

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove

Project No: EP23-108 (01)

**Prepared for Shire of Augusta Margaret River
July 2024**



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Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



Executive Summary

The Shire of Augusta engaged Emerge Associates to conduct a detailed flora and vegetation assessment within the Part Lot 5011, Davis Road, Forest Grove (the 'site').

The assessment included a desktop study of the environmental context of the site and the likelihood of occurrence of threatened and priority flora and ecological communities. A field survey was conducted on 15 November 2023 during which the composition and condition of vegetation was recorded. Flora and vegetation values were characterised to the standard required of a detailed survey with reference to EPA (2016b).

Outcomes of the assessment include the following:

- A total of 92 flora species were recorded, comprising 75 native and 17 non-native species.
- No threatened or priority flora species were recorded or considered likely to occur.
- Three vegetation units were recorded in the site:
 - **EmCcHh** comprises an open forest of *Eucalyptus marginata* and *Corymbia calophylla* over diverse native understorey. This vegetation extends over 1.84 ha (61% of the site) and occurs in 'good – degraded', 'good' and 'very good' condition.
 - **EmCcTo** comprises an open forest of *Eucalyptus marginata* and *Corymbia calophylla* over tall shrubland *Trymalium odoratissimum* subsp. *trifidum* on lower slopes. This vegetation extends over 0.91 ha (30% of the site) and occurs in 'very good' condition.
 - **Non-native** comprises bare ground and heavily disturbed areas with non-native flora and scattered native plants. This unit extends over 0.27 ha (9%) and occurs in 'completely degraded' condition.
- No threatened or priority ecological communities occur within the site.

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Conservation Significant Communities and Likelihood of Occurrence Assessment

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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 (now DBCA)
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
A	Annual
CR	Critically endangered
EN	Endangered
IBRA	Interim Biogeographic Regionalisation for Australia
NVIS	National Vegetation Information System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
P	Perennial
PG	Perennial geophyte
T	Threatened
TEC	Threatened ecological communities
VU	Vulnerable

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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	<i>Biodiversity Conservation Regulations 2018</i>

Table A4: Abbreviations – Units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre
m ²	Square metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

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1 Introduction

1.1 Purpose

Emerge Associates (Emerge) were engaged by Shire of Augusta Margaret River to conduct a flora and vegetation assessment within part of the Davis Road Waste Management Facility, which lies within Lot 5011, Davis Road, Forest Grove, as shown in **Figure 1** (referred to herein as the 'site').

Flora and vegetation assessments are required to characterise vegetation values and, in particular, confirm the presence or absence of values relevant to the environmental approvals process, such as, 'native vegetation', 'threatened' flora, 'priority' flora, 'threatened ecological communities' (TECs), 'priority ecological communities' (PECs) and weeds.

1.2 Legislation and policy

'Native vegetation' is defined by the *Environmental Protection Act 1986* (EP Act) as indigenous aquatic or terrestrial flora. In the *Environmental Factor Guideline – Flora and Vegetation* the EPA further defines it as native vascular flora and defines vegetation as groupings of flora (EPA 2016a). Native vegetation is protected in Western Australia and can't be cleared without a permit or valid exemption. Biological diversity, habitat function, scarcity, association with wetlands and other ecosystem services influence the value placed on native vegetation (DWER 2018a). Planted flora and vegetation are generally not regarded as native vegetation unless required to be established under the EP Act or other written law or regulation.

Flora and ecological communities may be listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DCCEEW 2021) and the State *Biodiversity Conservation Act 2016* (BC Act) (DBCA 2022c, 2023e). Threatened flora and TECs are classified as either 'critically endangered' (CR), 'endangered' (EN) and 'vulnerable' (VU) (DCCEEW 2021). Commonwealth and/or State ministerial approval is required to impact threatened flora or TECs.

Native flora and ecological communities that are not listed as threatened, but are otherwise considered rare or under threat, may be added to a Department of Biodiversity, Conservation and Attractions (DBCA) priority list (DBCA 2022b, c). 'Priority flora' and PECs are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). They do not have direct statutory protection. However, their priority classification is taken into account during State and Local government approval processes.

Flora that are regarded as having negative environmental or economic impacts are often referred to as weeds (DBCA 2023g). Particularly detrimental weed species may be listed as a 'declared pest' pursuant to the State *Biosecurity and Agriculture Management Act 2007* (BAM Act) or as a 'weed of national significance' (WoNS) (DAWE 2021). Management of weeds, declared pests and WoNS may be required during government approval processes.

Further information on legislation and policy relevant to flora and vegetation assessments is provided in **Appendix A**.

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1.3 Scope of work

The Environmental Protection Authority (EPA) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* establishes standards for the assessment of flora and vegetation in Western Australia (EPA 2016b). The scope of work was to undertake a detailed survey with reference to EPA (2016b).

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

- Desktop study to provide contextual information and determine the likelihood of occurrence of threatened and priority flora or ecological communities.
- Field survey to record flora, vegetation units and vegetation condition.
- Analysis and mapping of contextual information, vegetation units, vegetation condition and threatened and priority flora or ecological communities (if present).
- Documentation of the desktop study, methods, results, discussion and conclusions.

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2 Desktop Study

2.1 Site context

2.1.1 Location and extent

The site is located in the Shire of Augusta Margaret River in the south-west of Western Australia and extends over 3.02 hectares (ha). The site comprises a portion of the facility which is bounded by private cleared land to the east, Davis Road to the north, Bussell Highway to the west and densely vegetated crown land to the south. The site location is shown in **Figure 1**.

2.1.2 Climate

The south-west region of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters (BoM 2024). Recent rainfall at the closest weather station to the site has been somewhat inconsistent with long term averages, as shown in **Plate 1** (BoM 2024). Flora and vegetation surveys should be undertaken during the season that is most suitable for detection and identification of the range of flora likely to occur in the area (EPA 2016b). For the south-west botanical province in which the site lies, the primary survey time is spring (EPA 2016b).

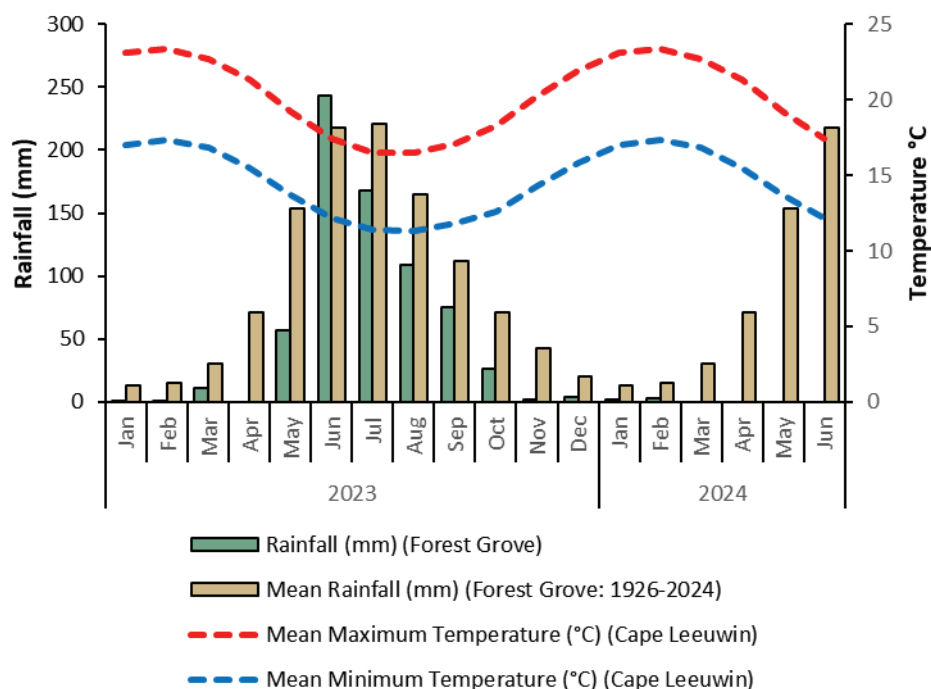


Plate 1: Rainfall 12 months prior to the field survey and long-term mean temperature and rainfall

2.1.3 Geomorphology and soils

The site lies within the Leeuwin Zone which is described as a 'moderately dissected lateritic plateau on granite (with) colluvial soils in the valleys.

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Fine scale soil landscape mapping by (DPIRD 2022) shows three units as occurring within the site, as described in **Table 1** and shown in **Figure 2**.

Table 1: Soil landscape mapping units within the site (DPIRD 2022)

Soil landscape unit	Location within site	Description
Wilyabrup, undifferentiated hillslope Phase	Majority of the site	Slopes with gradients generally 5-15%, but ranging from 2-30%, and gravelly soils (i.e. Forest Grove and Keenan Soils).
Wilyabrup narrow valley floor Phase	Small area in the southwestern portion	Narrow V-shaped drainage depressions.
Cowaramup, undifferentiated upland Phase	North-western portion	Flats and gentles slopes (0-5% gradient) with gravelly duplex (Forest Grove) and pale grey mottled (Mungite) soils.

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

2.1.4 Topography

The elevation of the site is relatively flat and ranges from approximately 70 m in relation to the Australian height datum (mAHD) on the southern side to 75 mAHD on the eastern and northern sides (WALIA 2024).

2.1.5 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. Review of the *Ramsar List of Wetlands of International Importance* (DBCA 2017) and *A Directory of Important Wetlands in Australia – Western Australia* (DBCA 2018) indicates that no Ramsar or listed 'important wetlands' are located within or near the site.

The Department of Water and Environmental Regulation hydrography linear dataset (DWER 2018) indicates shows no wetland or water related features occur within the site.

The *Geomorphic Wetlands, Leeuwin Naturaliste Ridge and Donnybrook to Nannup* dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence (DBCA 2018b). A review of the *Geomorphic Wetlands, Leeuwin Naturaliste Ridge and Donnybrook to Nannup* dataset indicates that no wetland features occur within the site but multiple occur nearby.

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2.1.6 Regional vegetation

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

The site lies within the Warren subregion which occurs along the coastline between Cape Naturaliste and Albany and comprises a variety of landforms including Holocene marine dunes, *Eucalyptus marginata* (jarrah) - *Corymbia calophylla* (marri) forest on laterite and *Eucalyptus diversicolor* (karri) forest on loamy soils (Beard 1990). The south-west of Western Australia is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation can be further classified based on regional vegetation mapping. (DBCA 2019) mapping of the south-west forest region shows the site as comprising three vegetation complexes which are described in **Table 2**.

Table 2. Vegetation complex units mapped within the site (DBCA 2019)

Vegetation complex	Location within site	Description
Cowaramup C1	Northwest portion	Open to tall open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> - <i>Corymbia calophylla</i> - <i>Banksia grandis</i> on lateritic uplands in the hyperhumid zone.
Wilyabrup Ww1	Southwest portion	Tall open forest of <i>Eucalyptus diversicolor</i> - <i>Agonis flexuosa</i> - <i>Callistachys lanceolata</i> with some <i>Corymbia calophylla</i> on flats and valleys in the hyperhumid zone.
Wilyabrup W1	Majority of site	Tall open forest of <i>Eucalyptus diversicolor</i> - <i>Corymbia calophylla</i> - <i>Allocasuarina decussata</i> - <i>Agonis flexuosa</i> on deeply incised valleys in the hyperhumid zone'

2.1.7 Threatened and priority flora

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has compiled various datasets relating to 'matters of national environmental significance' (MNES) (DCCEEW 2024). The *Protected Matters Search Tool* provides general guidance on threatened flora listed under the EPBC Act that may occur within a location based on validated records and less reliable unvalidated habitat distribution modelling (DCCEEW 2024).

DBCA's *Threatened and Priority Flora Database* and *WA Herbarium Database* contain records of threatened and priority flora in Western Australia (DBCA 2023f). Searches of these databases provide point data for threatened and priority flora within a location, comprising validated and historical unvalidated records.

The *Protected Matters Search Tool* (DCCEEW 2024) and DBCA's threatened and priority flora databases (reference no. 24-1123FL) identified 11 threatened and 22 priority flora occurring or potentially occurring within a 10 km radius of the site (refer **Appendix B**).

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2.1.8 TECs and PECs

The *Protected Matters Search Tool* provides general guidance on TECs listed as CR and EN under the EPBC Act that may occur within a location based on reliable records and less reliable habitat distribution modelling (DCCEE 2024).

DBCA's *Threatened and Priority Ecological Community buffers and boundaries in WA* dataset contains validated records of TECs and PECs. Searches of this dataset provides buffered polygons of TEC and PEC records.

The *Protected Matters Search Tool* (DCCEE 2024) and DBCA's TEC and PEC database (reference no. 15-1123EC) identified five TECs and two PECs occurring or potentially occurring within a 20 km radius of the site (refer **Appendix C**).

2.1.9 Historical land use

Review of historical images available from 1971 onwards shows that the majority of the site has remained undisturbed. However portions of adjacent land were cleared prior to 1986 as part the waste management facility (WALIA 2024).

2.1.10 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of habitat. This exchange of genetic material between vegetation improves the viability of this vegetation by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of Vegetation units 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 South West Biodiversity Project identified and mapped ecological linkages within the South West region of Western Australia (Molloy *et al.* 2009). Ecological linkage no. 118 exists to the east of the site and ecological linkage no. 119 and 120. These linkages generally follow waterways within the area and lead to densely vegetated areas and forests.

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.

2.1.11 Previous surveys

No previous flora and vegetation surveys are known to have been undertaken within the site.

2.2 Likelihood of occurrence

The distribution and habitat preferences of the threatened and priority flora species and ecological communities listed in **Appendix B** and **Appendix C** was reviewed against site context information described in **Section 2.1**. Likelihood of occurrence of threatened and priority flora species and ecological communities within the site was classified as 'high', 'moderate', 'low' or 'negligible' as outlined in **Table 3**.

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Table 3: Decision matrix for likelihood of occurrence of threatened and priority flora and ecological communities

		Distribution ¹	
		Reliable record within search area	No reliable record within search area
Habitat	Suitable	High	Negligible
	Potentially suitable	Moderate	
	Unsuitable	Low	

¹ Reliable record defined as validated, recent (within the last ~40 years) and spatially accurate (refer DBCA search meta data) in order to exclude unverified range or habitat projections.

2.2.1 Threatened and priority flora

Six priority flora were classified as having a ‘moderate’ likelihood of occurrence within the site, as outlined in **Table 4**. The remaining species identified in database searches were classified as having a low or ‘negligible’ likelihood of occurrence in the site. The complete likelihood of occurrence assessment is provided as **Appendix B**.

Table 4: Threatened or priority flora species with a moderate likelihood occurrence in the site

Species	Status		Life strategy	Flowering period
	WA	EPBC Act		
<i>Deyeuxia inaequalis</i>	P1	-	A	Nov-Dec
<i>Synaphea macrophylla</i>	P1	-	P	Oct
<i>Synaphea</i> sp. Redgate Road (J. Scott 16)	P1	-	P	Oct-Nov
<i>Pimelea ciliata</i> subsp. <i>longituba</i>	P3	-	P	Oct-Dec
<i>Acacia semitrullata</i>	P4	-	P	May-Oct
<i>Gahnia sclerioides</i>	P4	-	P	Feb, Apr, Jun, Aug or Nov

P1-P4=Priority 1-Priority 4, P=perennial

2.2.2 TECs and PECs

No TECs or PECs were classified as having a ‘high’ or ‘moderate’ likelihood of occurrence within the site. The complete likelihood of occurrence assessment is provided as **Appendix C**.

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3 Methods

3.1 Field survey

Two experienced botanists visited the site on 15 November 2023 to conduct the field survey. The site was traversed on foot and the composition and condition of vegetation was recorded. Plant specimens were collected where the identity of flora required further confirmation. Photographic images and notes were recorded as required.

3.1.1 Targeted searches

Targeted searches were conducted for threatened and priority flora and ecological communities, with a particular focus on those with a high or moderate likelihood of occurrence (refer **Section 2.2**). Transects for flora were traversed approximately 5 m apart through areas of potentially suitable habitat. Transects and records were marked using a hand-held GPS receiver (± 5 m accuracy).

3.1.2 Sampling

Detailed sampling of the vegetation was undertaken using non-permanent 10 x 10 m quadrats established with fence droppers bounded by measuring tape. The position¹ of each sample was recorded with a hand-held GPS receiver (± 5 m accuracy).

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, litter layer, topographical position, time since last fire event)
- biological information (species, plant specimens, vegetation structure, vegetation condition, 'foliage projective cover', and disturbance).

Three locations were sampled using quadrats, as shown in Error! Reference source not found..

3.1.3 Vegetation condition

The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 5**).

¹ The north-west corner was recorded.

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Table 5: Vegetation condition scale applied during the field survey

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.

^relative to the expected natural diversity for that vegetation.

3.2 Analysis and data preparation

3.2.1 Flora identification

Flora were identified through comparison with named material and through the use of taxonomic keys. Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the (Western Australian Herbarium 2024).

Flora was classified as native if indigenous to the IBRA region in which the site occurs. Non-native flora is denoted by '*' in text and raw data. The legal or policy status of flora was denoted using codes outlined in **Appendix A**.

3.2.2 Sampling adequacy

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.

Species richness was estimated in PRIMER v6 (Clarke and Gorley 2006). 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). Differences between recorded and estimated species richness was used to evaluate the adequacy of sampling effort.

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3.2.3 Threatened and priority flora confirmation

Threatened and priority flora were confirmed as absent from the site where no significant limitation was identified that could have affected their detection (refer **Section 3.3**).

3.2.4 Vegetation unit identification and description

The vegetation units 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).

3.2.5 TEC and PEC confirmation

Vegetation units were assessed against TEC and PEC diagnostic characteristics and, if available, size and/or vegetation condition thresholds (DBCA 2023c). TECs and PECs were confirmed as absent from the site where no significant limitation was identified that could have affected their detection (refer **Section 3.3**).

3.2.6 Mapping

Environmental features, vegetation units, vegetation condition, threatened or priority flora or ecological communities were mapped on aerial photography using notes and data collected in the field.

3.3 Limitations

It is important to note constraints imposed on assessments and the degree to which these may have limited outcomes. An evaluation of the desktop study and methods applied in the current assessment against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) is provided in

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Table 6.

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Table 6: Evaluation of assessment against standard constraints outlined in (EPA 2016b)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in Section 2.1 is adequate to place the site and vegetation in context.
		No previous surveys are known to have been undertaken within the site.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by qualified botanists with 13 and 20 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 13 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	In Mediterranean climates some flora spend part of their lifecycle as underground storage organs or seed to avoid excessive heat and drought over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter and are often most visible during spring, which is the flowering period for the majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA. The survey was conducted in November and thus within the main flowering season. Below average rainfall was recorded from July to October 2023 in the months preceding the site visit. However, a comprehensive species list was compiled which included a range of lifeforms such as orchids and annual species. This indicates that rainfall was sufficient to promote flowering and emergence. Furthermore, the survey was considered sufficient to determine the absence of threatened and priority flora species.
Temporal coverage	No 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. Considering the relatively small size of the site it was able to be traversed thoroughly and the one survey in spring was considered sufficient to compile a near comprehensive flora species inventory.
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 92 species were recorded, of which 61 were recorded from three samples and 31 were recorded opportunistically. Minimum species richness within site is estimated at between 78 (Jackknife1) and 80 (Chao2) species (refer species accumulation curve and estimates shown in Plate 2 . The number of species recorded in the site is higher to that of the Chao2 estimate which demonstrates that survey effort was adequate to prepare a comprehensive species inventory for the site.
Influence of disturbance	No limitation	Time since fire is greater than 40 years as interpreted from aerial imagery and therefore short-lived species more common after fire may not 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.

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4 Results

4.1 Flora

4.1.1 Species inventory

A total of 92 species were recorded during the field survey. A total of 41 families and 74 genera were recorded, with the most common genus being *Hibbertia* with four native taxa.

A summary of legal and policy status of flora records is provided in **Table 7**. A complete species list is provided in **Appendix D**.

Table 7: Summary of legal and policy status of taxa recorded in the site

Status	Unlisted	Threatened	Priority	Declared Pest	Planted	Total
Native	75	0	0	0	0	75
Non-native	16	0	0	1	0	17
Total	91	0	0	1	0	92

Sampling recorded 61 species from four samples. A further 31 species were recorded opportunistically across the site. A species accumulation curve derived from sample data is presented in **Plate 2**. Species richness was estimated to be between 78 (Jackknife1) and 80 (Chao2).

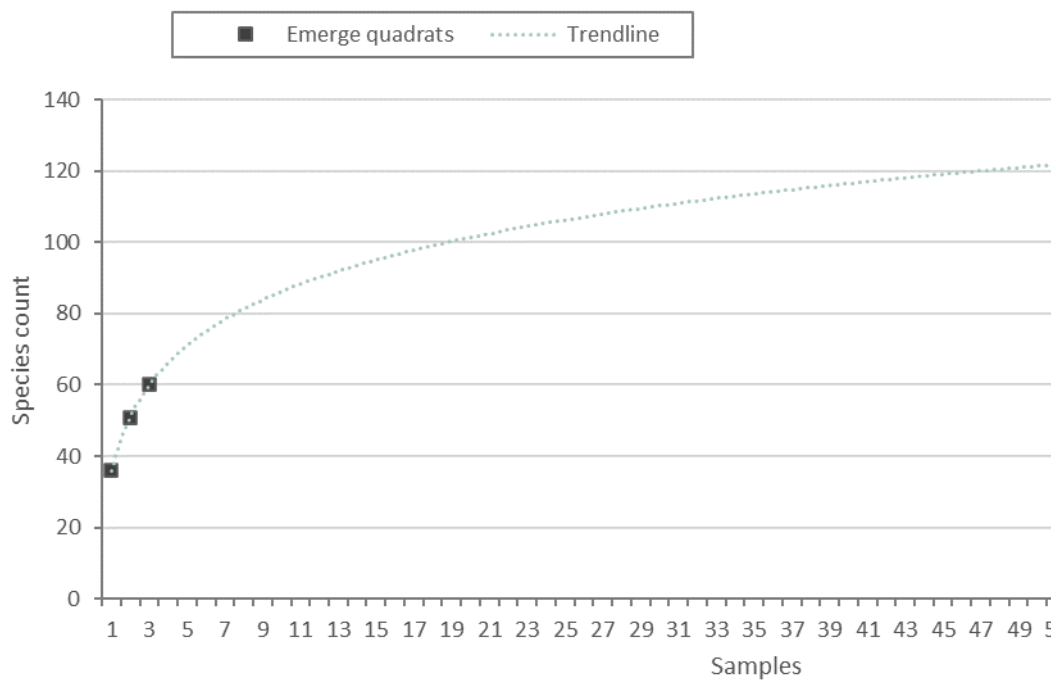


Plate 2: Species accumulation curve derived from sample data ($21.824\ln(x) + 35.966$, $R^2 = 1$)

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



4.1.2 Threatened and priority flora

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

The threatened and priority flora species identified in **Section 2.2** are not considered to occur in the site as no significant limitation affecting their detection was identified (refer **Section 3.3**).

4.1.3 Declared pests

One species listed as a declared pest (C3) pursuant to the BAM Act, **Zantedeschia aethiopica* (arum lily), was recorded within the site. Juvenile arum lily plants were recorded scattered throughout the site. No weeds of national significance (WoNS) were recorded.

4.2 Vegetation

4.2.1 Vegetation units



Three vegetation units were identified within the site. A description and the area of each vegetation unit is provided in **Table 8**. The location of each vegetation unit is shown in **Figure 4**. Raw sample data is provided in **Appendix E**.

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



Table 8: Description and extent of vegetation units identified within the site

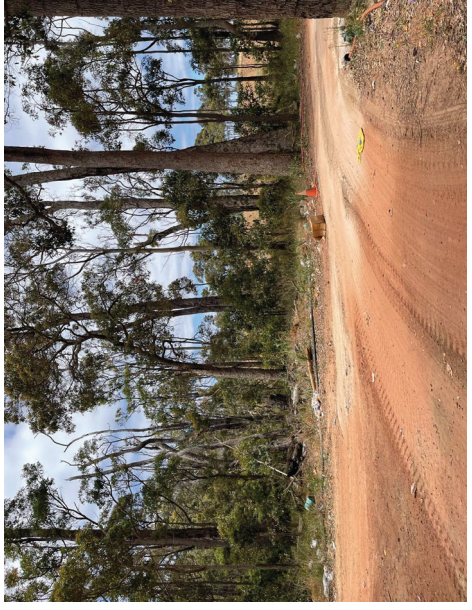
Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
EmCchh	Open forest to woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over shrubland <i>Hibbertia hypericoides</i> , <i>Macrozamia riedlei</i> , <i>Hovea elliptica</i> , <i>Hakea amplexicaulis</i> and <i>Hakea lissocarpa</i> over open forbland <i>Scaevola calliptera</i> , <i>Agrostocrinum hirsutum</i> , <i>Patersonia babianoides</i> and <i>Patersonia occidentalis</i> over scattered grasses/sedges <i>Microlaena stipoides</i> , <i>Tetrarrhena laevis</i> , <i>Morelotia octandra</i> and <i>*Anthoxanthum odoratum</i> .	Q2, Q3	1.84 ha	61%	
EmCcto	Open forest <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over tall shrubland <i>Trymalium odoratissimum</i> subsp. <i>trifidum</i> over low open shrubland <i>Tremandra stelligera</i> , <i>Hovea elliptica</i> and <i>Pteridium esculentum</i> over scattered herbs/grasses including <i>Lagenophora huegelii</i> , <i>Opercularia hispidula</i> and <i>Tetrarrhena laevis</i> . Located on lower slopes.	Q1	0.91 ha	30%	

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



Table 9: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Non-native	Heavily disturbed areas comprising non-native flora with scattered native plants. Tracks and areas of bare ground were also included in this unit.	-	0.27 ha	9%	

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



4.2.2 Vegetation condition

The extent of vegetation by condition category is detailed in **Table 10** and shown in **Figure 5**.

Table 10: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Total area (ha)	Proportion of site (%)
Pristine	0	0%
Excellent	0	0%
Very good	2.45	81%
Good	0.21	7%
Good – degraded	0.09	3%
Degraded	0	0%
Completely degraded	0.27	9%

4.2.3 Threatened and priority ecological communities

No TECs or PECs occur within the site.

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



5 Discussion

5.1 Flora

While only sampled once within the main flowering season, the survey was considered sufficient to collect a comprehensive inventory of flora taxa as the entire site was traversed. All of the threatened and priority flora species listed in **Table 4** would have been visible in the site during the survey, if present. No unidentified specimens that could represent threatened or priority flora taxa were collected and so none are considered to occur.

The one declared pest, arum lily, is common across the south-west of Western Australia and the Margaret River region and so the presence of this species was not unexpected. Arum lily is listed as a 'declared pest - s22(2) (exempt)' under the BAM Act which indicates it is established within Western Australia and desirable for management but exempt from permits.

5.2 Vegetation

The vegetation within the site was clearly discernible into two remnant native vegetation units as well as disturbed areas dominated by non-native species or bare ground. The **EmCchH** vegetation comprises a dryland community, whereas the **EmCcTo** vegetation represents a lower lying community which extends into *Eucalyptus diversicolor* (karri) dominated riparian forest to the south-west of the site associated with a watercourse.

The site is part of a larger patch of native vegetation in the same or more intact condition. The narrow linear portions of the site are subject to ongoing edge effects from the adjacent waste management facility, as evidenced by the presence of weeds and rubbish. The larger parts of the site adjacent to works areas also contained weeds and rubbish but to a lesser degree, with considerable native species persisting.

The TECs and PECs identified in **Section 2.1.8** are associated with vegetation types and landforms (such as caves) which do not occur in the site and so confirming their absence was straightforward.

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



6 Conclusions

Outcomes of the assessment include the following:

- A total of 92 flora species were recorded, comprising 75 native and 17 non-native species.
- No threatened or priority flora species were recorded or considered likely to occur.
- Three vegetation units were recorded in the site:
 - **EmCcHh** comprises an open forest of *Eucalyptus marginata* and *Corymbia calophylla* over diverse native understorey. This vegetation extends over 1.84 ha (61% of the site) and occurs in 'good – degraded', 'good' and 'very good' condition.
 - **EmCcTo** comprises an open forest of *Eucalyptus marginata* and *Corymbia calophylla* over tall shrubland *Trymalium odoratissimum* subsp. *trifidum* on lower slopes. This vegetation extends over 0.91 ha (30% of the site) and occurs in 'very good' condition.
 - **Non-native** comprises bare ground and heavily disturbed areas with non-native flora and scattered native plants. This unit extends over 0.27 ha (9%) and occurs in 'completely degraded' condition.
- No TECs or PECs occur within the site.

Detailed Flora and Vegetation Assessment

Part Lot 5011, Davis Road, Forest Grove



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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**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
(BoM 2024)	2 July 2024	Climate Data Online
(DBCA 2023e)	2 July 2024	Threatened Ecological Communities
(DAWE 2021)	2 July 2024	Weeds of National Significance (WoNS)
(DCCEEW 2024)	11 December 2023	Protected Matters Search Tool
(WALIA 2024)	2 July 2024	Landgate Map Viewer
(Western Australian Herbarium 2024)	2 July 2024	Florabase

Detailed Flora and Vegetation Assessment

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Figures



Figure 1: Site Location

Figure 2: Geology

Figure 3: Regional Vegetation

Figure 4: Vegetation Units

Figure 5: Vegetation Condition



Figure 1: Site Location

Plan Number: EP23-108(01)-F09
Drawn: CTH
Date: 20/06/2024
Checked: GAB
Approved: RAW
Date: 22/07/2024

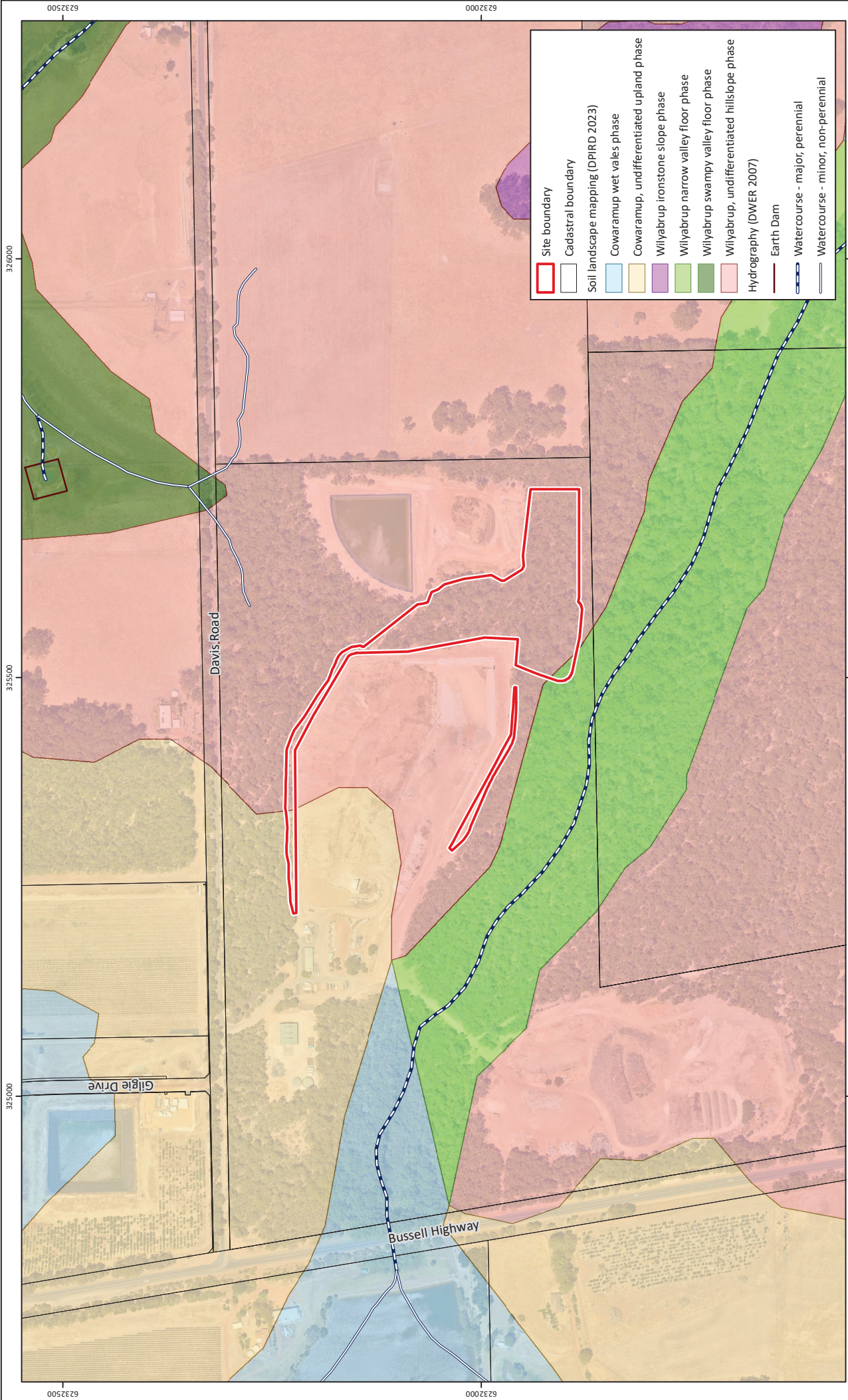


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 Metres
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 GDA2020 MGA Zone 50

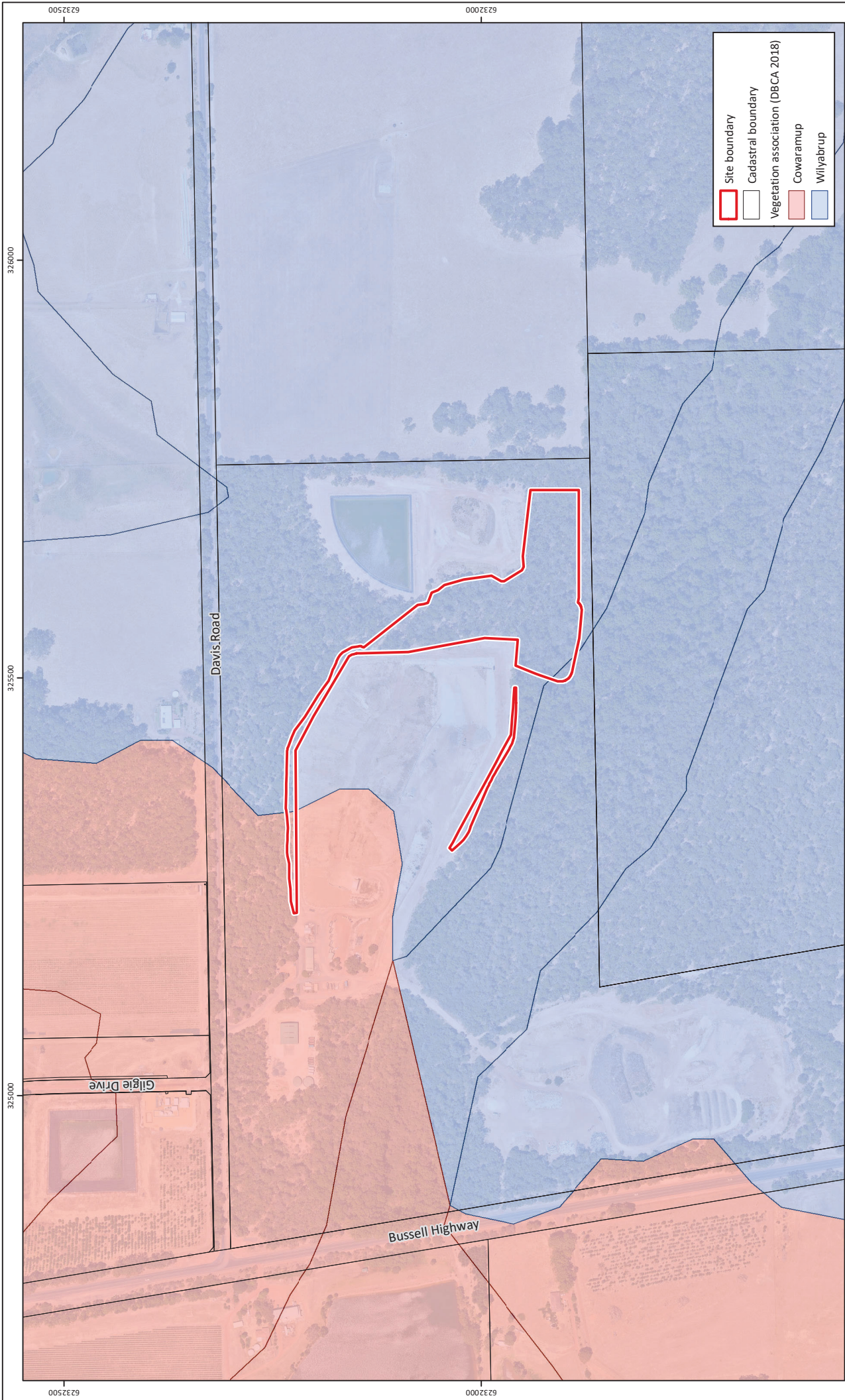


Project: Detailed Flora and Vegetation Assessment
 Part Lot 5011 Davis Road, Forest Grove
Client: Shire of Augusta Margaret River

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2024). Landgate / SLIP Imagery date: 28/01/2022



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Site boundary
 Cadastral boundary
 Vegetation association (DBCA 2018)
 Cowaramup
 Willyabrup



0 100 200
 Metres
 Scale: 1:6,000@A4
 GDA2020 MGA Zone 50

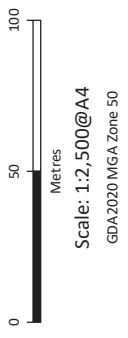


Plan Number: EP23-108(01)-F12
Drawn: CTH
Date: 20/06/2024
Checked: GAB
Approved: RAW
Date: 25/07/2024

Figure 3: Regional Vegetation

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Client: Shire of Augusta Margaret River

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Plan Number: EP23-108(01)-F07
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 Date: 27/05/2024
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 Date: 22/07/2024

Figure 4: Vegetation Units

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	Site boundary
	Cadastral boundary
Vegetation condition	
	Pristine (0 ha)
	Excellent (0 ha)
	Very good (2.45 ha)
	Good (0.21 ha)
	Good - degraded (0.09 ha)
	Degraded (0 ha)
	Completely degraded (0.27 ha)



0 50 100
Metres

Scale: 1:2,500@A4
GDA2020 MGA Zone 50



Plan Number: EP23-108(01)-F08
 Drawn: GAR
 Date: 27/05/2024
 Checked: GAB
 Approved: RAW
 Date: 22/07/2024

Figure 5: Vegetation Condition

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Client: Shire of Augusta Margaret River

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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 as ‘threatened’ pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

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 and published in the Biodiversity Conservation (Species) Order 2022. 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.

Threatened flora are assigned categories under the EPBC Act and BC Act according to their conservation status, as outlined in **Table 1**.

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 2018b). Priority flora species are considered during State approval processes. Priority flora are assigned categories as listed in **Table 1**.

Additional Background Information

Table 1: Definitions of threatened and priority flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2023b)

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 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

In Western Australia TECs are listed under sections 27(1), 31 and 33 of the BC Act. 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 listed under the BC Act are defined in Schedule 1 of the Biodiversity Conservation (Threatened Ecological Communities) Order 2023. State TECs are also acknowledged through other 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*.

TECs are assigned to one of the categories outlined in **Table 2** according to their level of threat.

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 with insufficient information available to be considered a TEC or which are rare but not currently threatened may be listed as a 'priority ecological community' (PEC). PECs are categorised based on a variety of criteria, as described in **Table 3**. Listed PECs are published by DBCA (DBCA 2023a).

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>

Reporting

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.

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

Additional Background Information

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 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 (2017) 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 2017)

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 2017)

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 2017) 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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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>Caladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Negligible
<i>Caladenia lodgeana</i>	CR	CR	PG	Seasonally moist to wet clay/sand soils on the margins of either low granite outcrops or ephemeral wetlands	Oct	Low
<i>Calectasia cyanea</i>	CR	CR	P	Heathland on white sand or laterite gravel over laterite. Known only from one population near Albany.	Jun-Oct	Negligible
<i>Gastrolobium papilio</i>	CR	EN	P	Sandy clay over ironstone and laterite. Flat plains.	Oct-Dec	Negligible
<i>Lambertia echinata subsp. occidentalis</i>	CR	EN	P	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Feb, Apr or Dec	Negligible
<i>Caladenia excelsa</i>	EN	EN	PG	Hilltops, slopes, swales and low plains in deep pale yellow, white or grey sandy soils among dense low shrubs in banksia, jarrah and marri woodlands	Sep-Oct	Low
<i>Caladenia hoffmanii</i>	EN	EN	PG	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	Aug-Oct	Negligible
<i>Drakaea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Low
<i>Reedia spathacea</i>	EN	CR	P	Low nutrient, anoxic and highly acidic wetlands usually over peat.	Nov (flowering is rare)	Low
<i>Banksia mimica</i>	VU	EN	P	Flat to gentle slopes in grey and white sand in open woodlands.	Dec-Jan	Negligible
<i>Banksia squarrosa subsp. argillacea</i>	VU	VU	P	White/grey sand, gravelly clay or loam predominantly in winter-wet areas over ironstone in open to tall shrubland.	Jun-Nov	Negligible
<i>Deyeuxia inaequalis</i>	P1	-	A	Loam soils	Nov-Dec	Moderate
<i>Netrostylis sp. Nannup (P.A. Jurjevich 1133)</i>	P1	-	P	Sand and clay loam in valley flats and creeks	Undocumented (likely Mar-Nov)	Low

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Synaphea macrophylla</i>	P1	-	P	Gravelly loam with jarrah or marri woodland or forest	Oct	Moderate
<i>Synaphea sp. Redgate Road (J. Scott 16)</i>	P1	-	P	Grey clay, litter. Winter-wet areas, wet areas along road verges and ditches.	Oct-Nov	Moderate
<i>Machaerina ascendens</i>	P2	-	P	Water or waterlogged soil on edges of swamps and boggy ground in peat, sand and clay soils. Occurs in swamps associated with the Blackwood River, Rosa Brook and Gingilup Swamp.	Aug-Oct	Low
<i>Xyris maxima</i>	P2	-	P	Black peaty sand on drainage flats.	Nov-Dec/Jan	Low
<i>Acacia inops</i>	P3	-	P	Black peaty sand, clay. Swamps, creeks.	Sep-early Nov	Low
<i>Actinotus repens</i>	P3	-	P	Sand, clay or loam in wetlands or low lying areas in scrub, woodland or forest with <i>Agonis</i> spp. and/or <i>Taxandria</i> and often karri trees.	Dec-Mar	Low
<i>Caladenia abbreviata</i>	P3	-	PG	Sand dunes.	Nov-Dec	Negligible
<i>Gastrolobium formosum</i>	P3	-	P	Clay loam. Along river banks or in swamps.	Nov	Low
<i>Grevillea bronweniae</i>	P3	-	P	Grey sand over laterite, lateritic loam on hillslopes.	Jun-Dec	Low
<i>Juncus meianthus</i>	P3	-	P	Black sand, sandy clay. Creeks, seepage areas.	Nov-Dec/Jan	Low
<i>Netrostylis sp. Blackwood River (A.R. Annel's 3043)</i>	P3	-	P	Creebeds, edges of lakes and swamps. Clay, peat or loam soils.	?Nov (limited information)	Low
<i>Pimelea ciliata subsp. longituba</i>	P3	-	P	Grey sand over clay, loam.	Oct-Dec	Moderate
<i>Stylidium lowrieianum</i>	P3	-	P	Sand or sandy loam over limestone. Eucalypt or <i>Agonis</i> woodland, forest.	Oct-Nov	Low
<i>Thysanotus cymosus</i>	P3	-	P	Shrubland or woodland on clay, granitic or lateritic sand.	Sep-Oct	Low
<i>Tricostularia davisii</i>	P3	-	P	Mallee woodland and heath on flats, hillsides and vales in a variety of soils including grey sand, brown sandy clay, peaty sand over clay, lateritic loam and granite.	Oct-Nov	Low

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Acacia semitrullata</i>	P4	-	P	White/grey sand, sometimes over laterite, clay sometimes in sandplains, swampy areas.	May-Oct	Moderate
<i>Astartea onycis</i>	P4	-	P	Seasonally inundated swamps and low-lying areas on sandy clay, loam or peat	Nov-Mar	Low
<i>Banksia sessilis var. cordata</i>	P4	-	P	White/grey sand. Coastal limestone.	Jul-Oct	Low
<i>Gahnia sclerioides</i>	P4	-	P	Loam, sandy soils. Moist shaded situations.	Feb, Apr, Jun, Aug or Nov	Moderate
<i>Melaleuca basicephala</i>	P4	-	P	Black peaty sand, clay. Winter-wet flats, swamps.	Dec or Jan	Low
<p>Note: CR=critically endangered, EN=endangered, VU=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.</p>						

Appendix C

Conservation Significant Communities and Likelihood of
Occurrence Assessment



Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
CAVES LEEWIN02	Aquatic Root Mat Community Number 2 of Caves of the Leeuwin-Naturaliste Ridge (Strongs Cave)	TEC	CR	EN	Low
CAVES LEEWIN04	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin-Naturaliste Ridge (Kudjal Yolgah and Budjur Mar Caves)	TEC	CR	EN	Low
CAVES LEEWIN03	Aquatic Root Mat Community Number 4 of Caves of the Leeuwin-Naturaliste Ridge (Calgardup Cave)	TEC	CR	EN	Low
174	Empodisma peatlands of southwestern Australia	TEC	-	EN	Negligible
Melaleuca lanceolata forests	Melaleuca lanceolata forests, Leeuwin Naturaliste Ridge	PEC	P2	-	Low
Reedia swamps - Blackwood	Reedia spathacea - Empodisma gracillimum - Sporadanthus rivularis dominated floodplains and paluslopes of the Blackwood River catchment.	PEC	P1	EN	Low
Augusta-microbial	Rimstone pools and cave structures formed by microbial activity on marine shorelines (Augusta microbialites)	TEC	EN	-	Low
<p>Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, P1=priority 1, P2=priority 2</p>					

Appendix D

Species List



Family	Status	Species
Apiaceae		<i>Daucus glochidiatus</i>
Araceae	* , DP	<i>Zantedeschia aethiopica</i>
Asparagaceae		<i>Lomandra ?caespitosa</i>
		<i>Lomandra nigricans</i>
		<i>Lomandra sericea</i>
		<i>Thysanotus multiflorus</i>
Asphodelaceae		<i>Tricoryne humilis</i>
Asteraceae	*	<i>Cirsium vulgare</i>
	*	<i>Erigeron sp.</i>
	*	<i>Hypochaeris glabra</i>
		<i>Lagenophora huegelii</i>
	*	<i>Osteospermum ecklonis</i>
		<i>Trichocline spathulata</i>
Cyperaceae		<i>Lepidosperma ?calpicola</i>
		<i>Morelotia octandra</i>
Dennstaedtiaceae		<i>Pteridium esculentum</i>
Dilleniaceae		<i>Hibbertia amplexicaulis</i>
		<i>Hibbertia cuneiformis</i>
		<i>Hibbertia grossulariifolia</i>
		<i>Hibbertia hypericoides</i>
Elaeocarpaceae		<i>Tremandra stelligera</i>
Ericaceae		<i>?Ericaceae sp. 1</i>
		<i>?Ericaceae sp. 2</i>
		<i>Leucopogon sp.</i>
		<i>Leucopogon verticillatus</i>
		<i>Styphelia propinqua</i>
Fabaceae		<i>Acacia browniana var. browniana</i>
	*	<i>Acacia iteaphylla</i>
		<i>Acacia pulchella</i>
		<i>Bossiaea ornata</i>
		<i>Bossiaea linophylla</i>
		<i>Chorizema nanum</i>
	*	<i>?Genista monspessulana</i>
		<i>Gompholobium marginatum</i>
		<i>Gompholobium polymorphum</i>
		<i>Hovea elliptica</i>
		<i>Mirbelia dilatata</i>
		<i>Templetonia retusa</i>

Family	Status	Species
Goodeniaceae		<i>Dampiera linearis</i>
		<i>Goodenia trinervis</i>
		<i>Scaevola calliptera</i>
Haemodoraceae		<i>Conostylis aculeata</i>
Hemerocallidaceae		<i>Agrostocrinum hirsutum</i>
		<i>Caesia micrantha</i>
		<i>Johnsonia lupulina</i>
		<i>Tricoryne humilis</i>
Hypericaceae	*	<i>Hypericum perforatum</i>
Iridaceae		<i>Patersonia babianooides</i>
		<i>Patersonia occidentalis</i>
	*	<i>Watsonia meriana</i>
Juncaceae		<i>Juncus subsecundus</i>
Lauraceae		<i>Cassytha racemosa</i>
Lindsaeaceae		<i>Lindsaea linearis</i>
Loganiaceae		<i>Orianthera serpyllifolia</i>
Malvaceae		<i>Lasiopetalum occidentale</i>
Moraceae	*	<i>Ficus carica</i>
Myrtaceae		<i>Corymbia calophylla</i>
		<i>Eucalyptus diversicolor</i>
		<i>Eucalyptus marginata</i>
		<i>Taxandria parviceps</i>
Oleaceae	*	<i>Olea europaea</i>
Orchidaceae		<i>Caladenia flava</i>
		<i>Thelymitra crinita</i>
Oxalidaceae	*	<i>Oxalis pes-caprae</i>
Pittosporaceae		<i>Billardiera fusiformis</i>
Plantaginaceae	*	<i>Plantago lanceolata</i>
Poaceae		<i>Amphipogon amphipogonoides</i>
	*	<i>Anthoxanthum odoratum</i>
	*	<i>Briza maxima</i>
	*	<i>Briza minor</i>
	*	<i>Lolium rigidum</i>
		<i>Microlaena stipoides</i>
	<i>Tetrarrhena laevis</i>	

Family	Status	Species
Podocarpaceae		<i>Podocarpus drouynianus</i>
Proteaceae		<i>Hakea amplexicaulis</i> <i>Hakea lissocarpha</i> <i>Hakea ruscifolia</i> <i>Persoonia ?saccata</i>
Ranunculaceae		<i>Clematis pubescens</i>
Restionaceae		<i>Desmocladius fasciculatus</i> <i>Hypolaena exsulca</i> <i>Netrostylis sp. Jarrah Forest (R. Davis 7391)</i>
Rhamnaceae		<i>Trymalium odoratissimum subsp. trifidum</i>
Rubiaceae		<i>Opercularia hispidula</i>
Rutaceae		<i>Boronia gracilipes</i>
Sterculiaceae		<i>Thomasia sp.</i>
Stylidiaceae		<i>Stylidium adnatum</i> <i>Stylidium amoenum</i>
Thymelaeaceae		<i>Pimelea angustifolia</i> <i>Pimelea rosea subsp. rosea</i>
Xanthorrhoeaceae		<i>Xanthorrhoea gracilis</i>
Zamiaceae		<i>Macrozamia riedlei</i>
*=non-native, DP=declared pest under the BAM Act		

Appendix E

Sample Data



Sample Name: Q1

Project no.: EP23-108

Date: 15/11/2023

Author: RAW,TAA

Status Non-permanent

Q1: Page 1 of 1

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: slightly damp

Landform: lower slope

Time since fire: > 5 yrs

Disturbance: moderate - kangaroos rubbish

Soil type/texture loam/ with organic layer

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 60% (leaves,branches,logs)

Vegetation condition: very good



Sample Name: Q2

Project no.: EP23-108

Date: 15/11/2023

Author: RAW,TAA

Status Non-permanent

Q2: Page 1 of 1

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: slightly damp

Landform: mid-slope

Time since fire: > 5 yrs

Disturbance: low - animaks weeds

Soil type/texture loam/ with organic layer

Bare ground (%): 2

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 25% (leaves,branches,logs)

Vegetation condition: very good



Sample Name: Q3

Project no.: EP23-108

Date: 15/11/2023

Author: RAW,TAA

Status Non-permanent

Q3: Page 1 of 1

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: upper slope

Time since fire: > 5 yrs

Disturbance: low - animaks weeds, rubbish

Soil type/texture loam/ with organic layer

Bare ground (%): 2

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 30% (leaves,branches,logs)

Vegetation condition: very good

