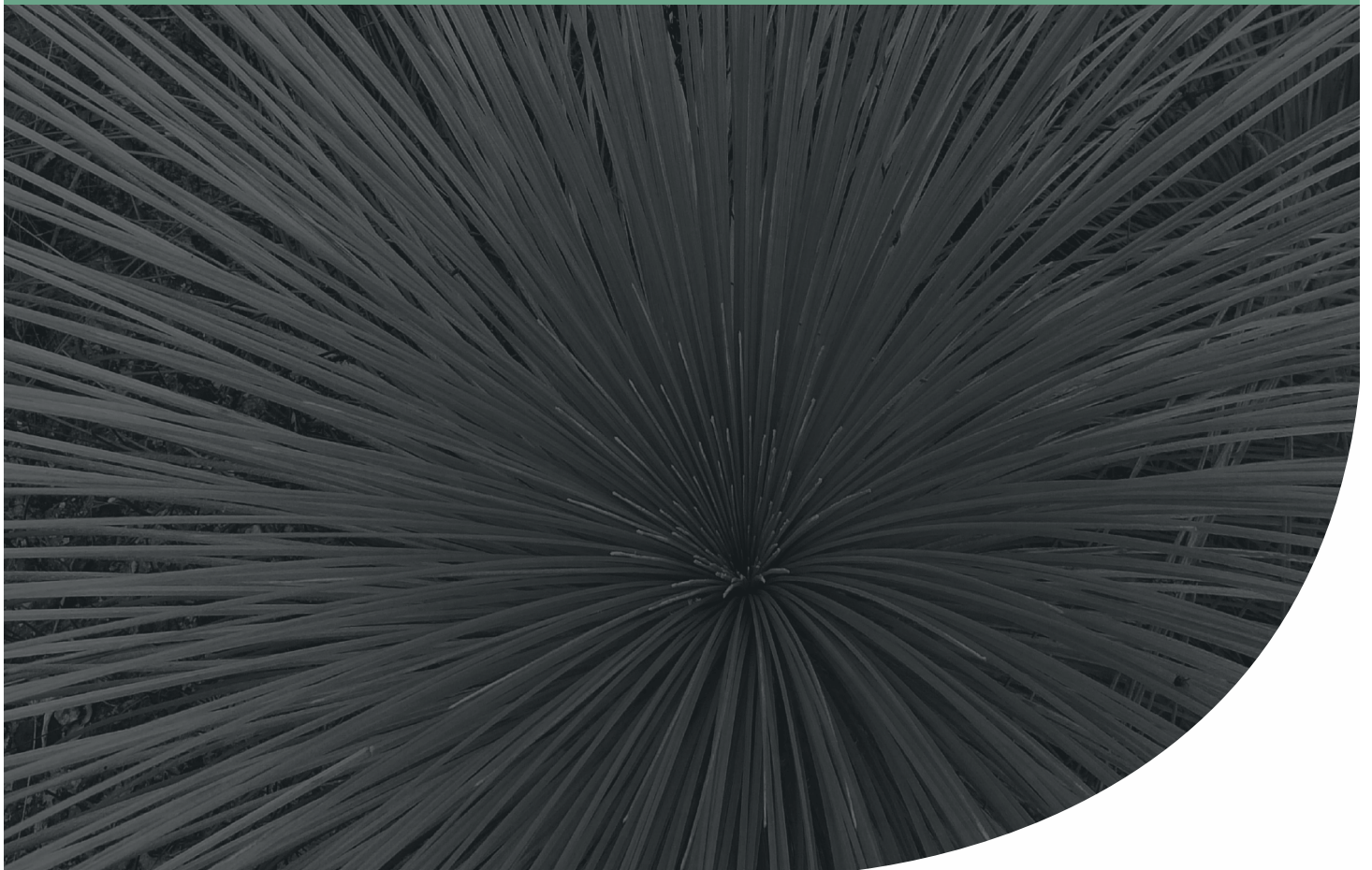


Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins
Street) Jarrahdale

Project No: EP22-113(01)

**Prepared for Shire of Serpentine Jarrahdale
December 2022**



Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



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Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



Executive Summary

The Shire of Serpentine Jarrahdale engaged Emerge Associates to conduct a detailed flora and vegetation assessment to provide information on the flora and vegetation values within part of two public roads (land ID numbers 3781175 and 3781160 (Atkins Street)) in Jarrahdale (referred to herein as the 'site').

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken on 7 November 2022. During the field survey an assessment was made on the type, condition and values of vegetation across the site.

Outcomes of the survey include the following:

- A total of 46 native and 12 non-native (weed) species were recorded in the site.
- No threatened or priority flora species were recorded within the site. Whilst the majority of threatened or priority flora species with potential to occur would have been flowering, one priority annual species (*Millotia tenuifolia* var. *laevis*) would not have been visible at the time of survey, and thus it is possible that this species occurs within the site. Further survey in September or October would be required to confirm the presence or absence of this species.
- The vegetation within the site was classified into one plant community (**EmCcPe**) that is present in 'very good' (0.13 ha), 'good' (0.3 ha), 'good to degraded' (0.03 ha) and 'completely degraded' (0.04 ha) condition.
- *Corymbia calophylla* and *Eucalyptus marginata* trees present within the site provide foraging and roosting habitat, and potentially breeding habitat, for threatened species of black cockatoo.

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Appendices

Appendix A

Additional Information

Appendix B

Conservation Significant Flora Species and likelihood of Occurrence Assessment

Appendix C

Species List

Appendix D

Conservation Significant Communities and Likelihood of Occurrence Assessment

Appendix E

Sample Data

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Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
DPaW	Department of Parks and Wildlife
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
ESA	Environmentally sensitive area
IBRA	Interim Biogeographic Regionalisation of Australia
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
T	Threatened
TEC	Threatened ecological communities
UFI	Unique feature identifier

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Table A3: Abbreviations – Legislation

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BC Regs	Biodiversity Conservation Regulations 2018

Table A4: Abbreviations – Units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m ²	square metre
m AHD	m in relation to the Australian height datum

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1 Introduction

1.1 Project background

Emerge Associates (Emerge) were engaged by the Shire of Serpentine Jarrahdale to characterise the flora and vegetation values within part of two public roads (land ID numbers 3781175 and 3781160 (Atkins Street)) in Jarrahdale (referred to herein as the 'site'). The site is located approximately 65 kilometres (km) south-east of the Perth Central Business District within the Shire of Serpentine Jarrahdale.

The site is approximately 0.51 hectares (ha) in size and is bounded by rural land to the east, Gooralong Conservation Park to the north and west and Atkins Road to the south. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of work

The scope of work was specifically to undertake a flora and vegetation assessment within the site to the standard required of a detailed survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- A field survey to record a comprehensive list of flora species and assess vegetation type and condition.
- Mapping of plant communities, vegetation condition and conservation significant flora and vegetation.
- Identification of potential habitat for conservation significant flora and vegetation and an assessment of likelihood of occurrence.
- Documentation of the desktop assessment, methodology, field survey and results into a report.

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2 Environmental Context

2.1 Climate

Climate influences the types of vegetation that grow in a region and the life cycles of the flora present. Therefore, it is critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. In Mediterranean type climates some flora species will typically spend part of their lifecycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter when favourable conditions return and are most visible during spring, which is the flowering period for a majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA.

An average of 1169.7 millimetres (mm) of rainfall is recorded annually from the Jarrahdale weather station (no. 9023), which is the closest weather station, located approximately 2 km from the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Karnet weather station (no. 9111), which is the nearest temperature recording station approximately 11 km south of the site, range from 15.5°C in July to 30.6°C in January, while mean minimum temperatures range from 6.4°C in July and August to 15.8°C in February (BoM 2022).

A total of 831.4 mm of rain was recorded from May to September 2022 prior to the survey, which is approximately 91.4% of the mean of 910 mm for this period (BoM 2022). Although lower than the mean this amount of rainfall was considered to have been sufficient to promote the flowering and emergence of native flora.

2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Darling Plateau which lies east of Perth CBD and directly east of the Darling Scarp. The Darling Plateau is an ancient erosion surface capped with laterite and dissected by drainage channels (Beard 1990). The eastern part of the Plateau is characterised by flat-topped hills bound by breakaways and more prominent hills (monadnocks) which protrude above the general level of the plateau (Gozzard 2011). The western part comprises valleys with steep, rocky slopes and narrow, flat floors (Gozzard 2011).

Examination of broad scale soil mapping places the site primarily within the Murray association, whilst the south-western most corner of the site falls within the Dwellingup association (Churchward and McArthur 1980). The Murray association comprises deeply incised valleys with red and yellow earths on slopes and narrow alluvial terraces. The Dwellingup association comprises a gently undulating landscape with duricrust on ridges and with sands and gravels in shallow depressions.

The soil types mapped within the site are shown in **Figure 2**.

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The site is not known to contain any restricted landforms or unique geological features.

2.3 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Wetlands can be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017c)
- *A Directory of Important Wetlands in Australia* (DBCA 2018)

No Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows no wetland or water related features occur within the site. However, the perennial waterway (Gooralong Brook) runs approximately 200 m to the north of the site.

2.4 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides Australia into floristic subregions (Environment Australia 2000).

The site is contained within the jarrah forest region and within the 'JF1' or northern jarrah forest subregion. The northern jarrah forest subregion is characterised by *Eucalyptus marginata* (jarrah) – *Corymbia calophylla* (marri) forest on laterite gravels with *Eucalyptus wandoo* – marri woodlands in the eastern part (DEC 2002).

Variations in native vegetation can be further classified based on regional vegetation mapping.

DBCA (2019) mapping shows the majority of the southern and western portions of the site as comprising 'Dwellingup, D2' complex which is described as a 'open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on lateritic uplands in subhumid and semiarid zones'. The north-eastern portion of the site was mapped as comprising the 'Murray 1, My1' complex which is described as 'open forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* - *Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* - *Melaleuca raphiophylla* on the valley floors in humid and subhumid zones'.

The 'Dwellingup, D2' complex was determined to have 82.5% of its pre-European extent remaining, of which 19.4% is protected for conservation purposes. The 'Murray 1, My1' complex was determined to have 76.1% of its pre-European extent remaining, of which 15.2% is protected for conservation purposes (Government of Western Australia 2019).

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2.5 Historical land use

Review of historical images available from 1965 onwards shows that the track to the south of the site has been present since 1965 and was formalised into a road in 1989 (WALIA 2022). The vegetation within the site itself has remained relatively stable in the intervening time.

2.6 Conservation significant values

2.6.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's *Priority Flora List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes.

Further information on threatened and priority species and their categories is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1** and **4.2.1**).

2.6.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DAWE 2021a). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the EPBC Act. Similar to flora species, TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the BC Act and the BC Regulations. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

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An ecological community that is under consideration for listing as a TEC in Western Australia but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes.

Further information on categories of TECs and PECs is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1** and **4.3.1**).

2.7 Weeds and pests

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds. The likelihood of weeds occurring is higher in areas disturbed areas, especially areas that have been agricultural or urban landuse.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to *Western Australia's Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread.

The Commonwealth government has further compiled a list of 32 *Weeds of National Significance* (WoNS) (DAWE 2021b). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on weeds and declared pests is provided in **Appendix A**.

2.8 DBCA managed or legislated land

DBCA has tenure of or interests in numerous areas of land across the state for a range of purposes. Tenure categories include national parks, nature reserves, conservation parks, marine parks, marine nature reserves, marine management areas, section 5(1)(g) reserves, state forest and timber reserves. These areas are mapped within the *Legislated Lands and Waters* (DBCA 2017a) and *Lands of Interest* (DBCA 2017b) datasets. The *Legislated Lands and Waters* (DBCA 2017a) dataset includes lands subject to the following legislation; the *Conservation and Land Management Act 1984* (CALM Act 1984), *Swan and Canning Rivers Management Act 2006* (SCRM Act) and lands identified under the *Land Administration Act 1997* (LA Act). The *Lands of Interest* (DBCA 2017b) dataset includes all other lands of which DBCA is recognised as the manager but is not vested under any act. These lands comprise of crown land and freehold land which DBCA has been acknowledged by the Department of Lands as the responsible agency.

The western boundary of the site is directly adjacent to the 'Gooralong Conservation Park' (R 990) under the CALM Act. This conservation park connects to the 'Serpentine National Park' to the south (DBCA 2017a).

2.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic

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diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

There are no mapped ecological linkages within or in close proximity to the site. One regional ecological linkage (No. 156) occurs approximately 600 m east of the site running from north to south.

Review of aerial imagery indicates that much of the vegetation within the site is connected to extensive areas of native vegetation within the local area.

2.10 Previous surveys

No previous surveys are known.

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3 Methods

3.1 Database searches

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022), *NatureMap* (DBCA 2022) and DBCA's threatened and priority flora database (reference no. 40-1122FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2022), the *weed and native flora dataset* (Keighery *et al.* 2012) and DBCA's threatened and priority ecological communities' database (reference no. 20-1122EC).

Prior to undertaking the field survey, information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. This was compared to existing environmental information available for the site, such as geomorphology, soils, regional vegetation and historic land use, to identify species and communities for which habitat may occur in the site.

3.2 Field survey

A botanist from Emerge visited the site on 7 November 2022 to conduct the flora and vegetation field survey.

The site was traversed on foot and the composition and condition of vegetation was recorded. Photographs were taken throughout the field visit to show particular site conditions.

Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the Western Australian Herbarium (2022). Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk (‘*’) in text and raw data.

3.2.1 Sampling

Detailed sampling of the vegetation was undertaken using non-permanent 10 x 10 m quadrats. The quadrats were established using fence droppers bound by measuring tape. The position of each sample was recorded with a hand-held GPS unit.

The data recorded within each sample included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, ‘foliage projective cover’ (FPC), degree of disturbance and species present).

Additional plant taxa not observed within samples were recorded opportunistically as the botanist traversed the site.

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3.2.2 Targeted searches

The suitability of habitat within the site for conservation significant flora and communities identified in the desktop assessment was assessed (refer **Section 3.1**). Areas of suitable habitat were traversed along transects and searched for conservation significant species, as required.

3.2.3 Vegetation condition

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 1**).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
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 very 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 some very aggressive weeds at high density, 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, 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.

3.3 Mapping and analysis

3.3.1 Conservation significant flora and communities

Based on the database searches and information recorded during the field survey, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in **Table 2**.

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Table 2: Likelihood of occurrence assessment categories and definitions

Likelihood	Definition
Recorded	The species was recorded during the current field survey.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains suitable habitat for the species but there is no other information to suggest that the species may occur within or close to the site.
Unlikely	The site does not contain suitable habitat for the species or the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

3.3.2 Plant community identification and description

The plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System (NVIS)* (NVIS Technical Working Group 2017). The identified plant communities were mapped on aerial photography from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the samples and notes recorded during the field survey to define areas with differing condition.

3.3.3 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC or PEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds.

3.3.4 Species accumulation curve

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. PRIMER v6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jackknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 3**.

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Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Section 2 is adequate to place the site and vegetation in context.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with 12 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 20 years' experience in environmental science in Western Australia.
Suitability of timing	Limitation	The survey was conducted in November and thus late within the main flowering season. The site has been subject to historical and recent (fire) disturbance but there is still the possibility that annual and geophytic threatened and priority species may occur and would not have been detectable at the time of survey. The survey timing was considered adequate to allow the detection of most species for which seasonal timing is critical.
Temporal coverage	Limitation	Detailed flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. Although only sampled once, the site data was considered conclusive as it was collected in the spring main flowering period and much of the vegetation present within the site is still relatively intact. However, the survey does not meet the full requirements of a 'detailed' survey. In order for the survey to be considered a 'detailed' survey a second visit in a different season is required.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	A total of 58 species were recorded, of which 35 were recorded from two sample locations and 23 were recorded opportunistically. Minimum species richness within site is estimated at between 44 (Jackknife1) and 59 (Chao2) species (refer species accumulation curve and estimates shown in Plate 8). The number of species recorded in the site is more than the Jackknife1 estimate and close to that of the Chao2 estimate. Thus, while it is acknowledged that a sample size of two is limiting from a statistical perspective, it is demonstrated that the survey effort was adequate to prepare a comprehensive species inventory particularly given the small area of the site and the consistency of the vegetation structure.
Influence of disturbance	No limitation	Time since fire is less than 6 months as interpreted from evidence on the ground and therefore short lived species more common after fire are likely to have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale

4 Results

4.1 General site conditions

The site comprises a gentle east facing slope and vegetation on the edge of the Serpentine National Park along the side of a road reserve (**Plate 1 to Plate 3**) and extending into remnant vegetation further to the north-east. Portions of the site showed recent evidence of a low intensity burn (**Plate 4**).



Plate 1: Vegetation present along the road reserve.



Plate 2: Vegetation within the site.



Plate 3: Unburnt vegetation with high cover of litter.



Plate 4: Recent evidence of fire.

4.2 Flora

4.2.1 Desktop assessment

The database search results identified a total of 13 threatened and 21 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences and flowering period is provided in **Appendix B**.

Based on background information available for the site, suitable habitat was considered to potentially occur within the site for six priority flora species as shown in **Table 4**.

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



Table 4: Conservation significant flora species considered to have potential to occur in the site based on known habitat preferences

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Millotia tenuifolia</i> var. <i>laevis</i>	P2	-	A	Granite or lateritic soils.	Sep-Oct
<i>Acacia horridula</i>	P3	-	P	Gravelly soils over granite, sand, rocky hillsides.	May-Aug
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	P3	-	P	Brown clay loam on slopes	Sep-Dec
<i>Thysanotus anceps</i>	P3	-	P	White or grey sand, lateritic gravel, laterite.	Oct-Dec
<i>Pimelea rara</i>	P4	-	P	Lateritic soils.	Dec-Jan
<i>Senecio leucoglossus</i>	P4	-	A	Gravelly lateritic or granitic soils on outcrops or slopes.	Aug-Dec

CR=critically endangered, EN=endangered, VU=vulnerable, P1-P4=Priority 1-Priority 4, P=perennial, PG=perennial geophyte.

4.2.2 Species inventory

A total of 46 native and 12 non-native (weed) species were recorded within the site during the field survey, representing 30 families and 51 genera. The dominant families containing native taxa were Fabaceae (seven native taxa and one weed taxa) and Asparagaceae (five native taxa). The most common genus was *Lomandra* with three taxa. Of the species recorded 36 were recorded in sample locations and 22 were recorded opportunistically.

A complete species list is provided in **Appendix C**.

4.2.3 Threatened and priority flora

No occurrences of threatened or priority flora species were recorded within the site.

The majority of the threatened and priority flora species identified in the desktop assessment are not considered to occur in the site due to lack of suitable habitat and/or because they were not recorded during the field survey.

The presence or absence of *Millotia tenuifolia* var. *laevis* (P2) was not able to be confirmed.

The likelihood of occurrence results are provided in **Appendix D**.

4.2.4 Locally and regionally significant flora

No locally or regionally significant flora species were recorded within the site.

4.2.5 Declared pests

No declared pests or weeds of national significance (WoNS) were recorded.

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



4.3 Vegetation

4.3.1 Desktop assessment

The database search results identified nine TECs and three PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in **Appendix D**.

Based geomorphology, soils and regional vegetation patterns, one PEC was considered to have potential to occur in the site, 'granite communities of the northern Jarrah Forest' (P3).

4.3.2 Plant communities

A total of two locations were sampled, comprised of two quadrats, as shown in **Figure 3**.

One plant community (**EmCcPe**) was identified within the site. This community extends over 0.468 ha of the site. The remainder of the site (0.04 ha) contains bare soil or bitumenised road.

A description and the area of the plant community is provided in **Table 5** and representative photographs are provided in **Plate 5** to **Plate 7**. The location of the plant community and cleared areas is shown in **Figure 3**. Raw sample data in **Appendix F**.

Table 5: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
EmCcPe	Open forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over shrubland of <i>Xanthorrhoea preissii</i> , <i>Macrozamia riedlei</i> and <i>Pteridium esculentum</i> , over open vineland of <i>Clematis pubescens</i> and <i>Hardenbergia comptoniana</i> over forbland of <i>Lagenophora huegelii</i> , <i>Trachymene pilosa</i> and * <i>Briza maxima</i> (Plate 5 and Plate 6)	0.47
Cleared	Cleared areas comprising bare earth, bitumenised road or lateritic gravel (Plate 7)	0.04

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*Plate 5: Plant community **EmCcPe** in 'very good' condition*



*Plate 6: Plant community **EmCcPe** in 'good to degraded' condition showing evidence of disturbances such as vehicular access, edge effects, weeds, fire and reduced native diversity.*

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



Plate 7: Cleared areas in ‘completely degraded’ condition along the southern edge of the site

4.3.3 Vegetation condition

The most intact native vegetation is located in the south-eastern portion of the site. Some of the **EmCcPe** vegetation was mapped as being in ‘very good’ condition as it retains the structure expected of a jarrah forest community and has moderate native species diversity. Past disturbance of this area is evident from historical aerial photography and through the presence of weed species. Portions of the **EmCcPe** vegetation close to the road were mapped as being in ‘good to degraded’ condition due to higher weed cover with lower native species cover and evidence of recent disturbances.

Remaining areas in the site are in ‘completely degraded’ condition and consist of non-native species such as pasture grasses with bare ground, gravel or bitumen.

The extent of vegetation by condition category is detailed in **Table 6** and shown in **Figure 4**.

Table 6: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0.13
Good	0.3
Good - degraded	0.03
Degraded	0
Completely degraded	0.04

Detailed Flora and Vegetation Assessment

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4.3.4 Threatened and priority ecological communities

No TECs or PECs occur within the site.

The likelihood of occurrence results are provided in **Appendix C**.

4.3.5 Locally and regionally significant vegetation

The site is in close proximity to Gooralong Conservation Park and Serpentine National Park.

The vegetation contains mature *Corymbia calophylla*, *Eucalyptus marginata* and *Banksia grandis* trees that may provide nesting, foraging and/or roosting values for black cockatoos listed as threatened under the EPBC Act and BC Act.

4.4 Species richness

A total of 33 species were recorded from two samples. A species accumulation curve derived from sample data is presented in **Plate 8**. After two samples the curve is still increasing and has not reached its asymptote. This indicates that a proportion of species likely remain undetected by sampling.

Species richness was estimated in PRIMER v6 to be between 45 (Jackknife1) and 59 (Chao2). Based on the trend of the species accumulation curve approximately 5 to 10 samples would be required to capture that many species. Including the 25 additional species recorded opportunistically, a total of 58 species was recorded in the site. This indicates that between 98 and 100% of the estimated 44-59 species in the site were recorded. Thus the survey effort was considered to be adequate to prepare a comprehensive species inventory.

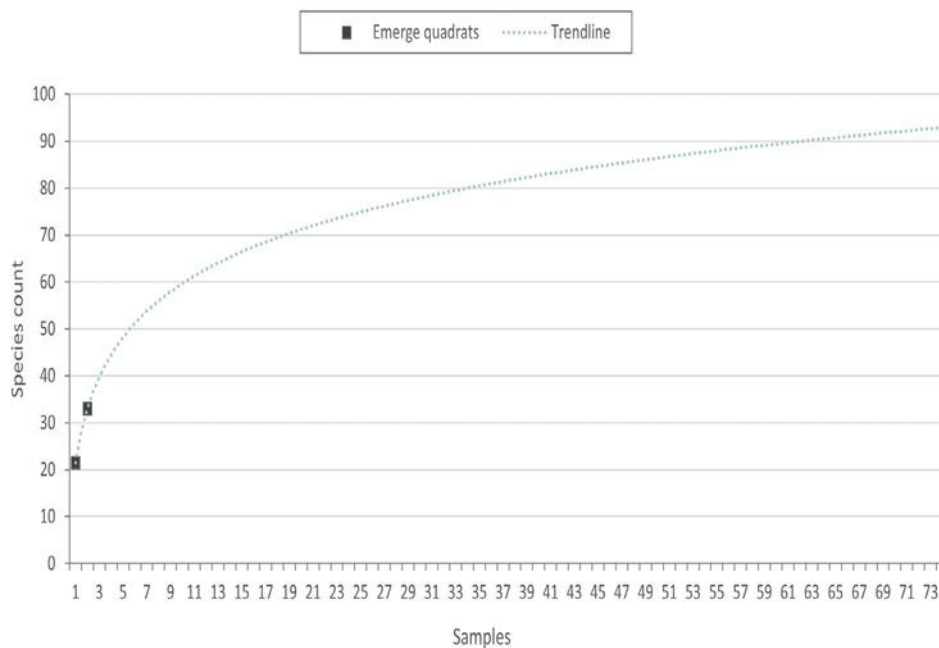


Plate 8: Species accumulation curve derived from sample data ($y = 16.591\ln(x) + 21.5$
 $R^2 = 1$)

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



5 Discussion

5.1 Threatened and priority flora

No threatened or priority flora species were recorded within the site.

Prior to the survey, based on background information, one threatened and six priority flora species were considered to potentially occur within the site. The field survey in November was considered sufficient to determine that the majority of these species are unlikely to occur. This is because either suitable habitat does not occur or the species were not recorded during traverses within potentially suitable habitat.

The absence of the larger perennial species with potential to occur such as *Acacia horridula*, *Pimelea rara* and *Lasiopetalum glutinosum* subsp. *glutinosum* was relatively easy to confirm. However, due to their size and seasonal lifeform, smaller annual or geophytic species such as *Thelymitra stellata*, *Millotia tenuifolia* var. *laevis* and *Senecio leucoglossus* can be more difficult to detect. The timing of the surveys coincided with the main flowering period of the majority of the conservation significant flora identified in the desktop assessment. The species with flowering periods outside of November are perennials and would be visible throughout the year, with the exception of *Millotia tenuifolia* var. *laevis* (P2) which flowers in September to October and thus would have finished flowering and may not have been easily detectable at the time of the survey. Further survey in September or October would be required to confirm the presence or absence of this species.

5.2 Vegetation condition

A compound condition category ('good to degraded') was included in the results of this survey for patches of plant community **EmCcPe** that comprised a mature native tree overstorey over a disturbed native shrub understorey. These areas had been recently burnt and thus there may be annual species that would not have been visible at the time of the survey.

5.3 Locally and regionally significant flora and vegetation

Flora and vegetation may be significant irrespective of protection under policy or legislation. Two key reasons that flora or vegetation within the site may be significant are listed below:

- The site is in close proximity to Gooralong Conservation Park and Serpentine National Park.
- The vegetation has potential value as habitat for threatened or priority fauna species. In particular, the vegetation contains mature *Corymbia calophylla* and *Eucalyptus marginata* trees that have the potential to provide nesting, foraging and/or roosting values for black cockatoos listed as threatened under the EPBC Act and BC Act.

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



6 Conclusions

The majority of the site comprises intact native vegetation in good and very good condition on the edge of Gooralong Conservation Park with evidence of disturbances such as weeds and fire particularly near the road.

No threatened or priority flora species or TECs and PECs were recorded within the site. Due to the survey timing, the presence or absence of *Millotia tenuifolia* var. *laevis* (P2) could not be confirmed. Further survey in September or October would be required to confirm whether this species occurs.

Corymbia calophylla and *Eucalyptus marginata* trees within the site provide foraging and roosting habitat, and potentially breeding habitat, for threatened species of black cockatoo.

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



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7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Detailed Flora and Vegetation Assessment

Land ID numbers 3781175 and 3781160 (Atkins Street) Jarrahdale



Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
BoM (2022)	21 November 2022	Climate Data Online
DAWE (2021a)	21 November 2022	Threatened Ecological Communities
DAWE (2021b)	21 November 2022	Weeds of National Significance (WoNS)
DAWE (2022)	23 November 2022	Protected Matters Search Tool
DBCA (2022)	23 November 2022	NatureMap
WALIA (2022)	21 November 2022	Landgate Map Viewer
Western Australian Herbarium (2022)	23 November 2022	Florabase

Figures



Figure 1: Site Location

Figure 2: Environmental Features

Figure 3: Plant Communities

Figure 4: Vegetation Condition

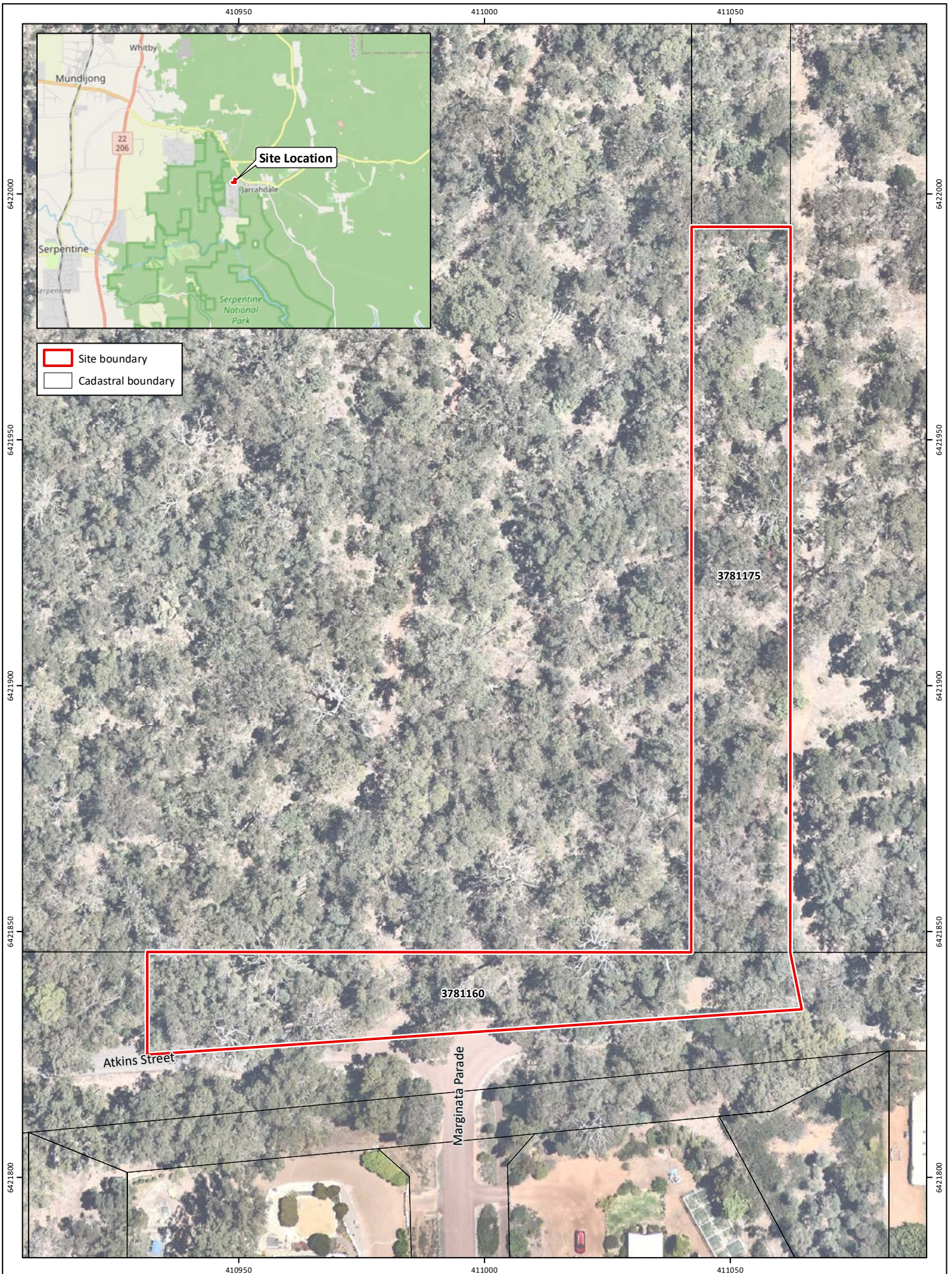
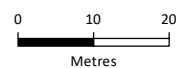


Figure 1: Site Location

Project: Detailed Flora and Vegetation Assessment
 Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale

Client: Shire of Serpentine Jarrahdale

Plan Number: EP22-113(01)-F01
Drawn: GAR
Date: 01/12/2022
Checked: SKP
Approved: TAA
Date: 09/12/2022



Scale: 1:1,000@A4
 GDA 1994 MGA Zone 50



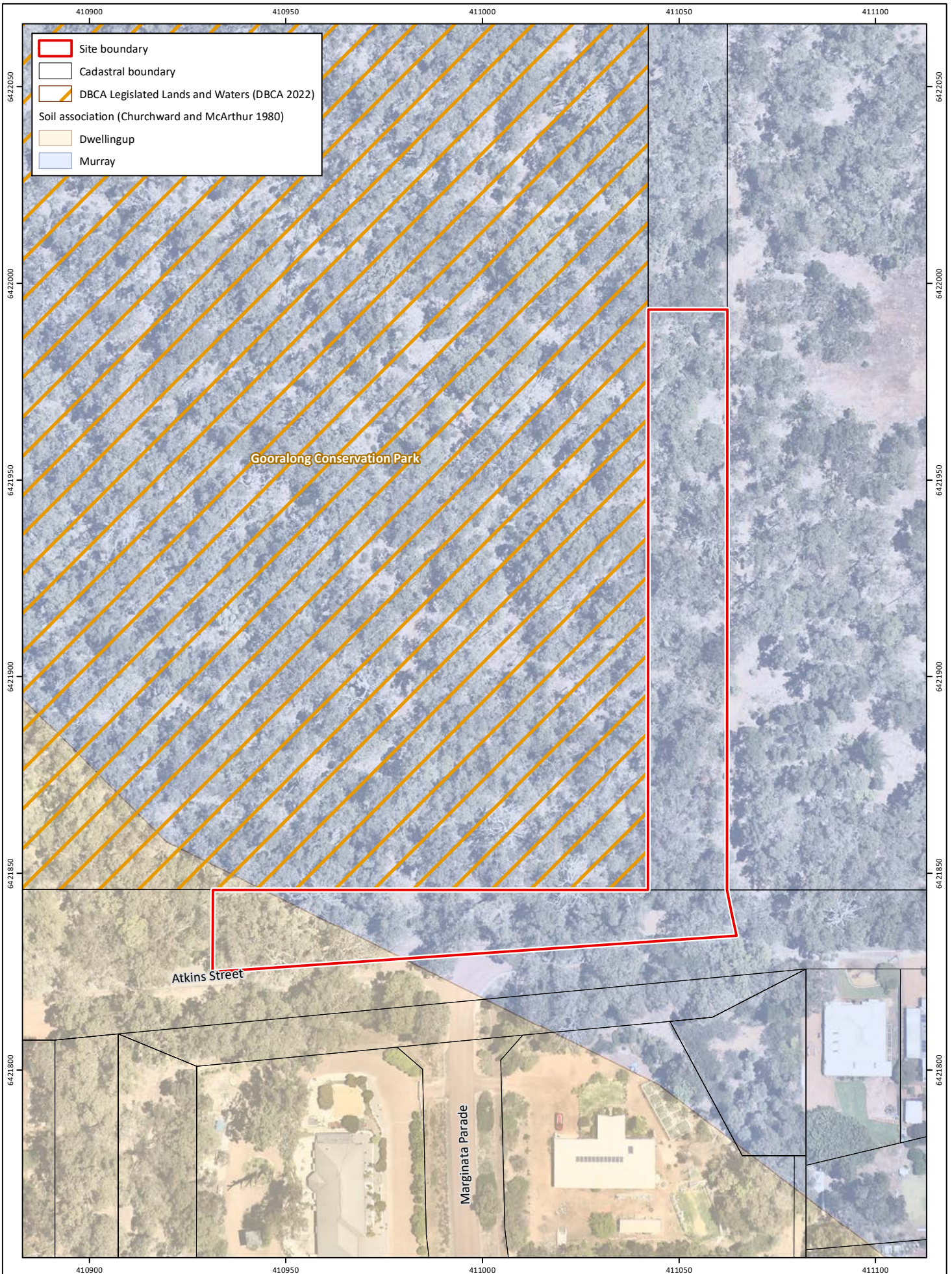
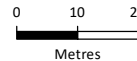


Figure 2: Environmental Features

Project: Detailed Flora and Vegetation Assessment
Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale

Client: Shire of Serpentine Jarrahdale

Plan Number: EP22-113(01)-F02
Drawn: GAR
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Approved: TAA
Date: 19/12/2022



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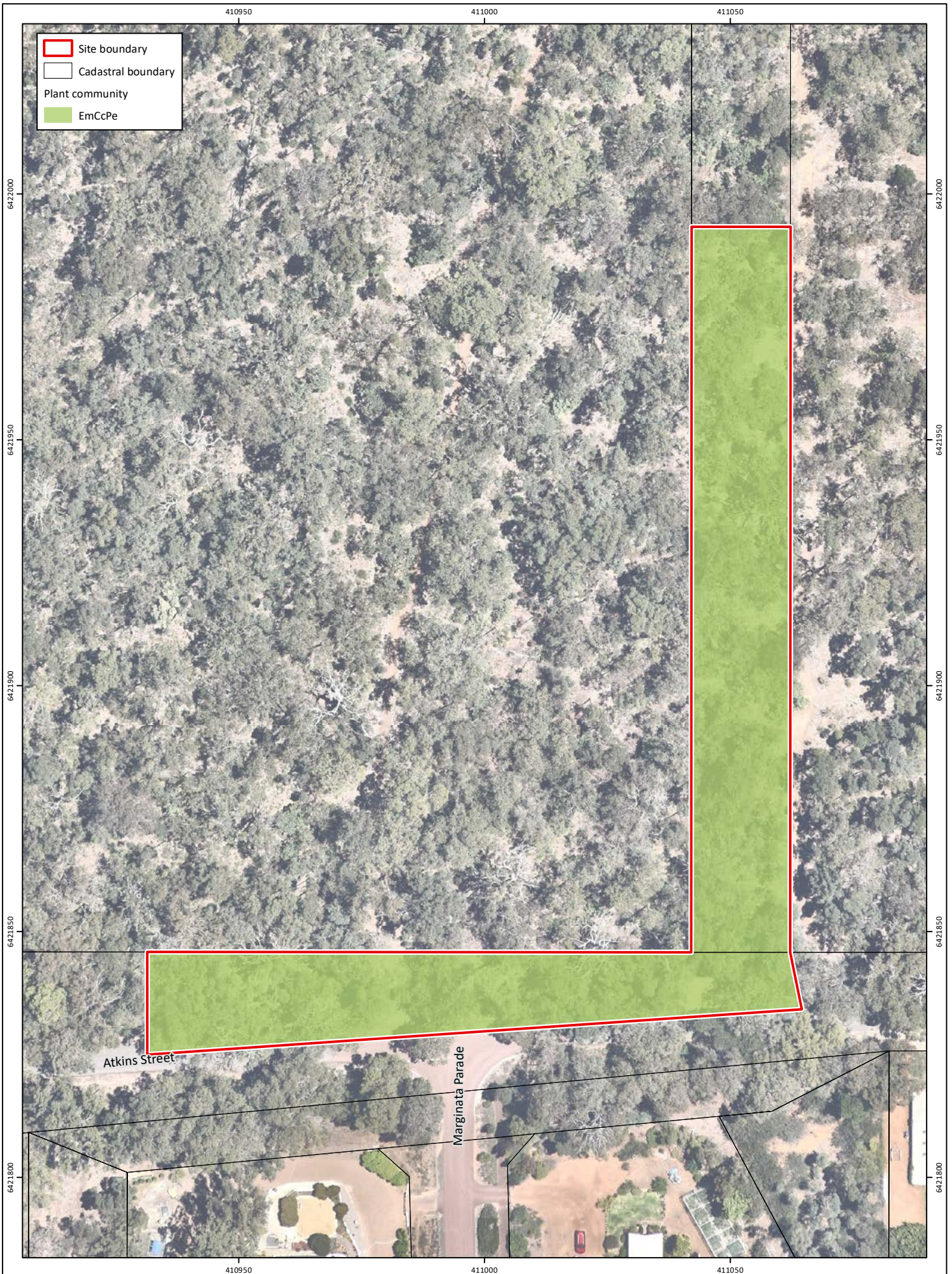
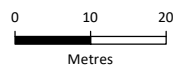


Figure 3: Plant Community

Project: Detailed Flora and Vegetation Assessment
Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale

Client: Shire of Serpentine Jarrahdale

Plan Number: EP22-113(01)-F03
Drawn: GAR
Date: 01/12/2022
Checked: SKP
Approved: TAA
Date: 19/12/2022



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GDA 1994 MGA Zone 50



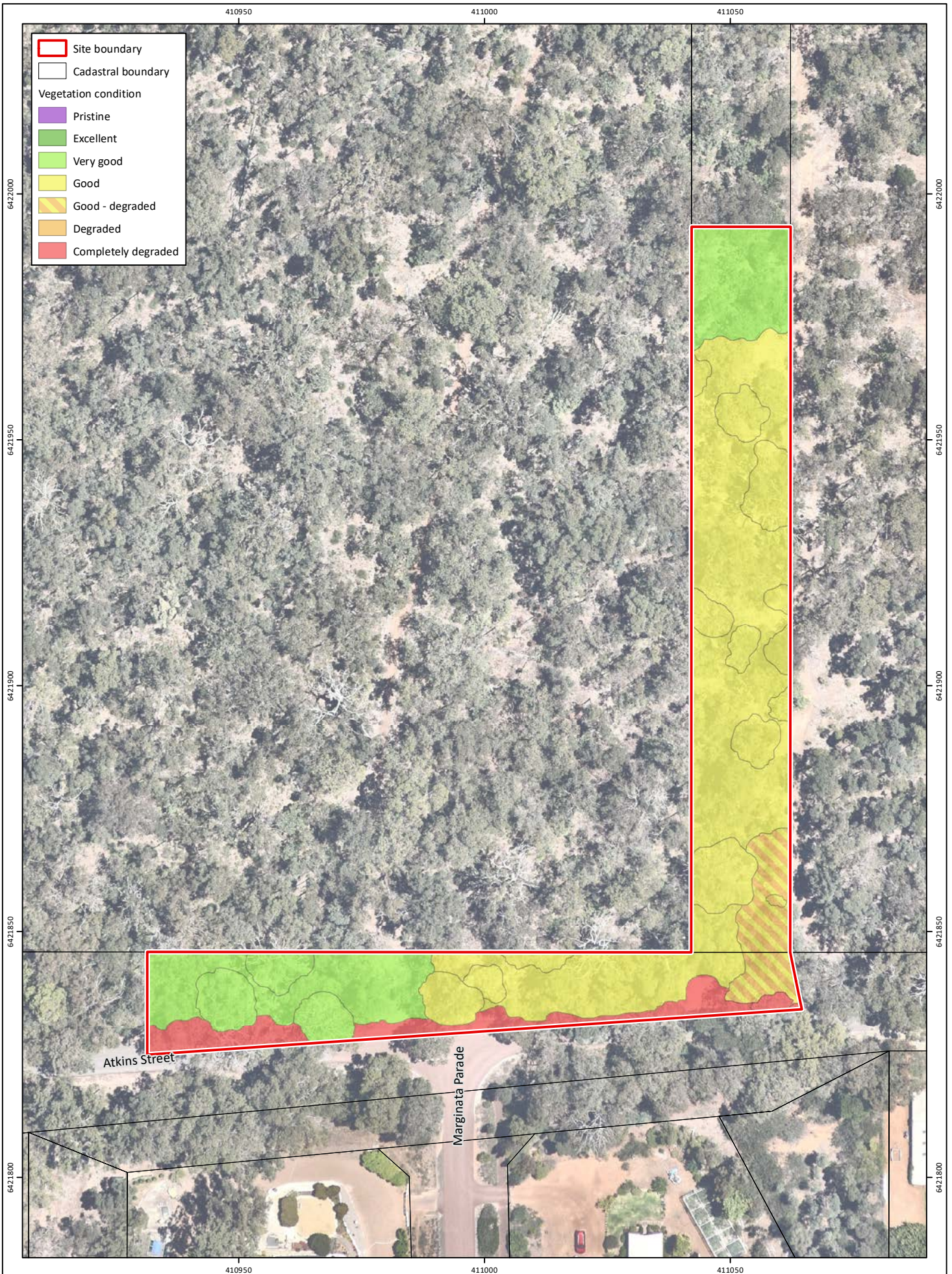
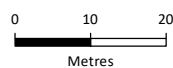


Figure 4: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
Land ID numbers 3781175 and 3781160 (Atkins Street), Jarrahdale

Client: Shire of Serpentine Jarrahdale

Plan Number: EP22-113(01)-F04
Drawn: GAR
Date: 01/12/2022
Checked: SKP
Approved: TAA
Date: 19/12/2022



Scale: 1:1,000@A4
GDA 1994 MGA Zone 50



Appendix A

Additional Information



Conservation Significant Flora and Vegetation

Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories according to their conservation status, as outlined in **Table 1**.

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "... to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done. The definition of threatened flora under the BC Act is provided in **Table 1**.

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018c). Priority flora species are considered during State approval processes. Priority flora categories and definitions are listed in **Table 1**.

Additional Background Information

Table 1: Definitions of conservation significant flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2018c)

Conservation code	Description
EX [†]	Threatened Flora – Presumed Extinct Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
T [†]	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR [^]	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN [^]	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU [^]	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1 [□]	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2 [□]	Priority Two – Poorly Known Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3 [□]	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4 [□]	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

[^]pursuant to the EPBC Act, [†]pursuant to the BC Act, [□]on DBCA's Priority Flora List

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in **Table 2**. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.

Additional Background Information

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs endorsed by the State Minister are published by DBCA (DBCA 2018b).

TECs are assigned to one of the categories outlined in **Table 2** according to their status (in relation to the level of threat). TECs are afforded direct statutory protection at a State level under the BC Act and BC Regulations. Ecological communities are listed under Section 27(1) and 33 of the BC Act. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017b).

Additional Background Information

Table 3: Categories of priority ecological communities (DEC 2013)

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

Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; “a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 7**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 8**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the ‘declared pest - s22(2)’ category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 9**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their

Additional Background Information

Category	Description
	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.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 10**.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in **Table 11**.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

Additional Background Information



over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category.

Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

References

General references

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Additional Background Information



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Appendix B

Conservation Significant Flora Species and likelihood of
Occurrence Assessment



Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	late Sep-Oct/Nov, survey Jul-Aug	Unlikely
<i>Lasiopetalum pterocarpum</i>	CR	EN	P	Dark brown or red brown loam or clayey-sand over granite, near creek lines and on sloping banks. Associated with riparian vegetation including flooded gum, marri and swamp peppermint.	Aug-Nov	Unlikely
<i>Synaphea sp. Fairbridge Farm (D. Papenfus 696)</i>	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
<i>Synaphea sp. Serpentine (G.R. Brand 103)</i>	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Unlikely
<i>Verticordia plumosa var. ananeotes</i>	CR	EN	P	Sand in open jarrah woodland or sandy/clay soils with marri.	Nov-Dec	Unlikely
<i>Diuris purdiei</i>	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid-October, but only after a summer or early autumn fire (Brown et al., 1998)	Unlikely
<i>Grevillea curviloba</i>	EN	EN	P	Grey sand, sandy loam. Winter-wet heath.	Aug-Oct	Unlikely
<i>Lepidosperma rostratum</i>	EN	EN	P	Peaty sand and clay amongst low heath, in winter-wet swamps.	May-Jun (survey late Jun-Aug)	Unlikely
<i>Synaphea sp. Pinjarra Plain (A.S. George 17182)</i>	EN	CR	P	White grey clayey sand on edges of seasonally inundated low lying areas.	Sep-Oct	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Thelymitra stellata</i>	EN	EN	PG	Sandy loam, clay or gravel over laterite or gravel.	Sep-Nov	Unlikely
<i>Anthocercis gracilis</i>	VU	VU	P	Steep granite slopes along the Darling Scarp in shallow, humus-rich sandy or loamy soils.	Sep-Oct, Apr	Unlikely
<i>Diuris micrantha</i>	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
<i>Morelotia australiensis</i>	VU	VU	P	Sand over clay, winter wet depressions and drainage lines.	Nov-Dec	Unlikely
<i>Paracaleana gracilicordata</i>	P1	-	PG	Growing on moss mats, granite. Outcrops.	Oct-Nov	Unlikely
<i>Paracaleana granitica</i>	P1	-	PG	Growing on moss mats, granite. Outcrops.	Oct-Dec	Unlikely
<i>Synaphea odocoileops</i>	P1	-	P	Brown orange loam and sandy clay, granite, in swamps and winter wet areas.	Aug-Oct	Unlikely
<i>Millotia tenuifolia</i> var. <i>laevis</i>	P2	-	A	Granite or lateritic soils.	Sep-Oct	Possible
<i>Bossiaea modesta</i>	P2	-	P	Soils derived from granite. Damp areas close to stream.	Oct-Dec	Unlikely
<i>Calectasia grandiflora</i>	P2	-	P	White, grey or yellow sand.	Jun-Nov	Unlikely
<i>Grevillea ornithopoda</i>	P2	-	P	River bank, creek. Clay, loam and sand.	Sep-Nov	Unlikely
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep	Unlikely
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>	P3	-	P	Granitic soils	Aug-Oct	Unlikely
<i>Andersonia</i> sp. <i>Audax</i> (F. Hort, B. Hort & J. Hort 3179)	P3	-	P	Loam slopes and flats with outcropping sheet granite, gravel and laterite	Oct-Dec	Unlikely
<i>Babingtonia urbana</i>	P3	-	P	Grey sand, lateritic gravel.	Jan-Mar	Unlikely
<i>Isopogon autumnalis</i>	P3	-	P	Yellow-grey sand.	Feb, Mar, Apr, May or June	Unlikely
<i>Acacia horridula</i>	P3	-	P	Gravelly soils over granite, sand, rocky hillsides.	May-Aug	Unlikely
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	P3	-	P	Brown clay loam on slopes	Sep-Dec	Unlikely
<i>Thysanotus anceps</i>	P3	-	P	White or grey sand, lateritic gravel, laterite.	Oct-Dec	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Pithocarpa corymbulosa</i>	P3	-	P	Gravelly or sandy loam, amongst granite outcrops.	Jan-Apr	Unlikely
<i>Drosera occidentalis</i>	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps.	Oct-Dec/Jan	Unlikely
<i>Grevillea pimeleoides</i>	P4	-	P	Gravelly soils over granite. Rocky hillsides.	May-Nov	Unlikely
<i>Parsonsia diaphanophleba</i>	P4	-	P	Alluvial soils along rivers.	Jan-Feb or Apr-Sep	Unlikely
<i>Pimelea rara</i>	P4	-	P	Lateritic soils.	Dec-Jan	Unlikely
<i>Senecio leucoglossus</i>	P4	-	A	Gravelly lateritic or granitic soils on outcrops or slopes.	Aug-Dec	Unlikely

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Species considered to potentially occur within the site are shaded green

Appendix C

Species List



Family	Status	Species
Apiaceae		<i>Daucus glochidiatus</i> <i>Pentapeltis peltigera</i> <i>Xanthosia candida</i>
Araliaceae		<i>Trachymene pilosa</i>
Asparagaceae		<i>Lomandra nigricans</i> <i>Lomandra sonderi</i> <i>Lomandra sp.</i> <i>Thysanotus manglesianus</i> <i>Thysanotus sparteus</i>
Asteraceae	*	<i>Hypochaeris radicata</i> <i>Lagenophora huegelii</i>
Caryophyllaceae	*	<i>Petrorhagia dubia</i>
Colchicaceae		<i>Burchardia congesta</i>
Dennstaedtiaceae		<i>Pteridium esculentum</i>
Dilleniaceae		<i>Hibbertia amplexicaulis</i>
Droseraceae		<i>Drosera ?macrantha</i>
Elaeocarpaceae		<i>Tetratheca hirsuta</i> subsp. <i>viminea</i> <i>Tremandra diffusa</i>
Ericaceae		<i>Styphelia propinqua</i>
Fabaceae		<i>Acacia pulchella</i> var. <i>glaberrima</i> <i>Acacia urophylla</i> <i>Chorizema cordatum</i> * <i>Dipogon lignosus</i> <i>Hardenbergia comptoniana</i> <i>Hovea trisperma</i> <i>Mirbelia dilatata</i> <i>Sphaerolobium linophyllum</i>
Goodeniaceae		<i>Scaevola calliptera</i>
Haemodoraceae		<i>Conostylis setigera</i>
Hemerocallidaceae		<i>Caesia micrantha</i>
Iridaceae	*	<i>Freesia alba x leichtlinii</i> * <i>Ixia polystachya</i>

Family	Status	Species
Lamiaceae	*	<i>Lavenula stoechas</i>
Malvaceae	*	<i>Brachychiton</i> sp.
Myrtaceae		<i>Corymbia calophylla</i> <i>Eucalyptus marginata</i>
Orchidaceae		<i>Diuris</i> sp. <i>Thelymitra crinita</i>
Oxalidaceae	*	<i>Oxalis corniculata</i>
	*	<i>Oxalis pes-caprae</i>
Phyllanthaceae		<i>Phyllanthus calycinus</i>
Poaceae		<i>Austrostipa compressa</i>
	*	<i>Briza maxima</i>
		<i>Microlaena stipoides</i>
	*	<i>Pentameris airoides</i>
		<i>Tetrarrhena laevis</i>
Primuleceae	*	<i>Lysimachia arvensis</i>
Proteaceae		<i>Banksia grandis</i> <i>Banksia sessilis</i> <i>Hakea prostrata</i> <i>Persoonia elliptica</i>
Ranunculaceae		<i>Clematis pubescens</i>
Rhamnaceae		<i>Trymalium odoratissimum</i> subsp. <i>odoratissimum</i>
Rubiaceae		<i>Opercularia hispidula</i>
Stylidiaceae		<i>Stylidium ciliatum</i> <i>Stylidium dichotomum</i>
Xanthorrhoeaceae		<i>Xanthorrhoea gracilis</i> <i>Xanthorrhoea preissii</i>
Zamiaceae		<i>Macrozamia riedlei</i>

*=non-native, Pl=planted

Appendix D

Conservation Significant Communities and Likelihood of
Occurrence Assessment



Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP3a	<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain	TEC	CE	EN	Does not occur
SCP3c	<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain	TEC	CE	EN	Does not occur
SCP20b	<i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain	TEC	EN	EN	Does not occur
SCP10a	Shrublands on dry clay flats	TEC	EN	CE	Does not occur
SCP02	Southern wet shrublands, Swan Coastal Plain	TEC	EN	-	Does not occur
SCP3b	<i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> woodlands on sandy clay soils of the southern Swan Coastal Plain	TEC	VU	-	Does not occur
SCP07	Herb rich saline shrublands in clay pans	TEC	VU	CE	Does not occur
SCP08	Herb rich shrublands in clay pans	TEC	VU	CE	Does not occur
Banksia WL SCP	Banksia woodlands of the Swan Coastal Plain	TEC/ PEC	P3	EN	Does not occur
SCP1a	<i>Eucalyptus haematoxylon</i> - <i>E. marginata</i> woodlands on Whicher foothills	PEC	P3	-	Does not occur
	Granite communities of the northern Jarrah Forest	PEC	P3	-	Does not occur

Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3

Appendix E

Sample Data



Sample Name:

Q1

Project no.: EP22-113

Date: 7/11/2022

Author: SKP,

Status: Non-permanent

Q1: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 0

NW corner northing: 0

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: 3-5 yrs

Disturbance: moderate - weeds,adj clearing, fire

Soil type/texture loam/ with organic layer

Bare ground (%): 1

Rocks (%) and type: 5%, laterite

Soil colour: brown/

Litter: 35% (leaves,branches,)

Vegetation condition: very good



Sample Name:

Q1

Project no.: EP22-113

Date: 7/11/2022

Author: SKP,

Status Non-permanent

Q1: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia urophylla</i>	opp
	<i>Austrostipa compressa</i>	opp
	<i>Banksia grandis</i>	20
	<i>Banksia sessilis</i>	opp
*	<i>Brachychiton sp.</i>	opp
*	<i>Briza maxima</i>	3
	<i>Burchardia congesta</i>	opp
	<i>Caesia micrantha</i>	1
	<i>Clematis pubescens</i>	0.5
	<i>Conostylis setigera</i>	opp
	<i>Corymbia calophylla</i>	20
	<i>Daucus glochidatus</i>	opp
*	<i>Dipogon lignosus</i>	opp
	<i>Drosera ?macrantha</i>	opp
	<i>Eucalyptus marginata</i>	15
*	<i>Freesia alba</i> × <i>leichtlinii</i>	opp
	<i>Hakea prostrata</i>	opp
*	<i>Hypochaeris radiata</i>	2
*	<i>Ixia polystachya</i>	0.5
	<i>Lagenophora huegelii</i>	1
*	<i>Lavandula stoechas</i>	opp
	<i>Lomandra nigricans</i>	opp
	<i>Lomandra sonderi</i>	opp
	<i>Lomandra sp.</i>	0.5
	<i>Macrozamia riedlei</i>	5
	<i>Microlaena stipoides</i>	0.5
	<i>Mirbelia dilatata</i>	2
	<i>Opercularia hispidula</i>	opp
*	<i>Pentameris airoides</i>	2
	<i>Pentapeltis peltigera</i>	opp
	<i>Phyllanthus calycinus</i>	3
	<i>Pteridium esculentum</i>	10
	<i>Sphaerolobium linophyllum</i>	0.5
	<i>Stylidium ciliatum</i>	0.5

Sample Name: Q1

Project no.: EP22-113

Date: 7/11/2022

Status Non-permanent

Author: SKP,

Q1: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Stylidium dichotomum</i>	0.5
	<i>Styphelia propinqua</i>	0.5
	<i>Tetradlea hirsuta subsp. viminea</i>	opp
	<i>Thelymitra crinita</i>	0.5
	<i>Thysanotus manglesianus</i>	0.5
	<i>Thysanotus sparteus</i>	opp
	<i>Trachymene pilosa</i>	0.5
	<i>Xanthorrhoea gracilis</i>	opp
	<i>Xanthosia candida</i>	opp

Sample Name:

Q2

Project no.: EP22-113

Date: 7/11/2022

Author: SKP,

Status: Non-permanent

Q2: Page 1 of 3

Quadrat and landform details

Sample type: quadrat

Size: 10 m x 10 m

NW corner easting: 0

NW corner northing: 0

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: <1 yr

Disturbance: moderate - weeds,adj clearing, fire

Soil type/texture loam/ with organic layer

Bare ground (%): 4

Rocks (%) and type: 5%, laterite

Soil colour: brown/

Litter: 15% (leaves,branches,)

Vegetation condition: very good



Sample Name:

Q2

Project no.: EP22-113

Date: 7/11/2022

Author: SKP,

Status Non-permanent

Q2: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i> var. <i>glaberrima</i>	1
	<i>Acacia pulchella</i> var. <i>glaberrima</i>	opp
*	<i>Brachychiton</i> sp.	2
*	<i>Briza maxima</i>	2
	<i>Caesia micrantha</i>	0.5
	<i>Chorizema cordatum</i>	2
	<i>Clematis pubescens</i>	2
	<i>Corymbia calophylla</i>	10
	<i>Daucus glochidatus</i>	0.5
	<i>Diuris</i> sp.	0.5
	<i>Diuris</i> sp.	opp
	<i>Drosera ?macrantha</i>	0.5
	<i>Eucalyptus marginata</i>	20
*	<i>Freesia alba</i> × <i>leichtlinii</i>	1
	<i>Hardenbergia comptoniana</i>	1
	<i>Hibbertia amplexicaulis</i>	opp
	<i>Hovea trisperma</i>	opp
	<i>Hypochaeris radiata</i>	0.5
*	<i>Ixia polystachya</i>	opp
*	<i>Lysimachia arvense</i>	opp
	<i>Microlaena stipoides</i>	1
	<i>Mirbelia dilatata</i>	1
	<i>Opercularia hispidula</i>	0.5
*	<i>Oxalis corniculata</i>	opp
*	<i>Oxalis pes-caprae</i>	opp
	<i>Pentapeltis peltigera</i>	0.5
	<i>Persoonia elliptica</i>	opp
*	<i>Petrorhagia dubia</i>	0.5
	<i>Phyllanthus calycinus</i>	3
	<i>Pteridium esculentum</i>	5
	<i>Scaevola calliptera</i>	opp
	<i>Stylidium ciliatum</i>	0.5
	<i>Tetrarrhena laevis</i>	opp
	<i>Tetradthea hirsuta</i> subsp. <i>viminea</i>	0.5

Sample Name: Q2

Project no.: EP22-113

Date: 7/11/2022

Status Non-permanent

Author: SKP,

Q2: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Thysanotus manglesianus</i>	0.5
	<i>Tremandra diffusa</i>	opp
	<i>Trymalium odoratissimum subsp. odoratissimum</i>	opp
	<i>Xanthorrhoea preissii</i>	3