



Vegetation Assessment, Mather Reserve Neerabup and Lot 24 Mary Street Wanneroo

The City of Wanneroo

ecoscape



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Vegetation Assessment, Mather Reserve Neerabup and Lot 24 Mary Street Wanneroo
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TABLE OF CONTENTS

1	Introduction	1
1.1	Project Scope	1
1.2	Survey Areas	1
2	Methods.....	2
2.1	Survey Aims	2
2.2	Approach	2
2.3	Field Survey Timing	2
2.4	Floristic Quadrats.....	2
2.5	Introduced Species	2
2.6	Vegetation Description and Classification.....	3
2.7	Vegetation Condition and Mapping.....	3
2.8	Flora Identification and Data Entry.....	3
2.9	Permits.....	3
3	Results.....	4
3.1	Survey Timing	4
3.2	Rainfall	4
3.3	Flora	4
3.3.1	Flora Inventory.....	4
3.3.2	Species Diversity Per Quadrat	5
3.3.3	Lifeform per quadrat	5
3.3.4	Conservation Significant Flora.....	6
3.3.5	Introduced Flora	6
3.4	Vegetation.....	6
3.4.1	Vegetation Descriptions	6
3.4.1	Vegetation Condition	12
4	Discussion	13
4.1	Assessment of Vegetation Health.....	13
4.1.1	Species Diversity	13
4.1.2	Conservation Signifant Flora.....	13
4.1.3	Introduced Flora	13
4.1.4	Vegetation Condition	13
4.2	Recommendations	14
	References	15
	Maps.....	16
	Appendix One Definitions and Criteria	19
	Appendix Two Flora Inventory by Quadrat	24
	Appendix Three Flora Species by Year	26
	Appendix Four Quadrat Data.....	29

FIGURES

Figure 1-Regional location of Mather Reserve and Mary Street	1
Figure 2: Monthly rainfall comparison for 2016, 2018 and 2019 with the mean rainfall at Wanneroo (BoM station 9105) (BoM 2018)	4
Figure 3: Summary of taxa recorded within floristic quadrats.....	5
Figure 4- Summary of lifeforms recorded within floristic quadrats	6

TABLES

Table 1: Quadrat descriptions	7
Table 2: Vegetation Condition	12
Table 3: <i>EPBC Act 1999</i> categories for flora and fauna (Commonwealth of Australia 1999)	19
Table 4: Conservation codes for Western Australian flora and fauna (DBCA 2019)	20
Table 5: NVIS structural formation terminology, terrestrial vegetation (NHT 2003) (ESCAVI 2003)	22
Table 6: NVIS height classes (ESCAVI 2003)	23
Table 7: Vegetation Condition Scale for the South West and Interzone Botanical Provinces (Environmental Protection Authority 2016)	23
Table 8: Site x Species flora inventory	24
Table 9-Species occurrence in 2016, 2018 and 2019 quadrats	26

MAPS

Map 1-Vegetation Quadrats Mather Reserve	17
Map 2-Vegetation Quadrats Lot 24 Mary Street	18

1 INTRODUCTION

In 2014 the City of Wanneroo (the City) received environmental approval from the Department of Environment and Energy for the development of Meridian Business Park, Neerabup (EPBC 2007/3479) located off Flynn Drive within the Neerabup Industrial Area (NIA).

As part of the approval Lot 9000 Flynn Drive, Neerabup (Mather Reserve – 55 ha) and Lot 24 Mary Street, Wanneroo (Lot 24 Mary Street – 4 ha) formed part of a Commonwealth conservation offset agreement for the development of the Meridian Business Park. Both conservation areas contain the Banksia Woodlands of the Swan Coastal Plain ecological community which is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Condition 3 of EPBC 2007/3479 requires the development and implementation of a Conservation Area Management Plan (CAMP). The City has progressed the implementation of the CAMP and in 2016 contracted environmental consultants Terratree to undertake a Detailed (previously known as a Level 2) Vegetation and Flora survey for both conservation areas. Terratree also established permanent monitoring quadrats (six in Mather Reserve and two in Lot 24 Mary Street) to ensure the City is meeting the objectives of the Black Cockatoo habitat sub management plan. Ecoscape had previously monitored all eight quadrats in 2018 and in spring 2019 the City commissioned Ecoscape to reassess these monitoring quadrats.

1.1 PROJECT SCOPE

The scope of the vegetation assessment was to ensure the objectives of the Black Cockatoo habitat management plan are on target through the assessment of changes in the structure and composition of vegetation within the fixed monitoring quadrats.

1.2 SURVEY AREAS

The location of Mather Reserve and Lot 24 Mary Street are shown in **Figure 1**.

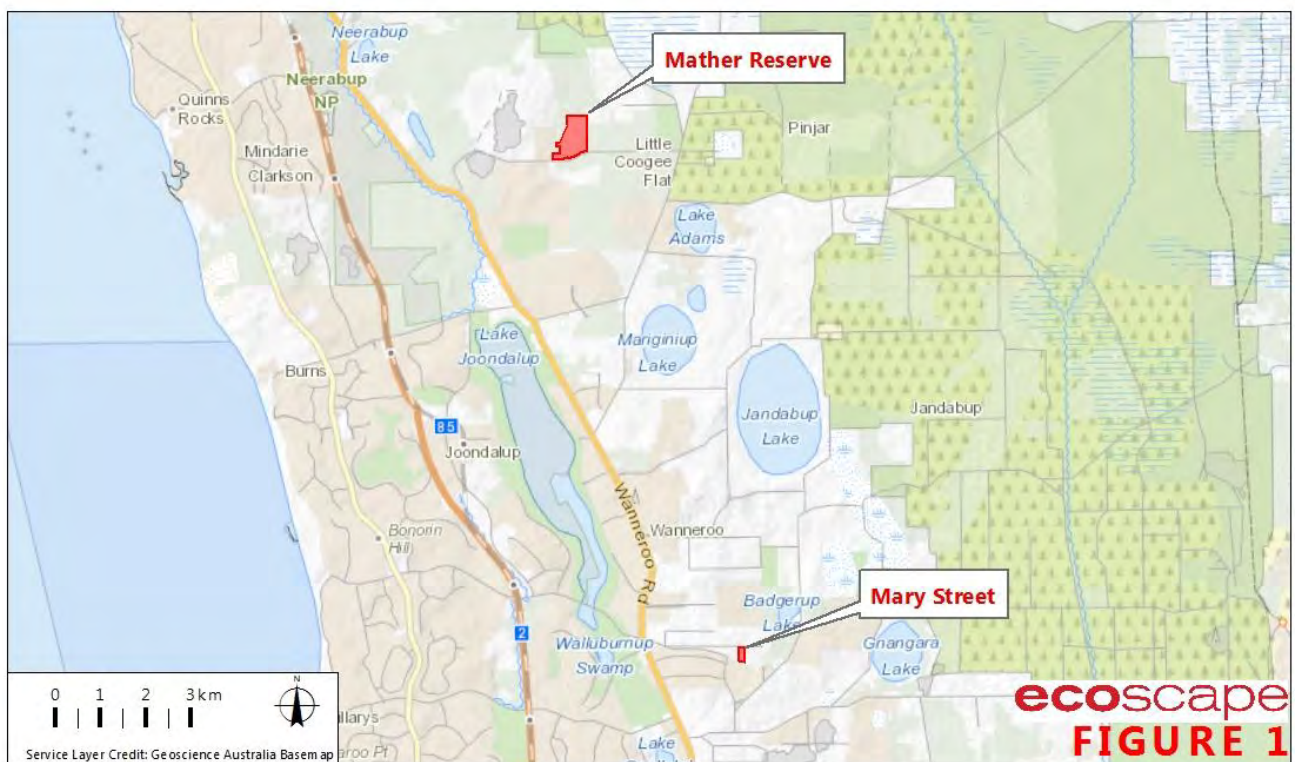


Figure 1-Regional location of Mather Reserve and Mary Street

2 METHODS

2.1 SURVEY AIMS

The main aims of the field survey were to rescore permanent flora quadrats to:

- identify the floristic diversity
- identify conservation significant flora
- identify vegetation types
- record Weeds of National Significance (WONS) and Declared Pest plants.

2.2 APPROACH

The flora and vegetation survey was conducted according to the Environmental Protection Authority (2016) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016), known as the *Flora and Vegetation Technical Guidance*.

2.3 FIELD SURVEY TIMING

The field survey was conducted in November 2019, which corresponds with the recommended timing of the primary season of survey for the South-West Botanical Province, as described in the *Flora and Vegetation Technical Guidance*.

2.4 FLORISTIC QUADRATS

The flora survey consisted of the re-monitoring of eight permanently floristic quadrats that are 10 m x 10 m in dimension. Each quadrat was located using existing GPS coordinates.

The following parameters were recorded at each quadrat:

- photograph of the quadrat taken from the north-west corner, diagonally across the quadrat
- a vegetation description based on the height and estimated cover of dominant species, using the National Vegetation Information System (NVIS) Level V (Executive Steering Committee for Australian Vegetation Information [ESCAVI] 2003), see **Table 6** and **Table 7** in **Appendix One**
- an inventory of all species (native and introduced) including:
 - estimated average height
 - percent foliage cover
 - habit and lifeform
 - presence of Threatened Flora (TF) or Priority Flora (PF) (see **Table 5** in **Appendix One** for description of conservation codes)
- description of landform and habitat
- broad description of surface soil type and stony surface mantle
- percentage of litter cover and depth
- percentage of bare ground
- vegetation condition (according to **Table 8** in **Appendix One** (EPA 2016))
- notes on evidence of grazing, weed invasion, fires, rubbish dumping etc.
- other environmental values of the site e.g. habitat trees or presence of hollows.

Common species that were well known to the survey botanist were identified in the field. Voucher specimens of all other species was collected, assigned a unique number to facilitate tracking of data, and pressed in the field. Voucher specimens were dried and treated in accordance with the requirements of the WAH.

2.5 INTRODUCED SPECIES

Introduced species (weeds) were recorded within floristic quadrats. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2018), and are referred to using an asterisk (*) prefix.

The field survey included searches for WONS and Declared Pest plants within the quadrats. If present their locations and numbers/extents were recorded during the field survey, and each WONS or Declared Pest plant species photographed.

2.6 VEGETATION DESCRIPTION AND CLASSIFICATION

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the NVIS, recorded at Level V (Executive Steering Committee for Australian Vegetation Information 2003). Up to three species per stratum from each stratum (upper, mid and ground) was used to formulate vegetation descriptions for each quadrat and each vegetation type following NVIS guidelines (**Table 6** and **Table 7** in **Appendix One**).

2.7 VEGETATION CONDITION AND MAPPING

Vegetation condition was assessed at each quadrat using the Vegetation Condition Scale for the Southwest and Interzone Botanical Provinces (EPA 2016).

2.8 FLORA IDENTIFICATION AND DATA ENTRY

Voucher specimens were identified by Ecoscape's taxonomist (██████████) to infrataxa (subspecies, variety, affinity or hybrid) level where possible, using appropriate publications, and/or comparison with pressed specimens housed at the WAH.

Nomenclature was checked against the current listing of scientific names recognised by the WAH and listed on FloraBase (WAH 1998-2018) and updated as necessary.

2.9 PERMITS

The flora and vegetation surveys were conducted under the following permits issued by the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA), flora collecting permit FB62000005 ██████████.

3 RESULTS

3.1 SURVEY TIMING

The flora and vegetation survey were conducted by [REDACTED] (Ecologist/Environmental scientist), on 12 November 2019.

3.2 RAINFALL

Bureau of Meteorology (BoM) weather station Wanneroo (009105) receives an average annual rainfall of 795.8 mm, with the majority of rainfall occurring between April-September.

Table 1- Summary of rainfall in the three months prior to vegetation survey

Year	Survey timing	Total rainfall 3 months preceding the survey	Mean rainfall for 3 months preceding the survey	Percentage of rainfall average recorded in 3 months proceeding
2016	September	392.9 mm	441.2 mm	87.7%
2018	November	241.2mm	254.7 mm	94%
2019	November	180 mm	253.7 mm	70%

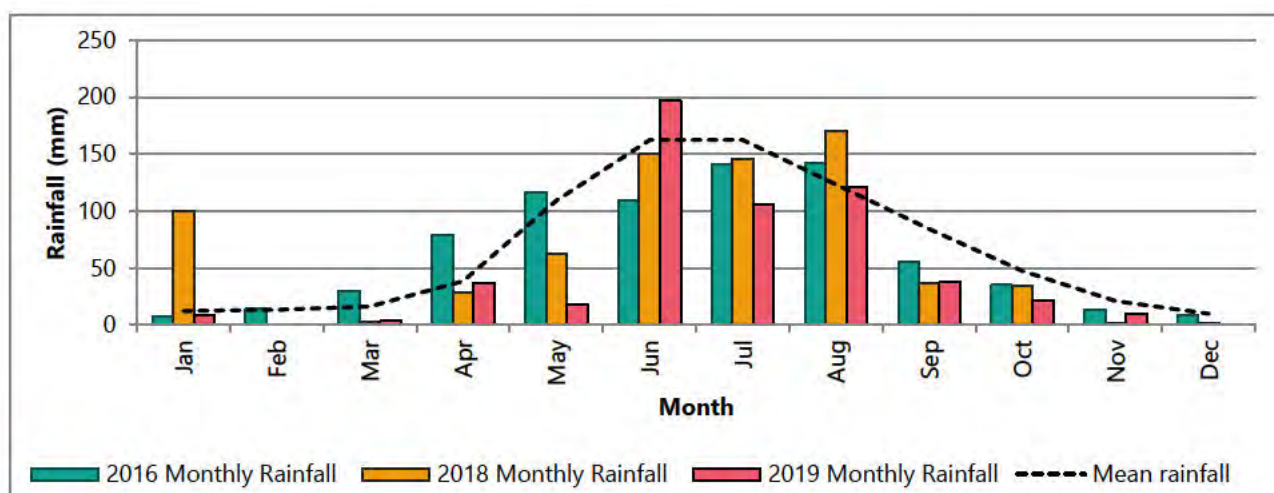


Figure 2: Monthly rainfall comparison for 2016, 2018 and 2019 with the mean rainfall at Wanneroo (BoM station 9105) (BoM 2018)

3.3 FLORA

3.3.1 FLORA INVENTORY

A total of 61 vascular flora taxa (species, subspecies and varieties) from 27 families and 55 genera were recorded from the 8 floristic quadrats. One of these could not be identified to species level due to lack of reproductive material, however, it unlikely to be of conservation significance. A complete flora inventory per quadrat is presented in **Table 9**.

Families with the highest number of taxa were Fabaceae (8 taxa), Proteaceae (5 taxa), and Poaceae (5 taxa). The most commonly recorded genera were, *Banksia* (2 taxa), *Daviesia* (2 taxa) *Gompholobium* (2 taxa) *Conostylis* (2 taxa), *Hibbertia* (2 taxa), and *Petrophile* (2 taxa).

The most commonly encountered species were *Bossiaea eriocarpa*, *Hibbertia hypericoides*, *Mesomelaena pseudostygia*, *Petrophile linearis*, *Waitzia suaveolens* recorded at eight quadrats. *Banksia attenuata*, *Dampiera linearis*, *Desmodcladus flexuosus*, *Gladiolus caryophyllaceus*, *Hypocalymma robustum*, *Stirlingia latifolia* *Xanthorrhoea preissii* were recorded at seven quadrats).

3.3.2 SPECIES DIVERSITY PER QUADRAT

Native species diversity per quadrat was assessed against 2016 baseline data. Species diversity decline was observed in 2018 at all eight quadrats, with the largest declines at quadrat 7 (reduction of 19 species), quadrat 5 (reduction of 15 species) and quadrat 2 (reduction of 12 species). In 2019 species diversity was also observed to be lower compared to 2016 at all eight quadrats, with the largest declines at quadrat 2 (reduction of 20 species), quadrat 5 (reduction of 16 species) and quadrat 7 (reduction of 16 species). A comparison of species diversity between 2019 and 2018 showed a decline at five quadrats, with the largest declines at quadrat 4 (reduction of 10 species) and quadrat 2 (reduction of 8 species) the remaining three quadrats had a slight increase of between two and three species. Overall species diversity increased from 2018 to 2019 from 58 to 61 indicating that overall no significant change in species diversity was recorded from 2018 to 2019.

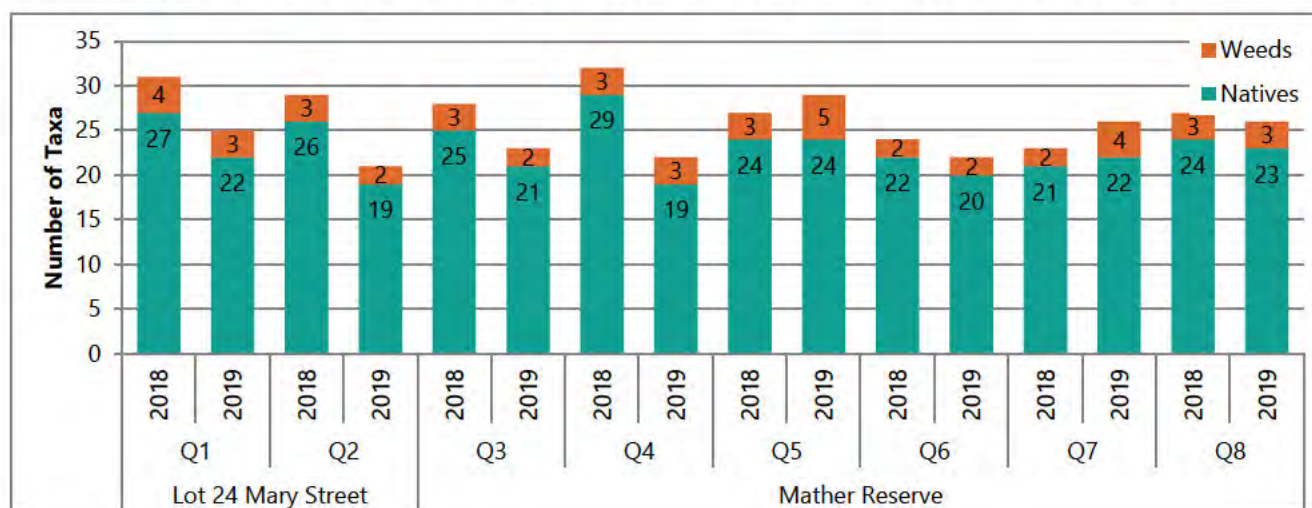


Figure 3: Summary of taxa recorded within floristic quadrats

3.3.3 LIFEFORM PER QUADRAT

The lifeform categories (climber, herb, grass, shrub, sedge and tree) per quadrat was assessed, with the specific objective of identifying individual quadrats that may have changed significantly since 2016. For the 2019 survey lifeform group change was observed across all eight quadrats, with the largest differences associated with reduction in the number of herbs occurring within quadrat 5 (reduction from 27 to 12 species), quadrat 3 (reduction from 20 to 9 species) and quadrat 7 (reduction from 18 to 9 species). The observed trend across all quadrats was of a reduction in perennial and annual herb species diversity from 2016 to 2019.

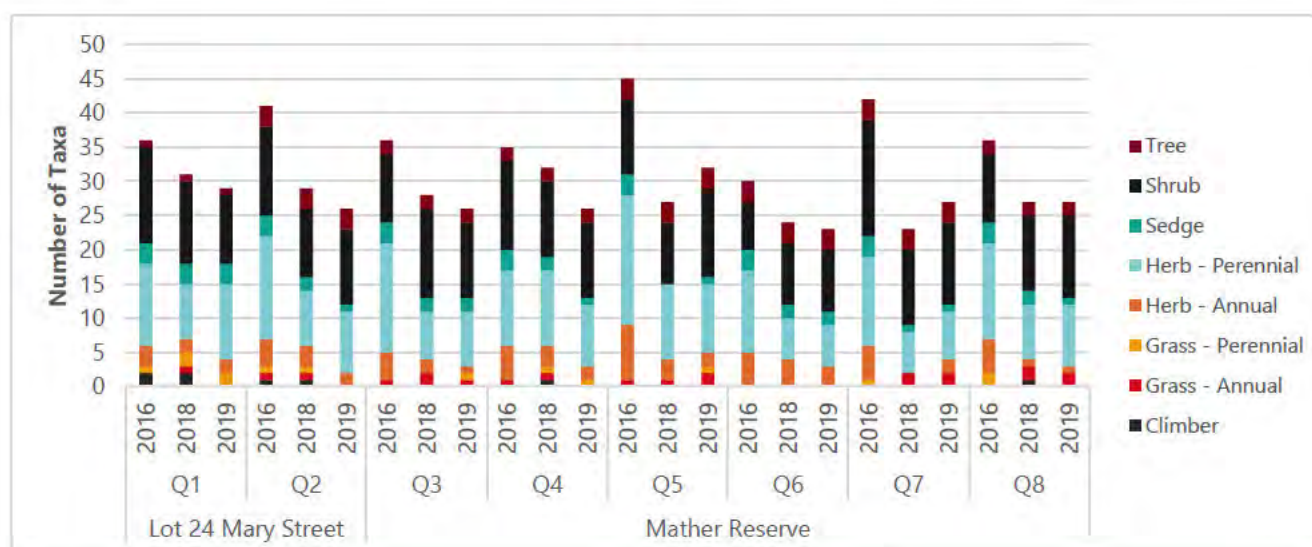


Figure 4- Summary of lifeforms recorded within floristic quadrats**3.3.4 CONSERVATION SIGNIFICANT FLORA**

- No EPBC Act or BC Act listed Threatened Flora were recorded from the floristic quadrats.
- No Priority Flora species listed by DBCA were recorded from the floristic quadrats.
- None of the other taxa identified are considered to be of conservation significance.

3.3.5 INTRODUCED FLORA

Seven introduced flora species (weeds), representing 11.29% of the total flora species, were recorded during the field survey (see **Table 9**). Species observed were *Aira caryophyllea* (Silvery Hairgrass), *Arctotheca calendula* (Cape Weed), *Avena barbata* (Bearded Oat), *Briza maxima* (Blowfly Grass), *Ehrharta calycina* (Perennial Veldt Grass), *Gladiolus caryophyllaceus* (Wild Gladiolus) and *Ursinia anthemoides* (Ursinia). Weed species diversity scores from 2016 to 2019 were observed to have declined at five quadrats, remained stable at two quadrats and increased at one quadrat.

No Declared Pest plant WONS species was recorded.

3.4 VEGETATION**3.4.1 VEGETATION DESCRIPTIONS**

Table 2 indicates the quadrat/s, their vegetation description and a vegetation code. A rescore of the previous quadrats reassessed the composition and structural vegetation types. Full quadrat details are included in **Appendix Four**.

RESULTS

Table 2: Quadrat descriptions

Quadrat	Vegetation Type Description	2016 Photograph	2018 Photograph	2019 Photograph
1	<i>Eucalyptus marginata</i> low woodland over <i>Xanthorrhoea preissii</i> mid open shrubland over <i>Hibbertia hypericoides</i> , <i>Dampiera linearis</i> , <i>Mesomelaena pseudostygia</i> low shrubland			
2	<i>Banksia attenuata</i> , <i>Banksia menziesii</i> , <i>Allocasuarina fraseriana</i> low woodland over <i>Hibbertia hypericoides</i> , <i>Stirlingia latifolia</i> , <i>Daviesia triflora</i> low shrubland.			

RESULTS

Quadrat	Vegetation Type Description	2016 Photograph	2018 Photograph	2019 Photograph
3	<i>Banksia menziesii</i> , <i>Banksia attenuata</i> low woodland over <i>Xanthorrhoea preissii</i> mid sparse grassland over <i>Hibbertia hypericoides</i> , <i>Mesomelaena pseudostygia</i> , <i>Stirlingia latifolia</i> low shrubland			
4	<i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> low woodland over <i>Xanthorrhoea preissii</i> mid sparse shrubland over <i>Eremaea pauciflora</i> , <i>Hibbertia hypericoides</i> , <i>Mesomelaena pseudostygia</i> low shrubland			

RESULTS

Quadrat	Vegetation Type Description	2016 Photograph	2018 Photograph	2019 Photograph
5	<i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> , <i>Banksia menziesii</i> low woodland over <i>Xanthorrhoea preissii</i> mid sparse shrubland over <i>Stirlingia latifolia</i> , <i>Hibbertia hypericoides</i> low shrubland			

RESULTS

Quadrat	Vegetation Type Description	2016 Photograph	2018 Photograph	2019 Photograph
6	<i>Eucalyptus marginata</i> , <i>Allocasuarina fraseriana</i> low woodland over <i>Xanthorrhoea preissii</i> mid sparse shrubland <i>Hibbertia hypericoides</i> , <i>Stirlingia latifolia</i> , <i>Bossiaea eriocarpa</i> low open shrubland			
7	<i>Banksia menziesii</i> , <i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> low woodland <i>Xanthorrhoea preissii</i> mid sparse shrubland over <i>Stirlingia latifolia</i> , <i>Hibbertia hypericoides</i> low shrubland			

RESULTS

Quadrat	Vegetation Type Description	2016 Photograph	2018 Photograph	2019 Photograph
8	<i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> low woodland <i>Xanthorrhoea preissii</i> mid open shrubland over <i>Hibbertia hypericoides</i> , <i>Stirlingia latifolia</i> , <i>Mesomelaena pseudostygia</i> low shrubland			

3.4.1 VEGETATION CONDITION

The vegetation of the survey area varied from Very Good to Excellent condition. Vegetation condition is provided in **Table 3** and shown on the **Map 1-Vegetation Quadrat** series.

Table 3: Vegetation Condition

Quadrat	Ecoscape 2019 Survey	Teratree 2016 Survey	Change
1	Very Good	Very Good	No change
2	Excellent	Excellent	No change
3	Very Good	Very Good	No change
4	Very Good	Very Good	No change
5	Excellent	Excellent	No change
6	Very Good	Very Good	No change
7	Excellent	Excellent	No change
8	Excellent	Excellent	No change

4 DISCUSSION

4.1 ASSESSMENT OF VEGETATION HEALTH

The parameters below are discussed in the context of identifying any changes to vegetation structure, composition and condition since 2016.

4.1.1 SPECIES DIVERSITY

A total of 61 species were recorded from the eight established floristic quadrats in November 2019, including seven weeds. Species diversity was observed to be lower than in 2016 where a total of 92 species were recorded, including nine weeds. Species diversity recorded during the 2018 survey was similar with a total of 58 vascular plants.

The observed reduction in overall species diversity from 2016-2019 is largely attributed to a reduction in annual and perennial herbs. Seasonal differences between 2018/2019 and 2016 survey indicate that lower rainfall and later survey timing has likely reduced the number of annual species being present within quadrats and resulted in lower number of species being recorded from each quadrat. If we compare rainfall in the three months preceding the survey, we can see that the 2016 survey had 151.7 mm more rainfall than the 2018 survey and 212.9 mm than the 2019 survey. Both 2018 and 2019 surveys were undertaken in November whereas the 2016 survey was in September which may have contributed to an overall lower species diversity for 2019 due to less rainfall in the preceding three months. Finally, it was noted in 2018 that quadrats 4,5 and 6 had recent minor fire damage, this may have caused a reduction in observed species diversity at these quadrats.

In the context of the objectives of the Black Cockatoo Habitat Management plan covering the reserves, the observed species diversity change is not considered to have altered the quality of potential breeding and foraging habitat. The observed diversity change has predominately occurred in species that are associated with a herb or grass lifeform category. Both sites contain high value foraging habitat with *Banksia attenuata* and *B. menzeisii* comprising a dominant structural component of the vegetation community, with emerging *Allocasuarina fraseriana* and *Eucalyptus marginata* trees also provide foraging value (Environmental Protection Authority 2019) The diversity and abundance of shrub and tree species comprising foraging habitat has not been observed to have been significantly altered.

4.1.2 CONSERVATION SIGNIFANT FLORA

No conservation significant flora were recorded. One species was incorrectly identified as being a conservation significant flora species from the 2018 survey. *Conostylis bracteata* (Priority 3) was incorrectly recorded at Quadrat 1, 2, 4, 5, 6 and 8. This species was recollected during the 2019 survey at Quadrat 1, 2, 4, and 8 with better identifying material. After taxonomic review it was determined that it was *Conostylis aculeata*.

4.1.3 INTRODUCED FLORA

No WONS or Declared Pest plants was recorded during 2019 survey consistent with the 2016 survey. Seven weed species were observed 2019 down from nine species in 2016. Weed infestation was observed as being less than one percent for all quadrats. Future monitoring should continue recording a total weed cover parameter per quadrat to enable identification of overall increases in weed cover.

4.1.4 VEGETATION CONDITION

Vegetation condition ratings was primarily influenced by levels of weed invasion and past modifications to vegetation structure. Due to the lack of weed cover, all the permanent quadrats remain unchanged in vegetation condition since 2016 and remained either as Very Good or Excellent. It was noted during the 2018 survey that quadrats 4, 5, 6 had minor recent fire damage but the extent of the burn was minimal. The results indicate that there has been a reduction in species diversity since 2016 but no change in condition.

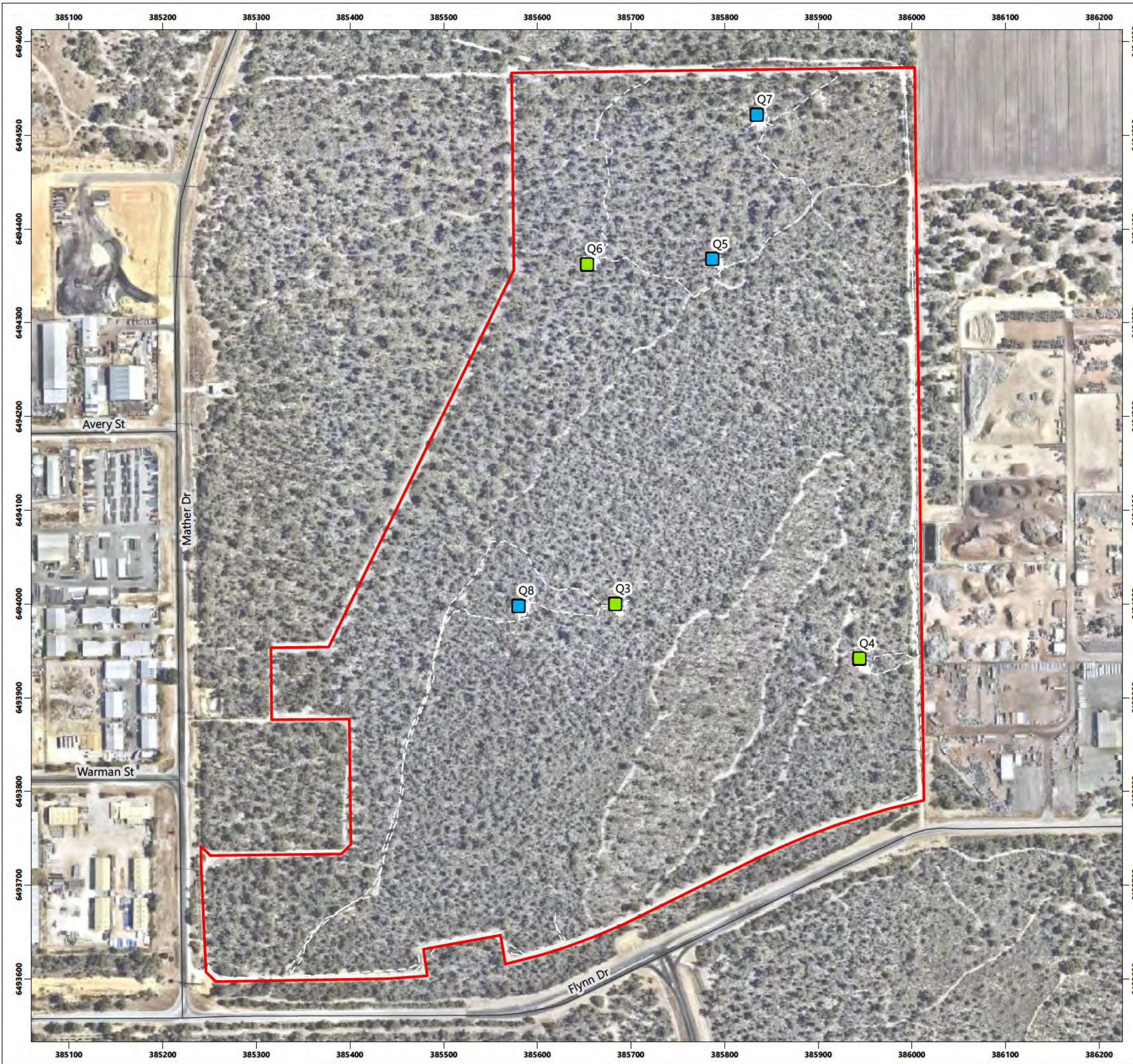
4.2 RECOMMENDATIONS

Ongoing monitoring is recommended to ensure the objectives of the Black Cockatoo habitat management plan are consistent and on target through the assessment of changes in the structure and composition of vegetation/habitat in fixed 8 monitoring quadrats.

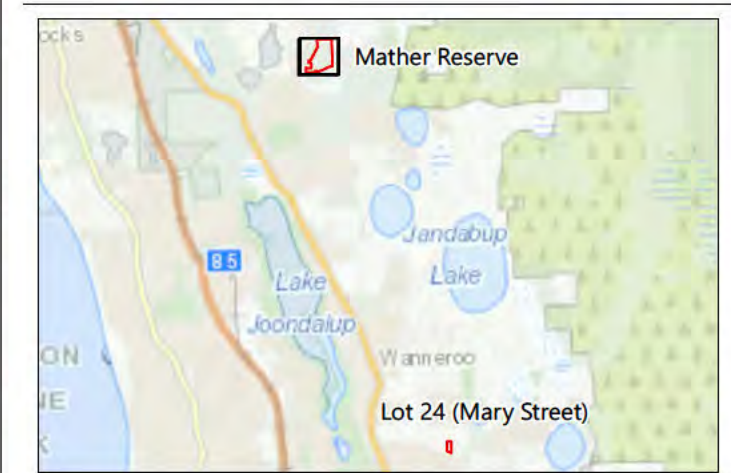
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MAPS



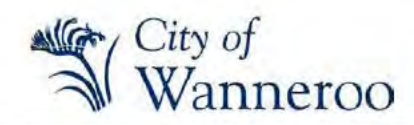
- LEGEND**
- Survey Area
 - Quadrats Vegetation Condition**
 - Excellent
 - Very Good



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VEGETATION QUADRATS

FLORA AND VEGETATION ASSESSMENT
MATHER RESERVE AND LOT 24
(MARY STREET) WANNEROO.



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

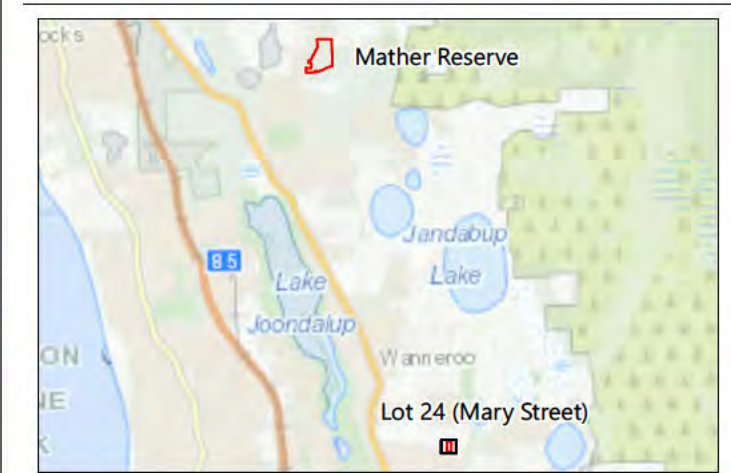


PROJECT NO: 4485-19			
REV	AUTHOR	APPROVED	DATE
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MAP
01



- LEGEND**
- Survey Area
 - Quadrats Vegetation Condition**
 - Excellent
 - Very Good



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VEGETATION QUADRATS

**FLORA AND VEGETATION ASSESSMENT
MATHER RESERVE AND LOT 24
(MARY STREET) WANNEROO.**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4485-19			
REV	AUTHOR	APPROVED	DATE
00	DR	SB	15/11/2019

**MAP
02**

APPENDIX ONE DEFINITIONS AND CRITERIA

Table 4: EPBC Act 1999 categories for flora and fauna (Commonwealth of Australia 1999)

EPBC ACT 1999 category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time:
	(a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or
	(b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time:
	(a) it is not critically endangered; and
	(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time:
	(a) it is not critically endangered or endangered; and
	(b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time:
	(a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or
	(b) the following subparagraphs are satisfied:
	(i) the species is a species of fish;
	(ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised;
	(iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory;
	(iv) cessation of the plan of management would adversely affect the conservation status of the species.

Table 5: Conservation codes for Western Australian flora and fauna (DBCA 2019)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.	
The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the Biodiversity Conservation Act 2016.	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	Threatened species Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	Critically endangered species Threatened species considered to be "<i>facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines</i>". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.
EN	Endangered species Threatened species considered to be "<i>facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines</i>". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.
VU	Vulnerable species Threatened species considered to be "<i>facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines</i>". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.
Extinct species	
Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	Extinct species Species where "<i>there is no reasonable doubt that the last member of the species has died</i>", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.
EW	Extinct in the wild species Species that "<i>is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form</i>", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.
Specially protected species	
Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.	
Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.	

Conservation Codes for Western Australian Flora and Fauna	
MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
P	Priority species Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
3	Priority 3: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
4	Priority 4: Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
¹ The definition of flora includes algae, fungi and lichens. ² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

Table 6: NVIS structural formation terminology, terrestrial vegetation (NHT 2003) (ESCAVI 2003)

Cover characteristics								
Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown	
Cover code	d	c	i	r	bi	bc	unknown	
Growth Form	Height Ranges (m)	Structural Formation Classes						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
herb	<0.5,>0.5	closed herbland	herbland	open herbland	sparse herbland	isolated herbs	isolated clumps of herbs	herb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 7: NVIS height classes (ESCAVI 2003)

Height		Growth form				
Height Class	Height Range (m)	tree, vine (M & U), palm (single-stemmed)	shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	tree mallee, mallee shrub	tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)	bryophyte, lichen, seagrass, aquatic
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low

Source: (based on Walker & Hopkins 1990)

Table 8: Vegetation Condition Scale for the South West and Interzone Botanical Provinces (Environmental Protection Authority 2016)

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. 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. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

APPENDIX TWO FLORA INVENTORY BY QUADRAT

Table 9: Site x Species flora inventory

Family	Name	Naturalised	Cons-code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Amaranthaceae	<i>Ptilotus manglesii</i>			X	X	X	X		X	X	
Anarthriaceae	<i>Lyginia imberbis</i>					X			X		
Asparagaceae	<i>Thysanotus arbuscula</i>			X							X
Asteraceae	<i>Arctotheca calendula</i>	*					X				
	<i>Ursinia anthemoides</i>	*		X	X		X	X	X	X	
	<i>Waitzia suaveolens</i>			X	X	X	X	X	X	X	X
Casuarinaceae	<i>Allocasuarina fraseriana</i>				X		X	X	X	X	X
Colchicaceae	<i>Burchardia congesta</i>			X					X		
Crassulaceae	<i>Crassula colorata</i>								X		
Cyperaceae	<i>Lepidosperma calcicola</i>			X							
	<i>Mesomelaena pseudostygia</i>			X	X	X	X	X	X	X	X
	<i>Tetraria octandra</i>			X							
Dasypogonaceae	<i>Calectasia narragara</i>										X
	<i>Dasypogon bromeliifolius</i>										X
Dilleniaceae	<i>Hibbertia hypericoides</i>			X	X	X	X	X	X	X	X
	<i>Hibbertia striata</i>						X	X		X	
Ericaceae	<i>Brachyloma preissii</i>						X	X			X
	<i>Conostephium pendulum</i>					X				X	X
Euphorbiaceae	<i>Monotaxis grandiflora</i>			X	X	X					
Fabaceae	<i>Bossiaea eriocarpa</i>			X	X	X	X	X	X	X	X
	<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>				X						
	<i>Daviesia triflora</i>				X						
	<i>Gastrolobium linearifolium</i>				X						
	<i>Gompholobium confertum</i>									X	
	<i>Gompholobium tomentosum</i>			X				X			X
	<i>Jacksonia sternbergiana</i>							X			
	<i>Kennedia prostrata</i>							X	X		X
Goodeniaceae	<i>Dampiera linearis</i>			X	X	X	X	X		X	X
	<i>Scaevola repens</i>			X	X	X	X	X		X	X
Haemodoraceae	<i>Anigozanthos manglesii</i>			X	X						
	<i>Conostylis aculeata</i>			X	X		X				X
	<i>Conostylis setigera</i> subsp. <i>setigera</i>					X		X	X	X	X
	<i>Haemodorum spicatum</i>			X	X	X	X		X	X	
	<i>Phlebocarya ciliata</i>							X			
Hemerocallidaceae	<i>Dianella revoluta</i>							X		X	
	<i>Tricoryne elatior</i>					X					
Iridaceae	<i>Gladiolus caryophyllaceus</i>	*		X	X		X	X	X	X	X
	<i>Patersonia occidentalis</i>			X			X	X			X
Macarthuriaceae	<i>Macarthuria australis</i>				X			X			
Myrtaceae	<i>Beaufortia elegans</i>						X				
	<i>Eremaea pauciflora</i>						X		X	X	
	<i>Eucalyptus marginata</i>			X					X		
	<i>Hypocalymma robustum</i>			X	X	X	X		X	X	X

FLORA INVENTORY BY QUADRAT

Family	Name	Naturalised	Cons-code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Poaceae	<i>Aira caryophyllea</i>	*						X			
	<i>Amphipogon turbinatus</i>			X			X				
	<i>Avena barbata</i>	*								X	X
	<i>Briza maxima</i>	*				X		X		X	X
	<i>Ehrharta calycina</i>	*		X		X		X			
	<i>Rhytidosperma</i> sp.			X	X	X	X	X			
Polygalaceae	<i>Comesperma calymega</i>							X			
Proteaceae	<i>Banksia attenuata</i>				X	X	X	X	X	X	X
	<i>Banksia menziesii</i>				X	X		X		X	
	<i>Petrophile linearis</i>			X	X	X	X	X	X	X	X
	<i>Petrophile macrostachya</i>					X			X	X	
	<i>Stirlingia latifolia</i>			X	X	X		X	X	X	X
Restionaceae	<i>Desmocladius flexuosus</i>			X	X	X	X	X	X	X	
	<i>Hypolaena exsulca</i>							X			X
Stylidiaceae	<i>Stylidium piliferum</i>					X		X			
	<i>Stylidium piliferum</i>				X						
Thymelaeaceae	<i>Pimelea sulphurea</i>			X		X	X				X
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>			X		X	X	X	X	X	X

APPENDIX THREE FLORA SPECIES BY YEAR

Table 10-Species occurrence in 2016, 2018 and 2019 quadrats

Family	Genus	Name	2016	2018	2019	Notes
Aizoaceae	<i>Carpobrotus</i>	<i>Carpobrotus virescens</i>	X			
Amaranthaceae	<i>Ptilotus</i>	<i>Ptilotus manglesii</i>		X	X	
Anarthriaceae	<i>Lyginia</i>	<i>Lyginia imberbis</i>		X	X	
Apiaceae	<i>Daucus</i>	<i>Daucus glochidiatus</i>	X			
	<i>Xanthosia</i>	<i>Xanthosia huegelii</i>	X			
Asparagaceae	<i>Lomandra</i>	<i>Lomandra micrantha</i> subsp. <i>micrantha</i>	X			
	<i>Sowerbaea</i>	<i>Sowerbaea laxiflora</i>	X			
	<i>Thysanotus</i>	<i>Thysanotus arbuscula</i>		X	X	
		<i>Thysanotus thyrsoides</i>	X			
Asteraceae	<i>Arctotheca</i>	* <i>Arctotheca calendula</i>	X		X	
	<i>Hyalosperma</i>	<i>Hyalosperma cotula</i>	X			
	<i>Hypochaeris</i>	* <i>Hypochaeris glabra</i>	X			
	<i>Lagenophora</i>	<i>Lagenophora huegelii</i>	X			
	<i>Leptorhynchos</i>	<i>Leptorhynchos scaber</i>	X			
	<i>Millotia</i>	<i>Millotia tenuifolia</i>	X			
	<i>Monoculus</i>	* <i>Monoculus monstrosus</i>	X			
	<i>Podotheca</i>	<i>Podotheca gnaphalioides</i>	X			
	<i>Rhytidosperra</i>	<i>Rhytidosperra</i> sp.			X	New record
	<i>Sonchus</i>	* <i>Sonchus oleraceus</i>	X			
	<i>Ursinia</i>	* <i>Ursinia anthemoides</i>	X	X	X	
	<i>Waitzia</i>	<i>Waitzia suaveolens</i>		X	X	
Campanulaceae	<i>Lobelia</i>	<i>Lobelia tenuior</i>		X		
Caryophyllaceae	<i>Petrorhagia</i>	* <i>Petrorhagia dubia</i>	X			
Casuarinaceae	<i>Allocasuarina</i>	<i>Allocasuarina fraseriana</i>	X	X	X	
Colchicaceae	<i>Burchardia</i>	<i>Burchardia congesta</i>	X		X	
Crassulaceae	<i>Crassula</i>	<i>Crassula colorata</i>	X	X	X	
Cyperaceae	<i>Lepidosperma</i>	<i>Lepidosperma calcicola</i>		X	X	
	<i>Mesomelaena</i>	<i>Mesomelaena pseudostygia</i>	X	X	X	
	<i>Tetraria</i>	<i>Tetraria octandra</i>	X	X	X	
Dasypogonaceae	<i>Dasypogon</i>	<i>Calectasia narragara</i>	X	X	X	
		<i>Dasypogon bromeliifolius</i>	X	X	X	
Dilleniaceae	<i>Hibbertia</i>	<i>Hibbertia huegelii</i>	X			
		<i>Hibbertia hypericoides</i>	X	X	X	
		<i>Hibbertia racemosa</i>	X			
		<i>Hibbertia striata</i>		X	X	
Droseraceae	<i>Drosera</i>	<i>Drosera erythrorhiza</i>	X			
		<i>Drosera macrantha</i> subsp. <i>macrantha</i>	X			
		<i>Drosera menziesii</i>	X			
Ericaceae	<i>Brachyloma</i>	<i>Brachyloma preissii</i>	X	X	X	
	<i>Conostephium</i>	<i>Conostephium pendulum</i>	X	X	X	
Euphorbiaceae	<i>Monotaxis</i>	<i>Monotaxis grandiflora</i>	X	X	X	

Family	Genus	Name	2016	2018	2019	Notes
Fabaceae	<i>Acacia</i>	<i>Acacia pulchella</i> var. <i>goadbyi</i>	X	X	X	
	<i>Bossiaea</i>	<i>Bossiaea eriocarpa</i>	X	X	X	
	<i>Daviesia</i>	<i>Daviesia divaricata</i>	X			
		<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>	X	X	X	
		<i>Daviesia triflora</i>	X	X	X	
	<i>Gastrolobium</i>	<i>Gastrolobium linearifolium</i>	X	X	X	
	<i>Gompholobium</i>	<i>Gompholobium confertum</i>		X	X	
		<i>Gompholobium tomentosum</i>	X	X	X	
	<i>Hardenbergia</i>	<i>Hardenbergia comptoniana</i>	X	X		
	<i>Hovea</i>	<i>Hovea stricta</i>	X			
		<i>Hovea trisperma</i>	X			
	<i>Isotropis</i>	<i>Isotropis cuneifolia</i> subsp. <i>cuneifolia</i>	X			
	<i>Jacksonia</i>	<i>Jacksonia furcellata</i>	X			
		<i>Jacksonia sternbergiana</i>	X	X	X	
	<i>Kennedia</i>	<i>Kennedia prostrata</i>	X	X	X	
Goodeniaceae	<i>Dampiera</i>	<i>Dampiera linearis</i>	X	X	X	
	<i>Scaevola</i>	<i>Scaevola repens</i> var. <i>angustifolia</i>	X		X	
Haemodoraceae	<i>Anigozanthos</i>	<i>Anigozanthos humilis</i>	X	X	X	
		<i>Anigozanthos manglesii</i>	X		X	
	<i>Conostylis</i>	<i>Conostylis aculeata</i> subsp. <i>cygnorum</i>	X			
		<i>Conostylis aurea</i>	X			
		<i>Conostylis aculeata</i>		X	X	Species identified as <i>C. bracteata</i> (p3) in the 2018 survey has now been updated to <i>C. aculeata</i> .
		<i>Conostylis setigera</i> subsp. <i>setigera</i>	X	X	X	
	<i>Haemodorum</i>	<i>Haemodorum laxum</i>	X			
		<i>Haemodorum spicatum</i>		X	X	
	<i>Phlebocarya</i>	<i>Phlebocarya ciliata</i>		X	X	
	<i>Tricoryne</i>	<i>Tricoryne elatior</i>			X	
Hemerocallidaceae	<i>Caesia</i>	<i>Caesia micrantha</i>	X			
	<i>Dianella</i>	<i>Dianella revoluta</i>	X	X	X	
Iridaceae	<i>Gladiolus</i>	* <i>Gladiolus caryophyllaceus</i>	X	X	X	
	<i>Patersonia</i>	<i>Patersonia occidentalis</i>	X	X	X	
Macarthuriaceae	<i>Macarthuria</i>	<i>Macarthuria australis</i>			X	New Record
Myrtaceae	<i>Calothamnus</i>	<i>Calothamnus sanguineus</i>	X			
	<i>Eremaea</i>	<i>Eremaea pauciflora</i> var. <i>pauciflora</i>	X	X	X	
	<i>Eucalyptus</i>	<i>Eucalyptus marginata</i>	X	X	X	
	<i>Hypocalymma</i>	<i>Hypocalymma robustum</i>	X	X	X	
Orchidaceae	<i>Caladenia</i>	<i>Caladenia flava</i>	X			

Family	Genus	Name	2016	2018	2019	Notes
	<i>Diuris</i>	<i>Diuris magnifica</i>	X			
	<i>Drakaea</i>	<i>Drakaea glyptodon</i>	X			
	<i>Elythranthera</i>	<i>Elythranthera brunonis</i>	X			
	<i>Pterostylis</i>	<i>Pterostylis vittata</i>	X			
	<i>Pyrorchis</i>	<i>Pyrorchis nigricans</i>	X			
	<i>Thelymitra</i>	<i>Thelymitra campanulata</i>	X			
Pittosporaceae	<i>Billardiera</i>	<i>Billardiera fraseri</i>	X	X		
Poaceae	<i>Aira</i>	* <i>Aira caryophylla</i>			X	New record
	<i>Amphipogon</i>	<i>Amphipogon turbinatus</i>	X	X	X	
	<i>Avena</i>	* <i>Avena barbata</i>	X	X	X	
	<i>Briza</i>	* <i>Briza maxima</i>		X	X	
	<i>Ehrharta</i>	* <i>Ehrharta calycina</i>	X	X	X	
Polygalaceae	<i>Comesperma</i>	<i>Comesperma calymega</i>		X	X	
Proteaceae	<i>Adenanthos</i>	<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>		X		
	<i>Banksia</i>	<i>Banksia attenuata</i>	X	X	X	
		<i>Banksia menziesii</i>	X	X	X	
	<i>Petrophile</i>	<i>Petrophile linearis</i>	X	X	X	
		<i>Petrophile macrostachya</i>	X	X	X	
	<i>Stirlingia</i>	<i>Stirlingia latifolia</i>	X	X	X	
Restionaceae	<i>Alexgeorgea</i>	<i>Alexgeorgea nitens</i>	X			
	<i>Desmocladus</i>	<i>Desmocladus flexuosus</i>		X	X	
	<i>Hypolaena</i>	<i>Hypolaena exsulca</i>	X	X	X	
	<i>Lepidobolus</i>	<i>Lepidobolus preissianus</i>	X			
Rubiaceae	<i>Opercularia</i>	<i>Opercularia vaginata</i>	X	X		
Rutaceae	<i>Philotheca</i>	<i>Philotheca spicata</i>	X			
Stylidiaceae	<i>Stylidium</i>	<i>Stylidium androsaceum</i>	X			
		<i>Stylidium carnosum</i>	X			
		<i>Stylidium piliferum</i>	X	X	X	
Thymelaeaceae	<i>Pimelea</i>	<i>Pimelea ferruginea</i>	X			
		<i>Pimelea suaveolens</i>	X			
		<i>Pimelea sulphurea</i>	X	X	X	
Violaceae	<i>Hybanthus</i>	<i>Hybanthus calycinus</i>	X			
Xanthorrhoeaceae	<i>Xanthorrhoea</i>	<i>Xanthorrhoea preissii</i>	X	X	X	

APPENDIX FOUR QUADRAT DATA

Quadrat 1

Staff	DJR	Date	12/11/2019	Season	P
Revisit					
Type	Q 10 m x 10 m				
Location	Flat of shallow dune swale				
MGA Zone	50				
Habitat	Flat				
Aspect		Slope			
Soil Type	Grey Bassendean Sand				
Rock Type					
Loose Rock		Litter	10 % cover ; <1 cm in depth		
Bare ground	10 % cover	Weeds	<1 % cover		
Vegetation	U+ ^Eucalyptus marginata\^tree\6\i;M ^Xanthorrhoea preissii\^grass tree\3\i;G ^^Hibbertia hypericoides,Dampiera linearis,Mesomelaena pseudostygia\^shrub\2\c				
Veg. Condition	Very Good				
Disturbance					
Fire Age	<5 years				

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Amphipogon turbinatus</i>		0.5	<1	
<i>Anigozanthos manglesii</i>		0.3	<1	
<i>Bossiaea eriocarpa</i>		0.3	3	
<i>Burchardia congesta</i>		0.3	<1	
<i>Conostylis aculeata</i>		0.2	<1	
<i>Dampiera linearis</i>		0.2	5	

Wanneroo Vegetation Assessment 2019

<i>Desmocladius flexuosus</i>	0.5	<1
<i>*Ehrharta calycina</i>	0.5	<1
<i>Eucalyptus marginata</i>	7	30
<i>*Gladiolus caryophyllaceus</i>	0.5	<1
<i>Gompholobium tomentosum</i>	0.2	<1
<i>Haemodorum spicatum</i>	0.2	<1
<i>Hibbertia hypericoides</i>	0.5	10
<i>Hypocalymma robustum</i>	0.5	2
<i>Lepidosperma calcicola</i>	0.6	<1
<i>Mesomelaena pseudostygia</i>	0.2	5
<i>Monotaxis grandiflora</i>	0.2	<1
<i>Patersonia occidentalis</i>	0.6	<1
<i>Petrophile linearis</i>	0.5	1
<i>Pimelea sulphurea</i>	0.2	<1
<i>Ptilotus manglesii</i>	0.2	<1
<i>Rytidosperma</i> sp.	0.5	<1
<i>Scaevola repens</i>	0.2	<1
<i>Stirlingia latifolia</i>	0.5	1
<i>Tetraria octandra</i>	0.2	<1
<i>Thysanotus arbuscula</i>	0.2	<1
<i>*Ursinia anthemoides</i>	0.2	<1
<i>Waitzia suaveolens</i>	0.2	<1
<i>Xanthorrhoea preissii</i>	1	25

Quadrat 2

Staff DJR **Date** 12/11/2019 **Season** P
Revisit
Type Q 10 m x 10 m
Location Flat top of shallow dune
MGA Zone 50
Habitat Flat
Aspect **Slope**
Soil Type Grey Bassendean Sand
Rock Type
Loose Rock **Litter** 15 % cover ; <1 cm in depth
Bare ground 5 % cover **Weeds** <1 % cover
Vegetation U+ *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina fraseriana* \tree\6\i; G *Hibbertia hypericoides*, *Stirlingia latifolia*, *Daviesia triflora* \shrub\2\c
Veg. Condition Very Good
Disturbance
Fire Age <5 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Allocasuarina fraseriana</i>		3	2	
<i>Anigozanthos manglesii</i>		0.3	<1	
<i>Banksia attenuata</i>		6	15	
<i>Banksia menziesii</i>		4	5	
<i>Bossiaea eriocarpa</i>		0.5	1	
<i>Conostylis aculeata</i>			<1	

Wanneroo Vegetation Assessment 2019

<i>Dampiera linearis</i>	0.3	1
<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>		<1
<i>Daviesia triflora</i>	0.8	2
<i>Desmocladus flexuosus</i>	0.4	<1
<i>Gastrolobium linearifolium</i>	0.5	<1
* <i>Gladiolus caryophyllaceus</i>	0.6	<1
<i>Haemodorum spicatum</i>	0.2	<1
<i>Hibbertia hypericoides</i>	0.5	6
<i>Hypocalymma robustum</i>	0.5	<1
<i>Macarthuria australis</i>	0.3	<1
<i>Mesomelaena pseudostygia</i>	0.3	2
<i>Monotaxis grandiflora</i>	0.1	<1
<i>Petrophile linearis</i>	0.2	<1
<i>Ptilotus manglesii</i>	0.2	<1
<i>Rytidosperma</i> sp.	0.5	<1
<i>Scaevola repens</i>	0.2	<1
<i>Stirlingia latifolia</i>	0.5	4
<i>Stylidium piliferum</i>	0.1	<1
* <i>Ursinia anthemoides</i>	0.1	<1
<i>Waitzia suaveolens</i>	0.1	<1

Quadrat 3

Staff DJR **Date** 12/11/2019 **Season** P
Revisit
Type Q 10 m x 10 m
Location Midslope of shallow dune
MGA Zone 50
Habitat Flat
Aspect **Slope**
Soil Type Grey Bassendean Sand
Rock Type
Loose Rock **Litter** 5 % cover ; <1 cm in depth
Bare ground 20 % cover **Weeds** <1 % cover
Vegetation U+ ^*Banksia menziesii*,^*Banksia attenuata*\^tree\6\i;M ^*Xanthorrhoea preissii*\^grass tree\3\r;G
^*Hibbertia hypericoides*,*Mesomelaena pseudostygia*,*Stirlingia latifolia*\^shrub\2\c
Veg. Condition Very Good
Disturbance
Fire Age <5 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Banksia attenuata</i>		5	4	
<i>Banksia menziesii</i>		3	15	
<i>Bossiaea eriocarpa</i>		0.3	<1	
* <i>Briza maxima</i>		0.2	<1	
<i>Conostephium pendulum</i>		0.3	<1	
<i>Conostylis setigera</i> subsp. <i>setigera</i>		0.1	<1	

Wanneroo Vegetation Assessment 2019

<i>Dampiera linearis</i>	0.2	<1
<i>Desmocladius flexuosus</i>	0.3	1
<i>*Ehrharta calycina</i>	0.3	<1
<i>Haemodorum spicatum</i>	0.2	<1
<i>Hibbertia hypericoides</i>	0.5	30
<i>Hypocalymma robustum</i>	0.5	<1
<i>Lyginia imberbis</i>	0.3	<1
<i>Mesomelaena pseudostygia</i>	0.5	8
<i>Monotaxis grandiflora</i>	0.3	<1
<i>Petrophile linearis</i>	0.2	<1
<i>Petrophile macrostachya</i>	0.5	1
<i>Pimelea sulphurea</i>	0.2	<1
<i>Ptilotus manglesii</i>	0.1	<1
<i>Rytidosperma</i> sp.	0.3	<1
<i>Scaevola repens</i>	0.1	<1
<i>Stirlingia latifolia</i>	0.5	6
<i>Stylidium piliferum</i>	0.2	<1
<i>Tricoryne elatior</i>	0.3	<1
<i>Waitzia suaveolens</i>	0.1	<1
<i>Xanthorrhoea preissii</i>	1.5	25

Quadrat 4

Staff DJR **Date** 12/11/2019 **Season** P
Revisit
Type Q 10 m x 10 m
Location Upper slope of shallow dune
MGA Zone 50 
Habitat Flat
Aspect **Slope**
Soil Type Grey Bassendean Sand
Rock Type
Loose Rock **Litter** 15 % cover ; <1 cm in depth
Bare ground 10 % cover **Weeds** <1 % cover
Vegetation U+ ^*Banksia attenuata*,^*Allocasuarina fraseriana*^tree\6\i;M ^*Xanthorrhoea preissii*^grass tree\3\i;G ^*Eremaea pauciflora*,*Hibbertia hypericoides*,*Mesomelaena pseudostygia*^shrub\2\c
Veg. Condition Very Good
Disturbance
Fire Age 1-2 years
Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Allocasuarina fraseriana</i>		4	2	
<i>Amphipogon turbinatus</i>		2	3	
* <i>Arctotheca calendula</i>		0.2	<1	
<i>Banksia attenuata</i>		5	13	
<i>Beaufortia elegans</i>		0.5	<1	
<i>Bossiaea eriocarpa</i>		0.5	3	

Wanneroo Vegetation Assessment 2019

<i>Brachyloma preissii</i>	0.6	<1
<i>Conostylis aculeata</i>	0.2	<1
<i>Dampiera linearis</i>	0.2	<1
<i>Desmocladius flexuosus</i>	0.4	1
<i>Eremaea pauciflora</i>	0.5	25
* <i>Gladiolus caryophyllaceus</i>	0.5	<1
<i>Haemodorum spicatum</i>	0.3	<1
<i>Hibbertia hypericoides</i>	0.5	15
<i>Hibbertia striata</i>	0.5	2
<i>Hypocalymma robustum</i>	0.2	<1
<i>Mesomelaena pseudostygia</i>	0.5	15
<i>Patersonia occidentalis</i>	0.4	<1
<i>Petrophile linearis</i>	0.3	<1
<i>Pimelea sulphurea</i>	0.2	<1
<i>Ptilotus manglesii</i>	0.2	<1
<i>Rytidosperma</i> sp.	0.3	<1
<i>Scaevola repens</i>	0.2	<1
* <i>Ursinia anthemoides</i>	0.1	<1
<i>Waitzia suaveolens</i>	0.2	<1
<i>Xanthorrhoea preissii</i>	1.5	8

Quadrat 5

Staff	DJR	Date	12/11/2019	Season	P
Revisit					
Type	Q 10 m x 10 m				
Location	Crest of shallow dune				
MGA Zone	50				
Habitat	Flat				
Aspect		Slope			
Soil Type	Grey Bassendean Sand				
Rock Type					
Loose Rock		Litter	10 % cover ; <1 cm in depth		
Bare ground	10 % cover	Weeds	<1 % cover		
Vegetation	U+ ^ <i>Banksia attenuata</i> , <i>Allocasuarina fraseriana</i> , <i>Banksia menziesii</i> ^tree\6\i;M ^ <i>Xanthorrhoea preissii</i> ^grass tree\3\r;G ^ <i>Stirlingia latifolia</i> ,^ <i>Hibbertia hypericoides</i> ^shrub\2\c				
Veg. Condition	Excellent				
Disturbance					
Fire Age	1-2 years				
Notes					



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Aira caryophyllea</i>		0.1	<1	
<i>Allocasuarina fraseriana</i>		6	2	
<i>Banksia attenuata</i>		5	11	
<i>Banksia menziesii</i>		4	2	
<i>Bossiaea eriocarpa</i>		0.5	1	
<i>Brachyloma preissii</i>		0.4	<1	

Wanneroo Vegetation Assessment 2019

<i>*Briza maxima</i>	0.2	<1
<i>Comesperma calymega</i>	0.4	<1
<i>Conostylis setigera</i> subsp. <i>setigera</i>	0.2	<1
<i>Dampiera linearis</i>	0.3	<1
<i>Desmocladius flexuosus</i>	0.5	<1
<i>Dianella revoluta</i>	0.4	<1
<i>*Ehrharta calycina</i>	0.2	<1
<i>*Gladiolus caryophyllaceus</i>	0.6	<1
<i>Gompholobium tomentosum</i>	0.3	<1
<i>Hibbertia hypericoides</i>	0.5	9
<i>Hibbertia striata</i>	0.3	1
<i>Hypolaena exsulca</i>	0.8	<1
<i>Jacksonia sternbergiana</i>	1	<1
<i>Kennedia prostrata</i>	0.1	<1
<i>Macarthuria australis</i>	0.1	<1
<i>Mesomelaena pseudostygia</i>	0.4	<1
<i>Patersonia occidentalis</i>	0.4	<1
<i>Petrophile linearis</i>	0.3	<1
<i>Phlebocarya ciliata</i>	0.4	<1
<i>Rytidosperma</i> sp.	0.4	<1
<i>Scaevola repens</i>	0.2	<1
<i>Stirlingia latifolia</i>	0.8	14
<i>Stylidium piliferum</i>	0.1	<1
<i>*Ursinia anthemoides</i>	0.2	<1
<i>Waitzia suaveolens</i>	0.2	<1
<i>Xanthorrhoea preissii</i>	2	9

Quadrat 6

Staff DJR **Date** 12/11/2019 **Season** P
Revisit
Type Q 10 m x 10 m
Location Crest of shallow dune
MGA Zone 50
Habitat Flat
Aspect **Slope**
Soil Type Grey Bassendean Sand
Rock Type
Loose Rock **Litter** 2 % cover ; <1 cm in depth
Bare ground 25 % cover **Weeds** <1 % cover
Vegetation U+ ^*Eucalyptus marginata*,^*Allocasuarina fraseriana*^tree\6i;M ^*Xanthorrhoea preissii*^grass tree\3r;G ^*Hibbertia hypericoides*,*Stirlingia latifolia*,*Bossiaea eriocarpa*^shrub\2i
Veg. Condition Excellent
Disturbance
Fire Age 1-2 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Allocasuarina fraseriana</i>		7	9	
<i>Banksia attenuata</i>		1.5	2	
<i>Bossiaea eriocarpa</i>		0.6	5	
<i>Burchardia congesta</i>		0.5	<1	
<i>Conostylis setigera</i> subsp. <i>setigera</i>		0.2	<1	
<i>Crassula colorata</i>		0.2	<1	

Wanneroo Vegetation Assessment 2019

<i>Desmocladius flexuosus</i>	0.4	<1
<i>Eremaea pauciflora</i>	0.5	1
<i>Eucalyptus marginata</i>	10	10
<i>*Gladiolus caryophyllaceus</i>	0.7	<1
<i>Haemodorum spicatum</i>	0.6	<1
<i>Hibbertia hypericoides</i>	0.8	15
<i>Hypocalymma robustum</i>	0.3	<1
<i>Kennedia prostrata</i>	0.1	<1
<i>Lyginia imberbis</i>	0.3	<1
<i>Mesomelaena pseudostygia</i>	0.3	<1
<i>Petrophile linearis</i>	0.5	<1
<i>Petrophile macrostachya</i>	0.2	<1
<i>Ptilotus manglesii</i>	0.3	<1
<i>Stirlingia latifolia</i>	1	12
<i>*Ursinia anthemoides</i>	0.2	<1
<i>Waitzia suaveolens</i>	0.1	<1
<i>Xanthorrhoea preissii</i>	1.8	8

Quadrat 7

Staff DJR **Date** 12/11/2019 **Season** P
Revisit
Type Q 10 m x 10 m
Location Upper slope of shallow dune
MGA Zone 50 
Habitat Flat
Aspect **Slope**
Soil Type Grey Bassendean Sand
Rock Type
Loose Rock **Litter** 10 % cover ; <1 cm in depth
Bare ground 10 % cover **Weeds** <1 % cover
Vegetation U+ ^*Banksia menziesii*, *Banksia attenuata*, *Allocasuarina fraseriana* \^tree\6\i; M ^*Xanthorrhoea preissii* \^grass tree\3\r; G ^*Stirlingia latifolia*, ^*Hibbertia hypericoides* \^shrub\2\c
Veg. Condition Excellent
Disturbance
Fire Age <5 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Allocasuarina fraseriana</i>		5	4	
* <i>Avena barbata</i>		0.2	<1	
<i>Banksia attenuata</i>		6	5	
<i>Banksia menziesii</i>		6	5	
<i>Bossiaea eriocarpa</i>		0.5	1	
* <i>Briza maxima</i>		0.1	<1	

Wanneroo Vegetation Assessment 2019

<i>Conostephium pendulum</i>	0.5	4
<i>Conostylis setigera</i> subsp. <i>setigera</i>	0.3	<1
<i>Dampiera linearis</i>	0.3	<1
<i>Desmocladus flexuosus</i>	0.5	<1
<i>Dianella revoluta</i>	0.5	<1
<i>Eremaea pauciflora</i>	0.8	3
* <i>Gladiolus caryophyllaceus</i>	0.6	<1
<i>Gompholobium confertum</i>	0.3	<1
<i>Haemodorum spicatum</i>	0.3	<1
<i>Hibbertia hypericoides</i>	1	25
<i>Hibbertia striata</i>	0.4	<1
<i>Hypocalymma robustum</i>	0.6	2
<i>Mesomelaena pseudostygia</i>	0.4	<1
<i>Petrophile linearis</i>	0.3	<1
<i>Petrophile macrostachya</i>	0.4	<1
<i>Ptilotus manglesii</i>	0.2	<1
<i>Scaevola repens</i>	0.2	<1
<i>Stirlingia latifolia</i>	1	22
* <i>Ursinia anthemoides</i>	0.1	<1
<i>Waitzia suaveolens</i>	0.2	<1
<i>Xanthorrhoea preissii</i>	2	8

Quadrat 8

Staff DJR Date 12/11/2019 Season P

Revisit

Type Q 10 m x 10 m

Location Midslope of shallow dune

MGA Zone 50

Habitat Flat

Aspect Slope

Soil Type Grey Bassendean Sand

Rock Type

Loose Rock Litter 10 % cover ; <1 cm in depth

Bare ground 15 % cover Weeds <1 % cover

Vegetation U+ ^*Banksia attenuata*,^*Allocasuarina fraseriana*^tree\6\i;M ^*Xanthorrhoea preissii*^grass tree\3\i;G ^*Hibbertia hypericoides*,*Stirlingia latifolia*,*Mesomelaena pseudostygia*^shrub\2\c

Veg. Condition Excellent

Disturbance

Fire Age <5 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Allocasuarina fraseriana</i>		6	10	
* <i>Avena barbata</i>		0.3	<1	
<i>Banksia attenuata</i>		8	25	
<i>Bossiaea eriocarpa</i>		0.3	1	
<i>Brachyloma preissii</i>		0.3	<1	
* <i>Briza maxima</i>		0.1	<1	

Wanneroo Vegetation Assessment 2019

<i>Calectasia narragara</i>	0.6	<1
<i>Conostephium pendulum</i>	0.3	<1
<i>Conostylis aculeata</i>	0.3	<1
<i>Conostylis setigera</i> subsp. <i>setigera</i>	0.1	<1
<i>Dampiera linearis</i>	0.2	<1
<i>Dasypogon bromeliifolius</i>	0.2	1
* <i>Gladiolus caryophyllaceus</i>	0.6	<1
<i>Gompholobium tomentosum</i>	0.1	<1
<i>Hibbertia hypericoides</i>	0.5	18
<i>Hypocalymma robustum</i>	0.2	<1
<i>Hypolaena exsulca</i>	0.2	<1
<i>Kennedia prostrata</i>	0.2	<1
<i>Mesomelaena pseudostygia</i>	0.5	2
<i>Patersonia occidentalis</i>	0.2	<1
<i>Petrophile linearis</i>	0.3	<1
<i>Pimelea sulphurea</i>	0.2	<1
<i>Scaevola repens</i>	0.1	<1
<i>Stirlingia latifolia</i>	0.5	12
<i>Thysanotus arbuscula</i>	0.3	<1
<i>Waitzia suaveolens</i>	0.2	<1
<i>Xanthorrhoea preissii</i>	1.8	25