
	<i>Acacia sulcata</i> var. <i>platyphylla</i>	x			x	x
	<i>Acacia</i> sp.			x		x
	<i>Daviesia anceps</i>	x	x	x	x	x
	<i>Daviesia benthamii</i>	x				
	<i>Daviesia ?benthamii</i>					x
	<i>Daviesia ?incrassata</i>			x		
	<i>Daviesia nematophylla</i>	x	x			
	<i>Daviesia scoparia</i>				x	
	<i>Gastrolobium ?parviflorum</i>					x
	* <i>Medicago minima</i>	x				
	* <i>Melilotus indicus</i>				x	
	<i>Pultenaea purpurea</i>			x	x	
	<i>Pultenaea rotundifolia</i>	x			x	x
	<i>Pultenaea</i> sp.					x
	<i>Senna artemisioides</i>			x		
	<i>Senna artemisioides</i> subsp. <i>x artemisioides</i>					x
	<i>Senna ?artemisioides</i> subsp. <i>x artemisioides</i>	x				
	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	x			x	x
	<i>Senna</i> ?sp. Pallinup River (J.W. Green 4847)				x	
	<i>Sphaerolobium ?drummondii</i>			x		
	<i>Templetonia battii</i>	x			x	
	<i>Templetonia retusa</i>	x	x		x	x
* <i>Trifolium</i> sp.					x	
GERANIACEAE	<i>Pelargonium littorale</i>	x				
OXALIDACEAE	* <i>Oxalis ?incarnata</i>	x				
	<i>Oxalis perennans</i>				x	
	* <i>Oxalis purpurea</i>			x		
	<i>Oxalis</i> sp.				x	
RUTACEAE	<i>Boronia inornata</i>	x	x			
	<i>Boronia inornata</i> subsp. <i>inornata</i>				x	
	<i>Boronia scabra</i> subsp. <i>scabra</i>	x				
	<i>Boronia</i> sp.			x		

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FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018
POLYGALACEAE	<i>Comesperma flavum</i>			X	
EUPHORBIACEAE	<i>Euphorbia dallachyana</i>				X
CELASTRACEAE	<i>Stackhousia monogyna</i> <i>Stackhousia</i> sp.	X			X
SAPINDACEAE	<i>Dodonaea caespitosa</i> <i>Dodonaea concinna</i> <i>Dodonaea pinifolia</i> <i>Dodonaea ?pinifolia</i> <i>Dodonaea ptarmicaefolia</i> <i>Dodonaea stenozyga</i> <i>Dodonaea</i> sp.	X X X X X	X X X	X X X X	X X X X X
RHAMNACEAE	<i>Stenanthemum tridentatum</i>	X			
MALVACEAE	<i>Alyogyne hakeifolia</i> <i>Alyogyne</i> sp. Southern Coast (A.S. George 289) <i>?Guichenotia anota</i> (P1) <i>Guichenotia ledifolia</i> <i>?Lysiosepalum involucreatum</i> <i>Thomasia angustifolia</i> <i>Thomasia foliosa</i>	X X X	X X	X X X X	X X X X
DILLENIACEAE	<i>Hibbertia ?exasperata</i> <i>Hibbertia pungens</i> <i>Hibbertia rupicola</i> <i>Hibbertia</i> sp. <i>?Hibbertia</i> sp.	X X	X	X	X X
VIOLACEAE	<i>Hybanthus floribundus</i> <i>Hybanthus floribundus</i> subsp. <i>adpressus</i> <i>Hybanthus floribundus</i> subsp. <i>?adpressus</i>	X	X	X	X
THYMELAEACEAE	<i>Pimelea erecta</i> <i>Pimelea</i> sp.	X	X		X
MYRTACEAE	<i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i> <i>Eucalyptus ?aequioperta</i> <i>Eucalyptus angulosa</i> <i>Eucalyptus annulata</i> <i>Eucalyptus astringens</i> <i>Eucalyptus astringens</i> subsp. <i>astringens</i> <i>Eucalyptus brachycalyx</i> <i>Eucalyptus ?brachycalyx</i> <i>Eucalyptus calycogona</i> subsp. <i>calycogona</i> <i>Eucalyptus celastroides</i> subsp. <i>virella</i> <i>Eucalyptus cernua</i>	X X X X X X X	X X X X	X X X	X X X X X X X

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FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018
MYRTACEAE (continued)	<i>Eucalyptus conferruminata</i>		x		
	<i>Eucalyptus globata</i> subsp. <i>perata</i>			x	x
	<i>Eucalyptus densa</i> subsp. <i>densa</i>				x
	<i>Eucalyptus</i> × <i>erythrandra</i>			x	
	<i>Eucalyptus extensa</i>			x	x
	<i>Eucalyptus flocktoniae</i> subsp. <i>flocktoniae</i>	x	x		
	<i>Eucalyptus</i> ? <i>indurata</i>		x		
	<i>Eucalyptus</i> ? <i>kondininensis</i>		x		
	<i>Eucalyptus melanoxydon</i>				x
	<i>Eucalyptus myriadena</i> subsp. <i>myriadena</i>	x			x
	<i>Eucalyptus occidentalis</i>	x			x
	<i>Eucalyptus</i> ? <i>occidentalis</i>			x	
	<i>Eucalyptus</i> ? <i>oleosa</i>			x	x
	<i>Eucalyptus oleosa</i> subsp. <i>corvina</i>	x			x
	<i>Eucalyptus oleosa</i> subsp. <i>oleosa</i>				x
	<i>Eucalyptus</i> ? <i>ovularis</i>				x
	<i>Eucalyptus phenax</i> subsp. <i>phenax</i>	x			x
	<i>Eucalyptus proxima</i>	x			
	<i>Eucalyptus</i> ? <i>rigidula</i>			x	
	<i>Eucalyptus salmonophloia</i>	x			x
	<i>Eucalyptus spathulata</i> subsp. <i>spathulata</i>				x
	<i>Eucalyptus suggrandis</i> subsp. <i>suggrandis</i>				x
	<i>Eucalyptus uncinata</i>	x			
	<i>Eucalyptus</i> ? <i>uncinata</i>				x
	<i>Eucalyptus</i> ? <i>utilis</i>			x	
	<i>Eucalyptus</i> sp. aff. <i>orthostemon</i>			x	
	<i>Eucalyptus</i> sp.			x	x
	<i>Leptospermum oligandrum</i>				x
	<i>Melaleuca acuminata</i>			x	
	<i>Melaleuca acuminata</i> subsp. <i>acuminata</i>				x
	<i>Melaleuca cliffortioides</i>				x
	<i>Melaleuca cucullata</i>	x			x
	<i>Melaleuca cuticularis</i>			x	x
	<i>Melaleuca eleuterostachya</i>	x			
	<i>Melaleuca elliptica</i>	x		x	x
	<i>Melaleuca hamata</i>	x		x	
	<i>Melaleuca hamulosa</i>			x	
	<i>Melaleuca</i> ? <i>lateriflora</i>				x
	<i>Melaleuca pauperiflora</i>	x			
	<i>Melaleuca</i> ? <i>pauperiflora</i> subsp. <i>pauperiflora</i>				x
	<i>Melaleuca scalena</i>				x
	<i>Melaleuca teuthidoides</i>			x	
	<i>Melaleuca uncinata</i>	x			
<i>Melaleuca</i> ? <i>viminea</i> subsp. <i>viminea</i>				x	
<i>Melaleuca</i> sp.				x	
<i>Tetrapora verrucosa</i>				x	
HALORAGACEAE	<i>Glischrocaryon flavescens</i>	x			
	<i>Haloragis hamata</i>	x			

APPENDIX C: VASCULAR PLANT SPECIES RECORDED FROM SURVEYS WITHIN THE MT CATTLIN PROJECT

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2017a, WAH 1998-); ENV (2008); Botanica (Botanica Consulting 2008); MCPL 2017 (Mattiske Consulting 2018); MCPL 2018 - current survey conducted by Mattiske Consulting Pty Ltd

FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018
ARALIACEAE	<i>Trachymene ornata</i>	x			
APIACEAE	* <i>Bupleurum semicompositum</i> <i>Platysace trachymenioides</i>	x		x	
ERICACEAE	<i>Astroloma epacridis</i> <i>Astroloma</i> sp. <i>Leucopogon cuneifolius</i> Ericaceae sp.	x		x	x x x
PRIMULACEAE	* <i>Lysimachia arvensis</i> <i>Samolus repens</i>	x		x x	
GENTIANACEAE	<i>Schenkia australis</i>			x	
APOCYNACEAE	<i>Alyxia buxifolia</i> * <i>Gomphocarpus fruticosus</i>	x	x	x	
CONVOLVULACEAE	<i>Dichondra repens</i> <i>Wilsonia humilis</i>			x	x
BORAGINACEAE	<i>Halgania anagalloides</i> var. Southern (A.E. Orchard 1609) <i>Halgania andromedifolia</i>	x x			
LAMIACEAE	* <i>Marrubium vulgare</i> <i>Teucrium sessiliflorum</i> ? <i>Teucrium</i> sp. <i>Westringia dampieri</i> * ?Lamiaceae sp.	x	x	x	x x
SOLANACEAE	* <i>Lycium ferocissimum</i> * <i>Solanum nigrum</i>	x x	x	x x	x x
SCROPHULARIACEAE	<i>Eremophila decipiens</i> <i>Eremophila</i> ? <i>decipiens</i> subsp. <i>decipiens</i> <i>Eremophila densifolia</i> ?subsp. <i>densifolia</i> <i>Eremophila</i> sp.	x	x	x	x
PLANTAGINACEAE	<i>Plantago</i> ? <i>exilis</i> <i>Plantago</i> sp.			x	x
CUCURBITACEAE	* <i>Citrullus lanatus</i>		x		
GOODENIACEAE	<i>Dampiera lavandulacea</i> <i>Goodenia affinis</i> <i>Goodenia laevis</i> subsp. <i>humifusa</i> <i>Goodenia scapigera</i> subsp. <i>scapigera</i> <i>Scaevola cuneiformis</i> <i>Scaevola spinescens</i>	x x x x x		x	x

APPENDIX C: VASCULAR PLANT SPECIES RECORDED FROM SURVEYS WITHIN THE MT CATTLIN PROJECT

Note: * denotes introduced species; P1 - P4 denotes priority taxon (DBCA 2017a, WAH 1998-); ENV (2008); Botanica (Botanica Consulting 2008); MCPL 2017 (Mattiske Consulting 2018); MCPL 2018 - current survey conducted by Mattiske Consulting Pty Ltd

FAMILY	SPECIES	ENV	BOTANICA	MCPL 2017	MCPL 2018	
ASTERACEAE	* <i>Arctotheca calendula</i>			X		
	<i>Asteridea asteroides</i>			X		
	* <i>Carduus pycnocephalus</i>	X				
	* <i>Carduus</i> sp.		X			
	* <i>Carthamus lanatus</i>	X		X		
	* <i>Centaurea melitensis</i>			X		
	<i>Centipeda crateriformis</i>		X			
	* <i>Cirsium vulgare</i>	X		X		
	* ? <i>Conyza</i> sp.			X		
	<i>Euchiton sphaericus</i>			X		
	* <i>Hypochaeris</i> sp.			X		
	* <i>Leontodon rhagadioloides</i>	X		X		
	<i>Olearia muelleri</i>	X	X	X	X	
	* <i>Osteospermum ecklonis</i>	X				
	<i>Ozothamnus lepidophyllus</i>				X	
	<i>Podolepis capillaris</i>	X				
	<i>Podolepis rugata</i>	X				
	<i>Podolepis rugata</i> subsp. <i>rugata</i>				X	X
	<i>Pseudognaphalium luteoalbum</i>				X	
	<i>Rhodanthe ?citrina</i>				X	
	<i>Rhodanthe oppositifolia</i> subsp. <i>oppositifolia</i>	X				
	<i>Senecio quadridentatus</i>	X				X
	? <i>Senecio</i> sp.				X	
	* <i>Sonchus oleraceus</i>				X	
	* <i>Sonchus</i> sp.				X	
	* <i>Urospermum picroides</i>				X	
	<i>Vittadinia ?australasica</i>				X	
	<i>Vittadinia gracilis</i>	X			X	X
	<i>Vittadinia nullarborensis</i>	X				
	Asteraceae sp.			X		X

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Acacia rhamphophylla</i>	Fabaceae	T	EN	Habit: low spreading shrub to 0.4 m high Flowers: yellow Flowering period: August to September Soils: rocky or sandy clay; upper slopes of ranges IBRA Distribution: ESP, MUR Florabase records: 9	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Conostylis lepidospermoides</i>	Haemodoraceae	T	EN	Habit: rhizomatous, tufted perennial herb to 0.36 m high Flowers: yellow Flowering period: September to October Soils: grey or yellow-brown sand over laterite IBRA Distribution: ESP, MAL Florabase records: 39	Low Preferred soils not expected to be present within survey area
<i>Daviesia megacalyx</i>	Fabaceae	T	EN	Habit: erect shrub Flowers: yellow/orange and red/brown/pink Flowering period: August to September Soils: gravelly laterite on ridges and hillslopes IBRA Distribution: ESP Florabase records: 33	Low Preferred vegetation not expected to be present within survey area
<i>Eucalyptus purpurata</i>	Myrtaceae	T	-	Habit: tree (or mallet) to 10 m high; smooth bark throughout, decorticating in short, long strips, dull light grey over cream Flowers: cream Flowering period: November Soils: white powdery loam, magnesite; eastern and north-eastern slopes of ridges IBRA Distribution: ESP Florabase records: 13	Low Preferred soils not expected to be present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Eucalyptus steedmanii</i>	Myrtaceae	T	V	Habit: tree to 12 m high with smooth bark Flowers: white Flowering period: January to March Soils: gravelly loam over ironstone, sand; on low hills and undulating plains IBRA Distribution: COO, ESP, MAL Florabase records: 41	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Acacia besleyi</i>	Fabaceae	P1	-	Habit: shrub to 2.5 m high Flowers: yellow Flowering period: September Soils: rocky loamy/sandy clay on drainage lines IBRA Distribution: ESP Florabase records: 15	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Acacia</i> sp. Ravensthorpe Range (B.R. Maslin 5463)	Fabaceae	P1	-	Habit: low spreading shrub to 0.3 m high Flowers: yellow Flowering period: August to October Soils: rocky clay and clayey loam IBRA Distribution: ESP Florabase records: 12	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Austrostipa</i> sp. Carlingup Road (S. Kern & R. Jasper LCH 18459)	Poaceae	P1	-	Habit: grass to 0.4 m high Flowers: Insufficient information Flowering period: Insufficient information Soils: sandy clay loam IBRA Distribution: COO, ESP, MAL Florabase records: 12	Medium Preferred soils and associated vegetation potentially present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Austrostipa</i> sp. Ravensthorpe Range (A. Markey & J. Allen 6261)	Poaceae	P1	-	Habit: grass to 0.5 m high Flowers: Insufficient information Flowering period: Insufficient information Soils: brown sandy clay loam IBRA Distribution: ESP, MAL Florabase records: 15	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Caladenia longifimbriata</i>	Orchidaceae	P1	-	Habit: tuberous, perennial herb to 0.35 m high Flowers: green, yellow and red Flowering period: September to October Soils: seasonal creeks IBRA Distribution: ESP, MAL Florabase records: 6	Low Preferred vegetation not expected to occur within survey area
<i>Drosera grieveri</i>	Droseraceae	P1	-	Habit: fibrous rooted, perennial herb to 0.03 m high Flowers: white Flowering period: September Soils: clayey sand IBRA Distribution: ESP, MAL Florabase records: 18	Low Preferred vegetation not expected to occur within survey area
<i>Grevillea sulcata</i>	Proteaceae	P1	-	Habit: spreading shrub to 0.3 m high Flowers: red Flowering period: July Soils: loam IBRA Distribution: ESP Florabase records: 14	Medium Preferred soils and associated vegetation potentially present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Guichenotia anota</i>	Malvaceae	P1	-	Habit: shrub to 1 m high Flowers: pink-purple Flowering period: November to December Soils: sandy, loamy gravel IBRA Distribution: ESP Florabase records: 20	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Guichenotia apetala</i>	Malvaceae	P1	-	Habit: compact, much branched shrub to 0.4 m high Flowers: blue-pink/pink Flowering period: May or September to December Soils: gravel, laterite IBRA Distribution: ESP Florabase records: 30	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Hibbertia atrichosepala</i>	Dilleniaceae	P1	-	Habit: erect shrub to 1 m high; pungent leaves Flowers: yellow Flowering period: Insufficient information Soils: slopes and flats associated with laterite IBRA Distribution: ESP Florabase records: 4	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Lasiopetalum</i> sp. Desmond (N. McQuoid 653)	Malvaceae	P1	-	Habit: erect shrub to 0.6 m high Flowers: pale pink Flowering period: August Soils: Insufficient information IBRA Distribution: ESP, MAL Florabase records: 4	Medium Preferred soils and associated vegetation potentially present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Lepidosperma</i> sp. Archer Drive (S. Kern & R. Jasper LCH 18300)	Cyperaceae	P1	-	Habit: Sedge to 0.3 m Flowers: Insufficient information Flowering period: Insufficient information Soils: Insufficient information IBRA Distribution: ESP Florabase records: 2	Low Insufficient data on species
<i>Lepidosperma</i> sp. Hopetoun Road (S. Kern et al. LCH 16552)	Cyperaceae	P1	-	Habit: Sedge to 0.4 m Flowers: Insufficient information Flowering period: Insufficient information Soils: Insufficient information IBRA Distribution: ESP Florabase records: 3	Low Insufficient data on species
<i>Lepidosperma</i> sp. Mt Chester (S. Kern et al. LCH 16596)	Cyperaceae	P1	-	Habit: Sedge to 0.3 m Flowers: Insufficient information Flowering period: Insufficient information Soils: Insufficient information IBRA Distribution: ESP Florabase records: 8	Low Insufficient data on species
<i>Lepidosperma</i> sp. Mt Short (S. Kern et al. LCH 17510)	Cyperaceae	P1	-	Habit: Sedge to 0.5 m Flowers: Insufficient information Flowering period: Insufficient information Soils: Insufficient information IBRA Distribution: ESP Florabase records: 12	Low Insufficient data on species

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

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TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Lepidosperma</i> sp. Steere River (S. Kern, R. Jasper, H. Hughes LCH 17764)	Cyperaceae	P1	-	Habit: Sedge to 0.4 m Flowers: Insufficient information Flowering period: Insufficient information Soils: Insufficient information IBRA Distribution: ESP Florabase records: 7	Low Insufficient data on species
<i>Pultenaea wudjariensis</i>	Fabaceae	P1	-	Habit: erect shrub Flowers: yellow Flowering period: October Soils: gravelly clay; gently hilly country IBRA Distribution: ESP Florabase records: 8	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Tetralochea applanata</i>	Elaeocarpaceae	P1	-	Habit: lax to domed, slender shrub to 0.35 m high Flowers: purple/pink Flowering period: August to September Soils: sand, brown gravelly clay, well-drained gravelly sandy clay; well exposed flat plain, slopes IBRA Distribution: AW, ESP, JF Florabase records: 4	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Cassinia arcuata</i>	Asteraceae	P2	-	Habit: aromatic shrub to 2 m high Flowers: brown Flowering period: January to April Soils: loam, clay-loam IBRA Distribution: ESP, GVD, MAL Florabase records: 27	Medium Preferred soils and associated vegetation potentially present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Thomasia</i> sp. Hopetoun (K.R. Newbey 4896)	Malvaceae	P2	-	Habit: shrub to 1 m high Flowers: light mauve/pink, white Flowering period: Insufficient information Soils: Insufficient information IBRA Distribution: ESP Florabase records: 11	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Acacia bifaria</i>	Fabaceae	P3	-	Habit: prostrate or semi-prostrate, commonly domed shrub to 0.8 m high and 2 m wide Flowers: yellow Flowering period: August to October or December Soils: clay, rocky loam, sandy soils; undulating plains, roadsides, low-lying areas IBRA Distribution: ESP Florabase records: 33	High Species has been recorded within the survey area in all previous surveys
<i>Acacia errabunda</i>	Fabaceae	P3	-	Habit: dense, bushy, spreading shrub to 2.5 m high Flowers: yellow Flowering period: Insufficient information Soils: clay, loam, gravelly loam, sand; undulating plains, clay flats IBRA Distribution: AW, ESP, MAL Florabase records: 25	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Acacia improcera</i>	Fabaceae	P3	-	Habit: spreading, spiny shrub to 0.4 m high Flowers: yellow Flowering period: August Soils: sand, loamy clay, clay; undulating plains, flats IBRA Distribution: COO, ESP, MAL Florabase records: 13	Medium Preferred soils and associated vegetation potentially present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

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TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Banksia corvijuga</i>	Proteaceae	P3	-	Habit: dense, rounded, ?non-lignotuberous shrub to 1.3 m high Flowers: yellow/orange and red/brown Flowering period: September to October Soils: gravelly lateritic soils; hillslopes IBRA Distribution: ESP, MUR Florabase records: 22	Low Preferred vegetation not expected to occur within survey area
<i>Banksia rufa</i> subsp. <i>chelomacarpa</i>	Proteaceae	P3	-	Habit: prostrate shrub to 0.45 m high Flowers: yellow Flowering period: July to October Soils: sandy loam over gravel IBRA Distribution: AW, ESP, MAL Florabase records: 20	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Dampiera sericantha</i>	Goodeniaceae	P3	-	Habit: erect, slender perennial, herb to 0.6 m high, stems with blunt angles Flowers: blue Flowering period: May to August to December Soils: sand, sometimes with gravel; plains IBRA Distribution: ESP Florabase records: 26	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Dampiera</i> sp. Ravensthorpe (G.F. Craig 8277)	Goodeniaceae	P3	-	Habit: perennial herb to 0.5 m high Flowers: blue/purple Flowering period: September to October Soils: loam; rocky outcrops IBRA Distribution: ESP Florabase records: 13	Low Preferred soil not expected to occur within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Daviesia newbeyi</i>	Fabaceae	P3	-	Habit: bushy, multi-stemmed, broom-like shrub to 1.5 m high Flowers: orange/yellow and red Flowering period: August to October Soils: sand or sandy clay over granite; rocky slopes IBRA Distribution: ESP, MAL Florabase records: 15	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Daviesia pauciflora</i>	Fabaceae	P3	-	Habit: diffuse, many stemmed shrub to 0.8 m high Flowers: yellow and red Flowering period: October to December or January Soils: white or grey sand over laterite or limestone; flats IBRA Distribution: ESP, MAL Florabase records: 22	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Grevillea fulgens</i>	Proteaceae	P3	-	Habit: spreading to straggling, non-lignotuberous shrub to 2 m high Flowers: red/pink-red Flowering period: May to October or December Soils: gravel over laterite on hillsides IBRA Distribution: AW, ESP Florabase records: 37	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Grevillea punctata</i>	Proteaceae	P3	-	Habit: shrub to 2 m high Flowers: red Flowering period: April to May or November Soils: stony red loam, red clay IBRA Distribution: ESP Florabase records: 23	Medium Preferred soils and associated vegetation potentially present within survey area

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Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Isolepis australiensis</i>	Cyperaceae	P3	-	Habit: sedge to 0.055 m high; glumes 0.8 - 1.2 mm long; stamens 1(-2); style branches 3; nut with abaxial angle acute Flowers: Insufficient information Flowering period: June or September Soils: silty sand, sandy clay; lake margins, pools IBRA Distribution: AW, COO, ESP, MAL Florabase records: 9	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Melaleuca coccinea</i>	Myrtaceae	P3	-	Habit: much branched shrub to 2.6 m high; leaf blade elliptic to ovate, 1.5 - 2.2 times as long as wide Flowers: red Flowering period: September to November or January Soils: sandy loam over granite; granite outcrops, sandplain, river valleys IBRA Distribution: COO, ESP Florabase records: 33	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Micromyrtus navicularis</i>	Myrtaceae	P3	-	Habit: spindly, erect shrub to 1.6 m high Flowers: white Flowering period: Insufficient information Soils: sand with gravel, laterite, granite; hillslopes IBRA Distribution: ESP Florabase records: 33	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Pultenaea craigiana</i>	Fabaceae	P3	-	Habit: shrub to 1 m high Flowers: orange/yellow flowers Flowering period: Insufficient information Soils: gentle slopes/hills loam, some association with quartz IBRA Distribution: ESP Florabase records: 19	Medium Preferred soils and associated vegetation potentially present within survey area

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TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Pultenaea indira</i> subsp. <i>monstrosita</i>	Fabaceae	P3	-	Habit: procumbent or erect, sparse or bushy shrub to 0.6 m high Flowers: Insufficient information Flowering period: Insufficient information Soils: sand, sandy clay or loamy sand, gravel; gentle slopes, flat to undulating plains, adjacent to salt lake IBRA Distribution: ESP, MAL Florabase records: 12	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Sphaerolobium validum</i>	Fabaceae	P3	-	Habit: erect shrub to 0.9 m high Flowers: yellow and red Flowering period: September Soils: white-grey sand, red-brown clayey sand, laterite gravel and quartz pebbles; gently undulating areas, flats, roadsides IBRA Distribution: ESP, MAL Florabase records: 21	Low Preferred vegetation not expected to occur within survey area
<i>Synaphea drummondii</i>	Proteaceae	P3	-	Habit: shrub Flowers: yellow Flowering period: July to September Soils: sand over laterite IBRA Distribution: AW, ESP, MAL Florabase records: 27	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Verticordia gracilis</i>	Myrtaceae	P3	-	Habit: low, slender shrub to 0.6 m high Flowers: pink Flowering period: October to November Soils: yellow sand, gravelly sand, sandy loam IBRA Distribution: AW, COO, MAL Florabase records: 13	Low Preferred soils and associated vegetation not expected to occur within survey area. Closest record approximately 150 km away.

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Allocasuarina hystricosa</i>	Casuarinaceae	P4	-	Habit: dioecious herb to 3 m high, with erect branchlets with 10-12 teeth per whorl Flowers: Insufficient information Flowering period: Insufficient information Soils: orange, red or brown loam with limestone or granite outcropping; plains, lower slopes, hilltops IBRA Distribution: ESP Florabase records: 36	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Banksia foliosissima</i>	Proteaceae	P4	-	Habit: dense, erect, non lignotuberous shrub to 3 m high Flowers: yellow Flowering period: May or August Soils: gravelly sand or sandy clay over laterite; hilltop and upper slope IBRA Distribution: AW, ESP, MAL Florabase records: 36	Low Preferred vegetation not expected to occur within survey area
<i>Banksia laevigata</i> subsp. <i>laevigata</i>	Proteaceae	P4	-	Habit: non-lignotuberous shrub to 3.5 m high Flowers: green-yellow Flowering period: September to December Soils: rocky soils (spongolite, laterite) on hills, top of breakaways IBRA Distribution: ESP, MAL Florabase records: 41	Low Preferred vegetation not expected to occur within survey area
<i>Beyeria villosa</i>	Euphorbiaceae	P4	-	Habit: shrub 1.5 m high Flowers: Insufficient information Flowering period: Insufficient information Soils: clay loam, sandy clay; low hills IBRA Distribution: ESP Florabase records: 22	Medium Preferred soils and associated vegetation potentially present within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Chorizema ulotropis</i>	Fabaceae	P4	-	Habit: sprawling, open, semi-prostrate shrub to 0.45 m high Flowers: orange-yellow Flowering period: July to September Soils: moist to dry soils, white sand with gravel, laterite, granite; outcrops, winter damp to dry areas, flats IBRA Distribution: ESP, JF, MAL Florabase records: 24	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Dampiera deltoidea</i>	Goodeniaceae	P4	-	Habit: erect perennial herb to 0.4 m high Flowers: blue Flowering period: September to November Soils: sand, sandy clay, loam; sandplains, around quartzite rocks IBRA Distribution: ESP Florabase records: 21	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Eucalyptus desmondensis</i>	Myrtaceae	P4	-	Habit: mallee, slender, willowy to 4.5 m high with smooth bark Flowers: yellow Flowering period: January to June or August to December Soils: stony loam or sand, clay, granitic rocks; rocky hillsides and sandplains IBRA Distribution: ESP Florabase records: 73	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Eucalyptus x bennettiae</i>	Myrtaceae	P4	-	Habit: mallee to 2.5 m high with smooth bark Flowers: yellow-green Flowering period: November, December Soils: red quartzite rubble, red loam; slopes IBRA Distribution: ESP Florabase records: 23	Low Preferred soils and associated vegetation not expected to occur within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Goodenia phillipsiae</i>	Goodeniaceae	P4	-	Habit: shrub to 0.3 m high Flowers: yellow Flowering period: November Soils: clay loam, sandy loam IBRA Distribution: ESP Florabase records: 36	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Goodenia stenophylla</i>	Goodeniaceae	P4	-	Habit: erect shrub to 2 m high Flowers: white Flowering period: September to December or January Soils: rocky soils; granite or quartzite rocks; steep slopes IBRA Distribution: ESP Florabase records: 29	Low Preferred soils and associated vegetation not expected to occur within survey area
<i>Grevillea prostrata</i>	Proteaceae	P4	-	Habit: loose prostrate shrub to 0.1 m high and 1.2 m wide Flowers: cream-white/pink-red Flowering period: August to December or January Soils: white, grey or yellow sand, gravel; sandplains IBRA Distribution: COO, ESP, MAL Florabase records: 38	Low Preferred soils not expected to occur within survey area
<i>Leucopogon compactus</i>	Ericaceae	P4	-	Habit: much-branded shrub to 1 m high Flowers: white Flowering period: June to August or December Soils: yellow sand with lateritic gravel, stony clay, loam over granite; plains, hillslopes IBRA Distribution: ESP Florabase records: 20	Low Preferred vegetation not expected to occur within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Marianthus mollis</i>	Pittosporaceae	P4	-	Habit: low branching, spreading, silky hairy shrub to 0.5 m high Flowers: blue Flowering period: August to September Soils: laterite soils on hills and ridges IBRA Distribution: ESP Florabase records: 26	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Melaleuca penicula</i>	Myrtaceae	P4	-	Habit: spreading shrub to 3 m high; leaf blade narrowly ovate, 2.7-3.8 times as long as wide Flowers: red Flowering period: January to February Soils: red/brown loamy sand or red sandy clay; granite outcrops and valley slopes IBRA Distribution: ESP Florabase records: 20	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Pultenaea calycina</i> subsp. <i>proxena</i>	Fabaceae	P4	-	Habit: many-branched, compact shrub Flowers: yellow Flowering period: September to November Soils: sand, clay, sandy clay or loam, with gravel, over magnesite; moderate slopes, adjacent to creek beds IBRA Distribution: ESP Florabase records: 38	Medium Preferred soils and associated vegetation potentially present within survey area
<i>Thysanotus parviflorus</i>	Asparagaceae	P4	-	Habit: perennial herb to 0.3 m high Flowers: purple Flowering period: October to November Soils: grey sand IBRA Distribution: AW, ESP, MAL Florabase records: 20	Low Preferred soils not expected to occur within survey area

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT IN THE MT CATTLIN PROJECT

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AW – Avon Wheatbelt; COO – Coolgardie; ESP – Esperance Plains; MAL – Mallee; MUR – Murchison; JF – Jarrah Forest; GVD – Great Victoria Desert

TAXON	FAMILY	SCC	FCC	DESCRIPTION AND HABITAT	POTENTIAL TO OCCUR IN SURVEY AREA
<i>Verticordia integra</i>	Myrtaceae	P4	-	Habit: spindly shrub to 1 m high Flowers: yellow Flowering period: October to December Soils: sandy soils over laterite IBRA Distribution: ESP, MAL Florabase records: 35	Low Preferred vegetation not expected to occur within survey area

**APPENDIX F: GEOGRAPHIC LOCATIONS OF PRIORITY SPECIES RECORDED
IN THE MT CATTLIN PROJECT EXTENSION**

***Acacia bifaria* (P3)**

QUADRAT	LOCATION (GDA94 Z51H)		NO. PLANTS ALIVE (DEAD)
	EASTING (mE)	NORTHING (mN)	
MC033	225004	6283177	1
MC034	225042	6283069	2-5
MC036	225384	6283228	2-5
MC038	225449	6283072	2-5
MC041	225946	6282999	2-5
MC044	226267	6282985	2-5
MC045	226287	6283273	2-5
MC046	226313	6283047	1
MC047	226390	6283855	2-5
MC049	226487	6282980	6-10
MC050	226552	6283398	1 (1)
MC052	226593	6283013	2-5
MC053	226627	6283570	6-10
MC054	226630	6283904	2-5
MC055	226742	6283370	1
MC056	226818	6283076	2-5
MC057	226821	6283652	1
MC058	226847	6283888	2-5
MC060	226986	6283627	2-5
MC062	227006	6281935	2-5 (1)
MC063	227039	6283353	1
MC064	227099	6283115	2-5
MC066	227124	6282900	11-25
MC068	227135	6282977	6-10
MC071	227285	6282659	1
MC072	227339	6282894	2-5
MC074	227472	6283769	2-5
MC075	227475	6283341	1

? *Guichenotia anota* (P1)

QUADRAT	LOCATION (GDA94 Z51H)		NO. PLANTS ALIVE (DEAD)
	EASTING (mE)	NORTHING (mN)	
MC076	227536	6283514	1

APPENDIX G: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE MT CATTLIN PROJECT EXTENSION

Note: * denotes an introduced species; P1 - P4 denotes priority taxon (DBCA 2017a, WAH 1998-); Oppo denotes species only recorded opportunistically and not within a survey quadrat; Vegetation communities W1 and CR1 were not represented in any survey quadrats during the Matisse Consulting 2018 survey

SPECIES	VEGETATION COMMUNITY				
	W2	W3	W4	S1	CR2
<i>Acacia bifaria</i> (P3)	x	x		x	x
<i>Acacia binata</i>	x				
<i>Acacia ?chrysellia</i>	x	x			
<i>Acacia cyclops</i>	x	x			
<i>Acacia erinacea</i>	x	x		x	
<i>Acacia lachnophylla</i>		x			
<i>Acacia redolens</i>					x
<i>Acacia saligna</i>		x			
<i>Acacia sulcata</i> var. <i>platyphylla</i>		x		x	x
<i>Acacia</i> sp.	x	x			
<i>Allocasuarina campestris</i>				x	x
* <i>Asparagus asparagoides</i>	x	x	x	x	x
* <i>Asphodelus fistulosus</i>		x	x		
Asteraceae sp.	x	x			
<i>Astroloma epacridis</i>		x		x	
<i>Atriplex semibaccata</i>	x	x	x		
<i>Austrostipa</i> sp.	x	x	x	x	
<i>Boronia inornata</i> subsp. <i>inornata</i>	x	x			
<i>Callitris drummondii</i>				x	x
<i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>				x	
<i>Carpobrotus</i> sp.					x
<i>Cassytha</i> sp.		x		x	
Chenopodiaceae sp.	x	x			
* <i>Chenopodium glaucum</i>	x				
Cyperaceae sp.				x	x
<i>Daviesia anceps</i>				x	
<i>Daviesia ?benthamii</i>	x				
<i>Dianella</i> sp.		x			x
<i>Dodonaea caespitosa</i>				x	
<i>Dodonaea concinna</i>	x				
<i>Dodonaea ?pinifolia</i>		x			
<i>Dodonaea ptarmicaefolia</i>	x	x		x	
<i>Dodonaea</i> sp.		x		x	
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	x	x	x	x	x
<i>Eremophila densifolia</i> ?subsp. <i>densifolia</i>		x			
Ericaceae sp.				x	
<i>Eriochilus dilatatus</i> subsp. <i>undulatus</i>		x		x	
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>		x		x	
<i>Eucalyptus brachycalyx</i>		x			
<i>Eucalyptus calycogona</i> subsp. <i>calycogona</i>		x			
<i>Eucalyptus celastroides</i> subsp. <i>virella</i>	x	x	x	x	

APPENDIX G: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE MT CATTLIN PROJECT EXTENSION

Note: * denotes an introduced species; P1 - P4 denotes priority taxon (DBCA 2017a, WAH 1998-); Oppo denotes species only recorded opportunistically and not within a survey quadrat; Vegetation communities W1 and CR1 were not represented in any survey quadrats during the Matiske Consulting 2018 survey

SPECIES	VEGETATION COMMUNITY				
	W2	W3	W4	S1	CR2
<i>Eucalyptus cernua</i>	x	x		x	
<i>Eucalyptus conglobata</i> subsp. <i>perata</i>	x	x		x	
<i>Eucalyptus densa</i> subsp. <i>densa</i>				x	
<i>Eucalyptus extensa</i>	x	x		x	
<i>Eucalyptus myriadena</i> subsp. <i>myriadena</i>		x		x	
<i>Eucalyptus ?oleosa</i>		x		x	
<i>Eucalyptus oleosa</i> subsp. <i>corvina</i>	x	x			
<i>Eucalyptus oleosa</i> subsp. <i>oleosa</i>	x		x	x	x
<i>Eucalyptus ?ovularis</i>			x		
<i>Eucalyptus phenax</i> subsp. <i>phenax</i>	x		x		
<i>Eucalyptus salmonophloia</i>		x			
<i>Eucalyptus spathulata</i> subsp. <i>spathulata</i>			x		
<i>Eucalyptus</i> sp.	x	x			
<i>Euphorbia dallachyana</i>			x		
<i>Exocarpos aphyllus</i>		x			
<i>Exocarpos sparteus</i>	x				
<i>Gahnia ancistrophylla</i>				x	x
<i>Gastrolobium ?parviflorum</i>				x	
<i>Goodenia laevis</i> subsp. <i>humifusa</i>	x	x			
<i>Grevillea anethifolia</i>				x	
<i>Grevillea patentiloba</i> subsp. <i>patentiloba</i>	x	x		x	
? <i>Guichenotia anota</i> (P1)				x	
<i>Guichenotia ledifolia</i>		x			
<i>Hakea verrucosa</i>				x	
<i>Hibbertia ?exasperata</i>				x	
<i>Hibbertia</i> sp.				x	
<i>Hybanthus floribundus</i> subsp. <i>adpressus</i>		x		x	
<i>Lepidosperma diurnum</i>		x		x	x
<i>Lepidosperma humile</i>		x		x	x
<i>Lepidosperma</i> sp.	x	x		x	
<i>Leptospermum oligandrum</i>				x	
<i>Leucopogon cuneifolius</i>				x	
* <i>Lycium ferocissimum</i>	x	x	x		x
<i>Maireana brevifolia</i>	x	x	x		
<i>Maireana suaedifolia</i>	x	x			
<i>Maireana trichoptera</i>	x				
<i>Maireana</i> sp.		x			
* <i>Marrubium vulgare</i>			x		
<i>Melaleuca acuminata</i> subsp. <i>acuminata</i>		x		x	x
<i>Melaleuca cliffortioides</i>	x			x	
<i>Melaleuca cucullata</i>	x	x		x	

APPENDIX G: VASCULAR PLANT SPECIES RECORDED IN EACH VEGETATION COMMUNITY IN THE MT CATTLIN PROJECT EXTENSION

Note: * denotes an introduced species; P1 - P4 denotes priority taxon (DBCA 2017a, WAH 1998-); Oppo denotes species only recorded opportunistically and not within a survey quadrat; Vegetation communities W1 and CR1 were not represented in any survey quadrats during the Matisse Consulting 2018 survey

SPECIES	VEGETATION COMMUNITY				
	W2	W3	W4	S1	CR2
<i>Melaleuca cuticularis</i>					X
<i>Melaleuca elliptica</i>		X		X	X
<i>Melaleuca ?lateriflora</i>				X	
<i>Melaleuca ?pauperiflora</i> subsp. <i>pauperiflora</i>		X			
<i>Melaleuca scalena</i>				X	
<i>Melaleuca ?viminea</i> subsp. <i>viminea</i>				X	
<i>Melaleuca</i> sp.	X	X			
<i>Neurachne alopecuroidea</i>				X	
<i>Olearia muelleri</i>		X		X	
<i>Oxalis perennans</i>	X				
<i>Oxalis</i> sp.		X	X	X	X
<i>Pimelea</i> sp.				X	
<i>Plantago ?exilis</i>		X			
Poaceae sp.	X	X	X	X	
<i>Podolepis rugata</i> subsp. <i>rugata</i>	X	X			X
<i>Ptilotus</i> sp.		X			
<i>Pultenaea rotundifolia</i>		X		X	
<i>Pultenaea</i> sp.		X			
<i>Rhagodia crassifolia</i>	X	X	X		
<i>Rhagodia preissii</i> subsp. <i>preissii</i>	X	X	X		
<i>Rhagodia</i> sp.	X	X			
<i>Salicornia quinqueflora</i> subsp. <i>quinqueflora</i>					X
<i>Salsola australis</i>			X		
<i>Santalum murrayanum</i>		X		X	
<i>Santalum</i> sp.	X	X		X	X
<i>Sclerolaena diacantha</i>	X	X			
<i>Sclerolaena uniflora</i>		X	X		
<i>Senecio quadridentatus</i>	X	X			
<i>Senna artemisioides</i> subsp. <i>xartemisioides</i>	X	X		X	X
<i>Senna artemisioides</i> subsp. <i>filifolia</i>		X			
* <i>Solanum nigrum</i>	X	X			
<i>Stackhousia</i> sp.				X	
<i>Tecticornia lepidosperma</i>					X
<i>Tecticornia</i> sp.				X	X
<i>Templetonia retusa</i>		X		X	X
<i>Tetrapora verrucosa</i>				X	
<i>Teucrium sessiliflorum</i>	X				
<i>Thomasia foliosa</i>				X	
* <i>Trifolium</i> sp.					X
<i>Vittadinia gracilis</i>	X				
<i>Wilsonia humilis</i>		X			X

APPENDIX H: SUMMARY OF VEGETATION COMMUNITIES DEFINED IN THE MT CATTLIN PROJECT EXTENSION

VEGETATION COMMUNITY DESCRIPTION

Community Code: W2

Community Description:

Eucalyptus oleosa subsp. *corvina* and *Eucalyptus extensa* mid mallee woodland over *Senna artemisioides* mid sparse shrubland over *Acacia erinacea*, *Rhagodia crassifolia* and *Sclerolaena diacantha* low sparse shrubland on brown clay-loam soils on slopes

Statistically Associated Species:

Acacia bifaria (P3), Poaceae sp., *Vittadinia gracilis*, Chenopodiaceae sp.

Soil and Landform:	brown clay-loam slopes	Surface Rocks:	not present
Outcropping:	not present	Vegetation Condition:	D, VG, EX
Community Area:	159.14 (ha)	Proportion of Survey Area:	37.89 %
Total No. Quadrats:	14	Average Native Spp. Richness:	11.86 ± 3.32

REPRESENTATIVE PHOTOGRAPH: MC033



APPENDIX H: SUMMARY OF VEGETATION COMMUNITIES DEFINED IN THE MT CATTLIN PROJECT EXTENSION

VEGETATION COMMUNITY DESCRIPTION

Community Code: W3

Community Description:

Eucalyptus myriadena subsp. *myriadena* and *Eucalyptus oleosa* subsp. *corvina* mid mallee woodland over *Acacia bifaria* (P3), *Acacia erinacea* and *Senna artemisioides* low sparse shrubland over *Austrostipa puberula* isolated grasses on brown clay-loam soils on slopes

Statistically Associated Species:

Enchylaena tomentosa var. *tomentosa*, *Exocarpos aphyllus*, *Grevillea patentiloba* subsp. *patentiloba*

Soil and Landform: brown clay-loam slopes **Surface Rocks:** occasionally present

Outcropping: not present **Vegetation Condition:** G, VG, EX

Community Area: 50.77 (ha) **Proportion of Survey Area:** 12.09 %

Total No. Quadrats: 21 **Average Native Spp. Richness:** 12.04 ± 3.14

REPRESENTATIVE PHOTOGRAPH: MC052



APPENDIX H: SUMMARY OF VEGETATION COMMUNITIES DEFINED IN THE MT CATTLIN PROJECT EXTENSION

VEGETATION COMMUNITY DESCRIPTION

Community Code: W4

Community Description:

Mixed *Eucalyptus* spp. mid mallee woodland over *Rhagodia crassifolia*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena uniflora* low sparse shrubland over *Austrostipa exilis*, *Austrostipa* sp. and *Rytidosperma caespitosum* low sparse grassland on brown clay-loam soils on slopes

Statistically Associated Species:

N/A

Soil and Landform:	brown clay-loam slopes	Surface Rocks:	not present
Outcropping:	not present	Vegetation Condition:	D
Community Area:	1.43 (ha)	Proportion of Survey Area:	0.34 %
Total No. Quadrats:	2	Average Native Spp. Richness:	13.00 ± 0.00

REPRESENTATIVE PHOTOGRAPH: MC031



APPENDIX H: SUMMARY OF VEGETATION COMMUNITIES DEFINED IN THE MT CATTLIN PROJECT EXTENSION

VEGETATION COMMUNITY DESCRIPTION			
Community Code: S1			
Community Description:			
<p><i>Acacia sulcata</i> var. <i>platyphylla</i>, <i>Santalum murrayanum</i> and <i>Melaleuca</i> spp. mid open shrubland over <i>Dodonaea caespitosa</i>, <i>Astroloma</i> sp. and <i>Hibbertia</i> sp. low sparse shrubland over <i>Lepidosperma diurnum</i> and <i>Neurachne alopecuroidea</i> isolated clumps of sedges and grasses on red-brown clay loam soils on rocky slopes adjacent to creeklines and drainage lines</p>			
Statistically Associated Species:			
<p><i>Melaleuca elliptica</i>, <i>Melaleuca acuminata</i> subsp. <i>acuminata</i>, <i>Melaleuca scalena</i>, <i>Astroloma epacridis</i>, <i>Hakea verrucosa</i></p>			
Soil and Landform:	red-brown clay loam	Surface Rocks:	present
Outcropping:	occasionally present	Vegetation Condition:	VG, EX
Community Area:	33.67 (ha)	Proportion of Survey Area:	8.02 %
Total No. Quadrats:	10	Average Native Spp. Richness:	15.50 ± 3.72
REPRESENTATIVE PHOTOGRAPH: MC051			

APPENDIX H: SUMMARY OF VEGETATION COMMUNITIES DEFINED IN THE MT CATTLIN PROJECT EXTENSION

VEGETATION COMMUNITY DESCRIPTION

Community Code: CR1

Community Description:

Dodonaea ptarmicaefolia, *Melaleuca cuticularis* and *Melaleuca elliptica* mid sparse shrubland over *Tecticornia* ?*pergranulata* subsp. *pergranulata* low sparse chenopod shrubland, with occasional emergent *Eucalyptus occidentalis*, on red-brown clay-loam soils on creeklines

Statistically Associated Species:

Cassythia ?melantha, *Spergularia marina*, *Santalum murrayanum*

Soil and Landform: red-brown clay-loam creeklines

Surface Rocks: present

Outcropping: present

Vegetation Condition: VG, EX

Community Area: 1.40 (ha)

Proportion of Survey Area: 0.33 %

Total No. Quadrats: 0

Average Native Spp. Richness: N/A

REPRESENTATIVE PHOTOGRAPH: MC005



APPENDIX H: SUMMARY OF VEGETATION COMMUNITIES DEFINED IN THE MT CATTLIN PROJECT EXTENSION

VEGETATION COMMUNITY DESCRIPTION

Community Code: CR2

Community Description:

Melaleuca cuticularis and *Santalum murrayanum* mid sparse shrubland over *Acacia bifaria* (P3) low sparse shrubland over *Salicornia quinqueflora* subsp. *quinqueflora* low sparse chenopod shrubland, on brown sandy-loam soils on rocky drainage lines

Statistically Associated Species:

Cyperaceae sp., *Gahnia ancistrophylla*

Soil and Landform:	brown sandy-loam drainage lines	Surface Rocks:	present
Outcropping:	present	Vegetation Condition:	G, EX
Community Area:	3.58 (ha)	Proportion of Survey Area:	0.85 %
Total No. Quadrats:	2	Average Native Spp. Richness:	18.00 ± 2.82

REPRESENTATIVE PHOTOGRAPH: MC055

