Natural Area
CONSULTING MANAGEMENT SERVICES

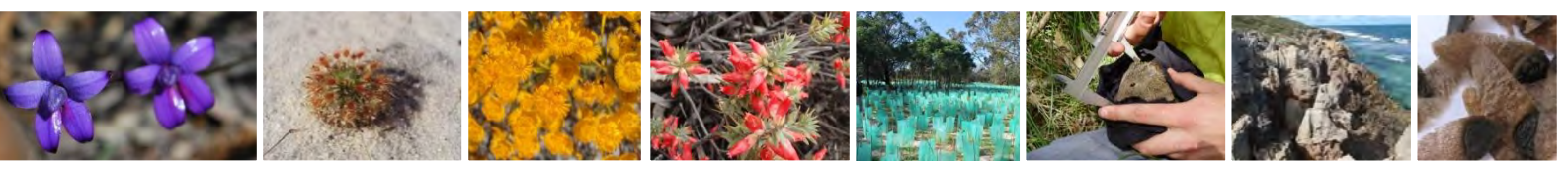
Mr Ivan Yujnovich

Detailed Flora and Vegetation Survey

Lot 123 Mortimer Road, Casuarina

July 2022

Natural Area Holdings Pty Ltd
233C Drumpellier Drive, Whiteman, WA, 6076
Ph: (08) 9209 2767
info@naturalarea.com.au
www.naturalarea.com.au



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Executive Summary

Natural Area Consulting Management Services (Natural Area) was contracted by Mr Ivan Yujnovich to undertake a detailed flora and vegetation survey within Lot 123 Mortimer Rd, Casuarina during spring 2020. This was a follow-up to the previous flora and vegetation survey carried out by Natural Area in September 2018 and was undertaken after a request for additional information to support the impact assessment process being carried out by the Environmental Protection Agency and the Department of Agriculture, Water, and the Environment (Cwlth). The survey aimed to determine:

- flora species present, and included a targeted survey for the following species listed as matters of national environmental significance (MNES):
  - *Caladenia huegelii* – Grand Spider Orchid (Endangered)
  - *Diuris micrantha* – Dwarf Bee-orchid (Vulnerable)
  - *Drakaea elastica* – Glossy-leaved Hammer Orchid (Endangered)
- the extent and boundaries of vegetation type and condition
- the presence and location of any threatened or priority flora and/or threatened ecological communities (TEC) listed under the *Biodiversity Conservation Act 2016* (WA) (BC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act).

The survey was carried over three visits, two in September 2020 and one in October 2021, during the optimal flowering time for the three target species. The following was confirmed:

- a total of 227 flora species present from 55 families
- a total of 45 weeds and 182 native flora species
- no threatened flora species listed under the BC Act and/or the EPBC Act were recorded, including the three main target species
- the presence of one Priority 2 species (*Poranthera moorokatta)* listed under the BC Act
- the presence of one Priority 3 species (*Jacksonia gracillima*) listed under the BC Act
- vegetation across the site ranges from Degraded to Excellent with majority of the site in Excellent condition
- the Banksia Woodland vegetation type identified in 2018 was refined through the installation of three additional quadrats, with four vegetation types now identified for the site; the two sub-communities associated with the Banksia Woodlands of the Swan Coastal Plain TEC covering 37.9 ha (84%) of the site are:
  - SCP 23a Central *Banksia attenuata - Banksia menziesii* Woodlands and
  - SCP 21a Central *Banksia attenuata - Eucalyptus marginata* Woodlands.

Survey outcomes provided in this report will inform relevant stakeholders and support environmental approvals that are currently in progress at a State and Commonwealth level through the accredited assessment process.

Although approximately 7.82 ha of vegetation and CCW are proposed to be retained for conservation (refer to Figure 8, there are still a number of residual impacts remaining for the site. This includes impacts to matters of nation environmental significance (MNES) listed under the EPBC Cay 1999, including:

- The loss of 27.489 ha of Banksia Woodland 21a
- The loss of 6.555 ha of Banksia Woodland 23a.

Other non MNES residual impacts include:

- The loss of 37.357 ha of remnant flora in mostly Excellent condition
- The loss of 0.885 ha of resource enhancement wetland from UFI 6690 and 13969 Loss of P3
- Loss of P3 *Jacksonia gracillima* individuals.

Contents

1.0 Introduction

Natural Area Consulting Management Services (Natural Area) was commissioned by Mr Ivan Yujnovich to undertake a targeted declared rare flora search and supplementary vegetation survey within Lot 123 Mortimer Road, Casuarina. The survey area is approximately 45 ha of remnant bushland that includes a Conservation Category Wetland and portions of two Resource Enhancement Wetlands. This survey was undertaken to inform environmental approvals associated with the clearing of up to 37.14 ha of the site for development. Works were undertaken as a follow-up to September 2018 surveys, in order to gather additional flora and vegetation data pertinent to the site to inform ongoing environment approvals processes currently being undertaken by the Environmental Protection Authority (EPA) in an accredited assessment process that will satisfy State and Commonwealth approvals. The area is proposed for urban development, with current development plans proposing to retain 7.82 ha for conservation purposes surrounding the conservation category wetland at the north of the Lot (Figure 8).

The three main target species are listed as matters of national environmental significance under the EPBC Act:

- *Caladenia huegelii* – Grand Spider Orchid (Endangered)
- *Diuris micrantha* – Dwarf Bee-orchid (Vulnerable)
- *Drakaea elastica* – Glossy-leaved Hammer Orchid (Endangered).

All are typically associated with swampy-wet areas, with the designated conservation category wetland (CCW) the most likely area within the site where they could be found.

1.1 Background

Lot 123 Mortimer Road is a 45 ha vegetated lot within an area zoned urban development, with the change from rural to urban deferred through Amendment 1117/33 that was referred to the EPA in February 2006, at which time the EPA deferred their decision to formally assess the site. The site was later rezoned to urban in 2013, thus, as a legacy site in private ownership for more than 60 years, consideration of the environmental values on Lot 123 has not previously been considered by the EPA or any other state agency. The project was referred to the then Department of the Environment and Energy (now the Department of Agriculture, Water, and the Environment) in December 2018, with the proposed development being considered a controlled action. It was submitted to the Western Australian Planning Commission in October 2019, with the EPA determining in April 2020 that it should be formally assessed under Part IV of the *Environmental Protection Act 1986* (WA). In July 2020, it was determined that the assessment level for the proposal will be Assessment on Referral Information (ARI), with additional information to be provided. Outcomes of this survey are one of those additional information requirements.

1.2 Location

Lot 123 Mortimer Road is located approximately 32 km south of the Perth Central Business District (Figure 1), in the suburb of Casuarina within the City of Kwinana. The site is bounded by Mortimer Road to the south and existing development to the south, west, and east. It is zoned Residential Development, as per the City of Kwinana Town Planning Scheme No. 2 (City of Kwinana, 2019) and Local Planning Policy 6 – Guidelines for Structure Planning in the Casuarina Cell (City of Kwinana, 2018). This zoning is consistent with the Metropolitan Regional Scheme, which indicates that Lot 123 is zoned Urban

(Department of Planning, Lands, and Heritage, 2019).

1.3 Scope

Activities undertaken by Natural Area personnel included:

- desktop database searches to identify potential conservation significant flora species that may occur within the site or a 10 km buffer around the site
- desktop searches to review the habitat suitability of conservation significant flora listed in the 2020 NatureMap and Protected Matters Search Tool reports that were not shown in the 2018 searches
- a targeted search for conservation significant flora, with a focus on rare orchids and all other Declared Rare Flora potentially present on site
- installation of three additional flora quadrats to further define the floristic community sub-groups within the Banksia TEC area described in the 2018 survey
- recording of additional species which were not originally recorded during the 2018 survey
- identification of any species collected
- reporting outcomes of the survey.

Figure 1:
Site Location
Lot 123 Mortimer Rd, Casuarina

2.0 Site Characteristics

The characteristics of a site have a strong bearing on the flora, vegetation, fauna, and ecological communities present. Key characteristics of Lot 123 are outlined in this section.

2.1 Regional Context

According to Interim Biogeographical Regionalisation of Australia (IBRA) descriptions, the suburb of Casuarina is located in the Perth Swan Coastal Plain 2 (SWA 2 – Swan Coastal Plain subregion). This area is described as a being a low-lying coastal plain with sands of colluvial and aeolian origin. The region is dominated by Banksia and/or Jarrah Woodland over sandy soils associated with the dune systems, with Paperbark (*Melaleuca*) in swampy/damp areas and Jarrah Woodland to the east where the Swan Coastal Plain rises (Mitchell, Williams & Desmond, 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 (Perth Airport, Station ID 009021, 2020):

- average rainfall is 762.1 mm pa, with the majority falling between May and August
- average maximum temperature ranges from 18.0 °C in winter to 32.0 °C in summer, with the highest recorded maximum being 46.7 °C
- average minimum temperatures range from 8.0 °C in winter to 17.5 °C in summer, with the lowest recorded minimum being -1.3 °C
- predominant wind directions include morning easterlies and south-westerly sea breezes during summer months, with an average wind speed of 16.5 km/h and gusts of more than 100 km/h.

2.3 Topography and soils

Topography across the site ranges from 16 m AHD in the north to 38 m AHD in the south-east. Lot 123 is located on the Bassendean Dune System within the Swan Coastal Plain. This system is characterised by undulating land associated with sand dunes, interdunal swales and sandplains with pale, deep sand, semi-wet and wet soils (Department of Primary Industries and Regional Development, 2020). Two distinct soil types were identified using the Natural Resource Information Portal (NRInfo) and are described in Table 1 (Department of Primary Industries and Regional Development, 2020, Figure 2).

Table 1: Soil types and descriptions

Name	Symbol	Description
Bassendean B1 Phase	212Bs_B1	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2m; Banksia dominant.
Bassendean B3 Phase	212Bs_B3	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with iron-organic hardpan 1-2 m or clay subsoils. Surface soils are dark grey sand or sandy loam.

Source: Department of Primary Industries and Regional Development, 2020

Figure 2:
Soil Types
Lot 123 Mortimer Rd, Casuarina

2.4 Vegetation Complex

The vegetation complex indicated by the DBCA 2017 dataset as occurring within the site is the *Bassendean Complex – Central and South* (DBCA, 2017). The Complex comprises vegetation ranging from Jarrah, Sheoak and Banksia on sand dunes to low woodlands of Melaleuca species, and sedgelands on the low-lying depressions and swamps. It also includes transitional areas of Jarrah and Coastal Blackbutt in the vicinity of Perth.

Banksia attenuata, B. grandis and *B. menziesii* are common on upper slopes, with *B. menziesii* decreasing towards the southern limit of its range near Mandurah. *Banksia ilicifolia, B. littoralis* and *Melaleuca preissiana* are common in low-lying moister soils, where Marri replaces Jarrah as the dominant species. Common shrub species include *Kunzea ericifolia*, *Hypocalymma angustifolium*, *Adenanthos obovatus* and *Verticordia* spp. (Heddle, Loneragan and Havel, 1980).

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

- 23,508.66 ha (26.87%) for the Swan Coastal Plain (Government of Western Australia, 2019)
- 1,741.09 ha (37.21%) for the City of Kwinana local government area (Government of Western Australia, 2019).

2.5 Hydrology

A designated Conservation Category Wetland occurs in the central northern portion of the site within the *Melaleuca preissiana* Woodland vegetation type. Similarly, designated Resource Enhancement Wetlands occur along the western boundary of the where the three southern portions of *Corymbia* and *Melaleuca* Woodland occur (Department of Biodiversity, Conservation and Attractions, 2020c). Depth to ground water was measured using multiple bores across the site and ranges from 1.6 m in the Conservation Category Wetland to 13.5 m in the south-west corner of the site, with flow primarily to the west towards the Kwinana Freeway (Geo & Hydro Environmental Management, 2020).

2.6 Bush Forever Sites

Lot 123 is located within 5 km of 13 Bush Forever sites, with the closest approximately 70 m to the north-east (Site 273):

- Bush Forever Site 67 – Parmelia Ave Bushland, Parmelia, 6.8 ha
- Bush Forever Site 68 – Jackson Road Bushland, 19.3 ha
- Bush Forever Site 70 – Duckpond Bushland, 8.8 ha
- Bush Forever Site 268 – Mandogalup Road Bushland, Mandogalup 99.62 ha
- Bush Forever Site 269 – The Spectacles, 349.7 ha (including lake)
- Bush Forever Site 270 – Sandy Lake and Adjacent Bushland, Anketell, 181.3 ha
- Bush Forever Site 272 – Sicklemore Road Bushland, Parmelia/Casuarina, 84.6 ha
- Bush Forever Site 273 – Casuarina Prison Bushland, Casuarina, 116.9 ha; this portion is 70 m to the north-east of the Lot and is connected by adjacent vegetated properties
- Bush Forever Site 347 – Wandi Nature Reserve and Anketell Road Bushland, Wandi/Oakford 558.41 ha
- Bush Forever Site 348 – Modong Nature Reserve and Adjacent Bushland, Oakford, 242.0 ha
- Bush Forever Site 349 – Leda and adjacent bushland, Leda, 959.8 ha

- Bush Forever Site 353 – Banksia Road Nature Reserve, Wellard, 32.3 ha
- Bush Forever Site 360 Mundijong and Watkins Road Bushland, Mundijong/Peel Estate 150.23 ha.

All except three sites 67, 68 and 360 contain some portion of the *Bassendean Complex – Central and South* vegetation complex that is located on Lot 123 (DPLH, 2017).

3.0 Methodology

3.1 Objectives

The objective of the survey was to collect sufficient data to adequately inform a formal environmental impact assessment process for Lot 123 that will satisfy state and commonwealth approval requirements. Works included undertaking a desktop review, determining flora species present, undertaking a targeted flora search including rare orchids and other threatened (declared rare) flora, assessing vegetation type and condition, and recording fauna species noted during assessment. The three orchid species targeted were the:

- *Caladenia huegelii* – Grand Spider Orchid (Endangered)
- *Diuris micrantha* – Dwarf Bee-orchid (Vulnerable)
- *Drakaea elastica* – Glossy-leaved Hammer Orchid (Endangered).

According to the Commonwealth of Australia (2013) and the DBCA (2020):

- *Caladenia huegelii* occurs in open banksia/jarrah woodlands, with a peak flowering time of mid- September to October, associated with Bassendean sands
- *Diuris micrantha* occurs in winter-wet depressions or swamps, in shallow water, with a peak flowering period between August through to early October, grows in brown loamy clay
- *Drakaea elastica* occurs in sandy soils adjacent to winter-wet depressions, swamps, and water courses, growing in mixed woodlands, often under Kunzea species as well as in open areas such as tracks other disused, disturbed areas; the peak flowering period occurs between late September to early November. Note that the *Paracaleana nigrita* (Flying Duck Orchid) is often found in a close association with the *Drakaea elastica*.

3.2 Desktop and Literature Review

The desktop flora and vegetation survey was undertaken to identify any changes that might have occurred since the 2018 flora and vegetation survey, and to determine the:

- likely native and non-native flora species present
- current extent of native vegetation
- general floristic community types
- likely presence of threatened or priority flora 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, 2020d) (Appendix 1)
- Protected Matters Search Tool (Department of Agriculture, Water and the Environment, 2022) (Appendix 2)
- A 20 km search of the Atlas of Living Australia database (ALA, 2022)
- A 10 km search of Keighery et al. (2012) dataset (Keighery et al., 2012)
- FloraBase (Department of Biodiversity, Conservation and Attractions, 2020b).

A summary table of threatened flora potentially occurring in the area is provided in Appendix 3.

A review of previous flora surveys undertaken within Lot 123 Mortimer Road was also undertaken, namely:

- *Geomorphic Wetland Swan Coastal Plain Dataset Request for Modification Lot 123 Mortimer Rd, Casuarina City of Kwinana* (Bioscience, 2008)
- *Vegetation and Black Cockatoo Assessment* (Bioscience, 2015)
- *Lot 123 Mortimer Road Flora and Vegetation Survey and Black Cockatoo Habitat Assessment* (Natural Area Consulting Management Services, 2018).

3.2.1 Flora Likelihood Analysis

Flora species found during the desktop survey as being previously recorded within 10 km of the site were assessed and ranked for their likelihood of occurrence within the survey site. Likelihood of occurrence analysis for conservation significant flora:

- Present – species has been recorded within the survey site
- Likely – known to occur within close proximity of the site and species habitat is present
- Possible - species previously recorded within 10 km and suitable habitat occurs in survey area
- Unlikely – Suitable habitat for the species does not occur or suitable habitat is present but survey site is outside of the known distribution of the species.

3.3 On-ground Methodology

Natural Area lead botanist Sharon Hynes and assistant Lachlan Crossley undertook the targeted survey for the three orchids, as well as traversing the site to record additional species on the 10 and 24 September 2020. Track logs are provided after Quadrat Data in Appendix 7. An additional visit on 6 October 2020 included the installation of three additional quadrats. Key GPS data was recorded using a handheld tablet and Mappt software to record:

- the locations of any *Caladenia huegelii* (King Spider Orchid), *Diuris micrantha* (Dwarf Bee-orchid), and the *Drakaea elastica* (Glossy-leaved Hammer Orchid) which were considered likely to occur within the conservation category wetland
- the location of the three additional 10 m x 10 m quadrats (Q10, Q11, Q12) to further define the sub- groups associated with the threatened ecological community Banksia woodlands on the Swan Coastal Plain determined on site during the 2018 flora surveys (Figure 7)
- potential significant flora locations based on desktop likelihood analysis (Appendix 3)
- the re-assessment of vegetation condition
- the boundaries of differing vegetation types and condition across the site
- the presence of any additional threatened or priority listed flora species and/or ecological communities listed under the *Biodiversity and Conservation Act 2016* (WA) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth).

The following were recorded for each quadrat installed during this survey:

- location
- vegetation description
- aspect
- habitat
- soil type and colour
- inundation
- leaf litter depth (cm) and cover (%)

- evidence of disturbance, including fire
- height of species
- percentage foliar cover of each species.

The flora and vegetation survey was carried out in accordance with *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016). Samples were collected or photographs taken of unfamiliar species to enable later identification. The targeted search for the nominated orchid species was carried out in accordance with the *Survey Guidelines for Australia's Threatened Orchids – Guidelines for Detecting Orchids Listed as 'Threatened' Under* the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth of Australia, 2013).

3.3.1 Flora Species

Flora species were recorded on observation within each of the three additional quadrats and any additional species when the remainder of the site was traversed, with the list of potential threatened or priority flora species used to guide targeted searches for those species (Appendix 3).

3.3.2 Floristic Community Type Determination

The floristic community type determined in 2018 was reconfirmed during the 2020 survey using the structural classes described in *Bush Forever Volume 2* (Government of Western Australia, 2000), and records dominant over, middle and understorey species (Table 2). The Banksia Woodland of the Swan Coastal Plain TEC was further assessed to determine the floristic community type (FCT) subgroups within this area by comparison to Gibson *et al.* data (1994). This was further assessed against the Keighery *et al*. (2012) dataset in 2022. Multivariate analysis using flora species and abundance data was also used to determine similarity of the quadrats within the site.

Table 2: Vegetation structural classes

Life Form/Height Class	Canopy Percentage Cover			
	100 – 70%	**70 – 30%**	**30 – 10%**	**10 – 2 %**
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10 – 30 m	Closed forest	Open forest	Woodland	Open woodland
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland
Tree Mallee	Closed tree mallee	Tree mallee	Open tree mallee	Very open tree mallee
Shrub Mallee	Closed shrub mallee	Shrub mallee	Open shrub mallee	Very open shrub mallee
Shrubs over 2 m	Closed tall scrub	Tall open scrub	Tall shrubland	Tall open shrubland
Shrubs 1 – 2 m	Closed heath	Open heath	Shrubland	Open shrubland
Shrubs under 1 m	Closed low heath	Open low heath	Low shrubland	Low open shrubland
Grasses	Closed grassland	Grassland	Open grassland	Very open grassland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland

(Source: Government of Western Australia, 2000)

3.3.3 Vegetation Condition

Vegetation condition was re-assessed using the rating scale attributed to Keighery in *Bush Forever Volume 2* (Government of Western Australia, 2000). A mobile GPS unit was used to differentiate the locations of the vegetation condition across the site and assist with mapping outcomes (Table 3).

Table 3: Vegetation condition ratings

Category		**Description**
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.

Category		Description
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: Government of Western Australia, 2000)

3.4 Statistical Data Analysis and TEC Determination

Data was re-analysed using multivariate statistical analysis in Primer (V7) software utilising the additional abundance flora data gathered in 2020, to further differentiate the subgroups for the Banksia Woodland TEC present on site. The identification of the Banksia Woodland community type, as outlined in the EPBC Act's Approved Conservation Advice for Banksia Woodlands of the Swan Coastal Plain (Department of the Environment and Energy, 2016) is determined through:

- location and physical environment
- soils and landform
- structure and composition.

The EPBC Act's Approved Conservation Advice (Department of the Environment and Energy, 2016) outlines the following requirements for the structure of Banksia Woodlands:

- a distinctive upper sclerophyllous layer of low trees (> 2 m) typically dominated or co-dominated by *Banksia attenuata* and/or *B. menziesii*
- the possible presence of emergent medium or tall (> 10 m) trees above the Banksia canopy
- a species-rich understorey consisting of a layer of sclerophyllous shrubs of various heights
- an herbaceous ground layer of cord rushes, sedges and perennial and ephemeral herbs that may include grasses; the development of a ground layer depends on the density of the shrub layer and disturbance history.

The EPBC Act's Approved Conservation Advice (Department of the Environment and Energy, 2016) outlined the following requirements for the composition of Banksia Woodlands:

- must include at least one of the following Banksia species: *B. attenuata*, *B. menziesii*, *B. prionotes* or *B. ilicifolia*
- a variety of other species that may occur in the emergent layer, at the main canopy level and understory level are listed in the approved conservation listing advice.

Quadrats were also compared to the Gibson *et al.* dataset (1994) from *A Floristic Survey of the Southern Swan Coastal Plain* to assign comparable vegetation types. A presence/absence (PA) matrix was created for the quadrat data collected and the Gibson *et al*. (1994) dataset as it did not have abundance data. Taxa names from Gibson *et al.* (1994) that were no longer current were updated to match current taxa names from the data collected. The P/A matrices were inputted into the statistical analysis package PRIMER (version 7) and resemblance matrices were created to determine the similarities in species composition between quadrats. This was further assessed against the Keighery *et al*. (2012) dataset in 2022.

As outlined by the EPBC Act's Approved Conservation Advice (Department of the Environment and Energy, 2016), there are minimum size thresholds based on the vegetation condition, and are:

- 'Pristine' – no minimum patch size applies
- 'Excellent' – 0.5 ha or 5,000 m^2 (e.g., 50 m x 100 m)
- 'Very Good' – 1 ha or 10,000 m^2 (e.g., 100 m x 100 m)
- 'Good' – 2 ha or 20,000 m^2 (e.g., 200 m x 100 m).

A patch of *Banksia* Woodland must meet at least the category 'Good' condition to potentially trigger the definition of the TEC, noting that the patch may contain small - scale (< 30 metre) breaks, gaps, and disturbances.

3.4 Survey Sufficiency

The detailed flora and vegetation survey, including the targeting of the three nominated orchid species, carried out by Natural Area is considered sufficient for the purpose for which it was undertaken, with justification provided based on the survey checklist included in Commonwealth (2013) orchid survey guidelines (Table 4).

Table 4: Orchid survey checklist (after Commonwealth of Australia, 2013)

Activity	Description	Application to Lot 123 Survey
Survey design	▪ Sought expert advice to optimise survey effort and species detection ▪ Consultation with key stakeholders	▪ No – Survey carried out by Sharon Hynes, a botanist with more than 10 years experience undertaking flora and vegetation surveys on the Swan Coastal Plain; advice in relation to these species sought previously ▪ Sharon's experience includes undertaking survey activities targeting the *Caladenia huegelii*, *Diuris micrantha*, and *Drakaea elastica*, so is familiar with their form, growth habit, and typical habitats in which they are found
	▪ Detection probability	▪ Yes – targeted survey was carried out during the optimal flowering time for these species, with three visits made to the site over between September and October to ensure maximum probability of detection ▪ The survey focused on areas where the habitat was most favourable for the target species
	▪ Survey technique ▪ Sampling intensity	▪ Yes – techniques included sampling of quadrats as well as traversing the designated wetland area where they are more likely to occur and the broader site

Activity	Description	Application to Lot 123 Survey
	▪ Survey constraints	▪ Yes – refer Section 3.6
	▪ Data sources	▪ Yes – outlined in Section 3.0
	▪ Survey dates	▪ Yes – included in Section 3.3
	▪ Survey approach	▪ Yes – informed by WA and Cwlth guidelines, refer Section 3.3
Survey Considerations	▪ Personnel	▪ Survey was carried out by Sharon Hynes, Natural Area's lead botanist ▪ Sharon has more than 10 years experience carrying out botanical surveys on the Swan Coastal Plain, including those targeting the nominated orchid species ▪ Details of surveyors included in Section 3.3
	▪ Licence	▪ Sharon Hynes holds a current Regulation 62 Flora taking (biological assessment) licence issued by the DBCA ▪ A threatened flora authorisation was not applied for due to Sharon's extensive botanical survey experience that includes previous surveys for the target species
Desktop Review	▪ Survey area	▪ Yes, clearly identified, including extent of designated wetland where the nominated orchids are most likely to occur ▪ Habitat is not rare or uncommon ▪ Habitat is permanent rather than ephemeral, and has been surveyed on several occasions (Section 3.2) ▪ The habitat is not likely to be critical to the survival of the species as water quality sampling programs have indicated the depth to groundwater is a minimum of 1.5 – 2 m below the natural surface level
	▪ Target species ▪ Data sources ▪ Current taxonomic listing status and names	▪ Yes – Nature Map and PMST search reports obtained in 2018 and 2020, DBCA threatened flora database search obtained in 2018 ▪ Names and listing status are current ▪ the DoEE (now DAWE) indicated that more information was required to confirm the presence/absence of the *Caladenia*

Activity	Description	Application to Lot 123 Survey
		huegelii, the *Diuris micrantha*, and the *Drakaea elastica* ▪ data sources, the number of previous surveys combined with Sharon's experience means Natural Area considers the data sources are ▪ sufficient for the survey
Survey Timing	▪ Optimal flowering period ▪ Flowering influences ▪ Flowering periods ▪ Other considerations	▪ Yes - the 2020 and 2018 surveys carried out by Natural Area were carried out at the optimal flowering time for the target orchid species ▪ Three visits to the site were made in September and October 2020 to provide the maximum likelihood of any target orchids flowering during one or more the visits to the site
Survey Locations	▪ Location and extent of target species	▪ Yes – the three target orchid species are typically found in swampy, wetter habitat areas, with the designated CCW present with Lot 123 being the location with the habitat that would be most suitable for these species ▪ The wider site was also surveyed to check for their presence in other locations
	▪ Vegetation communities	▪ Yes – vegetation type and condition was assessed by Natural Area in 2018 and 2020; refer Sections 4.2.3 and 4.2.6
	▪ Precise survey location and layout	▪ Yes – refer Figure 7, quadrat data within Appendix 6
	▪ Vegetation type	▪ Yes, refer Section 4.2.3
	▪ Disturbance	▪ Yes, refer Section 4.2.6
Survey Report	▪ Aims, methods, results	▪ Yes, this report includes those sections
	▪ Survey information	▪ Yes – refer Appendix 6 for quadrat data, along with various sections of this report for key information relevant to the survey

3.6 Limitations

The flora survey was undertaken during the optimum time to survey flora on the Swan Coastal Plain, however some limitations may still exist (Table 5).

Table 5: Flora survey limitations

Potential Limitation	Comments
Availability of contextual information	Not a limitation - a wide variety of regional contextual information in the form of literature and online datasets is available for the Swan Coastal Plain
Competency/experience of team	Not a limitation – the team had extensive experience carrying out detailed flora surveys within this bioregion. Sharon Hynes has over 10 years' experience, Harley Taylor had over 2 years' experience undertaking flora surveys on the Swan Coastal Plain. Sharon Hynes has previously surveyed for and recorded *Drakaea elastica, Drakaea micrantha* and *Caladenia huegelii* in other sites through the Swan Coastal Plain during spring.
Proportion of flora recorded/collected, any identification issues	227 flora species were recorded with 12 quadrats installed within and the site traversed to record additional species opportunistically across the entire Lot. All but four species were identified to species level, of these one was a weed and three were native. The three native species that were not able to be identified to species level did not bear any strong resemblance to any of the species listed as potentially occurring on the desktop potential priority and threatened species list.
Survey effort and extent	A detailed flora survey was undertaken in accordance with EPA technical guidance for flora surveys in WA (2016). The entire site was traversed in 2018 and again in 2020 during supplementary surveys. These included targeted surveys for the threatened orchids in early and late September. A total of 80 hours was spent undertaking flora survey activities within Lot 123.
Access restrictions	Not a limitation – there were no access limitations were encountered during this survey.
Survey timing	Not a limitation - The survey was conducted in spring which is the optimal time for the Swan Coastal Plain. This is done to maximise the ease of identification of species, the majority of which flower at this time of year. Additional targeted surveys were undertaken in early September and late September for Orchid species including *Drakaea elastica* and which are known to flower from September to Nov.

Potential Limitation	Comments
	Mean annual rainfall for 2018 is 737.2 mm, which is higher than the mean annual rainfall of 698.8 mm for the past 30 years (1991 to 2020). Annual rainfall for 2018 is more consistent with long term rainfall statistics (1944- 2022) of 759.9 mm (Bureau of Meteorology, 2020). It is unlikely that climatic changes will limit the detection and/or presence of flora species within the survey site.
Disturbances	Minor - there was one area that had been burnt during the 2018 flora survey period however this area had regenerated by the timing of the supplementary and targeted survey in 2020. Some longer-term disturbance such as clearing for fire breaks, and remnant house and sheds and associated human impacts exist in the southern portion of the site. Unauthorised activity and dumping of household and construction waste was noted particularly along the edges of firebreaks in the northern portion of the site.

4.0 Flora Survey Results

Assessment of flora at the site included desktop and field activities, outcomes for both are provided in this section.

4.1 Desktop Survey

4.1.1 Flora Species

The NatureMap report (DBCA, 2020) indicated the potential presence of 470 flora species, of which 242 were dicotyledons, 223 were monocotyledons, two were gymnosperms, and one was a Pteridophyte (fern) (Appendix 1).

4.1.2 Significant Flora

A review of the online databases and literature available recorded a total of 42 conservation significance with the potential to be present within the site (Appendix 3). Some of the data from the ALA 10 km database search was historic records and therefore assessed against current range and habitat requirements, with some results being omitted as they do not occur within 10 km of the known range of those species or were incomplete. A likelihood analysis of the species considered the habitat (soil type, drainage, location) suitable for eight species listed (Table 6). Two of the species listed were recorded on site, which are highlighted green in Table 6.

Table 6: Potential threatened and priority species

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site	Post survey comments
Andersonia gracilis	Slender Andersonia	EN		X					Unlikely
Caladenia huegelii	Grand Spider Orchid	T/EN	x	x			x	Possible – not detected	Unlikely – would have been flowering during survey and identifiable if present
Cyathochaeta teretifolia		P3	x				x	Possible – not detected	Unlikely larger sedge would have been identifiable if present
Dillwynia dillwynioides		P3				x		Possible – not detected	Unlikely larger shrub would have been identifiable if present
Diuris micrantha	Dwarf Bee-orchid	EN		X					Unlikely
Drakaea elastica	Glossy-leaved Hammer Orchid	T, EN	x	x			x	Possible	Unlikely not detected

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site	Post survey comments
Drakaea micrantha	Dwarf Hammer-orchid	T, VU	x	x				Possible – not detected	Unlikely – not detected
Eleocharis keigheryi	Keighery's Eleocharis	VU							Unlikely
Eucalyptus x balanites	Cadda Road Mallee, Cadda Mallee			X					Unlikely
Jacksonia gracillima		P3	x				x	Present - found on site	Present
Johnsonia pubescens subsp. *cygnorum*		P2				x		Possible – not detected	Unlikely – would have been flowering during survey and identifiable if present
Poranthera moorokatta		P2			x			Present – found on site	Present
Synaphea sp. Fairbridge Farm	Selena's Synaphea	T/CR	X	X					Unlikely
Synaphea sp. Pinjarra Plain		EN	X	X					Unlikely
Synaphea sp. Serpentine		CR		X					Unknown

4.1.3 Threatened Ecological Communities

A 2022 review of the PMST report indicated the potential for the six threatened ecological communities to occur within Lot 123, capturing an additional four communities not listed in the 2018 PMST report. The five threatened ecological communities that may potentially occur within or in proximity to the site include (Department of Agriculture, Water and the Environment, 2020) (Table 7).

Table 7: Potential threatened and priority communities occurring at Lot 123

Name	Status	Presence
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Community known to occur within area
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla – Kingia Australia woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla-Xanthorrhoea preissii woodlands and shrublands of the San Coastal Plain	Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area
Sedgelands in Holocene Dune Swales	Endangered	Community likely to occur within area

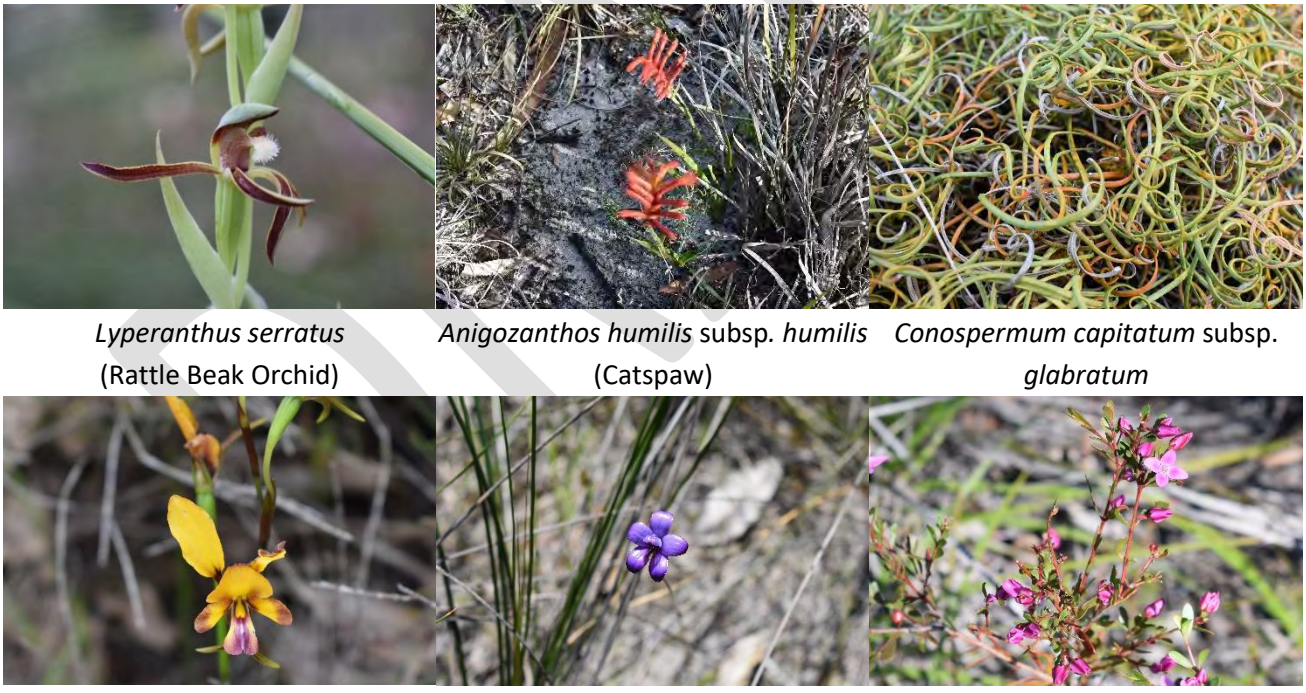
Source: DAWE, 2022

4.2 On-ground Flora Survey

4.2.1 Flora

The initial field survey was undertaken on 9, 10 and 12 October 2018 by Natural Area lead Sharon Hynes assisted by Harley Taylor. Additional flora and targeted DRF surveys were undertaken on 10 and 24 September and 6 October 2020 by lead botanist Sharon Hynes assisted by Lachlan Crossley. This was to cover the potential flowering times of conservation significant species particularly the orchid species. The soil types identified during the desktop survey were confirmed. An additional eight flora species were recorded during the 2020 survey activities, with total of 227 flora species identified from 55 families. Of these, 45 were weeds and 182 were native species. Examples of native flora species recorded during the 2020 survey are shown in Figure 3, and weed species shown in Figure 4; the list of flora species is provided in Appendix 5.

Two conservation significant species were identified within the site during the 2020 survey, namely *Jacksonia gracillima* (Priority 3) and *Poranthera moorokatta* (Priority 2) (Section 4.2.2). The *Poranthera moorokatta* may not have been found during the 2018 survey due to its small size (1-4 cm high) and the fact that it is an annual that may not occur every year. The *Jacksonia gracillima* was likely misidentified as juvenile *Jacksonia sternbergiana* during the 2018 survey as it was not flowering at the time. The 227 species recorded in 2020 represents a 3.5% increase in the number recorded in 2018, when 219 were identified.



Lyperanthus serratus (Rattle Beak Orchid) | *Anigozanthos humilis* subsp. *humilis* (Catspaw) | *Conospermum capitatum* subsp. *glabratum*

Diuris magnifica | *Elythranthera brunonis* (Purple Enamel Orchid) | *Boronia crenulata* subsp. *crenulata*

Figure 3: Examples of native flora species recorded during the survey

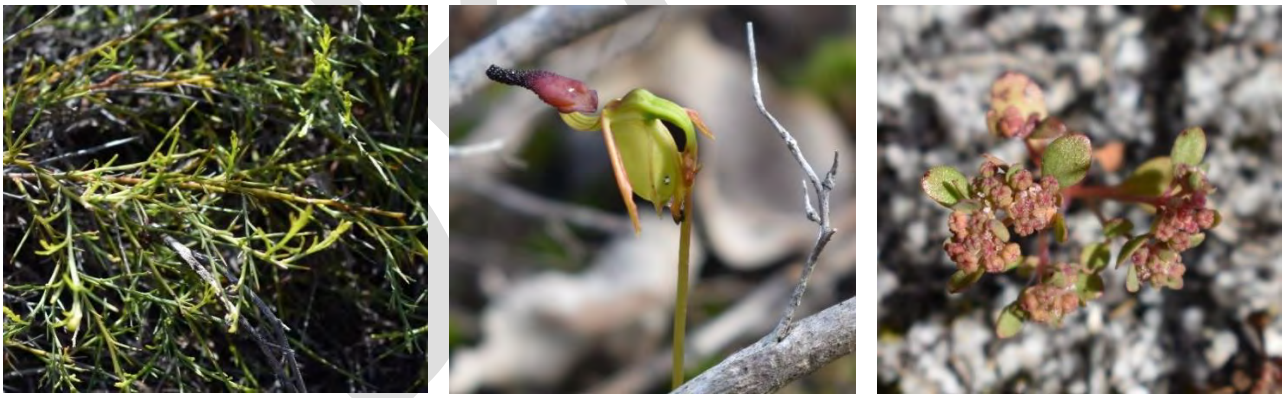
*Opuntoid Cactus (*Opuntia* sp.) | *False Sowthistle (*Reichardia tingitana*) | *Italian Lavender (*Lavandula stoechas*)

Figure 4: Examples of weed species found on site

4.2.2 Targeted DRF Search Results/Conservation Significant Species

No threatened flora species were recorded during the 10 and 24 September and the 06 October 2020 targeted searches for *Caladenia huegelii* (Grand Spider Orchid), *Diuris micrantha* (Dwarf Bee-orchid), and the *Drakaea elastica* (Glossy-leaved Hammer Orchid). This outcome is consistent with the 2018 Natural Area survey as well as those undertaken by Bioscience in 2008 and 2015.

Two priority species listed under the BC Act were identified during the 2020 survey, namely *Jacksonia gracillima* (Priority 3) and *Poranthera moorokatta* (Priority 2) (Section 4.2.2) (Figures 5, 6). The *Poranthera moorokatta* may not have been found during the 2018 survey due to its small size (1-4 cm high), combined with it being an annual species that may not present every year. The *Jacksonia gracillima* was probably misidentified as juvenile *Jacksonia sternbergiana* during the 2018 survey as it was not flowering at the time of the 2018 survey.



Jacksonia gracillima (P3) | *Paracaleana nigrita* (Flying Duck Orchid) | *Poranthera moorokatta* (P2)

Figure 5: Priority species and orchid found during targeted searches (2020)

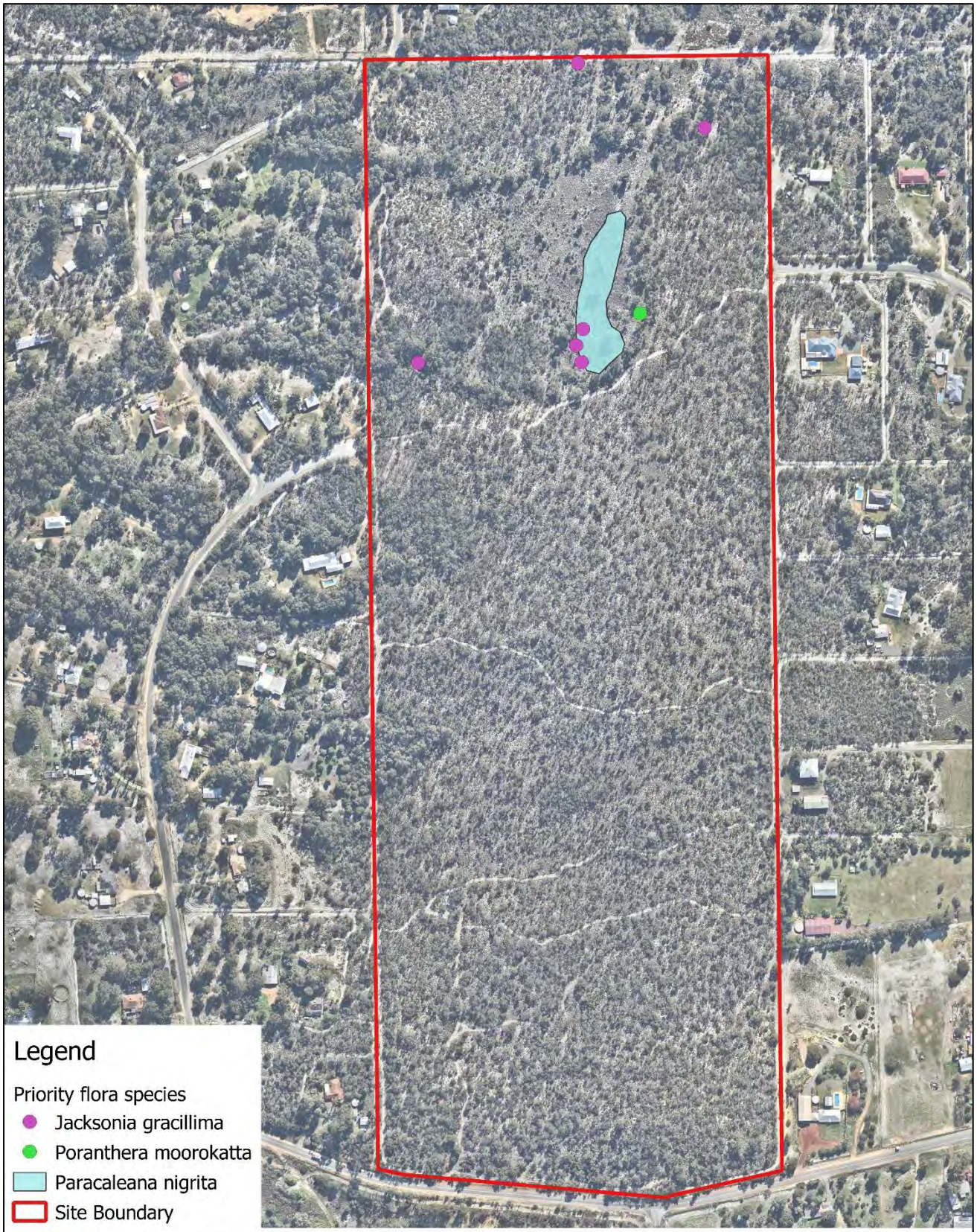


Figure 6:

Priority Flora Locations and Associated Flora
Lot 123 Mortimer Rd, Casuarina

4.2.3 Vegetation Types

Four vegetation types were recorded on site during the September and October 2020 surveys, with Banksia Woodland being the dominant type (Table 8, Figure 8). The Banksia Woodlands were classified more broadly as Banksia Woodlands of the Swan Coastal Plain TEC in 2018 and have been further refined into two separate subgroups of Floristic Community Types (FCT's) with 21a and 23a determined as being present in 2020. The other two vegetation types remain the same as those identified during the 2018 survey.

Table 8: Vegetation types

Vegetation Type	Description	Photograph
Banksia Woodland SCP 21a	*Banksia attenuata, Banksia menziesii* and *Eucalyptus marginata* Woodland over *Hibbertia hypericoides* and mixed shrubs and an understorey of *Mesomelaena pseudostygia*, *Amphipogon turbinatus*, *Desmocladus flexuosus;* this vegetation type was on higher elevations across most of the site.	
Banksia Woodland SCP 23a	*Banksia attenuata* and *Banksia menziesii* Woodland over *Kunzea glabrescens* and *Hibbertia hypericoides* shrubland, and an understorey of *Desmocladus flexuosus* and mixed herbs and sedges; this occurred in low-lying areas adjacent to the wetlands and in dune swales. This vegetation type is also associated with Allocasuarina fraseriana.	

Vegetation Type	Description	Photograph
Corymbia and *Melaleuca* Woodland	A woodland of *Corymbia calophylla* and *Melaleuca preissiana* over *Xanthorrhoea preissii* and mixed shrubland and a mixed understorey usually dominated by *Phlebocarya ciliata*; this vegetation type occurred in low-lying dune swales across the site.	
Melaleuca preissiana Woodland	Open Woodland of *Melaleuca preissiana* over *Xanthorrhoea preissii* and *Astartea scoparia* shrubland and an understorey of *Phlebocarya ciliata* and mixed sedges and herbs; this vegetation type occurred in the dampland area to the north of the site.	

4.2.4 Floristic Community Types Statistical analysis

Overarching floristic community types were determined after the 2018 analysis, with additional assessment during 2020 enabling further clarification of the Banksia Woodland subgroups. Results of the 2020 statistical data analysis process determined that the Banksia Woodland vegetation communities on site were most similar to SCP21a and SCP 23a (Gibson *et al., 1994*) which are subgroups of the Banksia Woodlands of the Swan Coastal Plain threatened ecological community (Table 8, Figure 7). The other vegetation types on site were associated with SCP4 for the *Melaleuca preissiana* Woodlands and SCP3b (with 30% similarity) for the *Corymbia* and *Melaleuca* Woodland (Table 8, Figure 7), consistent with the 2018 assessment. The Keighery *et al*. (2012) dataset was also statistically assessed against Lot 123 data and results are shown in Table 9 below and are consistent with results from the Gibson comparison.

The Lot 123 Banksia woodland quadrats comparison with the Keighery *et al*. (2012) data also showed over 35% similarity to community types SCP21b, SCP21c, SCP22, and SCP28 using the cluster group analysis (Figure 7b). However, these were ruled out based on habitat and location that these communities occur, or because they were the minority of results for a particular quadrat and not considered statistically significant (2 results for these FCTs as opposed to 8 and 24, for 21a and 23a respectively). A multivariate analysis between the quadrats within Lot 123 was undertaken comparing

flora species and abundance within quadrats. Similarity between the SCP 21a quadrats ranged from 19 - 37%, whilst SCP23a similarity ranged from 26% - 42%. There was also high similarity of the quadrats between the two vegetation communities (Figure 7a), with the dominant species within the quadrats used to determine vegetation community. Quadrat 12 showed the most variation from the other quadrats and may be explained by the lower vegetation condition in the area due to the area having historic buildings and sheds and more anthropogenic disturbances, with lower understorey diversity found.

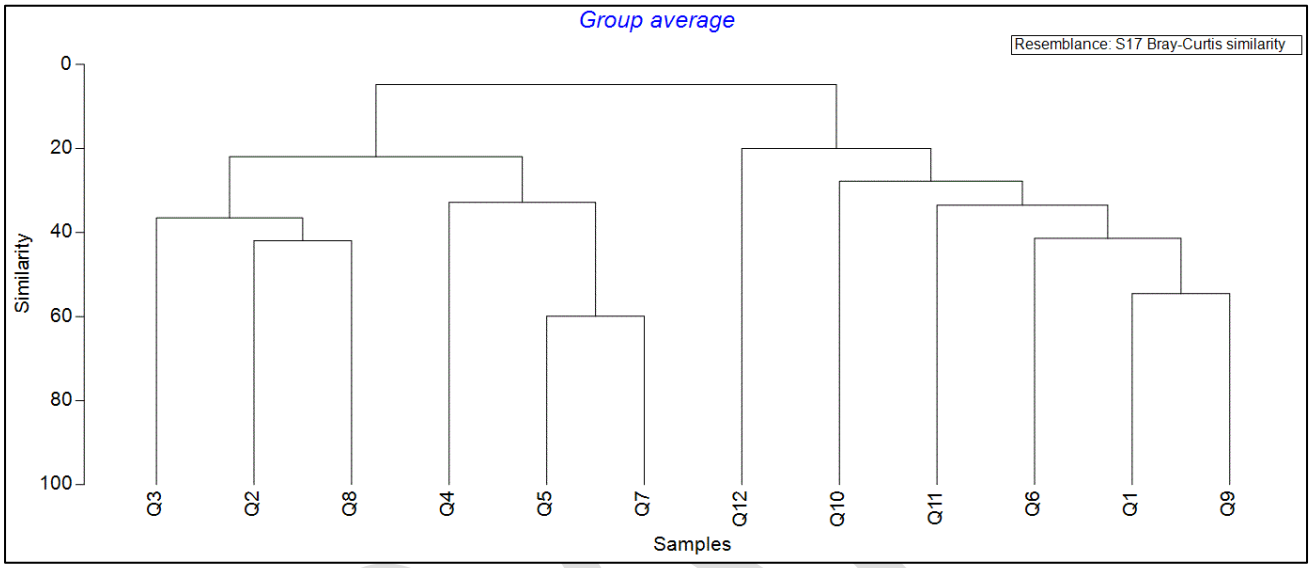


Figure 7a: Flora species and abundance cluster analysis dendrogram for Lot 123 quadrats

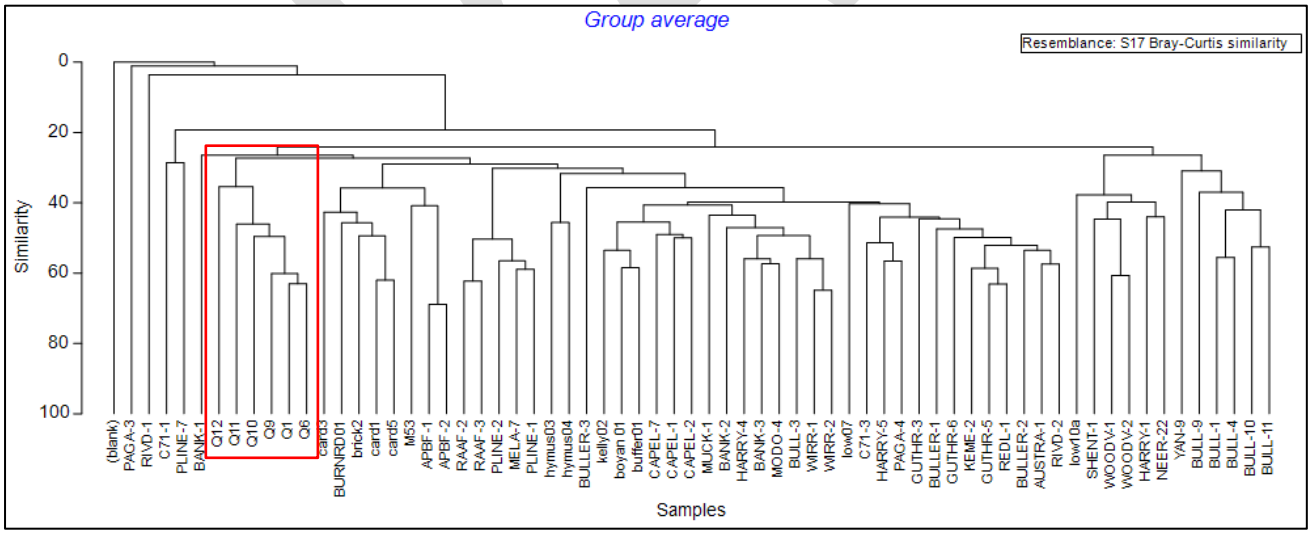


Figure 7b: Flora species cluster analysis dendrogram Lot 123 Banksia quadrats against Keighery data, Lot 123 quadrats outline in red

Table 9: Statistical analysis of Lot 123 community types compared to Gibson *et al*.

Vegetation type	Most similar community type (from Gibson *et al.* 1999 and Keighery 2012)	Similarity	Comments	Community Type determined
Banksia Woodland 21a (Q9,10,12)	Central *Banksia attenuata – Eucalyptus marginata* Woodland – SCP21a	Gibson 51% Keighery 39%	Species composition listed typical of quadrats surveyed. Vegetation structure consistent, with Jarrah scattered throughout, although *B. menziesii* dominant at all quadrats (not listed in listed composition)	SCP21a
Banksia Woodland 23a (Q1,6,11)	Central *Banksia attenuata – B. menziesii* Woodlands – SCP23a	Gibson 53% Keighery 44%	Species composition listed typical of quadrats, vegetation structure consistent	SCP23a
Melaleuca preissiana Woodland (Q2,3,8)	Mixed shrub damplands – SCP5	Gibson 41% Keighery 36%	Typical species present although missing overstory	SCP4
	Melaleuca preissiana damplands – SCP4	Gibson 39% Keighery 38%	Most likely community type – structure and species composition fits description	
Marri Woodland (Q4,5,7)	Central *Banksia attenuata – Eucalyptus marginata* Woodland – SCP21a	Gibson 43%	The dominant overstorey species do not match these vegetation types, similar understory however missing key overstory species	SCP3b (upland areas) or SCP3c (lowland areas). Structure more typical of 3c, although species composition more similar to 3b which has a 31% similarity with the Marri Woodland quadrats
	Banksia attenuata – B. menziesii Woodlands – SCP23a	Gibson 40%	Similar understory however missing key overstory species	
	*Corymbia calophylla – Eucalyptus marginata W*oodlands on sandy clay soils SCP3b	Gibson 31% Keighery 21.35%	Correct overstorey dominant species and similar understorey	SCP3b
	Corymbia calophylla - Xanthorrhoea preissii woodlands and	12%	Had Marri and Xanthorrhoea but also Melaleuca as dominant and understorey did	SCP3b correct overstorey and

Vegetation type	Most similar community type (from Gibson *et al.* 1999 and Keighery 2012)	Similarity	Comments	Community Type determined
	shrublands of the Swan Coastal Plain SCP3c		not match listing advice species	understorey species

4.2.5 Assessment Against EPBC Act 1999 Listing Information

The survey confirmed the presence of two floristic community types (SCP 21a and SCP 23a) that are classified as components of the Banksia Woodlands of the Swan Coastal Plain, TEC listed as endangered under the *EPBC Act 1999*, with 37.9 ha of the site (approximately 84%) covered by these vegetation communities. The minimum patch size for referral for a vegetation community in Excellent condition is 0.5 ha. When reviewed against the EPBC listing criteria for this community type, its condition and patch size mean that the proposed development will have a significant impact, which is why it was referred to the Department of Environment and Energy in 2019 (now the Department of Agriculture, Water and Environment) and was determined to be a controlled action.

The species composition for the two Banksia Woodland vegetation communities on site contains most of the understorey and middle storey species listed for this community in the listing advice, with 43 of the 48 recorded. The Banksia Woodland vegetation communities on site meet all key diagnostic characteristics in the TEC listing advice, including soil type and landforms, vegetation structure and composition, and high species richness (Department of Agriculture, Water and the Environment 2020a).

The Marri Woodland on site does have similar dominant species to the threatened ecological community SCP 3c *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain, however it does not occur on heavy soils with soils in this vegetation type changing from grey sand to sandy brown loam. Apart from the Marri and *Xanthorrhoea preissii* there was only one other common species listed in the Approved Conservation Advice (DAWE, 2017a) that occurred within these quadrats and that was *Lepidosperma squamatum* and it only occurred in one of the three quadrats. Statistical analysis with both the Keighery *et al*. (2012) data and the Gibson *et al*. (1994) data did not show any strong similarity between Lot 123 Marri woodland and quadrats of this community, with the highest similarity being 12% and most were lower than 8%. Therefore, this community is not considered present.

4.2.6 Vegetation Condition

Vegetation condition ranged from Degraded to Excellent, with the majority of the site (82.7%) in Excellent condition (Table 10, Figure 9), with a slight decrease in condition noted as a portion in the south of the site was reduced from Excellent in 2018 to Very Good condition in 2020 due to lower native species richness and increased weed coverage. Degraded areas occurred along sandy vehicle tracks/firebreaks and at the southern end of the site where areas had been previously cleared for buildings/sheds, with remnants of old buildings and dumped rubbish present.

Table 10: Vegetation condition within Lot 123 Mortimer Road

Vegetation Condition	Pristine	Excellent	Very Good	Good	Degraded	Completely Degraded	Totals
Area (ha)	0.00	37.17	4.95	0.49	2.22	0.12	44.95
Area (%)	0.00	82.70	11.00	1.10	4.90	0.30	100

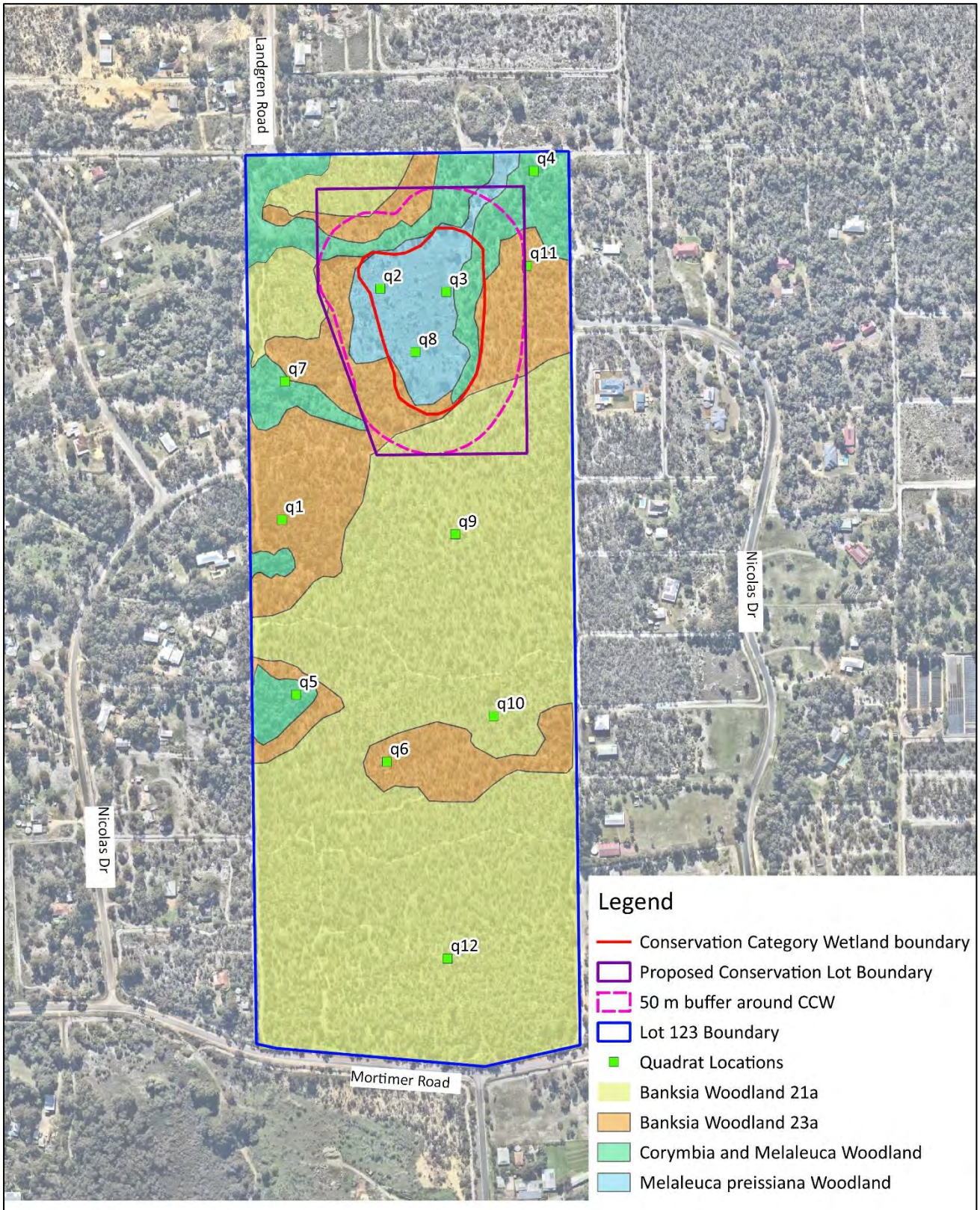


Figure 8:
Vegetation Type
Lot 123 Mortimer Rd, Casuarina

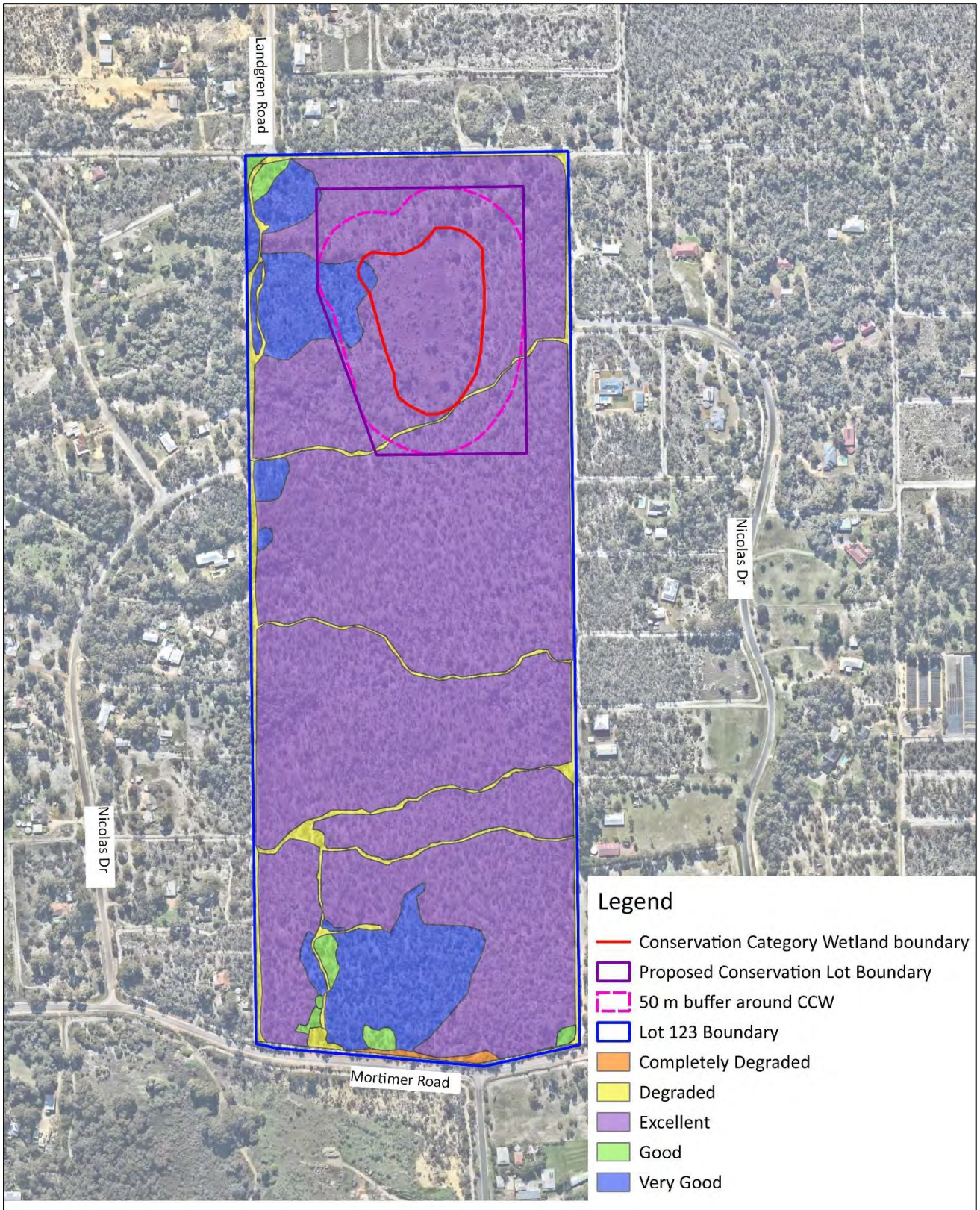


Figure 9:
Vegetation Condition
Lot 123 Mortimer Rd, Casuarina

5.0 Implications of Results

5.1 Flora species

Natural Area's spring 2020 survey at Lot 123 Mortimer Road, Casuarina recorded 227 flora species from 55 families, 45 of which were introduced and 182 were native species. The area shows a high level of plant diversity which is typical of Banksia Woodlands of the Swan Coastal Plain.

5.2 Conservation Significant Flora Likelihood Analysis

Targeted surveys were carried out to search for threatened and priority flora species listed as possible to occur in the desktop assessment. Two priority flora species were recorded during the 2020 flora survey (Refer to Section 5.2.4). Despite the 2020 survey being carried out at the optimal flowering time the target orchids, no threatened flora species were recorded during the early and late September and October 2020 surveys. Initial flora surveys of the site were conducted by Natural Area on the 9 to the 12th October 2018, with no conservation significant flora identified during the survey.

Of the eight species recorded as possibly occurring in the desktop assessment, two were found. Others were searched for during their correct flowering season and were not recorded but have been found by our botanist as the same time of year at similar sites. Of the remaining six that were possible to occur due to suitable habitat they would have been flowering or are large enough to be found if they were present and are therefore not considered present within the site. Of the species identified during the survey only four could not be identified to species level, one was a weed and the other three were natives. The three natives did not bear any strong resemblance to any of the species that were listed in the desktop analysis as being potentially present on site.

5.2.1 *Caladenia huegelii*

The Department of Environment and Conservation (2008) indicates that the *Caladenia huegelii* typically occurs on Bassendean soils in a mixed woodland of Jarrah and Banksia with a thick understorey. Typical associated species include *Banksia attenuata* (Candlestick Banksia), *Banksia ilicifolia* (Holly Banksia) and *Banksia menziesii* (Firewood Banksia), along with a range of shrubs and herbs. Despite the presence of these and other associated species, no *Caladenia huegelii* was recorded by Natural Area in 2020 or 2018. Given the number of surveys undertaken at the site during the known flowering time for this species, it can reasonably be concluded that *Caladenia huegelii* is not present within Lot 123.

5.2.2 *Diuris micrantha*

The approved conservation advice (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2008) for the *Diuris micrantha* indicates that it is typically found on dark, grey to blackish, sandy clay-loam substrates in winter wet depressions or swamps, and that the bases of plants are often known to be covered with water. While there is a designated conservation category wetland within Lot 123, the soils are primarily Bassendean Sands and anecdotal information provided by the owner indicates there has been no water present on any portion of the site during his ownership, i.e., 60 or more years (Yujnovich, 2018, personal communication).

Geo & Hydro Environmental Management (2020) hydrological assessments indicate a minimum depth to groundwater of 1.5 to 2 m within the designated wetland area, it is probable that site conditions are not suitable for this species. As no evidence of this species has been found during the 2020 or 2018 surveys carried out by Natural Area, it can be reasonably concluded that the *Diuris micrantha* is not present within Lot 123.

5.2.3 *Drakaea elastica*

According to the Department of Environment and Conservation (2009), the *Drakaea elastica* often grows in association with *Paracaleana nigrita* (Flying Duck Orchid) (Figures 5 and 6). During the 2020 survey, approximately 20 Flying Duck Orchid individuals were recorded across the southern half of the wetland, however, no *Drakaea elastica* were recorded. The previous survey undertaken by Natural Area in 2018 did not record any *Drakaea elastica*. Given the number of surveys undertaken at the site during the known flowering time for this species, it can reasonably be concluded that *Drakaea elastica* is not present within Lot 123. However, rainfall can affect when certain species present and this species can be search for early in July or August when their leaves are presenting, additional surveys may be required for this species.

5.2.4 Priority Listed Species

This survey confirmed the presence of two Priority species listed under the BC Act. One Priority 2 listed *Poranthera moorokatta* individual was recorded in the proposed Conservation Lot, and six Priority 3 listed *Jacksonia gracillima* individuals were recorded. The presence of these species should be considered during environmental approvals processes.

5.3 Threatened Ecological Community

The DAWE (2020) PMST report indicated the potential presence of six threatened ecological communities, namely:

- Banksia Woodlands of the Swan Coastal Plain
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain
- Assemblages of Plants and Invertebrate Animals of Tumulus (Organic Mound) Springs of the Swan Coastal Plain
- Corymbia calophylla – Kingia Australia woodlands on heavy soils of the Swan Coastal Plain
- Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain
- Clay Pans of the Swan Coastal Plain
- Sedgelands in Holocene Dune Swales.

5.3.1 Banksia Woodland TEC

The presence of the Banksia Woodland of the Swan Coastal Plain ecological community was confirmed during the 2018 and 2020 surveys carried out by Natural Area (Sections 4.2.4 and 4.2.5). During the 2020 survey, Natural Area further refined the Floristic Community Types present within the Banksia Woodland, identifying them as SCP 23a and SCP21a; both are associated with the Banksia Woodland TEC. The amount of clearing is yet to be determined, with the maximum clearing being 37.14 ha. However, portions of this vegetation and ecological community are likely to be retained within Public Open Space

(POS) areas, with the amount yet to be quantified. The large size of the area makes it more resilient to edge effects such as weed invasion, and recruitment in 2018 following a fire sometime previously showed successful resilience to site specific disturbances.

5.3.2 Tuart Woodlands TEC

The Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community does not occur within the site. The primary defining feature of this ecological community is for Tuart to be the dominant and most abundant tree species in the canopy (Table 9, Threatened Species Scientific Community (TSSC), 2019). This is not the case at Lot 123, where the Tuart was not recorded by Natural Area and thus was not a dominant tree species on site. Dominant species recorded by Natural Area in 2018 and 2020 includes various Banksia species, Marri (*Corymbia calophylla*), and *Melaleuca preissiana* (Section 4.2.3, Natural Area, 2018).

Table 9: Comparison of Lot 123 characteristics with key diagnostic features of the Tuart Woodlands TEC

No.	Diagnostic Feature	Lot 123
1	Occurs in Swan Coastal Plain Bioregion	Yes – Lot 123 occurs within the Swan Coastal Plain Bioregion
2	Occurs primarily on the Spearwood and Quindalup dune systems, but can also occur on the Bassendean dunes and the Pinjarra Plain	Yes – Lot 123 is located on the Bassendean dune system
3	The primary defining feature of this ecological community is the presence of at least two living established Tuarts are present in the uppermost canopy layer	No – Tuart was not recorded by Natural Area in the 2018 and 2020 surveys
4	Occurs as a woodland or other structural forms	No – Tuart was not recorded by Natural Area in the 2018 and 2020 surveys
5	Other species present in the canopy including *Agonis flexuosa*, *Corymbia calophylla*, and/or several Banksia species	No - *Corymbia calophylla* and Banksia species present as dominant species rather than co- dominant with Tuart, which is not present
6	Native understorey present that may include grasses, herbs, and shrubs	Yes, species present typical of those associated with the Banksia Woodland TEC
7	Native fauna species	Yes – some fauna species recorded on Lot 123 are known to utilise Tuart Woodlands, they are also associated with the use of species known to occur in the Banksia Woodland TEC

5.3.3 Tumulus (Organic Mound) Springs TEC

According to the Department of Agriculture, Water, and the Environment (2020) and the Department of Environment and Conservation (2006), the Tumulus (Organic Mound) Springs of the Swan Coastal Plain

ecological community is characterised by a habitat of groundwater continually discharging in areas of raised peat, which provides permanently moist habitats suited to flora and fauna species. While some of the terrestrial species associated with this ecologic community have been recorded during the 2018 and 2020 surveys, including the Swamp Banksia (*Banksia littoralis*) and Moonah (*Melaleuca preissiana*), there were no observations of non-vascular plants typical of this community (e.g.: Bog Clubmoss (*Pseudolycopodiella serpentina*, previously *Lycopodiella serpentina*, previously *Lycopodium serpentinum*), *Riccardia aequicellularis* and *Jungermannia inundata*). There are also no permanently moist areas located within Lot 123, indicating the absence of suitable conditions for the presence of the Tumulus organic mound springs ecological community.

5.3.4 Corymbia calophylla – Kingia Australia TEC

According to the Department of Agriculture, Water, and the Environment (2017b), the Corymbia calophylla – Kingia Australia woodlands on heavy soils of the Swan Coastal Plain (SCP) is characterised by Woodland community of heavy soils at the east of the SCP including *Corymbia calophylla Banksia dallanneyi, Philotheca spicata, Kingia australis and Xanthorrhoea preissii, Cyathochaeta avenacea, Dampiera linearis, Haemodorum laxum, Desmocladus fasciculatus, Mesomelaena tetragona and Tetraria octandra.* This vegetation type was ruled our due to a lack of the common species associated and the lack of Kingia australis which is one of the dominant species of this vegetation type.

5.3.5 Corymbia calophylla - Xanthorrhoea preissii TEC

According to the Department of Agriculture, Water, and the Environment this community occurs on heavy soils on the eastern edge of the swan coastal plain. The Marri Woodland on site does have similar dominant species to the threatened ecological community SCP 3c *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain, however it does not occur on heavy soils with soils in this vegetation type changing from grey sand to sandy brown loam. Apart from the Marri and *Xanthorrhoea preissii* there was only one other common species listed in the Approved Conservation Advice (DAWE, 2017a) that occurred within these quadrats and that was *Lepidosperma squamatum* and it only occurred in one of the three quadrats. Statistical analysis with both the Keighery *et al*. (2012) data and the Gibson *et al*. (1994) data did not show any strong similarity between Lot 123 Marri woodland and quadrats of this community, with the highest similarity being 12% and most lower than 8%. Therefore, this community is not considered present with quadrats more consistent with community SCP3b.

5.3.6 Clay Pans of the Swan Coastal Plain

According to the Department of Agriculture, Water, and the Environment (2012), this community occurs as a shrubland or less commonly a low open woodland where clayey soils form an impermeable layer close to the soil surface. These communities have a high species richness with a lot of annuals and geophytes that come up and flower in late spring and summer. It occurs in seasonally inundated wetlands on the Swan coastal Plain. As the soils within the site were mainly sandy Bassendean soils this vegetation type is not considered present within the site.

5.3.7 Sedgelands in Holocene Dune Swales

This vegetation community occurs in alkaline soils along the coast, in damplands and sumpland of Holocene dune swales. They are waterlogged in winter with water close to the surface in summer. Typical species include *Xanthorrhoea preissii, Baumea juncea, Ficinia nodosa, Lepidosperma gladiatum* and *Poa*

porphyroclados. As the habitat and majority of the species are not present within the site this vegetation community is not considered to be present.

5.4 Potential Environmental Impacts of Development

Fragmentation of ecological communities can lead to a reduction of genetic material through the landscape by reducing interactions between fauna and flora, particularly pollinator species. Edge effects can lead to increased impacts on remaining flora, changes in micro-climate such as increased sun exposure, humidity and soil temperature that can alter vegetation structures. This may increase weed loads or favour species that are more tolerant of the new micro-climate reducing biodiversity of the flora present. Increase weed encroachment can occur due to degradation of soil and through increased access including introduction via human vectors or domestic animals.

Increased access can lead to more unauthorised human access into bushland areas via vehicles, dirt bikes or by foot, increasing the potential for a number of disturbances including:

- Illegal rubbish dumping including garden waste
- Introduced / increased presence of non-native weed species
- Spread of dieback
- Damage to vegetation as a result of driving/trampling/vandalism
- Soil erosion or compaction.

Clearing native vegetation in Lot 123 may result in direct and indirect impacts, including but not limited to mortality of flora and fauna, loss of fauna habitat, fragmentation of remnant vegetation and disruption of ecological linkages. Changes in topography and hydrology as a result of vegetation removal may also result in increased land degradation, erosion or exacerbate the incidence of flooding.

5.4.1 Residual Impact of Development

Although approximately 7.82 ha of vegetation and CCW are proposed to be retained for conservation (refer to Figure 8, there are still a number of residual impacts remaining for the site. This includes impacts to matters of nation environmental significance (MNES) listed under the EPBC Cay 1999, including:

- The loss of 27.489 ha of Banksia Woodland 21a
- The loss of 6.555 ha of Banksia Woodland 23a.

Other non MNES residual impacts include:

- The loss of 37.357 ha of remnant flora in mostly Excellent condition
- The loss of 0.885 ha of resource enhancement wetland from UFI 6690 and 13969
- Loss of P3 *Jacksonia gracillima* individuals.

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Appendix 1: NatureMap Report

Appendix 2: Protected Matter Search Tool Report

Appendix 3: Potential Priority and Threatened Flora

The table below provides a combined list of potential flora in a 10 km radius of the site from NatureMap, Protected Matters Search Tool, DBCA threatened and priority flora database, Keighery et al. 2012 dataset and ALA database (2022).

Potential threatened and priority species in Lot 123:

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site
Acacia lasiocarpa var. *bracteolata* long peduncle variant (G.J. Keighery 5026)		P1				x		Unlikely habitat unsuitable
Acacia sp. Binningup (G. Cockerton et al. WB 37784)		P1					x	Unlikely habitat unsuitable
Andersonia gracilis	Slender Andersonia	T/EN		x				Unlikely habitat unsuitable
Angianthus drummondii		P3				x	x	Unlikely habitat unsuitable
Aponogeton hexatepalus	Stalked Water Ribbons	P4	x		x	x	x	Unlikely habitat unsuitable
Babingtonia urbana	Coastal Plain Babingtonia	P3					x	

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site
Boronia juncea subsp. *juncea*		P1			x			Unlikely habitat unsuitable
Caladenia huegelii	Grand Spider Orchid	T/EN	x	x			x	Possible – not detected
Carex tereticaulis		P3					x	Unlikely habitat unsuitable
Cyathochaeta teretifolia		P3	x				x	Possible – not detected
Dillwynia dillwynioides		P3				x		Possible – not detected
Diuris micrantha	Dwarf Bee-orchid	T/VU		x			x	Unlikely habitat unsuitable
Diuris drummondii	Tall Donkey Orchid	T, VU		x				Unlikely habitat unsuitable
Diuris purdiei	Purdie's Donkey Orchid	T, EN	x	x				Unlikely habitat unsuitable

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site
Dodonaea hackettiana	Hackett's Hopbush	P4			x		x	Unlikely habitat unsuitable
Drakaea elastica	Glossy-leaved Hammer Orchid	T, EN	x	x			x	Possible – not detected
Drakaea micrantha	Dwarf Hammer-orchid	T, VU	x	x				Possible – not detected
Eleocharis keigheryi	Keighery's Eleocharis	T, VU		x				Unlikely habitat unsuitable
Eucalyptus x balanites	Cadda Road Mallee	T, VU					x	Unlikely habitat unsuitable
Grevillea curviloba subsp. *incurva*		T, EN		x				Unlikely outside known distribution
Jacksonia gracillima		P3	x				x	Present - found on site
Jacksonia sericea	Waldjumi	P4					x	Unlikely habitat unsuitable

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site
Johnsonia pubescens subsp. *cygnorum*		P2				x		Possible – not detected
Lepidosperma rostratum	Beaked Lepidosperma	T, EN	x				x	Unlikely habitat unsuitable
Parsonia diaphanophleba		P4					x	Unlikely habitat unsuitable
Pithocarpa corymbulosa	Corymbose Pithocarpa	P3				x		Unlikely habitat unsuitable
Poranthera moorokatta		P2			x			Present – found on site
Schoenus capillifolius		P3			x		x	Unlikely habitat unsuitable
Schoenus sp. Waroona (G.J. Keighery 12235)		P3					x	Unlikely habitat unsuitable
Stylidium aceratum		P3					x	Unlikely habitat unsuitable

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site
Stylidium ireneae		P4					x	Unlikely habitat unsuitable
Stylidium longitubum	Jumping Jacks	P4			x			Unlikely habitat unsuitable
Stylidium paludicola		P3			x		x	Unlikely habitat unsuitable
Stylidium striatum		P4	x					Unlikely habitat unsuitable
Styphelia filifolia		P3					x	
Synaphea sp. Fairbridge Farm (D. Papenfus 696)		T, CR	x	x				Unlikely habitat unsuitable
Synaphea sp. Pinjarra Plain (A.S. George 17182)		T, EN		x			x	Unlikely outside known distribution
Synaphea sp. Serpentine		T, CR		x				Unknown
Tetraria australiensis	Southern Tetraria	T, VU		x			x	Unlikely habitat unsuitable

Species	Common Name	Cons. Code	NatureMap	PMST	DBCA	Keighery et al. 2012	ALA	Potential to occur on site
Tetraria sp. Chandala		P2	x					Unknown
Thelymitra stellata	Star Sun-orchid	T, EN		x				Unlikely habitat unsuitable
Verticordia plumosa var. *plumosa*	Tufted Plumed Featherflower	T, EN		x				Unlikely habitat unsuitable

Appendix 4: Conservation Codes

Western Australia (Biodiversity Conservation Act 2016)

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

Conservation Code	Name	Description
		categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.
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, 2020a)

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

(Source: Department of the Environment and Energy, 2020a)

Appendix 5: Flora Species List

A complete flora list is provided in the table below, it is compiled from the two previous surveys undertaken by Bioscience in 2008 and 2015, and the two surveys undertaken in 2018 and 2020 by Natural Area. It also includes an indication of known food species used by Carnaby's Cockatoo (DEC, 2011). It is sorted by species with weeds listed first then natives.

Note: *denotes an introduced species.

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Fabaceae	**Acacia iteaphylla*					x	x
Fabaceae	**Acacia longifolia*					x	x
Poaceae	**Aira cupaniana*	Silvery Hairgrass				x	x
Asteraceae	**Arctotheca calendula*	Cape Weed				x	x
Poaceae	**Avena barbata*	Bearded Oat				x	x
Poaceae	**Briza maxima*	Blowfly Grass				x	x
Poaceae	**Briza minor*	Shivery Grass				x	x
Poaceae	**Briza* sp.				x		
Poaceae	**Bromus diandrus*	Great Brome				x	x
Aizoaceae	**Carpobrotus edulis*	Hottentot Fig				x	x
Fabaceae	**Chamaecytisus palmensis*	Tagasaste				x	x
Myrtaceae	**Chamelaucium uncinatum*	Geraldton Wax				x	x
Asteraceae	**Conyza sumatrensis*					x	x
Poaceae	**Cynodon dactylon*	Couch				x	x
Poaceae	**Ehrharta calycina*	Perennial Veldt Grass				x	x
Poaceae	**Eragrostis curvula*	African Lovegrass				x	x
Geraniaceae	**Erodium botrys*	Long Storksbill	Y			x	x
Euphorbiaceae	**Euphorbia terracina*	Geraldton Carnation Weed				x	x
Iridaceae	**Freesia alba* x *leichtlinii*	Freesia				x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Iridaceae	**Gladiolus caryophyllaceus*	Pink Gladiolus				x	x
Apocynaceae	**Gomphocarpus fruticosus*	Narrowleaf Cottonbush				x	x
Asteraceae	**Hypochaeris glabra*	Smooth Catsear		x		x	x
Asteraceae	**Hypochaeris radicata*	Flat Weed				x	x
Asteraceae	**Lactuca serriola*	Prickly Lettuce				x	x
Poaceae	**Lagurus ovatus*	Hare's Tail Grass				x	x
Lamiaceae	**Lavandula stoechas*	Italian Lavender				x	x
Poaceae	**Lolium rigidum*	Wimmera Ryegrass				x	x
Fabaceae	**Lupinus angustifolius*	Narrowleaf Lupin	Y			x	x
Fabaceae	**Lupinus cosentinii*	Blue Lupin	Y			x	x
Primulaceae	**Lysimachia arvensis*	Pimpernel				x	x
Cactaceae	**Opuntia* sp.					x	x
Orobanchaceae	**Orobanche minor*	Lesser Broomrape				x	x
Oxalidaceae	**Oxalis pes-caprae*	Soursob				x	x
Geraniaceae	**Pelargonium capitatum*	Rose Pelargonium				x	x
Caryophyllaceae	**Petrorhagia dubia*					x	x
Poaceae	**Phleum arenarium*					x	x
Asteraceae	**Reichardia tingitana*	False Sowthistle				x	x
Anacardiaceae	**Schinus terebinthifolius*	Japanese Pepper Tree				x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Asteraceae	**Senecio vulgaris*	Common Groundsel				x	x
Fabaceae	**Trifolium campestre*	Hop Clover				x	x
Asteraceae	**Ursinia anthemoides*	Ursinia		x		x	x
Poaceae	**Vulpia myuros*	Rat's Tail Fescue				x	x
Campanulaceae	**Wahlenbergia capensis*	Cape Bluebell				x	x
Iridaceae	**Watsonia meriana*	Bulbil Watsonia			x		
Araceae	**Zantedeschia aethiopica*	Arum Lily			x		
Fabaceae	*Acacia applanata*			x	x	x	x
Fabaceae	*Acacia huegelii*			x		x	x
Fabaceae	*Acacia insolita* subsp. *insolita*			x			
Fabaceae	*Acacia pulchella*	Prickly Moses				x	x
Fabaceae	*Acacia saligna*	Orange Wattle				x	x
Fabaceae	*Acacia stenoptera*	Narrow Winged Wattle				x	x
Proteaceae	*Adenanthos cygnorum*	Common Woollybush				x	x
Proteaceae	*Adenanthos obovatus*	Basket Flower		x	x	x	x
Casuarinaceae	*Allocasuarina fraseriana*	Sheoak		x	x	x	x
Casuarinaceae	*Allocasuarina humilis*	Dwarf Sheoak		x	x	x	x
Poaceae	*Amphipogon turbinatus*			x		x	x
Haemodoraceae	*Anigozanthos humilis* subsp. *humilis*			x	x	x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Haemodoraceae	*Anigozanthos manglesii*	Mangles Kangaroo Paw				x	x
Fabaceae	*Aotus gracillima*			x	x	x	x
Myrtaceae	*Astartea affinis*	West-coast Astartea		x			
Myrtaceae	*Astartea zephyra*			x	x		
Asteraceae	*Asteridea pulverulenta*	Common Bristle Daisy					x
Ericaceae	*Astroloma pallidum*	Kick Bush				x	x
Poaceae	*Austrostipa compressa*					x	x
Poaceae	*Austrostipa flavescens*					x	x
Poaceae	*Austrostipa hemipogon*						x
Myrtaceae	*Babingtonia camphorosmae*	Camphor Myrtle				x	x
Proteaceae	*Banksia attenuata*	Slender Banksia	Y	x	x	x	x
Proteaceae	*Banksia ilicifolia*	Holly-leaved Banksia	Y	x	x	x	x
Proteaceae	*Banksia littoralis*	Swamp Banksia	Y			x	x
Proteaceae	*Banksia menziesii*	Firewood Banksia	Y	x	x	x	x
Proteaceae	*Banksia nivea*	Honeypot Dryandra	Y		x		
Pittosporaceae	*Billardiera fusiformis*	Australia Bluebell				x	x
Rutaceae	*Boronia crenulata* subsp. *viminea*			x	x	x	x
Fabaceae	*Bossiaea eriocarpa*	Common Brown Pea		x	x	x	x
Colchicaceae	*Burchardia bairdiae*				x	x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Colchicaceae	*Burchardia congesta*			x	x	x	x
Hemerocallidaceae	*Caesia occidentalis*					x	x
Orchidaceae	*Caladenia discoidea*	Dancing Orchid		x			
Orchidaceae	*Caladenia flava*	Cowslip Orchid		x	x	x	x
Orchidaceae	*Caladenia flava* subsp. *flava*	Cowslip Orchid		x		x	x
Montiaceae	*Calandrinia corrigioloides*	Strap Purslane				x	x
Dasypogonaceae	*Calectasia grandiflora*	Blue Tinsel Lily			x		
Dasypogonaceae	*Calectasia narragara*			x		x	x
Myrtaceae	*Calytrix angulata*	Yellow Starflower		x		x	x
Myrtaceae	*Calytrix flavescens*	Summer Starflower		x	x	x	x
Myrtaceae	*Calytrix fraseri*	Pink Summer Calytrix		x	x	x	x
Aizoaceae	*Carpobrotus virescens*	Coastal Pigface			x		
Lauraceae	*Cassytha glabella*	Tangled Dodder Laurel				x	x
Lauraceae	*Cassytha racemosa*	Dodder Laurel				x	x
Lauraceae	*Cassytha* sp.			x			
Centrolepidaceae	*Centrolepis drummondiana*					x	x
Xanthorrhoeaceae	*Chamaescilla corymbosa* var. *corymbosa*			x	x	x	x
Myrtaceae	*Chamelaucium micranthum*				x	x	x
Proteaceae	*Conospermum capitatum* subsp. *glabratum*			x		x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Ericaceae	*Conostephium pendulum*	Pearl Flower		x	x	x	x
Haemodoraceae	*Conostylis aculeata* subsp. *aculeata*			x		x	x
Haemodoraceae	*Conostylis juncea*			x	x	x	x
Haemodoraceae	*Conostylis setigera* subsp. setigera			x	x	x	x
Myrtaceae	*Corymbia calophylla*	Marri	Y	x	x	x	x
Hemerocallidaceae	*Corynotheca micrantha*	Sand Lily				x	x
Crassulaceae	*Crassula colorata* var. *colorata*			x		x	x
Cyperaceae	*Cyathochaeta avenacea*					x	x
Goodeniaceae	*Dampiera linearis*	Common Dampiera		x	x	x	x
Dasypogonaceae	*Dasypogon bromeliifolius*	Pineapple Bush		x	x	x	x
Fabaceae	*Daviesia incrassata* subsp. *incrassata*			x	x		
Fabaceae	*Daviesia physodes*					x	x
Fabaceae	*Daviesia triflora*					x	x
Restionaceae	*Desmocladus fasciculatus*					x	x
Restionaceae	*Desmocladus flexuosus*			x		x	x
Hemerocallidaceae	*Dianella revoluta*	Blueberry Lily				x	x
Restionaceae	*Dielsia stenostachya*			x		x	x
Orchidaceae	*Diuris magnifica*					x	x
Sapindaceae	*Dodonaea aptera*	Coast Hop-bush				x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Droseraceae	*Drosera drummondii*			x	x		
Droseraceae	*Drosera erythrorhiza*	Red Ink Sundew		x	x	x	x
Droseraceae	*Drosera glanduligera*	Pimpernel Sundew				x	x
Droseraceae	*Drosera macrantha*	Bridal Rainbow				x	x
Droseraceae	*Drosera paleacea*	Dwarf Sundew				x	x
Droseraceae	*Drosera pallida*						x
Droseraceae	*Drosera porrecta*			x	x	x	x
Orchidaceae	*Elythranthera brunonis*	Purple Enamel Orchid		x	x	x	x
Myrtaceae	*Eremaea asterocarpa* subsp. *asterocarpa*			x			
Myrtaceae	*Eremaea pauciflora*			x	x	x	x
Orchidaceae	*Eriochilus* sp.	Bunny Orchid				x	x
Myrtaceae	*Eucalyptus gomphocephala*	Tuart	Y	x	x		
Myrtaceae	*Eucalyptus marginata*	Jarrah	Y	x	x	x	x
Myrtaceae	*Eucalyptus todtiana*	Coastal Blackbutt	Y			x	x
Fabaceae	*Euchilopsis linearis*	Swamp Pea		x		x	x
Fabaceae	*Gastrolobium capitatum*					x	x
Fabaceae	*Gompholobium tomentosum*	Hairy Yellow Pea		x	x	x	x
Haloragaceae	*Gonocarpus pithyoides*					x	x
Goodeniaceae	*Goodenia pulchella* subsp. Coastal Plain			x			

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Haemodoraceae	*Haemodorum paniculatum*						x
Haemodoraceae	*Haemodorum spicatum*	Mardja				x	x
Fabaceae	*Hardenbergia comptoniana*	Native Wisteria				x	x
Lamiaceae	*Hemiandra pungens*	Snakebush		x	x	x	x
Dilleniaceae	*Hibbertia hypericoides*	Yellow Buttercups		x	x	x	x
Dilleniaceae	*Hibbertia racemosa*	Stalked Guinea Flower		x	x	x	x
Dilleniaceae	*Hibbertia vaginata*			x	x	x	x
Fabaceae	*Hovea trisperma*	Common Hovea				x	x
Fabaceae	*Hovea trisperma* var. *trisperma*			x			
Violaceae	*Hybanthus calycinus*	Wild Violet			x	x	x
Myrtaceae	*Hypocalymma angustifolium*	White Myrtle		x	x	x	x
Myrtaceae	*Hypocalymma robustum*	Swan River Myrtle		x	x	x	x
Restionaceae	*Hypolaena exsulca*			x		x	x
Cyperaceae	*Isolepis marginata*	Course Club-rush				x	x
Proteaceae	*Isopogon linearis*				x		
Fabaceae	*Isotropis cuneifolia*	Granny bonnets			x	x	x
Fabaceae	*Isotropis cuneifolia* subsp. *cuneifolia*			x	x		
Fabaceae	*Jacksonia calcicola*					x	x
Fabaceae	*Jacksonia furcellata*	Grey Stinkwood	Y	x	x	x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Fabaceae	*Jacksonia gracillima (P3)*						x
Fabaceae	*Jacksonia sericea*	Waldjumi		x	x		
Fabaceae	*Jacksonia sternbergiana*	Stinkwood		x	x	x	x
Fabaceae	*Kennedia prostrata*	Scarlet Runner				x	x
Myrtaceae	*Kunzea glabrescens*	Spearwood		x	x	x	x
Asteraceae	*Lagenophora huegelii*			x		x	x
Asparagaceae	*Laxmannia ramosa* subsp. *ramosa*					x	x
Asparagaceae	*Laxmannia squarrosa*			x	x	x	x
Goodeniaceae	*Lechenaultia floribunda*	Free-flowering Leschenaultia		x		x	x
Cyperaceae	*Lepidosperma longitudinale*	Pithy Sword-sedge				x	x
Cyperaceae	*Lepidosperma pubisquameum*					x	x
Cyperaceae	*Lepidosperma scabrum*						x
Cyperaceae	*Lepidosperma sp.*						x
Cyperaceae	*Lepidosperma squamatum*			x		x	x
Orchidaceae	*Leporella fimbriata*	Hare Orchid				x	x
Santalaceae	*Leptomeria empetriformis*					x	x
Santalaceae	*Leptomeria pauciflora*	Sparse-flowered Currant Bush		x		x	x
Ericaceae	*Leucopogon australis*	Spiked Beard-heath		x	x	x	x
Ericaceae	*Leucopogon conostephioides*			x	x	x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Ericaceae	*Leucopogon propinquus*					x	x
Stylidiaceae	*Levenhookia stipitata*	Common Stylewort				x	x
Campanulaceae	*Lobelia tenuior*	Slender Lobelia		x	x	x	x
Asparagaceae	*Lomandra caespitosa*	Tufted Mat Rush				x	x
Asparagaceae	*Lomandra hermaphrodita*			x	x	x	x
Asparagaceae	*Lomandra preissii*					x	x
Asparagaceae	*Lomandra sericea*	Silky Mat Rush		x	?	x	x
Asparagaceae	*Lomandra suaveolens*				x	x	x
Anarthriaceae	*Lyginia barbata*					x	x
Anarthriaceae	*Lyginia imberbis*			x		x	x
Orchidaceae	*Lyperanthus serratus*	Rattle Beak Orchid				x	x
Ericaceae	*Lysinema ciliatum*	Curry Flower		x	x	x	x
Macarthuriaceae	*Macarthuria australis*				x	x	x
Zamiaceae	*Macrozamia riedlei*	Zamia		x	x	x	x
Myrtaceae	*Melaleuca preissiana*	Moonah		x	x	x	x
Myrtaceae	*Melaleuca rhaphiophylla*	Swamp Paperbark		x	x		
Myrtaceae	*Melaleuca thymoides*					x	x
Cyperaceae	*Mesomelaena pseudostygia*		Y	x	x	x	x
Cyperaceae	*Mesomelaena tetragona*		Y	x	x	x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Orchidaceae	*Microtis media*	Tall Mignonette Orchid				x	x
Euphorbiaceae	*Monotaxis occidentalis*			x		x	x
Poaceae	*Neurachne alopecuroidea*	Foxtail Mulga Grass				x	x
Loranthaceae	*Nuytsia floribunda*	Christmas Tree			x	x	x
Rubiaceae	*Opercularia vaginata*	Dog Weed				x	x
Orchidaceae	*Paracaleana nigrita*	Flying Duck Orchid				x	x
Iridaceae	*Patersonia occidentalis* var. *occidentalis*	Purple Flag		x	x	x	x
Myrtaceae	*Pericalymma ellipticum* var. *ellipticum*					x	x
Myrtaceae	*Pericalymma ellipticum* var. *floridum*			x			
Proteaceae	*Persoonia saccata*	Snottygobble		x	x	x	x
Proteaceae	*Petrophile linearis*	Pixie Mops		x	x	x	x
Rutaceae	*Philotheca spicata*	Pepper and Salt		x	x	x	x
Haemodoraceae	*Phlebocarya ciliata*			x		x	x
Loganiaceae	*Phyllangium paradoxum*					x	x
Thymelaeaceae	*Pimelea rosea* subsp. *rosea*			x	x	x	x
Apiaceae	*Platysace filiformis*					x	x
Asteraceae	*Podolepis gardneri*				x		
Asteraceae	*Podolepis gracilis*	Slender Podolepis		x		x	x
Asteraceae	*Podotheca angustifolia*	Sticky Longhead				x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Asteraceae	*Podotheca chrysantha*	Yellow Podotheca		x		x	x
Phyllanthaceae	*Poranthera microphylla*	Small Poranthera				x	x
Phyllanthaceae	*Poranthera moorokatta (P2)*						x
Orchidaceae	*Pterostylis recurva*	Jug Orchid				x	x
Orchidaceae	*Pterostylis sanguinea*			x	?		
Orchidaceae	*Pterostylis* sp.					x	x
Amaranthaceae	*Ptilotus manglesii*	Pom Poms			x		
Fabaceae	*Pultenaea reticulata*					x	x
Orchidaceae	*Pyrorchis nigricans*	Red Beak Orchid		x		x	x
Asteraceae	*Rhodanthe citrina*					x	x
Asteraceae	*Rhodanthe floribunda*			x	x		
Poaceae	*Rytidosperma occidentale*					x	x
Goodeniaceae	*Scaevola canescens*	Grey Scaevola				x	x
Goodeniaceae	*Scaevola repens*					x	x
Cyperaceae	*Schoenus clandestinus*					x	x
Cyperaceae	*Schoenus curvifolius*			x		x	x
Cyperaceae	*Schoenus efoliatus*					x	x
Myrtaceae	*Scholtzia involucrata*	Spiked Scholtzia		x	?	x	x
Asteraceae	*Siloxerus humifusus*	Procumbent Siloxerus				x	x

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Asparagaceae	*Sowerbaea laxiflora*	Purple Tassels		x	x	x	x
Celastraceae	*Stackhousia monogyna*					x	x
Proteaceae	*Stirlingia latifolia*	Blueboy		x		x	x
Stylidiaceae	*Stylidium androsaceum*			x		x	x
Stylidiaceae	*Stylidium brunonianum*	Pink Fountain Triggerplant				x	x
Stylidiaceae	*Stylidium carnosum*	Fleshy-leaved Triggerplant				x	x
Stylidiaceae	*Stylidium ciliatum*	Golden Triggerplant					x
Stylidiaceae	*Stylidium guttatum*	Dotted Triggerplant		x			
Stylidiaceae	*Stylidium neurophyllum*	Coastal Plain Triggerplant				x	x
Stylidiaceae	*Stylidium piliferum*	Common Butterfly Triggerplant		x	x	x	x
Stylidiaceae	*Stylidium repens*	Matted Triggerplant		x		x	x
Stylidiaceae	*Stylidium scariosum*			x			
Stylidiaceae	*Stylidium schoenoides*	Cow Kicks		x	x	x	x
Ericaceae	*Styphelia conostephioides*						x
Proteaceae	*Synaphea spinulosa*				x	x	x
Proteaceae	*Synaphea spinulosa* subsp. *spinulosa*			x	x		
Orchidaceae	*Thelymitra* sp.			x			
Poaceae	*Thyridolepis multiculmis*	Soft Wanderrie Grass		x			

Family	Species	Common Name	Known Cockatoo Feeding Plant	BS 2008	BS 2015	NAC 2018	NAC 2020
Asparagaceae	*Thysanotus manglesianus*	Fringed Lily				x	x
Asparagaceae	*Thysanotus patersonii*			x	x	x	x
Asparagaceae	*Thysanotus sparteus*						x
Asparagaceae	*Thysanotus sparteus*			x		x	x
Apiaceae	*Trachymene pilosa*	Native Parsnip		x	x	x	x
Hemerocallidaceae	*Tricoryne tenella*				x	x	x
Campanulaceae	*Wahlenbergia preissii*					x	x
Asteraceae	*Waitzia suaveolens* var. *suaveolens*					x	x
Xanthorrhoeaceae	*Xanthorrhoea brunonis*					x	x
Xanthorrhoeaceae	*Xanthorrhoea preissii*	Grass Tree	Y	x	x	x	x
Apiaceae	*Xanthosia huegelii*					x	x
Proteaceae	*Xylomelum occidentalis*	Woody Pear			x	x	x

Appendix 6: Additional Quadrata Data

Quadrat No.: 10
Survey Date: 6/10/2020
Personnel: SH, LC
Latitude: -32.252091
Longitude: 115.863404
Location: Lot 123 Mortimer Rd
Topography: Upper Slope
Aspect: SW
Slope: 1-3%
Soil: Grey sand
Rock: 0%
Leaf Litter: 0%
Bare Ground: 5%
Drainage: Well
Condition: Excellent

Notes: Banksia Woodland SCP 21a

Native Species	Cover (%)	Height (m)
Acacia applanata	0.1	0.1
Acacia huegelii	0.5	0.3
Amphipogon turbinatus	25	0.4
Anigozanthos humilis	0.1	0.1
Astroloma pallidum	0.5	0.1
Austrostipa compressa	0.1	0.1
Banksia attenuata	2.5	3
Banksia menziesii	7	4
Bossiaea eriocarpa	0.5	0.3
Burchardia congesta	0.5	0.3
Calytrix flavescens	1	0.3
Chamaescilla corymbosa	0.1	0.1
Conostephium pendulum	3	0.1
Conostylis aculeata	1	0.2
Conostylis setigera	0.5	0.1
Dampiera linearis	0.1	0.2

Native Species	Cover (%)	Height (m)
Desmocladus flexuosus	1	0.1
Drosera erythrorhiza	0.1	0.1
Gompholobium tomentosum	2	0.3
Hibbertia hypericoides	8	0.5
Hibbertia racemosa	0.1	0.1
Hybanthus calycinus	0.1	0.2
Laxmannia squarrosa	0.1	0.1
Levenhookia stipitata	0.1	0.1
Lomandra hermaphrodita	0.5	0.2
Lomandra preissii	0.1	0.3
Lomandra suaveolens	0.5	0.2
Lyginia imberbis	0.5	0.5
Mesomelaena pseudostygia	12	0.5
Patersonia occidentalis	5	0.5
Petrophile linearis	2.5	0.2
Phyllangium paradoxum	0.1	0.1
Rytidosperma occidentale	0.1	1
Schoenus clandestinus	0.1	0.1
Schoenus curvifolius	0.1	0.3
Siloxerus humifusus	0.1	0.1
Stylidium ciliatum	0.1	0.1
Stylidium neurophyllum	0.1	0.1
Stylidium repens	1	0.1

Quadrat No.: 11
Survey Date: 6/10/2020
Personnel: SH, LC
Latitude: -32.247045
Longitude: 115.863904
Location: Lot 123 Mortimer Rd
Topography: Lower Slope
Aspect: NE
Slope: 1-3%
Soil: Grey sand
Rock: 0%
Leaf Litter: 0%
Bare Ground: 2%
Drainage: Well
Condition: Excellent

Notes: Banksia Woodland SCP 23a

Native Species	Cover (%)	Height (m)
Allocasuarina fraseri	5	8
Amphipogon turb	1	0.3
Austrostipa hemipogon	0.1	1
Banksia attenuata	10	6
Banksia ilicifolia	0.5	2
Banksia menziesii	8	7
Bossiaea eriocarpa	0.5	0.2
Burchardia congesta	0.1	0.3
Cassytha glabella	0.1	0.3
Chamaescilla corymbosa	0.1	0.1
Conostephium pendulum	0.5	0.5
Conostylis aculeata	0.5	0.2
Conostylis setigera	0.1	0.1
Dampiera linearis	0.1	0.3
Dasypogon bromeliifolius	1	0.1
Desmocladus flexuosus p 336	3	0.1
Drosera erythrorhiza	0.5	0.1
Drosera pallida	0.1	0.3

Native Species	Cover (%)	Height (m)
Gompholobium tomentosum	0.1	0.1
Hibbertia hypericoides	7	0.5
Hovea trisperma	0.1	0.1
Kunzea glabrescens	20	2.5
Lepidosperma sp.	0.5	0.4
Lomandra caespitosa	0.5	0.1
Lomandra hermaphrodita	0.5	0.2
Lomandra preissii	0.1	0.3
Lomandra sericea	0.1	0.3
Lyginia imberbis	0.1	0.4
Macrozamia reidlei	0.5	1
Patersonia occidentalis	3	0.5
Petrophile linearis	0.5	0.3
Pyrorchis nigra	0.1	0.1
Schoenus curvifolius	0.5	0.3
Scholtzia involucrata	1	0.5
Stirlingia latifolia	2.5	0.5
Stylidium pilifera	0.1	0.1
Stylidium repens	0.1	0.1
Styphelia conostephioides	3	0.5
Thysanotus patersonii	0.1	0.1
Trachymene pilosa	0.1	0.1

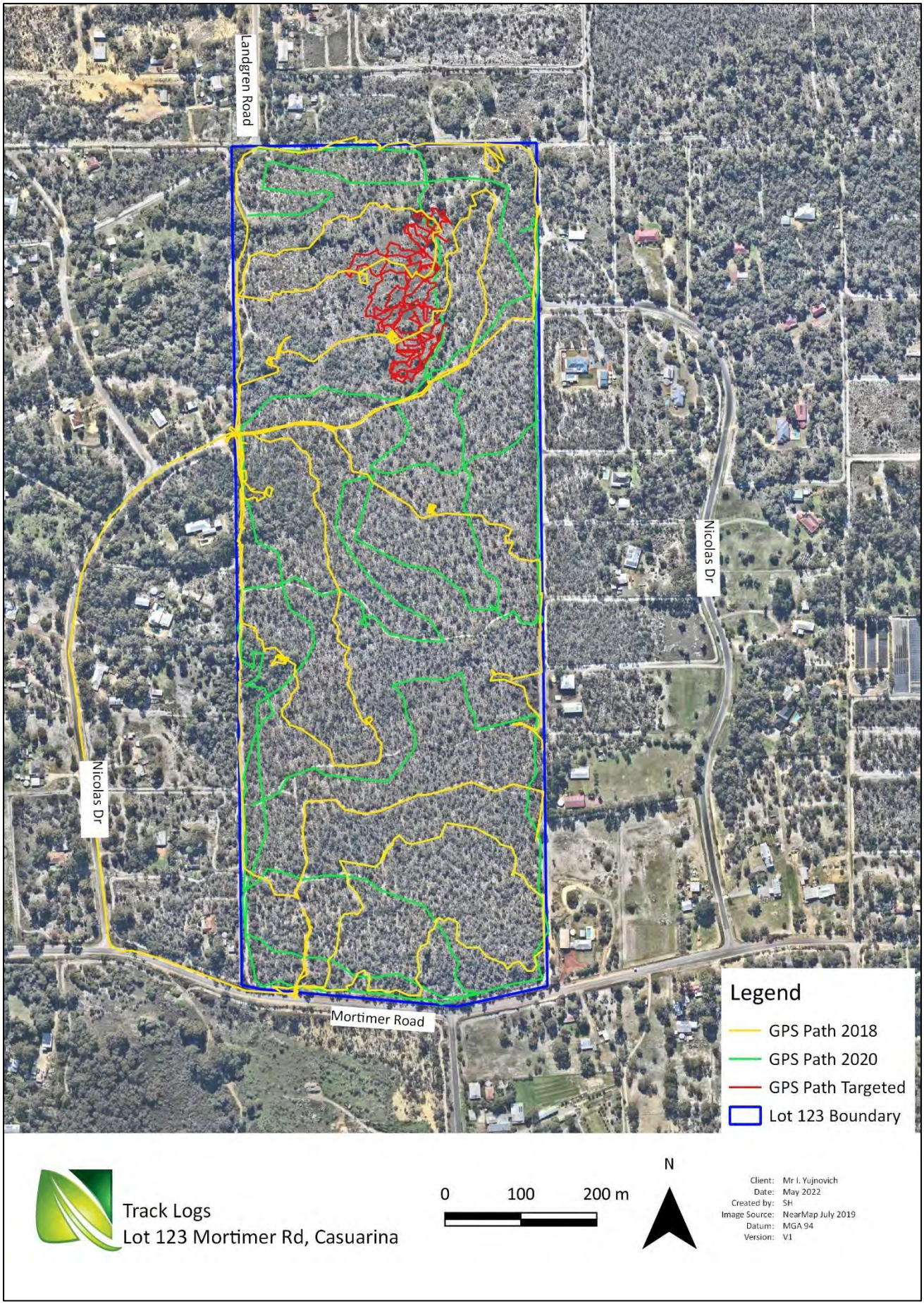
Quadrat No.: 12
Survey Date: 6/10/2020
Personnel: SH, LC
Latitude: -32.254804
Longitude: 115.862761
Location: Lot 123 Mortimer Rd
Topography: Lower Slope
Aspect: NW
Slope: 3-5%
Soil: Brown sand
Rock: 0%
Leaf Litter: 10%
Bare Ground: 10%
Drainage: Well
Condition: Very Good

Notes: Banksia woodland SCP 21a

Native Species	Cover (%)	Height (m)
Acacia huegelii	0.5	0.3
Acacia stenoptera	0.1	0.2
Adenanthos cygnorum	2	2
Allocasuarina fraseriana	0.1	0.3
Anigozanthos humilis	0.1	0.5
Asteridea pulverulenta	0.1	0.2
Austrostipa compressa	0.1	0.5
Banksia attenuata	4	4
Banksia menziesii	3	3
Bossiaea eriocarpa	0.1	0.2
Burchardia congesta	0.1	0.5
Conostephium pendulum	0.5	2
Conostylis aculeata	0.5	0.3
Corynotheca micrantha	0.1	0.2
Dampiera linearis	0.5	0.2
Desmocladus flexuosus	1.5	0.1
Drosera pallida	0.1	0.1
Eucalyptus marginata	20	30

Native Species	Cover (%)	Height (m)
Gompholobium tomentosum	0.5	0.3
Haemodorum paniculatum	0.1	0.1
Hemiandra pungens	0.5	0.1
Hibbertia hypericoides	4	0.5
Isotropis cernua	0.1	0.1
Laxmannia squarrosa	0.5	0.1
Lepidosperma scabrum	0.5	0.6
Lepidosperma sp.	0.5	0.5
Leucopogon conostephioides	2	0.5
Levenhookia stipitata	0.1	0.1
Lomandra hermaphrodita	0.1	0.2
Lyperanthus serratus	0.1	0.4
Macrozamia reidlei	3	1.5
Mesomelaena pseudostygia	3	0.5
Microtis media	0.1	0.1
Paresthesia microphylla	0.5	0.1
Schoenus clandestinus	0.5	0.1
Scholtzia involucrata	5	1.5
Stylidium repens	0.1	0.1
Thysanotus manglesianus	0.1	0.2
Thysanotus sparteus	0.1	0.5
Trachymene pilosa	0.5	0.1
Invasive Species		
**Briza maxima*	1	0.1
**Ehrharta calycina*	3	1
**Gladiolus caryophyllaceus*	0.1	0.3
**Ursinia anthemoides*	1	0.1

Appendix 7: Track Logs


Landgren Road
Nicolas Dr
Nicolas Dr
Mortimer Road
Legend
GPS Path 2018
GPS Path 2020
GPS Path Targeted
Lot 123 Boundary
Track Logs
Lot 123 Mortimer Rd, Casuarina
0
100
200 m
N
Client: Mr I. Yujnovich
Date: May 2022
Created by: SH
Image Source: NearMap July 2019
Datum: MGA 94
Version: V1