Mindarie Regional Council

Offset Revegetation Plan

Tamala Park

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Quality management system registered to ISO 9001:2015
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Document Title	MRC-R-Offset Revegetation Plan Tamala Park
Location	ConsultingSP/Shared Documents/Mindarie Regional Council/2024 Quotes/2024 06 078 Revegetation Plan/Offset Site Revegetation Plan/Report/MRC-R-Offset Revegetation Plan.docx

Draft/Version No.	Date	Changes	Prepared by	Approved by	Status
D1	July 2024	New Document	KE	LI	Superseded
V1	Sept 2024	Removal of Watermark		KE	Superseded
V2	Nov 2024	Addressing DWER Comments	KE	JW	Released

Executive Summary

Natural Area Consulting Management Services (Natural Area) has been commissioned by the Mindarie Regional Council (MRC) to prepare an offset revegetation plan for the clearing of 0.77 ha of native vegetation associated with the construction of an infiltration pond within Bush Forever site 323, Tamala Park, City of Wanneroo. This revegetation plan has been prepared in response to a request for further information received by MRC on June 14, 2024, in relation to Native Vegetation Clearing Permit (NVCP) application CPS 10554/1 and to satisfy the requirements for the required offset works associated with the proposed clearing. The development of the infiltration pond requires the impact and or removal of:

- approximately 0.77 ha suitable foraging habitat for Carnaby's Black-Cockatoos (*Zanda latirostris*) and Baudin's Black-Cockatoos (*Calyptorhynchus baudinii*)
- approximately 0.765 ha of native vegetation that is mapped within Bush Forever site 323.

Natural Area has drawn upon 20 years of experience planning and implementing revegetation across Western Australia, using this on-ground collective experience to deliver revegetation plans that:

- are practical to implement, based on best and current industry practice
- are scientifically accurate and ecologically appropriate, while capturing horticultural and agricultural knowledge to effectively establish functioning ecosystems
- provide the most significant environmental impact, while understanding the value of investment.

The outlined prescription in the document addresses the primary goals of the plan:

1. revegetate degraded and completely degraded vegetation to a good condition as defined by *Keighery Vegetation Condition Scale* (EPA, 2016).
2. Vegetation structure to be broadly representative of Banksia Woodland.
3. Revegetation that provides suitable foraging habitat for black cockatoo species.

Reports and surveys associated with the installation of the infiltration ponds include the following and are to be read in conjunction with this revegetation plan:

- *Mindarie Regional Council 2016 Bushland Survey Tamala Park* (Natural Area, 2017)
- *Mindarie Regional Council Flora and Fauna Survey Areas - 1 and 2* (Natural Area, 2024a)
- *Mindarie Regional Council Threatened Ecological Community Assessment -Tamala Park* (Natural Area, 2024b).
- *Mindarie Regional Council Revegetation Offset Site Suitability Assessment - Tamala Park* (Natural Area, 2024c).

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1.0 Introduction

Natural Area Consulting Management Services (Natural Area) was commissioned by the Mindarie Regional Council (MRC) to develop an offset revegetation plan associated with the clearing of 0.77 ha of native vegetation required for the construction of infiltration ponds within Tamala Park. Four potential offset sites were assessed to determine the most suitable area for future revegetation works. Site 2 was selected as per *Mindarie Regional Council Revegetation Offset Site Suitability Assessment - Tamala Park* (Natural Area, 2024c).

1.1 Purpose

This revegetation plan has been prepared to address the request for further information received by MRC on June 14, 2024, in relation to Native Vegetation Clearing Permit (NVCP) application CPS 10554/1 and to satisfy the requirements for the required offset works associated with the proposed clearing.

The following activities were undertaken by Natural Area during the development of the offset revegetation plan:

- Desktop assessment to determine:
  - potential flora species including declared rare and priority listed flora species (DRF) and ecological communities that may occur across the site.
- Basic site assessment survey to determine:
  - vegetation type
  - vegetation condition
  - flora species present (including invasive species)
  - priority/threatened flora species and ecological communities present.
- proposed revegetation methodology including
  - recommended species list and densities
  - site preparation
  - revegetation methodology
  - maintenance activities
  - monitoring and reporting
  - indicative implementation
- proposed completion criteria and contingency actions.

1.2 Location

The offset site is located within the MRC Tamala Park facility and within Bush Forever Site 323 (Department of Planning, Lands and Heritage (DPLH), 2019; Figure 1). The site is located in Tamala Park within the City of Wanneroo approximately 31 km north of Perth Central Business District (CBD).



Figure 1:
Site Location and
Proposed Offset Area

Tamala Park, City of Wanneroo

Legend

- Bush Forever 323 Site Boundary
- Offset Site Boundary

Client:	Mindarie Regional Council
Date:	13/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 8700

0 100 200 m

N

1.3 Legislative Context

State and Federal environment-related laws impact how environmental values are governed in Western Australia. The following legislation and policies are relevant to this report.

1.3.1 Relevant Legislation

***Biodiversity Conservation Act 2016* (WA)**

The *Biodiversity Conservation Act 2016* (BC Act) aims to protect and conserve biodiversity as well as to promote the ecologically sustainable use of biodiversity components in the State. The BC Act provides the statute relating to conservation and legal protection of flora, fauna, and ecological communities. The BC Act follows the principles of ecologically sustainable development, detailing that decision-making processes should effectively integrate long-term and short-term economic, environmental, social, and equity considerations.

***Biosecurity and Agriculture Management Act 2007* (WA)**

The *Biodiversity and Agriculture Management Act 2007* (BAM Act) regulates the framework for plant and animal pest and disease biosecurity in Western Australia. The framework provides for the control of declared flora and fauna species (declared organisms) that are known to be a significant environmental threat and the management, control and prevention of these declared plants and animals.

***Environmental Protection Act 1986* (WA)**

The *Environmental Protection Act 1986* (EP Act) provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The Environmental Protection Authority (EPA) is established under this act and provides a structured policy framework that is consistent with the EP Act. The EPA produces the guidelines and procedures associated with conducting environmental assessments in line with the EP Act.

***Environment Protection and Biodiversity Conservation Act 1999* (Cth)**

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) serves to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places. The primary objective of the EPBC Act is to promote the conservation of biodiversity and the sustainable use of natural resources while allowing for ecologically sustainable development. The EPBC Act allows for the creation of conservation agreements between the Australian government and individuals, communities, or organizations to support the conservation of biodiversity.

2.0 Site Characteristics

The characteristics of a site have a strong bearing on the flora, vegetation, fauna, and ecological communities present. The key characteristics of the survey areas are outlined in this section.

2.1 Regional Context

The site is located within the Swan Coastal Plain 4 (SWA02) IBRA subregion (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024). This region is low-lying coastal plain characterised by soils comprised of sands of colluvial and aeolian origin, as well as alluvial river flats and coastal limestone. It is dominated by *Banksia* or Tuart vegetation types, as well as some areas of *Casuarina obesa, Melaleuca* sp. or Jarrah Woodlands (Mitchell *et al*. 2002).

2.2 Climate

The climate experienced in the area is mediterranean, with dry, hot summers and cool, wet winters. According to the Bureau of Meteorology (BoM, 2024); Gingin Aero, site number 009178, the region has an average:

- Rainfall of 629.0 mm pa, with rain falling predominantly between June and August.
- Maximum temperatures ranging from 18.4 °C in winter to 33.3 °C in summer with a maximum recorded temperature of 46.3 °C.
- Minimum temperatures ranging from 6.5 °C in winter to 17.1 °C in summer with a minimum recorded temperature of -3.7 °C.
- Predominant wind directions include morning easterlies and westerly sea breezes during the summer months, with an average wind speed of 12.4 km/h and gusts of more than 100 km/h.

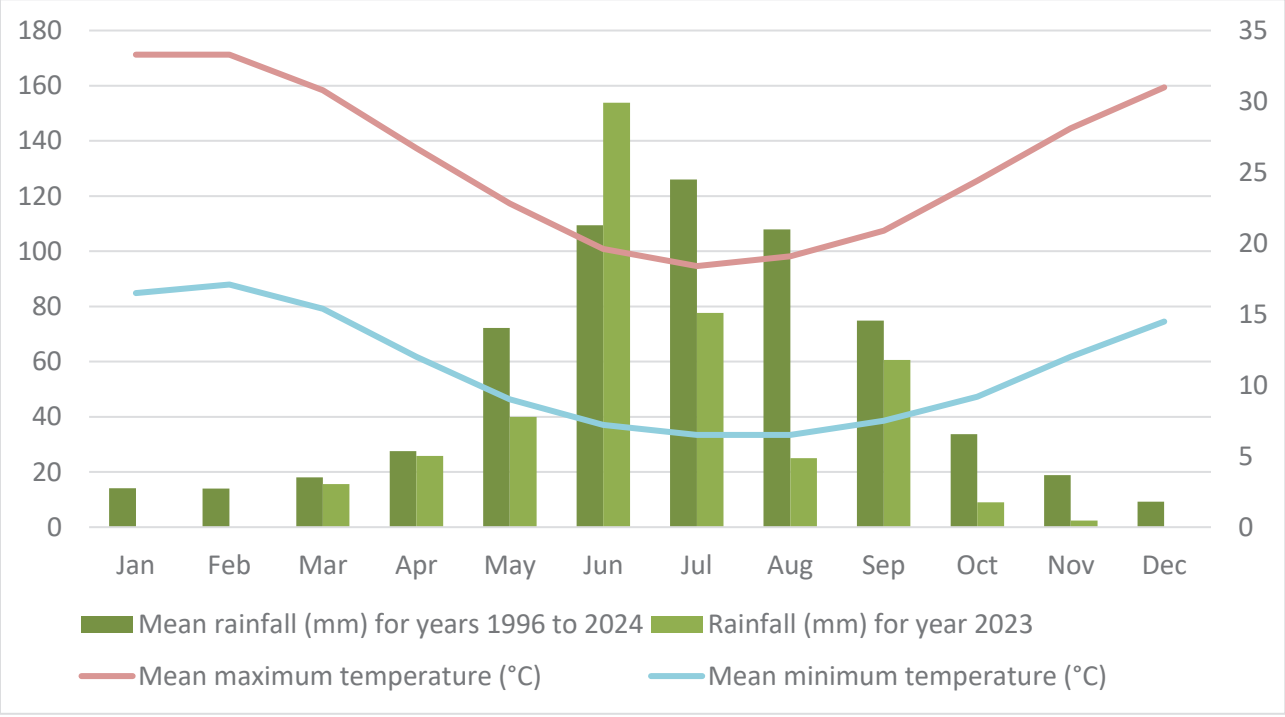


Figure 2: Average maximum and minimum temperature and rainfall from 1996-2024 and 2023 rainfall at Gingin Aero (Station ID 009178) (BoM, 2024)

2.3 Topography and Soils

Two soil types were identified on site, being Karrakatta Sand Yellow Phase and Quindalup South oldest dune Phase (Department of Primary Industries and Regional Development (DPIRD), 2022). The site ranges from 10 m Australian Height Datum (AHD) in the centre of site and rises to 16 m AHD in the west (DPIRD, 2019) (Table 1 and Figure 3).

Table 1: Soil types within revegetation offset site (DPIRD, 2022)

Symbol	Name	**Description**
211Sp_Ky	Karrakatta Sand Yellow Phase	Low hilly to gently undulating terrain. Yellow sand over limestone at 1-2 m. Banksia spp. woodland with scattered emergent *E. gomphocephala,* and *E. marginata* and a dense shrub layer.
211Qu_Q1	Quindalup South oldest dune Phase	The oldest phase. Dunes or remnants with low relief. Calcareous sands have organic staining to about 30 cm, overlying pale brown sand with definite cementation below 1 m.



Figure 3:
Topography and Soils

Tamala Park, City of Wanneroo

Legend

- Offset Site Boundary
- 2 m Contours

Soil Types

- Karrakatta Sand Yellow phase
- Quindalup South oldest dune phase

Client:	Mindarie Regional Council
Date:	13/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 950

0 15 30 m

N

2.4 Vegetation Complex

Two vegetation complexes exist throughout the proposed revegetation area (Figure 4). Cottesloe Complex-Central and South is described by Heddle, Loneragan, and Havel (1980) as supporting heaths on limestone outcrops with deeper sands supporting *Eucalyptus gomphocephala* woodland and an open-forest of *E*. *gomphocephala*, *E*. *marginata* and *Corymbia calophylla* (Heddle *et al.,* 1980).

The pre-European extent of this vegetation complex remaining is:

- 32.16 % within the Swan Coastal Plain
- 41.65% within the City of Wanneroo (Government of Western Australia, 2019).

Quindalup Complex is described by Heddle, Loneragan, and Havel (1980) as being restricted to the coastal dunes and can be divided into separate sections. The Quindalup Complex foredune contains species such as *Atriplex isatidea, *Cakile maritima, Leucophyta brownii, Carpobrotus virescens, *Pelargonium capitatum,* and *Spinifex longifolius.* The Quindalup Complex mobile and stable dune contains *Acacia cyclops, Lepidosperma gladiatum, Myoporum insulare, Olearia axillaris, Scaevola crassifolia and Spyridium globulosum* (Heddle *et al.,* 1980).

The pre-European extent of this vegetation complex remaining is:

- 60.49 % within the Swan Coastal Plain
- 60.70 % within the City of Wanneroo (Government of Western Australia, 2019).



Figure 4:
Vegetation Complex

Tamala Park, City of Wanneroo

Legend

Offset Site Boundary

Vegetation Complex

Cottesloe Complex-Central and South

Quindalup Complex

Client:	Mindarie Regional Council
Date:	13/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 950

0 15 30 m

N

2.5 Heritage Values

There are several heritage areas located within the site boundaries these have been outlined in Table 2 (Figure 5).

Table 2: Heritage sites located within site boundaries (DPLH, 2024a; DPLH, 2024b)

ID	Name	Place type
3567	Mindarie Waugal	Artefacts/Scatter; Creation/Dreaming Narrative
18801	Scarred Tree	Modified Tree
18802	Tamala Park Campsite	Camp; Creation/ Dreaming Narrative
18803	Tamala Park Waterhole	Creation/Dreaming Narrative

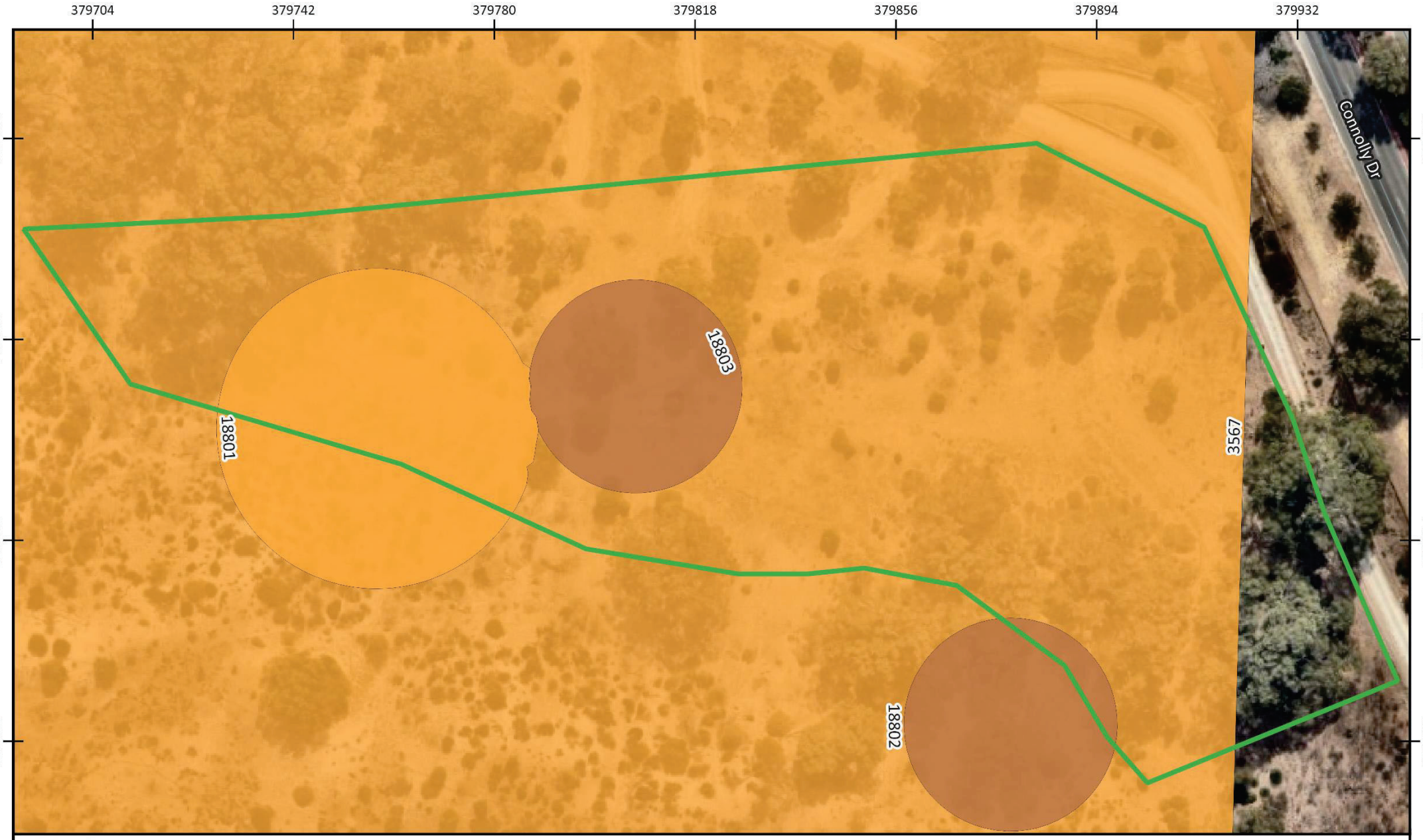


Figure 5:
Heritage Sites

Tamala Park, City of Wanneroo

Legend

- Offset Site Boundary
- Aboriginal Cultural Heritage Historic
- Aboriginal Cultural Heritage Register

Client:	Mindarie Regional Council
Date:	28/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 950

0 15 30 m

N

3.0 Survey Methodology

3.1 Desktop and Literature Review

The desktop survey included reviewing online databases to gather contextual knowledge and determine preliminary site characteristics including:

- likely native and non-native flora and fauna species present
- current extent of native vegetation
- general floristic community types
- likely presence of threatened or priority flora and fauna species
- likely presence of any threatened or priority ecological communities.

The following databases were accessed to obtain relevant information:

- NatureMap (Department of Biodiversity, Conservation and Attractions (DBCA), 2023a)
- Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water (DCCEEW)), 2023) (Appendix 1)
- FloraBase (WA Herbarium, 1998-)
- Threatened and priority flora/fauna/ecological community database searches (DBCA, 2023b; 2023c; 2023d).

Conservation code definitions for the State and Commonwealth are provided in Appendix 2.

3.2 On-ground Flora Survey

The flora and vegetation survey was conducted in accordance with *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority (EPA), 2016). Samples were collected, or photographs taken of unfamiliar species to enable later identification.

Natural Area ecologists undertook the survey on 5 July 2024, with key data recorded using QField software on a handheld tablet. Survey activities included:

- Traversing the entirety of the site and recording all species present, including native and invasive species.
- Marking locations of any conservation significant flora, Declared Pests (DP) and/or Weeds of National Significance (WoNS) identified.
- Recording vegetation type including dominant over, middle and understorey species to describe vegetation type in line with the National Vegetation Information System (NVIS) Level V- Association (Executive Steering Committee for Australian Vegetation Information (ESCAVI) 2003).
- Recording vegetation condition using the scale attributed to Keighery (Table 5) (Government of Western Australia, 2000).
- The use of GPS to map significant species and boundaries of differing vegetation type and condition.
- Recording evidence of disturbance, such as fire.

3.2.1 Vegetation Type

Vegetation type is described using the structural classes outlined in the Australian Vegetation Attribute Manual (ESCAVI, 2003). Vegetation type is described to Level V (Association). This includes the dominant growth form, height, cover and three dominant species for each stratum (ESCAVI, 2003).

3.2.2 Vegetation Condition

Vegetation condition was assessed using the rating scale attributed to Keighery in *Technical Guidance-Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016). Table 3 provides a description of the rating scale.

Table 3: Vegetation condition ratings

	Category	Description
1	Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
2	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.
3	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.
4	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 some very aggressive weeds, partial clearing, dieback and grazing.
5	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.
6	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.

Source: EPA, 2016

3.3 Limitations

Limitations associated with the site assessment survey are outlined in Table 4.

Table 4: Site assessment survey limitations

Potential Limitation	Degree of Limitation	Comments
Availability of contextual information	None	Government data on regional and local contextual information are readily available for the survey area.

Potential Limitation	Degree of Limitation	Comments
Competency/experience of team	None	Survey activities were undertaken by experienced environmental scientists who have extensive experience undertaking flora surveys and site assessments within the Swan Coastal Plain bioregion.
Survey effort and extent	None	A site assessment was undertaken over one day. The survey areas were traversed and flora species, vegetation condition and vegetation types within the survey areas were adequately assessed.
Access restrictions	None	Environmental scientists were able to traverse throughout the survey area with no access restrictions present.

4.0 Flora Survey Results

4.1 Desktop Survey

A desktop survey of online databases indicated the potential for a total of 39 conservation significant species to occur within 10 km of the survey area (Table 5). NatureMap indicated 27 conservation significant flora species listed under the *Biodiversity Conservation Act 2016* (WA) (*BC Act 2016*) or by the Western Australian Herbarium (1998-), as potentially occurring within 10 km radius of the site (DBCA, 2023a). A review of the Protected Matters Search Tool (PMST) (DCCEEW, 2023) indicated 14 significant flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (*EPBC Act 1999*) as potentially occurring within a 10 km radius of the site (Appendix 1).

A review of the DBCA (2023b) threatened and priority flora database indicated 28 threatened or priority species have been recorded within 10 km of the site. Of the conservation significant species potentially found in the area, it was determined that the site conditions (soil type, drainage, location) may be suitable for 12 (highlighted green) of these species (Table 5). Conservation code descriptions are provided in Appendix 2.

Table 5: Threatened and Priority flora species listed by NatureMap, PMST and DBCA

Species Name	Cons Code	NatureMap	PMST	DBCA
Acacia benthamii	P2	X		X
Andersonia gracilis	EN		X	
Anigozanthos viridis subsp. *terraspectans*	VU		X	
Austrostipa mundula	P3	X		X
Baeckea sp. Limestone	P1	X		X
Banksia mimica	EN		X	
Caladenia huegelii	EN		X	
Calectasia elegans	P2			X
Conostylis bracteata	P3	X		X
Cyathochaeta teretifolia	P3	X		X
Diuris micrantha	VU		X	
Diuris purdiei	EN		X	
Drakaea elastica	EN		X	
Drakaea micrantha	VU		X	
Drosera x *sidjamesii*	P1	X		X
Eleocharis keigheryi	VU		X	
Eucalyptus argutifolia	VU	X	X	X
Eucalyptus foecunda subsp. *foecunda*	P4	X		X

Species Name	Cons Code	NatureMap	PMST	DBCA
Fabronia hampeana	P2	X		X
Grevillea sp. Ocean Reef	P1	X		X
Hibbertia leptotheca	P3	X		X
Jacksonia gracillima	P3	X		X
Jacksonia sericea	P4	X		X
Lecania turicensis var. *turicensis*	P2	X		X
Leucopogon maritimus	P1	X		X
Leucopogon sp. Yanchep	P3	X		X
Macarthuria keigheryi	EN		X	
Marianthus paralius	EN	X	X	X
Melaleuca sp. Wanneroo	EN	X	X	X
Netrostylis sp. Chandala	P2	X		X
Paracaleana dixonii	EN		X	
Pimelea calcicola	P3	X		X
Poranthera moorokatta	P2	X		X
Sarcozona bicarinata	P3	X		X
Stylidium maritimum	P3	X		X
Stylidium paludicola	P3	X		X
Styphelia filifolia	P3	X		X
Thelymitra variegata	P2	X		X
Utricularia oppositiflora	P3	X		X

4.1.1 Threatened and Priority Ecological Communities

A review of the PMST report identified three listed Threatened Ecological Communities that could potentially occur within 10 km of the site (Table 6).

Table 6: Potential Threatened Ecological Communities within the survey area

Name	Status	Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within the area
Empodisma peatlands of southwestern Australia	Endangered	Community may occur within area
Tuart (*Eucalyptus gomphocephala)* Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within the area

4.2 Flora Survey Results

4.2.1 Vegetation Types

Two vegetation types were recorded within the revegetation offset area. Vegetation types are described in Table 7 and shown in Figure 6.

Table 7: Vegetation type within survey area

Vegetation Type	Vegetation Symbol	Description	Photograph
Eucalyptus gomphocephala Open Forest	EgOF	*Eucalyptus gomphocephala* Tall Woodland over a sparse middle layer of *Xanthorrhoea preissii* and mixed shrubs, and an understorey of weedy herbs and grasses.	
Spyridium globulosum Shrubland	SgS	*Spyridium globulosum* and *Melaleuca systena* and mixed coastal shrubs over an understorey of *Lomandra maritima* and *Desmocladus flexuosus*	

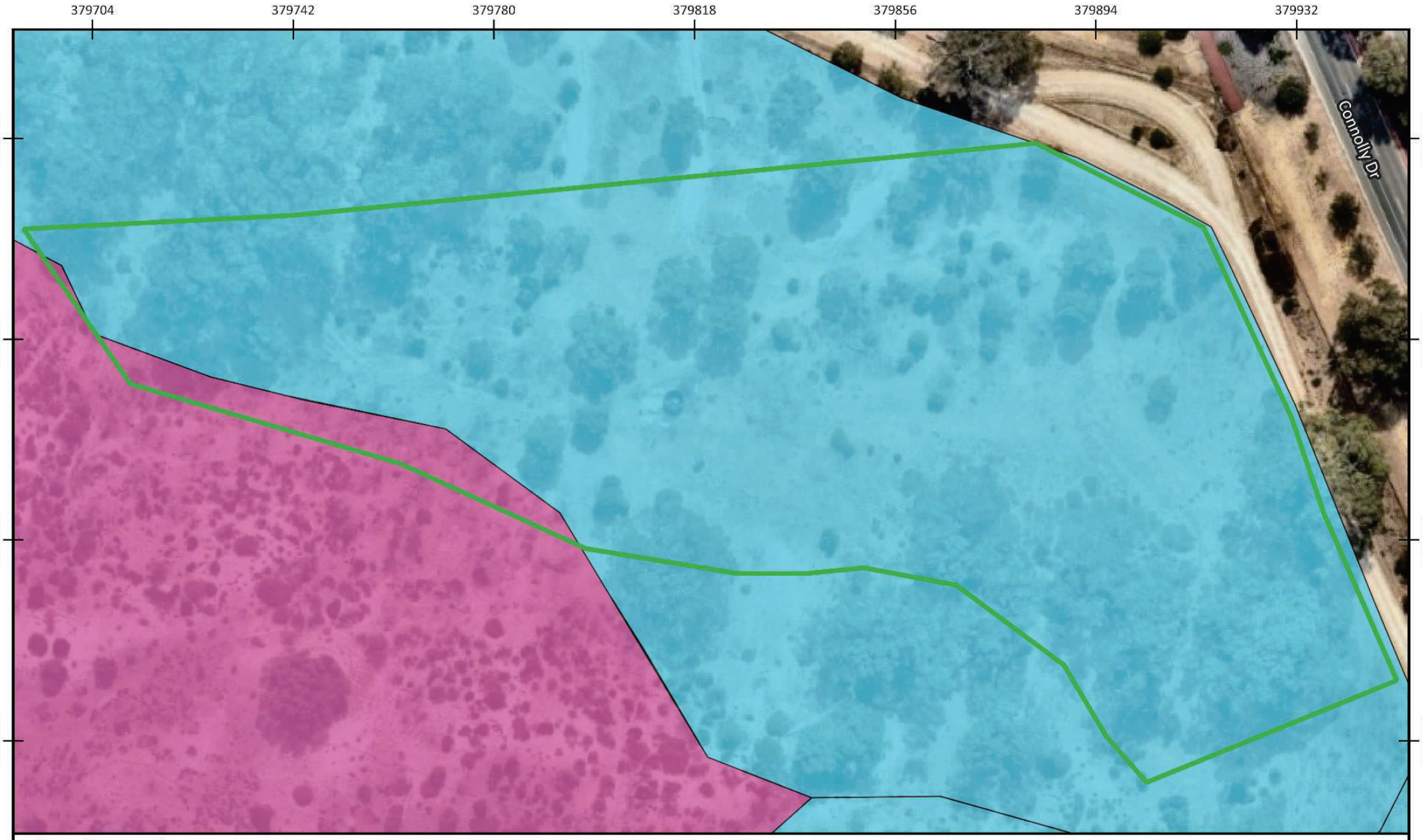


Figure 6:
Vegetation Types

Tamala Park, City of Wanneroo

Legend

Offset Site Boundary

Vegetation Type

EgOF

SgS

Client:	Mindarie Regional Council
Date:	13/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 950

0 15 30 m

N

4.2.2 Vegetation Condition

Vegetation condition on site ranged from completely degraded to excellent (Table 8, Figure 7).

Table 8: Vegetation condition within offset site

Vegetation Condition	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded	Total
Area (ha)	0	0	0	0.38	0.18	1.06	1.62
Area (%)	0	0	0	23.5	11.1	65.4	100

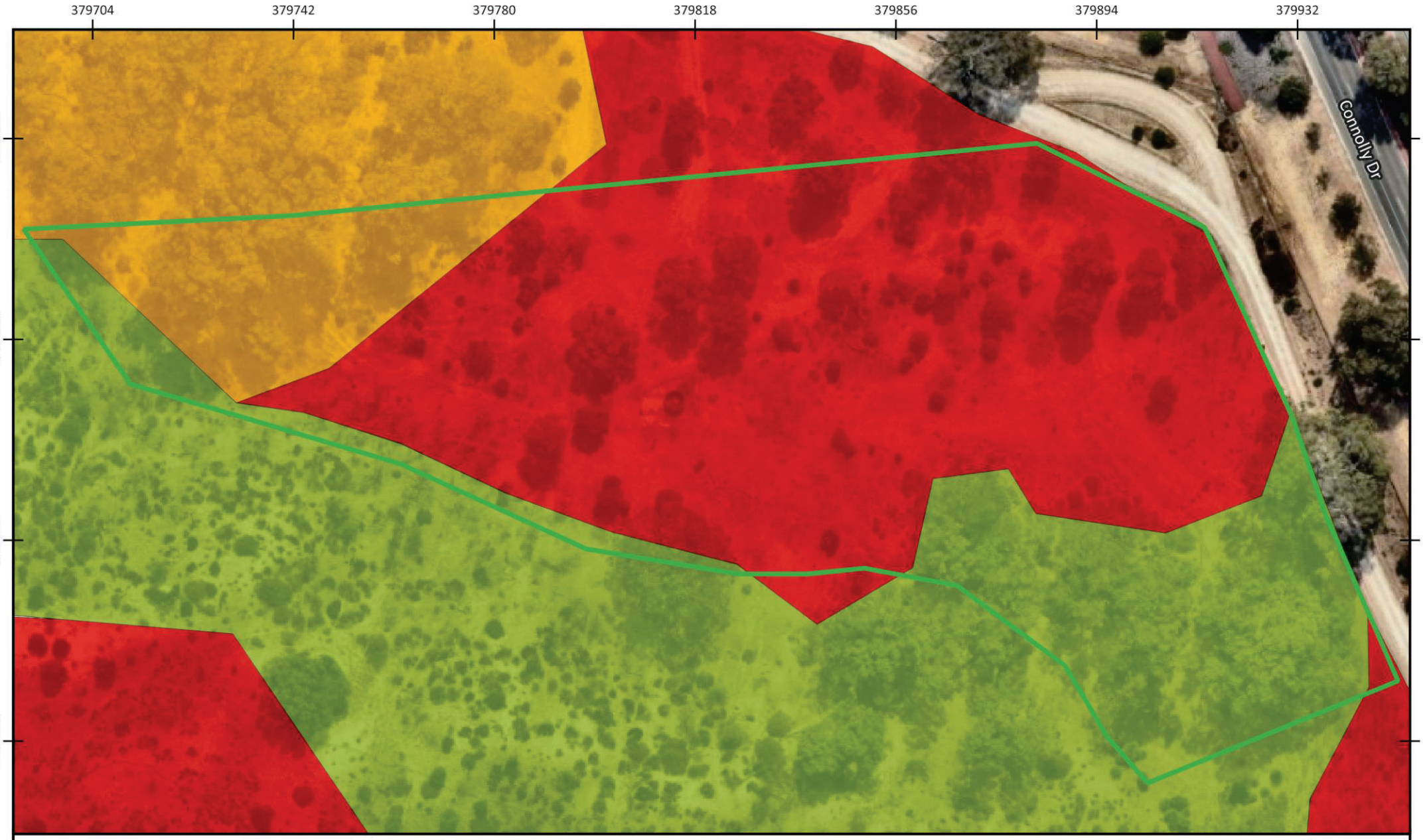


Figure 7:
Vegetation Condition

Tamala Park, City of Wanneroo

Legend

Offset Site Boundary

Vegetation Condition

- Good
- Degraded
- Completely Degraded

Client:	Mindarie Regional Council
Date:	14/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 950

0 15 30 m

N

4.2.3 Flora

As per the *Mindarie Regional Council Flora and Fauna Survey – Areas 1 and 2* (Natural Area, 2024a) and *Mindarie Regional Council Revegetation Offset Site Suitability Assessment – Tamala Park* (Natural Area, 2024c) a total of 107 flora species (taxa) were recorded from 39 families during the field survey, comprised of 50 introduced (weeds) and 58 native species. Examples of native flora species are shown in Figure 8 and weed species in Figure 9. A complete flora species list is provided in Appendix 4. Two declared pests (DP) were identified within the bush forever site, Bridal Creeper (**Asparagus asparagoides*) and One Leaf Cape Tulip (**Moraea flaccida*). One leaf cape tulip was recorded within the offset site. Bridal Creeper is also known as a Weed of National Significance (WoNS). Examples of these pests are shown in Figure 8. Declared pests are listed on the Western Australian Organism List (WAOL) under the *Biosecurity and Agriculture Management Act 2007* (WA). This classification requires the landowner/land manager to control the population to limit damage as a result of the presence of these species (DPIRD, 2024).



Hibbertia hypericoides (Yellow Buttercups)



Drosera macrantha (Bridal Rainbow)



Drosera erythrorhiza (Red Ink Sundew)



Spyridium globulosum (Basket Bush)

Figure 8: Examples of native flora species recorded



Bridal Creeper (*_Asparagus asparagoides_) (DP & WoNS)



One-leaf Cape Tulip (*_Moraea flaccida_) (DP)



Hottentot Fig (*_Carpobrotus edulis_)



Long Storksbill (*_Erodium botrys_)

Figure 9: Examples of introduced flora species recorded

4.2.4 Threatened and Priority Communities

A threatened ecological community (TEC) assessment was carried out in July 2024 for the clearing area and adjacent bushland. Please refer to *Mindarie Regional Council Threatened Ecological Community Assessment Tamala Park* (Natural Area, 2024b). The offset site is located within one vegetation TEC 'Tuart *(Eucalyptus gomphocephala)* woodlands and forest of the Swan Coastal Plain' which is listed as Priority 3 at the state level and critically endangered under the EPBC Act.

5.0 Suitability of Reference Site

The following sections outline the process and methodology undertaken in selecting the reference site, as well as justification on the suitability of the reference site to inform this revegetation plan.

The quadrat data collected during the *Mindarie Regional Council Threatened Ecological Community Assessment – Tamala Park* (Natural Area, 2024b), and *Mindarie Regional Council 2016 Bushland Survey Tamala Park* (Natural Area, 2017) has been analysed to inform the development of an appropriate reference site for this revegetation plan. Reference site and quadrat locations are shown in Figure 10.

The *Mindarie Regional Council Threatened Ecological Community Assessment – Tamala Park* (Natural Area, 2024b) report provides additional baseline information on the site and outlines the methodology for the flora and vegetation survey and establishment of quadrats. This following was undertaken during the Natural Area (2024b) survey:

- desktop survey and literature review
- outlines survey findings and methodology including:
    - Establishing three 10 x 10 m quadrats recording the upper, middle and understorey as specified in the EPA technical guidance document (EPA, 2016) across the one vegetation type present.
    - Photographing each quadrat in the north-west corner and recording GPS coordinates.
    - Recording landscape characteristics including soil types/colour, aspect, slope, surface rock, topography and drainage using Natural Area's modified recording sheets based on the NAIA templates developed for the Perth Biodiversity Project.
    - Determining leaf litter depth, percentage cover, and percentage of bare ground.
    - Recording percentage cover, height, number of alive/dead stems and life forms for each flora species in the quadrats.
    - Marking locations of any conservation significant flora, declared pests (DP) and/or weeds of national significance (WoNS) identified.
    - Recording vegetation type including dominant over, middle and understorey species and condition using the scale attributed to Keighery (Government of Western Australia, 2000).
    - The use of GPS to map significant species and boundaries of differing vegetation type and condition.

A summary of the results from the flora survey is listed below in Table 9. The average combined attributes indicate what target values should be considered when establishing completion criteria.

Table 9: Site species and attributes based on reference quadrats

Location		Q1	Q2	Q3	Q4	Average Combined Attributes
Vegetation Condition*		4	3	3	3	3
Vegetation Cover %	**Upper**	20	35	15	0.0	17.5
	Mid	14.6	16.6	19	76.0	31.55
	Lower	28.7	26.5	43.2	31.8	32.55
	Total	63.3	78.1	77.2	107.8	81.6
Species Richness		34	30	35	30	32
Gravel %		0	0	0	0	0
Rock %		0	0	0	0	0
Leaf Litter %		0	0	0	12	3
Bare Ground %		7	8	8	12	8.25

Vegetation Condition Key*	
Rating	**Vegetation Condition**
0	Completely Degraded
1	Degraded
2	Good
3	Very Good
4	Excellent
5	Pristine

The target vegetation condition for the offset revegetation area is good. To increase the diversity opportunities, target attributes for the revegetation site have been determined using the *Mindarie Regional Council Threatened Ecological Community Assessment – Tamala Park* (Natural Area, 2024b) and *Mindarie Regional Council 2016 Bushland Survey Tamala Park* (Natural Area, 2017) undertaken for the Mindarie Regional Council. Quadrat data is outlined in Appendix 5.



Figure 10:
Quadrat Locations

Tamala Park, City of Wanneroo

Legend

- Bush Forever 323 Site Boundary
- Offset Site Boundary
- Quadrat Locations

Client:	Mindarie Regional Council
Date:	12/11/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 8700

0 100 200 m

N

5.1 Species List and Density

An indicative species list for revegetation is provided in Table 10 and Table 11 which has been created based on the reference sites and the surrounding vegetation. The species selected also adheres to the DWERs requirements that specify rehabilitation of black cockatoo foraging species (Section 5.1.1).

The flora species lists aim to indicate species that could be included within the revegetation process, with the actual list being informed from seed collected for propagation during initial works and by those available from a nursery (or nurseries) contracted to provide the tubestock for the project. Species strata selection is to occur at a rate of 1:1 (middle: lower), and 1 upper strata species per 10 m^2 to achieve a similar structure to the vegetation structure of the surrounding bushland.

Table 10: Indicative species list and plant quantities for revegetation

Species	Common Name	Indicative Plant Numbers
Lower Strata		
Acanthocarpus preissii		16,400
*Austrostipa compressa^*		
*Clematis linearifolia^*	Slender Clematis	
Conostylis aculeata	Prickly Conostylis	
Enchylaena tomentosa	Barrier Saltbush	
*Hardenbergia comptoniana^*	Native Wisteria	
Middle Strata		
*Acacia cochlearis^*		16,400
*Acacia cyclops^*	Coastal Wattle	
*Acacia pulchella^*		
*Acacia rostellifera^*	Summer-scented Wattle	
*Austrostipa flavescens^*		
*Calothamnus quadrifidus^*	One-sided Bottlebrush	
Leucopogon parviflorus	Coast Beard-heath	
Macrozamia fraseri	Sandplain Zamia	
*Melaleuca huegelii^*		
*Melaleuca systena^*	Coastal Honeymyrtle	
*Melaleuca lanceolata^*		
*Olearia axillaris^*	Coastal Daisybush	
Pimelea argentea	Silvery Leaved Pimelea	
*Rhagodia baccata^*	Berry Saltbush	
*Spyridium globulosum^*	Basket Bush	

Species	Common Name	Indicative Plant Numbers
*Templetonia retusa^*	Cockies tongues	

^ indicates species is suitable for direct seeding

5.1.1 Cockatoo Foraging Species

To enhance the black cockatoo foraging value of the offset cockatoo foraging species will be established to promote natural gregarious feeding behaviour. Revegetation of foraging species also provide high value habitat for nectivorous and insectivorous species within the site. Black cockatoo foraging species will initially be installed at a rate of 1 per 1 m^2.

Table 11: Species suitable for cockatoo foraging bands

Species	Strata	Max Height (m)	Cockatoo Value	Part Consumed	Phytophthora Susceptible	Indicative Plant Numbers
Middle Strata						
*Acacia saligna^*	M	6	F	Seed	N	14,760
Banksia menziesii	M	7	F	Seed, flower	Y	
Banksia sessilis	M	5	F	Seed, flower	N	
Hakea lissocarpha	M	1.5	F	Seed	N	
Hakea prostrata	M	3	F	Seed	Y	
Hakea ruscifolia	M	3	F	Seed, flower	N	
Hakea trifurcata	M	3	F	Seed	Y	
Hakea varia	M	4	F	Seed	N	
Jacksonia furcellata	M	4	F	Seed	Y	
Xanthorrhoea preissii	M	3	F	Seed	Y	
Upper Strata						
*Allocasuarina fraseriana^*	U	15	F	Seed	Y	1,640
Banksia attenuata	U	10	F	Seed, flower, invertebrate	Y	
Banksia prionotes	U	10	F	Seed	Y	
*Corymbia calophylla^*	U	40	F, N, R	Seed, flower, nectar	N	
*Eucalyptus gomphocephala^*	U	40	F, N, R	Seed	Y	
*Eucalyptus todtiana^*	U	8	F	Seed	Y	
*Eucalyptus marginata^*	U	40	F, R	Seed	Y	

^ indicates species is suitable for direct seeding

5.2 Planting Densities

The proposed target density is 3 plants per m^2. To achieve this, it is recommended a total of 49,200 tubestock are planted during the initial planting event, with 14,760 tubestock planted during the first infill planting event and 4,428 tubestock to be planted during the second infill planting event. This will ensure that density is maintained in the event there is some tubestock loss. Further infill planting should be undertaken as required to maintain the target density throughout the site. The location of the planting has been outlined in Figure 11.

Plants utilised should meet the following requirements:

- Plants will be preferentially sourced from a Nursery Industry Accreditation Scheme Australia (NIASA) facility which will undertake dieback testing and can propagate majority of the stock from seed.
- All plant stock and seed to be free from pest and diseases.
- Only healthy, true to form plants will be installed on site.
- Plant stock is (preferentially) propagated from provenance specific seed or from seed sourced as close to the appropriate provenance as possible.
- Plant stock to have a large healthy root system with no evidence of having been restricted or damaged (e.g. Root bound) and the root ball of the plant shall remain intact with only a minor amount of loose soil present.



Figure 11:
Revegetation Site

Tamala Park, City of Wanneroo

Legend

Offset Site Boundary

Client:	Mindarie Regional Council
Date:	19/08/2024
Created by:	K.Evans
Image Source:	Nearmap, 2024
Datum:	GDA2020 / MGA zone 50
Scale:	1: 950

N

0 15 30 m

6.0 Completion Criteria

Monitoring activities will assess the success of the revegetation works by comparing the outcomes of monitoring to the completion criteria. The completion criteria outlined in Table 12 are to be achieved by the final monitoring event.

Monitoring and maintenance will be conducted for a period of 5 years following revegetation completion or until completion criteria has been met for three consecutive years. If tubestock seedlings are planted at the optimum time of year and watering of plants occurs during the hottest months, losses can be minimised. Additional infill planting may be required in order to achieve completion criteria which can be sourced from the initial indicative planting list in Section 5.1.

Although the methodology has been prescribed in Section 7.0 to ensure the completion criteria stated are achieved, unforeseen site conditions may impede the desired outcomes. It is important that informal monitoring during maintenance events and formal monitoring guide the progression of the revegetation. Contingency actions and adaptive management recommendations below should be implemented if completion criteria are likely to not be met. If completion criteria are not met by the end of the defined establishment period further work should be carried out to ensure the best possible outcomes for the project.

Table 12: Completion Criteria and Contingency Actions

Completion Criteria	Potential Issue	Contingency Actions
Vegetation in good condition	Vegetation condition degraded or completely degraded	Determine factors reducing condition rating (species diversity, weed coverage etc.) and implement control measures.
Weed coverage < 15 %	Weed coverage > 15 %	Implement additional weed control events.
	Adverse weather does not allow for weed control to occur	Implement weed control as weather permits.
No WoNS or DP present within revegetation site	WoNS or DP present	Conduct targeted weed control events.
Species richness consists of ≥ 32 native species	Species richness < 32 native species	▪ Conduct investigation into the likely cause (e.g. ecotoxicity, species not suitable for site conditions, adverse weather conditions). ▪ Assess species selected and review infill planting list. ▪ Consider implementing additional infill planting.

Completion Criteria	Potential Issue	Contingency Actions
		▪ Implement appropriate remedial actions for example: – implement watering events – additional soil investigations – implement pest management program – install tree guards to plants outside of fenced area.
Black cockatoo foraging species coverage ≥ 60 %	Black cockatoo foraging species coverage < 60 %	▪ Conduct investigation into the cause of deaths (Dieback etc.). ▪ Consider implementing additional infill planting of species. ▪ Consider implementing remedial actions such watering for species.
Vegetation coverage ≥ 80 % coverage	Vegetation coverage < 80 %	▪ Conduct investigation into the likely cause (e.g. ecotoxicity, species not suitable for site conditions, adverse weather conditions). ▪ Assess species selected and review infill planting list. ▪ Consider implementing additional infill planting. ▪ Implement appropriate remedial actions for example: – implement watering events – additional soil investigations – implement pest management program – install tree guards to plants outside of fenced area.
No rubbish present within the revegetation site	Rubbish present	▪ Undertake rubbish removal. ▪ Consider fence installation or installation of shade cloth to fence to reduce rubbish entering revegetation area.
No erosion present within revegetation site	Erosion present	▪ Undertake erosion control measures for example: – matting and/or coir log installation – surface water diversion – consider installation of additional rock pitching – installation of habitat logs to slow down and divert water.

Completion Criteria	Potential Issue	Contingency Actions
		▪ Consider implementing surface water management plan and/or follow management actions as per surface water management plan.

6.1 Project Limitations and Potential Issues

Several project specific limitations are present which could limit the rehabilitation of the site. The following limitations have been considered during the planning stage of this project (Table 13). Limitations and potential issues should be assessed throughout the project during maintenance and monitoring events. At this time MRC should be made aware of any issues and the project should be driven by adaptive management throughout the project.

Table 13: Potential limitations and considerations

Potential Limitations/Issues	Considerations
Soil profile not suitable for revegetation	Soil composition changes over time due to landfill leakage adjacent to revegetation site. Consider reassessing species list and refine to species that establish within the soil profile. Consider undertaking soil investigation to ensure no contamination to revegetation site.
Excessive weed load due to historic and current use of land	Consider undertaking additional weed control activities.
Excessive rubbish on site due to surrounding land use	Consider undertaking additional rubbish collection. Install, repair and maintain any barrier fencing surrounding revegetation site.
Damage to vegetation through herbivory	▪ Consider fencing or maintain fence line surrounding revegetation area. ▪ Consider installation of tree guards to revegetation outside of fence line. ▪ Ensure tubestock species are hardened off prior to plant installation. ▪ Installation density expected to produce enough stems to offset herbivory. ▪ Consider implementing pest control.
Acquiring local provenance seed and tubestock	▪ Seed collection to occur across multiple collection events to capture diversity required. ▪ Seed to be provided to nursery for propagation in April of the year before planned planting activities. ▪ If local provenance seed is not collected, tubestock to be ordered by September the year prior to installation.
Erosion present on site	▪ Consider undertaking erosion control activities. ▪ Develop/ implement surface water management plan.

7.0 Revegetation Methodology

Revegetation activities will primarily involve direct seeding and planting at the site to restore the vegetation structure. Revegetation methodology is discussed in the following section. Revegetation, weed control and maintenance works discussed within this section should be carried out though the entirety of the offset site. All revegetation methodology should be discussed and approved by native title holders and Traditional Owners prior to works being undertaken.

7.1 Site Preparation

An Initial weed control event will be required prior to revegetation works commencing. It is recommended that weed control take place within the month prior earth works. Minor earth works such as ripping will be required over the revegetation areas. Care is to be taken when undertaking earthworks to ensure no damage is done to existing vegetation. Areas should be ripped to a maximum depth of 500 mm.

Conservation fencing is to be installed surrounding the retained vegetation and revegetation site (Figure 11). Fencing should be a minimum of 1,100 mm and include a 300 mm vermin proof skirting to reduce the impact of herbivory.

7.2 Seed Collection

An experienced revegetation seed collection consultant will be engaged to conduct seed collection throughout the bushland adjacent to the revegetation site and other nature reserves within the region to provide prevenance specific seed which will produce a similar vegetation representation to the immediate area. Seed collectors will be licenced and ideally be accredited by the Revegetation Industry Association of Western Australia (RIAWA). All correct permissions are to be obtained prior to seed collectors mobilising. All seed is to be handled and stored under RIAWA standards at a minimum.

Seed collection and salvage should occur within the clearing boundary prior to clearing works being undertaken and continue for a minimum of one year prior to plant installation to ensure a range of diversity is captured. Seed collection events will need to obtain enough seed to produce the required 68,388 stems required for initial and infill planting events. Final seed weights will be determined by the species collected and availability.

7.3 Direct Seeding

Direct seeding is most commonly conducted when autumn and early winter rainfall presents adequate soil moisture and rain to settle seed. Seeding is only to be carried out by a competent and qualified revegetation consultant. Seed is to be treated to alleviated dormancy and stimulate germination prior to distribution. Incorrect treatment and handling of seed can be detrimental to final stem counts. Seed treatments will include:

- heat treatment
- scarification
- smoke treatment
- removal of physical dormancy inhibitors.

Following review and adjustments of seeding calculations based on seed collected over the collection period seed will be broadcast over the site (Figure 11). The areas to be seeded will need to be scarified to allow an appropriate settlement of seed within the soil and appropriate seed to soil contact is made. It is preferential that equipment that can direct drill seeds to an appropriate depth and cover the seed with minimal seed disturbance. Seed which requires light for germination does not need drilling or covering. Seeding activities are to be tracked via GPS to document the 1.64 ha of seeded area.

7.4 Tubestock

Tubestock is to be installed after the first major rains throughout the entirety of the offset site. The following methodology will be used to install tubestock:

- Tubestock will be installed utilising pottiputki's or augers as required.
- One fertiliser tablet per tubestock will be incorporated into the hole at the time of planting.
- All plants will be installed at a sufficient depth to enable the root ball of the tubestock to be below the surface of the soil.
- Soil surrounding the installed plant will be backfilled and patted down firmly to eliminate air pockets from forming around the root ball.

Infill planting is recommended in the second and third years to account for natural attrition of tubestock. Infill planting numbers have been estimated based on 30 % of the original tubestock in year 2 and 30 % in year 3; however, this is to be confirmed and adjusted based on observations made during monitoring and maintenance events. Beyond year three of revegetation events, infill planting numbers will be determined on an as needed basis.

7.5 Vegetation Establishment

The vegetation establishment period will extend for a period of 3 years following the completion of the initial planting works. During this period maintenance works such as weed control, erosion control repairs fencing repairs and infill planting will be implemented to increase the chance of tubestock survival.

7.6 Maintenance and Contingencies

Ongoing maintenance will be required to ensure success of the revegetation. Maintenance works are recommended and will include:

- weed control
- infill planting (if required)
- watering over the summer months (November to March) (if required)
- general maintenance events
- ongoing management recommendations.

7.6.1 Weed Control

Weeds within the site need to be controlled to allow native species to establish and to reduce the presence of exotic weeds. An integrated weed management plan will be implemented across the rehabilitation areas, consisting of chemical and mechanical methodologies.

Characteristics of a particular species determine the most appropriate type of weed control method/s and can typically be found on the FloraBase website (Western Australian Herbarium, 1998-). Recommended treatment types and methodology for the weeds present are described in Table 14.
Weed species listed as declared pests under the *Biosecurity and Agriculture Management Act 2007* (WA) requires the landowner to remove these species to reduce their impact and spread (DPIRD, 2023). A summary of the recommended treatment methods and optimal timing of herbicide application for each of the high and medium priority weed species is provided in Table 14; a summary of weed species recorded within the revegetation site prior to construction is located in Table 15.

The ecological impact and invasiveness ratings for the Swan Region (DBCA, 2016) was used as a tool to determine weed management priorities for the species recorded within the site. The prioritisation process can be used to inform management recommendations and treatment strategies for the species present through focusing on species with greatest ecological impact, as well as any site-specific requirements. Weed prioritisation according to ecological impact and invasiveness is summarised in Table 15.

Table 14: Treatment types for each targeted species and the application method (green indicates recommended weed control methodologies)

Treatment Number	Treatment Type	Targeted Species	Application Method and Comments
1	Non-selective (Glyphosate/Biactive Glyphosate)	Annual and perennial grass and broadleaf weeds	Spot spray target species
2	Grass selective (e.g. Fusilade)	Annual and perennial grasses	Spot spray - selective grass spray (will affect native grass species)
3	Selective (Metsulfuron)	Annual broadleaf weeds and bulbs	Spot spray – semi selective
4	Wick wipe (Glyphosate & Metsulfuron wipe)	One-leaf Cape Tulip	Wipe leaves with sponge prior to or just on flowering
5	Woody weeds (Triclopyr, Picloram, or Glyphosate)	Woody weeds and trees	Cut and paint, basal bark or drill and fill (method is species dependant as some are prone to suckering e.g. *Schinus terebinthifolia*)
6	Manual removal/hand weeding	Carnation weeds (*Euphorbia* sp.), Fleabane (*Erigeron* sp.) and other similar species including woody weed seedlings when small	Gloves required due to caustic sap of Carnation weeds. Manual removal can also include slashing
7	Selective (Triasulfuron)	Carnation weeds (*Euphorbia* sp.), Fleabane (*Erigeron* sp.) and other similar species.	Spot spray target species

(Source: Brown and Brooks, 2002; WA Herbarium, 1998-)

Table 15: Weed species, weed priority ranking (DBCA, 2016) and treatment recommendations

Species	Common Name	Weed Priority Ranking		Treatment Type (Table 14)	Optimal Treatment Timing
		Impact	Invasiveness		
**Acacia iteaphylla*		H	R	5 or 6	Mar - Jul
**Arabidopsis thaliana*		U	U	1	Jun – Nov
**Arctotheca calendula*	Cape Weed	H	R	1	Jun - Nov
**Asparagus asparagoides*		H	R	3	Jul – Aug
**Asphodelus fistulosus*	Onion Weed	U	R	3	Jul - Oct
**Avena barbata*	Bearded Oat	H	R	1	Jul- Oct
**Bellardia trixago*	Bellardia	U	U	1	Jul - Oct
**Brassica ciliate*		H	R	1	Jul - Oct
**Brassica tournefortii*	Mediterranean Turnip	H	R	1	Jul - Oct
**Briza maxima*	Blowfly Grass	U	R	1 or 2	Jul - Oct
**Bromus diandrus*	Great Brome	H	R	1 or 2	Jul - Oct
**Carpobrotus edulis*	Hottentot Fig	H	R	1 or 6	Jun - Oct
**Centaurea melitensis*	Maltese Cockspur	H	R	1	Jul - Oct
**Chamelaucium uncinatum*	Geraldton Wax	M	S	5 or 6	Jan - Dec
**Diplotaxis tenuifolia*	Sand Rocket	L	S	1	Jul - Oct
**Ehrharta longiflora*	Annual Veldt Grass	M	R	1 or 2	Jul - Oct
**Erigeron bonariensis*		L	M	1	Jun – Sep
**Erigeron sumatrensis*		M	R	1 or 6	Jun - Nov
**Euphorbia peplus*		U	M	1	May – Nov
**Euphorbia terracina*	Geraldton Carnation Weed	H	R	1 or 6	May – Nov
**Foeniculum vulgare*	Fennel	L	S	1 or 6	Jul – Oct
**Fumaria capreolata*	Whiteflower Fumitory	H	R	1 or 3	Jul - Sep
**Galium mural*		L	R	1	Jul – Oct
**Gaudium laevigatum*	Coast Teatree	H	R	5	Jan - Dec
**Geranium molle*	Dove's Foor Cranesbill	L	M	1 and 3 or 6	Jul – Oct
**Hypochaeris radicata*		H	R	1	Jul - Oct
**Lactuca serriola*	Prickly Lettuce	H	R	1	Jul - Oct
**Lagurus ovatus*	Hare's Tail Grass	H	R	1	Jul - Oct
**Leontodon rhagadioloides*	Cretan Weed	U	U	1	Jul - Oct

Species	Common Name	Weed Priority Ranking		Treatment Type (Table 14)	Optimal Treatment Timing
		Impact	Invasiveness		
**Lolium rigidum*	Wimmera Ryegrass	H	R	1	Jul - Oct
**Lysimachia arvensis*	Pimpernel	U	R	1	Jul - Oct
**Malva parviflora*	Marshmallow	L	U	1	Jul - Oct
**Medicago polymorpha*		U	R	1	Jul - Oct
**Melilotus indicus*		U	R	1	Jul - Dec
**Moraea flaccida*	One-leaf Cape Tulip	H	R	1, 3 or 4	Jul – Aug
**Oenothera stricta*	Common Evening Primrose	L	M	1 or 6	Jul – Oct
**Poa annua*	Winter Grass	L	R	1	Jun - Dec
**Portulaca oleracea*	Purslane	L	R	1	Dec - Feb
**Raphanus raphanistrum*	Wild Radish	U	M	1	Jul - Oct
**Reichardia tingitana*	False Sowthistle	U	U	1	Aug - Oct
**Retama raetam*		H	R	5 or 6	Jan - Dec
**Romulea rosea*	Guildford Grass	U	R	1 or 3	Jul - Oct
**Rumex crispus*	Curled Dock	U	R	1	Jun - Dec
**Senecio vulgaris*	Common Groundsel	L	U	1	Sep - Dec
**Silene gallica*	French Catchfly	L	M	1	Jul - Oct
**Solanum nigrum*	Black Berry Nightshade	M	R	1 or 6	Jul - Jan
**Sonchus oleraceus*	Common Sowthistle	U	R	1	Jul - Oct
**Taraxacum khatoonae*	Dandelion	U	U	1	Jun - Dec
**Trachyandra divaricata*		M	R	1 and 3	Jun- Sep
**Trifolium campestre*	Hop Clover	U	U	1	Jul - Oct
**Ursinia anthemoides*	Ursinia	U	R	1	Jul - Nov
**Verbesina encelioides*	Crownbeard	U	U	1 or 6	Jun - Feb
**Yucca aloifolia*		U	U	5 or 6	Jan - Dec

Metsulfuron application should occur once a year at the recommended dose to reduce the potential for residual effect in soils, which can lead to some species becoming resistant and death of non-target species. Herbicide application should always occur as per the manufacturer's usage and safety specifications as detailed on labels and Safety Data Sheets (SDS), which can be provided by the manufacturer or accessed online. Herbicide application works can enable the targeting and treatment of several species during the same management event.

7.6.2 Maintenance

Ongoing maintenance may be required to meet the completion criteria and is based on the outcomes from the revegetation monitoring and observations on site. Maintenance should be carried out by environmental specialists with experience in adaptive management and identifying threats and opportunities to revegetation outcomes. Maintenance tasks include:

- regular weed control events (autumn and spring)
- rubbish collection (on an as-needed basis)
- removal of tree guards once plants have become established (if required)
- inspection and maintenance to fence line (if required)
- watering (including wetting agent) at rate of 2L per plant per watering event during warmer months (November to March) for the first year of establishment (if required, depending on time of plant installation, seasonal variations and establishment success)
- infill planting (if required)
- ongoing management recommendations as per monitoring reports.

It is recommended that the revegetation area is subjected to ongoing weed control events to reduce competition with the native tubestock installed. The frequency of events will be on an as required basis to ensure natural regeneration of the native vegetation occurs. The revegetation area should be monitored following events such as drought or fire which may result in a decline in native vegetation. The decline in vegetation cover will allow colonising weed species to establish and outcompete the regeneration of native species. This can be managed by implementing further maintenance activities post drought or fire.

7.7 Hygiene Management

Hygiene management is an important component of any successful revegetation project as it can affect site compliance with success criteria. Hygiene management in terms of weeds and Dieback are discussed within this section.

7.7.1 Weed Hygiene

The introduction of weeds into a site can have negative effects on revegetation establishment. Weed seeds can be spread in a variety of ways, including on tools, equipment, and footwear. The following procedures should be implemented to mitigate the spread of weed seed as a result of revegetation activities:

- Ensure vehicle tyres/tracks are clean and free of weed seed when entering and exiting the site.
- Ensure equipment, tools and footwear are clean and free of weed seed when entering and exiting the site.
- Any weed material removed from site should be transported in a manner that prevents the spread of weed seed during transit.
- Any weed material that has not seeded or are able to reproduce vegetatively through suckers or bulbs can be removed from site and disposed of at an appropriate green waste disposal facility.
- Ensuring a clear vehicle accessway to limit the spread of weeds.

7.7.2 Dieback (Phytophthora) Hygiene

Best management practices for Dieback (*Phytophthora*) are recommended to be followed. *Phytophthora cinnamomi* or Dieback is an introduced fungal pathogen with a widespread distribution in areas of south-

west Western Australia. The fungus acts by infecting the roots, absorbing the carbohydrates and nutrients from the plants and causing the roots to rot. Dieback spreads quickly down slopes in surface and sub-surface water flow as well as uphill via root-to-root contact. Human activities cause the greatest spread of Dieback through the natural landscape. The pathogen can enter bushland sites via infected soil on footwear, vehicles and equipment.

Currently no method of completely eradicating *Phytophthora* has been discovered; as such management methods and objectives are geared toward minimising the spread into uninfected areas and to mitigate the impacts of the fungi where infections are present. Hygiene management at the site should be carried out in a manner that reduces the risk of moving infected material from one location to another.

The following precautions should be followed:

- Vehicles are to remain on designated vehicle tracks unless it is necessary for management purposes.
- All vehicles, equipment and footwear are to be free of soil/mud before entering and departing the project area.
- All personnel working at the site to wash down equipment and shoes prior to working on the site with a disinfectant solution, 70% disinfectant (methylated spirits) to 30% water. Cleaning of all tools, footwear and vehicle tyres should be conducted before and after working at the site (Figure 12).



Figure 12: Example washdown procedures of shoes and vehicles.

7.8 Monitoring and Reporting

Monitoring of revegetation success within the revegetation area is to occur once in spring for a period of five consecutive years after the initial planting or until completion criteria is met for three consecutive years. Example monitoring sheets have been provided in Appendix 6. Monitoring will involve:

- Setting up a minimum of two photo monitoring points after initial planting has occurred, with photos taken in the same direction to enable comparison of plant growth and establishment over time.
- Establishing a minimum of four 10 x 10 m quadrats placed evenly across the rehabilitation site to monitor species survival, vegetation health, native species coverage and composition, weed species present and their density.
- A general assessment of the entire site, considering maintenance issues, identification of potential success inhibiting factors, fauna presences and other relevant information.
- Provision of a yearly report to MRC to determine any required management actions or requirements for infill planting.

Monitoring should be carried out by personnel with botanical knowledge and experience, either by Mindarie Regional Council or through use of a consultant and/or contractor.

8.0 Implementation Schedule

The proposed implementation schedule has been outlined in Table 16 below outlining the optimal timing for the initial and infill planting, weed control, maintenance and monitoring visits.

Table 16: Indicative implementation schedule for revegetation works.

Item	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	Year 1 FY											
Seed collection												
Propagation												
Fence installation												
Weed Control												
Direct Seeding (if applicable)												
	Year 2 FY											
Procurement of tubestock (if not propagated)												
Weed control												
Plant installation												
	Year 3 FY											
Weed control												
Plant installation												
Maintenance event												
Monitoring												
Reporting												
	Year 4 FY											
Weed control												
Plant installation												
Maintenance event												
Monitoring												
Reporting												
	Year 5 FY											
Maintenance												
Monitoring												

Item	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Reporting												
Year 6 FY												
Maintenance												
Monitoring												
Reporting												
Year 7 FY												
Maintenance												
Monitoring												
Reporting												

9.0 References

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Appendix 1: PMST Report 10 km

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 15-Nov-2023

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	56
Listed Migratory Species:	48

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	46
Commonwealth Heritage Places:	None
Listed Marine Species:	74
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	7
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	60
Key Ecological Features (Marine):	2
Biologically Important Areas:	10
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name	Buffer Status
Commonwealth Marine Areas (EPBC Act)	In buffer area only

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area	In feature area
Empodisma peatlands of southwestern Australia	Endangered	Community may occur within area	In buffer area only
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area	In buffer area only
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Zanda latirostris listed as Calyptorhynchus latirostris			
Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Breeding known to occur within area	In feature area
FISH			
Thunnus maccoyii			
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only
INSECT			
Hesperocolletes douglasi			
Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
Balaenoptera musculus			
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Dasyurus geoffroii			
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eubalaena australis			
Southern Right Whale [40]	Endangered	Breeding known to occur within area	In buffer area only
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Neophoca cinerea			
Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat likely to occur within area	In buffer area only
PLANT			
Andersonia gracilis			
Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area	In feature area
Anigozanthos viridis subsp. terraspectans			
Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Banksia mimica			
Summer Honeypot [82765]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area	In buffer area only
Caleana dixonii listed as Paracaleana dixonii Sandplain Duck Orchid [87944]	Endangered	Species or species habitat may occur within area	In buffer area only
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area	In buffer area only
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area	In feature area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat known to occur within area	In feature area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat may occur within area	In buffer area only
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area	In feature area
Melaleuca sp. Wanneroo (G.J. Keighery 16705) [89456]	Endangered	Species or species habitat known to occur within area	In buffer area only
REPTILE			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Caretta caretta			
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Chelonia mydas			
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea			
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Natator depressus			
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
SHARK			
Carcharias taurus (west coast population)			
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Carcharodon carcharias			
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Rhincodon typus			
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Sphyrna lewini			
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area	In buffer area only

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area	In buffer area only
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In feature area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area	In buffer area only
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area	In buffer area only
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Migratory Marine Species			
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In buffer area only
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In buffer area only
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In buffer area only
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In buffer area only
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat may occur within area	In buffer area only
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In buffer area only
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Migratory Terrestrial Species			
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [50574]	WA	In buffer area only
Commonwealth Land - [50575]	WA	In buffer area only
Commonwealth Land - [50587]	WA	In buffer area only
Commonwealth Land - [50586]	WA	In buffer area only
Commonwealth Land - [50585]	WA	In buffer area only
Commonwealth Land - [50584]	WA	In buffer area only
Commonwealth Land - [50582]	WA	In buffer area only
Commonwealth Land - [50583]	WA	In buffer area only
Commonwealth Land - [50588]	WA	In buffer area only
Commonwealth Land - [50489]	WA	In buffer area only
Commonwealth Land - [50553]	WA	In buffer area only
Commonwealth Land - [50711]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [50668]	WA	In buffer area only
Commonwealth Land - [50559]	WA	In buffer area only
Commonwealth Land - [50667]	WA	In buffer area only
Commonwealth Land - [50576]	WA	In buffer area only
Commonwealth Land - [50626]	WA	In buffer area only
Commonwealth Land - [50439]	WA	In buffer area only
Commonwealth Land - [50606]	WA	In buffer area only
Commonwealth Land - [50598]	WA	In buffer area only
Commonwealth Land - [50430]	WA	In buffer area only
Commonwealth Land - [50625]	WA	In buffer area only
Commonwealth Land - [50413]	WA	In buffer area only
Commonwealth Land - [50436]	WA	In buffer area only
Commonwealth Land - [50593]	WA	In buffer area only
Commonwealth Land - [51118]	WA	In buffer area only
Commonwealth Land - [50410]	WA	In buffer area only
Commonwealth Land - [50682]	WA	In buffer area only
Commonwealth Land - [50594]	WA	In buffer area only
Commonwealth Land - [50355]	WA	In buffer area only
Commonwealth Land - [50562]	WA	In buffer area only
Commonwealth Land - [50563]	WA	In buffer area only
Commonwealth Land - [50315]	WA	In buffer area only
Commonwealth Land - [50316]	WA	In buffer area only
Commonwealth Land - [50494]	WA	In buffer area only
Commonwealth Land - [50592]	WA	In buffer area only
Commonwealth Land - [50440]	WA	In buffer area only
Commonwealth Land - [50271]	WA	In buffer area only
Commonwealth Land - [50448]	WA	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [51120]	WA	In buffer area only
Commonwealth Land - [50502]	WA	In buffer area only
Commonwealth Land - [50508]	WA	In buffer area only
Commonwealth Land - [50630]	WA	In buffer area only
Commonwealth Land - [50560]	WA	In buffer area only
Commonwealth Land - [51111]	WA	In buffer area only
Commonwealth Land - [50561]	WA	In buffer area only

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area	In buffer area only
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area	In feature area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]		Species or species habitat may occur within area	In buffer area only
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour may occur within area	In buffer area only
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area	In feature area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In buffer area only
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area	In buffer area only
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area	In buffer area only
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area	In buffer area only
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Stercorarius antarcticus as Catharacta skua Brown Skua [85039]		Species or species habitat may occur within area	In buffer area only
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area	In buffer area only
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat may occur within area overfly marine area	In buffer area only
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Fish			
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area	In buffer area only
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area	In buffer area only
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area	In buffer area only
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area	In buffer area only
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In buffer area only
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area	In buffer area only
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area	In buffer area only
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In buffer area only
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area	In buffer area only
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area	In buffer area only
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area	In buffer area only
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In buffer area only
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area	In buffer area only
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In buffer area only
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In buffer area only
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In buffer area only
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In buffer area only
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In buffer area only
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In buffer area only
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Reptile			
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area	In buffer area only
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area	In buffer area only
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In buffer area only
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area	In buffer area only

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area	In buffer area only
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In buffer area only
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area	In buffer area only
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In buffer area only

Current Scientific Name	Status	Type of Presence	Buffer Status
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area	In buffer area only
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In buffer area only
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In buffer area only
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area	In buffer area only
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area	In buffer area only
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In buffer area only
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In buffer area only

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories	Buffer Status
Two Rocks	Multiple Use Zone (IUCN VI)	In buffer area only
Two Rocks	National Park Zone (IUCN II)	In buffer area only

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Lake Joondalup	Nature Reserve	WA	In buffer area only
Marmion	Marine Park	WA	In buffer area only
Neerabup	National Park	WA	In buffer area only
Neerabup	Nature Reserve	WA	In buffer area only
Unnamed WA21176	5(1)(h) Reserve	WA	In buffer area only

Protected Area Name	Reserve Type	State	Buffer Status
Unnamed WA43290	Conservation Park	WA	In buffer area only
Woodvale	5(1)(h) Reserve	WA	In buffer area only

Nationally Important Wetlands [Resource Information]

Wetland Name	State	Buffer Status
Joondalup Lake	WA	In buffer area only

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Alkimos Seawater Desalination	2019/8453		Assessment	In buffer area only
Carabooda Quarry	2023/09554		Referral Decision	In buffer area only
Expansion of Limestone Extraction	2022/09324		Assessment	In buffer area only
Land clearing for timber storage	2022/09367		Assessment	In buffer area only
Land Development, James Street and Well Street, East Wanneroo, Elberton Property	2021/9106		Assessment	In buffer area only
Wattle Avenue East Quarry	2022/09326		Referral Decision	In buffer area only
Controlled action				
Alkimos city centre and central development, WA	2015/7561	Controlled Action	Post-Approval	In buffer area only
Alkimos Coastal Node	2020/8861	Controlled Action	Further Information Request	In buffer area only
Butler North District Open Space playing fields development, Wanneroo, WA	2017/8053	Controlled Action	Post-Approval	In buffer area only
Catalina Residential Development	2010/5785	Controlled Action	Post-Approval	In feature area
Excavate sand and limestone resources	2010/5621	Controlled Action	Completed	In buffer area only
Jindee Residential Development	2012/6631	Controlled Action	Post-Approval	In buffer area only
Limestone extraction on Lot 8 Wattle Avenue, Nowergup	2013/6767	Controlled Action	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Lot 1665 Wanneroo Road, Sinagra.	2017/7921	Controlled Action	Post-Approval	In buffer area only
Lot 9000 Wanneroo Road Sinagra Mixed Use Development, Western Australia	2020/8798	Controlled Action	Proposed Decision	In buffer area only
Meridian Business Park Industrial Development	2007/3479	Controlled Action	Post-Approval	In buffer area only
Mitchell Freeway Extension and Wanneroo Road Upgrade, WA	2018/8367	Controlled Action	Post-Approval	In buffer area only
Mitchell Freeway Extension between Burns Beach Rd and Hester Av, Neerabup, WA	2013/7091	Controlled Action	Post-Approval	In buffer area only
Mitchell Freeway Principal Shared Path Gaps Project Ocean Reef Road to Hepburn Avenue	2020/8833	Controlled Action	Post-Approval	In buffer area only
National Lifestyle Villages Development	2011/6020	Controlled Action	Post-Approval	In buffer area only
Nava-1 Cable System	2001/510	Controlled Action	Completed	In buffer area only
Neerabup Industrial Area, WA	2021/8917	Controlled Action	Assessment Approach	In buffer area only
Neerabup Industrial Estate, Lot 701 Flynn Drive Neerabup WA	2012/6424	Controlled Action	Post-Approval	In buffer area only
Ocean Reef Marina Development	2009/4937	Controlled Action	Completed	In buffer area only
Proposed Urban Development of Lots 1005 & 1006	2008/4638	Controlled Action	Post-Approval	In buffer area only
Residential development Lot 1004 Alkimos WA	2011/5902	Controlled Action	Post-Approval	In buffer area only
Shark Hazard Mitigation Drum Line Program, WA	2014/7174	Controlled Action	Completed	In buffer area only
Subdivision of Lot 902 Flynn Drive Neerabup for Industrial Development	2021/8977	Controlled Action	Assessment Approach	In buffer area only
Urban and Residential Development at Lot 9 Brighton	2011/6137	Controlled Action	Post-Approval	In buffer area only
Urban development in accordance with the Local Structure Plan	2008/4601	Controlled Action	Post-Approval	In buffer area only
Urban Residential Development at Lot 9049 Marmoin Avenue	2009/5155	Controlled Action	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Vegetation Clearing, Wannaroo Rd and Nowergup Rd	2011/5955	Controlled Action	Completed	In buffer area only
Not controlled action				
Alkimos seawater desalination plant, offshore investigations, WA	2018/8224	Not Controlled Action	Completed	In buffer area only
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed	In buffer area only
Butler Railway Extension Project - Nowergup Depot Eastern Alignment	2011/5989	Not Controlled Action	Completed	In buffer area only
Commercial development of Lot 9004 Hodges Drive, Joondalup, WA	2016/7844	Not Controlled Action	Completed	In buffer area only
Connect Joondalup - Lot 9000 McLarty Ave and Lot 999 Piccadilly Circus, Joondalup, WA	2016/7758	Not Controlled Action	Completed	In buffer area only
Container Deposit Scheme Project	2019/8517	Not Controlled Action	Completed	In feature area
Development of ECU Engineering Annex, Joondalup Campus, WA	2017/7995	Not Controlled Action	Completed	In buffer area only
Development of new Alkimos Wastwater Treatment Plant	2007/3259	Not Controlled Action	Completed	In buffer area only
Eradication of the European House Borer, Perth metropolitan area, WA	2009/5027	Not Controlled Action	Completed	In buffer area only
Extension of 7.5km of the Joondalup Line electrified passenger railway from Cla	2010/5632	Not Controlled Action	Completed	In buffer area only
Flynn Drive / Pinjar Road Intersection Works, Lot 9000 Flynn Drive, Neerabup, WA	2017/7983	Not Controlled Action	Completed	In buffer area only
Groundwater Replenishment Scheme (GWRS) Stage 2	2016/7786	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed	In buffer area only
Nowergup Strawberry Farm McLennan Drive, Nowergup, WA	2017/8042	Not Controlled Action	Completed	In buffer area only
Ocean Reef Marina Development, City of Joondalup, WA	2014/7237	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Pinjar Motorcycle Park Raceway Development	2012/6419	Not Controlled Action	Completed	In buffer area only
Quinns Main sewer extension, Clarkson - Neerabup, WA	2018/8215	Not Controlled Action	Completed	In buffer area only
Realignment of Flynn Drive	2011/6170	Not Controlled Action	Completed	In buffer area only
Residential Development, Lot 4 Coogee Road, Mariginiup, WA	2019/8452	Not Controlled Action	Completed	In buffer area only
Residential Development, Lots 10 Dundebar Road and 28 and 29 Belgrade Road, East Wanneroo, WA	2019/8521	Not Controlled Action	Completed	In buffer area only
Residential development of 118 Coogee Road, Mariginiup, WA	2017/8011	Not Controlled Action	Completed	In buffer area only
Residential Subdivision - Lots 12, 36 & 38 Capron St, Wanneroo	2012/6409	Not Controlled Action	Completed	In buffer area only
Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin	2004/1700	Not Controlled Action	Completed	In buffer area only
Wanneroo Road Duplication, WA	2015/7632	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Road realignment and widening	2009/4926	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Subdivision Lot 4 Flynn Drive and earthworks for industrial development, 240 Fl	2009/5028	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Key Ecological Features

[Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region	Buffer Status
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	South-west	In buffer area only

Name	Region	Buffer Status
Western rock lobster	South-west	In buffer area only

Biologically Important Areas

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging (in high numbers)	Known to occur	In buffer area only
Hydroprogne caspia Caspian Tern [808]	Foraging (provisioning young)	Known to occur	In buffer area only
Larus pacificus Pacific Gull [811]	Foraging (in high numbers)	Former Range	In buffer area only
Onychoprion anaethetus Bridled Tern [82845]	Foraging (in high numbers)	Known to occur	In buffer area only
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur	In buffer area only
Sterna dougallii Roseate Tern [817]	Foraging	Known to occur	In feature area
Sternula nereis Fairy Tern [82949]	Foraging (in high numbers)	Known to occur	In buffer area only
Seals			
Neophoca cinerea Australian Sea Lion [22]	Foraging (male)	Likely to occur	In buffer area only
Whales			
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur	In buffer area only
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix 2: Conservation Codes

Western Australia

Conservation Code	Name	Description
T	Threatened	Flora or fauna that is rare or likely to become extinct, ranked according to their level of threat using IUCN Red List criteria (Schedules 1-3 of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice)
CR	Critically endangered	Species considered to be facing an extremely high risk of extinction within the wild in the immediate future
EN	Endangered	Species considered to be facing a very high risk of extinction in the wild in the near future
VU	Vulnerable	Species considered to be facing a high risk of extinction in the wild in the medium-term future
EX	Extinct Species	Species where 'there is no reasonable doubt that the last member of the species has died (Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice or the Wildlife Conservation (Rare Flora) Notice)
EW	Extinct in the Wild	Species that are known to only survive in cultivation, in captivity, or as a naturalised population well outside its past range; and it has not been recorded in its known or expected habitat at appropriate seasons anywhere in its past range, despite surveys over a timeframe appropriate to its life cycle and form
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 (Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice)
CD	Conservation Dependent	Species of special conservation interest (conservation dependent fauna), being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened (Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice)
OS	Specially Protected	Fauna otherwise in need of special protection to ensure their conservation (Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice)
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

Conservation Code	Name	Description
		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.
P1	Priority One	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, such as road verges, urban areas, farmland, active mineral lease and under threat of habitat destruction or degradation.
2	Priority Two	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, such as national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves and similar.
3	Priority Three	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
4	Priority Four	Rare or near threatened and other species in need of monitoring.

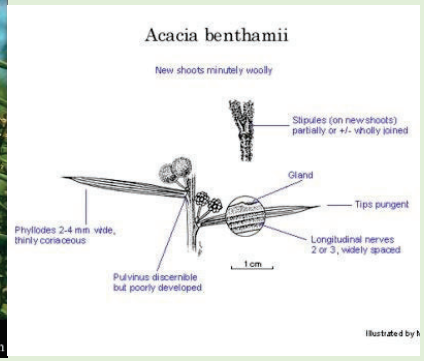
(Source: Department of Biodiversity, Conservation and Attractions, 2023e)

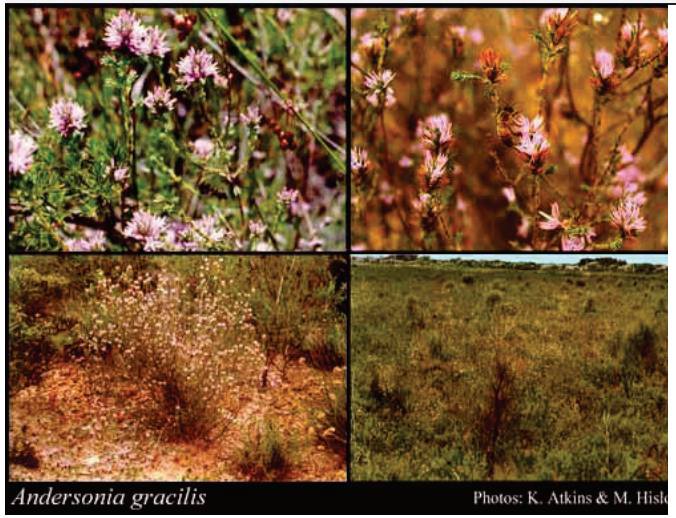
Commonwealth

Category	Description
Critically Endangered	Species facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Species facing a very high risk of extinction in the wild in the near future
Vulnerable	Species facing a high risk of extinction in the wild in the medium term

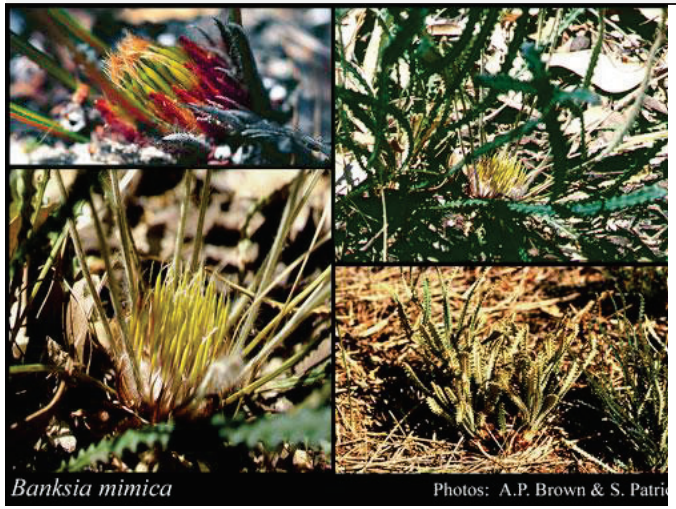
Appendix 3: Significant Species

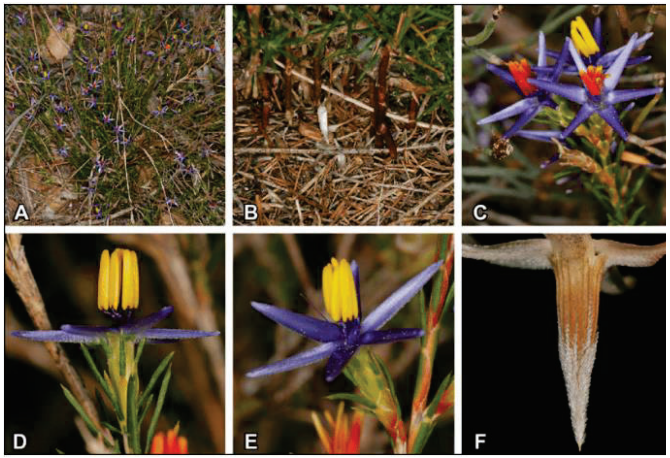
Green indicates suitable habitat for species to occur

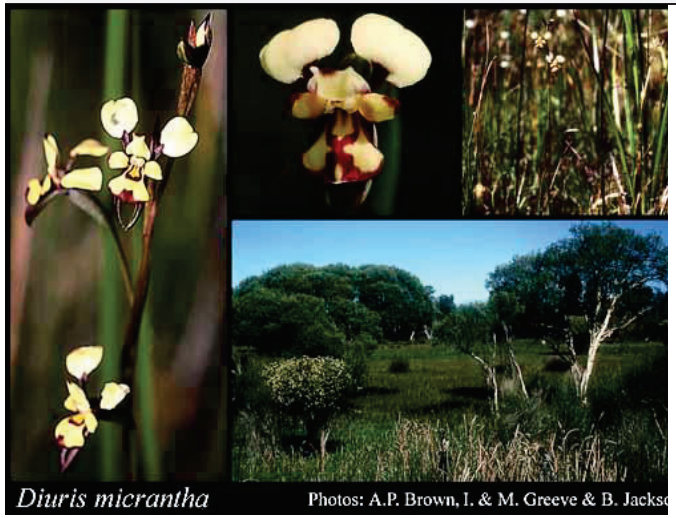
		Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
			Shrub, 1 m high. Fl. Yellow.	Aug to Sep.	Typically on limestone breakaways.	P2	Y	Habitat and soil suitable

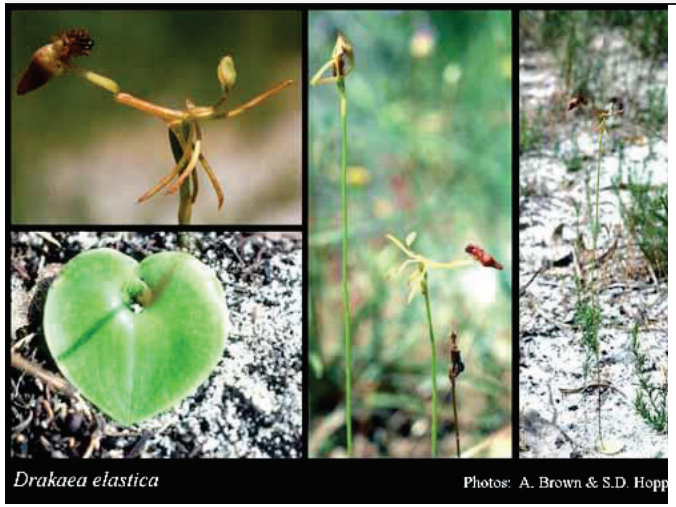
	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
		Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple.	Sep to Nov.	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	T	N	Habitat not suitable
	Dwarf Green Kangaroo Paw	Rhizomatous, perennial, herb, 0.05-0.2 m high. Fl. green/yellow-green	Aug to Sep.	Grey sand, clay loam. Winter-wet depressions.	T	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Austrostipa mundula 		No information.			P3	N	Habitat not suitable
Baeckea sp. Limestone		No information.			P1	N	Habitat not suitable

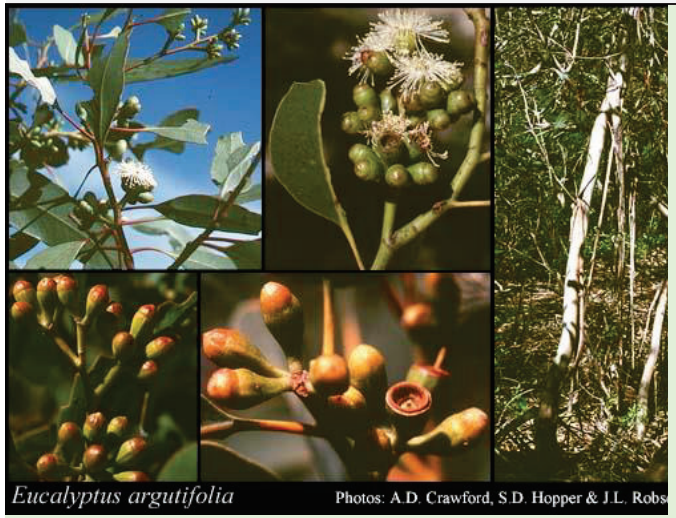
	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
	Summer Honeypot	Prostrate, lignotuberous shrub, 0.15-0.4 m high	Fl. yellow-brown, Dec or Jan to Feb.	White or grey sand over laterite, sandy loam.	T	N	Habitat not suitable
	Grand Spider Orchid	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red.	Sep to Oct.	Grey or brown sand, clay loam.	T	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Calectasia elegans 	Elegant Tinsel Lily	No information.			P2	N	Habitat not suitable
Conostylis bracteata		Rhizomatous, tufted or shortly proliferous perennial, grass-like or herb, 0.2-0.45 m high. Fl. Yellow.	Aug to Sep.	Sand, limestone. Consolidated sand dunes.	P3	Y	Habitat and soil suitable
Cyathochaeta teretifolia		Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. Brown.	No information.	Grey sand, sandy clay. Swamps, creek edges.	P3	N	Habitat not suitable

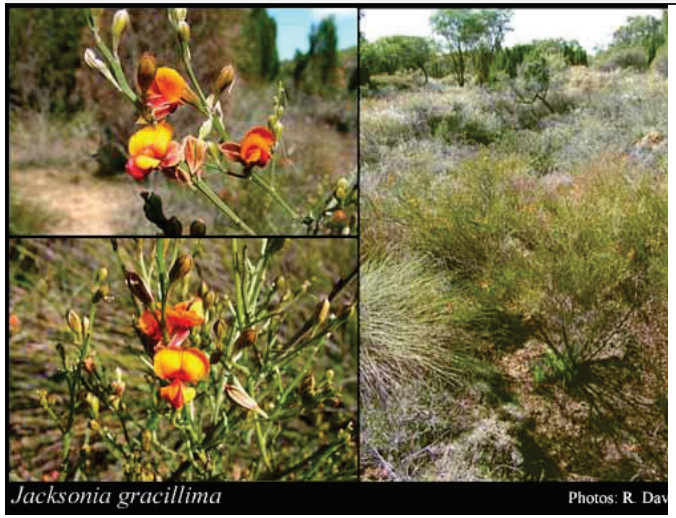
	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
		Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown.	Sep to Oct.	Brown loamy clay. Winter-wet swamps, in shallow water.	T	N	Habitat not suitable
	Purdie's Donkey Orchid	Tuberous, perennial, herb, 0.15-0.35 m high.	Fl. yellow, Sep to Oct.	Grey-black sand, moist. Winter-wet swamps.	T	N	Habitat not suitable

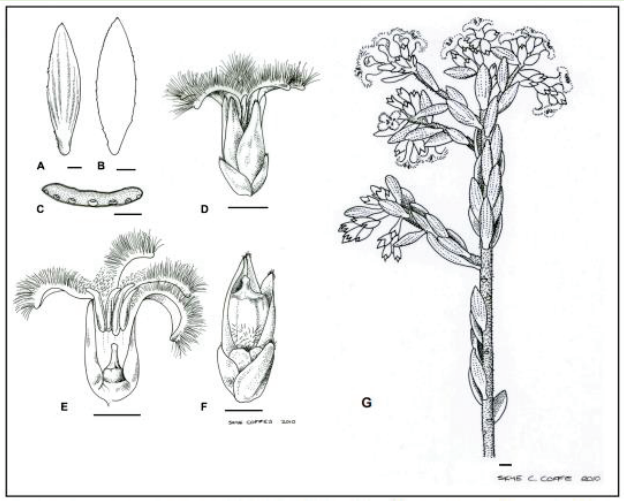
	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
	Glossy-leaved Hammer Orchid	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow.	Oct to Nov.	White or grey sand. Low-lying situations adjoining winter-wet swamps.	T	N	Habitat not suitable
		Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow.	Sep to Oct.	White-grey sand.	T	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Drosera x *sidjamesii* 		Fibrous-rooted perennial, herb, to 0.06 m high. Fl. green-pink.	Nov to Dec or Jan to Mar.	Peaty sand. Along lake margins, close to winter high-water line.	P1	N	Habitat not suitable
		Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. Green.	Aug to Nov.	Clay, sandy loam. Emergent in freshwater: creeks, claypans.	T	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
	Wabling Hill Mallee	(Mallee), 1.5-4 m high, bark smooth. Fl. White.	Mar to Apr.	Shallow soils over limestone. Slopes or gullies of limestone ridges, outcrops.	T	Y	Habitat and soil suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Eucaltyptus foecunda subsp. *foecunda* 		Sand dunes and plains, limestone ridges, cliffs & hills, road verges.			P4	Y	Habitat and soil suitable
Fabronia hampeana		No Information			P2	N	Habitat not suitable
Grevillea sp. Ocean Reef (D. Pike Joon 4*)*		No Information			P1	N	Habitat not suitable
Hibbertia leptotheca		No information.			P3	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
		No information.			P3	N	Habitat not suitable
	Waldjumi	Low spreading shrub, to 0.6 m high. Fl. Orange.	usually Dec or Jan to Feb.	Calcareous & sandy soils.	P4	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Lecania turicensis var. *turicensis*		No Information			P2	N	Habitat not suitable
Leucopogon maritimus  Figure 1. *Leucopogon maritimus*. A – leaf, abaxial surface; B – leaf, adaxial surface; C– leaf, section; D – flower; E– flower, longitudinal section; F – fruit; G – flowering branchlet. Scale bars: all = 1 mm. Drawn by Skye Coffey from *M. Hislop* 3769 (A–F), *M. Hislop* 3792 (G).		Low, spreading shrubs to c. 40 cm high and 60 cm wide, often multi-stemmed close to the base but single-stemmed at ground level with a fire-sensitive rootstock.	November and August	Restricted to near-coastal Quindalup dunes, from a small area of coastline about 40–70 km north of Perth	P1	Y	Habitat and soil suitable

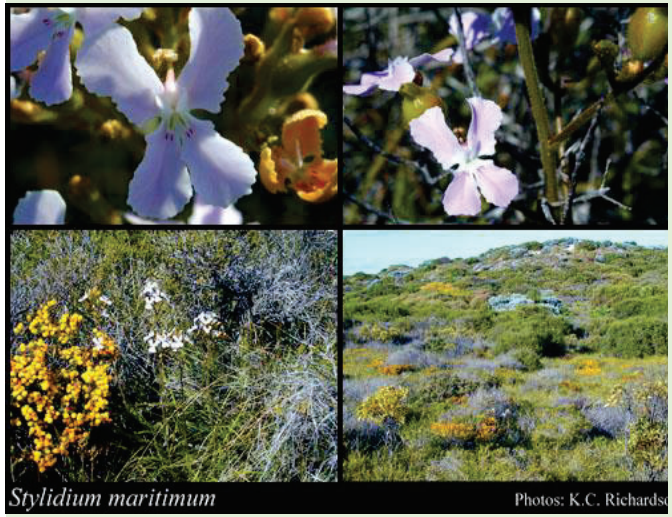
	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
		Erect shrub, 0.15-1 m high, to 0.6 m wide. Fl. white/pink.	Apr to Jun or Sep.	Light grey-yellow sand, brown loam, limestone, laterite, granite. Coastal plain, breakaways, valley slopes, low hills.	P3	Y	Habitat and soil suitable
		Erect or spreading perennial, herb or shrub, 0.2-0.4 m high, 0.3-0.6 m wide.	Sep to Dec or Feb to Mar.	White or grey sand.	T	Y	Habitat and soil suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Marianthus paralius 		Almost prostrate, eventually scandent, woody shrub. Fl. Red.	Sep to Nov.	White sand over limestone. Low coastal cliffs.	T	Y	Habitat and soil suitable

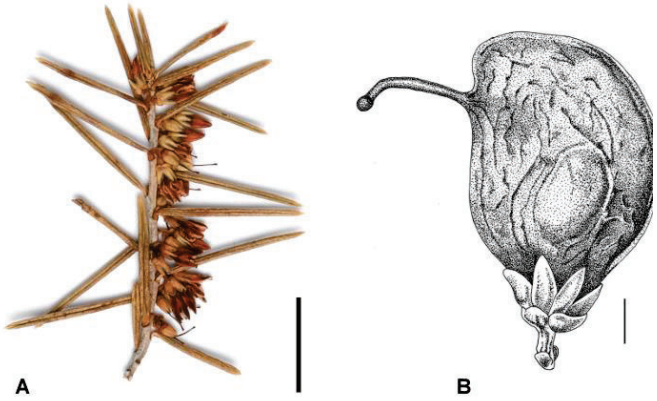
	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Melaleuca sp. Wanneroo 		No information.			T	Y	Habitat and soil suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Netrostylis sp. Chandala (G.J. Keighery 17055)		No information.			P2	N	Habitat not suitable
		tuberous, perennial, herb, 0.09-0.2 m high. Fl. yellow-brown.	Oct to Dec or Jan.	Grey sand over granite.	T	N	Habitat not suitable
		Erect to spreading shrub, 0.2-1 m high. Fl. Pink.	Sep to Nov.	Sand. Coastal limestone ridges.	P3	Y	Habitat and soil suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Poranthera moorokatta 		No information.			P2	N	Habitat not suitable
Sarcozona bicarinata		Shrub, ca 0.1 m high. Fl. White.	Aug.	White sand.	P3	Y	Habitat and soil suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
		Caespitose perennial, herb, 0.3-0.7 m high, Leaves tufted, linear to narrowly oblanceolate, 10-40 cm long, 1-5.5 mm wide, apex acute to mucronate, margin involute, glabrous. Membraneous scale leaves present at base of mature leaves. Scape glandular throughout. Inflorescence paniculate. Fl. white/purple.	Sep to Nov.	Sand over limestone. Dune slopes and flats. Coastal heath and shrubland, open Banksia woodland.	P3	Y	Habitat and soil suitable
Stylidium paludicola		Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute,	Oct to Dec.	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland.	P3	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 		margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. Pink.					

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
Styphelia filifolia 		Usually erect shrubs to c. 150 cm high and 150 cm wide, but occasionally low and spreading, from a fire-sensitive rootstock. Leaves helically arranged, variably orientated, usually rather steeply antrorse but occasionally with some leaves shallowly antrorse to retrorse	September and November.	Has a scattered distribution in the Geraldton Sandplains and Swan Coastal Plain bioregions, Almost all records are from sandy soils on the coastal plain and in association with Banksia woodland	P3	N	Habitat not suitable

	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
	Queen of Sheba	Tuberous, perennial, herb, 0.1-0.35 m high. Fl. orange & red & purple & pink	Jun to Sep.	Sandy clay, sand, laterite.	P2	N	Habitat not suitable
Utricularia oppositiflora		No information			P3	N	Habitat not suitable

Appendix 4: Flora Species List (Natural Area, 2024b)

Species	Common Name
**Arabidopsis thaliana*	
**Asparagus asparagoides*	Bridal Creeper
**Brassica ciliate*	
**Brassica tournefortii*	Mediterranean Turnip
**Briza maxima*	Blowfly Grass
**Carpobrotus edulis*	Hottentot Fig
**Ehrharta longiflora*	Annual Veldt Grass
**Erodium botrys*	Long Storksbill
**Euphorbia peplus*	Petty Spurge
**Euphorbia terracina*	Geraldton Carnation Weed
**Ficinia marginata*	
**Galium murale*	Small Goosegrass
**Geranium molle*	Dove's Foot Cranesbill
**Gladiolus caryophyllaceus*	Wild Gladiolus
**Hypochaeris glabra*	Smooth Cats-ear
**Hypochaeris radicata*	Flat Weed
**Lactuca serriola*	Prickly Lettuce
**Lagurus ovatus*	Hare's Tail Grass
**Lolium rigidum*	
**Lupinus cosentinii*	
**Lysimachia arvensis*	Pimpernel
**Lysimachia arvensis*	Pimpernel
**Medicago polymorpha*	Burr Medic
**Moraea flaccida*	One-leaf Cape Tulip
**Portulaca oleracea*	Purslane
**Retama raetam*	
**Rumex crispus*	Curled Dock
**Solanum nigrum*	Black Berry Nightshade
**Sonchus oleraceus*	Common Sowthistle
**Ursinia anthemoides*	Ursinia

Species	Common Name
Acacia cochlearis	Rigid Wattle
Acacia cyclops	Coastal Wattle
Acacia pulchella	Prickly Moses
Acacia rostellifera	Summer-scented Wattle
Acacia saligna	Orange Wattle
Acanthocarpus preissii	
Allocasuarina fraseriana	Sheoak
Banksia attenuata	Slender Banksia
Banksia menziesii	Firewood Banksia
Burchardia congesta	Milkmaids
Caladenia flava	
Caladenia sp.	
Calothamnus quadrifidus	One-sided Bottlebrush
Clematis linearifolia	Slender Clematis
Conostylis aculeata	
Conostylis teretifolia	
Cyrtostylis huegelii	Midge Orchid
Desmocladus asper	
Drosera erythrorhiza	Red Ink Sundew
Drosera macrantha	Bridal Rainbow
Drosera pallida	Pale Rainbow
Enchylaena tomentosa	Barrier Saltbush
Erigeron sumatrensis	
Eucalyptus gomphocephala	Tuart
Eucalyptus gomphocephala	Tuart
Hakea lissocarpha	Honey Bush
Hakea prostrata	Harsh Hakea
Hibbertia hypericoides	Yellow Buttercups
**Ficinia marginata*	
Isopogon dubius	Pincushion Coneflower
Lagenophora huegelii	
Lepidosperma striatum	

Species	Common Name
Lobelia tenuior	Slender Lobelia
Lomandra maritima	Maritime Mat Rush
Lysiandra calycina	False Boronia
Melaleuca lanceolata	Rottnest Teatree
Melaleuca systena	Coastal Honeymyrtle
Mesomelaena pseudostygia	Semaphore Sedge
Olearia axillaris	Coastal Daisybush
Pimelea argentea	Silvery Leaved Pimelea
Podotheca gnaphalioides	
Pyrorchis nigricans	Red Beaks
Rhagodia baccata	Berry Saltbush
Scaevola crassifolia	Thick-leaved Fan-flower
Schoenus caespititius	
Spyridium globulosum	Basket Bush
Styphelia propinqua	
Templetonia retusa	Cockies Tongues
Thysanotus manglesianus	Mangles' Fringed Lily
Trachyandra divaricata	
Xanthorrhoea gracilis	Graceful Grass Tree
Xanthorrhoea preissii	Grass tree

Appendix 5: Quadrat Data

Quadrat No.:	**1**
Survey Date:	13/09/2016
Personnel:	SH, TB
Latitude:	31.71127
Longitude:	115.73032
Topography:	Mid-Slope
Aspect:	SW
Slope:	3-5 %
Soil:	Grey Sand
Gravel:	0 %
Rock:	0 %
Leaf Litter:	0 %
Bare Ground:	7%
Drainage:	Well
Condition:	Excellent



Notes: *Banksia* Low Woodland

Native Species	**Cover (%)**	**Height (m)**	**Weed Species**	**Height (m)**	**Cover (%)**
Acacia pulchella	1.5	1.0	**Briza maxima*	<0.5	0.1
Anigozanthos humilis	0.5	<0.5	**Carpobrotus edulis*	<0.5	4
Banksia attenuata	20.0	<10	**Ehrharta longiflora*	0.5	0.1
Burchardia congesta	0.1	<0.5	**Gladiolus caryophyllaceus*	0.5	0.1
Caladenia flava	1	<0.5	**Heliophila pusilla*	<0.5	0.1
Conostylis aculeata	0.5	<0.5	**Hypochaeris glabra*	<0.5	3.0
Drosera menziesii	0.5	<0.5	**Lythrum hyssopifolia*	<0.5	0.1
Eryngium pinnatifidum	1	<0.5	**Trifolium campestre*	<0.5	1
Haemodorum sp.	0.5	<0.5	**Ursinia anthemoides*	<0.5	3.0
Hakea lissocarpha	0.1	1			
Hibbertia hypericoides	10.0	1.0			
Isotropis cuneifolia	0.5	<0.5			
Lagenophora huegelii	0.5	<0.5			
Leucopogon propinquus	1	<0.5			

Native Species	Cover (%)	Height (m)	Weed Species	Height (m)	Cover (%)
Lomandra caespitosa	0.1	<0.5			
Lomandra hermaphrodita	0.1	<0.5			
Melaleuca systena	1.0	1.0			
Mesomelaena pseudostygia	8.0	<0.5			
Opercularia vaginata	0.1	<0.5			
Podotheca gnaphalioides	2	<0.5			
Schoenus clandestinus	0.1	<0.5			
Sowerbaea laxiflora	0.5	<0.5			
Thysanotus manglesianus	0.1	0.5			
Trachymene pilosa	0.1	<0.5			
Xanthorrhoea preissii	2.0	2.0			

Note: *denotes introduced species.

Quadrat No.:	**2**
Survey Date:	13/09/2016
Personnel:	SH, TB
Latitude:	-31.70184
Longitude:	115.72407
Topography:	Mid-Slope
Aspect:	SE
Slope:	1-3 %
Soil:	Brown Sand
Gravel:	0 %
Rock:	0 %
Leaf Litter:	0 %
Bare Ground:	8%
Drainage:	Well
Condition:	Very Good



Notes: *Banksia* Low Woodland

Native Species	**Cover (%)**	**Height (m)**	**Weed Species**	**Height (m)**	**Cover (%)**
Acacia pulchella	0.5	0.5	**Brassica tournefortii*	<0.5	0.1
Acanthocarpus preissii	0.5	<0.5	**Carpobrotus edulis*	1.0	2.0
Alexgeorgea nitens	0.1	<0.5	**Crassula alata*	<0.5	0.1
Banksia attenuata	30.0	<10	**Ehrharta longiflora*	<0.5	7
Banksia menziesii	5.0	<10	**Hypochaeris glabra*	<0.5	0.1
Caladenia flava	0.1	<0.5	**Lysimachia arvensis*	<0.5	0.5
Caladenia longicauda	0.1	<0.5	**Moraea flaccida*	<0.5	1.0
Conostylis aculeata	0.1	<0.5	**Trifolium campestre*	<0.5	0.5
Dianella revoluta	0.1	1.0	**Urospermum picroides*	<0.5	0.1
Drosera erythrorhiza	1.5	<0.5	**Ursinia anthemoides*	<0.5	0.5
Drosera menziesii	0.1	<0.5	**Wahlenbergia capensis*	<0.5	0.1
Hibbertia hypericoides	12.0	<0.5			
Lagenophora huegelii	0.5	<0.5			
Leucopogon propinquus	0.5	<0.5			
Macrozamia riedlei	0.5	1.5			
Mesomelaena pseudostygia	10.0	1.0			

Native Species	Cover (%)	Height (m)	Weed Species	Height (m)	Cover (%)
Schoenus clandestinus	0.5	0.5			
Spyridium globulosum	1	1.5			
Xanthorrhoea preissii	3.0	1.5			

Note: *denotes introduced species.

Quadrat No.:	**3**
Survey Date:	13/09/2016
Personnel:	SH, TB
Latitude:	-31.70176
Longitude:	115.72303
Topography:	Mid-Slope
Aspect:	S
Slope:	1-3 %
Soil:	Brown Sand
Gravel:	0 %
Rock:	0 %
Leaf Litter:	0 %
Bare Ground:	8%
Drainage:	Well
Condition:	Very Good



Notes: *Banksia* Low Woodland

Native Species	**Cover (%)**	**Height (m)**	**Weed Species**	**Height (m)**	**Cover (%)**
Acacia rostellifera	5.0	2.0	**Briza maximus*	<0.5	0.5
Acacia saligna	2.0	2.5	**Ehrharta calycina*	0.5	0.1
Banksia attenuata	2	1.5	**Ehrharta longiflora*	<0.5	1
Banksia menziesii	15.0	3-10	**Gladiolus caryophyllaceus*	<0.5	0.1
Burchardia congesta	0.1	<0.5	**Lolium rigidum*	<0.5	0.1
Caladenia flava	0.1	<0.5	**Lysimachia arvensis*	<0.5	0.1
Caladenia latifolia	0.1	<0.5	**Lythrum hyssopifolia*	<0.5	0.1
Caladenia longicauda	0.1	<0.5	**Urospermum picroides*	<0.5	0.1
Conostylis aculeata	0.1	<0.5	**Ursinia anthemoides*	<0.5	0.1
Conostylis setigera	0.1	<0.5			
Drosera erythrorhiza	0.1	<0.5			
Drosera menziesii	0.1	0.5			
Hakea lissocarpha	1	0.5			
Hibbertia hypericoides	3	1.0			
Isotropis cuneifolius	0.1	<0.5			
Lepidosperma pubisquameum	0.5	<0.5			

Native Species	Cover (%)	Height (m)	Weed Species	Height (m)	Cover (%)
Leucopogon propinquus	0.5	<0.5			
Lomandra hermaphrodita	0.5	<0.5			
Mesomelaena pseudostygia	35.0	<0.5			
Podotheca gnaphalioides	0.1	<0.5			
Schoenus clandestinus	0.5	<0.5			
Sowerbaea laxiflora	0.5	<0.5			
Spyridium globulosum	0.5	0.5			
Thysanotus manglesianus	0.5	<0.5			
Trachymene pilosa	0.5	<0.5			
Xanthorrhoea preissii	7.0	1.5			

Note: *denotes introduced species.

Quadrat No.:	**4**
Survey Date:	05/07/2024
Personnel:	LC, BD
Easting:	379008.449
Northing:	6491877.478
Topography:	Slight Slope
Aspect:	South
Slope:	0.5 %
Soil:	Yellow Sand
Gravel:	0 %
Rock:	0 %
Leaf Litter:	13 %
Bare Ground:	12 %
Drainage:	Well
Condition:	Excellent



Notes: *Banksia attenuata* and *B. menziesii* woodland over *Xanthorrhoea preissii* and *Hibbertia hypericoides* open shrubland and *Mesomelaena pseudostygia* sparse rushland.

Native Species	**Cover (%)**	**Height (m)**	**Weed Species**	**Height (m)**	**Cover (%)**
Acacia pulchella	2.00	1.00	**Briza maxima*	0.30	0.10
Acacia saligna	3.00	2.50	**Carpobrotus edulis*	2.00	0.15
Banksia attenuata	30.00	5.50	**Ehrharta longiflora*	1.00	0.10
Banksia menziesii	13.00	4.50	**Gladiolus caryophyllaceus*	0.01	0.10
Burchardia congesta	0.01	0.01	**Lysimachia arvensis*	0.10	0.01
Caladenia sp. 2	0.05	0.10	**Medicago polymorpha*	0.20	0.01
Conostylis sp.	0.01	0.10	**Moraea flaccida*	0.10	0.30
Conostylis teretifolia	0.05	0.10	**Ursinia anthemoides*	0.10	0.01
Cyrtostylis huegelii	0.20	0.01			
Desmocladus asper	0.10	0.10			
Drosera erythrorhiza	0.30	0.01			
Drosera micrantha	0.01	0.01			
Drosera pallida	0.01	0.01			
Hakea lissocarpha	1.00	0.40			
Hibbertia hypericoides	20.00	0.50			

Native Species	Cover (%)	Height (m)	Weed Species	Height (m)	Cover (%)
Isolepis sp.	0.05	0.05			
Isopogon dubious	0.50	0.30			
Lagenophora sp.	0.10	0.05			
Lepidosperma sp.	0.05	0.30			
Lobelia tenuior	0.05	0.10			
Lomandra maritima	0.01	0.10			
Melaleuca systena	5.50	1.00			
Mesomelaena pseudostygia	8.00	0.40			
Pyrorchis nigricans	0.30	0.01			
Schoenus caespititius	0.05	0.01			
Spyridium globulosum	2.50	1.00			
Styphelia propinqua	0.50	0.20			
Thysanotus manglesianus	0.10	0.20			
Xanthorrhoea gracilis	0.50	0.60			
Xanthorrhoea preissii	20.00	1.70			

Note: *denotes introduced species.

Appendix 6: Sample Monitoring Record Sheets

General Site Information

Site:

Date:

Assessors:

Weather Conditions:

Fauna sighted (list)

Maintenance issues present?
Describe

Potential success inhibiting factors present?
Describe

General Comments

Photo Monitoring

Photo Point	Location description	GPS location	Photo ID

Quadrat Monitoring

Site:	**Quadrat No:**
Date:	**Photo ID:**
Location Description:	**GPS:**
Native Vegetation	**Weeds**
Health (Rate 1-5; 1=Poor):	**Health (Rate 1-5; 1=Poor):**
Native Abundance (% Cover):	**Weed Abundance (% Cover):**
% Survival:	
Comments/Recommendations:	

Native Species Present		**Weed Species Present**	
Species	**No:**	**Species**	**No:**
Total:		**Total:**	
Species Diversity:		**Species Diversity:**	