Spring Flora and Vegetation Assessment

Lot 4131 Smiths Beach Road, Yallingup

Project No: EP18-085(05)

Prepared for Smiths 2014 Pty Ltd
March 2019

Document Control

Doc name:	Spring Flora and Vegetation Assessment Lot 4131 Smiths Beach Road, Yallingup				
Doc no.:	**EP18-085(05)--004**				
Version	**Date**	**Author**		**Reviewer**	
1	March 2019	Rachel Omodei	RAO	Tom Atkinson	TAA
		Sarah Paul	SKP	Kirsten Knox	KK
	Issued for client review				

Executive Summary

Smiths 2014 Pty Ltd engaged Emerge Associates (Emerge) to undertake a spring flora and vegetation survey within Lot 431 Smiths Beach Road in Yallingup (referred to herein as 'the site'). The site is approximately 40.53 hectares (ha) in size and is bound by Smiths Beach Road to the east and north, the Leeuwin-Naturaliste National Park to the south and unallocated crown land to the west.

Two botanists from Emerge Associates visited the site on 17 August 2018 and 26-28 November 2018 to conduct a detailed flora and vegetation survey. During the survey targeted searches were conducted for 'threatened' and 'priority' flora and an assessment was made on the type, condition and values of vegetation across the site. A regional survey was also undertaken to better understand the extent of the 'low shrublands on acidic grey-brown sands' PEC across the Leeuwin-Naturaliste Ridge.

Outcomes of the survey include the following:

- Remnant native vegetation is present across 37.97 ha of the site.
- Non-native vegetation is present across 2.56 ha of the site.
- A total of 164 native and 50 non-native (weed) species were recorded in the site.
- Approximately 210 individuals of the priority four species *banksia sessilis* var. *cordata* were recorded in the site.
- No other threatened or priority flora species were recorded within the site or are considered highly likely to occur.
- The native vegetation within the site was classified into 13 plant communities that are present in 'excellent', 'very good', 'very good to good', 'good', 'degraded' and 'completely degraded' condition.
- No threatened ecological communities (TECs) were found to occur within the site, but two State listed priority ecological communities (PECs) were recorded. The 9.25 ha of **KcSg** vegetation was considered to represent the 'low shrublands on acidic grey-brown sands' PEC. The 4.05 ha of plant communities **MlKc** and **MlDr** considered to represent the '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC. The occurrences of both PECs were located within the western portion of the site close to the coastline. All vegetation representing these PECs within the site was in excellent condition.
- The 'low shrublands on acidic grey-brown sands' PEC was found at six locations from the north-western portion of the Leeuwin-Naturaliste Ridge north of Gracetown, to just south of Yallingup.
- Native vegetation within the site is locally and regionally significant due to the fact that it provides habitat for threatened black cockatoo species and western ringtail possums.

This page has been left blank intentionally.

Table of Contents

1 Introduction 1

1.1 Project background 1
1.2 Purpose and scope of work 1

2 Background 2

2.1 Planning and approval context 2
2.2 Environmental context 2
2.2.1 Climate 2
2.2.2 Geomorphology and soils 3
2.2.3 Topography 3
2.2.4 Hydrology and wetlands 4
2.2.5 Regional vegetation 4
2.2.6 Historic land use 5
2.3 Significant flora and vegetation 6
2.3.1 Threatened and priority flora 6
2.3.2 Threatened and priority ecological communities 9
2.3.3 Local and regional significance 11
2.3.4 Weeds 11
2.4 Land use planning considerations 12
2.4.1 DBCA managed or legislated lands 12
2.4.2 Environmentally sensitive areas 12
2.4.3 Ecological linkages 13
2.5 Previous flora surveys 13

3 Methods 14

3.1 Site survey 14
3.1.1 Field survey 14
3.1.2 Flora 14
3.1.3 Vegetation 14
3.2 Regional PEC survey 15
3.2.1 Rationale and desktop assessment 15
3.2.2 Field survey 17
3.3 Mapping and data analysis 17
3.3.1 Plant community identification and description 17
3.3.2 Threatened and priority ecological communities 17
3.3.3 Species accumulation curve 18
3.4 Survey limitations 18

4 Results 20

4.1 Site survey 20
4.1.1 General site conditions 20
4.1.2 Flora 20
4.1.2.1 Threatened and priority flora 20
4.1.2.2 Locally and regionally significant flora 21
4.1.2.3 Declared pests 21
4.1.3 Vegetation 21
4.1.3.1 Plant communities 21
4.1.3.2 Vegetation condition 29
4.1.4 Threatened and priority ecological communities 30
4.1.5 Locally and regionally significant vegetation 31
4.2 Species richness and sampling adequacy 31
4.3 Regional PEC survey 32

5 Discussion 34

5.1 Threatened and priority flora 34
5.2 Vegetation condition 35
5.3 Threatened and priority ecological communities 35
5.3.1 Regional context for 'low shrublands on acidic grey-brown sands' PEC 36
5.3.2 Regional context for '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC 36
5.4 Fauna habitat 37

6 Conclusions 38

7 References 39

7.1 General references 39
7.2 Online references 41

List of Tables

Table 1: Significant flora species known or likely to occur within 10 km of the site (species considered to be potentially present within the site shaded green). 7
Table 2: TECs and PECs known or likely to occur within the region (communities considered to be potentially present within the site shaded green). 10
Table 3: Vegetation condition scale applied during the field assessment 15
Table 4: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). 18
Table 5: Plant communities identified within the site 21
Table 6: Vegetation condition categories within the site 30

List of Plates

Plate 1: Regional vegetation association mapping showing the three different vegetation associations within the site (Beard et al. 2013). 5
Plate 2: Regional vegetation complex mapping showing the three different vegetation complexes within the site (DBCA 2019). 16
Plate 3: Plant community **AfPe** in very good-good condition. 22
Plate 4: Plant community **AhHe** in very good condition. 23
Plate 5: Plant community **AsDc** in very good condition 23
Plate 6: Plant community **AsHh** in good condition. 24
Plate 7: Plant community **BaMrXp** in very good condition 24
Plate 8: Plant community **CcHh** in very good condition 25
Plate 9: Plant community **DciDcL** in very good-good condition. 25
Plate 10: Plant community **KcSg** in excellent condition 26
Plate 11: Plant community **KcDcPp** in excellent condition. 26
Plate 12: Plant community **MhGl** in excellent condition 27
Plate 13: Plant community **MlDr** in excellent condition 27
Plate 14: Plant community **MlKc** in excellent condition 28
Plate 15: Plant community **NfCcXp** in very good-good condition 28
Plate 16: Non-native vegetation on cleared track in completely degraded condition. 29
Plate 17: White-tailed black cockatoo observed foraging on vegetation during the survey. 31
Plate 18: Species accumulation curve derived from sample data (y = 52.3ln(x) + 6.7354 R^2 = 0.9878 32

Figures

Figure 1: Site Location
Figure 2: Environmental Features
Figure 3: Conservation Significant Flora and Sample Locations
Figure 4: Regional Survey Locations
Figure 5: Plant Communities
Figure 6: Vegetation Condition
Figure 7: Priority Ecological Communities in the Site
Figure 8: Priority Ecological Community in the Region

Appendices

Appendix A

Additional Background Information

Appendix B

Species List

Appendix C

Sample Data

This page has been left blank intentionally.

Abbreviation Tables

Table A1: Abbreviations – Organisations

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

Table A2: Abbreviations – General terms

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

Table A3: Abbreviations –Legislation

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

Table A4: Abbreviations – planning

Planning terms	
LPS	Local planning scheme

Table A5: Abbreviations – units of measurement

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

1 Introduction

1.1 Project background

Smiths 2014 Pty Ltd intends to develop part of Lot 4131 Smiths Beach Road in Yallingup for tourism purposes. This lot (referred to herein as 'the site') is located approximately 240 kilometres (km) south of the Perth Central Business District within the City of Busselton and is zoned 'tourism' under the City of Busselton *Local Planning Scheme (LPS) No. 21.*

The site is approximately 40.53 hectares (ha) in size and is bound by Smiths Beach Road to the east and north, the Leeuwin-Naturaliste National Park to the south and unallocated crown land to the west. The location and extent of the site is shown in **Figure 1**.

1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Smiths 2014 Pty Ltd to provide environmental consultancy services to support the development process for the site. The purpose of this survey is to provide sufficient information on the flora and vegetation values within the site to inform this process.

The scope of work was specifically to undertake a spring flora and vegetation assessment to the standard required of a detailed survey in accordance with the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

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

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of plant communities and vegetation condition.
- Identification of conservation significant flora and vegetation.
- Regional survey for the 'low shrublands on acidic grey-brown sands' PEC.
- Documentation of the desktop assessment, survey methodology and results into a report.

2 Background

2.1 Planning and approval context

The site has historically been subject to both Commonwealth and State environmental assessments, pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Environmental Protection Act 1986* (EP Act) respectively. These assessments were completed in response to a proposed development of the site for a range of tourism land uses including accommodation and residential lots (refer EPBC 2017/3483 and EPA assessment 1597). The proposed development was granted both State (15 June 2010) and Commonwealth (3 March 2011) environmental approval as part of these assessment processes.

2.2 Environmental context

2.2.1 Climate

Climate has a strong influence on the types of vegetation that grow in a region and the life cycles of the flora present. It is therefore critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

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

An average of 916.5 millimetres (mm) of rainfall is recorded annually from the Glenmore weather station, which is the closest weather station, located approximately 2.3 km south of the site. The majority of this rainfall is received between the months of May and August. Mean maximum temperatures at the Cape Naturaliste station, which is the nearest temperature recording station approximately 13.7 km north of the site, range from 16.4^{o}C in July to 25.9^{o}C in February, while mean minimum temperatures range from 10.1^{o}C in August to 15.7^{o}C in February (BoM 2018).

A total of 902.5 mm of rain was recorded from May to November 2019 (BOM 2019) indicating sufficient seasonal rainfall occurred at the site to promote the growth of flora species prior to this survey.

2.2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site lies in the Jarrah Forest bioregion and within the Southern Jarrah Forest subregion, as defined by the *Interim Biogeographic Regionalisation of Australia* (IBRA) (Environment Australia 2000). The Southern Jarrah Forest subregion extends from Collie in the north to Yallingup in the west and Albany in the south east. This subregion comprises the southern part of the Darling Plateau, where it broadens and slopes gently to the southern coastline, being dissected by multiple rivers (Beard 1990). Generally, the soils within the Southern Jarrah Forest subregion comprise laterite gravels but clay/loam soils occur in the eastern portion where the Plateau is flatter and drainage is poor (DEC 2002). The north-western portion of the Southern Jarrah Forest subregion comprises a combination of limestone and granites as it lies on the northern tip of the Leeuwin-Naturaliste Ridge.

The Department of Primary Industries and Regional Development (DPIRD) has compiled data from various surveys to produce a soil landscape mapping dataset for Western Australia (DPIRD 2018), which places the site within the following four soil landscapes:

- 'Wilyabrup granitic headland phase' which occurs in the western portion of the site and is described as 'areas on the west coast dominated by granitic outcrop'.
- 'Wilyabrup exposed slopes phase' which occurs in the central and north-eastern portions of the site and is described as 'low slopes (gradients generally 5-10%) exposed to strong winds off ocean'.
- 'Gracetown exposed slopes phase' which occurs in the south central portion of the site and is described as 'moderate slopes (gradients 10-15%) on the west coast exposed to prevailing wind directly off the ocean, with deep and shallow yellow brown siliceous sands over limestone (i.e. Spearwood Sands).'
- 'Wilyabrup gentle slope phase' which occurs in the south-eastern portion of the site and is described as 'gradients 5-10%'.

The site occurs on the Leeuwin-Naturaliste Ridge, which is a unique geological feature approximately 93 km in length, between Cape Naturaliste in the north and Cape Leeuwin in the south.

2.2.3 Topography

The elevation of the site ranges from 55 m in relation to the Australian height datum (mAHD) on the central southern side of the site to 5 mAHD on the north western side of the site (WALIA 2019).

2.2.4 Hydrology and wetlands

Wetlands include "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al*. 1996).

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

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

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

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows that no wetland or water related features occur in the site.

2.2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns of distribution due to a variety of factors such as climate, geomorphology, soils and topography. The south-west of Western Australia is internationally recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types. The Southern Jarrah Forest IBRA subregion is characterised as mainly containing *Eucalyptus marginata* (jarrah) forest on lateritic soils of the Plateau and on the loam soils of the valleys, with *Corymbia calophylla* (marri) – *Eucalyptus wandoo* (wandoo) woodland on the drier laterite-free soils (Beard 1990).

Beard *et al.* (2013) mapping of pre-European vegetation shows the following vegetation associations in the site:

- 'Chapman 37' over the majority of the site, which is described as 'shrublands, teatree thicket' (Beard *et al.* 2013)
- 'Chapman 990' in very small areas in the eastern and western portions of the site, which is described as 'low forest: peppermint (Agonis flexuosa)' (Beard *et al.* 2013)
- 'Chapman 1180' in the south eastern and north western portions of the site, which is described as 'shrublands, *Calothamnus quadrifidus* and *Hakea trifurcata'* (Beard *et al.* 2013)

The extent of vegetation associations as assigned by Beard *et al.* (2013) within the site is shown in **Plate 1**

Plate 1: Regional vegetation association mapping showing the three different vegetation associations within the site (Beard et al. 2013).

'Chapman 37' has 50.38% of its pre-European extent remaining on the Southern Jarrah Forest subregion with 17.77% protected for conservation purposes (Government of Western Australia 2018). 'Chapman 990' has 77.14% of its pre-European extent remaining on the Southern Jarrah Forest subregion with 23.11% protected for conservation purposes (Government of Western Australia 2018). 'Chapman 1180' has 94.03% of its pre-European extent remaining on the Southern Jarrah Forest subregion with 76.28% protected for conservation purposes (Government of Western Australia 2018).

Studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). The national objectives and targets for biodiversity conservation (Environment Australia 2001) established an objective of retaining 30% of the original extent of each vegetation complex. The percentage remaining of the three regional vegetation associations mapped in the site exceeds 30%. However, less than 30% of the pre-European Chapman 37 and Chapman 990 vegetation associations are protected for conservation.

2.2.6 Historic land use

Review of historical images available from 1996 (WALIA 2019) onwards shows that the site supported intact native vegetation from 1996 to 2019. Some disturbance in the form of vegetation clearing (less dense vegetation) is visible in the central and north eastern portions of the site in imagery from 2001, and has appeared to regenerate in the intervening period. New tracks are visible within the eastern portion of the site in imagery from 2018.

2.3 Significant flora and vegetation

2.3.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on species listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment and Energy.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Threatened flora listed under the EPBC Act and/or BC Act are further categorised as 'critically endangered', 'endangered' or 'vulnerable' depending on their level of threat.

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

Further information on threatened and priority species and their categories is provided in **Appendix A**.

A search was conducted for threatened and priority flora within a 10 km radius of the site using the *Protected Matters Search Tool* (DoEE 2019a), *NatureMap* (DPaW 2019) and DBCA's threatened and priority flora database (reference no. 27-1218FL). A total of 17 threatened and 16 priority flora species were identified as potentially occurring in the wider local area as listed in **Table 1**. None of the recorded locations are present within the site.

Of the flora species potentially occurring in the local area, only those with habitat preferences of granitic, limestone or sandy coastal soils were deemed likely to occur in the site. On this basis 11 threatened flora species and nine priority flora species were identified as having potential to occur within the site (shaded green in **Table 1**).

Table 1: Significant flora species known or likely to occur within 10 km of the site (species considered to be potentially present within the site shaded green).

Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
Brachyscias verecundus	T	CE	A	Granite outcrops.	Dec	**Possible**
Gastrolobium argyrotrichum	T	CE	P	Granite rocks, slopes	Oct-Nov	**Possible**
Banksia nivea subsp. *uliginosa*	T	E	P	Sandy clay, gravel.	Aug-Sep	**Possible**
Caladenia busselliana	T	E	PG	Sandy loam and winter-wet swamps.	Sep-Oct	**Unlikely**
Caladenia caesarea subsp. *maritima*	T	E	PG	Loam, granite and rock outcrops.	Aug-Sep	**Possible**
Caladenia excelsa	T	E	PG	White, grey or brown sand, sandy loam.	Sep-Oct	**Possible**
Caladenia huegelii	T	E	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	**Possible**
Drakaea elastica	T	E	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps.	Sep-Oct	**Unlikely**
Eucalyptus x phylacis	T	E	P	Laterite, loam over granite in coastal area	May	**Possible**
Gastrolobium papilio	T	E	P	Sandy clay over ironstone and laterite. Flat plains.	Oct-Dec	**Unlikely**
Lambertia echinata subsp. occidentalis	T	E	P	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Feb or Apr or Dec	**Unlikely**
Petrophile latericola	T	E	P	Red lateritic clay. Winter-wet flats.	Nov	**Unlikely**
Sphenotoma drummondii	T	E	P	Stony or shallow soils over granite or quartzite.	Sep-Dec	**Possible**
Wurmbea calcicola	T	E	P	Coastal limestone cliffs.	Jun	**Possible**
Banksia squarrosa subsp. *argillacea*	T	V	P	White/grey sand, gravelly clay or loam.	Jun-Nov	**Possible**
Chamelaucium sp. S coastal plain (R.D. Royce 4872)	T	V	P	Flat. Well drained, grey sandy loam.	Jul-Nov	**Possible**
Drakaea micrantha	T	V	PG	Open sandy patches often adjacent to winter-wet swamps.	Sep-early Oct	**Unlikely**

Table 1: Significant flora species known or likely to occur within 10 km of the site (cont.)

Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
Caladenia nivalis	P2	-	PG	Sand, loam, granite and coastal granite.	Sep-Oct	**Possible**
Caladenia viridescens	P2	-	PG	Loam, grey sand.	Sep-Oct	**Possible**
Hydrocotyle sp. Hamelinensis (G.J. Keighery s.n. PERTH 02391325)	P2	-	A	Brown and grey sand. Dunes and limestone ridges.	Jul-Oct	**Possible**
Acacia inops	P3		P	Black peaty sand, clay. Swamps, creeks.	Sep-early Nov	**Unlikely**
Acacia lateriticola var. Glabrous variant (B.R.Maslin 6765)	P3		P	Lateritic soils	Aug or Oct	**Unlikely**
Boronia capitata subsp. gracilis	P3	-	P	White/grey or black sand in winter-wet swamps, hillslopes.	Jun-Nov	**Unlikely**
Cyathochaeta teretifolia	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	**Unlikely**
Johnsonia inconspicua	P3	-	P	White-grey or black sand. Low dunes, winter-wet flats	Oct-Nov	**Unlikely**
Pultenaea pinifolia	P3	-	P	Loam or clay. Floodplains, swampy areas.	Oct-Nov	**Unlikely**
Stylidium lowrieanum	P3	-	P	Sand or sandy loam over limestone. Eucalypt or Agonis woodland, forest, scrub.	Oct-Nov	**Possible**
Tetratheca parvifolia	P3	-	P	Dry, brown or grey sand over rocky outcrops of granite or laterite.	Oct	**Possible**
Banksia sessilis var. cordata	P4	-	P	White/grey sand. Coastal limestone.	Jul-Oct	**Possible**
Boronia tenuis	P4	-	P	Laterite, stony soils, granite.	Aug-Nov	**Possible**
Eucalyptus rudis subsp. cratyantha	P4	-	P	Loam on flats and hillsides.	Jul-Sep	**Possible**
Gahnia sclerioides	P4	-	P	Loam, sandy soils. Moist shaded situations	Unknown	**Unlikely**
Thysanotus isantherus	P4		P	Hillsides, sand over granite.	Nov-Dec	**Possible**

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual.

2.3.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DoEE 2019b).

'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment and Energy.

TECs are also listed within Western Australia under Section 27(1) and 33 of the BC Act and under the Biodiversity Conservation Regulations (BC Regulations). Their conservation significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. A plant community that is under consideration for listing as a TEC in Western Australia, but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes. Further information on categories of TECs and PECs is provided in **Appendix A**.

Known locations of TECs and PECs within the Leeuwin-Naturaliste Ridge area were searched for using DBCA's threatened and priority ecological communities' database (reference no. 3-01218EC). A larger search area (20 km radius from the site) was used due to the low number of surveys undertaken within the immediate vicinity of the site. The publicly available *Protected Matters Search Tool* (DoEE 2019a) was also searched for known and likely TECs and PECs, also using a 20 km radius from the site. The search results indicated that no TECs or PECs are recorded within the site, but that 11 TECs and 12 PECs occur within 10 km of the site as listed in **Table 2**. Note that some of the communities in **Table 2** occur on the adjacent Swan Coastal Plain and would not occur in the site. Five communities (shaded green in **Table 2**) are considered to have potential to occur in the site based on geomorphology, soils and regional vegetation patterns including:

- '*Calothamnus graniticus* heaths on south west coastal granites' TEC (vulnerable in WA)
- 'granite community dominated by the shrubs *Calothamnus graniticus* subsp. *graniticus, Acacia cyclops, A. saligna, Hakea oleifolia, H. prostrata* and *Jacksonia furcellata* (Sugar Loaf Rock)' PEC (P1)
- 'tall closed sedgeland on shallow soils derived from granite gneiss on the Leeuwin Naturaliste Ridge' PEC (P1)
- 'low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system' PEC (P2)
- *'Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC (P2)[1].

[1] The '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC was previously recorded within the site (ATA Environmental 2007a).

Table 2: TECs and PECs known or likely to occur within the region (communities considered to be potentially present within the site shaded green).

Code	Community name	TEC/ PEC	Level of significance	
			State	EPBC Act
SCP09	Dense shrublands on clay flats	TEC	Vulnerable	Critically Endangered (clay pans of the Swan Coastal Plain)
CAVES LEEUWIN01	Aquatic Root Mat Community Number 1 of Caves of the Leeuwin Naturaliste Ridge	TEC	Critically Endangered	Endangered
CAVES LEEUWIN02	Aquatic Root Mat Community Number 2 of Caves of the Leeuwin Naturaliste Ridge	TEC	Critically Endangered	Endangered
CAVES LEEUWIN03	Aquatic Root Mat Community Number 3 of Caves of the Leeuwin Naturaliste Ridge	TEC	Critically Endangered	Endangered
CAVES LEEUWIN04	Aquatic Root Mat Community Number 4 of Caves of the Leeuwin Naturaliste Ridge	TEC	Critically Endangered	Endangered
SCP10b	Shrublands on southern Swan Coastal Plain Ironstones (Busselton area)	TEC	Critically Endangered	Endangered
Banksia WL SCP	Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region	TEC/ PEC	Priority 3	Endangered (Banksia Woodlands of the Swan Coastal Plain)
SCP21b	Southern *Banksia attenuata* woodlands	TEC/ PEC	Priority 3	
Whicher Scarp B2	West Whicher Scarp *Banksia attenuata* woodland (Swan Coastal Plain centred woodlands of grey/white sands community B2)	TEC/ PEC	Priority 1	
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	TEC/ PEC	Priority 3	Vulnerable
Augusta-microbial	Rimstone Pools and Cave Structures Formed by Microbial Activity on Marine Shorelines	TEC	Endangered	-
MEELUP GRANITES	*Calothamnus graniticus* heaths on south west coastal granites	TEC	Vulnerable	-
SCP3b	*Corymbia calophylla - Eucalyptus marginata* woodlands on sandy clay soils of the southern Swan Coastal Plain	PEC	Vulnerable	-
SCP1b	*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	PEC	Vulnerable	-
Dunsborough Forest Swamp	*Corymbia calophylla, Melaleuca rhaphiophylla, Banksia littoralis, Eucalyptus rudis, Agonis flexuosa* low open forest with seasonal subsoil moisture (Dunsborough area)	PEC	Priority 1	-
Sugar Loaf Granites	Granite community dominated by the shrubs *Calothamnus graniticus* subsp. *graniticus, Acacia cyclops, A. saligna, Hakea oleifolia, H. prostrata* and *Jacksonia furcellata* (Sugar Loaf Rock)	PEC	Priority 1	-

Table 2: TECs and PECs known or likely to occur within the region (cont.)

Code	Community name	TEC/ PEC	Level of significance	
			State	EPBC Act
Reedia swamps - Blackwood Plateau	*Reedia spathacea - Empodisma gracillimum - Sporadanthus rivularis* dominated floodplains and paluslopes of the Blackwood Plateau	PEC	Priority 1	-
Whicher Scarp G2	Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (Whicher Scarp community G2)	PEC	Priority 1	-
Whicher Scarp Paluslope Wetlands	Swan Coastal Plain Paluslope Wetlands	PEC	Priority 1	-
Sedgelands of Cape Leeuwin Spring	Tall closed sedgeland on shallow soils derived from granite gneiss on the Leeuwin Naturaliste Ridge ('Sedgelands of the Cape Leeuwin Spring')	PEC	Priority 1	-
Low shrublands (Gracetown)	Low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system	PEC	Priority 2	-
Melaleuca lanceolata forests	*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge	PEC	Priority 2	-

2.3.3 Local and regional significance

Flora species and ecological communities may be significant for a number of reasons irrespective of whether they have special protection under policy or legislation.

Two key reasons that vegetation within the site may be significant are listed below:

- The site is in close proximity to the Leeuwin-Naturaliste National Park.
- Vegetation within the site and the wider area is identified as habitat for threatened and priority fauna species including, western ringtail possum (critically endangered), Carnaby's cockatoo (endangered), Baudin's cockatoo (endangered) and forest red-tailed black cockatoo (vulnerable) (ATA Environmental 2007b).

2.3.4 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. 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. Further information on categories of declared pests is provided in **Appendix A.**

Due to historical disturbance some weed species are expected to be present at the site (DoEE 2019c).

2.4 Land use planning considerations

A range of legislation, regulations and polices are relevant to the evaluation of vegetation in Western Australia. Key considerations applicable to the site are described below and also shown in **Figure 2**.

2.4.1 DBCA managed or legislated lands

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

The site is freehold and therefore not managed by DBCA. A large National Park (R 8428), referred to as 'Leeuwin-Naturaliste National Park', lies to the south of the site (DBCA 2017a). A narrow linear portion of land described in Landgate's cadastre as 'road isolation' lies to the south of the site and separates the site from the National Park. The Leeuwin-Naturaliste National Park also occurs approximately 240 m north east of the site and extends to the north. The extent of the Leeuwin-Naturaliste National Park close to the site is shown on **Figure 2**.

2.4.2 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. However, exemptions under Schedule 6 of the EP Act still apply, including any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the EP Act).

No ESAs occur in the site. One large ESA occurs directly around the northern and western boundaries of the site and close to the southern boundary and appears to be associated with the Leeuwin-Naturaliste National Park. The location of this ESA is shown in **Figure 2**.

2.4.3 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The movement of fauna and the exchange of genetic material between vegetation remnants improve the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009). The regional ecological linkages are axis lines that assist in recognising the spatial relationship between patches of remnant vegetation when planning and managing biodiversity at both patch and landscape scales (Molloy *et al.* 2009).

A regional ecological linkage (no. 86) runs through the eastern portion of the site, connecting vegetation present within the Leeuwin-Naturaliste National Park to the north east and south of the site. The location of this linkage is shown in **Figure 2**.

2.5 Previous flora surveys

Multiple flora and vegetation surveys have been previously undertaken within the site, including:

- Keating and Trudgen (1986) undertook a flora and vegetation survey of a wider region including the site, and mapped three native plant communities in the site.
- Maunsell & Partners (1987) described the vegetation but no quadrat data was collected.
- Bennett Environmental Consulting (2001) undertook a vegetation survey and mapped five native plant communities in the site.
- ATA Environmental undertook multiple flora and vegetation surveys of the site between 2003 and 2006, with the results combined in one report (ATA Environmental 2007a). A total of 179 plant species were recorded in the site, of which 146 are native. No threatened flora were recorded in the site. Seventy-five individuals of the priority flora species *Banksia sessilis* var. *cordata* (P4) were recorded. No other priority flora species were recorded. A total of 17 vegetation associations were mapped in the site. ATA Environmental (2007a) identified the '*Melaleuca lanceolata* forests on the Leeuwin Naturaliste Ridge' PEC (P2) as occurring in the site.

3 Methods

A detailed survey of the site was conducted during spring to describe the flora and vegetation, as described in **Section 3.1**. A subsequent regional survey was undertaken within the region to identify occurrences of PEC/s of interest in order to determine the regional context of the vegetation in the site, as described in **Section 3.2**.

3.1 Site survey

3.1.1 Field survey

An initial reconnaissance survey was undertaken by a botanist and an environmental consultant on 17 August 2018. Subsequently, two botanists from Emerge visited the site over three days (26-28 November 2018) to conduct the spring flora and vegetation assessment.

3.1.2 Flora

The site was traversed on foot and searches were conducted for threatened and priority flora species with potential to occur in the site, with a particular focus on identifying areas of suitable habitat. The location of threatened or priority flora individuals or populations were recorded with a hand-held GPS unit.

3.1.3 Vegetation

The site was traversed on foot and the composition and condition of vegetation was recorded.

Detailed sampling of the vegetation was undertaken using a combination of non-permanent 10 x 10 m quadrats and relevés. The quadrats were established using fence droppers bound by measuring tape. The relevés were completed over an equivalent 10 x 10 m area without the use of physical markers and were included to provide a more rapid sample of patches of vegetation in poorer condition and/or of smaller size.

A total of 37 locations were sampled, comprised of 34 quadrats and three relevés. The position of each sample location was recorded with a hand-held GPS unit, as shown in **Figure 3**.

The data recorded within each sample included:

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

The species percentage ‘foliage projective cover’ (FPC) was also recorded within each quadrat. Additional plant taxa not observed within samples were recorded opportunistically as the botanists traversed the site. Photographs were taken throughout the field visit to show particular site conditions.

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

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using the Keighery (1994) scale, as shown in **Table 3**.

Table 3: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3.2 Regional PEC survey

3.2.1 Rationale and desktop assessment

The DBCA threatened and priority ecological communities' database search results indicated that there are a few known occurrences of certain PECs in the area, as detailed in **Section 2.3.2**. In particular, the 'low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system' PEC (P2) (hereafter referred to as the 'low shrublands on acidic grey-brown sands' PEC), which was recorded during the site survey (refer **Section 4.1.4**), was only represented by one occurrence in Gracetown. Due to the lack of information available for this PEC, a regional PEC survey was required to identify other occurrences of the PEC in the local area.

DBCA have published vegetation complex mapping of the south west forest region which comprises multiple datasets including mapping undertaken by Havel and Mattiske (1998) for the *Regional Forest Agreement* (RFA) (DBCA 2019). This mapping is an alternative to the regional vegetation mapping Beard *et al.* (2013) outlined in **Section 2.2.5** that is more useful for identifying potential areas of this PEC as it is based on units that better align to the PEC description. The DBCA (2019) vegetation complexes mapped in the site are shown in **Plate 2**.

Plate 2: Regional vegetation complex mapping showing the three different vegetation complexes within the site (DBCA 2019).

A desktop assessment was undertaken to determine survey locations that may support the 'low shrublands on acidic grey-brown sands' PEC. Attributes used to determine the survey locations included the following:

- The location of the existing Gracetown occurrence of the 'low shrublands on acidic grey-brown sands' PEC.
- The intersection of the existing Gracetown occurrence of the PEC and the PEC within the site with vegetation and soil mapping including:
  - 'Wilyabrup granitic headland Phase' soil landscape mapping unit in which the Gracetown PEC occurrence and the PEC in the site occur
  - 'Gracetown exposed slopes Phase' soil landscape mapping unit in which the Gracetown PEC occurrence occurs
  - 'Wilyabrup exposed slopes Phase' soil landscape mapping unit in which the PEC in the site occurs
  - 'Wilyabrup, We' vegetation complex in (DBCA 2019) which the PEC in the site occurs
  - 'Wilyabrup, WE' or 'Gracetown, GE' vegetation complex in (DBCA 2019) within which the Gracetown PEC occurrence occurs.
- *Kunzea ciliata* records from Florabase (Western Australian Herbarium 1998–2019), which is a dominant species in the PEC occurrence in the site.
- The public accessibility of land parcels.

A total of 22 survey locations were chosen, including the DBCA Gracetown PEC occurrence. The sites lie between Yallingup in the north and Boranup in the south, as shown in **Figure 4**.

3.2.2 Field survey

Two botanists from Emerge surveyed the 22 survey locations on the 24 February 2019. Each location was traversed on foot and an assessment was made as to whether the vegetation was considered likely to represent the 'low shrublands on acidic-brown sands' PEC. Attributes recorded during the assessment included:

- soil type
- type of rock (if present)
- vegetation structure
- flora species composition.

3.3 Mapping and data analysis

3.3.1 Plant community identification and description

The local plant communities within the site were identified from the sample data collected during the field survey. A cluster analysis was performed by converting the FPC for each species in each sample to a Domin value (Kent and Coker 1994). Classification into communities was undertaken using hierarchical clustering within the analysis package PRIMER v6 (Clarke and Gorley 2006), with groups defined using the Bray-Curtis distance measure and further refined using a similarity probability measure (significance level of 0.05).

Once a group was defined from the cluster analysis, the vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003). The identified plant communities were then mapped on aerial photography (1:6,000) from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography (1:6,000) based on the locations and notes recorded during the field survey to define areas with differing condition.

3.3.2 Threatened and priority ecological communities

No published diagnostic characteristics exist for four of the five PECs considered to have potential to occur in the site (as listed in **Section 2.3.2**). Therefore areas of native vegetation potentially representing one of these four PECs were assessed against the community name and description in the *Priority Ecological Communities for Western Australia* (Version 27) document (DBCA 2017c).

Native vegetation potentially representing the 'low shrublands on acidic grey-brown sands of the Gracetown soil-landscape system' PEC (P2) was additionally compared to information provided in the document *Summary of landform, soil, vegetation and floristic data for the proposed ecological community: "Low heathland on acidic grey-brown sands of the Gracetown soil-landscape system"* (Smith 2005).

The boundaries of vegetation considered to represent a PEC during the site and regional surveys were mapped on aerial photography (1:105,000) and boundaries were interpreted from aerial photography and notes taken in the field.

3.3.3 Species accumulation curve

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft *Excel*. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. PRIMER v6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the '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). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 4**.

Table 4: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016).

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in **Section 2** is adequate to place the site and vegetation in context.
		Information from previous assessments of the flora and vegetation values within the site was available. This information was used to characterise the general vegetation prior to the survey and inform the survey methodology.
	Minor limitation	There is no publicly available regional flora survey dataset available for the south-west region that would allow for statistical analysis to determine the presence or absence of conservation significant vegetation types. As such the plant communities identified were compared to the TECs and PECs within the wider local area based on the species presence, soils, landforms and location information available.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by two qualified botanists with eight years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 16 years' experience in environmental science in Western Australia.
Suitability of timing	Minor limitation	The site survey was conducted in August and November and thus within the main flowering season. High rainfall was recorded from May to October 2018 in the months preceding the site visit. Therefore it is likely that many plant species would have been in flower and/or visible at the time of survey. Some orchid species had finished flowering in November and were unidentifiable, but other species were still flowering and able to be identified. Including the reconnaissance visit in August, the survey timing was considered adequate to allow the detection of most species for which seasonal timing is critical. However, the November timing of the detailed component of the survey was later than ideal to allow detection of some orchid species that finish flowering in September or October, including threatened species *Caladenia caesarea* subsp. m*aritima* and *C. excelsa*.

Table 4: Evaluation of survey methodology against standard constraints outlined in EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) (cont.)

Constraint	Degree of limitation	Details
Suitability of timing (cont)	No limitation	The regional survey was conducted in February 2019 outside of the optimal season for flora detection. However, the timing did not result in significant limitation as perennial and easily detectable flora plus surficial soil information could be used indicate PEC occurrences.
Temporal coverage	No limitation	Comprehensive 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 once in August 2018 and over three days in late November 2018. The August site visit provided an insight into the vegetation condition and composition out of the main flowering period. The detailed survey component allowed multiple formal samples and targeted searches to be completed across the entire site. 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). All parts of the site could be accessed as required.
	Limitation	A total of 22 locations from Yallingup to south of Gracetown were surveyed as part of the regional PEC survey which represents reasonable spatial coverage. Nonetheless, not all areas where suitable soils and landform were predicted to occur could be accessed during the regional survey due to time constraints. It is therefore likely that the number of occurrences identified provides an underestimate of the actual number of occurrences that are present.
Sampling intensity	No limitation	A total of 214 species were recorded, of which 200 were recorded from 37 sample locations and 14 were recorded opportunistically. Minimum species richness within site is estimated at between 239 (Chao2) and 256 (Jacknife1) species (refer species accumulation curve and estimates shown in **Plate 18**). The number of species recorded in the site is 89% of the Chaos 2 estimate indicating that survey effort was adequate to prepare a near-comprehensive species inventory for the site.
	No limitation	A total of 22 locations from Yallingup to south of Gracetown were surveyed as part of the regional PEC survey which represents reasonable sampling intensity and provided sufficient information to predict the extent of occurrence of the PEC and refine predications of the likely location of as yet unidentified occurrences of the PEC.
Influence of disturbance	Minor limitation	Time since fire is greater than 30 years as interpreted form aerial imagery and therefore short lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident in parts of the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey of the site were available.
	Limitation	Additional resources (time) would have been required to complete a comprehensive regional survey of PEC locations.

4 Results

4.1 Site survey

4.1.1 General site conditions

The site is undulating and supports a variety of landforms and soil types. The north western portion of the site contains a low ridgeline with north westerly and north easterly aspects. Soils on this ridge and associated slopes are grey-brown sand with outcropping granite, which increases in density towards the western boundary where granite becomes dominant. The south western portion of the site has a westerly aspect with some yellow sands and granite near the boundary that transitions into brown-grey sand and outcropping limestone as elevation increases. A rise with white-grey sand and outcropping limestone is present in the southern central portion of the site. The eastern portion of the site is gently undulating with the highest point being the southern boundary, and the majority of this area supports deep brown sands without outcropping rock. A narrow linear portion of orange-brown sandy soils with outcropping granite occurs near the eastern boundary of the site.

Native vegetation occurs across the majority of the site except for a few access tracks that are devoid of native vegetation. The vegetation in the central portion of the site showed signs of disturbance such as lower native vegetation cover and higher cover of non-native species. The vegetation in the north eastern portion of the site, near Smiths Beach Road, also showed signs of disturbance as it was dominated by thick *Acacia saligna* which is a native shrub that can act as a coloniser of disturbed soils. The eastern portion of the site appears to have been subject to low level disturbance due to the presence of non-native species. The remainder of the site, particularly the western portion, supports relatively undisturbed native vegetation.

The entire site was accessible and able to be traversed during the field survey.

4.1.2 Flora

A total of 164 native and 50 non-native (weed) species were recorded within the site during the field survey, representing 58 families and 145 genera. The dominant families containing native taxa were Fabaceae (22 native taxa and five weed taxa), Poaceae (11 native and 13 non-native taxa), Myrtaceae (ten native taxa) and Asteraceae (ten native and nine non-native taxa). The most common genera were *Acacia* (with eight taxa), *Banksia* and *Hibbertia* (with five taxa each) and *Austrostipa, Rytidosperma* and *Stylidium* (with four taxa each). Of the species recorded, 200 were recorded in sample locations and 14 were recorded opportunistically. The complete species list and species list by plant community are provided in **Appendix B** and sampled data in **Appendix C**.

4.1.2.1 Threatened and priority flora

One priority 4 (P4) species, *Banksia sessilis* var. *cordata*, was recorded in the site. A total of 210 individuals were recorded, primarily in the central and north western portions of the site, as shown in **Figure 3**. No other threatened or priority flora species were recorded within the site.

4.1.2.2 Locally and regionally significant flora

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

4.1.2.3 Declared pests

Two species listed as declared pests (s22) pursuant to the BAM Act, **Asparagus asparagoides* and **Zantedeschia aethiopica*, were recorded within the site. These species were primarily found within vegetation in the eastern portion of the site. **Asparagus asparagoides* was recorded mainly as individual plants and **Zantedeschia aethiopica* was recorded as individual plants as well as dense populations, particularly in the south eastern portion of the site underneath native *Agonis flexuosa* trees.

**Asparagus asparagoides* is also listed as a WoNS.

4.1.3 Vegetation

4.1.3.1 Plant communities

A total of 13 native plant communities were identified within the site. A description and the area of each plant community is provided in **Table 5** and representative photographs of each are provided in **Plate 3** to **Plate 16**. The location of each plant community is shown in **Figure 5**.

Table 5: Plant communities identified within the site

Plant community	Description	Area (ha)
AfPe	Low open forest *Agonis flexuosa* over fernland *Pteridium esculentum* subsp. *esculentum* over open herbland mixed non-native species such as **Lysimachia arvensis* and **Asparagus asparagoides* (**Plate 3**).	7.71
AhHe	Shrubland *Allocasuarina humilis* over low sparse herbland over low sparse grassland *Austrostipa mollis* and *Rytidosperma occidentale* over low open rushland *Hypolaena exsulca* (**Plate 4**).	1.25
AsDc	Shrubland *Acacia saligna* and *Dodonaea ceratocarpa* over low herbland *Trachymene pilosa* over low sparse grassland *Rytidosperma occidentale* (**Plate 5**).	3.26
AsHh	Shrubland *Acacia saligna* over low open shrubland *Hibbertia hypericoides* over grassland non-native species such as **Vulpia bromoides* (**Plate 6**).	0.61
BaMrXp	Low open forest *Banksia attenuata* and occasional *Agonis flexuosa* over open shrubland *Macrozamia riedlei* and *Xanthorrhoea preissii* over open mixed herbland (**Plate 7**).	4.16
CcHh	Low forest *Corymbia calophylla* over open shrubland *Xanthorrhoea preissii* and over low shrubland *Hibbertia hypericoides* over sparse low herbland *Scaevola calliptera* (**Plate 8**).	0.99
DciDcL	Shrubland *Darwinia citriodora* and *Dodonaea ceratocarpa* over low sedgeland *Lepidosperma* spp. over low open grassland of native and non-native species over low open herbland *Crassula* spp. (**Plate 9**).	0.86
KcSg	Closed shrubland *Kunzea ciliata* and *Spyridium globulosum* over low open shrubland *Eutaxia myrtifolia* over sparse sedgeland over low sparse herbland (**Plate 10**).	9.40

Table 5: Plant communities identified within the site (cont.)

Plant community	Description	Area (ha)
KcDcPp	Low open shrubland *Kunzea ciliata* and *Darwinia citriodora* over low sparse herbland *Stypandra glauca* over low sparse grassland *Poa poiformis* on granite (**Plate 11**).	0.53
MhGl	Low woodland to low open forest *Melaleuca huegelii, M. lanceolata* and *Guichenotia ledifolia* over tall open shrubland *Hakea oleifolia* over shrubland *Hibbertia cuneiformis* over low open herbland *Stylidium adnatum* (**Plate 12**).	4.41
MlDr	Low closed forest *Melaleuca lanceolata* over sparse shrubland *Melaleuca systena* and *Spyridium globulosum* over low open herbland *Dianella revoluta* var. *revoluta* over low open sedgeland *Lepidosperma* spp. (understorey absent in areas of dense canopy cover) (**Plate 13**).	1.81
MlKc	Closed shrubland *Melaleuca lanceolata* and *Kunzea ciliata* over occasional grasses and herbs (**Plate 14**).	2.31
NfCcXp	Low open forest *Nuytsia floribunda* and *Corymbia calophylla* over open shrubland *Xanthorrhoea preissii* over low open mixed herbland over low open grassland native and non-native species (**Plate 15**).	0.67
Non-native vegetation	Heavily disturbed areas comprising tracks and non-native vegetation with occasional native plants (**Plate 16**)**.**	2.56

*Plate 3: Plant community **AfPe** in very good-good condition.*

*Plate 4: Plant community **AhHe** in very good condition.*

*Plate 5: Plant community **AsDc** in very good condition*

*Plate 6: Plant community **AsHh** in good condition.*

*Plate 7: Plant community **BaMrXp** in very good condition*

*Plate 8: Plant community **CcHh** in very good condition*

*Plate 9: Plant community **DciDcL** in very good-good condition.*

*Plate 10: Plant community **KcSg** in excellent condition*

*Plate 11: Plant community **KcDcPp** in excellent condition.*

*Plate 12: Plant community **MhGl** in excellent condition*

*Plate 13: Plant community **MlDr** in excellent condition*

*Plate 14: Plant community **MlKc** in excellent condition*

*Plate 15: Plant community **NfCcXp** in very good-good condition*

Plate 16: Non-native vegetation on cleared track in completely degraded condition.

4.1.3.2 Vegetation condition

The most intact native vegetation was located in the western portion of the site (plant communities **KcDcPp**, **KcSg**, **MhGl**, **MlK**, and **MlDr**). This vegetation was mapped as being in excellent condition as it has an intact vegetation structure and low weed cover and diversity. Disturbance was low and appeared to be limited to fauna tracks and occasional weeds. Native vegetation cover was high in these plant communities, particularly those close to the western edge of the site.

Vegetation in the central portion of the site (west of the central north-south track), plant communities **AsDc**, **NfCcXp** and **AhHe**, were mapped as being in 'very good' and 'very good – good' condition due to historical disturbance which has resulted in a more open vegetation structure and slightly higher cover of non-native species.

Some vegetation in the eastern side of the site, such as plant community **MhGl** and portions of **CcHh**, were mapped as being in 'excellent' and 'very good' condition due to intact vegetation structure and low disturbance. However, the majority of vegetation in this portion of the site, plant communities **AfPe** and **DciDcL** and portions of **CcHh**, were mapped as an intermediate category: 'very good – good'. This vegetation supports a mosaic of high quality native vegetation interspersed with patches of non-native vegetation and/or aggressive non-native species such as **Zantedeschia aethiopica*.

Remaining areas in the site were mapped as being in 'completely degraded' condition and consist primarily of bare areas of ground such as tracks, as well as scattered native and non-native vegetation.

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

Table 6: Vegetation condition categories within the site

Condition category (Keighery (1994))	Size (ha)
Pristine	0
Excellent	18.59
Very Good	8.82
Very Good - Good	9.26
Good	1.27
Degraded	0.04
Completely Degraded	2.56

4.1.4 Threatened and priority ecological communities

No TECs occur within the site.

Two PECs were recorded within the western portion of the site. Plant community **KcSg** was determined to meet the State listed 'low shrublands on acidic grey-brown sands' PEC (P2). This PEC extends over approximately 9.25 ha of the site.

Plant communities **KcDcPp** and **MlKc** were determined to meet the State listed '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC (P2). This PEC extends over approximately 4.05 ha of the site.

The locations of the two PECs within the site are shown in **Figure 7**.

No other PECs occur within the site.

4.1.5 Locally and regionally significant vegetation

White-tailed black cockatoos[2] were observed foraging on the shrubland at the northern periphery of the site during the survey (**Plate 17**). Based on this and previous fauna surveys (ATA Environmental 2007b), the site comprises foraging habitat for Carnaby's, Baudin's and Forest red-tailed black cockatoos. Foraging habitat for black cockatoos within the site includes the shrubland at the northern periphery, the banksia woodland in the eastern portion of the site, as well as marri trees within the site. The site does not contain many habitat trees (mature eucalypt trees with a diameter at breast height larger than 500 mm), thus is not likely to provide important roosting or nesting habitat for black cockatoo species.

Plate 17: White-tailed black cockatoo observed foraging on vegetation during the survey.

Vegetation within the site, in particular, *Agonis flexuosa* trees within plant community **AfPe** provide habitat for western ringtail possums, as identified by ATA Environmental (2007b).

4.2 Species richness and sampling adequacy

A total of 200 species were recorded from 37 samples. A species accumulation curve derived from sample data is presented in **Plate 18**. After 37 samples the curve has reached its asymptote and is increasing more gradually. This indicates that a relatively small proportion of species are likely to remain undetected by sampling.

Species richness was estimated in PRIMER v6 to be between 239 (Chao2) and 256 (Jacknife1). Based on the trend of the species accumulation curve approximately 80 to 100 samples would be required to capture that many species. Including the 14 additional species recorded opportunistically, a total of 214 species was recorded in the site. This indicates that between 84-89% of the estimated 239-256 species in the site were recorded. Thus the survey effort was considered to be adequate to prepare a representative species inventory.

[2] Carnaby's cockatoo or Baudin's cockatoo.

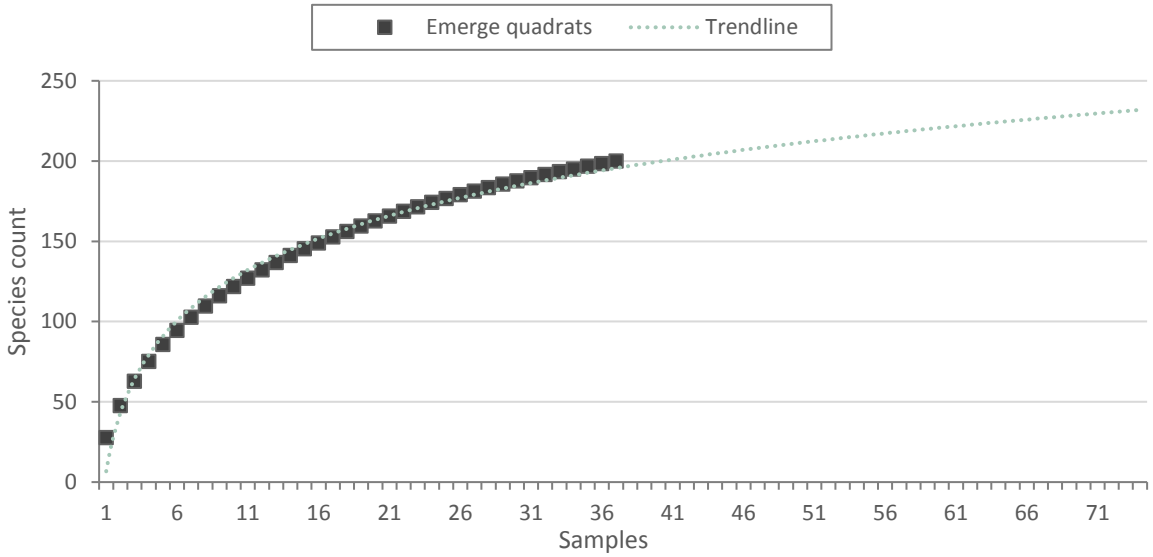


Plate 18: Species accumulation curve derived from sample data (y = 52.3ln(x) + 6.7354 R^2 = 0.9878

4.3 Regional PEC survey

Four of the 22 survey locations visited were considered to represent the 'low shrublands on acidic grey-brown sands' PEC (P2) due to the presence of grey-brown soils, outcropping granite and similar flora species composition to that recorded in the site. The PEC locations are shown on **Figure 8**. The remaining sites visited were not considered to represent the 'low shrublands on acidic grey-brown sands' PEC.

Two survey locations determined to represent the 'low shrublands on acidic grey-brown sands' PEC occur in the same location as the DBCA Gracetown PEC occurrence. This occurrence lies approximately 20 km south west of the site and was determined to comprise two patches of vegetation to the north and south of Cowaramup Bay Road, extending over approximately 10.57 ha. Some similarities were observed between this occurrence and the 'low shrublands on acidic grey-brown sands' PEC in the site, but some flora species differed.

An additional area adjacent to the Gracetown occurrence in the north (approximately 10.6 ha) is considered likely to represent the 'low shrublands on acidic grey-brown sands' PEC but was not confirmed during the survey due to its remoteness and time constraints during the survey.

The other survey locations determined to represent the PEC are located in Yallingup and Moses Rock. The Yallingup occurrence is located approximately 1.8 km north-west of the site and the vegetation determined to represent the 'low shrublands on acidic grey-brown sands' PEC lies primarily to the west of Yallingup Beach Road. This occurrence was most similar to the PEC vegetation identified in the site due to the presence of grey-brown soils, outcropping granite and similar flora species composition. The primary difference between this occurrence and the 'low shrublands on acidic grey-brown sands' PEC vegetation in the site is that the shrubs in this occurrence are lower; likely due to the difference in aspect. This PEC occurrence extends over approximately 3.9 ha.

The Moses Rock occurrence is located approximately 11 km south west of the site and the vegetation determined to represent the 'low shrublands on acidic grey-brown sands' PEC comprises a small patch of vegetation approximately 0.1 ha in size. This occurrence supported grey-brown soils, outcropping granite and similar flora species composition. Other native vegetation surrounds this PEC occurrence.

5 Discussion

5.1 Threatened and priority flora

In the south-west of Western Australia, September to November is considered the optimal period for undertaking flora and vegetation surveys, with this period also extending into December the further south the site is located. This is when the majority of flora species are flowering and therefore easiest to detect and identify. In 2018 many species in the south-west were still in flower later than usual due to the higher (albeit average) rainfall compared to previous years and the late start to the flowering period (anecdotally, some species were nearly a month behind their typical flowering times). The detection of flora was effective during this survey with the 204 species recorded representing an increase in flora of 35 species since the most recent previous survey (ATA Environmental 2007a).

An increased number of *B. sessilis* var. *cordata* individuals was also recorded within the site compared to previous surveys (ATA Environmental 2007a). The species is an emergent, tall shrub in the lower shrubland present in the western half of the site and the transects traversed over the **BaMrXp** vegetation (which contained the highest densities of *B. sessilis* var. *cordata*) were thorough. Thus it was relatively straightforward to confirm that *B. sessilis var. cordata* was only present at the identified location and the recorded locations are likely to represent the complete distribution of the species within the site. *B. sessilis* var. *cordata* is widespread in the region despite a relatively restricted distribution close to the coastline from Cape Naturaliste in the north around to Albany in the south (DBCA 2019). A total of 58 collected specimens exist within the WA Herbarium collection (DBCA 2019).

Other than the occurrences of *B. sessilis* var. *cordata* (P4), no other threatened or priority flora species were recorded within the site. The absence of the larger perennial species that had potential to occur within the site, such as *Eucalyptus x phylacis* and *Banksia squarrosa* subsp. *argillacea,* was also relatively easy to confirm. However, smaller geophytic species that had potential to occur within the site, such as *Caladenia excelsa* and *Caladenia huegelii,* can be more difficult to detect. Considerable search effort was applied to locate these species within the site, including within the main flowering period (albeit relatively late in the main flowering season). Orchids and geophytes were recorded during the survey including *Caladenia attingens* subsp. *attingens* and also some *Caladenia* sp. individuals that had finished flowering and were in fruit (and thus were not able to be identified to species level).

Despite not having full visibility of orchids within the site during this survey, it is not considered particularly likely that any other conservation significant species occur. The survey timing was adequate to allow the detection of most species for which seasonal timing is critical and no threatened or priority orchids have previously been recorded in any of the previous surveys (Keating and Trudgen 1986; Maunsell and Partners Pty Ltd. 1987; Bennett Environmental Consulting 2001; ATA Environmental 2007a) undertaken across the site. The timing of the survey was most relevant to the detection of orchid species that finish flowering in September or October (such as *Caladenia caesarea* subsp. m*aritima* and *C. excelsa*). It is not considered likely that any of the unidentified orchid individuals were these species or that there is high likelihood that any threaten or priority orchids or geophytes occur within the site.

5.2 Vegetation condition

The site generally contains intact, high-quality vegetation (especially in the western portion), with approximately 45% of the site area comprising 'excellent' condition vegetation.

The disturbance to the vegetation recorded in the central and eastern portions of the site was also noted in previous assessments (Bennett Environmental Consulting 2001; ATA Environmental 2007a). This disturbance precedes the earliest publicly available historical aerial photography (1996) and is likely to have occurred many decades ago. Colonising native species such as *Acacia saligna* have overtaken some areas along the northern boundary of the site closest to the road. At the time of the survey, the **AfPe** vegetation in the north eastern portion of the site was considered to be in 'very good to good' or 'good' condition as it had a moderate diversity of native species present but was subject to higher weed loads (particularly the declared pest, **Zantedeschia aethiopica*).

5.3 Threatened and priority ecological communities

The two PECs recorded within the site were associated with excellent condition vegetation in the western portion of the site. The floristic information obtained during the survey was sufficient to accurately map the extent of these PECs within the site and also confirm that no other TECs or PECs occur.

The extent of each PEC within the site was defined based on each community's name, the descriptions provided in the *Priority Ecological Communities for Western Australia* (Version 27) document and information provided in the document *Summary of landform, soil, vegetation and floristic data for the proposed ecological community: "Low heathland on acidic grey-brown sands of the Gracetown soil-landscape system"* (Smith 2005). This information provided a reasoned basis for classification of areas of native vegetation that, in the absence of detailed diagnostic criteria for either PEC, was considered satisfactory basis for assessment.

With regards to the 'low shrublands on acidic grey-brown sands' PEC, the areas of the **KcSg** vegetation mapped within the site satisfied criterion as low shrubland or heath, on grey brown sand with a bleached surface, near the west coast of the Leeuwin-Naturaliste Ridge and as well as including dominant shrubs identified in PEC description such as *Calothamnus sanguineus, Hakea trifurcata, Kunzea ciliata, Pimelea ferruginea, Spyridium globulosum* and *Xanthorrhoea brunonis.* However, more generally distributed flora species were also present such as *Agonis flexuosa* that are less indicative of the PEC based on its description.

With regards to the '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC, the areas of **MlDr** and **MlKc** vegetation mapped within the site satisfied criterion as a low closed forest of *Melaleuca lanceolata* near the coastline of the Leeuwin-Naturaliste Ridge. The **MlDr** vegetation in the south western corner of the site tended to be taller (with a dominant shrub layer over two metres tall). Whereas the occurrences on the north-western boundary (comprising the **MlKc** vegetation) were somewhat lower (one to two m tall), while still satisfying the broad definition of the community.

5.3.1 Regional context for 'low shrublands on acidic grey-brown sands' PEC

The 'low shrublands on acidic grey-brown sands' PEC was found to occur at six locations from the north-western portion of the Leeuwin-Naturaliste Ridge north of Gracetown, to just south of Yallingup. The occurrences of this PEC were recorded within approximately 500 m of the coast.

Some variation in species composition and structure was observed across the regional sites visited, which is explicable given the distance between occurrences. However, each identified occurrence was considered to satisfy criteria derived from the description provided in the *Priority Ecological Communities for Western Australia* (Version 27) document and information provided in the document *Summary of landform, soil, vegetation and floristic data for the proposed ecological community: "Low heathland on acidic grey-brown sands of the Gracetown soil-landscape system"* (Smith 2005).

Based on the regional survey the 'area of occupancy' of the community is at least 37 ha and its 'extent of occurrence' is approximately 37.21 ha (minimum convex polygon). The area of occupancy and extent of occurrence of this community indicate that it has a restricted geographic distribution (Bland *et al.* 2017).

The 'low shrublands on acidic grey-brown sands' PEC was consistently recorded in association with granite outcroppings. The regional data therefore has some value as a predictive tool for occurrences of this PEC. However, while there was a clear relationship between the identified locations of this PEC and specific regional soil or vegetation complexes, the PEC occurrences did not align with the entirety of associated mapping units in the regional data. The 'low shrublands on acidic grey-brown sands' PEC is therefore considered likely to occur near to areas of granite outcropping within the Kilcarnup exposed rocky dunes, Gracetown exposed slopes, Wilyabrup granitic headland and Wilybrup exposed slopes phases.

Not all targeted areas where the relevant soil or vegetation complexes occur could be assessed during the survey due to time constraints and/or a lack of access to privately owned land. Therefore, some potential sites could not be ground truthed and it is likely that further unrecorded occurrences of the 'low shrublands on acidic grey-brown sands' PEC occur.

The 'low shrublands on acidic grey-brown sands' PEC is likely to have a naturally restricted distribution due to its occurrence on granite outcroppings scattered along the Leeuwin-Naturaliste coastline. While restricted in distribution, a significant portion of the 'low shrublands on acidic grey-brown sands' PEC is likely to be under formal protection (approximately 78% of existing vegetation and 73% of the original extent based on the RFA vegetation complexes).

5.3.2 Regional context for '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC

With regard to the '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC there were approximately 25 other occurrences of the PEC in the DBCA search results, and areas dominated by *Melaleuca lanceolata* were observed whilst undertaking the regional context survey for the 'low shrublands on acidic grey-brown sands' PEC. Thus this PEC is considered to be relatively common in the local area.

5.4 Fauna habitat

The site contains foraging habitat for all three threatened species of black cockatoo (ATA Environmental 2007b), and white-tailed black cockatoos were observed foraging on the shrubland at the northern periphery of the site during the survey. The site does not contain many habitat trees (mature eucalypt trees with a diameter at breast height larger than 500 mm), thus is not likely to provide important nesting habitat for black cockatoo species, which is also supported by previous fauna investigations by ATA Environmental (2007b).

Vegetation within the site, in particular, *Agonis flexuosa* trees within plant community **AfPe** provide habitat for western ringtail possums, as identified by ATA Environmental (2007b).

6 Conclusions

The site generally contains intact, high-quality vegetation (especially in western portion), with approximately 45% of the site area comprising 'excellent' condition vegetation. The central and eastern portions showed signs of historical disturbance, were subject to higher levels of weed invasion and were largely mapped as being in 'very good', 'very good to good' and 'good' condition. A small proportion of the site (6.4%) was mapped as being in 'degraded' or 'completely degraded' condition.

A total of 210 individuals of the priority flora species *Banksia sessilis* var. *cordata* (P4) were recorded within the site. It is not considered highly likely that any other threatened or priority species occur within the site.

No TECs were found to occur within the site, but two State listed PECs were recorded. The 9.25 ha of **KcSg** vegetation was considered to represent the 'low shrublands on acidic grey-brown sands' PEC. The 4.05 ha of plant communities **MlKc** and **MlDr** were considered to represent the '*Melaleuca lanceolata* forests, Leeuwin Naturaliste Ridge' PEC. The occurrences of both PECs were located within the western portion of the site close to the coastline. All vegetation representing these PECs within the site was in excellent condition.

The 'low shrublands on acidic grey-brown sands' PEC was found at six locations from the north-western portion of the Leeuwin-Naturaliste Ridge north of Gracetown, to just south of Yallingup. These occurrences are consistently recorded in association with granite outcroppings.

The vegetation within the site is locally and regionally significant due to the fact that some of it provides habitat for threatened black cockatoo species and western ringtail possums.

7 References

7.1 General references

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*.

ATA Environmental 2007a, *Sussex Location 413 Yallingup – Smiths Beach – Strategic Environmental Assessment*, (EPA Assessment No.1597 Volume 1), version 4.

ATA Environmental 2007b, *Vertebrate Fauna Assessment - Smiths Beach, Yallingup*.

Beard, J. S. 1990, *Plant Life of Western Australia*, Kangaroo Press Pty Ltd., Kenthurst, N.S.W.

Beard, J. S., Beeston, G. R., Harvey, J. M., Hopkins, A. J. M. and Shepherd, D. P. 2013, *The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition.*, Conservation Science Western Australia, 9: 1-152.

Bennett Environmental Consulting 2001, *Vegetation Survey of Sussex Location 413 Yallingup*.

Bland, L. M., Keith, D. A., Miller, R. M., Murray, N. J. and Rodríguez, J. P. 2017, *Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria*, IUCN, Gland, Switzerland.

Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *DBCA - Legislated Lands and Waters (DBCA-011)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017b, *Lands of Interest (DBCA-012)*.

Department of Biodiversity Conservation and Attractions (DBCA) 2017c, *Priority Ecological Communities for Western Australia Version 27*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017d, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity Conservation and Attractions (DBCA) 2019, *Vegetation Complexes - South West forest region of Western Australia (DBCA-047)*, Kensington.

Department of Environment and Conservation (DEC) 2002, *A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002*, Perth.

Department of Primary Industries and Regional Development (DPIRD) 2018, *Soil Landscape Mapping - Best Available (DPIRD-027)*, Perth.

Department of Water and Environmental Regulation (DWER) 2018, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

Environment Australia 2001, *National Objectives and Targets for Biodiversity Conservation 2001-2005*, Commonwealth of Australia, Canberra.

Environmental Protection Authority (EPA) 2016, *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, Perth.

ESCAVI 2003, *Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0*, Department of the Environment and Heritage, Canberra.

Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.

Government of Western Australia 2018, *Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of December 2017*, WA Department of Biodiversity, Conservation and Attractions, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Keating, C. and Trudgen, M. 1986, *A Flora and Vegetation Survey of the Coastal Strip from Forrest Beach - Cape Naturaliste - Woodlands*, Department of Conservation and the Environment, Perth.

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

Kent, M. and Coker, P. 1994, *Vegetation description and analysis: A practical approach*, John Wiley & Sons, Chichester.

Maunsell and Partners Pty Ltd. 1987, *Botanical Survey of Sussex Location 413 at Smiths Beach*.

Miles, C. 2001, *NSW Murray Catchment Biodiversity Action Plan*, Nature Conservation Working Group Inc, Albury, New South Wales.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. 2009, *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

Smith, R. 2005, *Summary of landform, soil, vegetation and floristic data for the proposed ecological community: "Low heathland on acidic grey-brown sands of the Gracetown soil-landscape system"* Department of Conservation and Land Management, Bunbury.

Western Australian Local Government Association and Perth Biodiversity Project (WALGA and PBP) 2004, *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*, Perth.

Wetlands Advisory Committee (Report of the Wetlands Advisory Committee to the Environmental Protection Authority), 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

7.2 Online references

Bureau of Meteorology (BoM) 2019, *Climate Averages,* viewed 26 February 2019, <http://www.bom.gov.au/climate/data/>.

Department of the Environment (DoEE) 2018, *Weeds of National Significance*, viewed 13 December 2018, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>.

Department of the Environment (DoEE) 2019, *Protected Matters Search Tool*, viewed 27 February 2019 <https://www.environment.gov.au/epbc/protected-matters-search-tool>.

Department of the Environment (DoEE) 2019b, *Threatened Ecological Communities*, viewed 27 February 2019 <http://www.environment.gov.au/biodiversity/threatened/communities/about>.

Department of the Environment (DoEE) 2019c, *Weeds in Australia,* viewed 22 March 2019 <http://www.environment.gov.au/biodiversity/invasive/weeds/index.html>.

Department of Parks and Wildlife (DPaW) 2019, *NatureMap,* viewed 27 February 2019 <https://naturemap.dpaw.wa.gov.au/>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, Geomorphic Wetlands, Swan Coastal Plain (DBCA-019), viewed 13 December 2018 <https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>.

Western Australian Herbarium (1998–2019), *FloraBase—the Western Australian Flora*, Department of Biodiversity, Conservation and Attractions, <https://florabase.dpaw.wa.gov.au>.

West Australian Land Information Authority (WALIA) 2019, *Landgate Map Viewe*r, viewed February 2019, <http://landgate.wa.gov.au>.

This page has been left blank intentionally.

Figures

Figure 1: Site Location

Figure 2: Environmental Features

Figure 3: Conservation Significant Flora and Sample Locations

Figure 4: Regional Survey Locations

Figure 5: Plant Communities

Figure 6: Vegetation Condition

Figure 7: Priority Ecological Communities in the Site

Figure 8: Priority Ecological Community in the Region

Figure 1: Site Location

Project:	Spring Flora and Vegetation Assessment Lot 4131 Smiths Beach Road, Yallingup
Client:	Smiths 2014 Pty Ltd

Plan Number:
EP18-085(05)--F11

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

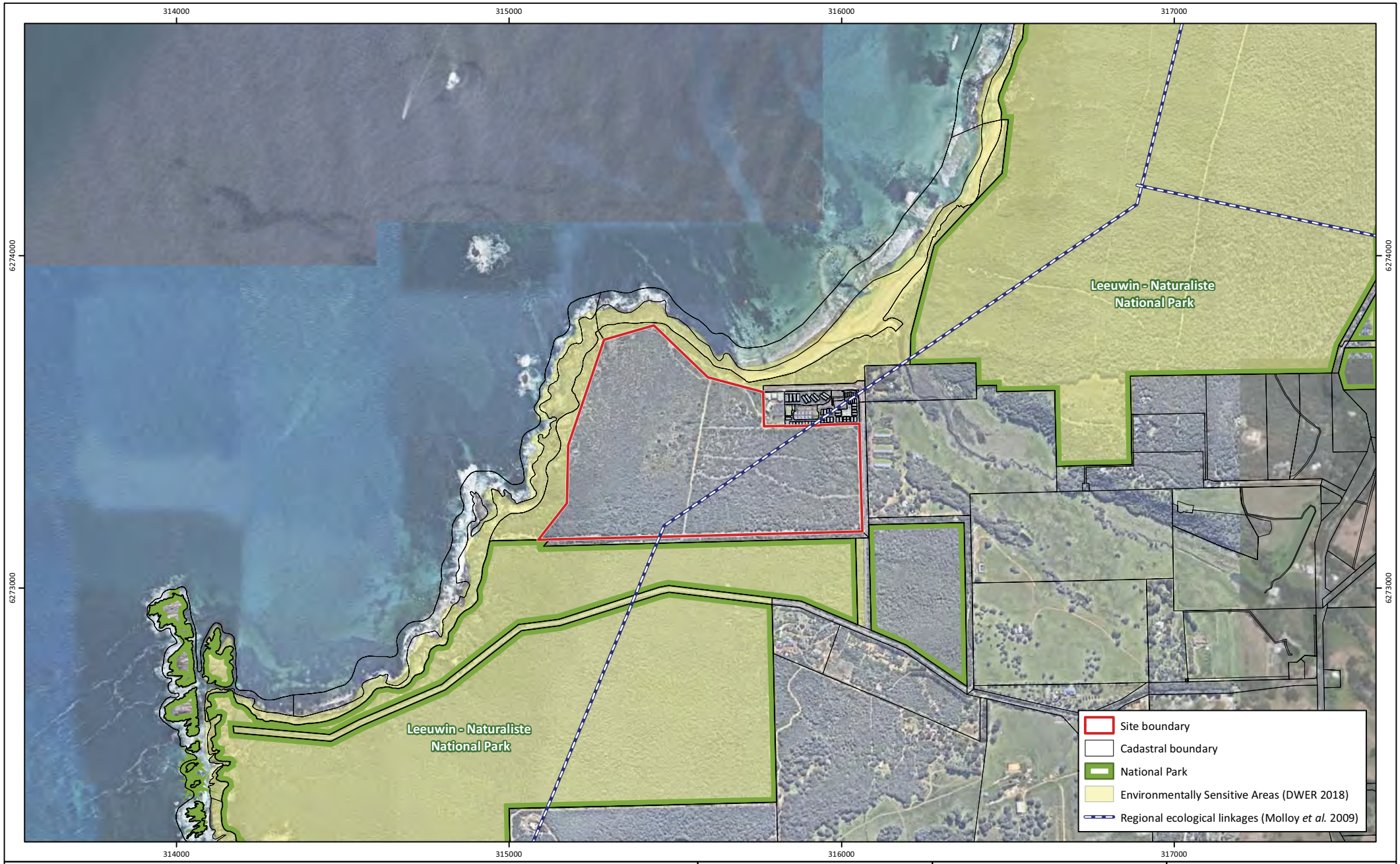


Figure 2: Environmental Features

Project: Spring Flora and Vegetation Assessment
Lot 4131 Smiths Beach Road, Yallingup

Client: Smiths 2014 Pty Ltd

Plan Number:
EP18-085(05)--F12

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 200 400 600
Metres

Scale: 1:15,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 3: Conservation Significant Flora and Sample Locations

Project: Spring Flora and Vegetation Assessment
Lot 4131 Smiths Beach Road, Yallingup

Client: Smiths 2014 Pty Ltd

Plan Number:
EP18-085(05)--F13

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

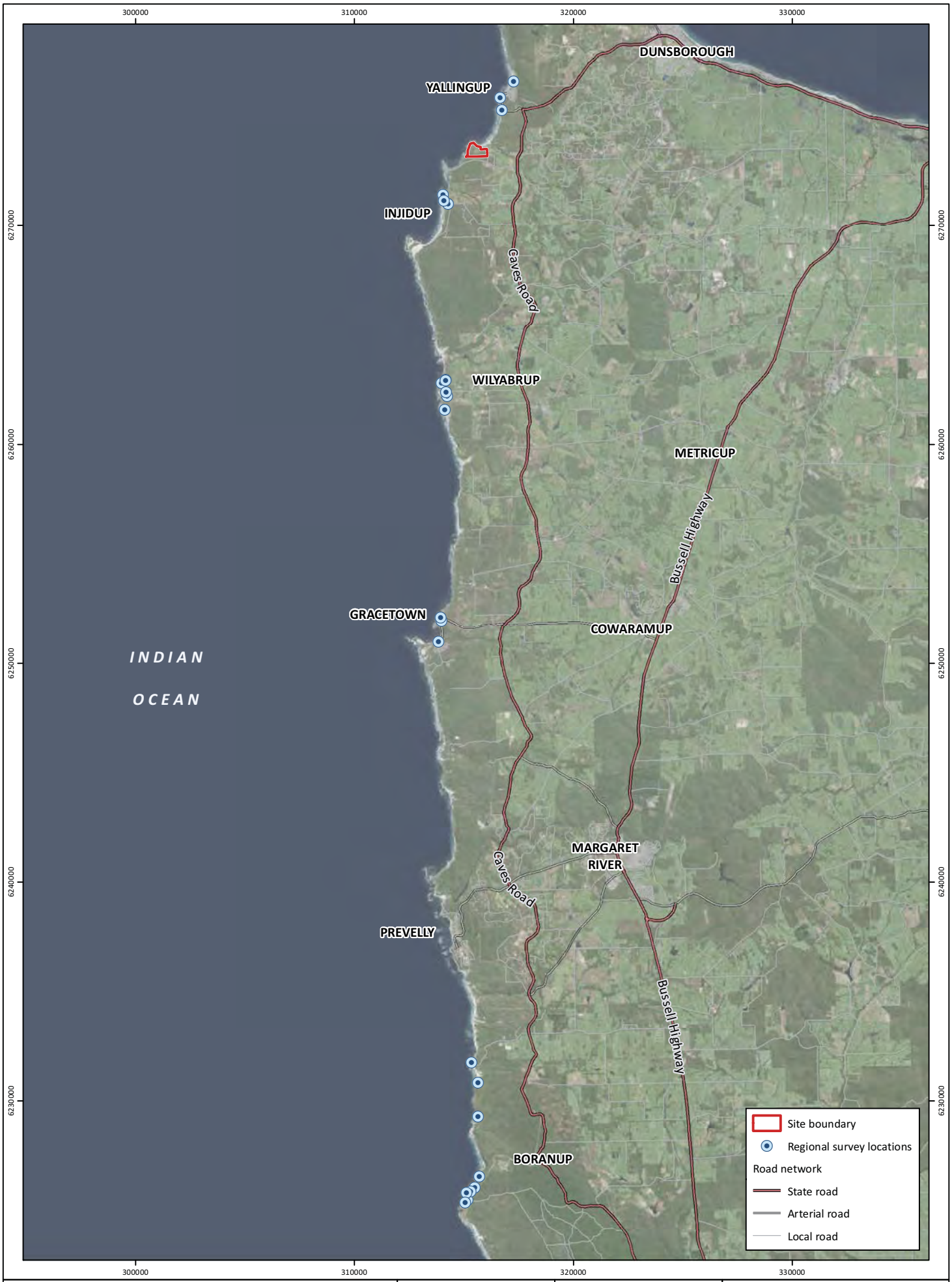


Figure 4: Regional Survey Locations

Project: Spring Flora and Vegetation Assessment
Lot 4131 Smiths Beach Road, Yallingup
Client: Smiths 2014 Pty Ltd

Plan Number: EP18-085(05)--F14

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 2,000 4,000 6,000
Metres

Scale: 1:225,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 5: Plant Communities

Project: Spring Flora and Vegetation Assessment
Lot 4131 Smiths Beach Road, Yallingup

Client: Smiths 2014 Pty Ltd

Plan Number:
EP18-085(05)--F15
Drawn: SCM
Date: 14/03/2019
Checked: TAA
Approved: TAA
Date: 15/03/2019

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Figure 6: Vegetation Condition

Project:	Spring Flora and Vegetation Assessment Lot 4131 Smiths Beach Road, Yallingup
Client:	Smiths 2014 Pty Ltd

Plan Number:
EP18-085(05)--F16

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

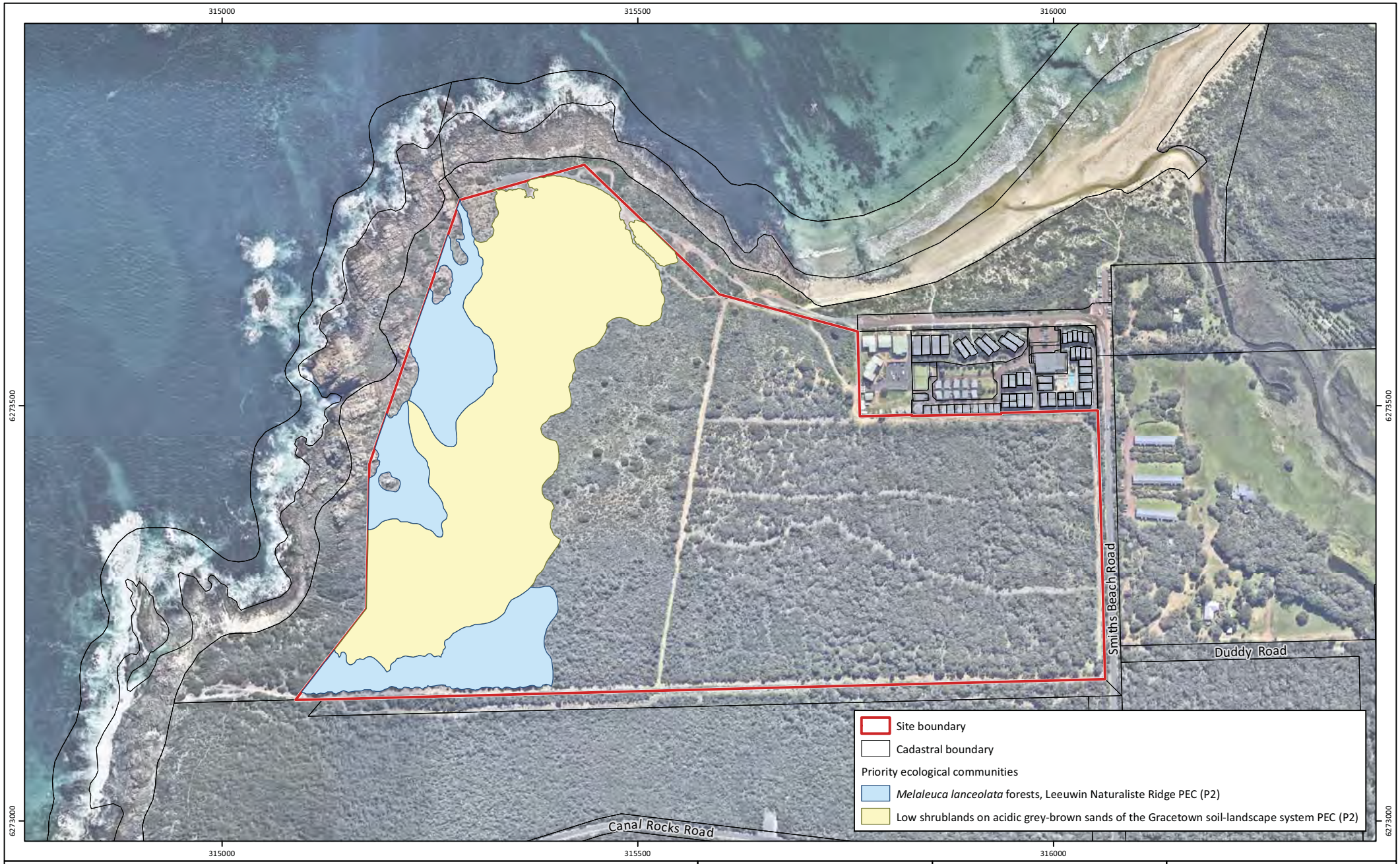


Figure 7: Priority Ecological Communities (Site)

Project: Spring Flora and Vegetation Assessment
Lot 4131 Smiths Beach Road, Yallingup

Client: Smiths 2014 Pty Ltd

Plan Number:
EP18-085(05)--F17

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

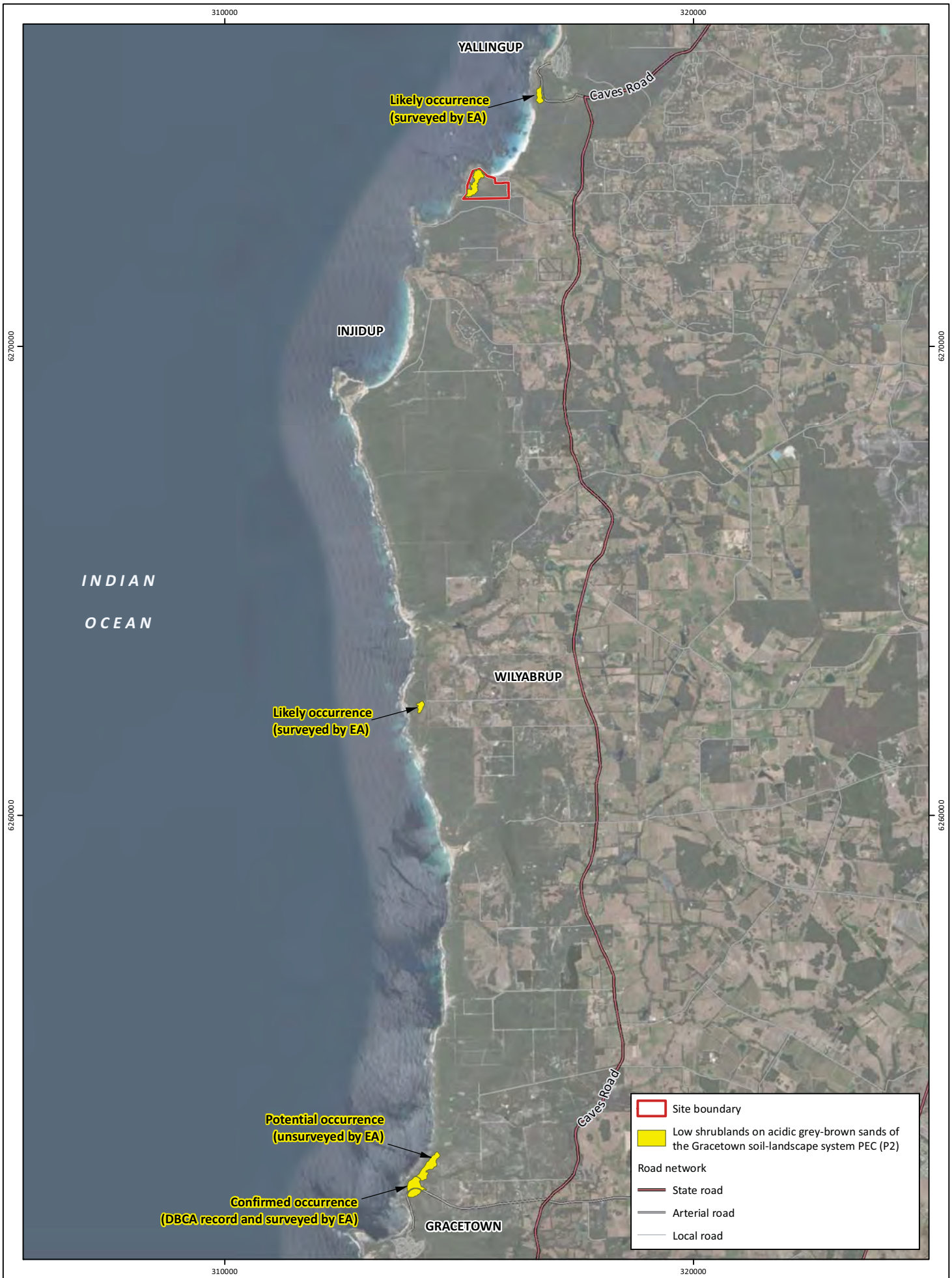


Figure 8: **Priority Ecological Communities (Region)**

Project: Spring Flora and Vegetation Assessment
Lot 4131 Smiths Beach Road, Yallingup

Client: Smiths 2014 Pty Ltd

Plan Number: EP18-085(05)--F18

Drawn:	SCM
Date:	14/03/2019
Checked:	TAA
Approved:	TAA
Date:	15/03/2019

N

0 1,000 2,000 3,000
Metres

Scale: 1:105,000@A4

GDA 1994 MGA Zone 50

emerge ASSOCIATES

Appendix A

Additional Background Information

Conservation Significant Flora and Vegetation

Threatened and priority flora

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

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

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

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

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

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

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

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

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

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

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment and Energy. 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 and Energy.

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

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

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

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

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2009). Listed PECs are published by DBCA (DBCA 2017b).

Table 3: Categories of priority ecological communities (DEC 2009).

Priority code	Description
P1	Priority One Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. 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 Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat 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 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: (i) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (ii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. 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.
P5	Priority Five 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.

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 4**. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in

Table 5.

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 *6*.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016).

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 (DAFWA 2016).

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 (DAFWA 2016).

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.

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *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.

Department of Biodiversity Conservation and Attractions (DBCA) 2017b, *Priority Ecological Communities for Western Australia Version 27*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018c, *Threatened and Priority Flora List 16 January 2018*, Perth.

Department of Environment and Conservation (DEC) 2007, *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset*, Perth.

Department of Environment and Conservation (DEC) 2009, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

English, V. and Blyth, J. 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, ANCA National Reserves System Cooperative Program, Project Number N702, Perth.

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) 2019, The Western Australian Organism List (WAOL), < https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>.

Appendix B

Species List

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Aizoaceae	
	Carpobrotus virescens
Amaranthaceae	
	Ptilotus drummondii
	Ptilotus manglesii
Apiaceae	
	Daucus glochidiatus
	Homalosciadium homalocarpum
	Platysace tenuissima
	Xanthosia candida
	Xanthosia sp.
Araceae	
	D *Zantedeschia aethiopica*
Araliaceae	
	Trachymene pilosa
Asparagaceae	
	Acanthocarpus preissii
	D *Asparagus asparagoides*
	Dichopogon preissii
	Lomandra hermaphrodita
	Lomandra micrantha subsp. *micrantha*
	Lomandra pauciflora
	Lomandra suaveolens
	Thysanotus patersonii
	Thysanotus thyrsoideus
Asteraceae	
	* *Arctotheca calendula*
	Brachyscome iberidifolia
	* *Carduus pycnocephalus*
	* *Cotula coronopifolia*
	* *Cotula turbinata*
	Hyalosperma cotula
	* *Hypochaeris glabra*
	* *Hypochaeris radicata*
	Lagenophora huegelii
	* *Logfia gallica*
	Olearia axillaris
	Podolepis lessonii
	Quinetia urvillei
	Rhodanthe citrina

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Asteraceae (cont.)	
	Rhodanthe corymbosa
	Senecio pinnatifolius var. *maritimus*
	Siloxerus humifusus
	* *Sonchus oleraceus*
	* *Ursinia anthemoides*
Campanulaceae	
	Isotoma hypocrateriformis
	Lobelia tenuior
	* *Wahlenbergia capensis*
	Wahlenbergia sp.
Caryophyllaceae	
	* *Petrorhagia dubia*
	* *Polycarpon tetraphyllum*
	* *Silene gallica*
	* *Spergula arvensis*
Casuarinaceae	
	Allocasuarina fraseriana
	Allocasuarina humilis
Celastraceae	
	Tripterococcus brunonis
Centrolepidaceae	
	Centrolepis drummondiana
Chenopodiaceae	
	Enchylaena tomentosa
	Rhagodia baccata subsp. *baccata*
	Threlkeldia diffusa
Colchicaceae	
	Burchardia congesta
Convolvulaceae	
	Dichondra repens
Crassulaceae	
	Crassula colorata
	Crassula exserta
	* *Crassula glomerata*

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Cyperaceae	
	Cyathochaeta avenacea
	Ficinia nodosa
	Isolepis marginata
	Lepidosperma calcicola
	Lepidosperma gladiatum
	Lepidosperma squamatum
	Schoenus grandiflorus
	Schoenus sp.
	Tetraria octandra
Dennstaedtiaceae	
	Pteridium esculentum subsp. *esculentum*
Dilleniaceae	
	Hibbertia amplexicaulis
	Hibbertia cuneiformis
	Hibbertia cunninghamii
	Hibbertia hypericoides
	Hibbertia racemosa
Ericaceae	
	Astroloma ciliatum
	Leucopogon australis
	Leucopogon parviflorus
	Leucopogon propinquus
Euphorbiaceae	
	* *Euphorbia peplus*
	* *Euphorbia terracina*
Fabaceae	
	Acacia alata var. *alata*
	Acacia cochlearis
	Acacia cyclops
	* *Acacia iteaphylla*
	Acacia littorea
	Acacia pulchella var. *pulchella*
	Acacia rostellifera
	Acacia saligna
	Bossiaea eriocarpa
	Chorizema ?cordatum
	Chorizema diversifolium
	Eutaxia myrtifolia
	Fabaceae sp.
	Gastrolobium ebracteolatum

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Fabaceae (cont.)	
	Gompholobium marginatum
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Hovea ?chorizemifolia
	Isotropis cuneifolia subsp. *cuneifolia*
	Jacksonia furcellata
	Jacksonia horrida
	Jacksonia sp.
	Kennedia prostrata
	* *Lotus subbiflorus*
	* *Lotus* sp.
	* *Trifolium campestre*
	* *Trifolium* sp.
Gentianaceae	
	* *Centaurium tenuiflorum*
	* *Cicendia filiformis*
Geraniaceae	
	* *Pelargonium capitatum*
Goodeniaceae	
	Scaevola calliptera
	Scaevola crassifolia
Haemodoraceae	
	Anigozanthos manglesii
	Conostylis aculeata subsp. *gracilis*
	Haemodorum laxum
	Haemodorum simplex
	Haemodorum sp.
Hemerocallidaceae	
	Caesia ?micrantha
	Dianella brevicaulis
	Dianella revoluta var. *revoluta*
	Stypandra glauca
	Tricoryne elatior
Iridaceae	
	Patersonia occidentalis
	* *Romulea rosea var. australis*
Juncaceae	
	* *?Juncus capitatus*

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Lauraceae	
	Cassytha flava
	Cassytha racemosa
	Cassytha sp.
Linaceae	
	* *Linum trigynum*
Loranthaceae	
	Nuytsia floribunda
Malvaceae	
	Guichenotia ledifolia
	Thomasia foliosa
	Thomasia triphylla
Myrtaceae	
	Agonis flexuosa
	Calothamnus sanguineus
	Corymbia calophylla
	Darwinia citriodora
	Eucalyptus marginata
	Kunzea ciliata
	Kunzea glabrescens
	Melaleuca huegelii
	Melaleuca lanceolata
	Melaleuca systena
Orchidaceae	
	Caladenia ?attingens subsp. attingens
	Caladenia attingens subsp. attingens
	Caladenia sp.
Orobanchaceae	
	* *Orobanche minor*
	* *Parentucellia latifolia*
Oxalidaceae	
	* *Oxalis corniculata*
	* *Oxalis pes-caprae*
Pittosporaceae	
	Marianthus candidus

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Phyllanthaceae	
	Phyllanthus calycinus
	Poranthera microphylla
Plantaginaceae	
	* *Plantago lanceolata*
Poaceae	
	* *Aira cupaniana*
	* *Aira praecox*
	Austrostipa flavescens
	Austrostipa mollis
	Austrostipa variabilis
	Austrostipa sp.
	* *Avena sp.*
	* *Briza maxima*
	* *Briza minor*
	* *Bromus hordeaceus*
	* *Ehrharta calycina*
	* *Ehrharta longiflora*
	* *Hordeum leporinum*
	* Lagurus ovatus
	Microlaena stipoides
	Neurachne alopecuroidea
	* *Phleum arenarium*
	Poa poiformis
	* *Poaceae sp.*
	Rytidosperma acerosum
	Rytidosperma occidentale
	Rytidosperma setaceum
	Rytidosperma sp.
	* *Vulpia bromoides*
Polygalaceae	
	Comesperma ciliatum
	Comesperma confertum
Polygonaceae	
	Muehlenbeckia adpressa
Primulaceae	
	* *Lysimachia arvensis*

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Proteaceae	
	Banksia attenuata
	Banksia bipinnatifida
	Banksia dallanneyi var. dallanneyi
	Banksia dallanneyi var. sylvestris
	P4 *Banksia sessilis var. cordata*
	Hakea oleifolia
	Hakea prostrata
	Hakea trifurcata
	Persoonia longifolia
	Petrophile linearis
Pteridaceae	
	Cheilanthes austrotenuifolia
Ranunculaceae	
	Clematis linearifolia
	Ranunculus colonorum
Restionaceae	
	Desmocladus flexuosus
	Hypolaena exsulca
Rhamnaceae	
	Spyridium globulosum
Rubiaceae	
	* *Galium murale*
	Opercularia vaginata
Rutaceae	
	Diplolaena dampieri
Santalaceae	
	Santalum acuminatum
Sapindaceae	
	Dodonaea ceratocarpa
Stylidiaceae	
	Levenhookia stipitata
	Stylidium adnatum
	Stylidium brunonianum
	Stylidium megacarpum
	Stylidium sp.

Flora Species List - Lot 431 Smiths Beach Road, Yallingup

Note: * denotes introduced (weed) species, D denotes declared pest species and P4 denotes 'priority 4' species.

Family	Species
Thymelaeaceae	
	Pimelea ferruginea
	Pimelea rosea subsp. *rosea*
Violaceae	
	Hybanthus calycinus
Xanthorrhoeaceae	
	Chamaescilla corymbosa
	Xanthorrhoea brunonis
	Xanthorrhoea preissii
Zamiaceae	
	Macrozamia riedlei

Species	Plant communities																																						
	AfPe				AhHe	AsDc						AsHh	BaMrXp				CcHh		DciDcL			KcDcPp	KcSg					MhGl					MlDr				MlKc	NfCcXp	
	Q15	Q18	Q19	Q32	Q7	Q10	Q12	Q3	Q4	Q5	Q9	Q11	opp	Q13	Q14	R17	Q33	Q34	Q16	Q35	Q36	Q37	opp	Q1	Q2	Q20	R24	Q25	Q27	Q29	Q30	Q31	Q22	Q23	Q26	Q28	Q21	Q6	R8
?Caesia micrantha		X															X																						
*?Juncus capitatus																				X																			
Acacia alata var. alata																					X																		
Acacia cochlearis					X	X	X		X		X					X			X	X				X															
Acacia cyclops																																	X						
*Acacia iteaphylla			X																																				
Acacia littorea																																				X			
Acacia pulchella var. pulchella							X		X	X	X	X						X	X	X	X	X		X			X										X	X	
Acacia rostellifera																											X	X	X	X	X		X	X	X	X			
Acacia saligna							X	X	X			X						X	X						X						X	X							
Acanthocarpus preissii							X																								X								
Agonis flexuosa	X	X	X	X					X			X		X	X		X	X	X	X							X												X
*Aira cupaniana		X			X	X	X	X	X	X	X				X	X	X	X	X	X	X								X		X				X			X	
*Aira praecox																				X				X													X		
Allocasuarina fraseriana																																							
Allocasuarina humilis					X																																	X	X
Anigozanthos manglesii																																							
*Arctotheca calendula																																						X	
*Asparagus asparagoides	X	X		X								X					X	X		X								X		X	X	X	X	X	X			X	X
Astroloma ciliatum						X												X																					
Austrostipa flavescens															X													X			X		X						
Austrostipa mollis		X			X	X		X	X	X	X			X	X																								
Austrostipa sp.									X																														
Austrostipa variabilis								X																															
*Avena sp.							X		X																			X		X				X					
Banksia attenuata														X	X	X																							
Banksia bipinnatifida						X			X		X													X	X		X												
Banksia dallanneyi subsp. dallanneyi					X	X	X	X	X	X		X						X	X	X				X														X	
Banksia dallanneyi subsp. sylvestris																											X												
Banksia sessilis var. cordata														X										X															
Bossiaea eriocarpa					X						X																												
Brachyscome iberidifolia					X																	X		X						X									
*Briza maxima	X	X		X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X		X							X	X	X					X	
*Briza minor		X		X	X		X	X		X								X			X										X		X					X	
*Bromus hordeaceus	X	X		X			X					X					X		X	X		X																	
Burchardia congesta					X									X	X		X																						
Caladenia ?attingens subsp. attingens																																			X				
Caladenia attingens subsp. attingens																	X																						
Caladenia sp.		X													X																								
Calothamnus sanguineus					X	X					X						X		X		X			X														X	
*Carduus pycnocephalus																																							
Carpobrotus virescens																X						X															X		
Cassytha flava					X																							X											
Cassytha racemosa										X											X																		
Cassytha sp.					X																																		
*Centaurium tenuiflorum								X	X		X										X	X							X				X		X		X	X	X

	Plant communities																																						
	AfPe				AhHe	AsDc						AsHh	BaMrXp				CcHh		DciDcL			KcDcPp	KcSg					MhGl					MlDr				MlKc	NfCcXp	
Species	Q15	Q18	Q19	Q32	Q7	Q10	Q12	Q3	Q4	Q5	Q9	Q11	opp	Q13	Q14	R17	Q33	Q34	Q16	Q35	Q36	Q37	opp	Q1	Q2	Q20	R24	Q25	Q27	Q29	Q30	Q31	Q22	Q23	Q26	Q28	Q21	Q6	R8
Centrolepis drummondiana																				X															X				
Chamaescilla corymbosa														X	X		X	X																					
Cheilanthes austrotenuifolia	X		X				X					X						X		X																			
Chorizema ?cordatum																	X																						
Chorizema diversifolium	X														X																								
*Cicendia filiformis																																			X				
Clematis linearifolia				X																								X		X	X	X	X		X				
Comesperma ciliatum																					X																		
Comesperma confertum						X								X							X																		
Conostylis aculeata subsp. gracilis								X																X				X		X					X				
Corymbia calophylla			X	X										X	X		X	X	X																			X	X
*Cotula coronopifolia		X																																					
*Cotula turbinata																		X																					
Crassula colorata																								X													X	X	
Crassula exserta																				X													X						
*Crassula glomerata																	X																X						
Cyathochaeta avenacea								X	X	X																													
Darwinia citriodora		X							X									X	X	X	X	X																	
Daucus glochidiatus	X		X	X													X																						
Desmocladus flexuosus					X									X	X												X	X	X	X	X								
Dianella brevicaulis																						X																	
Dianella revoluta var. revoluta												X						X				X								X	X	X	X	X	X	X	X		
Dichondra repens	X			X																																		X	
Dichopogon preissii															X																								
Diplolaena dampieri	X		X												X							X				X		X	X			X			X		X		
Dodonaea ceratocarpa						X		X	X	X	X	X							X	X	X	X		X	X	X	X		X					X			X		
*Ehrharta calycina		X		X	X			X				X		X	X	X	X	X	X	X								X		X	X	X						X	
*Ehrharta longiflora																																X							
Enchylaena tomentosa																										X													
Eucalyptus marginata								X			X						X																						
*Euphorbia peplus																												X		X	X	X			X				
*Euphorbia terracina		X		X											X		X																						X
Eutaxia myrtifolia								X		X	X				X							X		X	X	X	X		X								X		
Fabaceae sp.			X																																				
Ficinia nodosa																										X											X		
*Galium murale																														X					X				
Gastrolobium ebracteolatum																					X																		
Gompholobium marginatum											X																												
Gompholobium tomentosum					X									X										X				X											
Guichenotia ledifolia			X				X																								X		X	X	X				
Haemodorum laxum								X												X																			
Haemodorum simplex									X																														
Haemodorum sp.									X	X								X	X																				
Hakea oleifolia	X	X	X						X			X												X						X	X				X	X			
Hakea prostrata						X	X	X			X	X																X											
Hakea trifurcata																					X			X	X														

	Plant communities																																						
	AfPe				AhHe	AsDc						AsHh	BaMrXp				CcHh		DciDcL			KcDcPp	KcSg					MhGl					MlDr				MlKc	NfCcXp	
Species	**Q15**	**Q18**	**Q19**	**Q32**	**Q7**	**Q10**	**Q12**	**Q3**	**Q4**	**Q5**	**Q9**	**Q11**	**opp**	**Q13**	**Q14**	**R17**	**Q33**	**Q34**	**Q16**	**Q35**	**Q36**	**Q37**	**opp**	**Q1**	**Q2**	**Q20**	**R24**	**Q25**	**Q27**	**Q29**	**Q30**	**Q31**	**Q22**	**Q23**	**Q26**	**Q28**	**Q21**	**Q6**	**R8**
Hardenbergia comptoniana	X	X		X										X	X		X																						
Hibbertia amplexicaulis	X		X					X	X	X				X	X			X	X					X														X	
Hibbertia cuneiformis	X	X	X	X			X	X	X			X		X		X		X						X				X	X	X	X	X	X		X				
Hibbertia cunninghamii																	X																						
Hibbertia hypericoides		X			X	X	X	X	X	X	X	X		X			X	X	X	X	X			X			X							X				X	X
Hibbertia racemosa					X																							X		X									
Homalosciadium homalocarpum		X																																					
**Hordeum leporinum*																				X																			
Hovea ?chorizemifolia													X											X															
Hyalosperma cotula						X					X					X	X																					X	
Hybanthus calycinus																	X											X		X	X				X			X	
**Hypochaeris glabra*		X	X	X				X		X	X	X		X			X			X	X									X	X	X			X			X	X
**Hypochaeris radicata*	X																																						
Hypolaena exsulca					X																																		
Isolepis marginata																																			X				
Isotoma hypocrateriformis																								X															
Isotropis cuneifolia subsp. cuneifolia					X	X																																	
Jacksonia furcellata									X																														
Jacksonia horrida						X						X																										X	
Jacksonia sp.																								X															
Kennedia prostrata																								X															
Kunzea ciliata					X	X		X	X	X									X			X		X	X	X	X		X								X		
Kunzea glabrescens							X				X	X																											
Lagenophora huegelii				X	X									X	X		X																		X				
**Lagurus ovatus*				X																		X																	
Lepidosperma calcicola																																		X					
Lepidosperma gladiatum															X																								
Lepidosperma squamatum					X	X			X	X	X						X	X	X	X	X	X		X	X	X	X	X	X	X				X			X		
Leucopogon australis																																	X						
Leucopogon parviflorus												X						X				X		X	X	X	X	X	X	X	X	X		X	X	X	X		
Leucopogon propinquus					X	X	X		X	X	X	X			X			X	2	X	X																		X
Levenhookia stipitata		X	X							X				X										X															
**Linum trigynum*								X																													X		
Lobelia tenuior			X											X	X													X		X		X							
**Logfia gallica*																				X																			
Lomandra hermaphrodita																																			X				
Lomandra micrantha subsp. micrantha										X			X				X	X						X	X		X		X										
Lomandra pauciflora														X																									
Lomandra suaveolens					X																																		
**Lotus sp.*																																X							
**Lotus subbiflorus*				X																X	X	X																	
**Lysimachia arvensis*	X	X	X	X	X		X	X									X	X										X	X	X	X	X	X		X		X	X	X
Macrozamia riedlei	X	X		X							X			X	X	X	X	X	X		X										X	X						X	
Marianthus candidus																																		X					
Melaleuca huegelii																												X	X	X	X	X	X	X	X				
Melaleuca lanceolata											X											X		X	X	X	X	X		X					X	X	X	X	X

Species	Plant communities																																								
	AfPe				AhHe	AsDc						AsHh	BaMrXp				CcHh		DciDcL			KcDcPp	KcSg					MhGl					MlDr					MlKc	NfCcXp	
	Q15	Q18	Q19	Q32	Q7	Q10	Q12	Q3	Q4	Q5	Q9	Q11	opp	Q13	Q14	R17	Q33	Q34	Q16	Q35	Q36	Q37	opp	Q1	Q2	Q20	R24	Q25	Q27	Q29	Q30	Q31	Q22	Q23	Q26	Q28	Q21	Q6	R8
Melaleuca systena					X	X	X		X		X			X	X	X									X		X	X		X					X		X	X	
Microlaena stipoides		X																X									X			X	X						X	
Muehlenbeckia adpressa							X		X			X																	X	X	X					X		
Neurachne alopecuroidea					X	X					X								X		X																X	X
Nuytsia floribunda																																						X	X
Olearia axillaris								X	X			X			X			X				X						X									X		
Opercularia vaginata									X												X																		
**Orobanche minor*			X						X																														
**Oxalis corniculata*																														X	X							
**Oxalis pes-caprae*		X	X	X								X					X	X																					
**Parentucellia latifolia*								X												X																			
Patersonia occidentalis					2	X	X	X	X	X	X			X		X	X	X						X	X		X	X	X								X		
**Pelargonium capitatum*		X							X																														
Persoonia longifolia																																							
Petrophile linearis																												X		X									
**Petrorhagia dubia*	X	X		X	X	X	X		X	X	X				X					X							X					X		X			X	
**Phleum arenarium*																																X							
Phyllanthus calycinus	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X		X	X			X	X			X		X	X		X				X	X	
Pimelea rosea subsp. rosea					X									X	X																						X	X
Pimelea ferruginea		X						X	X										X			X		X	X		X			X						X		
**Plantago lanceolata*		X																																					
Platysace tenuissima																				X																			
Poa poiformis																						X						X											
**Poaceae sp.*								X		X														X															
Podolepis lessonii											X									X	X																		
Polycarpon tetraphyllum																																							
Poranthera microphylla														X														X		X	X	X			X				
Pteridium esculentum subsp. esculentum		X																																					
Ptilotus drummondii																		X					X						X										
Ptilotus manglesii															X	X						X																	
Quinetia urvillei																				X																			
Ranunculus colonorum																	X																						
Rhagodia baccata	X	X				X	X		X	X		X				X		X						X	X	X		X		X	X	X			X		X	X	X
Rhodanthe citrina			X		X									X														X		X	X								
Rhodanthe corymbosa					X																	X																X	
Romulea rosea var. australis											X									X																			
Rytidosperma acerosum																						X																	
Rytidosperma occidentale					X			X		X									X					X				X									X	X
Rytidosperma setaceum										X											X																		
Rytidosperma sp.																													X										
Santalum acuminatum						X	X									X											X												
Scaevola calliptera		X	X														X																						
Scaevola crassifolia											X											X																	
Schoenus grandiflorus																																							
Schoenus sp.		X																																					
Senecio pinnatifolius var. maritimus																						X															X		

	Plant communities																																						
	AfPe				AhHe	AsDc						AsHh	BaMrXp				CcHh		DciDcL			KcDcPp	KcSg					MhGl					MlDr				MlKc	NfCcXp	
Species	Q15	Q18	Q19	Q32	Q7	Q10	Q12	Q3	Q4	Q5	Q9	Q11	opp	Q13	Q14	R17	Q33	Q34	Q16	Q35	Q36	Q37	opp	Q1	Q2	Q20	R24	Q25	Q27	Q29	Q30	Q31	Q22	Q23	Q26	Q28	Q21	Q6	R8
Silene gallica			X																	X																			
Siloxerus humifusus										X				X																									
**Sonchus oleraceus*		X		X													X											X			X	X							
**Spergula arvensis*										X																													
Spyridium globulosum	X	X	X	X		X	X	X	X		X	X		X	X	X	X	X	X		X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	
Stylidium adnatum	X	X	X	X				X						X	X	X	X	X										X		X	X	X							X
Stylidium brunonianum			X		X									X	X													X											
Stylidium megacarpum						X					X																												
Stylidium sp.									X																														
Stypandra glauca																						X																	
Tetraria octandra																	X																						
Thomasia foliosa												X					X				X										X	X			X				
Thomasia triphylla			X																															X					
Threlkeldia diffusa																						X																	
Thysanotus patersonii																					X							X											
Thysanotus thyrsoideus																																						X	
Trachymene pilosa	X	X	X	X	X			X			X			X		X	X	X			X			X				X		X	X	X	X		X			X	X
Tricoryne elatior					X	X				X	X																												
**Trifolium campestre*		X																																					
**Trifolium sp.*									X																													X	
Tripterococcus brunonis													X											X															
**Ursinia anthemoides*																																							
**Vulpia bromoides*						X	X		X	X	X								X	X	X								X	X					X				
**Wahlenbergia capensis*																								X									X						
Wahlenbergia sp.			X		X									X	X						X									X	X							X	
Xanthorrhoea brunonis									X	X	X																X												
Xanthorrhoea preissii	X	X	X		X	X	X	X	X	X	X	X		X			X	X						X	X	X			X						X			X	X
Xanthosia candida	X				X	X		X						X			X					X		X				X											
Xanthosia sp.											X									X																			
**Zantedeschia aethiopica*	X	X	X	X	X		X					X					X	X										X		X	X	X						X	X

Appendix C

Sample Data

Vegetation Sample Data

Sample Name: Q1

Project no.: EP18-085
Date: 26/11/2018
Author: SKP

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315399.2865	NW corner northing:	6273520.119
Altitude (m):	35	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	low - Weeds
Soil type/texture	sand/clay	Bare ground (%):	30
Rocks (%) and type:	20%, granite	Soil colour:	brown
Litter:	10% (branches,twigs,leaves)	Vegetation condition:	excellent

Strata	Cover (%)	Height (m)	
Upper:	0%	Treeless	
Mid:	30 to 70	1 to 2	Quartz rocks, lateritic gravel
Ground layer 1:	<10	<0.5	
Ground layer 2:	<10	<0.5	

Vegetation description

Shrubland *Kunzea ciliata, Melaleuca lanceolata* and *Calothamnus sanguineus* over low sparse herbland *Lepidosperma squamatum, Trachymene pilosa* over low sparse tussock grassland

Vegetation Sample Data

Sample Name: Q1

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: SKP Q1: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	0
	Acacia pulchella var. pulchella	2
*	*Aira praecox*	1
	Banksia bipinnatifida	2
	Banksia dallanneyi subsp. dallanneyi	opp
	Banksia sessilis var. cordata	opp
	Brachyscome iberidifolia	0
*	*Briza maxima*	0
	Calothamnus sanguineus	5
	Conostylis aculeata subsp. gracilis	0
	Crassula colorata	0
	Dodonaea ceratocarpa	2
	Dodonaea ceratocarpa	2
	Eutaxia myrtifolia	2
	Gompholobium tomentosum	opp
	Hakea oleifolia	2
	Hakea trifurcata	2
	Hibbertia amplexicaulis	0
	Hibbertia cuneiformis	1
	Hibbertia hypericoides	5
	Hovea ?chorizemifolia	0
	Isotoma hypocrateriformis	0
	Jacksonia sp.	0
	Kennedia prostrata	0
	Kunzea ciliata	20
	Lepidosperma squamatum	2
	Leucopogon parviflorus	1
	Levenhookia stipitata	0
	Lomandra micrantha subsp. micrantha	0
	Melaleuca lanceolata	5
	Patersonia occidentalis	0
	Phyllanthus calycinus	0
	Pimelea ferruginea	2
*	*Poaceae sp.*	1
	Rhagodia baccata	1
	Rytidosperma occidentale	1

Vegetation Sample Data

Sample Name: Q1

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: SKP Q1: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Spyridium globulosum	1
	Trachymene pilosa	1
	Tripterococcus brunonis	0
*	*Wahlenbergia capensis*	1
	Xanthorrhoea preissii	2
	Xanthosia candida	0

Vegetation Sample Data

Sample Name: Q2

Project no.: EP18-085
Date: 26/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315342.8006	NW corner northing:	6273466.667
Altitude (m):	37	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - occ weeds,compacted, loss of u/
Soil type/texture	sand/clay	Bare ground (%):	20
Rocks (%) and type:	10%, granite	Soil colour:	brown
Litter:	25% (branches,twigs,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)	
Upper:	0%	0	
Mid:	70 to 100	1 to 2	gravel, compacted soil
Ground layer 1:	<10	<0.5	
Ground layer 2:	0%	0	

Vegetation description

Closed shrubland *Kunzea ciliata, Acacia saligna, Spyridium globulosum* and *Eutaxia myrtifolia* over low sparse sedgeland *Lepidosperma squamatum.*

Vegetation Sample Data

Sample Name: Q2

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: SKP Q2: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia saligna	5
	Banksia bipinnatifida	0
	Dodonaea ceratocarpa	2
	Dodonaea ceratocarpa	1
	Eutaxia myrtifolia	8
	Hakea trifurcata	0
	Kunzea ciliata	35
	Lepidosperma squamatum	5
	Leucopogon parviflorus	3
	Lomandra micrantha subsp. micrantha	0
	Melaleuca lanceolata	opp
	Melaleuca systena	opp
	Patersonia occidentalis	0
	Phyllanthus calycinus	0
	Pimelea ferruginea	2
	Rhagodia baccata	2
	Spyridium globulosum	20
	Xanthorrhoea preissii	2

Vegetation Sample Data

Sample Name: Q3

Project no.: EP18-085
Date: 26/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315449.3963	NW corner northing:	6273504.887
Altitude (m):	32	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	high - Weeds, partial clearing?
Soil type/texture	sand	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	30% (twigs,leaves)	Vegetation condition:	very good-good

Strata	Cover (%)	Height (m)
Upper:	0 to 5	<10
Mid:	30 to 70	1 to 2
Ground layer 1:	0%	<0.5
Ground layer 2:	0%	0

Vegetation description

low isolated clumps of trees *Eucalyptus marginata* over shrubland *Acacia saligna, Dodonaea ceratocarpa, Eutaxia myrtifolia* and *Spyridium globulosum* over low herbland

Vegetation Sample Data

Sample Name: Q3

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: SKP Q3: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia saligna	20
*	*Aira cupaniana*	2
	Austrostipa mollis	opp
	Austrostipa variabilis	opp
	Banksia dallanneyi subsp. dallanneyi	opp
*	*Briza maxima*	3
*	*Briza minor*	0
*	*Centaurium tenuiflorum*	1
	Conostylis aculeata subsp. gracilis	0
	Cyathochaeta avenacea	0
	Dodonaea ceratocarpa	10
*	*Ehrharta calycina*	4
	Eucalyptus marginata	2
	Eutaxia myrtifolia	5
	Haemodorum laxum	1
	Hakea prostrata	1
	Hibbertia amplexicaulis	1
	Hibbertia cuneiformis	1
	Hibbertia hypericoides	2
*	*Hypochaeris glabra*	3
	Kunzea ciliata	1
*	*Linum trigynum*	0
*	*Lysimachia arvensis*	1
	Olearia axillaris	2
*	*Parentucellia latifolia*	0
	Patersonia occidentalis	1
	Phyllanthus calycinus	0
	Pimelea ferruginea	1
*	*Poaceae sp.*	0
	Rytidosperma occidentale	3
	Spyridium globulosum	5
	Stylidium adnatum	opp
	Trachymene pilosa	10
	Xanthorrhoea preissii	2
	Xanthosia candida	0

Vegetation Sample Data

Sample Name: Q4

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315564.9098	NW corner northing:	6273629.255
Altitude (m):	14	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - Weeds, ajd to track
Soil type/texture	sand	Bare ground (%):	0
Rocks (%) and type:	1%, granite	Soil colour:	brown
Litter:	5% (twigs)	Vegetation condition:	very good-good

Strata	Cover (%)	Height (m)
Upper:	0%	Treeless
Mid:	30 to 70	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

Shrubland *Dodonaea ceratocarpa, Darwinia citriodora, Pimelea ferruginea , Xanthorrhoea s* pp. and *Banksia dallanneyi* subsp. *dallanneyi* over low sparse sedgeland *Lepidosperma squamatum* over low sparse herbland

Vegetation Sample Data

Sample Name: Q4

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	1
	Acacia pulchella var. pulchella	2
	Acacia saligna	2
	Agonis flexuosa	opp
*	*Aira cupaniana*	2
	Austrostipa mollis	1
	Austrostipa sp.	0
*	*Avena sp.*	0
	Banksia bipinnatifida	1
	Banksia dallanneyi subsp. dallanneyi	10
*	*Briza maxima*	1
*	*Centaurium tenuiflorum*	2
	Cyathochaeta avenacea	opp
	Darwinia citriodora	3
	Dodonaea ceratocarpa	5
	Haemodorum simplex	opp
	Haemodorum sp.	0
	Hakea oleifolia	opp
	Hibbertia amplexicaulis	0
	Hibbertia cuneiformis	2
	Hibbertia hypericoides	3
	Jacksonia furcellata	2
	Kunzea ciliata	2
	Lepidosperma squamatum	3
	Leucopogon propinquus	2
	Leucopogon propinquus	2
	Melaleuca systena	opp
	Muehlenbeckia adpressa	2
	Olearia axillaris	2
	Opercularia vaginata	0
*	*Orobanche minor*	0
	Patersonia occidentalis	1
*	*Pelargonium capitatum*	1
*	*Petrorhagia dubia*	2
*	*Petrorhagia dubia*	1
	Phyllanthus calycinus	1

Vegetation Sample Data

Sample Name: Q4

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q4: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Pimelea ferruginea	10
	Rhagodia baccata	2
	Spyridium globulosum	opp
	Stylidium sp.	opp
*	*Trifolium sp.*	5
*	*Vulpia bromoides*	3
	Xanthorrhoea brunonis	1
	Xanthorrhoea preissii	3

Vegetation Sample Data

Sample Name: Q5

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315516.5251	NW corner northing:	6273554.882
Altitude (m):	28	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - Weeds
Soil type/texture	sand/clay	Bare ground (%):	10
Rocks (%) and type:	1%, granite	Soil colour:	brown
Litter:	2% (twigs)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)	
Upper:	0%	Treeless	
Mid:	30 to 70	1 to 2	granite nearby
Ground layer 1:	10 to 30	<0.5	
Ground layer 2:	0%	0	

Vegetation description

Shrubland *Kunzea ciliata, Hibbertia hypericoides,Dodonaea ceratocarpa, Xanthorrhoea* spp. and *Banksia dallanneyi subsp. dallanneyi* over low open herbland *Cyathochaeta avenacea, Lepidosperma squamatum* over open tussock grassland *Rytidosperma* spp. *Austrostipa mollis* and **Briza* spp.

Vegetation Sample Data

Sample Name: Q5

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q5: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	opp
*	*Aira cupaniana*	3
	Austrostipa mollis	1
	Banksia dallanneyi subsp. dallanneyi	1
*	*Briza maxima*	3
*	*Briza minor*	2
	Cassytha racemosa	0
	Cyathochaeta avenacea	2
	Dodonaea ceratocarpa	1
	Eutaxia myrtifolia	opp
	Haemodorum sp.	0
	Hibbertia amplexicaulis	1
	Hibbertia hypericoides	5
*	*Hypochaeris glabra*	1
	Kunzea ciliata	10
	Lepidosperma squamatum	2
	Leucopogon propinquus	2
	Levenhookia stipitata	0
	Lomandra micrantha subsp. micrantha	0
	Patersonia occidentalis	0
*	*Petrorhagia dubia*	1
	Phyllanthus calycinus	0
*	*Poaceae sp.*	0
	Rhagodia baccata	1
	Rytidosperma occidentale	10
	Rytidosperma setaceum	1
	Siloxerus humifusus	0
	Siloxerus humifusus	0
*	*Spergula arvensis*	0
	Tricoryne elatior	opp
*	*Vulpia bromoides*	2
	Xanthorrhoea brunonis	2
	Xanthorrhoea preissii	10

Vegetation Sample Data

Sample Name: Q6

Project no.: EP18-085
Date: 27/11/2018
Author: SKP

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315535.8177	NW corner northing:	6273497.233
Altitude (m):	32	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, diggings
Soil type/texture	sand with organic layer	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	40% (twigs,leaves)	Vegetation condition:	very good-good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	10 to 30	1 to 2
Ground layer 1:	10 to 30	<0.5
Ground layer 2:	0%	0

Vegetation description

low open forest *Nuytsia floribunda* and *Corymbia calophylla* over open shrubland *Melaleuca lanceolata, Spyridium globulosum* and *Xanthorrhoea preissii* over low open herb **Petrorhagia dubia* and **Trifolium* sp.

Vegetation Sample Data

Sample Name: Q6

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q6: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	opp
*	*Aira cupaniana*	3
	Allocasuarina humilis	1
*	*Arctotheca calendula*	0
*DP	*Asparagus asparagoides*	1
	Banksia dallanneyi subsp. dallanneyi	1
*	*Briza maxima*	1
*	*Briza minor*	2
	Calothamnus sanguineus	0
*	*Centaurium tenuiflorum*	0
	Corymbia calophylla	5
	Crassula colorata	1
	Dichondra repens	1
*	*Ehrharta calycina*	3
	Hibbertia amplexicaulis	opp
	Hibbertia hypericoides	10
	Hyalosperma cotula	0
	Hybanthus calycinus	opp
*	*Hypochaeris glabra*	2
	Jacksonia horrida	opp
*	*Lysimachia arvensis*	0
	Macrozamia riedlei	1
	Melaleuca lanceolata	5
	Melaleuca systena	1
	Microlaena stipoides	0
	Nuytsia floribunda	25
*	*Petrorhagia dubia*	2
	Phyllanthus calycinus	2
	Pimelea rosea subsp. rosea	opp
	Rhagodia baccata	2
	Rhodanthe corymbosa	1
	Rytidosperma occidentale	5
	Spyridium globulosum	5
	Thysanotus thyrsoideus	opp
	Trachymene pilosa	2
*	*Trifolium sp.*	3

Vegetation Sample Data

Sample Name: Q6

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q6: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Wahlenbergia sp.	1
	Xanthorrhoea preissii	5
*DP	*Zantedeschia aethiopica*	2

Vegetation Sample Data

Sample Name: Q7

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315468.1774	NW corner northing:	6273372.677
Altitude (m):	42	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, diggings
Soil type/texture	sand	Bare ground (%):	15
Rocks (%) and type:	No rocks	Soil colour:	yellow/brown
Litter:	10% (twigs,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	30 to 70	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

Shrubland Allocasuarina humilis, Hibbertia hypericoides and Melaleuca systena over low sparse herbland Brachyscome iberidifolia, Cassytha spp. Lepidosperma squamatum over low sparse tussock grassland Austrostipa mollis, *Briza spp.

Vegetation Sample Data

Sample Name: Q7

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q7: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	2
*	*Aira cupaniana*	0
	Allocasuarina humilis	25
	Austrostipa mollis	1
	Banksia dallanneyi subsp. dallanneyi	2
	Bossiaea eriocarpa	0
	Brachyscome iberidifolia	1
*	*Briza maxima*	3
*	*Briza minor*	3
	Burchardia congesta	0
	Calothamnus sanguineus	opp
	Cassytha flava	3
	Cassytha sp.	2
	Desmocladus flexuosus	1
*	*Ehrharta calycina*	0
	Gompholobium tomentosum	1
	Hibbertia hypericoides	15
	Hibbertia racemosa	0
	Hypolaena exsulca	3
	Isotropis cuneifolia subsp. cuneifolia	0
	Kunzea ciliata	1
	Lagenophora huegelii	0
	Lepidosperma squamatum	3
	Leucopogon propinquus	1
	Lomandra suaveolens	0
*	*Lysimachia arvensis*	0
	Melaleuca systena	3
	Neurachne alopecuroidea	0
	Patersonia occidentalis	1
	Patersonia occidentalis	0
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	1
	Pimelea rosea subsp. rosea	2
	Rhodanthe citrina	0
	Rhodanthe corymbosa	1
	Rytidosperma occidentale	5

Vegetation Sample Data

Sample Name: Q7

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q7: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Rytidosperma occidentale	0
	Stylidium brunonianum	0
	Trachymene pilosa	0
	Tricoryne elatior	2
	Wahlenbergia sp.	0
	Xanthorrhoea preissii	1
	Xanthosia candida	0
*DP	*Zantedeschia aethiopica*	0

Vegetation Sample Data

Sample Name: R8

Project no.: EP18-085
Date: 27/11/2018
Author: SKP

Status Non-permanent

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	315444.7624	NW corner northing:	6273413.162
Altitude (m):	40	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	yellow/brown
Litter:	30% (twigs,leaves)	Vegetation condition:	very good-good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	<10	1 to 2
Ground layer 1:	30 to 70	<0.5
Ground layer 2:	0%	0

Vegetation description

low open forest Nuytsia floribunda and Corymbia calophylla over open sparse shrubland Rhagodia baccata., Melaleuca spp.and Xanthorrhoea preissii over low herb *Zantedeschia aethiopica and *Lysimachia arvensis

Vegetation Sample Data

Sample Name: R8

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP

Species Data

* denotes non-native species

Status	Confirmed name
	Agonis flexuosa
	Allocasuarina humilis
*DP	*Asparagus asparagoides*
*	*Centaurium tenuiflorum*
	Corymbia calophylla
*	*Euphorbia terracina*
	Hibbertia hypericoides
*	*Hypochaeris glabra*
	Leucopogon propinquus
*	*Lysimachia arvensis*
	Melaleuca lanceolata
	Melaleuca systena
	Nuytsia floribunda
	Phyllanthus calycinus
	Pimelea rosea subsp. rosea
	Rhagodia baccata
	Rytidosperma occidentale
	Rytidosperma occidentale
	Stylidium adnatum
	Trachymene pilosa
	Xanthorrhoea preissii
*DP	*Zantedeschia aethiopica*

Vegetation Sample Data

Sample Name: Q9

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315610.0306	NW corner northing:	6273511.752
Altitude (m):	26	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	sand	Bare ground (%):	25
Rocks (%) and type:	5%, quartz	Soil colour:	grey
Litter:	15% (twigs,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	10 to 30	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

Open shrubland Calothamnus sanguineus, Xanthorrhoea spp., Kunzea glabrescens over low sparse herbland over low sparse tussock grassland

Vegetation Sample Data

Sample Name: Q9

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	opp
	Acacia pulchella var. pulchella	0
*	*Aira cupaniana*	2
	Austrostipa mollis	0
	Banksia bipinnatifida	0
	Bossiaea eriocarpa	0
*	*Briza maxima*	4
	Calothamnus sanguineus	5
*	*Centaurium tenuiflorum*	0
	Dodonaea ceratocarpa	3
	Eucalyptus marginata	opp
	Eutaxia myrtifolia	opp
	Gompholobium marginatum	0
	Hakea prostrata	1
	Hibbertia hypericoides	4
	Hyalosperma cotula	1
*	*Hypochaeris glabra*	1
	Kunzea glabrescens	5
	Lepidosperma squamatum	5
	Leucopogon propinquus	opp
	Leucopogon propinquus	2
	Macrozamia riedlei	opp
	Melaleuca lanceolata	opp
	Melaleuca systena	3
	Neurachne alopecuroidea	2
	Neurachne alopecuroidea	1
	Patersonia occidentalis	1
*	*Petrorhagia dubia*	2
	Phyllanthus calycinus	0
	Podolepis lessonii	0
*	*Romulea rosea var. australis*	1
	Scaevola crassifolia	0
	Spyridium globulosum	opp
	Stylidium megacarpum	3
	Trachymene pilosa	0
	Tricoryne elatior	0

Vegetation Sample Data

Sample Name: Q9

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q9: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	*Vulpia bromoides*	3
	Xanthorrhoea brunonis	2
	Xanthorrhoea preissii	5
	Xanthosia sp.	2

Vegetation Sample Data

Sample Name: Q10

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315604.1661	NW corner northing:	6273551.355
Altitude (m):	22	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	low - weeds
Soil type/texture	sand/clay	Bare ground (%):	3
Rocks (%) and type:	No rocks	Soil colour:	grey
Litter:	10% (twigs,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	10 to 30	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

Open shrubland Dodonaea ceratocarpa, Kunzea ciliata, Melaleuca systena, Xanthorrhoea preissii over low sparse herbland Lepidosperma squamatum, Stylidium megacarpum, *Petrorhagia dubia over low sparse tussock grassland *Briza maxima, *Vulpia bromoides, Austrostipa mollis

Vegetation Sample Data

Sample Name: Q10

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q10: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	2
*	*Aira cupaniana*	2
	Astroloma ciliatum	0
	Austrostipa mollis	0
	Banksia bipinnatifida	1
	Banksia dallanneyi subsp. dallanneyi	1
*	*Briza maxima*	4
	Calothamnus sanguineus	2
	Comesperma confertum	0
	Dodonaea ceratocarpa	10
	Hakea prostrata	1
	Hibbertia hypericoides	2
	Hyalosperma cotula	0
	Isotropis cuneifolia subsp. cuneifolia	0
	Jacksonia horrida	2
	Kunzea ciliata	3
	Lepidosperma squamatum	5
	Leucopogon propinquus	1
	Leucopogon propinquus	1
	Melaleuca systena	5
	Neurachne alopecuroidea	1
	Patersonia occidentalis	0
*	*Petrorhagia dubia*	2
	Rhagodia baccata	2
	Santalum acuminatum	opp
	Spyridium globulosum	1
	Stylidium megacarpum	5
	Tricoryne elatior	0
*	*Vulpia bromoides*	5
	Xanthorrhoea preissii	5
	Xanthosia candida	0

Vegetation Sample Data

Sample Name: Q11

Project no.: EP18-085
Date: 27/11/2018
Author: SKP

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315607.7704	NW corner northing:	6273576.164
Altitude (m):	18	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, changes to structure
Soil type/texture	sand	Bare ground (%):	0
Rocks (%) and type:	1%, granite	Soil colour:	brown
Litter:	20% (branches,twigs,leaves)	Vegetation condition:	good

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	10 to 30	>2
Ground layer 1:	10 to 30	1 to 2
Ground layer 2:	<10	<0.5

Vegetation description

Tall open shrubland Acacia saligna and Spyridium globulosum over open shrubland Hibbertia cuneiformis and Dodonaea ceratocarpa over low sparse herbland Cheilanthes austrotenuifolia

Vegetation Sample Data

Sample Name: Q11

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q11: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	0
	Acacia saligna	20
	Agonis flexuosa	opp
*DP	*Asparagus asparagoides*	0
	Banksia dallanneyi subsp. dallanneyi	0
*	*Briza maxima*	0
*	*Bromus hordeaceus*	0
	Cheilanthes austrotenuifolia	3
	Dianella revoluta var. revoluta	0
	Dodonaea ceratocarpa	3
*	*Ehrharta calycina*	3
	Hakea oleifolia	1
	Hakea prostrata	1
	Hibbertia cuneiformis	3
	Hibbertia hypericoides	1
*	*Hypochaeris glabra*	2
	Jacksonia horrida	1
	Kunzea glabrescens	0
	Leucopogon parviflorus	1
	Leucopogon propinquus	0
	Muehlenbeckia adpressa	1
	Olearia axillaris	0
*	*Oxalis pes-caprae*	0
	Rhagodia baccata	2
	Spyridium globulosum	3
	Thomasia foliosa	0
	Xanthorrhoea preissii	3
*DP	*Zantedeschia aethiopica*	2

Vegetation Sample Data

Sample Name: Q12

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315707.2046	NW corner northing:	6273432.193
Altitude (m):	24	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	low - weeds
Soil type/texture	sand with organic layer	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	50% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	N/A	<10
Mid:	30 to 70	1 to 2
Ground layer 1:	10 to 30	<0.5
Ground layer 2:	0%	<0.5

Vegetation description

Shrubland Acacia saligna, Guichenotia ledifolia, Hakea prostrata, Hibbertia cuneiformis, Santalum acuminatum and Spyridium globulosum over tussock grassland *Vulpia bromoides, *Aira cupaniana and *Briza spp.

Vegetation Sample Data

Sample Name: Q12

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q12: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	3
	Acacia pulchella var. pulchella	opp
	Acacia saligna	40
	Acanthocarpus preissii	0
*	*Aira cupaniana*	5
*	*Avena sp.*	1
	Banksia dallanneyi subsp. dallanneyi	2
*	*Briza maxima*	10
*	*Briza minor*	5
*	*Bromus hordeaceus*	0
	Cheilanthes austrotenuifolia	0
	Guichenotia ledifolia	8
	Hakea prostrata	5
	Hibbertia cuneiformis	10
	Hibbertia hypericoides	1
	Kunzea glabrescens	opp
	Leucopogon propinquus	0
*	*Lysimachia arvensis*	3
	Melaleuca systena	3
	Muehlenbeckia adpressa	2
	Patersonia occidentalis	0
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	1
	Rhagodia baccata	3
	Santalum acuminatum	8
	Spyridium globulosum	5
*	*Vulpia bromoides*	15
	Xanthorrhoea preissii	0
*DP	*Zantedeschia aethiopica*	2

Vegetation Sample Data

Sample Name: Q13

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315707.2046	NW corner northing:	6273432.193
Altitude (m):	24	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	low - weeds
Soil type/texture	sand with organic layer	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	50% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	10 to 30	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

low open forest Banksia spp. and Agonis flexuosa over open shrubland Spyridium globulosum over low sparse herbland Stylidium adnatum, Trachymene pilosa, *Hypochaeris glabra over low sparse tussock grassland *Briza maxima, *Ehrharta calycina, Austrostipa mollis

Vegetation Sample Data

Sample Name: Q13

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Agonis flexuosa	20
	Austrostipa mollis	0
	Austrostipa mollis	0
	Austrostipa mollis	0
	Banksia attenuata	20
	Banksia sessilis var. cordata	5
*	*Briza maxima*	4
	Burchardia congesta	0
	Chamaescilla corymbosa	0
	Comesperma confertum	0
	Corymbia calophylla	1
	Desmocladus flexuosus	0
*	*Ehrharta calycina*	2
	Gompholobium tomentosum	0
	Hardenbergia comptoniana	0
	Hibbertia amplexicaulis	0
	Hibbertia cuneiformis	0
	Hibbertia hypericoides	0
*	*Hypochaeris glabra*	1
*	*Hypochaeris glabra*	1
	Lagenophora huegelii	0
	Lagenophora huegelii	0
	Levenhookia stipitata	0
	Lobelia tenuior	0
	Lomandra pauciflora	0
	Macrozamia riedlei	2
	Melaleuca systena	1
	Patersonia occidentalis	0
	Phyllanthus calycinus	1
	Pimelea rosea subsp. rosea	0
	Poranthera microphylla	1
	Rhodanthe citrina	0
	Siloxerus humifusus	0
	Spyridium globulosum	5
	Stylidium adnatum	2
	Stylidium brunonianum	1

Vegetation Sample Data

Sample Name: Q13

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q13: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Trachymene pilosa	1
	Wahlenbergia sp.	0
	Xanthorrhoea preissii	2
	Xanthosia candida	0
	Xanthosia candida	0

Vegetation Sample Data

Sample Name: Q14

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315668.2431	NW corner northing:	6273374.31
Altitude (m):	32	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, adj to track
Soil type/texture	sand with organic layer	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	40% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	<10	1 to 2
Ground layer 1:	10 to 30	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

low open forest Banksia spp., Corymbia calophylla and Agonis flexuosa over open shrubland Spyridium globulosum and Diplolaena dampieri over low sparse herbland Lepidosperma gladiatum, Stylidium spp. over low sparse tussock grassland *Ehrharta calycina, Austrostipa spp.

Vegetation Sample Data

Sample Name: Q14

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q14: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Agonis flexuosa	40
*	*Aira cupaniana*	1
	Austrostipa flavescens	0
	Austrostipa mollis	0
	Banksia attenuata	10
	Burchardia congesta	0
	Caladenia sp.	0
	Chamaescilla corymbosa	0
	Chorizema diversifolium	0
	Corymbia calophylla	2
	Desmocladus flexuosus	1
	Dichopogon preissii	0
	Diplolaena dampieri	3
*	*Ehrharta calycina*	0
*	*Euphorbia terracina*	0
	Eutaxia myrtifolia	0
	Hardenbergia comptoniana	0
	Hibbertia amplexicaulis	0
	Lagenophora huegelii	0
	Lepidosperma gladiatum	10
	Leucopogon propinquus	0
	Lobelia tenuior	0
	Macrozamia riedlei	2
	Melaleuca systena	1
	Olearia axillaris	1
*	*Petrorhagia dubia*	0
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	1
	Pimelea rosea subsp. rosea	0
	Ptilotus manglesii	0
	Spyridium globulosum	5
	Stylidium adnatum	1
	Stylidium brunonianum	0
	Wahlenbergia sp.	0

Vegetation Sample Data

Sample Name: Q15

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315842.1411	NW corner northing:	6273434.233
Altitude (m):	16	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand with organic layer	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	60% (branches,leaves)	Vegetation condition:	good-very good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	30 to 70	1 to 2
Ground layer 1:	<10	>0.5
Ground layer 2:	<10	<0.5

Vegetation description

low open forest Agonis flexuosa over shrubland Spyridium globulosum, Hakea oleifolia, Diplolaena dampieri and Macrozamia riedlei over tall sparse herbland *Zantedeschia aethiopica, Dichondra repens, Stylidium adnatum and Trachymene pilosa over low sparse tussock grassland *Briza maxima, *Bromus hordeaceus

Vegetation Sample Data

Sample Name: Q15

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q15: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Agonis flexuosa	40
*DP	*Asparagus asparagoides*	0
*	*Briza maxima*	1
*	*Bromus hordeaceus*	0
	Cheilanthes austrotenuifolia	0
	Chorizema diversifolium	0
	Daucus glochidiatus	0
	Dichondra repens	2
	Diplolaena dampieri	5
	Hakea oleifolia	5
	Hardenbergia comptoniana	0
	Hibbertia amplexicaulis	opp
	Hibbertia cuneiformis	opp
*	*Hypochaeris radicata*	1
*	*Lysimachia arvensis*	1
	Macrozamia riedlei	5
*	*Petrorhagia dubia*	0
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	2
	Rhagodia baccata	1
	Spyridium globulosum	30
	Stylidium adnatum	1
	Trachymene pilosa	1
	Xanthorrhoea preissii	1
	Xanthosia candida	0
*DP	*Zantedeschia aethiopica*	5

Vegetation Sample Data

Sample Name: Q16

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	316018.3748	NW corner northing:	6273459.585
Altitude (m):	24	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, adj to track
Soil type/texture	clay	Bare ground (%):	20
Rocks (%) and type:	10%, granite	Soil colour:	orange
Litter:	25% (twigs,leaves)	Vegetation condition:	good-very good

Strata	Cover (%)	Height (m)
Upper:	~0	<10
Mid:	30 to 70	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

Low isolated trees Corymbia calophylla over shrubland Darwinia citriodora and Dodonaea ceratocarpa over low sparse sedgeland Lepidosperma squamatum over low open tussock grassland *Aira cupaniana, *Vulpia bromoides, *Briza maxima, Rytidosperma occidentale

Vegetation Sample Data

Sample Name: Q16

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP Q16: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	2
	Acacia pulchella var. pulchella	opp
	Acacia saligna	2
	Agonis flexuosa	opp
*	*Aira cupaniana*	3
	Banksia dallanneyi subsp. dallanneyi	1
*	*Briza maxima*	5
*	*Bromus hordeaceus*	opp
	Calothamnus sanguineus	opp
	Corymbia calophylla	2
	Darwinia citriodora	30
	Dodonaea ceratocarpa	20
*	*Ehrharta calycina*	opp
	Haemodorum sp.	opp
	Hibbertia amplexicaulis	opp
	Hibbertia hypericoides	2
	Kunzea ciliata	opp
	Kunzea ciliata	opp
	Lepidosperma squamatum	5
	Leucopogon propinquus	opp
	Leucopogon propinquus	opp
	Macrozamia riedlei	opp
	Neurachne alopecuroidea	3
	Pimelea ferruginea	2
	Rytidosperma occidentale	3
	Spyridium globulosum	3
*	*Vulpia bromoides*	5

Vegetation Sample Data

Sample Name: R17

Project no.: EP18-085
Date: 27/11/2018
Author: SKP
Status Non-permanent

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	315688.2973	NW corner northing:	6273532.562
Altitude (m):	14	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand	Bare ground (%):	15
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	30% (branches,twigs,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	10 to 30	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

low open forest Banksia attenuata over open shrubland Macrozamia riedlei over low sparse herbland over low sparse tussock grassland

Vegetation Sample Data

Sample Name: R17

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: SKP

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cochlearis	opp
*	*Aira cupaniana*	opp
	Banksia attenuata	opp
*	*Briza maxima*	opp
	Carpobrotus virescens	opp
*	*Ehrharta calycina*	opp
	Hibbertia cuneiformis	opp
	Hyalosperma cotula	opp
	Macrozamia riedlei	opp
	Melaleuca systena	opp
	Patersonia occidentalis	opp
	Phyllanthus calycinus	opp
	Ptilotus manglesii	opp
	Rhagodia baccata	opp
	Santalum acuminatum	opp
	Spyridium globulosum	opp
	Stylidium adnatum	opp
	Trachymene pilosa	opp

Vegetation Sample Data

Sample Name: Q18

Project no.: EP18-085
Date: 28/11/2018
Author: SKP

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315910.0048	NW corner northing:	6273354.33
Altitude (m):	24	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, diggings
Soil type/texture	sand with organic layer	Bare ground (%):	1
Rocks (%) and type:	No rocks	Soil colour:	brown/orange
Litter:	70% (logs,leaves)	Vegetation condition:	good-very good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	<10	1 to 2
Ground layer 1:	70 to 100	<0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

low open forest Agonis flexuosa over sparse shrubland Pimelea ferruginea and Hibbertia hypericoides over low closed herbland Scaevola calliptera, *Cotula coronopifolia over low tussock grassland Microlaena stipoides, Austrostipa mollis and *Ehrharta calycina

Vegetation Sample Data

Sample Name: Q18

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author:

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	?Caesia micrantha	1
	Agonis flexuosa	opp
*	*Aira cupaniana*	0
*DP	*Asparagus asparagoides*	opp
	Austrostipa mollis	2
*	*Briza maxima*	1
*	*Briza minor*	1
*	*Bromus hordeaceus*	1
	Caladenia sp.	2
*	*Cotula coronopifolia*	1
	Darwinia citriodora	0
*	*Ehrharta calycina*	2
*	*Euphorbia terracina*	0
	Hakea oleifolia	1
	Hardenbergia comptoniana	5
	Hibbertia cuneiformis	0
	Hibbertia hypericoides	3
	Homalosciadium homalocarpum	0
*	*Hypochaeris glabra*	1
	Levenhookia stipitata	1
*	*Lysimachia arvensis*	opp
	Macrozamia riedlei	0
	Microlaena stipoides	20
*	*Oxalis pes-caprae*	3
*	*Pelargonium capitatum*	opp
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	0
	Pimelea ferruginea	5
*	*Plantago lanceolata*	1
	Pteridium esculentum subsp. esculentum	2
	Rhagodia baccata	0
	Scaevola calliptera	5
	Schoenus sp.	2
*	*Sonchus oleraceus*	
	Spyridium globulosum	
	Stylidium adnatum	

Vegetation Sample Data

Sample Name: Q18

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: SKP Q18: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Trachymene pilosa	
*	*Trifolium campestre*	
	Xanthorrhoea preissii	
*DP	*Zantedeschia aethiopica*	

Vegetation Sample Data

Sample Name: Q19

Project no.: EP18-085
Date: 28/11/2018
Author: SKP

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315772.5885	NW corner northing:	6273307.646
Altitude (m):	34	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand	Bare ground (%):	10
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	60% (branches,twigs,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	<10	1 to 2
Ground layer 1:	10 to 30	<0.5
Ground layer 2:	~0	<0.5

Vegetation description

low open forest Agonis flexuosa and Corymbia calophylla over sparse shrubland Spyridium globulosum over low herbland *Lysimachia arvensis, *Hypochaeris glabra, *Zantedeschia aethiopica and Trachymene pilosa over low isolated tussock grassland

Vegetation Sample Data

Sample Name: Q19

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: SKP Q19: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	*Acacia iteaphylla*	opp
	Agonis flexuosa	40
	Cheilanthes austrotenuifolia	3
	Corymbia calophylla	20
	Daucus glochidiatus	0
	Diplolaena dampieri	2
	Fabaceae sp.	opp
	Guichenotia ledifolia	0
	Hakea oleifolia	2
	Hibbertia amplexicaulis	0
	Hibbertia cuneiformis	3
*	*Hypochaeris glabra*	2
	Levenhookia stipitata	0
	Lobelia tenuior	0
*	*Lysimachia arvensis*	3
*	*Orobanche minor*	0
*	*Oxalis pes-caprae*	2
	Phyllanthus calycinus	1
	Rhodanthe citrina	0
	Scaevola calliptera	0
*	*Silene gallica*	1
	Spyridium globulosum	5
	Stylidium adnatum	1
	Stylidium brunonianum	opp
	Thomasia triphylla	0
	Trachymene pilosa	2
	Wahlenbergia sp.	0
	Xanthorrhoea preissii	2
*DP	*Zantedeschia aethiopica*	5

Vegetation Sample Data

Sample Name: Q20

Project no.: EP18-085
Date: 28/11/2018
Author: SKP,RAO
Status Non-permanent

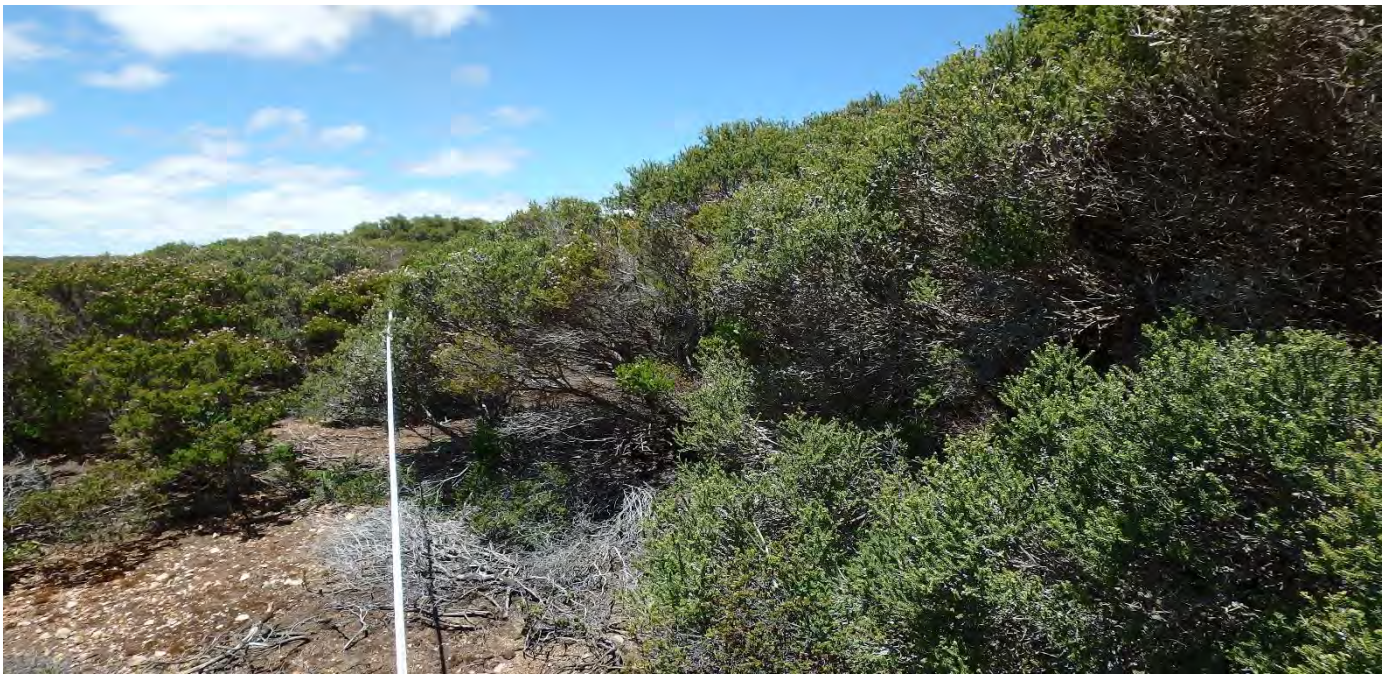
Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315312.5229	NW corner northing:	6273444.45
Altitude (m):	42	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	lower slope
Time since fire:	no evidence	Disturbance:	low - diggings
Soil type/texture	sand/clay with organic layer	Bare ground (%):	10
Rocks (%) and type:	10%, granite	Soil colour:	brown
Litter:	80% (branches,leaves)	Vegetation condition:	excellent

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	70 to 100	>2
Ground layer 1:	<10	<1
Ground layer 2:	0%	0

Vegetation description

Tall closed shrubland Melaleuca lanceolata



Vegetation Sample Data

Sample Name: Q20

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: SKP, RAO Q20: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Diplolaena dampieri	opp
	Dodonaea ceratocarpa	1
	Enchylaena tomentosa	0
	Eutaxia myrtifolia	0
	Ficinia nodosa	0
	Kunzea ciliata	1
	Lepidosperma squamatum	0
	Leucopogon parviflorus	0
	Melaleuca lanceolata	80
	Rhagodia baccata	0
	Xanthorrhoea preissii	opp

Vegetation Sample Data

Sample Name: Q21

Project no.: EP18-085
Date: 26/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315285	NW corner northing:	6273593
Altitude (m):	20	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low - fauna
Soil type/texture	sand/clay	Bare ground (%):	10
Rocks (%) and type:	10%, granite	Soil colour:	brown
Litter:	3% (leaves,twigs)	Vegetation condition:	excellent

Strata	Cover (%)	Height (m)	
Upper:	N/A	Treeless	
Mid:	70 to 100	1 to 2	Quartz rocks, lateritic gravel
Ground layer 1:	~0	<0.5	
Ground layer 2:	~0	<0.5	

Vegetation description

Closed shrubland Melaleuca lanceolata, Kunzea ciliata, Rhagodia baccata, Spyridium globulosum, Leucopogon parviflorus, Eutaxia myrtifolia over low isolated tussock grassland *Aira praecox over low isolated herbland

Vegetation Sample Data

Sample Name: Q21

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: RAO Q21: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	0
*	*Aira praecox*	0
	Carpobrotus virescens	0
*	*Centaurium tenuiflorum*	0
	Crassula colorata	0
	Dianella revoluta var. revoluta	0
	Diplolaena dampieri	1
	Dodonaea ceratocarpa	1
	Eutaxia myrtifolia	5
	Ficinia nodosa	opp
	Kunzea ciliata	15
	Lepidosperma squamatum	0
	Leucopogon parviflorus	10
*	*Linum trigynum*	0
*	*Lysimachia arvensis*	0
	Melaleuca lanceolata	60
	Muehlenbeckia adpressa	opp
	Olearia axillaris	opp
	Patersonia occidentalis	opp
	Pimelea ferruginea	opp
	Rhagodia baccata	5
	Senecio pinnatifolius var. maritimus	0
	Spyridium globulosum	10

Vegetation Sample Data

Sample Name: Q22

Project no.: EP18-085
Date: 26/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315126	NW corner northing:	6273179
Altitude (m):	20	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, fauna, humans
Soil type/texture	sand/clay	Bare ground (%):	10
Rocks (%) and type:	1%, granite	Soil colour:	brown
Litter:	30% (twigs,branches)	Vegetation condition:	good

Strata	Cover (%)	Height (m)	
Upper:	N/A	Treeless	
Mid:	10 to 30	>2	gravel
Ground layer 1:	30 to 70	1 to 2	
Ground layer 2:	<10	>0.5	

Vegetation description

Tall open shrubland Acacia rostellifera and Spyridium globulosum over shrubland Guichenotia ledifolia, Leucopogon australis and Melaleuca huegelii over tall sparse herbland Dianella revoluta var. revoluta, Crassula spp. and *Phleum arenarium

Vegetation Sample Data

Sample Name: Q22

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: RAO Q22: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia cyclops	0
	Acacia rostellifera	10
*DP	*Asparagus asparagoides*	0
	Austrostipa flavescens	0
*	*Briza maxima*	0
*	*Briza minor*	1
*	*Centaurium tenuiflorum*	0
	Clematis linearifolia	0
	Crassula exserta	1
*	*Crassula glomerata*	1
	Dianella revoluta var. revoluta	5
	Guichenotia ledifolia	10
	Guichenotia ledifolia	0
	Hibbertia cuneiformis	0
	Leucopogon australis	10
*	*Lysimachia arvensis*	1
	Melaleuca huegelii	5
*	*Phleum arenarium*	2
	Phyllanthus calycinus	0
	Spyridium globulosum	15
	Trachymene pilosa	1
*	*Wahlenbergia capensis*	0

Vegetation Sample Data

Sample Name: Q23

Project no.: EP18-085
Date: 26/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315142	NW corner northing:	6273185
Altitude (m):	22	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	sand/clay	Bare ground (%):	10
Rocks (%) and type:	20%, granite	Soil colour:	brown
Litter:	2% (leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	10 to 30	1 to 2
Ground layer 1:	10 to 30	<0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

Open shrubland Acacia rostellifera, Leucopogon parviflorus over low open herbland Dianella revoluta var. revoluta over low open sedgeland Lepidosperma calcicola and Lepidosperma squamatum

Vegetation Sample Data

Sample Name: Q23

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: RAO Q23: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	5
*DP	*Asparagus asparagoides*	0
*	*Avena sp.*	0
	Dianella revoluta var. revoluta	25
	Dodonaea ceratocarpa	1
	Guichenotia ledifolia	0
	Hibbertia hypericoides	0
	Lepidosperma calcicola	20
	Lepidosperma squamatum	5
	Leucopogon parviflorus	10
	Marianthus candidus	0
	Melaleuca huegelii	1
*	*Petrorhagia dubia*	0
	Spyridium globulosum	1
	Thomasia triphylla	0

Vegetation Sample Data

Sample Name: R24

Project no.: EP18-085
Date: 26/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	releve	Size:	other
NW corner easting:	315264	NW corner northing:	3273266
Altitude (m):	32	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	lower slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	clay	Bare ground (%):	20
Rocks (%) and type:	5%, granite	Soil colour:	brown
Litter:	10% (leaves,branches)	Vegetation condition:	excellent

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	<10	>2
Ground layer 1:	70 to 100	1 to 2
Ground layer 2:	<10	<0.5

Vegetation description

Tall sparse shrubland Melaleuca lanceolata over closed shrubland Kunzea ciliata, Leucopogon parviflorus over low sparse forbland

Vegetation Sample Data

Sample Name: R24

Project no.: EP18-085
Date: 26/11/2018 **Status** Non-permanent
Author: RAO

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	0
	Acacia rostellifera	1
	Agonis flexuosa	1
	Banksia bipinnatifida	0
	Banksia dallanneyi subsp. sylvestris	1
	Desmocladus flexuosus	1
	Dodonaea ceratocarpa	1
	Eutaxia myrtifolia	2
	Hibbertia hypericoides	0
	Kunzea ciliata	70
	Lepidosperma squamatum	0
	Leucopogon parviflorus	5
	Lomandra micrantha subsp. micrantha	0
	Melaleuca lanceolata	5
	Melaleuca systena	0
	Patersonia occidentalis	0
	Pimelea ferruginea	1
	Santalum acuminatum	0
	Spyridium globulosum	1
	Xanthorrhoea brunonis	0

Vegetation Sample Data

Sample Name: Q25

Project no.: EP18-085
Date: 27/11/2018
Author:

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315494	NW corner northing:	6273272
Altitude (m):	48	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low - fauna
Soil type/texture	sand	Bare ground (%):	5
Rocks (%) and type:	1%, limestone	Soil colour:	brown/orange
Litter:	60% (leaves,branches)	Vegetation condition:	very good-excellent

Strata	Cover (%)	Height (m)
Upper:	10 to 30	<10
Mid:	30 to 70	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	10 to 30	<0.5

Vegetation description

Low woodland Melaleuca lanceolata over shrubland Melaleuca huegelii, Acacia rostellifera, Hibbertia cuneiformis over low sparse tussock grassland over low open rushland Desmocladus flexuosus

Vegetation Sample Data

Sample Name: Q25

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q25: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	10
*DP	*Asparagus asparagoides*	0
	Austrostipa flavescens	0
*	*Avena sp.*	0
	Cassytha flava	0
	Clematis linearifolia	0
	Conostylis aculeata subsp. gracilis	1
	Desmocladus flexuosus	20
	Diplolaena dampieri	1
*	*Ehrharta calycina*	0
*	*Euphorbia peplus*	0
	Gompholobium tomentosum	0
	Hakea prostrata	2
	Hibbertia cuneiformis	5
	Hibbertia racemosa	0
	Hybanthus calycinus	1
	Lepidosperma squamatum	0
	Leucopogon parviflorus	1
	Lobelia tenuior	0
*	*Lysimachia arvensis*	15
	Melaleuca huegelii	10
	Melaleuca lanceolata	3
	Melaleuca systena	1
	Microlaena stipoides	1
	Olearia axillaris	2
	Patersonia occidentalis	1
	Petrophile linearis	0
	Phyllanthus calycinus	0
	Poa poiformis	0
	Poranthera microphylla	0
	Rhagodia baccata	0
	Rhodanthe citrina	0
	Rytidosperma occidentale	0
*	*Sonchus oleraceus*	0
	Spyridium globulosum	40
	Stylidium adnatum	0

Vegetation Sample Data

Sample Name: Q25

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q25: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Stylidium brunonianum	0
	Thysanotus patersonii	0
	Trachymene pilosa	0
	Xanthosia candida	0
*DP	*Zantedeschia aethiopica*	0

Vegetation Sample Data

Sample Name: Q26

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315349	NW corner northing:	6273207
Altitude (m):	50	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low - fauna
Soil type/texture	sand with organic layer	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	70% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	10 to 30	<10
Mid:	10 to 30	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	0%	0

Vegetation description

Low woodland Melaleuca lanceolata over open shrubland Spyridium globulosum and Melaleuca huegelii over low sparse herbland

Vegetation Sample Data

Sample Name: Q26

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q26: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	1
*	*Aira cupaniana*	0
*DP	*Asparagus asparagoides*	0
	Caladenia ?attingens subsp. attingens	0
*	*Centaurium tenuiflorum*	0
	Centrolepis drummondiana	0
*	*Cicendia filiformis*	0
	Clematis linearifolia	0
	Conostylis aculeata subsp. gracilis	0
	Dianella revoluta var. revoluta	0
	Diplolaena dampieri	0
*	*Euphorbia peplus*	0
*	*Galium murale*	0
	Guichenotia ledifolia	opp
	Hakea oleifolia	opp
	Hibbertia cuneiformis	1
	Hybanthus calycinus	0
*	*Hypochaeris glabra*	0
	Isolepis marginata	0
	Lagenophora huegelii	0
	Leucopogon parviflorus	0
	Lomandra hermaphrodita	0
*	*Lysimachia arvensis*	1
	Melaleuca huegelii	5
	Melaleuca lanceolata	25
	Melaleuca systena	1
	Poranthera microphylla	0
	Rhagodia baccata	0
	Spyridium globulosum	10
	Thomasia foliosa	0
	Trachymene pilosa	0
*	*Vulpia bromoides*	0
	Xanthorrhoea preissii	3

Vegetation Sample Data

Sample Name: Q27

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	0	NW corner northing:	0
Altitude (m):	0	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	sand	Bare ground (%):	10
Rocks (%) and type:	1%, granite	Soil colour:	brown/orange
Litter:	20% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	<10	1 to 2
Ground layer 1:	30 to 70	1 to 2
Ground layer 2:	<10	<0.5

Vegetation description

Sparse shrubland Diplolaena dampieri, Acacia rostellifera, Eutaxia myrtifolia, Dodonaea ceratocarpa, Melaleuca huegelii and Xanthorrhoea preissii

Vegetation Sample Data

Sample Name: Q27

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q27: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	5
*	*Aira cupaniana*	0
*	*Centaurium tenuiflorum*	0
	Desmocladus flexuosus	0
	Diplolaena dampieri	20
	Dodonaea ceratocarpa	5
	Eutaxia myrtifolia	20
	Hibbertia cuneiformis	0
	Kunzea ciliata	1
	Lepidosperma squamatum	1
	Leucopogon parviflorus	10
	Lomandra micrantha subsp. micrantha	0
*	*Lysimachia arvensis*	0
	Melaleuca huegelii	5
	Patersonia occidentalis	0
	Rytidosperma sp.	0
	Spyridium globulosum	5
*	*Vulpia bromoides*	0
	Xanthorrhoea preissii	5

Vegetation Sample Data

Sample Name: Q28

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315181	NW corner northing:	6273173
Altitude (m):	38	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	hilltop
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	sand/clay with organic layer	Bare ground (%):	10
Rocks (%) and type:	10%, limestone	Soil colour:	brown
Litter:	40% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)
Upper:	70 to 100	<10
Mid:	<10	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	0%	0

Vegetation description

Low closed forest Melaleuca lanceolata over sparse shrubland Acacia rostellifera over low sparse herb Dianella revoluta var. revoluta

Vegetation Sample Data

Sample Name: Q28

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q28: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia littorea	0
	Acacia rostellifera	5
	Dianella revoluta var. revoluta	0
	Hakea oleifolia	0
	Leucopogon parviflorus	1
	Melaleuca lanceolata	80
	Spyridium globulosum	0

Vegetation Sample Data

Sample Name: Q29

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315424	NW corner northing:	6273232
Altitude (m):	47	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	sand/clay with organic layer	Bare ground (%):	5
Rocks (%) and type:	1%, limestone	Soil colour:	brown
Litter:	40% (branches,leaves)	Vegetation condition:	very good-good

Strata	Cover (%)	Height (m)	
Upper:	30 to 70	<10	
Mid:	10 to 30	>2	bryophytes present
Ground layer 1:	<10	1 to 2	
Ground layer 2:	<10	<0.5	

Vegetation description

Low open forest Melaleuca lanceolata over tall open shrubland Hakea oleifolia, Spyridium globulosum and Acacia rostellifera over sparse shrubland Melaleuca huegelii over low sparse rushland Desmocladus flexuosus

Vegetation Sample Data

Sample Name: Q29

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q29: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	5
*DP	*Asparagus asparagoides*	0
*	*Avena sp.*	0
	Brachyscome iberidifolia	0
	Clematis linearifolia	0
	Conostylis aculeata subsp. gracilis	0
	Desmocladus flexuosus	1
	Dianella revoluta var. revoluta	0
*	*Ehrharta calycina*	0
*	*Euphorbia peplus*	0
*	*Galium murale*	0
	Hakea oleifolia	20
	Hibbertia cuneiformis	0
	Hibbertia racemosa	0
	Hybanthus calycinus	1
*	*Hypochaeris glabra*	0
	Lepidosperma squamatum	0
	Leucopogon parviflorus	1
	Lobelia tenuior	0
*	*Lysimachia arvensis*	1
	Melaleuca huegelii	10
	Melaleuca lanceolata	30
	Melaleuca systena	0
	Muehlenbeckia adpressa	0
	Petrophile linearis	0
	Phyllanthus calycinus	0
	Poranthera microphylla	0
	Ptilotus drummondii	0
	Rhagodia baccata	0
	Rhodanthe citrina	0
	Spyridium globulosum	25
	Stylidium adnatum	0
	Trachymene pilosa	0
*	*Vulpia bromoides*	0
*	*Vulpia bromoides*	0
	Wahlenbergia sp.	0

Vegetation Sample Data

Sample Name: Q29

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q29: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*DP	*Zantedeschia aethiopica*	0

Vegetation Sample Data

Sample Name: Q30

Project no.: EP18-085
Date: 27/11/2018
Author: RAO

Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315632	NW corner northing:	6273234
Altitude (m):	39	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, fauna
Soil type/texture	sand/clay with organic layer	Bare ground (%):	5
Rocks (%) and type:	1%, limestone	Soil colour:	brown
Litter:	30% (branches,leaves)	Vegetation condition:	very good

Strata	Cover (%)	Height (m)	
Upper:	30 to 70	<10	
Mid:	<10	>2	bryophytes present
Ground layer 1:	10 to 30	1 to 2	
Ground layer 2:	10 to 30	<0.5	

Vegetation description

Tall shrubland Acacia rostellifera, Spyridium globulosum over open shrubland Guichenotia ledifolia, Melaleuca huegelii, Hibbertia cuneiformis over low open herbland Acanthocarpus preissii

Vegetation Sample Data

Sample Name: Q30

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q30: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia rostellifera	1
	Acacia saligna	opp
	Acanthocarpus preissii	2
*	*Aira cupaniana*	0
*DP	*Asparagus asparagoides*	0
	Austrostipa flavescens	0
*	*Briza maxima*	0
*	*Briza minor*	0
	Clematis linearifolia	0
	Desmocladus flexuosus	opp
	Dianella revoluta var. revoluta	0
*	*Ehrharta calycina*	0
*	*Euphorbia peplus*	0
	Guichenotia ledifolia	30
	Hakea oleifolia	opp
	Hibbertia cuneiformis	5
	Hybanthus calycinus	opp
*	*Hypochaeris glabra*	0
	Leucopogon parviflorus	1
*	*Lysimachia arvensis*	1
	Macrozamia riedlei	0
	Melaleuca huegelii	20
	Melaleuca systena	2
	Microlaena stipoides	0
	Muehlenbeckia adpressa	0
*	*Oxalis corniculata*	0
	Phyllanthus calycinus	0
	Pimelea ferruginea	0
	Poranthera microphylla	0
	Rhagodia baccata	0
	Rhodanthe citrina	0
*	*Sonchus oleraceus*	0
	Spyridium globulosum	15
	Stylidium adnatum	0
	Thomasia foliosa	1
	Trachymene pilosa	0

Vegetation Sample Data

Sample Name: Q30

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q30: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Wahlenbergia sp.	0
*DP	*Zantedeschia aethiopica*	2

Vegetation Sample Data

Sample Name: Q31

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315604	NW corner northing:	6273194
Altitude (m):	48	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	moderate - weeds
Soil type/texture	sand/clay with organic layer	Bare ground (%):	10
Rocks (%) and type:	1%, limestone	Soil colour:	brown
Litter:	10% (branches,twigs)	Vegetation condition:	good-very good

Strata	Cover (%)	Height (m)	
Upper:	30 to 70	<10	
Mid:	<10	>2	bryophytes present
Ground layer 1:	10 to 30	1 to 2	
Ground layer 2:	10 to 30	<0.5	

Vegetation description

Low open forest Melaleuca huegelii over tall sparse shrubland Spyridium globulosum over open shrubland Diplolaena dampieri over low open herbland *Lysimachia arvensis

Vegetation Sample Data

Sample Name: Q31

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q31: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia saligna	0
*DP	*Asparagus asparagoides*	0
*	*Briza maxima*	0
	Clematis linearifolia	0
	Dianella revoluta var. revoluta	0
	Diplolaena dampieri	20
*	*Ehrharta calycina*	0
*	*Ehrharta longiflora*	0
*	*Euphorbia peplus*	1
	Hibbertia cuneiformis	2
*	*Hypochaeris glabra*	0
	Leucopogon parviflorus	1
	Lobelia tenuior	0
*	*Lotus sp.*	0
*	*Lysimachia arvensis*	10
	Macrozamia riedlei	1
	Melaleuca huegelii	40
	Melaleuca systena	1
	Microlaena stipoides	0
	Muehlenbeckia adpressa	0
*	*Oxalis corniculata*	0
*	*Petrorhagia dubia*	0
	Poranthera microphylla	0
	Rhagodia baccata	1
*	*Sonchus oleraceus*	0
	Spyridium globulosum	2
	Stylidium adnatum	0
	Thomasia foliosa	2
	Trachymene pilosa	0
*DP	*Zantedeschia aethiopica*	1

Vegetation Sample Data

Sample Name: Q32

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315845	NW corner northing:	6273231
Altitude (m):	35	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, altered vegetation struct
Soil type/texture	sand	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	15% (branches,leaves)	Vegetation condition:	good-degraded

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	<10	1 to 2
Ground layer 1:	70 to 100	<0.5
Ground layer 2:	~0	<0.5

Vegetation description

Low open forest Corymbia calophylla and Agonis flexuosa over sparse shrubland Spyridium globulosum over low closed herbland Dichondra repens, *Zantedeschia aethiopica over low isolated tussock grassland Ehrharta calycina, *Briza spp. and *Bromus hordeaceus

Vegetation Sample Data

Sample Name: Q32

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q32: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Agonis flexuosa	30
*DP	*Asparagus asparagoides*	0
*	*Briza maxima*	0
*	*Briza minor*	0
*	*Bromus hordeaceus*	0
	Clematis linearifolia	0
	Corymbia calophylla	40
	Daucus glochidiatus	0
	Dichondra repens	opp
*	*Ehrharta calycina*	0
*	*Euphorbia terracina*	0
	Hardenbergia comptoniana	0
	Hibbertia cuneiformis	opp
*	*Hypochaeris glabra*	0
	Lagenophora huegelii	opp
*	*Lagurus ovatus*	0
*	*Lotus subbiflorus*	0
*	*Lysimachia arvensis*	0
	Macrozamia riedlei	0
*	*Oxalis pes-caprae*	0
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	opp
*	*Sonchus oleraceus*	0
	Spyridium globulosum	15
	Stylidium adnatum	0
	Trachymene pilosa	0
*DP	*Zantedeschia aethiopica*	80

Vegetation Sample Data

Sample Name: Q33

Project no.: EP18-085
Date: 27/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	316037	NW corner northing:	6273244
Altitude (m):	44	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	sand/clay with organic layer	Bare ground (%):	1
Rocks (%) and type:	1%, ironstone	Soil colour:	brown
Litter:	20% (branches,twigs,leaves)	Vegetation condition:	excellent

Strata	Cover (%)	Height (m)
Upper:	30 to 70	<10
Mid:	30 to 70	1 to 2
Ground layer 1:	10 to 30	<0.5
Ground layer 2:	0%	0

Vegetation description

low open forest Corymbia calophylla and Eucalyptus marginata over shrubland Hibbertia hypericoides and Xanthorrhoea preissii over low open herb Scaevola calliptera, and Lomandra micrantha subsp. micrantha

Vegetation Sample Data

Sample Name: Q33

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q33: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	?Caesia micrantha	0
	Agonis flexuosa	1
*	*Aira cupaniana*	0
*DP	*Asparagus asparagoides*	0
*	*Briza maxima*	0
*	*Bromus hordeaceus*	0
	Burchardia congesta	0
	Caladenia attingens subsp. attingens	0
	Calothamnus sanguineus	opp
	Chamaescilla corymbosa	0
	Chorizema ?cordatum	0
	Corymbia calophylla	30
*	*Crassula glomerata*	0
	Daucus glochidiatus	0
*	*Ehrharta calycina*	0
	Eucalyptus marginata	20
*	*Euphorbia terracina*	0
	Hardenbergia comptoniana	0
	Hibbertia cunninghamii	0
	Hibbertia hypericoides	40
	Hyalosperma cotula	opp
	Hybanthus calycinus	0
*	*Hypochaeris glabra*	0
	Lagenophora huegelii	0
	Lepidosperma squamatum	0
	Lomandra micrantha subsp. micrantha	1
*	*Lysimachia arvensis*	0
	Macrozamia riedlei	1
*	*Oxalis pes-caprae*	0
	Patersonia occidentalis	0
	Phyllanthus calycinus	1
	Ranunculus colonorum	opp
	Scaevola calliptera	10
*	*Sonchus oleraceus*	0
	Spyridium globulosum	0
	Stylidium adnatum	0

Vegetation Sample Data

Sample Name: Q33

Project no.: EP18-085
Date: 27/11/2018 **Status** Non-permanent
Author: RAO Q33: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Tetraria octandra	0
	Thomasia foliosa	0
	Trachymene pilosa	0
	Xanthorrhoea preissii	30
	Xanthosia candida	0
*DP	*Zantedeschia aethiopica*	1

Vegetation Sample Data

Sample Name: Q34

Project no.: EP18-085
Date: 28/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	0	NW corner northing:	0
Altitude (m):	25	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	moderate - weeds, fauna
Soil type/texture	sand/clay	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	brown
Litter:	70% (branches,leaves)	Vegetation condition:	good-very good

Strata	Cover (%)	Height (m)
Upper:	70 to 100	<10
Mid:	<10	>2
Ground layer 1:	<10	1 to 2
Ground layer 2:	<10	<0.5

Vegetation description

Low closed forest Corymbia calophylla over tall sparse shrubland Spyridium globulosum over sparse shrubland Hibbertia hypericoides, Xanthorrhoea preissii over low sparse tussock grassland

Vegetation Sample Data

Sample Name: Q34

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: RAO Q34: Page 2 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	0
	Acacia saligna	0
	Agonis flexuosa	1
*	*Aira cupaniana*	0
*DP	*Asparagus asparagoides*	0
	Astroloma ciliatum	1
	Banksia dallanneyi subsp. dallanneyi	0
*	*Briza maxima*	0
*	*Briza minor*	0
	Chamaescilla corymbosa	0
	Cheilanthes austrotenuifolia	0
	Corymbia calophylla	70
*	*Cotula turbinata*	0
	Darwinia citriodora	opp
	Dianella revoluta var. revoluta	0
*	*Ehrharta calycina*	0
	Haemodorum sp.	0
	Hibbertia amplexicaulis	0
	Hibbertia cuneiformis	1
	Hibbertia hypericoides	20
	Lepidosperma squamatum	1
	Leucopogon parviflorus	0
	Leucopogon propinquus	1
	Lomandra micrantha subsp. micrantha	1
*	*Lysimachia arvensis*	0
	Macrozamia riedlei	0
	Microlaena stipoides	0
	Olearia axillaris	1
*	*Oxalis pes-caprae*	0
	Patersonia occidentalis	0
	Phyllanthus calycinus	0
	Ptilotus drummondii	0
	Rhagodia baccata	1
	Spyridium globulosum	10
	Stylidium adnatum	1
	Trachymene pilosa	0

Vegetation Sample Data

Sample Name: Q34

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: RAO Q34: Page 3 of 3

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Xanthorrhoea preissii	15
*DP	*Zantedeschia aethiopica*	0

Vegetation Sample Data

Sample Name: Q35

Project no.: EP18-085
Date: 28/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	316031	NW corner northing:	6273357
Altitude (m):	32	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	mid-slope
Time since fire:	no evidence	Disturbance:	high - fauna, clearing?
Soil type/texture	clay	Bare ground (%):	20
Rocks (%) and type:	12%, granite	Soil colour:	brown
Litter:	10% (branches,leaves)	Vegetation condition:	good-very good

Strata	Cover (%)	Height (m)	
Upper:	N/A	Treeless	
Mid:	30 to 70	1 to 2	bryophytes present
Ground layer 1:	<10	<0.5	
Ground layer 2:	<10	<0.5	

Vegetation description

Shrubland Darwinia citriodora and Dodonaea ceratocarpa over low sparse tussock grassland over low sparse sedgeland Lepidosperma squamatum

Vegetation Sample Data

Sample Name: Q35

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: RAO Q35: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	*?Juncus capitatus*	0
	Acacia cochlearis	opp
	Acacia pulchella var. pulchella	0
	Agonis flexuosa	1
*	*Aira cupaniana*	0
*	*Aira praecox*	0
*DP	*Asparagus asparagoides*	0
	Banksia dallanneyi subsp. dallanneyi	opp
*	*Briza maxima*	0
*	*Bromus hordeaceus*	1
	Centrolepis drummondiana	0
	Cheilanthes austrotenuifolia	0
	Crassula exserta	0
	Crassula exserta	0
	Darwinia citriodora	40
	Dodonaea ceratocarpa	30
*	*Ehrharta calycina*	2
	Haemodorum laxum	1
	Hibbertia hypericoides	0
*	*Hordeum leporinum*	1
*	*Hypochaeris glabra*	0
	Lepidosperma squamatum	10
	Leucopogon propinquus	0
*	*Logfia gallica*	0
*	*Lotus subbiflorus*	0
*	*Parentucellia latifolia*	0
*	*Petrorhagia dubia*	0
	Phyllanthus calycinus	0
	Platysace tenuissima	0
	Podolepis lessonii	0
	Quinetia urvillei	0
*	*Romulea rosea var. australis*	1
*	*Silene gallica*	0
*	*Vulpia bromoides*	2
*	*Vulpia bromoides*	0
	Xanthosia sp.	0

Vegetation Sample Data

Sample Name: Q36

Project no.: EP18-085
Date: 28/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315974	NW corner northing:	6273300
Altitude (m):	36	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	upper slope
Time since fire:	no evidence	Disturbance:	low - weeds, fauna
Soil type/texture	clay	Bare ground (%):	15
Rocks (%) and type:	20%, granite	Soil colour:	brown/orange
Litter:	20% (branches,leaves)	Vegetation condition:	very good-excellent

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	30 to 70	1 to 2
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

Shrubland Darwinia citriodora, Hakea trifurcata and Dodonaea ceratocarpa over low sparse sedgeland Lepidosperma squamatum over low sparse herbland Podolepis lessonii

Vegetation Sample Data

Sample Name: Q36

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: RAO Q36: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia alata var. alata	0
	Acacia pulchella var. pulchella	1
*	*Aira cupaniana*	0
*	*Briza maxima*	0
*	*Briza minor*	0
	Calothamnus sanguineus	0
	Cassytha racemosa	0
*	*Centaurium tenuiflorum*	0
	Comesperma ciliatum	0
	Comesperma confertum	0
	Darwinia citriodora	35
	Dodonaea ceratocarpa	20
	Gastrolobium ebracteolatum	0
	Hakea trifurcata	10
	Hibbertia hypericoides	2
*	*Hypochaeris glabra*	0
	Lepidosperma squamatum	10
	Leucopogon propinquus	0
*	*Lotus subbiflorus*	0
	Macrozamia riedlei	0
	Neurachne alopecuroidea	0
	Opercularia vaginata	0
	Phyllanthus calycinus	0
	Podolepis lessonii	1
	Rytidosperma setaceum	0
	Spyridium globulosum	2
	Thomasia foliosa	0
	Thysanotus patersonii	0
	Trachymene pilosa	0
*	*Vulpia bromoides*	1
	Wahlenbergia sp.	0

Vegetation Sample Data

Sample Name: Q37

Project no.: EP18-085
Date: 28/11/2018
Author: RAO
Status Non-permanent

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	315308	NW corner northing:	6273716
Altitude (m):	13	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	lower slope
Time since fire:	no evidence	Disturbance:	low -
Soil type/texture	clay	Bare ground (%):	10
Rocks (%) and type:	60%, granite	Soil colour:	brown
Litter:	2% (branches)	Vegetation condition:	very good-excellent

Strata	Cover (%)	Height (m)
Upper:	N/A	Treeless
Mid:	10 to 30	<1
Ground layer 1:	<10	<0.5
Ground layer 2:	<10	<0.5

Vegetation description

Low open shrubland Kunzea ciliata, Pimelea ferruginea, Eutaxia myrtifolia, Dodonaea ceratocarpa over low sparse herbland over low sparse tussock grassland

Vegetation Sample Data

Sample Name: Q37

Project no.: EP18-085
Date: 28/11/2018 **Status** Non-permanent
Author: RAO Q37: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Acacia pulchella var. pulchella	0
	Brachyscome iberidifolia	0
*	*Briza maxima*	0
*	*Bromus hordeaceus*	0
	Carpobrotus virescens	0
*	*Centaurium tenuiflorum*	0
	Darwinia citriodora	5
	Dianella brevicaulis	0
	Dianella revoluta var. revoluta	0
	Diplolaena dampieri	1
	Dodonaea ceratocarpa	5
	Eutaxia myrtifolia	5
	Kunzea ciliata	10
*	*Lagurus ovatus*	0
	Lepidosperma squamatum	opp
	Leucopogon parviflorus	opp
*	*Lotus subbiflorus*	0
	Melaleuca lanceolata	1
	Olearia axillaris	0
	Pimelea ferruginea	5
	Poa poiformis	0
	Ptilotus manglesii	opp
	Rhodanthe corymbosa	0
	Rytidosperma acerosum	0
	Scaevola crassifolia	0
	Senecio pinnatifolius var. maritimus	0
	Spyridium globulosum	0
	Stypandra glauca	0
	Threlkeldia diffusa	0
	Xanthosia candida	0