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Integrated Science & Design

Detailed Flora and Vegetation Assessment

Peel Health Campus, Greenfields

Project No: EP21-128(04)

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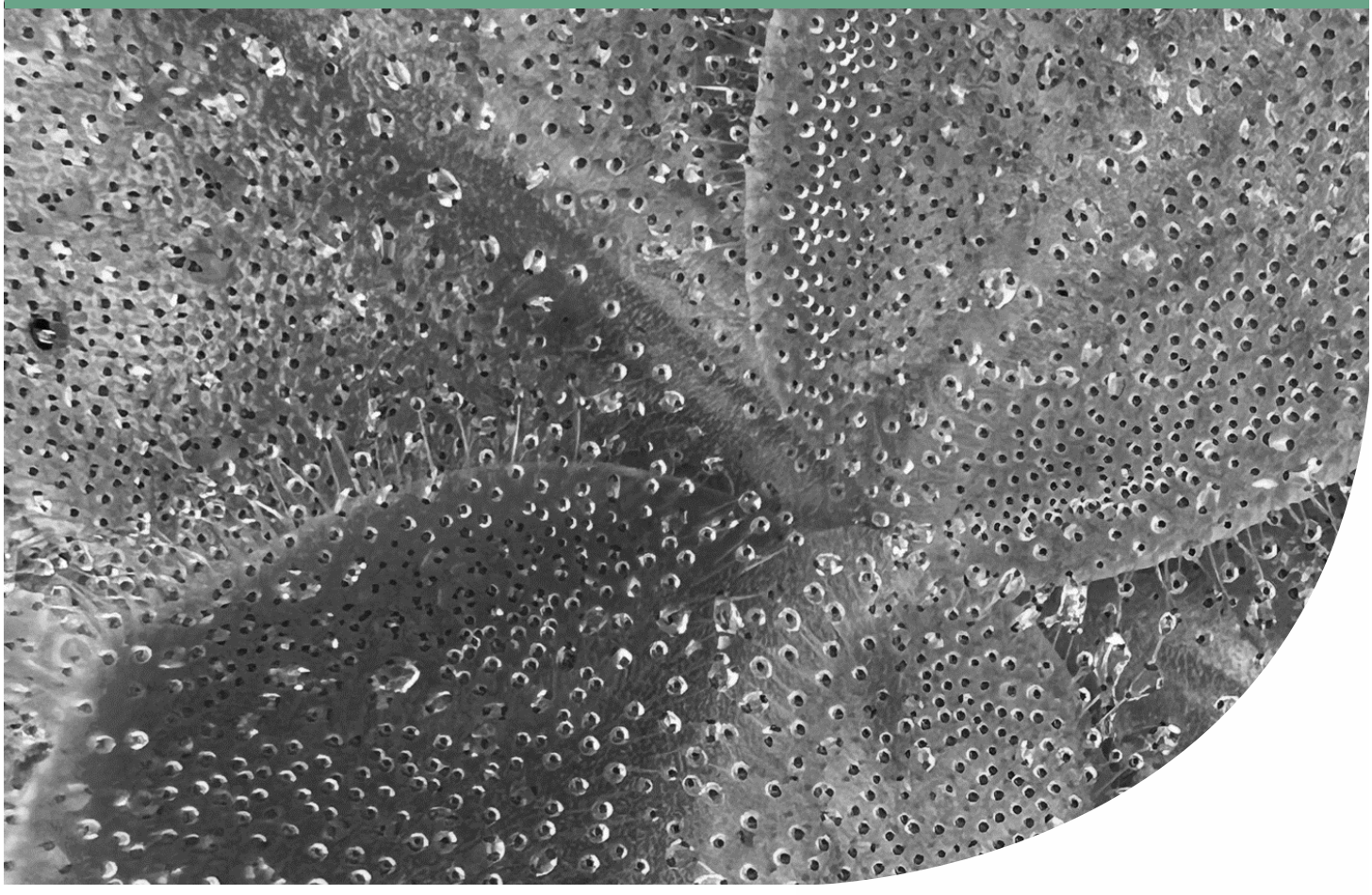

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Executive Summary

The Department of Finance engaged Emerge Associates to conduct a detailed flora and vegetation assessment within part of Peel Health Campus, 110 Lakes Road in Greenfields (the 'site').

The assessment included a desktop study of the environmental context and the likelihood of occurrence of threatened and priority flora and ecological communities. Field surveys were conducted during spring 2021, 2022, 2023 and 2024, 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:

- No threatened or priority flora species were recorded and none are considered to occur.
- Seven vegetation units were recorded in the site: **Ap**, **BaEm**, **Cc**, **Eg**, **EgBa**, **Mixed** and **non-native**. These units extend over 12.02 ha (64% of the site).
- The remainder of the site comprises hardstand and buildings (6.27 ha/33% of the site) and bare ground (0.53 ha/3% of the site).
- The vegetation was mapped as being in 'very good' (6.68 ha/35% of the site), 'good' (1.13 ha/6%), 'degraded' (2.43 ha/13%) and 'completely degraded' (8.58 ha/46%).
- The **BaEm** and **EgBa** vegetation represents FCT 21a 'central *Banksia attenuata* – *Eucalyptus marginata* woodlands'.
- The following TECs and PECs were identified within the site:
  - 'banksia woodlands of the Swan Coastal Plain' TEC/PEC (8.01 ha)
  - 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC/PEC (1.23 ha).
- An additional 0.78 ha of the 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC/PEC may occur in the site. Further investigations would be required to confirm whether this community occurs.

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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
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
CR	Critically endangered
EN	Endangered
FCT	Floristic community type
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

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
BC Act	*Biodiversity Conservation Act 2016*

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

1 Introduction

1.1 Purpose

Emerge Associates (Emerge) were engaged by the Department of Finance to conduct a flora and vegetation assessment within the Peel Health Campus, 110 Lakes Road in Greenfields, 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 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 2022b, 2023d). 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 2022a, b). '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 2023f). 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**.

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 surveys 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.

2 Desktop Study

2.1 Site context

2.1.1 Location and extent

The site is located in the City of Mandurah in the Peel Region of Western Australia and extends over 18.82 hectares (ha) as shown in **Figure 1**. The site is bounded by Teranca Road to the east, Minilya Parkway to the north, Lakes Road to the west and vegetation and buildings to the south.

2.1.2 Climate

The Peel 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, showing a much drier spring and summer period 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 Southwest botanical province in which the site lies, the primary survey time is spring (September to November) (EPA 2016b).

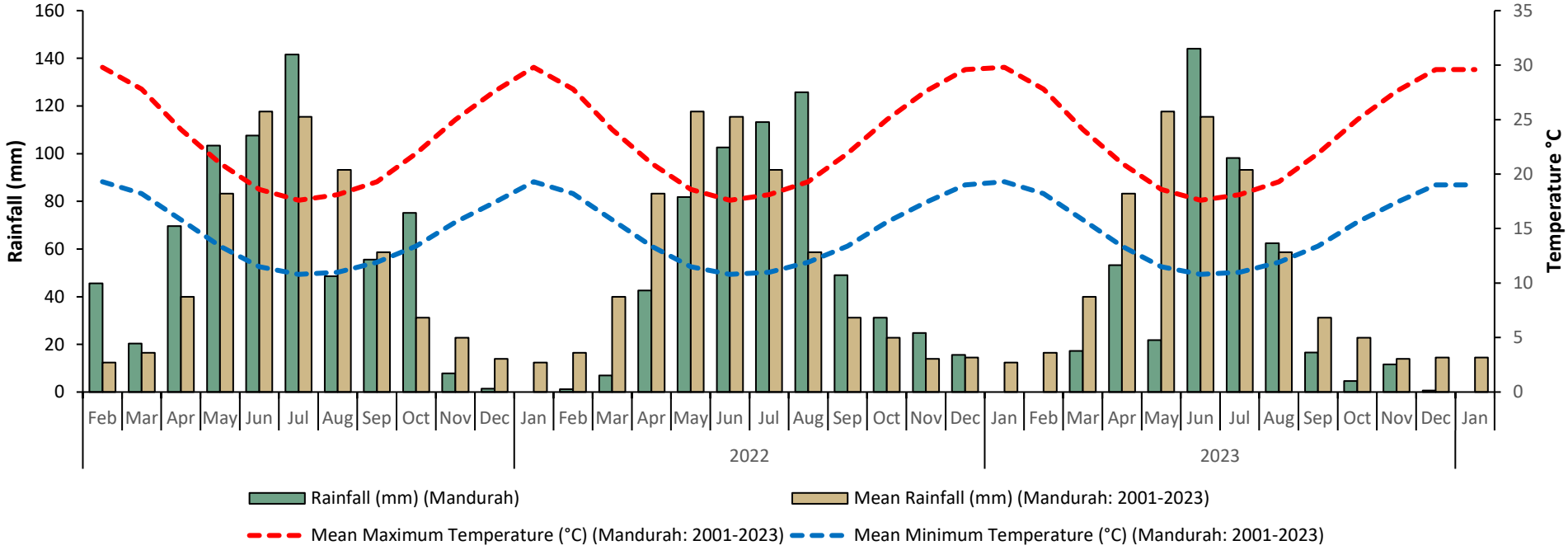

Plate 1: Recent rainfall and long-term mean temperature and rainfall

2.1.3 Geomorphology and soils

The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth and Peel metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bounded by the Indian Ocean to the west and the Darling Scarp to the east. Broadly, the Swan Coastal Plain consists of two sedimentary belts of different origin: its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp and its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline. These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition and, as a result, they contain soils at different stages of leaching and formation (Kendrick *et al.* 1991).

The site lies within the Spearwood dune system and the Yoongarillup soil association (Churchward and McArthur 1980). The Yoongarillup association comprises plains with low ridges and swales, shallow and brown sands over marine limestone.

Fine scale soil landscape mapping by DPIRD (2022) shows the 'Spearwood S4A Phase' soil unit occurs across the entire site. This unit comprises a 'flat to gently undulating sandplain with deep, pale and sometimes bleached, sands with yellow-brown subsoils'.

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

2.1.4 Topography

The elevation of the site ranges from 4 metres in relation to the Australian height datum (mAHD) in the southern portion to 7 mAHD on the western side adjacent to Lakes Road (DoW 2008) (**Figure 2**).

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 (DWER) hydrography linear dataset (DWER 2018b) records no wetland or water related features within the site.

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence and records no wetland features within the site {DBCA, 2024 #7210}.

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 is contained within the Swan Coastal Plain IBRA region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly banksia low woodland on leached sands with melaleuca swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Heddle *et al.* (1980) mapping shows the site as comprising the 'Yoongarillup complex', which is described as woodland to tall woodland of *Eucalyptus gomphocephala* with *Agonis flexuosa* in the second storey, and occasionally open forest of *Eucalyptus gomphocephala - Eucalyptus marginata - Corymbia calophylla*.

The Yoongarillup complex was determined to have 35.8% of its pre-European extent remaining on the Swan Coastal Plain in 2018, with 14.1% protected for conservation purposes[1] (Government of Western Australia 2019).

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 2023e). 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. 36-1121FL) identified 15 threatened and 46 priority flora occurring or potentially occurring within a 15 km radius of the site (refer **Appendix B**).

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 (DCCEEW 2024).

[1]Defined as being listed in the DBCA-legislated lands and waters dataset as either Crown reserves or lands managed under Section 8A of the CALM Act that have an IUCN category of I – IV (Government of Western Australia 2019).

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* (DCCEEW 2024) and DBCA's TEC and PEC database (reference no. 26_1121EC) identified 10 TECs and 8 PECs occurring or potentially occurring within a 10 km radius of the site (refer **Appendix C**).

2.1.9 Historical land use

Review of historical images available from 1960 onwards shows that the majority of the site was cleared of native vegetation prior to 1974. Subsequent imagery indicates the vegetation regenerated until around 1989 when development of the Peel Health Campus commenced. The vegetation in the eastern portion of the site appears to have remained relatively undisturbed since (WALIA 2024).

2.1.10 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site.

2.1.11 Regional natural areas

Environmental Protection Bulletin no. 12 Swan *Bioplan – Peel Regionally Significant Natural Areas* (EPB 12) (EPA 2013) is used to inform strategic land use planning in the Peel Region by identifying 'Peel regionally significant natural areas' (Peel RSNAs). Peel RSNAs are natural areas which have significant flora, vegetation and landform values that represent the original landscape of the Peel Region. Development proposals which may potentially impact upon a Peel RSNA require detailed flora, vegetation and fauna investigations to be undertaken. Based on the outcomes of these investigations, development proposals should firstly aim to avoid, and then minimise, potential impacts on identified natural areas.

The 'Greenfields Bushland' Peel RSNA occurs within the site, representing the entire patch of remnant vegetation in the east portion of the site, as shown in **Figure 2**.

2.1.12 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). No ecological linkages are mapped as occurring within the site. The closest mapped ecological linkage is number 13 which lies approximately 600 m east of the site along the Serpentine River. The site is separated from this linkage by urban residential dwellings.

2.1.13 Previous surveys

Emerge completed flora and vegetation surveys within the site in spring 2021 and 2022, the results of which have been included in this report. These surveys were previously documented separately to provide initial advice to the Department of Finance (Emerge Associates 2022, 2023).

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 1**.

Table 1: 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

One threatened and four priority flora were classified as having a 'high' or 'moderate' likelihood of occurrence within the site, as outlined in **Table 2**. The complete likelihood of occurrence assessment is provided as **Appendix B**.

Table 2: Threatened or priority flora species with a high or moderate likelihood occurrence in the site

Species	Status		Life strategy	Flowering period	Likelihood of occurrence
	WA	EPBC Act			
Caladenia huegelii	CR	EN	PG	Sep-early Nov	High
Acacia benthamii	P2	-	P	Aug-Sept	Moderate
Lasiopetalum membranaceum	P3	-	P	Sep-Dec	Moderate
Caladenia speciosa	P4	-	PG	Sep-Oct	Moderate
Jacksonia sericea	P4	-	P	Dec-Feb	Moderate

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

2.2.2 TECs and PECs

Two TECs and two PECs were classified as having a 'high' or 'moderate' likelihood of occurrence within the site, as detailed in **Table 3**. The complete likelihood of occurrence assessment is provided as **Appendix C**.

Table 3: Threatened or priority ecological communities with a high or moderate likelihood of occurrence in the site

Community	Status		Likelihood of occurrence
	WA	EPBC Act	
Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain	P3	CR	High
Banksia woodlands of the Swan Coastal Plain	P3	EN	High

3 Methods

3.1 Field survey

Experienced botanists visited the site on various dates between 2021 and 2024 to conduct the field survey, as summarised in **Table 4**. 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.

Table 4: Field survey summary dates and tasks

Date	Tasks
24 November 2021	Targeted search within suitable habitat and sampling of whole site (quadrat 1 and 2)
21 September 2022	Targeted search within suitable habitat across northern and southern portions of site
31 October 2022	Targeted search within suitable habitat across whole site
29 September 2023	Targeted search in central portion of site
23 October 2023	Targeted search in central portion of site and sampling of whole site (quadrats 1, 2 and 3)
17 September 2024	Targeted search within suitable habitat across whole site
8 October 2024	Targeted search within suitable habitat across whole site

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 spaced approximately 10 to 20 m apart through areas of potentially suitable habitat (refer **Figure 3**). 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. The quadrats were established using fence droppers bounded by measuring tape. The position[2] 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 (Q1, Q2 and Q3) as shown in **Figure 4**.

[2] For quadrats the north-west corner was recorded.

3.1.3 Vegetation condition

The condition of the vegetation was assessed using the Keighery (1994) scale (**Table 5**). For vegetation in the site containing *Banksia* spp., the condition scale provided in the DoEE (2016) conservation advice for the 'banksia woodlands of the Swan Coastal Plain TEC' was applied in addition to the Keighery scale, as shown in **Table 5**.

Table 5: Vegetation condition scale applied during the field survey

Category	Definition (Keighery 1994)	Indicator (DoEE 2016)	
		Typical native vegetation composition^	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
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.	Moderate native plant species diversity	5-20%
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.	Low native plant species diversity	5-50%
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.	Very low native plant species diversity	20-70%
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.	Very low to no native species diversity	Greater than 70%

^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). Jacknife1 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.

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 Floristic community type assignment

The identified vegetation units were compared to the regional 'floristic community type' (FCT) dataset *A floristic survey of the southern Swan Coastal Plain* (Gibson *et al.* 1994). Each sample was compared to Gibson *et al.* (1994) separately to limit the influence of spatial correlation when assigning an FCT. FCT analysis was not undertaken for samples located within disturbed vegetation with low native species diversity as the vegetation was considered unlikely to currently represent an FCT.

Sample data (presence/absence) was first reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded,

while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package PRIMER v6 (Clarke and Gorley 2006).

A resemblance matrix was generated using the Bray-Curtis distance measure which provided the percentage similarity between all pairs of samples. A cluster analysis was then performed using the resemblance matrix and hierarchical agglomerative clustering, to produce a dendrogram. Where a sample tended to cluster with a grouping of different FCTs, the resemblance matrix was examined. Ultimately a combination of cluster analysis, resemblance matrix and contextual information relating to the soils, landforms and known FCTs within the region was considered in the final determination of an FCT for vegetation within the site.

3.2.6 TEC and PEC confirmation

Vegetation units were assessed against TEC and PEC diagnostic characteristics and, if available, size and/or vegetation condition thresholds (DBCA 2023b). 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**).

3.2.7 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 **Table 6**.

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.
		This report includes the results of three survey years. No other surveys are known to have been undertaken in the site.
Availability of contextual information (continued)	No limitation	Regarding assignment of FCTs, the authoritative Gibson *et al.* (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now more than 30 years out of date. Consequently, it is unknown to what degree official FCTs are an appropriate reference for the biodiverse vegetation across the Swan Coastal Plain. Furthermore, Gibson *et al.* (1994) collected data in the main flowering period (spring) and in many cases sampled plots multiple times to provide a complete species list. This assessment sampled the site twice over two years and so the data is considered suitable to compare to the Gibson *et al.* (1994) dataset (particularly considering there is no alternative dataset).
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanists with between 5 and 13 years' botanical experience in Western Australia. Technical review was undertaken by a senior and principal environmental consultants with between 13 and 20 plus 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. Surveys were conducted in spring and thus within the main flowering season. The survey timing aligned with the flowering period of most native flora, including threatened and priority flora for which floral features are required for identification purposes. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
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. The site was visited over four years, with surveys in late November 2021, September and November 2022, September and October 2023 and September and October 2024. Quadrats were sampled twice (2021 and 2023) and targeted searches for threatened and priority flora species were conducted in two different years. Therefore, according to the EPA guidelines this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged, refer **Figure 3**).
	No limitation	All parts of the site could be accessed as required.

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

Constraint	Degree of limitation	Details
Sampling intensity	No limitation	A total of 89 species were recorded, of which 65 were recorded from three samples and 29 were recorded opportunistically. Minimum species richness within site is estimated at between 74 (Chao2) and 78 (Jacknife 1) species (refer species accumulation curve and estimates shown in **Plate 2**). The number of species recorded in the site is higher than the estimates which demonstrates that survey effort was adequate to prepare a comprehensive species inventory for the site.
Influence of disturbance	Minor limitation	Time since fire is greater than 15 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 and some native vegetation in the site is regrowth with minimal non-native species present. 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.

4 Results

4.1 Flora

4.1.1 Species inventory

A total of 89 species were recorded during the field survey. 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	80	-	3	-	0	**80**
Non-native	9	-	-	0	1	**9**
Total	89	0	0	0	1	**89**

Sampling recorded 65 species from three samples. A further 29 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 and 74 (Chao2) and 78 (Jacknife1).

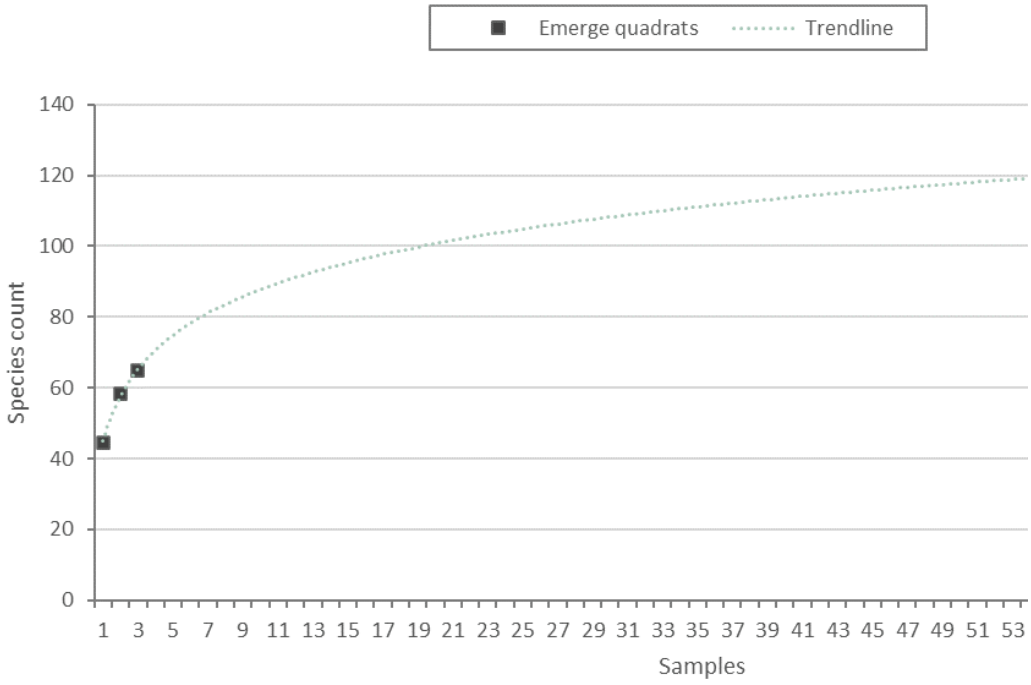

Plate 2: Species accumulation curve derived from sample data (y =28.261ln(x) + 46.345, R^2 = 0.9395)

4.1.2 Threatened and priority flora

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

The threatened and priority flora 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

No species listed as a declared pest pursuant to the BAM Act or weeds of national significance (WoNS) were recorded in the site.

4.2 Vegetation

4.2.1 Vegetation units

Seven 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 5**. Raw sample data is provided in **Appendix E**.

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

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Ap	Shrubland of *Acacia pulchella* var. *glaberrima*	-	0.19	1	
BaEm	Woodland *Banksia attenuata* and *Eucalyptus marginata* with scattered *Banksia grandis* over shrubland *Gompholobium aristatum, Hibbertia hypericoides* and *Macrozamia riedlei* over mixed native sedge/herbland over grassland **Ehrharta calycina*		7.86	42	

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
Cc	Forest *Corymbia calophylla* over scattered shrub *Macrozamia reidlei* and *Jacksonia sternbergiana* over grassland **Ehrharta calycina*		0.37	2	
Eg	Forest *Eucalyptus gomphocephala* and scattered planted trees over planted gardens, bare ground and hard stand		0.63	3	

Table 10: Description and extent of Vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
EgBA	Woodland *Eucalyptus gomphocephala* and *Banksia attenuata* over shrubland *Gompholobium aristatum* and *Jacksonia sternbergiana* over mixed native sedge/herbland over grassland **Ehrharta calycina*		0.84	4	
Mixed	Open woodland native species such as *Eucalyptus gomphocephala, Eucalyptus marginata*, *Banksia attenuata* and *Jacksonia furcellata* with non-native species such as **Eucalyptus camaldulensis*, **Ehrharta calycina* and **Eragrostis curvula* in modified drainage landform		0.34	2	

Table 11: 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 containing predominantly non-native vegetation with scattered native plants	-	1.8	10	
Hardstand and buildings			6.27	33	
Bare ground			0.53	3	

4.2.2 Vegetation condition

The extent of vegetation by condition category is detailed in **Table 12** and shown in **Figure 5**.

Table 12: 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	6.68	35
Good	1.13	6
Degraded	2.43	13
Completely degraded	8.58	46

4.2.3 Floristic community types

Vegetation unit **BaEm** was determined to represent FCT 21a 'central *Banksia attenuata* – *Eucalyptus marginata* woodlands', as shown in **Table 13**. The relevant portions of the cluster dendrograms showing Q1, Q2 and Q3 in **BaEm** are provided in **Appendix F**.

Table 13: Vegetation unit FCT classification by sample

Vegetation unit	Sample unit	Most similar Gibson *et al.* (1994) sites	Similarity (%)	Floristic community type (FCT)
BaEm	Q1	NINE-1 (FCT 21a)	44	21a: central *Banksia attenuata* – *Eucalyptus marginata* woodlands
	Q2	FL-4 (FCT21a)	39	
	Q3^	C71-3 (FCT 21a)	32	
		BOLD-2 (FCT 24)	30	
		CRAMPT-1 (FCT 21a)	29	

Note: ^ shows highest percent similarity to individual Gibson et al. (1994) samples from resemblance matrix rather than similarity in the cluster analysis.

4.2.4 Threatened and priority ecological communities

The following TECs and PECs were identified within the site:

- 'banksia woodlands of the Swan Coastal Plain' TEC/PEC
- 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC/PEC.

The locations of the TECs and PECs within the site are shown in **Figure 6**.

The structure, composition and patch size of the majority of vegetation units **BaEm** and **EgBa** indicates they represent the Commonwealth listed 'banksia woodlands of the Swan Coastal Plain' TEC, as outlined in **Table 13**.

Table 14: Criteria for determining presence of banksia woodlands of the Swan Coastal Plain TEC adapted from DoEE (2016)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	A variety of factors relating to: Location Soils Structure Composition	Site meets location and soils criteria. The **BaEm** and **EgBa** vegetation includes the key diagnostic feature of a tree layer of *Banksia attenuata.* The **BaEm** and **EgBa** vegetation within site also meets structure and composition criterion. FCT 21a is identified as one of the FCTs comprising the banksia woodland TEC.
2. Must meet condition thresholds	A patch should at least meet the 'good' condition category (see **Table 5**)	The **BaEm** and **EgBa** vegetation is present in 'very good', 'good' and 'degraded' condition, which meets this criterion. The conservation advice indicates that a single patch may include areas of variable condition, meaning parts of the **BaBm** and **EgBa** vegetation in 'degraded' condition may still be considered the TEC.
3. Must meet minimum patch size	Minimum size of patch: Pristine=no minimum size Excellent=0.5 ha Very Good=1 ha Good=2 ha	The **BaEm** and **EgBa** vegetation in 'very good' condition comprises 6.68 ha and meets this criterion. The **BaEm** vegetation in 'good' condition comprises 1.13 ha and does not independently meet this criterion. However, the adjacent 'very good' **BaBm** would be viewed as contiguous and part of the same patch. Therefore, the 'very good' and 'good' **BaBm** and **EgBa** vegetation comprise a patch of the TEC. The **BaEm** and **EgBa** vegetation in 'degraded' condition do not meet the condition threshold and are not contiguous with the 'very good' and 'good' patches of the TEC. Therefore, they do not comprise a patch of the TEC.
4. Must incorporate surrounding context	Breaks (e.g. tracks) < 30 m do not separate vegetation into separate patches Buffer zones may apply (20-50 m recommended from patch edge) The site should be thoroughly sampled (2 surveys in same spring). Survey timing should be appropriate. Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)	Small scale tracks (<30 m wide) exist within the patch. Land surrounding the patch is mostly urban residential and businesses. This survey was conducted in spring and included sampling within two years.
Result	The site supports 8.01 ha of the banksia woodlands of the Swan Coastal Plain TEC.	

The FCT, structure, composition and patch size of vegetation unit **EgBa** indicates that it represents the Commonwealth listed 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC, as outlined in **Table 15**. The **Eg** vegetation also has potential to represent this TEC, as outlined in **Table 15**.

Table 15: Assessment of site conditions against the tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain TEC criteria (adopted from (DoEE 2019))

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	Located in appropriate bioregion and landform. At least 2 living established *E. gomphocephala* trees with DBH≥ 15cm present in canopy layer and with <60 m between the outer edges of canopies^ Vegetation structure is a woodland, forest, open forest, open woodland, or mallee (various forms).	Site is located in appropriate bioregion and landform. The **EgBa** vegetation occurs as two patches: one in the eastern portion and one in the western portion. Each of these patches contain at least two living established *E. gomphocephala* trees with DBH≥ 15cm present in canopy layer and with <60 m between the outer edges of canopies. Vegetation within the patches comprises a woodland to open woodland structure. Therefore, the two patches of **EgBa** vegetation meet this criterion.
		Two living established *E. gomphocephala* trees with DBH≥ 15cm present in canopy layer and with <60 m between the outer edges of canopies occurs within an area of **BaEm** vegetation in the western portion of the site. Vegetation within this patch comprises a woodland to open woodland structure. Therefore, these trees meet this criterion.
		The **Eg** vegetation contains more than two living established *E. gomphocephala* trees with DBH≥ 15cm present in canopy layer and with <60 m between the outer edges of canopies. Vegetation within this patch comprises a woodland to open woodland structure. Therefore, these trees meet this criterion.
2. Must meet size threshold	A patch must be larger than 0.5 ha[#]	The eastern **EgBa** vegetation patch is >0.5 ha and meets this criterion. The western **EgBa** vegetation patch is >0.5 ha and meets this criterion.
		The patch of the two tuart trees within the western **BaEm** vegetation is >0.5 ha and meets this criterion.

Table 15: Assessment of site conditions against the tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain TEC criteria (adopted from (DoEE 2019)) (continued)

Criteria	Requirements for meeting criteria	Site implications
		The size of the **Eg** vegetation patch is >0.5 ha and meets this criterion.
3. Must meet condition thresholds	Patches >5 ha: no condition threshold Patches ≥0.5 – <2 ha: 'very high' or 'high' condition† Patches ≥2 – ≤5 ha: 'very high', 'high' or 'moderate' condition†	The eastern **EgBa** vegetation patch is ≥0.5 – <2 ha and in 'high' condition so meets this criterion. The western **EgBa** vegetation patch is ≥0.5 – <2 ha and in 'moderate' to 'poor' condition and so does not meet this criterion.
		The patch of two tuart trees within the western **BaEm** vegetation is ≥0.5 – <2 ha and in 'moderate' to 'poor' condition and so does not meet this criterion.
		The **Eg** patch in the site does not independently meet this criterion as it is not in 'very high' or 'high' condition. However it is likely connected to other tuart trees across Lakes Road, which may extend to 5 ha and meet this criterion. Further investigation of the surrounding vegetation would be required to confirm whether the **Eg** vegetation meets this criterion and represents the TEC.
4. Must incorporate surrounding context	Breaks (e.g. tracks, cleared areas) < 30 m do not separate vegetation into separate patches The site should be thoroughly sampled in the appropriate season. Survey timing should be appropriate. Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)	The survey timing was sufficient to determine that the eastern **EgBa** vegetation patch represents the TEC. 0.68 ha of the patch lies outside of the site and mainly comprises buildings and roads. Due to access limitations outside of the site, the extent of the patch of vegetation associated with vegetation unit **Eg** could not be confirmed.
Result	The site supports 1.23 ha of the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC. This includes the **EgBa** vegetation in 'very good' condition and surrounding areas which contribute to the patch. An additional patch comprising 0.78 ha may represent the TEC but would require further investigation.	

^Includes dead trees. Where species of dead tree is unclear it is assumed to be *E. gomphocephala* if its canopy is within 60 m of an identified *E. gomphocephala tree*. #Note that a patch comprises a 30 m buffer around the canopy of each *E. gomphocephala* tree, may extend beyond a lot boundary and may include areas of bare ground, waterbodies and hardscape. †Using the condition scale provided in (DoEE 2019).

DBCA's *Priority Ecological Community* list indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the 'banksia woodlands of the Swan Coastal Plain' PEC and 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' PEC (DBCA 2022a) . Therefore, total of 8.01 ha of the 'banksia woodlands of the Swan Coastal Plain' PEC and 1.23 ha (with a provisional additional 0.78 ha) of the

'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' PEC occur within the site, as shown in **Figure 6**.

No other TECs or PECs occur within the site.

5 Discussion

5.1 Flora

The targeted searches during field surveys are considered comprehensive enough to rule out the occurrence of threatened and priority flora in the site. Whilst the surveys in 2022 and 2023 were undertaken within different parts of the site, each year comprised two visits during spring to capture the range of flowering periods of the threatened and priority flora with moderate or high likelihood of occurrence listed in **Table 2**. Additionally, the entirety of the site was searched again twice in spring 2024.

Caladenia huegelii and *Caladenia speciosa* are perennial geophytes and so are generally only detectable when flowering. The September and October surveys undertaken over multiple spring seasons aligned with the flowering periods of these species and so they should have been visible, if present. None of the surveys aligned with the December to February flowering period of *Jacksonia sericea*. However, this species is perennial and is readily detectable and identifiable throughout the year. The Emerge botanists who undertook the field surveys are very familiar with this species and so were able to conclude that it is not present.

5.2 Vegetation

Vegetation units **BaEm** and **EgBa** comprise the most intact native vegetation in the site, with the remainder of the vegetation being highly disturbed. Surveys in 2023 recorded evidence of minor localised disturbance within the eastern portion of the **BaEm** vegetation that was not present in 2022 surveys. This comprised installation of temporary informal dwellings and associated informal tracks. These areas of disturbance were small compared to the whole size of the patch of **BaEm** vegetation and the patch was still considered to meet the 'very good' condition definition.

Assignment of samples Q1 and Q2 to FCT 21a was straightforward as they clearly clustered with this FCT. Sample Q3 clustered with multiple FCTs with low similarity but the resemblance matrix showed consistent resemblance to FCT 21a, with eight of the top 10 most similar sites being FCT 21a.

Q3 differed in vegetation structure to Q1 and Q2, being dominated by shrubs such as *Jacksonia sternbergiana.* However, the flora species recorded within the quadrats was mostly consistent and assigning them all to FCT 21a is considered appropriate.

5.3 Threatened and priority ecological communities

Application of the DoEE (2016) 'banksia woodlands of the Swan Coastal Plain' TEC conservation advice was simple as the vegetation clearly met (or did not meet) the criteria. Some patches of vegetation which include banksia trees do not represent the TEC as they are too disturbed and not contiguous with better condition patches.

The patch of 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC in the eastern portion of the site meets the DoEE (2019) criteria, although most of the patch outside of the site would not represent the TEC as it comprises human-made structures and gardens.

The status of the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC could not be confirmed for the **Eg** vegetation. The DoEE (2019) conservation advice states that the boundary a patch of the TEC is calculated by applying a 30 m buffer to the canopy of each tuart tree. Small areas without understorey vegetation, such as bare ground or hardscape, are included in calculation of a patch size if they do not significantly alter the overall function of the ecological community, but buildings and gardens do not represent the TEC or contribute to calculation of patch size and condition (DoEE 2019). Based on this, the majority of the 30 m buffer applied to the tuart trees within the **Eg** vegetation does not represent the TEC as it comprises hardstand (carparks) and buildings and so doesn't meet condition thresholds applicable to smaller patch sizes (0.5 to 2 ha). Inspection of adjacent areas of public land during the 2023 survey indicated that other tuart trees occur across Lakes Road within various private landholdings, and if buffered these are likely to connect to the tuarts within the **Eg** vegetation to form a larger patch. Therefore, the 0.78 ha of tuart canopy may still represent the TEC as part of a larger patch if that larger patch were greater than 5 ha in size (the threshold for the lowest condition category of the TEC). Due to access limitations, the properties across Lakes Road could not be surveyed to record all tuart trees and so the extent of the patch outside the site and the status of the **Eg** vegetation within the site could not be confirmed.

6 Conclusions

Outcomes of the assessment include the following:

- No threatened or priority flora species were recorded and none are considered to occur.
- Seven vegetation units were recorded in the site: **Ap**, **BaEm**, **Cc**, **Eg**, **EgBa**, **Mixed** and **non-native**. These units extend over 12.02 ha (64% of the site).
- The remainder of the site comprises hardstand and buildings (6.27 ha/33% of the site) and bare ground (0.53 ha/3% of the site).
- The vegetation was mapped as being in 'very good' (6.68 ha/35% of the site), 'good' (1.13 ha/6%), 'degraded' (2.43 ha/13%) and 'completely degraded' (8.58 ha/46%).
- The **BaEm** and **EgBa** vegetation represents FCT 21a 'central *Banksia attenuata* – *Eucalyptus marginata* woodlands'.
- The following TECs and PECs were identified within the site:
  - 'banksia woodlands of the Swan Coastal Plain' TEC/PEC (8.01 ha)
  - 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC/PEC (1.23 ha).
- An addition 0.78 ha of the 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC/PEC may occur in the site. Further investigations would be required to confirm whether this TEC occurs.

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7.1 General references

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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
(DBCA 2023d)	19 February 2024	Threatened Ecological Communities
(DAWE 2021)	19 February 2024	Weeds of National Significance (WoNS)
(DCCEEW 2024)	21 February 2024	Protected Matters Search Tool
DBCA (2023c)	17 November 2021	NatureMap
(WALIA 2024)	19 February 2024	Landgate Map Viewer
(Western Australian Herbarium 2024)	19 February 2024	Florabase

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Figures

Figure 1: Site Location

Project:	Detailed Flora and Vegetation Assessment Peel Health Campus
Client:	Department of Finance

Plan Number:
EP21-128(04)--F15

Drawn:	SCM
Date:	22/02/2024
Checked:	RAW
Approved:	TAA
Date:	22/02/2024

N

0 125 250
Metres

Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 2: Environmental Features

Project:	Detailed Flora and Vegetation Assessment Peel Health Campus
Client:	Department of Finance

Plan Number:
EP21-128(04)--F16

Drawn:	SCM
Date:	22/02/2024
Checked:	RAW
Approved:	TAA
Date:	22/02/2024

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Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

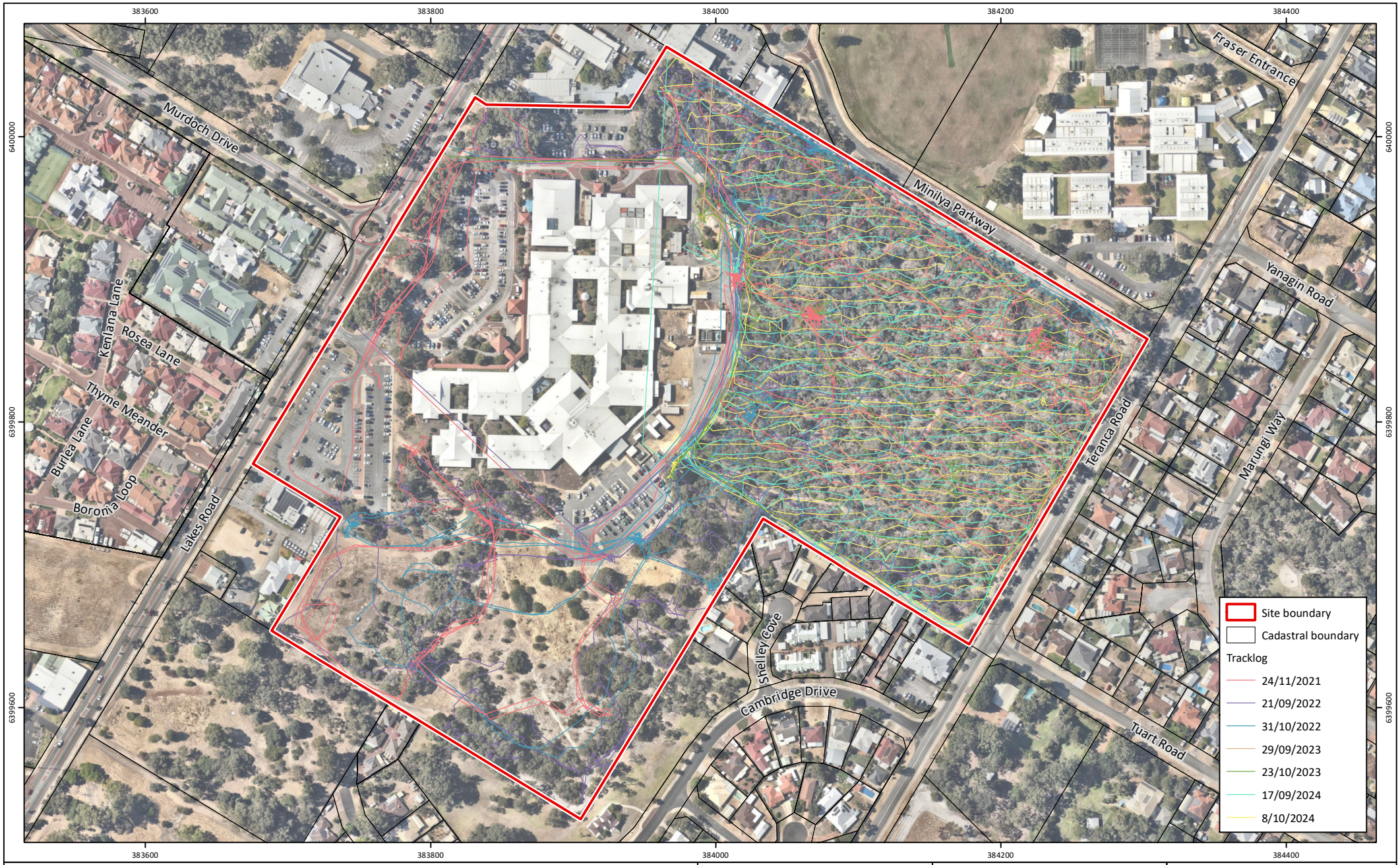

Figure 3: Survey Effort

Project:	Detailed Flora and Vegetation Assessment Peel Health Campus
Client:	Department of Finance

Plan Number:
EP21-128(04)--F20

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Date:	14/10/2024
Checked:	MS
Approved:	RAW
Date:	14/10/2024

N

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Metres

Scale: 1:3,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

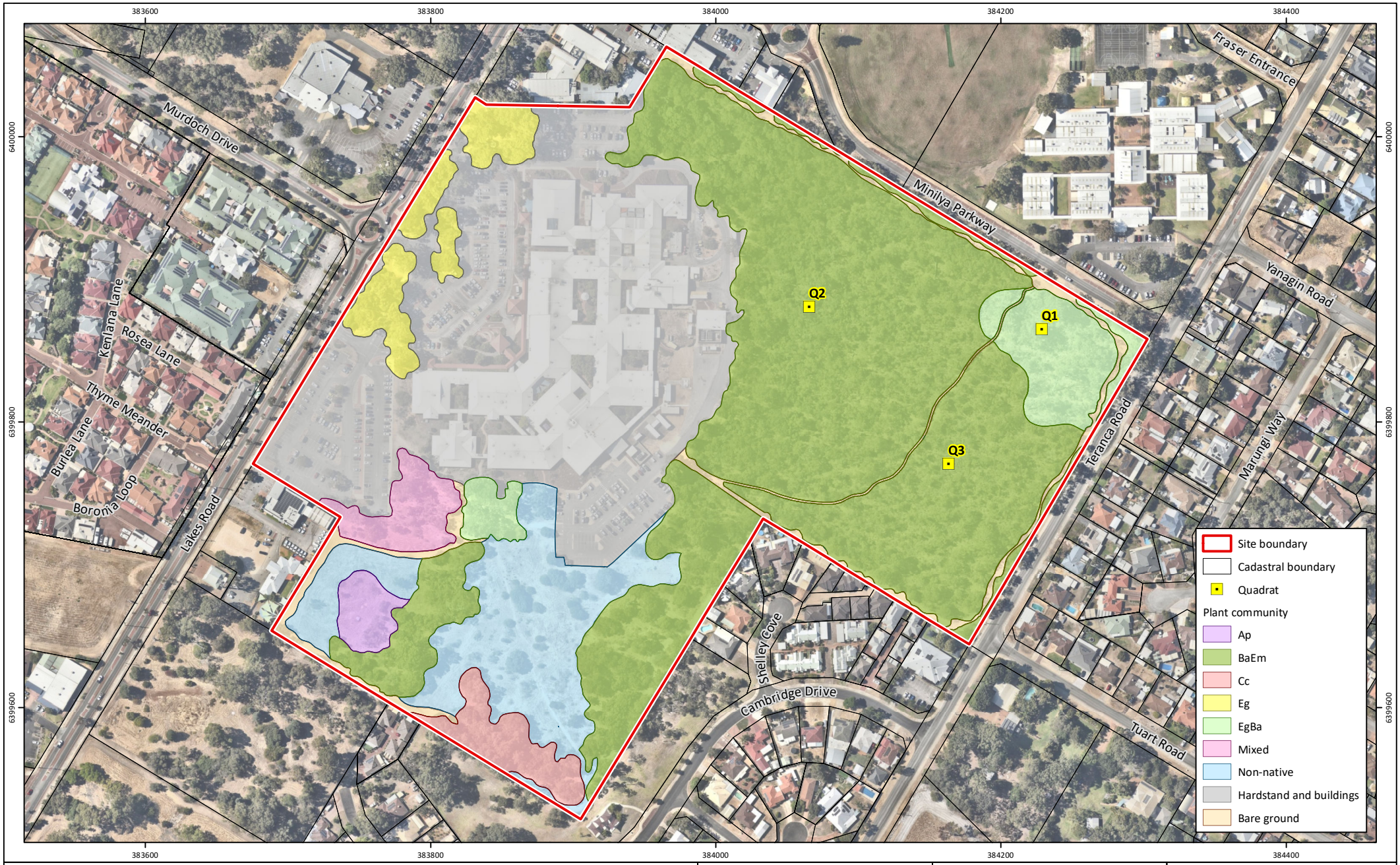

Figure 4: Vegetation Units

Project: Detailed Flora and Vegetation Assessment
Peel Health Campus
Client: Department of Finance

Plan Number:
EP21-128(04)--F17a
Drawn: GAR
Date: 14/10/2024
Checked: RAW
Approved: TAA
Date: 14/10/2024

N

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

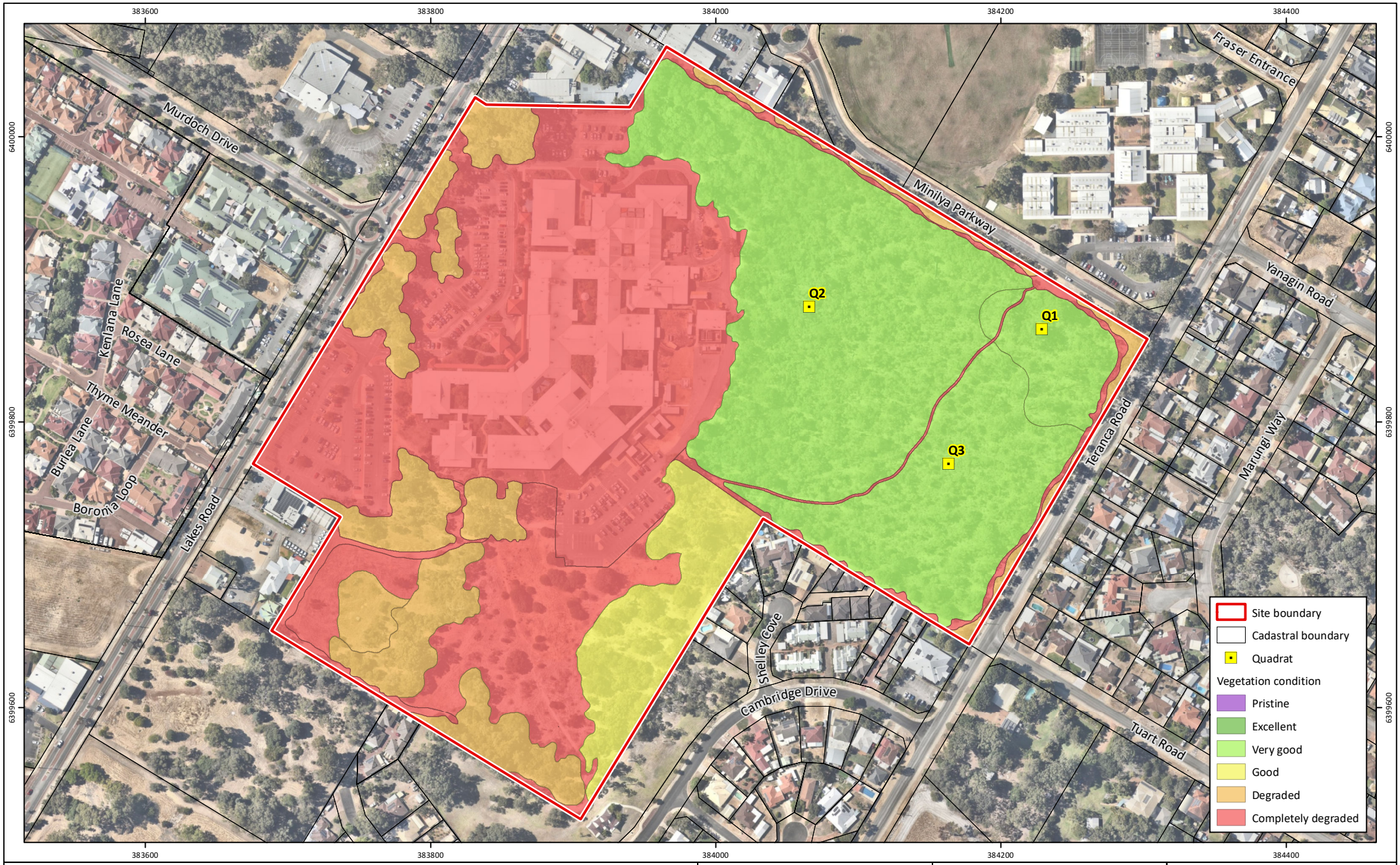

Figure 5: Vegetation Condition

Project:	Detailed Flora and Vegetation Assessment Peel Health Campus
Client:	Department of Finance

Plan Number:
EP21-128(04)--F18a

Drawn:	GAR
Date:	14/10/2024
Checked:	RAW
Approved:	TAA
Date:	14/10/2024

N

0 50 100 150
Metres

Scale: 1:3,500@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

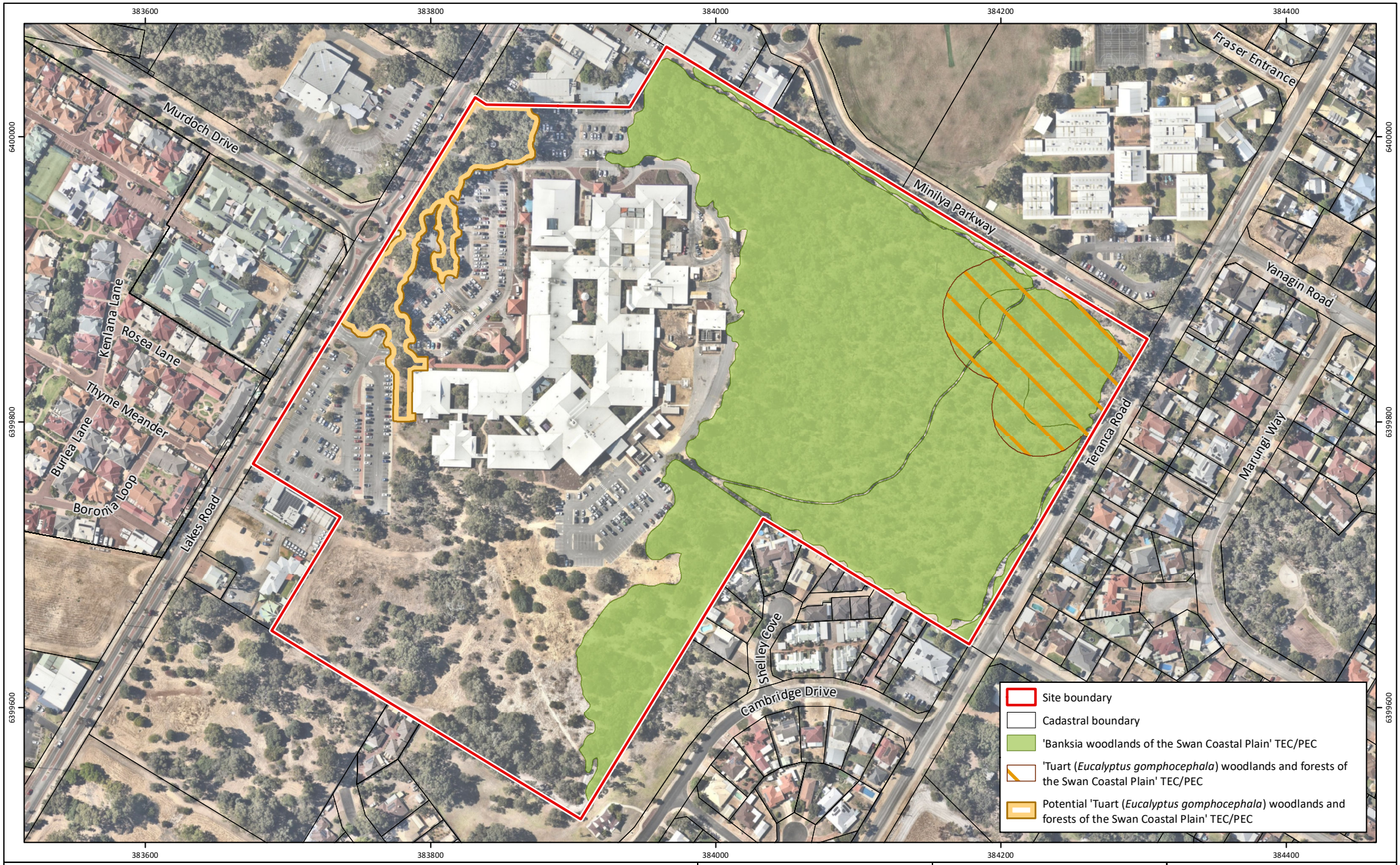

Figure 6: Threatened and Priority Ecological Communities

Project: Detailed Flora and Vegetation Assessment
Peel Health Campus
Client: Department of Finance

Plan Number:
EP21-128(04)--F19a

Drawn:	GAR
Date:	14/10/2024
Checked:	MS
Approved:	RAW
Date:	14/10/2024

N

0 50 100 150
Metres
Scale: 1:3,500@A4
GDA 1994 MGA Zone 50

emerge ASSOCIATES

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**.

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.

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).

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

Priority code	Description
P1	Priority One: Poorly known ecological communities 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.
P2	Priority Two: Poorly known ecological communities 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.
P3	Priority Three: Poorly known ecological communities (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: (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; (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. 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.
P4	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. (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. (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. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

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

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

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

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

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Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

Online references

Department of Environment and Energy (DoEE) 2018, Weeds of National Significance, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>.

Department of Primary Industries and Regional Development (DPIRD) 2020, The Western Australian Organism List (WAOL), < https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>.

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				
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Negligible
Synaphea sp. Pinjarra (R. Davis 6578)	CR	CR	P	White grey clayey sand on the edges of seasonally inundated low lying or swamp areas in dense wetland heath and shrubland.	Sep	Low
Synaphea sp. Serpentine (G.R. Brand 103)	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Negligible
Synaphea sp. Pinjarra Plain (A.S. George 17182)	EN	CR	P	White grey clayey sand on edges of seasonally inundated low lying areas.	Sep-Oct	Negligible
Caladenia huegelii	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	High
Drakaea elastica	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 Kunzea glabrescens.	late Sep-Oct/Nov, survey Jul-Aug	Low
Synaphea stenoloba	CR	EN	P	Sandy or sandy clay soils. Winter-wet flats, granite.	Aug-Oct	Low
Verticordia plumosa var. ananeotes	CR	EN	P	Sand in open jarrah woodland or sandy/clay soils with marri.	Nov-Dec	Negligible
Diuris purdiei	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)	Low
Andersonia gracilis	VU	EN	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Negligible

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Banksia mimica	VU	EN	P	Flat to gentle slopes in grey and white sand in open woodlands.	Dec-Jan	Negligible
Drakaea micrantha	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Negligible
Diuris drummondii	VU	VU	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Low
Diuris micrantha	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Low
Morelotia australiensis	VU	VU	P	Sand over clay, winter wet depressions and drainage lines.	Nov-Dec	Low
Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay. Swampy areas, winter wet lowlands.	May or Aug	Negligible
Grevillea bipinnatifida subsp. pagna	P1	-	P	Grey sandy clay and loam, ironstone. Seasonal wetlands, swamps, roadsides.	Aug or Oct-Nov	Negligible
Hibbertia acrotoma	P1	-	P	Brown loam with granite/laterite.	Aug-Sep/Oct	Negligible
Levenhookia preissii	P1	-	A	Grey or black, peaty sand. Swamps	Sep-Dec/Jan	Negligible
Ptilotus sericostachyus subsp. roseus	P1	-	P	Unknown. Seem to be associated with wetlands/rivers.	Sep-Dec	Negligible
Stachystemon exilis	P1	-	P	Low lying areas on sand.	Oct-Nov	Negligible
Acacia benthamii	P2	-	P	Sand, typically on limestone breakaways	Aug-Sept	Moderate
Cardamine paucijuga	P2	-	A	Winter wet areas, sand or clay	Sep-Oct	Low
Eryngium pinnatifidum subsp. Umbraphilum (G.J. Keighery 13967)	P2	-	A/P	Winter wet, clay, sand or limestone soils.	Oct-Nov	Low
Grevillea manglesii subsp. ornithopoda	P2	-	P	Red-brown loam over clay	Sep-Nov	Low
Johnsonia pubescens subsp. cygnorum	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep	Low
Phyllangium palustre	P2	-	A	Winter-wet claypans, low-lying seasonal wetlands on clay.	Oct-Nov	Low
Beyeria cinerea subsp. cinerea	P3	-	P	Sand, limestone in coastal areas.	May-Oct	Low

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Blennospora doliiformis	P3	-	A	Grey or red clay soils over ironstone. Seasonally-wet flats.	Oct-Nov	Low
Boronia capitata subsp. gracilis	P3	-	P	White/grey or black sand in winter-wet swamps, hillslopes.	Jun-Nov	Negligible
Calandrinia oraria	P3	-	A/P	Coastal dunes, in low heath, sand over limestone.	Aug-Oct	Low
Chamaescilla gibsonii	P3	-	P	Clay to sandy clay in winter-wet flats, shallow water-filled claypans.	Sep	Low
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Low
Dillwynia dillwynioides	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	Low
Eryngium pinnatifidum subsp. Palustre (G.J. Keighery 13459)	P3	-	P	Grey brown sand or clay in winter wet flats.	Sep-Nov	Negligible
Eryngium sp. Ferox (G.J. Keighery 16034)	P3	-	P	Winter wet flats on clay	Oct-Mar	Low
Hemigenia microphylla	P3	-	P	Sandy clay, peaty clay, granite. Winter-wet depressions.	Sep-Dec	Low
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Negligible
Lasiopetalum membranaceum	P3	-	P	Sand over limestone	Sep-Dec	Moderate
Meionectes tenuifolia	P3	-	P	Clay loam or grey sand in	Oct-Dec	Low
Myriophyllum echinatum	P3	-	A	Clay in winter-wet flats.	Nov	Low
Pimelea calcicola	P3	-	P	Sand, limestone on coastal	Sep-Nov	Negligible
Schoenus benthamii	P3	-	P	White, grey sand, sandy clay in winter wet flats and swamps.	Oct-Nov	Negligible
Schoenus pennisetis	P3	-	A	Grey or peaty sand in swamps	Aug-Sep	Low
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	-	A	Clay or sandy clay. Winter-wet flats.	Oct-Nov	Low
Sphaerolobium calcicola	P3	-	P	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Jun or Sep-Nov	Low
Stylidium aceratum	P3	-	A	Sandy soils in swamp heathland.	Oct-Nov	Low
Aponogeton hexatepalus	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Low
Caladenia speciosa	P4	-	PG	White, grey or black sand.	Sep-Oct	Moderate

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
Conostylis pauciflora subsp. pauciflora	P4	-	P	Grey sand, limestone. Hillslopes, consolidated dunes.	Aug-Oct	Low
Drosera occidentalis	P4	-	P	Flat, brown/white/yellow moist sand/clay/peat, often near swamps	Oct-Dec/Jan	Low
Eucalyptus rudis subsp. cratyantha	P4	-	P	Loam on flats and hillsides.	Jul-Sep	Low
Jacksonia sericea	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Moderate
Microtis quadrata	P4	-	PG	Sand, loam or peat in winter wet areas	Oct-Dec	Low
Ornduffia submersa	P4	-	A	Sandy clay in inundated wetland/creek.	Aug-Nov	Low
Parsonsia diaphanophleba	P4	-	P	Alluvial soils along rivers.	Jan-Feb or Apr-Sep	Low
Rumex drummondii	P4	-	P	Winter-wet disturbed areas.	Aug-Nov	Low
Schoenus natans	P4	-	A	Aquatic, in winter-wet depressions.	Oct	Low
Stylidium longitubum	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Low
Tripterococcus sp. Brachylobus (A.S. George 14234)	P4	-	P	Winter-wet areas on grey sand.	Oct-Feb	Low
Trithuria australis	P4	-	A	Seasonally wet areas. Edge of wetlands. Grey clay, clay over sand. Sand over laterite.	Oct-Nov	Low

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.

Appendix C

Conservation Significant Communities and Likelihood of Occurrence Assessment

Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP 26a	Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	TEC	CR	CR	Low
SCP07	Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. (1994))	TEC	VU	CR	Low
Tuart woodlands	Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain	TEC/ PEC	P3	CR	High
SCP19b	Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994).	TEC	CR	EN	Low
SCP22	Banksia ilicifolia woodlands	TEC/ PEC	P3	EN	Low
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain	TEC/ PEC	P3	EN	High
SCP21c	Low lying Banksia attenuata woodlands or shrublands	TEC/ PEC	P3	EN	Low
174	Empodisma peatlands of southwestern Australia	TEC	-	EN	Negligible
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	TEC/ PEC	P3	VU	Low
SCP15	Forests and woodlands of deep seasonal wetlands of the Swan Coastal Plain (floristic community type 15 as originally described in Gibson et al. (1994))	TEC	VU	-	Low
SCP29a	Coastal shrublands on shallow sands	PEC	P3	-	Low
SCP24	Northern Spearwood shrublands and woodlands	PEC	P3	-	Low
SCP25	Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands	PEC	P3	-	Low

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

Appendix D

Species List

Status	Species
*	*Acacia iteaphylla*
	Acacia pulchella var. glaberrima
	Acacia saligna
	Acacia stenoptera
	Allocasuarina fraseriana
	Ammothryon grandiflorum
	Amphipogon turbinatus
	Anigozanthos manglesii
	Arnocrinum preissii
	Astroloma pallidum
	Austrostipa flavescens
	Banksia attenuata
	Banksia grandis
	Banksia menziesii
	Boronia crenulata
	Bossiaea eriocarpa
*	*Briza maxima*
*	*Briza minor*
	Burchardia congesta
	Caesia micrantha
	Casuarina humilis
	Comesperma confertum
	Conostephium pendulum
	Conostylis aculeata
	Conostylis juncea
	Corynotheca micrantha
*	*Cynodon dactylon*
	Dampiera linearis
	Dasypogon bromeliifolius
	Desmocladus fascicularis
	Desmocladus flexuosus
	Dianella revoluta
	Dichopogon capillipes
*	*Ehrharta calycina*
	Eryngium pinnatifidum
	Eucalyptus gomphocephala
	Eucalyptus marginata
Pl	*Eucalyptus sp.*
	Gastrolobium capitatum
	Gompholobium aristatum
	Gompholobium tomentosum
	Grevillea crithmifolia
	Haemodorum laxum
	Haemodorum spicatum
	Hardenbergia comptoniana
	Hemiandra pungens
	Hibbertia acerosa
	Hibbertia cuneiformis

Status	Species
	Hibbertia hypericoides
	Hovea trisperma
	Hybanthus calycinus
	Hypochaeris glabra
	Isotropis cuneifolia
	Jacksonia furcellata
	Jacksonia sternbergiana
	Kennedia prostrata
	Kunzea glabrescens
	Laxmannia squarrosa
	Lepidosperma squamatum
	Leucopogon parviflorus
	Lobelia tenuior
	Lomandra ?caespitosa
	Lomandra ?nigricans
	Lomandra hermaphrodita
	Lomandra sericea
	Macrozamia riedlei
	Microtis media
	Opercularia vaginata
	Orobanche minor
	Pattersonia occidentalis
	Persoonia saccata
	Petrophile linearis
	Phlebocarya ciliata
	Pimelea sylvestris
	Podolepis gracilis
	Pterostylis sp.
*	*Romulea rosea*
	Rytidosperma occidentale
	Scaevola repens var. repens
	Synaphea spinulosa
	Tetraria octandra
	Thysanotus multiflorus
	Thysanotus sparteus
	Trichocline spathulata
*	*Ursinia anthemoides*
*	*Wahlenbergia capensis*
	Xanthorrhoea sp.
	Xanthosia huegelii
	Xylomelum occidentale

* indicates non-native, Pl indicates planted

Appendix E

Sample Data

Vegetation Sample Data

Sample Name: Q1

Project no.: ep21-128
Date: 24-11-2021, 23/10/2023
Author: RAO,

Status Non-permanent
Q1: Page 1 of 3

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	384228.758	NW corner northing:	6399865.463
Altitude (m):	3	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - weeds
Soil type/texture	sand/	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	grey/
Litter:	30% (leaves,twigs,branches)	Vegetation condition:	very good

Vegetation Sample Data

Sample Name: Q1

Project no.: ep21-128
Date: 24-11-2021, 23/10/2023 **Status** Non-permanent
Author: RAO, Q1: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. glaberrima	5
	Acacia stenoptera	1
	Ammothryon grandiflorum	5
	Astroloma pallidum	0.1
	Banksia attenuata	20
	Boronia crenulata	0.1
*	*Briza maxima*	0.1
	Burchardia congesta	0.1
	Conostephium pendulum	1
	Conostylis aculeata	1
	Conostylis juncea	0.1
	Corynotheca micrantha	5
	Dampiera linearis	0.1
	Dasypogon bromeliifolius	1
	Desmocladus flexuosus	15
	Dianella revoluta	1
	Ehrharta calycina	50
	Eucalyptus gomphocephala	60
	Gompholobium aristatum	10
	Gompholobium tomentosum	1
	Grevillea crithmifolia	0.1
	Hardenbergia comptoniana	0.1
	Hibbertia hypericoides	2
	Hovea trisperma	0.1
*	*Hypochaeris glabra*	0.1
	Isotropis cuneifolia	0.1
	Jacksonia sternbergiana	10
	Kennedia prostrata	3
	Lepidosperma squamatum	0.1
	Lomandra ?caespitosa	0.1
	Lomandra hermaphrodita	0.1
	Lomandra sericea	1
	Macrozamia riedlei	1
	Morelotia octandra	2
	Persoonia saccata	1
	Phlebocarya ciliata	2

Vegetation Sample Data

Sample Name: Q1

Project no.: ep21-128
Date: 0/01/1900 **Status** Non-permanent
Author: RAO, Q1: Page 2 of 3

	Scaevola repens var. repens	1
	Synaphea spinulosa	2
*	*Ursinia anthemoides*	1
	Xanthorrhoea sp.	2
	Xanthosia huegelii	5

Vegetation Sample Data

Sample Name: Q2

Project no.: ep21-128
Date: 24-11-2021, 23/10/2023 **Status** Non-permanent
Author: RAO, Q2: Page 1 of 3

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	384065.519	NW corner northing:	6399881.091
Altitude (m):	4	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	low -
Soil type/texture	sand/	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	grey/
Litter:	25% (,,)	Vegetation condition:	very good

Vegetation Sample Data

Sample Name: Q2

Project no.: ep21-128
Date: 24-11-2021, 23/10/2023 **Status** Non-permanent
Author: RAO, Q2: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia saligna	3
	Acacia stenoptera	0.1
	Allocasuarina fraseriana	5
	Ammothryon grandiflorum	10
	Arnocrinum preissii	0.1
	Banksia grandis	10
*	*Briza maxima*	0.1
	Burchardia congesta	0.1
	Conostylis aculeata	0.1
	Conostylis juncea	0.1
	Corynotheca micrantha	0.1
	Dasypogon bromeliifolius	0.1
	Desmocladus flexuosus	1
	Dianella revoluta	0.1
	Dichopogon capillipes	0.1
	Ehrharta calycina	1
	Eucalyptus marginata	5
	Gompholobium aristatum	15
	Gompholobium tomentosum	0.1
	Hemiandra pungens	0.1
	Hibbertia hypericoides	1
	Hovea trisperma	0.1
	Hybanthus calycinus	0.1
*	*Hypochaeris glabra*	0.1
	Jacksonia furcellata	2
	Jacksonia sternbergiana	1
	Kennedia prostrata	0.1
	Kunzea glabrescens	5
	Lepidosperma squamatum	0.1
	Lomandra ?nigricans	0.1
	Lomandra hermaphrodita	0.1
	Lomandra sericea	0.1
	Microtis media	0.1
	Morelotia octandra	5
	Petrophile linearis	0.1
	Phlebocarya ciliata	1

Vegetation Sample Data

Sample Name: Q2

Project no.: ep21-128
Date: 24-11-2021, 23/10/2023 **Status** Non-permanent
Author: RAO, Q2: Page 2 of 3

Pimelea sylvestris	3
Scaevola repens var. repens	0.1
Synaphea spinulosa	0.1
Xanthosia huegelii	5
Xylomelum occidentale	0.1

Vegetation Sample Data

Sample Name: Q3

Project no.: ep21-128
Date: 23/10/2023 **Status** Non-permanent
Author: RAO, Q3: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	384163.353	NW corner northing:	6399770.903
Altitude (m):	9	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - clearing or fire check?, foxes
Soil type/texture	sand/	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	grey/
Litter:	15% (leaves,twigs,branches)	Vegetation condition:	very good/good

Vegetation Sample Data

Sample Name: Q3

Project no.: ep21-128
Date: 23/10/2023 **Status** Non-permanent
Author: RAO, Q3: Page 2 of 2

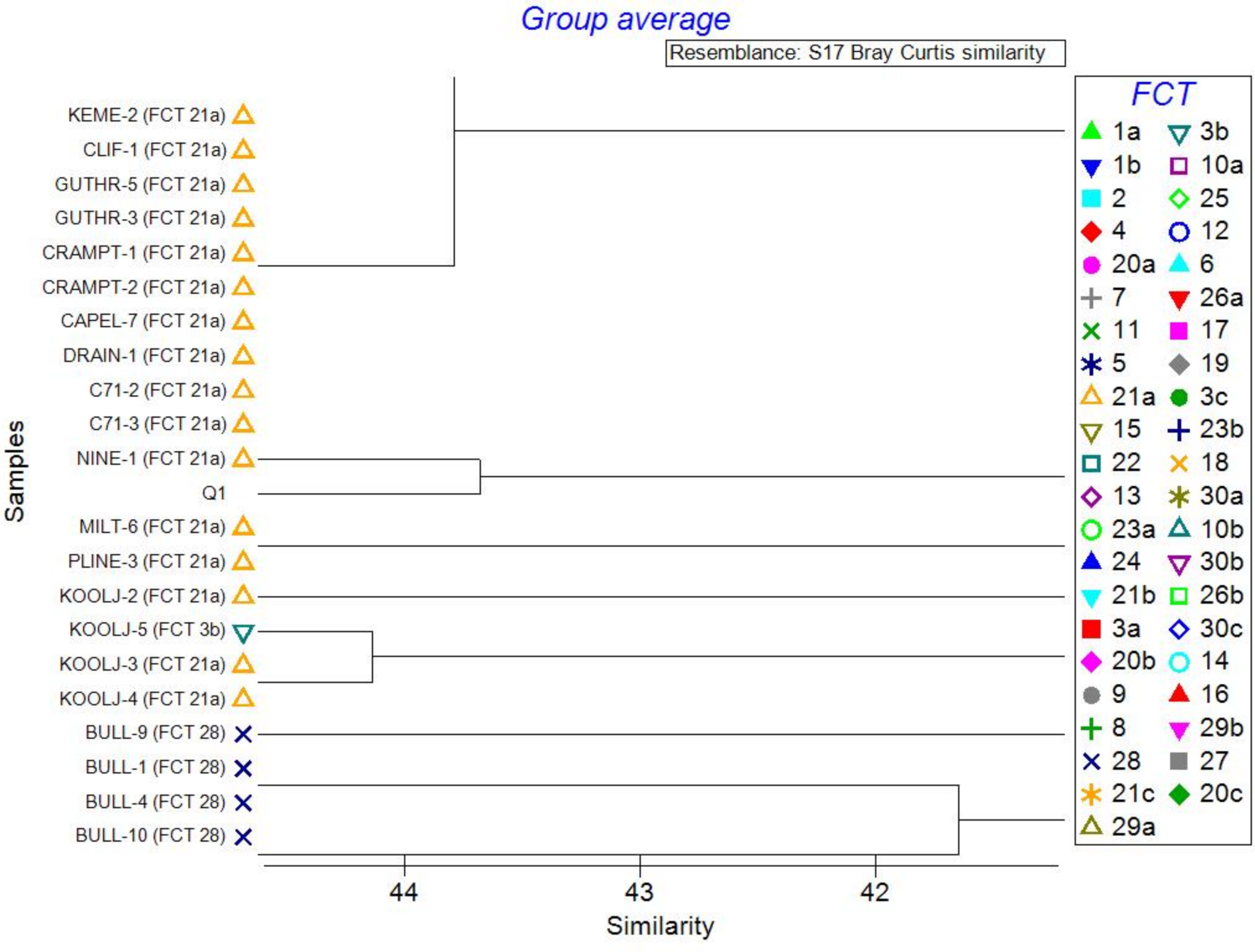
Species Data

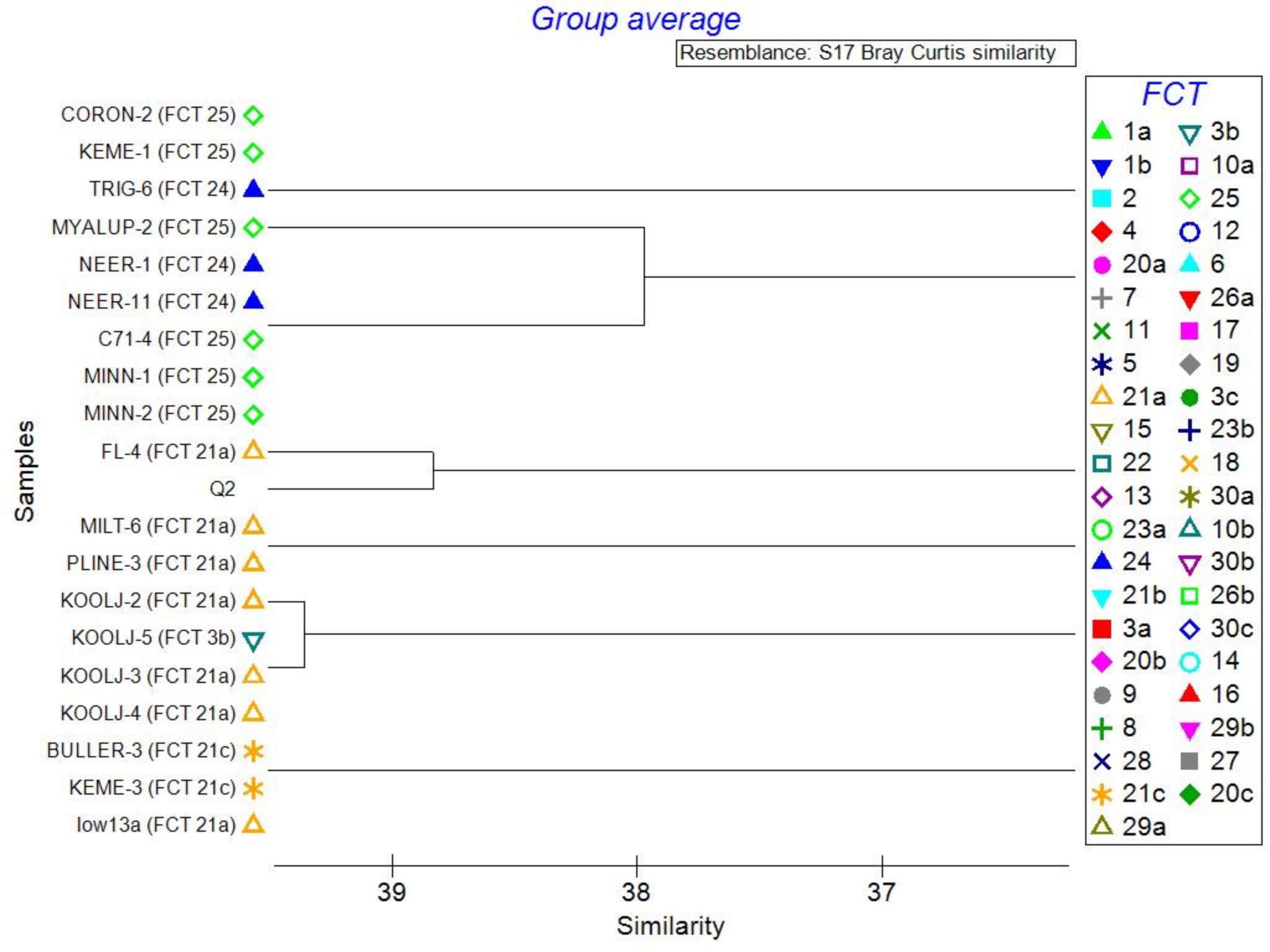
* denotes non-native species

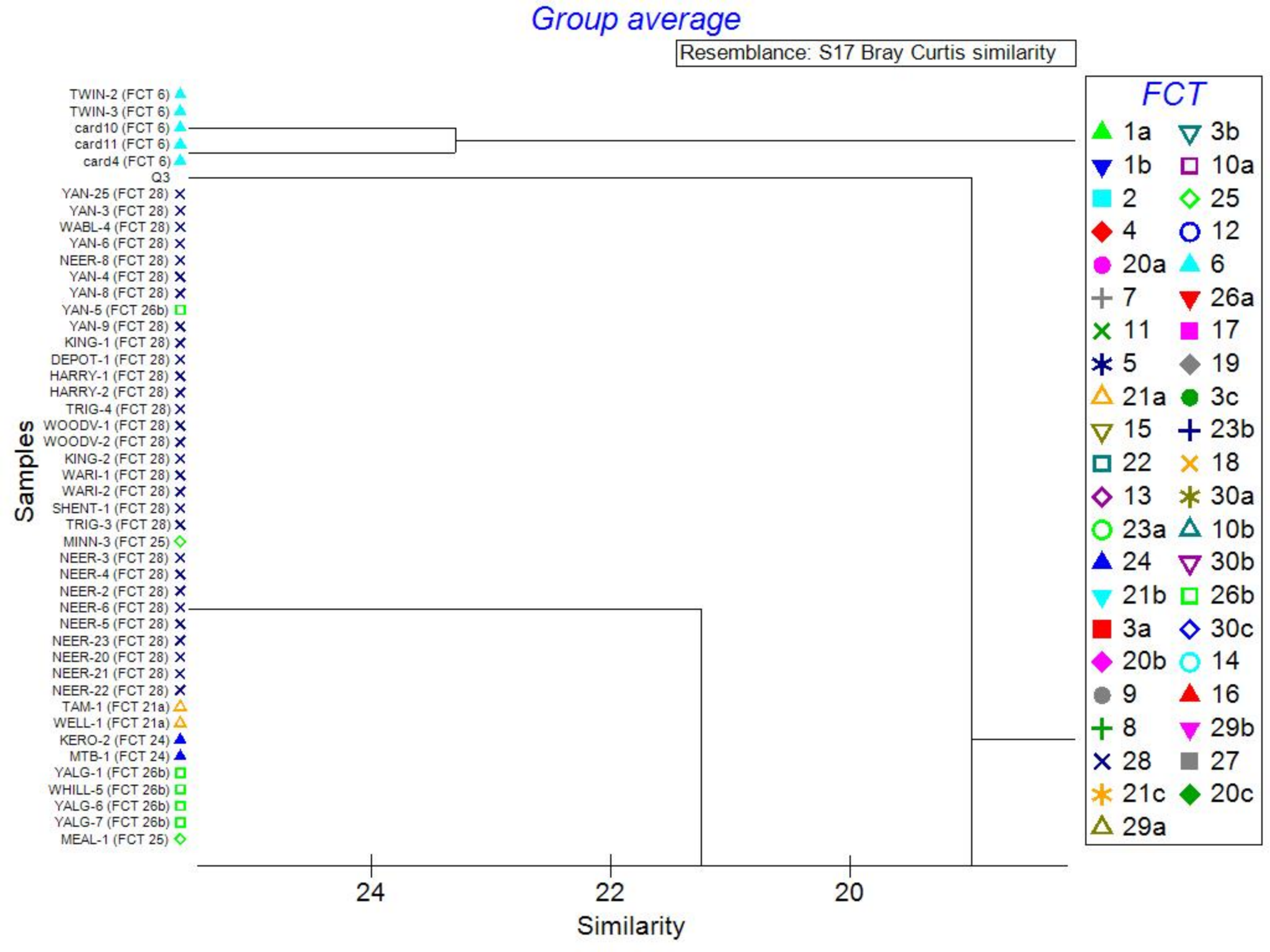
Status	Confirmed name	Cover (%)
	Acacia stenoptera	1
	Allocasuarina fraseriana	10
	Ammothryon grandiflorum	2
	Astroloma pallidum	1
	Banksia attenuata	5
	Bossiaea eriocarpa	2
	Burchardia congesta	0.1
	Caesia micrantha	0.1
	Conostylis aculeata	0.1
	Corynotheca micrantha	10
	Dianella revoluta	0.1
	Ehrharta calycina	10
	Gompholobium aristatum	1
	Hibbertia hypericoides	10
	Hovea trisperma	0.1
	Hybanthus calycinus	5
	Isotropis cuneifolia	0.1
	Laxmannia squarrosa	0.1
	Lepidosperma squamatum	0.1
	Leucopogon parviflorus	1
	Lomandra ?caespitosa	0.1
	Microtis media	0.1
	Morelotia octandra	3
	Opercularia vaginata	5
	Persoonia saccata	2
	Phlebocarya ciliata	5
	Podolepis gracilis	0.1
	Scaevola repens var. repens	0.1
	Synaphea spinulosa	2
*	*Ursinia anthemoides*	0.1
	Xanthosia huegelii	1
	Xylomelum occidentale	2

Appendix F

Cluster Dendrograms


Group average
Resemblance: S17 Bray Curtis similarity
KEME-2 (FCT 21a)
CLIF-1 (FCT 21a)
GUTHR-5 (FCT 21a)
GUTHR-3 (FCT 21a)
CRAMPT-1 (FCT 21a)
CRAMPT-2 (FCT 21a)
CAPEL-7 (FCT 21a)
DRAIN-1 (FCT 21a)
C71-2 (FCT 21a)
C71-3 (FCT 21a)
NINE-1 (FCT 21a)
Q1
MILT-6 (FCT 21a)
PLINE-3 (FCT 21a)
KOOLJ-2 (FCT 21a)
KOOLJ-5 (FCT 3b)
KOOLJ-3 (FCT 21a)
KOOLJ-4 (FCT 21a)
BULL-9 (FCT 28)
BULL-1 (FCT 28)
BULL-4 (FCT 28)
BULL-10 (FCT 28)
Samples
44
43
42
Similarity
FCT
1a
3b
1b
10a
2
25
4
12
20a
6
7
26a
11
17
5
19
21a
3c
15
23b
22
18
13
30a
23a
10b
24
30b
21b
26b
3a
30c
20b
14
9
16
8
29b
28
27
21c
20c
29a


Group average
Resemblance: S17 Bray Curtis similarity
CORON-2 (FCT 25)
KEME-1 (FCT 25)
TRIG-6 (FCT 24)
MYALUP-2 (FCT 25)
NEER-1 (FCT 24)
NEER-11 (FCT 24)
C71-4 (FCT 25)
MINN-1 (FCT 25)
MINN-2 (FCT 25)
FL-4 (FCT 21a)
Q2
MILT-6 (FCT 21a)
PLINE-3 (FCT 21a)
KOOLJ-2 (FCT 21a)
KOOLJ-5 (FCT 3b)
KOOLJ-3 (FCT 21a)
KOOLJ-4 (FCT 21a)
BULLER-3 (FCT 21c)
KEME-3 (FCT 21c)
low13a (FCT 21a)
Samples
39
38
37
Similarity
FCT
1a
3b
1b
10a
2
25
4
12
20a
6
7
26a
11
17
5
19
21a
3c
15
23b
22
18
13
30a
23a
10b
24
30b
21b
26b
3a
30c
20b
14
9
16
8
29b
28
27
21c
20c
29a


Group average
Resemblance: S17 Bray Curtis similarity
TWIN-2 (FCT 6)
TWIN-3 (FCT 6)
card10 (FCT 6)
card11 (FCT 6)
card4 (FCT 6)
Q3
YAN-25 (FCT 28)
YAN-3 (FCT 28)
WABL-4 (FCT 28)
YAN-6 (FCT 28)
NEER-8 (FCT 28)
YAN-4 (FCT 28)
YAN-8 (FCT 28)
YAN-5 (FCT 26b)
YAN-9 (FCT 28)
KING-1 (FCT 28)
DEPOT-1 (FCT 28)
HARRY-1 (FCT 28)
HARRY-2 (FCT 28)
TRIG-4 (FCT 28)
WOODV-1 (FCT 28)
WOODV-2 (FCT 28)
KING-2 (FCT 28)
WARI-1 (FCT 28)
WARI-2 (FCT 28)
SHENT-1 (FCT 28)
TRIG-3 (FCT 28)
MINN-3 (FCT 25)
NEER-3 (FCT 28)
NEER-4 (FCT 28)
NEER-2 (FCT 28)
NEER-6 (FCT 28)
NEER-5 (FCT 28)
NEER-23 (FCT 28)
NEER-20 (FCT 28)
NEER-21 (FCT 28)
NEER-22 (FCT 28)
TAM-1 (FCT 21a)
WELL-1 (FCT 21a)
KERO-2 (FCT 24)
MTB-1 (FCT 24)
YALG-1 (FCT 26b)
WHILL-5 (FCT 26b)
YALG-6 (FCT 26b)
YALG-7 (FCT 26b)
MEAL-1 (FCT 25)
Samples
24
22
20
Similarity
FCT
1a
3b
1b
10a
2
25
4
12
20a
6
7
26a
11
17
5
19
21a
3c
15
23b
22
18
13
30a
23a
10b
24
30b
21b
26b
3a
30c
20b
14
9
16
8
29b
28
27
21c
20c
29a