Burns Beach Foreshore Reserve Honeymyrtle Shrubland TEC report and Black Cockatoo assessment

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DOCUMENT TRACKING

Project Name	Burns Beach Foreshore Reserve Honeymyrtle Shrubland TEC report and Black Cockatoo assessment
Project Number	24PER8879
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Approved by	**Jeff Cargill**
Status	**Final**
Version Number	**v3**
Last saved on	**10 December 2024**

This report should be cited as 'Eco Logical Australia 2024. *Burns Beach Foreshore Reserve Honeymyrtle Shrubland TEC report and Black Cockatoo assessment*. Prepared for City of Joondalup.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from City of Joondalup.

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Abbreviations

Abbreviation	Description
BAM Act	State *Biosecurity and Agriculture Management Act 2007*
BC Act	State *Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
CLUSTER	Hierarchical Clustering
CR	Critically Endangered
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environment and Conservation
DotEE	Department of the Environment and Energy
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
ELA	Eco Logical Australia
EN	Endangered
EPA	Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Act 1999*
FCT	Floristic Community Type
IBRA	Interim Biogeographical Regionalisation for Australia
MDS	Multi-Dimensional Scaling
P	Priority
PEC	Priority Ecological Community
PRIMER	Plymouth Routines in Multivariate Ecological Research v6
SIMPER	Similarity Percentages
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
VU	Vulnerable
WA	Western Australia
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAOL	Western Australian Organism List
WoNS	Weed of National Significance

Executive Summary

Eco Logical Australia (ELA) was engaged by the City of Joondalup (the City) to undertake a Targeted Honeymyrtle Shrubland Threatened Ecological Community (TEC) assessment and Black Cockatoo habitat assessment of the Burns Beach café development area (herein referred to as the survey area). The survey area is 0.9 ha in size and located on the Burns Beach Foreshore approximately 30 km north of Perth, Western Australia.

A comprehensive desktop assessment was undertaken to assess the potential presence of Black Cockatoos and ecological communities listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), the WA Biodiversity Conservation Act 2016 (BC Act), and by the WA Department of Biodiversity, Conservation and Attractions (DBCA). One conservation significant ecological community, Honeymyrtle Shrubland Limestone TEC (Critically Endangered [CR]) was assessed as having Potential to occur, whilst the Priority Ecological Community (PEC) 'Coastal shrublands on shallow sands' (FCT29a; Priority 3 [P3]) was considered as Likely to occur given that the survey area is covered by the SgSa vegetation community mapped by ELA in 2020, which showed close affiliation with the Gibson *et al.* (1994) FCT29a. A desktop search of the DBCA threatened fauna database identified 521 records of Black Cockatoos within 10 km of the survey area (DBCA 2024b). Searches of the City of Joondalup Black Cockatoo database and Birdlife Australia database of Black Cockatoo roosting and nesting sites identified seven confirmed white-tailed roosts, one confirmed forest red-tailed roost, and three confirmed joint roosts within 12km of the survey area (Birdlife 2024).

The Targeted Honeymyrtle Shrubland TEC assessment and Black Cockatoo habitat assessment was conducted on the 6th of September 2024 in accordance with the EPA *Technical Guidance for Flora and Vegetation* (EPA 2016) and the *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo, and the Forest Red-tailed Black cockatoo* (DAWE 2022). Vegetation communities were described from three quadrats and one relevé established within the survey area. Black cockatoos were surveyed by walking transects across the survey area and mapping black cockatoo habitat.

A total of 39 flora species (15 native and 24 introduced) from 23 families and 34 genera were recorded from three quadrats and one relevé established across the survey area. No Threatened flora species listed under the EPBC Act or BC Act or Priority species listed by DBCA were recorded within the survey area.

A total of 24 introduced (weed) species were recorded within the survey area, representing 61.5% of the total species recorded. All these species are listed on the Western Australian Organism List Database as permitted (s-11) species (DPIRD 2024), indicating that no specific management of these species is required.

One intact vegetation community was delineated and mapped within the survey area, namely MiTdEl. This vegetation type covered 0.7 ha (82.2%) of the survey area. This community was assessed as having floristic affinities to Gibson *et al.* (1994) floristic community type FCT29a, listed as a Priority 3 PEC. In addition to this vegetation community, one highly modified vegetation type was recorded. This included managed gardens of **Casuarina equisetifolia* over a mix of understorey species, commonly **Tetragonia decumbens* and **Arctotis stoechadis.* This modified vegetation type covered 0.1 ha (12%) of the survey

area. The remainder of the survey area comprised of cleared areas. An assessment against the Honeymyrtle Shrubland TEC listed under the EPBC Act found that vegetation within the survey area was not representative of the TEC given that it did not meet the key diagnostic characteristics for the community (DCCEEW 2023). In addition, vegetation within the survey area was not found to align floristically with FCT26a and therefore also does not represent the Honeymyrtle Shrubland TEC listed under the BC Act.

The condition of intact native vegetation in the survey area ranged from Good to Completely Degraded, based on the vegetation condition scale of Keighery (1994) provided in EPA (2016) for the South-West Botanical Province. Most of the areas mapped as intact vegetation were classed as being in Good condition, with modified areas being classed as Completely Degraded. The remainder of the survey area was classed as Cleared. Disturbances in the survey area included tracks, clearing, weeds, housing and roadsides.

Black cockatoo foraging habitat quality within the survey area was assessed as having 'No foraging value' given that no species present in the survey area are listed as Primary or Secondary foraging species for Carnaby's or Forest Red-tailed Black Cockatoos. No potentially suitable breeding trees or roosting trees were recorded in the survey area, with the only tall trees in the survey area being **Casuarina equisetifolia,* not considered to be a suitable breeding or roosting tree.

1. Introduction

1.1 Project background

Eco Logical Australia (ELA) were engaged by the City of Joondalup (the City) to undertake a Targeted Honeymyrtle Shrubland TEC assessment and Black Cockatoo habitat assessment of the Burns Beach café development area (herein referred to as the survey area). The survey area is 0.9 ha in size and located on the Burns Beach Foreshore located approximately 30 km north of Perth, Western Australia (**Figure 1**).

The City plans to clear the survey area for a proposed restaurant development. ELA previously assessed flora and vegetation values within the survey area during ecological surveys of the Iluka-Burns Beach Foreshore (ELA 2021). This assessment builds on the results of that assessment to consider potential impacts to listed Black Cockatoo species and the Honeymyrtle Shrubland TEC. Specifically, the objectives of this assessment include:

- An assessment to verify if the vegetation meets the requirements specified in the Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) 'Approved Conservation Advice (incorporating listing advice) for Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain ecological community', using the four-stage assessment process itemised in the Approved Conservation Advice (Threatened Species Scientific Committee [TSSC] 2016);
- A targeted habitat assessment for Black Cockatoos, including the Carnaby's Cockatoo (*Zanda latirostris;* listed as Endangered [EN] under the EPBC Act and BC Act) and Forest Red-tailed Black Cockatoo (*Zanda banksii naso*; listed as Vulnerable [VU] under the EPBC Act and BC Act).

In addition, ELA has re-assessed the vegetation within the survey area in accordance with the EPA technical guidance (EPA 2016) to provide updated mapping of vegetation communities and condition within the survey area, at a more refined scale for the purposes of the overarching project.

1.2 Scope of works

The purpose of this project was to provide an assessment of the environmental values of the survey area to support the environmental assessment and approval process. This technical report addresses the following items:

- Undertaking an initial desktop assessment to determine environmental values such as flora, vegetation, and ecological communities relating to the survey area;
- Undertaking a field survey to assess values pertaining to flora, vegetation, and black cockatoo habitat values;
- Preparation of a technical flora, vegetation, and black cockatoo habitat survey report for the survey area; and
- Provision of all spatial/mapping data collected during the survey.

Figure 1: Survey area location

Survey Area

N

0 10 20 40

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879-SNC Date: 21/10/2024

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2. Environmental setting

2.1 Geology, landforms, and soils

The Perth Basin, on which the Swan Coastal Plain is located, is filled by Mesozoic to recent sediments. During the Quaternary the present coastal plain was formed by deposition of sediments on an underlying eroded embayment, which reaches east to the Darling Scarp (Beard 1990). Three dune systems run parallel to the present coastline and from west to east (youngest to oldest), namely the Quindalup, Spearwood, and Bassendean systems.

Soil-landscape mapping prepared by the Department of Primary Industries and Regional Development (DPIRD), provides an inventory and condition survey of lands at a 1:250,000 scale (DPIRD 2022). The survey area is located primarily on the Quindalup Dune System, with some minor intersections with the Spearwood Dune System. The Quindalup Dune System is the youngest of the aeolian dune systems associated with the Swan Coastal Plain. It is characterised by unconsolidated white calcareous sands that form a series of dunes and beach-ridge plains (DPIRD 2022). The Spearwood Dune System is comprised of sand overlaying cemented coastal limestone (i.e. Tamala Limestone) (Semeniuk & Glassford 1989). It is characterised by yellow deep sands, pale deep sands, and yellow/brown shallow sands that lay to the east of the Quindalup dune system (DPIRD 2022).

2.2 Regional vegetation

Vegetation type and extent have been mapped at a regional scale by Beard (1979) who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:250,000, DPIRD has compiled a list of vegetation extent and types across Western Australia (DPIRD 2019; Shepherd *et al.* 2002). One system-vegetation association, Spearwood 949, occurs within the survey area (DPIRD 2019). The floristic description of the 949 vegetation association is described as consisting of Acacia spp., Banksia spp., *Agonis flexuosa,* Callitris spp., Allocasuarina spp., and *Eucalyptus loxophleba* Low woodland or open low woodland (Shepherd *et al.* 2002). The 949 vegetation association has 56.45% of its total pre-European extent remaining in the SWA02 subregion (Table 1).

Table 1: Beard's (1979) vegetation associations in the survey area

Vegetation association	Vegetation	Pre-European extent in SWA02 subregion (ha)	Current extent in SWA02 subregion (ha)	% Remaining in SWA02 subregion
949	Low woodland; banksia (*Banksia sp*).	184,476	104,129	56.45

Source: DBCA Statewide Vegetation Statistics (DBCA 2019)

Vegetation within the Perth metropolitan area has been described by Heddle *et al.* (1980) as System 6 vegetation complexes. One vegetation complex occurs within the survey area, namely the Cottesloe Complex – Central and South) (**Table 2**).

Table 2: System 6 vegetation complexes within the survey area

Vegetation complex	System 6 code	Description	Pre-European extent in Swan Coastal Plain (ha)	Current extent in Swan Coastal Plain (ha)	% remaining
Cottesloe – Central and South	52	Mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri); closed heath on the Limestone outcrops.	44,676.1	14,724.6	33.0

Source: DBCA 2018

2.3 Previous vegetation mapping

A total of five vegetation communities were delineated and mapped within the Burns Beach area during surveys conducted by ELA in 2020. Vegetation within the survey area was mapped as part of the SgSa vegetation community, described as *Spyridium globulosum, Santalum acuminatum* tall sparse shrubland over *Olearia axillaris, Myoporum insulare* mid shrubland and *Rhagodia baccata* mid sparse chenopod shrubland over **Tetragona decumbens, Scaevola crassifolia* low open shrubland and *Lepidosperma gladiatum* low open sedgeland (ELA 2021). Vegetation condition within the survey area was mapped as being in Good condition. The SgSa vegetation community showed close affiliation with Gibson *et al.* (1994) Floristic Community Type (FCT) 29a. FCT 29a ('Coastal shrublands on shallow sands') is listed by the Department of Biodiversity, Conservation and Attractions (DBCA) as a Priority 3 ecological community.

3. Methodology

3.1 Desktop review

3.1.1 Database searches

The following databases were searched for information relating to Black Cockatoos and conservation-significant ecological communities (**Table 3**). Applied search buffers used are considered suitable based on ecological communities and fauna expected to occur within the survey area. Additionally, Commonwealth and State government spatial datasets for land system mapping and regional vegetation mapping were reviewed, as described in Sections 2.2 and 2.3.

Table 3: Database searches undertaken for the survey area

Database	Reference	Search area
Commonwealth EPBC Act Protected Matters Search Tool (PMST) for Matters of National Environmental Significance, including any Threatened species listed under the EPBC Act.	DCCEEW 2024	10 km buffer around the survey area
DBCA Database search – Honeymyrtle Shrubland TEC	DBCA 2024a	All known boundaries of Honeymyrtle Shrubland TEC
DBCA Database search – conservation significant fauna	DBCA 2024b	10km buffer around survey area
Birdlife roosting dataset	Birdlife 2024	12 km buffer around survey area
City of Joondalup Black Cockatoo Dataset	City of Joondalup 2024	12 km buffer around survey area

3.1.2 Likelihood of occurrence assessment

An assessment of the likelihood of Threatened and Priority ecological communities present within the survey area was undertaken. The assessment is based on specific likelihood of occurrence criteria. The criteria include factors such as: location and recency of previous records in relation to the survey area; suitable landforms, soils and habitat that appear to be present based on the desktop review and aerial imagery. Conservation codes, categories and criteria for flora, fauna, and ecological communities protected under the EPBC Act and BC Act are provided in **Appendix A**. Criteria used for the likelihood of occurrence assessment are presented in **Appendix B**.

3.2 Field survey

3.2.1 Survey team and timing

The Detailed vegetation survey and Targeted Black Cockatoo habitat assessment was conducted by [redacted] (Senior Ecologist) and [redacted] (Graduate Environmental Consultant) on the 6th of September 2024. Field staff had valid scientific licenses to conduct flora and vegetation surveys and to take Threatened and Priority flora in WA at the time of the survey. The survey timing was consistent with the Environmental Protection Authority (EPA) recommendations for undertaking flora and vegetation surveys in the South-west climatic region (i.e. Spring, September to November; EPA 2016).

Rainfall data from the nearby Wanneroo weather station (station number 9105, located approximately 10 km south-east of the survey areas) recorded a total of 13.2 millimetres (mm) during the flora survey (Bureau of Meteorology [BoM] 2024). In the three months prior to the flora field survey (June – August), a total of 458 mm of rainfall was recorded (BoM 2024). This is greater than the long-term average for the same time period (445.2 mm). Conditions at the time of survey were considered suitable with the majority of flora species in various reproductive stages (e.g. flowering, fruiting), allowing for positive identification of individuals.

3.2.2 Detailed vegetation survey

A single season Detailed vegetation survey was undertaken across the survey area (0.9 ha), in accordance with the EPA *Technical Guidance for Flora and Vegetation* (EPA 2016). Tasks undertaken during the flora and vegetation survey included:

- Compiling a flora species inventory (angiosperm and gymnosperm) of both native and introduced species across the survey area;
- Describing and mapping of vegetation units, including the presence of any TECs/PECs;
- Vegetation condition mapping, adapted from Keighery (1994), including the location of any Weeds of National Significance (WoNS) or Declared Pests listed under the BC Act or by DBCA; and
- Targeted searches for conservation significant flora species listed under the EPBC Act, BC Act, or by DBCA.

The survey involved the use of 10 x 10 m quadrats as recommended for the Swan Coastal Plain bioregion (EPA 2016). Quadrats were not permanently marked. Dominant vegetation communities were described, with respect to dominant species, structure, and overall condition. Photos were taken from the north-western corner of each quadrat. Where relevant, opportunistic sampling of species not recorded within the quadrats was undertaken to supplement the existing list of species recorded from within the survey area.

A total of three quadrats were established across the survey area (**Figure 2**). The following data were recorded within each quadrat:

- Vegetation structure and classes, cover of all species and dominant species list for each vegetation type (in accordance with the National Vegetation Information System (NVIS) Level V structure and floristics);
- Vegetation condition, in accordance with the scale outlined in EPA (2016) adapted from Keighery (1994);

- Full species inventory (angiosperm and gymnosperm) of both native and introduced species across the subject site; and
- Relevant site data including coordinates, site photograph, soil, geology, drainage, slope and any other relevant observational data.

Additionally, one relevé was established in the survey area in a section not considered to represent intact native vegetation (**Figure 2**). Dominant vegetation types were described, with respect to dominant species, structure, and overall condition. The following data was recorded in the relevé:

- Site details (site name, number, observer/s, date and location);
- Photograph from the centre of the relevé;
- Broad vegetation type survey based on an assessment of the dominant flora species for the three traditional strata (upper, mid and ground) and mapping extent; and
- Vegetation condition in accordance with the Keighery (1994) vegetation condition scale, as provided in the EPA Technical Guidance (EPA 2016).

Flora species able to be identified in the field were recorded, and voucher specimens of unfamiliar species were collected for later identification. All collections were assigned a unique collecting number. For conservation-significant flora identified in the field, the following was recorded:

- A colour photograph;
- GPS location;
- Population size estimate;
- Location of population boundaries;
- Associated habitat/landscape element;
- Time and date observed;
- Observer details; and
- A voucher specimen suitable for use as a reference specimen (if appropriate to do so for conservation significant flora).

3.2.3 Flora identification and nomenclature

Flora specimen identification following the field survey was undertaken by taxonomic specialists at the Western Australian Herbarium (WAH). Suitable material that meets WAH specimen lodgement requirements, such as flowering material and range extensions, was submitted along with Threatened and Priority Report forms to DBCA, as required by conditions of collection licences issued under the BC Act.

Nomenclature used for the flora species within this report follows the WA Plant Census as available on FloraBase (WAH 1998-).

Figure 2: Survey effort

Survey Area
Survey tracks

Sample sites
Photo-point
Quadrat

N

0 10 20 40
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879-SNC Date: 10/12/2024

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3.2.4 Flora and vegetation data analysis

3.2.4.1 Flora species accumulation curve

A flora species accumulation curve was undertaken to indicate adequacy of the survey effort (Clarke & Gorley 2015). As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence-based coverage estimator of species richness. When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered adequate.

3.2.4.2 Vegetation communities

Plymouth Routines in Multivariate Ecological Research v7 (PRIMER) statistical analysis software was used to analyse species-by-site data and discriminate survey sites based on their species composition (Clarke & Gorley 2015). To down-weight the relative contributions of quantitatively dominant species, a fourth-root transformation was applied to the species percentage cover dataset. Specimens not identified to species level and singletons (species not recorded at a single quadrat and not forming a dominant structural component) were excluded from the dataset prior to analysis. Computation of similarity matrices was based on the Bray-Curtis measure (Bray & Curtis 1957). Data were analysed using a series of multivariate analysis routines including Similarity Profile, Hierarchical Clustering, and Similarity Percentages. Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities.

3.2.4.3 FCT analysis

Species within the Gibson *et al*. (1994) dataset were updated to align with current names as specified by FloraBase (WAH 1998-). Using current records, several species in the Gibson *et al*. (1994) dataset were shown to be significant range extensions from the Swan Coastal Plain; where appropriate such cases were removed. In addition, excluded and misapplied names were removed from the dataset and infra-specific names were reduced. Data from individual quadrats in the current survey were merged with the updated Gibson *et al*. (1994) dataset. Each merged dataset was analysed using a combination of pre-treatments such as the removal of taxa not identified to species level and singletons. Transformed data were analysed using a combination of multivariate analysis routines including Bray-Curtis Similarity Matrices, Cluster Analysis (single site insertion Flexible Beta) and non-metric Multi-Dimensional Scaling (nMDS).

To identify potential TECs and PECs in the survey area, ELA quadrats and vegetation communities were compared to Floristic Community Types (FCTs) defined by Gibson *et al*. (1994). To identify the presence of FCTs appropriate multivariate analyses comparing current data to that of Gibson et al. (1994) species by quadrat data, and inferences based on dominant species and geomorphology were used. Given the nature of the data (e.g., spatial and temporal differences), results and subsequent extrapolations, assigned FCTs within the survey area were inferred and not absolute, i.e., a vegetation code assigned to an FCT was inferred to comprise, to varying degrees, floristic aspects of that FCT as defined by Gibson et al. (1994). These FCTs were subsequently compared with vegetation communities delineated by ELA.

3.2.4.4 Assessment of diagnostics to assess presence of Threatened Ecological Communities

The Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion (Honeymyrtle Shrubland TEC) was assessed as possible occurring within the survey area. The Honeymyrtle Shrubland

TEC is listed as Critically Endangered (CR) under the EPBC Act (DCCEEW 2023). For information to assist in referral, environmental assessment, and compliance issues, it has been recommended to refer to the Listing Advice and/or Conservation Advice and Recovery Plan on the Commonwealth Species Profile and Threats Database (DCCEEW 2023). The Listing Advice and/or Conservation Advice defines the national ecological community and includes key diagnostic characteristics, condition thresholds, and additional considerations.

To determine whether the Honeymyrtle Shrubland TEC is present in the flora, vegetation, and fauna survey area, key diagnostic characteristics must be met under Section 2.1 of the Conservation Advice (DCCEEW 2023). This includes an assessment of species assemblages, vegetation condition, patch size, and landform. This assessment was undertaken by ELA following the field survey.

3.2.5 Targeted Black Cockatoo Habitat Assessment

A Targeted black cockatoo habitat assessment was conducted in accordance with the *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo, and the Forest Red-tailed Black cockatoo* (DAWE 2022). Consideration was also given to the Survey guidelines for Australia's threatened birds (DEWHA 2010) when designing the survey methodology.

Three species of black cockatoo occur in the south-west of Western Australia:

- Baudin's Cockatoo (*Zanda baudinii*; listed as Endangered [EN] under the EPBC Act and BC Act);
- Carnaby's Cockatoo (*Zanda latirostris*; listed as Endangered [EN] under the EPBC Act and BC Act); and
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*; listed as Vulnerable [VU] under the EPBC Act and BC Act).

Broad scale maps are available for the modelled distribution of all three species of black cockatoo (DAWE 2022). The survey area occurs within the Likely to occur range of the Forest Red-tailed Black Cockatoo and Carnaby's Cockatoo, however is outside of the predicted range of the Baudin's Cockatoo. As such, the survey focused on assessing the habitat values for the Carnaby's and Forest Red-tailed Black Cockatoo. Any individuals of Carnaby's Cockatoo and/or Forest Red-tailed Black Cockatoo observed in the survey area were recorded, including the number of individuals.

The Targeted survey involved personnel walking transects across the survey area and mapping black cockatoo habitat. Black Cockatoo habitat is conventionally separated into foraging, potential breeding, and potential night roosting categories, as defined in **Appendix C**. Foraging, potential breeding and potential roosting habitat was assessed within the survey area. The field methodology for each of these is defined below.

3.2.5.1 Foraging habitat

Foraging habitat is defined for each species of black cockatoo in **Appendix C**. The foraging value (i.e. quality) of vegetation to black cockatoos depends upon several factors including the foraging plant species present, the extent and density (including projected foliage cover) of those foraging species, and the overall structure and condition of foraging species present. In addition, connectivity, proximity to known breeding and roosting sites, and the presence of weeds and/or tree deaths (i.e. disease or drought) is also to be considered.

Vegetation communities and types delineated and mapped within the survey area were assigned a foraging quality (i.e. negligible to low, low to moderate, moderate, moderate to high, or high) based on the criteria outlined in **Appendix D**. The DAWE (2022) foraging quality scoring tool was not used in this assessment given that the vegetated part of the survey area amounts to 0.9 ha, and this tool is only relevant for areas greater than 1 ha.

Evidence of black cockatoo foraging (i.e. branch clippings and/or chewed fruit) was also searched for to identify if the vegetation within the survey area has previously been or is currently being used by black cockatoos for feeding.

3.2.5.2 Potential breeding habitat

Potential breeding habitat is defined in **Appendix C**. Potential nesting trees 'diameter at breast height' (DBH) were recorded in the following ranges:

- Small; approximately 500-600 mm
- Medium; between 600 and 1000 mm
- Large; over 1000 mm.

All potential nesting trees encountered within the black cockatoo survey area were recorded with a GPS (+/- 5-10 m accuracy). Each potential nesting tree was also visually assessed from the ground (i.e., with binoculars) for the presence of suitable nest hollows (defined in **Appendix C**) and allocated a nesting and/or hollow rank

Table 4: Potential breeding trees nest and/or hollow ranking

Rank	Description of tree nest and/or hollows
1	Active nest observed (adult bird seen entering or emerging from hollow, their eggs, fledglings or other evidence of recent nesting activity present); known active nest (as described by Birdlife 2022).
2	Hollow of suitable size and angle (i.e., near-vertical) observed with chew marks around entrance.
3	Potentially suitable hollow observed but no chew marks present.
4	Tree lacking suitable hollows or broken branches that might have large hollows, a tree with mainly intact branches and a spreading crown.

[1]ELA takes a precautionary approach and identifies potentially suitable hollows as those with an entrance diameter over 10 cm that could potentially accommodate Forest Red-tailed Black Cockatoo, which requires a diameter opening range of 12 – 41 cm.

3.2.5.3 Potential roosting habitat

Potential night roosting habitat is defined in **Appendix C**. Potential night roosting habitat was delineated by mapping tall trees in proximity to water (i.e., within 12 km). A 5 m buffer was applied around each of these trees to depict projected foliage cover to estimate potential roosting habitat as hectares.

3.3 Limitations

The EPA Technical Guidance documents (EPA 2016; 2020) recommend including a discussion of the constraints and limitations of the survey methods used. An assessment of potential constraints and limitations of this survey are summarised in **Table 5** below. No survey constraints or limitations were identified.

Table 5: Survey limitations

Constraint	Limitations
Sources of information and availability of contextual information (i.e., pre-existing background versus new material).	**Not a limitation.** The Swan Coastal Plain has been well surveyed, with increasing survey work occurring due to the ongoing urban development of the Perth metropolitan area. Several flora and fauna surveys have been undertaken in the survey area which have been utilised for the purposes of this survey. Gibson *et al.* 1994 was a primary source for determination of methods, analysis and results for assessing FCTs. Broad-scale vegetation mapping at a scale of 1:1,000,000 was available. Land system mapping at a scale of 1:2,000,000 and soil and landform mapping was also available. The information which was available was sufficient and as such sources of information were not considered a major limitation.
Scope (i.e., what life forms, etc., were sampled).	**Not a limitation.** The survey requirement for a Detailed and Targeted flora survey and vegetation condition assessment in accordance with the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) was adequately met. The survey requirement for a Detailed fauna survey in accordance with the EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) was adequately met.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a limitation.** Adequacy of sampling effort was tested via a species accumulation curve; approximately 80% of the flora potentially present within the quadrats in the survey area were recorded. The urban location and stochastic occurrence of weeds (singletons) within the quadrats likely had an influence on the number of taxa recorded. This fact, as well as the seven additional taxa recorded via relevés and opportunistic collections, indicates that the majority of flora species potentially present within the survey area were recorded. The sample effort was considered acceptable.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a limitation.** The survey area was fully covered to meet requirements outlined in the scope of works. Site selection and replication was considered adequate to accurately analyse and discriminate sites based on species composition and subsequently delineate vegetation community boundaries.
Mapping reliability.	**Not a limitation**. Coverage of the survey area was considered to be good. High quality aerial maps were used for both the survey and subsequent vegetation mapping.
Timing, weather, season, cycle.	**Not a limitation**. The survey was undertaken in the appropriate season as specified by the EPA Technical Guidance (EPA 2016, 2020).
Disturbances (fire, flood, accidental human intervention, etc.).	**Not a limitation**. Disturbances within the survey area included weeds, tracks, invasive animals, nearby housing, and roadsides. These disturbances did not negatively impact the ability to meet objectives outlined in the scope of works.
Intensity (in retrospect, was the intensity adequate).	**Not a limitation.** The survey effort was adequately met. The area was searched for conservation significant flora and fauna species by field staff undertaking transects spaced adequately apart across the survey area. This method provides an accurate assessment of habitat characteristics and likelihood of conservation significant species. The number of quadrats established was sufficient to determine the vegetation communities present

Constraint	Limitations
	(including their structurally and compositionally dominant species) and to identify any vegetation of conservation significance.
Resources (i.e., were there adequate resources to complete the survey to the required standard).	**Not a limitation**. The number of personnel conducting this field survey in the given time was adequate to undertake the required level of survey. Additional resources, including equipment available, additional support and personnel were adequate.
Access problems (i.e., ability to access survey area).	**Not a limitation**. All relevant areas within the survey area were able to be accessed and surveyed.
Experience levels (e.g., degree of expertise in plant identification to taxon level).	**Not a limitation**. The personnel conducting this field survey were all suitably qualified to identify specimens, having previously undertaking flora and fauna surveys in the South-west of Western Australia.

The black cockatoo habitat assessment was undertaken in accordance with the Referral guidelines (DAWE 2022). The requirements of DAWE (2022) and detail regarding how the survey meets these requirements, is summarised in Table 6. All requirements are considered to have been met.

Table 6: Summary of survey compliance with black cockatoo referral guidelines

Referral guideline recommendation	Compliant	Justification
Surveys should be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken.	Yes	The ecologist undertaking the black cockatoo habitat assessment, Glenn Harris-Maslen, has five years' experience conducting habitat assessments for black cockatoos.
Survey should maximise the chance of detecting the species' habitat and/or signs of use.	Yes	The survey was undertaken in Spring which aligns with DCCEEW recommendations for undertaking surveys for black cockatoos on the Swan Coastal Plain (i.e., foraging habitat and night roosts – any time of the year; DAWE 2022
Survey should determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km).	Yes	The context of the habitats available within the survey area has been considered at a broader level and are discussed further below.
Survey should account for uncertainty and error (false presence and absences).	N/A	This recommendation refers to individual bird counts where presence/absence data is collected and is not applicable to this type of habitat assessment.
Survey should include collation of existing data on known locations of breeding and feeding birds and night roost locations.	Yes	Data have been obtained from Birdlife roosting and nesting database search (Birdlife 2023) and DBCA Threatened fauna database search (DBCA 2023b).
Survey should assess the extent, type and quality of the vegetation present, including the presence and extent of plants known to be used by the black cockatoos.	Yes	Foraging habitat was delineated and mapped in the field and a list of vegetation present has been compiled (refer to Section 4.3).
In potential breeding habitat, measurements of the diameter at breast height of trees in the patch of woodland/forest must be made to determine	Yes	Potential breeding trees are defined as trees of suitable species with a DBH over 50 cm. Trees were measured for DBH in the field, and where the DBH was over 50 cm, these trees were recorded, and

Referral guideline recommendation	Compliant	Justification
whether the habitat meets the definition of 'breeding habitat'.		signs of use/hollows were observed (refer to Sections below).
Search for signs of use by black cockatoos (e.g. suitable nest hollows, feeding signs or feeding debris, and sighting records).	Yes	The field survey involved walking transects through areas searching for feeding signs. In addition, where hollows were observed, chew marks and other signs of use were searched for using binoculars.

4. Results

4.1 Desktop assessment

A PMST search was undertaken to identify conservation-significant ecological communities recorded within or in proximity to the survey area (DCCEEW 2024; **Appendix E**). The location of known occurrences of the Honeymyrtle Shrubland TEC in proximity to the survey area was reviewed after being received from the City of Joondalup and DBCA (DBCA 2024). In addition, the City of Joondalup Black Cockatoo database and Birdlife Australia database of Black Cockatoo roosting and nesting sites was also queried to identify sites within or near to the survey area (Birdlife 2024).

4.1.1 Conservation significant ecological communities

Areas of the Honeymyrtle Shrubland TEC previously recorded within and in proximity to the survey area are presented in **Figure 3**. The survey area is located in the 'community may occur' range on the SPRAT database, while an area 50 m to the south-east of the survey area is considered likely to contain the Honeymyrtle Shrubland TEC. Given the proximity of this occurrence, the Honeymyrtle Shrubland TEC was considered as having Potential to occur within the survey area prior to the assessment. In addition, the PEC 'Coastal shrublands on shallow sands' (FCT29a) was considered as Likely to occur prior to the survey given that the survey area is located in an area covered by the SgSa vegetation community mapped by ELA in 2020, which showed close affiliation with the Gibson *et al.* (1994) FCT29a. FCT29a is listed by DBCA as a Priority 3 ecological community.

4.1.2 Black cockatoo roosting and nesting records

521 records of Black Cockatoos were identified within 10 km of the survey area as part of the desktop assessment (**Figure 4**). This included 494 records of Carnaby's Cockatoos, 6 records of Forest Red-tailed Black Cockatoos, 3 records of Baudin's Black cockatoos, and 18 records of 'white-tailed black cockatoos' (i.e. not distinguishing between Baudin's and Carnaby's cockatoos). Seven confirmed white-tailed (Carnaby's and/or Baudin's) roosts, one confirmed forest red-tailed roost and three confirmed joint (white-tailed and forest red-tailed) roosts occur within 12 km of the survey area (Birdlife 2024). The closest known confirmed roost occurs 3.4 km to the north-east of the survey area (WANTAMR001). An additional 19 unconfirmed roosts for Black Cockatoos occur within 12 km of the survey area (City of Joondalup 2024). The closest known unconfirmed roost occurs 2.1 km to the south-east of the survey area at Beaumaris Reserve in Ocean Reef (JOOILUR001) (City of Joondalup 2024).

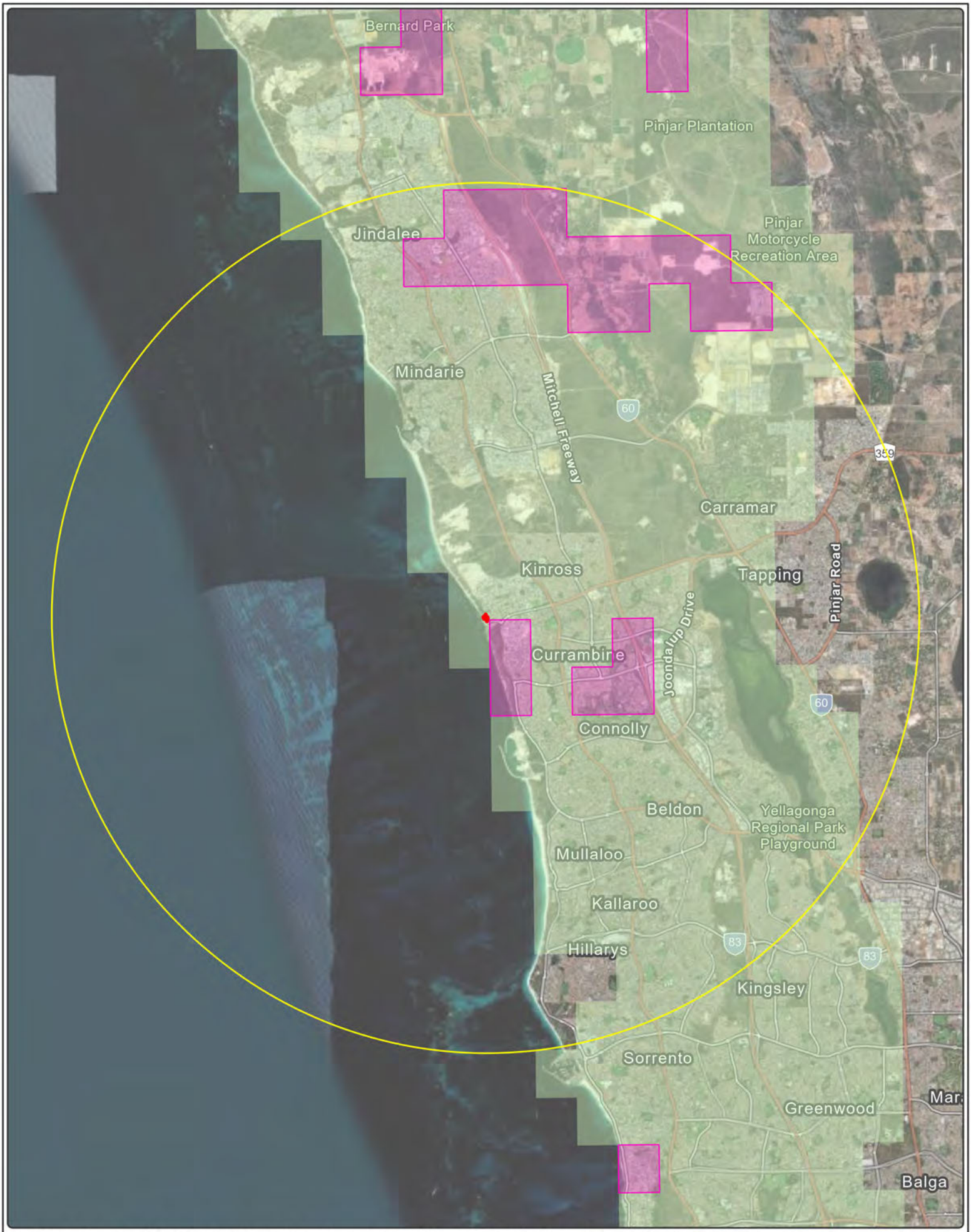

Figure 3: Previously mapped occurrences of Honeymyrtle Shrubland TEC in proximity to the survey area

Survey Area

10km buffer

Honeymyrtle Shrubland TEC

Community likely to occur within area

Community may occur within area

N

0 1 2 4

Kilometers

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879-SNC Date: 10/12/2024

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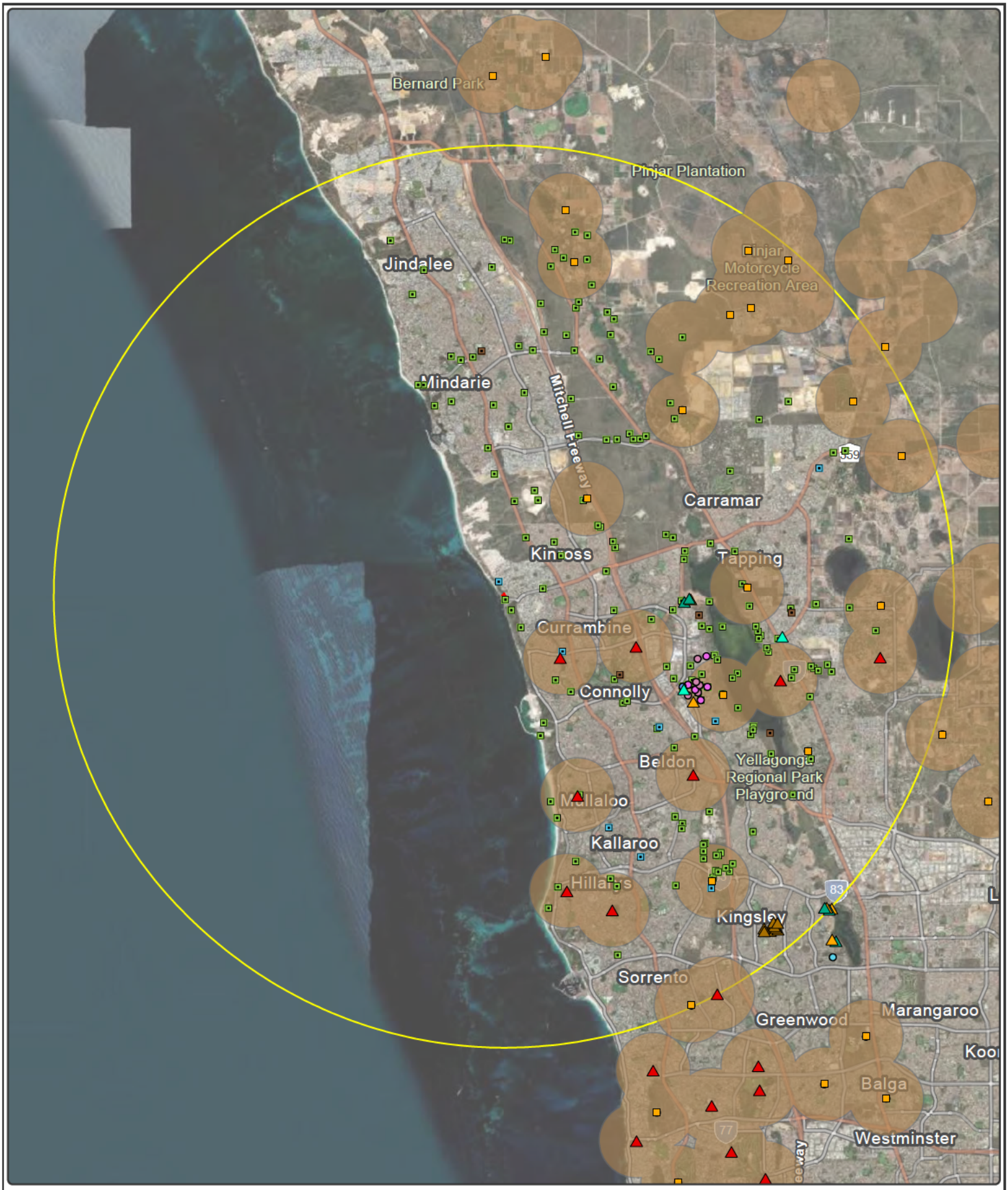

Figure 4: Black cockatoo habitat in proximity to the survey area

- 12km buffer
- Survey Area
- WA Carnaby Cockatoo roost
- Carnaby Cockatoo roosting sites 1km buffer

DBCA Data

- Baudin's cockatoo
- Carnaby's cockatoo
- Forest red-tailed black cockatoo
- White-tailed black cockatoo

CoJ Carnaby Cockatoo sites

- BC Dataset May 2024 DBCA,Confirmed Roost
- Birdlife Data,Confirmed roost
- WTBC Data Set May 2024 DBCA,Confirmed artificial hollow
- BC Dataset May 2024 DBCA,Confirmed Roost (Forest Red Only)
- WTBC Data Set May 2024DBCA,Confirmed artificial hollow
- WTBC Data Set May 2024DBCA,Confirmed natural hollow
- BC Dataset May 2024 DBCA,Unconfirmed Roost
- Eco Logical Data,Unconfirmed roost
- WTBC Data Set May 2024 DBCA,Unconfirmed artificial hollow
- WTBC Data Set May 2024 DBCA,Unconfirmed natural hollow
- WTBC Data Set May 2024DBCA,Unconfirmed artificial hollow

0 1.25 2.5 5
Kilometers

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879- SNC Date: 30/10/2024

N

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4.2 Flora and vegetation survey

4.2.1 Flora overview

A total of 39 flora species (15 native and 24 introduced) from 23 families and 34 genera were recorded from 3 quadrats and one relevé established across the survey area. Average species richness was 22 species, ranging from 19 species in BB02 to 26 species in BB01. The family with the highest number of species was Poaceae (6 species). Acacia was the best represented genus throughout the survey, with two taxa recorded. A full flora list is provided in **Appendix F** and a species by quadrat matrix is provided in **Appendix G**. ELA quadrat site data is provided in **Appendix H**. No flora species listed as Threatened under the EPBC Act or BC Act; or flora listed as Priority by DBCA were recorded within the survey area.

4.2.2 Species accumulation

A species accumulation curve was used to evaluate the adequacy of sampling (Clarke & Gorley 2015). Only species data recorded from defined quadrats were used; no relevé or opportunistic flora collections were included. The asymptotic value was determined using Michaelis Menten modelling. Using this analysis, the incidence-based coverage estimator of species richness was calculated to be 40. Based on this value and the total of 32 species recorded within quadrats, approximately 80% of the flora species potentially present within the survey area were recorded. The urban location and stochastic occurrence of weeds (singletons) within the quadrats likely had an influence of the number of taxa recorded. This fact, as well as the additional seven taxa recorded via relevés and opportunistic collections indicates that the majority of flora species potentially present in the survey area were recorded and the survey effort was therefore sufficient.

4.2.3 Introduced flora

A total of 24 introduced (weed) species were recorded within the survey area, representing 61.5% of the total species recorded. All weed species are listed on the Western Australian Organism List Database as permitted (s-11) species (DPIRD 2024), indicating that no specific management of these species is required.

4.2.4 Vegetation communities

One intact vegetation community – MiTdEl - was delineated and mapped within the survey area, covering 0.7 ha (82.2%) (**Table 7; Figure 5**). The hierarchical clustering dendrogram for this vegetation community is detailed in **Appendix I**. In addition to this vegetation community, one highly modified vegetation type was recorded. This included managed gardens of **Casuarina equisetifolia* over a mix of understorey species, commonly **Tetragonia decumbens* and **Arctotis stoechadis.* This modified vegetation type covered 0.1 ha (12%) of the survey area. Cleared areas covered 0.1 ha (5.9%) of the survey area.

Table 7: Vegetation communities recorded within the survey areas

Vegetation community code	Representative photograph	Vegetation description	Associated species	Quadrats	Extent within the survey area	Proportion of the survey area
MiTdEl		*Myoporum insulare, Olearia axillaris, Rhagodia baccata* Mid Shrubland over **Tetragonia decumbens, Scaevola crassifolia, *Pelargonium capitatum* Low Sparse Shrubland over **Ehrharta longiflora, *Bromus diandrus* Low Sparse Grassland and *Lepidosperma gladiatum* Low Sparse Sedgeland	*Acacia rostellifera, Hardenbergia comptoniana, Spinifex longifolius, Spyridium globulosum, Threlkeldia diffusa, *Arctotis stoechadis, *Brassica tournefortii, *Crassula glomerata, *Galium murale, *Lactuca serriola, *Lysimachia arvensis, *Melilotus indicus, *Sonchus oleraceus, *Stellaria media, *Trachyandra divaricata*	BB01, BB02, BB03	0.7	82.2
-		Managed gardens of planted **Casuarina equisetifolia* over shrubland	**Casuarina equisetifolia, *Metrosideros excelsa, *Tetragonia decumbens, *Arctotis stoechadis, *Atriplex prostrata, *Trifolium campestre, *Poaceae* sp., **Lactuca serriola, *Sonchus oleraceus, Grevillea banksii* x *bipinnatifida*	REL01	0.1	12.0
				Cleared	0.1	5.9
				Total	0.9	100

4.2.5 Conservation significant ecological communities

An analysis of vegetation floristics, structure, and composition was undertaken to identify conservation-significant ecological communities within the survey area. This involved an FCT analysis (Section 4.2.5.1) and an assessment against TEC approved conservation advice documentation (Section 4.2.5.2). Conservation-significant ecological communities that were recorded within the survey area are detailed in **Figure 7**.

4.2.5.1 FCT analysis

To identify potential TECs and PECs in the survey area, ELA quadrats and vegetation communities were compared to FCTs defined by Gibson *et al*. (1994). Results of the analysis are shown in Table 8.

Results of the multivariate analysis showed that quadrats assigned to the MiTdEl community floristically aligned with FCT29a (Gibson *et al.* 1994) (**Table 8**). As such, the inferred FCT type for this community is FCT29a, described as 'coastal shrublands on shallow sands'.

Table 8: Relationships between ELA vegetation communities and FCTs defined by GIbson *et al.* (1994).

Inferred FCT	ELA vegetation community	ELA quadrat numbers	Closest affiliated sites (FCT Gibson *et al.* 1994; Bray-Curtis similarity %)
FCT29a	MiTdEl	BB01	PRES-1 (34.8%), BURN-2 (33.3%)
		BB02	PRES-1 (33.3%), BURN-2 (31.8%)
		BB03	PRES-1 (37.2%)

4.2.5.2 Honeymyrtle Shrubland TEC assessment

Vegetation within the survey area was assessed against the key diagnostic characteristics outlined in the Honeymyrtle Shrubland TEC approved conservation advice (DCCEEW 2023) to determine the presence of the TEC in the survey area. The primary defining features of the Honeymyrtle Shrubland TEC include location, species assemblages, patch size, and condition.

Based on the assessment of the MiTdEl vegetation community against the conservation advice, it was determined that the Honeymyrtle Shrubland TEC was not present within the survey area. This was due to the absence of the three indicator species of the TEC (i.e. *Banksia sessilis, Melaleuca huegelii,* and/or *Melaleuca systena*) and absence of limestone outcropping. The assessment of vegetation against the key diagnostic characteristics for this TEC is presented in Appendix J.

The Honeymyrtle Shrubland TEC is also listed as Critically Endangered under the Western Australian *Biodiversity Conservation Act 2016* (BC Act). The state-listed Honeymyrtle Shrubland TEC is contingent on vegetation being floristically representative of FCT type 26a (Gibson *et al.* 1994). Given that the inferred FCT type for vegetation within the survey area is FCT29a, vegetation within the survey area is not considered to represent the Honeymyrtle Shrubland TEC listed under the BC Act.

4.2.6 Vegetation condition

The condition of vegetation in the survey area ranged from Good to Completely Degraded (**Table 9**; **Figure 6)** based on the vegetation condition scale of Keighery (1994) provided in EPA (2016) for the South West Botanical Province. Most of the intact vegetated part of the survey area was classed as being in Good condition, with modified areas of gardens being classed as Completely Degraded.

Disturbances in the survey area included tracks, clearing, weeds, housing, and roadsides. Cleared areas accounted for 5.9% of the survey area.

Table 9: Vegetation condition recorded in the survey area

Vegetation condition	Extent in the survey area (ha)	Proportion of the survey area (%)
Good	0.7	82.2
Completely Degraded	0.1	12.0
Cleared	0.1	5.9
Total	0.9	100%

4.3 Black cockatoo habitat assessment

Foraging quality for vegetation communities and types within the survey area was assessed as having 'No foraging value' based on the foraging habitat quality criteria depicted in Appendix D, given that no species present in the survey area are considered to be species used for foraging by Black Cockatoos. No potentially suitable breeding trees or roosting trees were recorded in the survey area during the assessment, with the only tall trees in the survey area being **Casuarina equisetifolia,* not considered to be a suitable breeding or roosting tree.

Figure 5: Vegetation communities in the survey area

Survey Area

MiTdEl

Cleared

Vegetation communities

Managed gardens of planted **Casuarina equisetifolia* over shrubland

N

0 10 20 40

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879-SNC Date: 10/12/2024

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Figure 6: Vegetation condition in the survey area

Survey Area

Vegetation condition

- Cleared
- Completely Degraded
- Good

N

0 10 20 40

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879-SNC Date: 10/12/2024

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Figure 7: Conservation significant ecological communities in the survey area

Survey Area

FCT29a Coastal shrublands on shallow sands PEC (P3)

N

0 10 20 40

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

24PER8879-SNC Date: 10/12/2024

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5. Discussion

5.1 Flora and vegetation

Flora species recorded in the survey area were typical of the Swan Coastal Plain IBRA bioregion (WAH 1998-). No flora species listed under the EPBC Act or BC Act, or as Priority by DBCA were recorded within the survey area. Approximately 62% of the total species recorded in the survey area were introduced species, reflective of the location of the survey area in proximity to urban development, which acts as a vector for the spread of weeds. All introduced species are listed on the Western Australian Organism List Database as permitted (s-11) species, indicating that no specific management of these species is required (DPIRD 2024).

One intact vegetation community – MiTdEl - was delineated and mapped within the survey area, covering approximately 80% of the total survey area. This vegetation community was dominated by shrublands consisting mainly of *Myoporum insulare, Olearia axillaris, Rhagodia baccata, *Tetragonia decumbens, Scaevola crassifolia, *Pelargonium capitatum, Acacia rostellifera,* and *Spyridium globulosum.* The floristic assemblage of this vegetation community is typical of coastal environments across the Perth metropolitan area (Beard 1990). Overall, this vegetation community was considered to be in Good condition, due to the presence of weeds throughout the community. The MiTdEl community does not represent the Federally-listed Honeymyrtle Shrubland TEC based on an assessment against the key diagnostic characteristics described by DCCEEW (2023) as it does not contain any of the key indicator species of the TEC and does not occur on skeletal soils of outcrops derived from Tamala limestone. In addition, this community is not considered to represent the State-listed Honeymyrtle Shrubland TEC as it does not align floristically with FCT type 26a (Gibson *et al.* 1994).

Statistical analysis and comparison of the community against the Gibson *et al.* (1994) dataset found that the quadrats within the MiTdEl vegetation community had a moderate affiliation with FCT29a. This community, covering a total of 0.7 ha (82.2% of the survey area) is considered as representing floristic aspects of FCT 29a, 'coastal shrublands on shallow sands'. FCT29a is listed as a Priority Ecological Community (PEC) by DBCA under the 'Priority 3' category. PECs listed as P3 are classified as 'poorly known' but are made up of several known occurrences, known from a few widespread occurrences, or made up of large and/or widespread occurrences (DEC 2013). The coastal vegetation within the survey area was considered to represent FCT29a PEC during previous assessments by ELA (2021).

In addition, one highly modified vegetation type was recorded in the survey area, comprising of managed gardens of **Casuarina equisetifolia* over a mix of understorey species, commonly **Tetragona decumbens* and **Arctotis stoechadis.* This modified vegetation type covered 0.11 ha and was considered to be in Completely Degraded condition.

5.2 Black Cockatoos

No foraging, breeding, or roosting habitat was recorded within the survey area. None of the flora species recorded during the assessment are listed as Primary or Secondary foraging species for Carnaby's Black Cockatoo or Forest Red-tailed Black Cockatoo. As such the vegetation within the survey area is considered to have 'No foraging value' for Black Cockatoos. No tall Eucalypt trees were recorded and as such, there is no breeding or roosting habitat considered to be present in the survey area.

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Appendix A Appendix A Framework for conservation significant flora and fauna ranking

CATEGORIES OF THREATENED SPECIES UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

Category	Definition
Extinct (EX)	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa has not been recorded in its known and/or expected habitat at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	Taxa considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Taxa considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Taxa considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status.
Not Evaluated (NE)	Taxa has not yet been evaluated against the criteria.
Migratory (MI)	Not an IUCN category. Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: • the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; • the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA); • the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or • the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA).

CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Specially protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

Threatened species (T)

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Critically Endangered species	CR	Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
Endangered species	EN	Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.
Vulnerable species	VU	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna)

Category	Code	Description
		Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild, as follows:

Category	Code	Description
Extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
Extinct in the wild species	EW	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

Categories are detailed below.

Category	Code	Description
Migratory species	MI	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Species of special conservation interest (conservation dependent fauna)	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Other specially protected species	OS	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

Priority species (P)

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Definition
Priority 1	P1	Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2	P2	Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3	P3	Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4	P4	Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Appendix B: Likelihood of occurrence assessment criteria

Likelihood rating	Criteria
Recorded	The species has previously been recorded within the survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
Likely	The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met): the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area; core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present; and there is a medium to high probability that a species uses the survey area.
Potential	The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met): targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area; the survey area has been assessed as having potentially suitable habitat through habitat modelling; the species is known to be cryptic and may not have been detected despite extensive surveys; the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys; The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met): doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution); and coordinates are doubtful.
Unlikely	The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded it is unlikely to occur due to few historic record/s and no other current collections in the local area. The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches. The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.
Does not occur (one or more criteria requires to be met).	The species is not known to occur within the IBRA bioregion based on current literature and distribution. The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat. The survey area lacks important habitat for a species that has highly selective habitat requirements. The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.

Appendix C: Black cockatoo habitat definitions

Habitat	Definition
Foraging habitat	Foraging habitat is defined as plant species known to support foraging within the range of each species. The specific foraging requirements differ slightly between the three species as described in DAWE 2022: • **Carnaby's Cockatoo** - mainly feeds in native shrubland, kwongan heathland and woodland. Food items include seeds, flowers and nectar of native proteaceous plant species (i.e. *Banksia* spp., *Hakea* spp., and *Grevillea* spp.), as well as *Callistemon* spp. and marri (*Corymbia calophylla*). Also feeds on the seeds of introduced species including *Pinus* spp., *Erodium* spp., wild radish, canola, almonds, macadamia and pecan nuts; insects and insect larvae; occasionally flesh and juice of apples and persimmons; and liquid amber. • **Baudin's Cockatoo –** mainly feeds in eucalypt woodlands and forest, and proteaceous woodlands and heath. Food items primarily include seeds of marri, rarely jarrah (*Eucalyptus marginata*) and seeds of native proteaceous plant species (e.g. *Banksia* spp. and *Hakea* spp.). Also feeds on insects and insect larvae, pith of kangaroo paw (*Anigozanthos flavidus*); tips of *Pinus* spp.; *Macadamia* spp., almonds and pecans; seeds of apples, pears and persimmons. • **Forest Red-tailed Black Cockatoo** – mainly feeds in jarrah and marri woodlands and forest, and edges of karri forests including wandoo and blackbutt. Food items primarily include seeds of marri and jarrah. Also feeds on *Allocasuarina* cones, fruits of Snottygobble (*Persoonia longifolia*) and Mountain Marri (*Corymbia haematoxylon*). Other less important foods include: Blackbutt, Bullich, *Allocasuarina fraseriana*, *Hakea* spp., Tuart, Redheart Moit (*Eucalyptus decipiens*) and Bushy Yate (*E. lehmanni*). Also, some introduced eucalypts such as river red gum (*E. camaldulensis*) and flooded or rose gum (*E. grandis*).
Night roosting habitat	Habitat that contains one, or a group of, known or potential roosting trees: • **Known roosting tree** - a tree (generally the tallest), native or introduced know to be used for night roosting or which demonstrates evidence of roosting. Usually close to an important water source and within an area of high-quality foraging habitat. During the breeding season, male black cockatoos roost in the vicinity of the nesting trees, therefore a breeding area may also be considered to be night roosting habitat. • **Potential roosting tree** - a tall tree of any species within close proximity to water.
Breeding habitat	Breeding habitat: Habitat that contains known, suitable or potential nesting trees: • **Known nesting trees**: Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers). • **Suitable nesting trees**: Trees with suitable nesting hollows present, although no evidence of use. Note that any species of tree may develop suitable hollows for breeding. • **Suitable nest hollow**: Any hollow with dimensions suitable for use for nesting by black cockatoos (Carnaby's Cockatoo 23-30cm [EPA 2019], Baudin's Cockatoo 30-40 cm [Chapman 2008], Forest Red-tailed Black Cockatoo 12–41 cm [Chapman 2008]). Suitable nest hollows are only found in live trees with a DBH of at least 500 mm. Usually this will be a natural hollow, but artificial hollows may also be suitable in some circumstances (for example, where the artificial hollow has been specifically designed for use by black cockatoos). Note that artificial hollows have only been shown to have value for Carnaby's Cockatoos to date. • **Potential nesting trees**: Trees that have a suitable DBH to develop a nest hollow, but do not currently have hollows. For most species of trees, suitable nest hollows are only found in live trees with a DBH of at least 500 mm. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding.

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Appendix D: Black cockatoo foraging habitat quality criteria

Foraging habitat quality	Carnaby's Cockatoo	Forest Black Cockatoo (Baudin's Cockatoo and Forest Red-tailed Black Cockatoo)
High	• Presence of suitable foraging plant species[1] at a high density (i.e. primary food sources[2] present at >60% PFC[3], secondary food sources[2] present at >70% PFC) and presence of preferred food sources at several strata; • Low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term); and/or • Lower quality foraging habitat based on vegetation characteristics, but with evidence of use (i.e. chewed nuts, cones, seeds or flowers). • Example: Banksia forest >60% PFC and Good or higher vegetation condition with low weed invasion and/or low tree deaths.	• Presence of suitable foraging plant species[1] at a high density (i.e. food sources present at >60% PFC[3]) and presence of preferred food sources at several strata; • Low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term); and/or • Lower quality foraging habitat based on vegetation characteristics, but with evidence of use (i.e. chewed nuts, cones, seeds or flowers). • Example: Marri-Jarrah Forest >60% PFC and Good or higher vegetation condition with low weed invasion and/or low tree deaths.
Moderate to high	• Presence of suitable foraging plant species at a high density (i.e. primary food sources present at 40-60% PFC, secondary food sources at >60% PFC) and presence of preferred food sources at several strata; • Foraging species with >60% PFC but foraging habitat viability reduced due to high weed invasion and/or tree deaths indicating that the vegetation could potentially decline in the medium term due to suppressed regrowth or disease; and/or • Lower quality foraging habitat but with evidence of use (i.e. chewed nuts, cones, seeds or flowers).	• Presence of suitable foraging plant species at a high density (i.e. food sources present at 40-60% PFC) and presence of preferred food sources at several strata; • Foraging species with >60% PFC but foraging habitat viability reduced due to high weed invasion and/or tree deaths indicating that the vegetation could potentially decline in the medium term due to suppressed regrowth or disease; and/or • Lower quality foraging habitat but with evidence of use (i.e. chewed nuts, cones, seeds or flowers).
Moderate	• Presence of suitable foraging plant species at a low to moderate density (i.e. primary food sources present at 20-40% PFC, secondary food sources at 40-60% PFC); • Foraging species with 40-60% PFC but foraging habitat viability reduced due to high weed invasion and/or tree deaths indicating that the vegetation could potentially decline in the medium term due to suppressed regrowth or disease; and/or • Lower quality foraging habitat but with evidence of use (i.e. chewed nuts, cones, seeds or flowers).	• Presence of suitable foraging plant species at a low to moderate density (i.e. food sources present at 20-40% PFC); • Foraging species with 40-60% PFC but foraging habitat viability reduced due to high weed invasion and/or tree deaths indicating that the vegetation could potentially decline in the medium term due to suppressed regrowth or disease; and/or • Lower quality foraging habitat but with evidence of use (i.e. chewed nuts, cones, seeds or flowers).
Low to moderate	• Suitable foraging species present but at a lower density (i.e. primary food sources present at 10-20% PFC, secondary food sources present at 20-40% PFC);	• Suitable foraging species present but at a lower density (i.e. food sources present at 5-20% PFC); • Foraging species with 20-40% projected foliage cover but foraging habitat viability

Foraging habitat quality	Carnaby's Cockatoo	Forest Black Cockatoo (Baudin's Cockatoo and Forest Red-tailed Black Cockatoo)
	• Foraging species with 20-40% projected foliage cover but foraging habitat viability reduced due to high weed invasion and/or tree deaths indicating that the vegetation could potentially decline in the medium term due to suppressed regrowth or disease; and/or • Lower quality foraging habitat but with evidence of use (i.e. chewed nuts, cones, seeds or flowers).	reduced due to high weed invasion and/or tree deaths indicating that the vegetation could potentially decline in the medium term due to suppressed regrowth or disease; and/or • Lower quality foraging habitat but with evidence of use (i.e. chewed nuts, cones, seeds or flowers).
Low	• Suitable foraging species present at a low density (i.e. primary food sources present at <10% PFC, secondary food sources present at 10-20% PFC); and/or • Scattered foraging species or paddocks with known food sources such as melons or weeds that represent a short-term food source.	• Suitable foraging species present at a low density (i.e. food sources present at 1-5% PFC); and/or • Scattered foraging species or paddocks with known food sources such as melons or weeds that represent a short-term food source.
Negligible to low	• Presence of some scattered foraging species but <2% PFC.	• Presence of some scattered foraging species but <1% PFC.
No foraging value	• No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: water bodies, bare ground, developed sites, mown grass.	• No foraging value. No eucalypts or other potential sources of food. Examples: water bodies, bare ground, developed sites.

[1] Based on the list of suitable foraging plants collated from the following sources: DAWE (2022), Groom (2011), Johnstone et al. (2010), Heydenrych (2012) and Lee et al. (2013).

[2] Primary food sources for Carnaby's Cockatoo are defined as those species which are known to provide a regular foraging resource and have been designated as being 'high' priority for planting by the Department of Environment and Conservation (now known as DBCA), where as secondary food items are defined as those species that are only occasionally foraged upon, and which have been assigned as being moderate to low priority for planting by DBCA (Groom 2011).
[3] PFC = projected foliage cover

Note: the general context of the site (i.e., surrounding landscape, connectivity, proximity of species records, proximity of known breeding or roosting sites and any evidence of use) is also taken into consideration when assigning a quality rating.

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Appendix E: PMST database search results

Appendix F: Flora species list

Family	Species name	Status
Aizoaceae	**Carpobrotus edulis*	Permitted – s11
Aizoaceae	**Tetragonia decumbens*	Permitted – s11
Apiaceae	*Daucus glochidiatus*	
Asphodelaceae	**Trachyandra divaricata*	Permitted – s11
Asteraceae	**Arctotis stoechadifolia*	Permitted – s11
Asteraceae	**Lactuca serriola*	Permitted – s11
Asteraceae	**Sonchus oleraceus*	Permitted – s11
Asteraceae	*Olearia axillaris*	
Brassicaceae	**Brassica tournefortii*	Permitted – s11
Caryophyllaceae	**Stellaria media*	Permitted – s11
Casuarinaceae	**Casuarina equisetifolia*	
Chenopodiaceae	**Atriplex prostrata*	Permitted – s11
Chenopodiaceae	*Rhagodia baccata*	
Chenopodiaceae	*Threlkeldia diffusa*	
Crassulaceae	**Crassula glomerata*	Permitted – s11
Cyperaceae	*Lepidosperma gladiatum*	
Euphorbiaceae	**Euphorbia terracina*	Permitted – s11
Fabaceae	**Acacia pycnantha*	Permitted – s11
Fabaceae	*Acacia rostellifera*	
Fabaceae	**Melilotus indicus*	Permitted – s11
Fabaceae	**Trifolium campestre*	Permitted – s11
Fabaceae	*Hardenbergia comptoniana*	
Fabaceae	*Templetonia retusa*	
Geraniaceae	**Pelargonium capitatum*	Permitted – s11
Goodeniaceae	*Scaevola crassifolia*	
Myrtaceae	**Metrosideros excelsa*	Permitted – s11
Oxalidaceae	**Oxalis pes-caprae*	Permitted – s11
Papaveraceae	**Fumaria capreolata*	Permitted – s11
Poaceae	**Bromus diandrus*	Permitted – s11
Poaceae	**Catapodium rigidum*	Permitted – s11
Poaceae	**Ehrharta longiflora*	Permitted – s11
Poaceae	**Lagurus ovatus*	Permitted – s11
Poaceae	*Poaceae* sp.	
Poaceae	*Spinifex longifolius*	

Family	Species name	Status
Primulaceae	**Lysimachia arvensis*	Permitted – s11
Proteaceae	*Grevillea banksii x bipinnatifida*	
Rhamnaceae	*Spyridium globulosum*	
Rubiaceae	**Galium murale*	Permitted – s11
Scrophulariaceae	*Myoporum insulare*	

Appendix G: Species by site matrix

Species	BB01	BB02	BB03
**Arctotis stoechadifolia*	x		
**Brassica tournefortii*	x	x	x
**Bromus diandrus*	x	x	x
**Carpobrotus edulis*			x
**Catapodium rigidum*	x		
**Crassula glomerata*	x	x	x
**Ehrharta longiflora*	x	x	x
**Fumaria capreolata*		x	
**Galium murale*	x		x
**Lactuca serriola*		x	x
**Lagurus ovatus*	x		
**Lysimachia arvensis*	x		x
**Melilotus indicus*	x		x
**Oxalis pes-caprae*	x		
**Pelargonium capitatum*	x	x	x
**Sonchus oleraceus*	x	x	x
**Stellaria media*	x	x	x
**Tetragonia decumbens*	x	x	x
**Trachyandra divaricata*	x	x	
**Trifolium campestre*			x
Daucus glochidiatus	x		
Hardenbergia comptoniana	x	x	
Lepidosperma gladiatum	x	x	x
Myoporum insulare	x	x	x
Olearia axillaris	x	x	
Poaceae sp.	x		
Rhagodia baccata	x	x	x
Scaevola crassifolia	x	x	x
Spinifex longifolius	x		x
Spyridium globulosum	x	x	
Threlkeldia diffusa		x	x

Appendix H: Quadrat data

Site name	Date	Site type	Observer
BB01	06/09/2024	Quadrat 10 x 10m	GM, OS
Vegetation condition	**Disturbance notes**	**Age since fire (years)**	**Vegetation community**
Good	Weeds	Old (>20)	MiTdEl
Habitat description	**Landform unit**	**Aspect**	**Slope %**
Myoporum shrubland	Dune	South	20
Soil colour	**Soil type**	**Rock type**	**Outcropping (%)**
Grey/yellow	Sand	Limestone	0
Easting		**Northing**	
[redacted]		[redacted]	

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-stratum
Myoporum insulare	40	M	Shrubs 1-2m
Spyridium globulosum	5	M	Shrubs 1-2m
**Tetragonia decumbens*	10	M	Shrubs 1-2m
Olearia axillaris	1.5	M	Shrubs <1m
Scaevola crassifolia	1	M	Shrubs <1m
Rhagodia baccata	1	M	Shrubs <1m

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-stratum
Lepidosperma gladiatum	4	M	Sedges
**Ehrharta longiflora*	15	G	Grasses
**Bromus diandrus*	10	G	Grasses
Spinifex longifolius	0.5	G	Grasses
Poaceae sp.	0.5	G	Grasses
**Catapodium rigidum*	0.01	G	Grasses
**Lagurus ovatus*	0.01	G	Grasses
Daucus glochidiatus	0.01	G	Herbs
**Crassula glomerata*	0.2	G	Herbs
**Brassica tournefortii*	0.6	G	Herbs
**Melilotus indicus*	0.01	G	Herbs
**Galium murale*	0.01	G	Herbs
**Pelargonium capitatum*	1.5	G	Herbs
**Stellaria media*	0.01	G	Herbs
**Trachyandra divaricata*	1	G	Herbs
**Arctotis stoechadifolia*	4	G	Herbs
**Sonchus oleraceus*	0.1	G	Herbs
**Oxalis pes-caprae*	0.01	G	Herbs
**Lysimachia arvensis*	0.01	G	Herbs
Hardenbergia comptoniana	0.01	G	Climber

Site name	Date	Site type	Observer
Burns Beach ELA02	06/09/2024	Quadrat 10 x 10m	GM, OS
Vegetation condition	**Disturbance notes**	**Age since fire (years)**	**Vegetation community**
Good	Weeds	Old (>20)	MiTdEl
Habitat description	**Landform unit**	**Aspect**	**Slope %**
Myoporum shrubland	Dune slope into swale	North	15
Soil colour	**Soil type**	**Rock type**	**Outcropping (%)**
Grey/yellow	Fine sand	Limestone	0
Easting		**Northing**	
[redacted]		[redacted]	

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-stratum
Myoporum insulare	50	M	Shrubs 1-2m
Olearia axillaris	2.5	M	Shrubs 1-2 m
Spyridium globulosum	1	M	Shrubs 1-2 m
Scaevola crassifolia	1.5	M	Shrubs <1m
Rhagodia baccata	2	M	Shrubs <1m
**Tetragonia decumbens*	6	M	Shrubs <1m
Lepidosperma gladiatum	5	M	Sedges
**Ehrharta longiflora*	12	G	Grasses
**Bromus diandrus*	0.1	G	Grasses

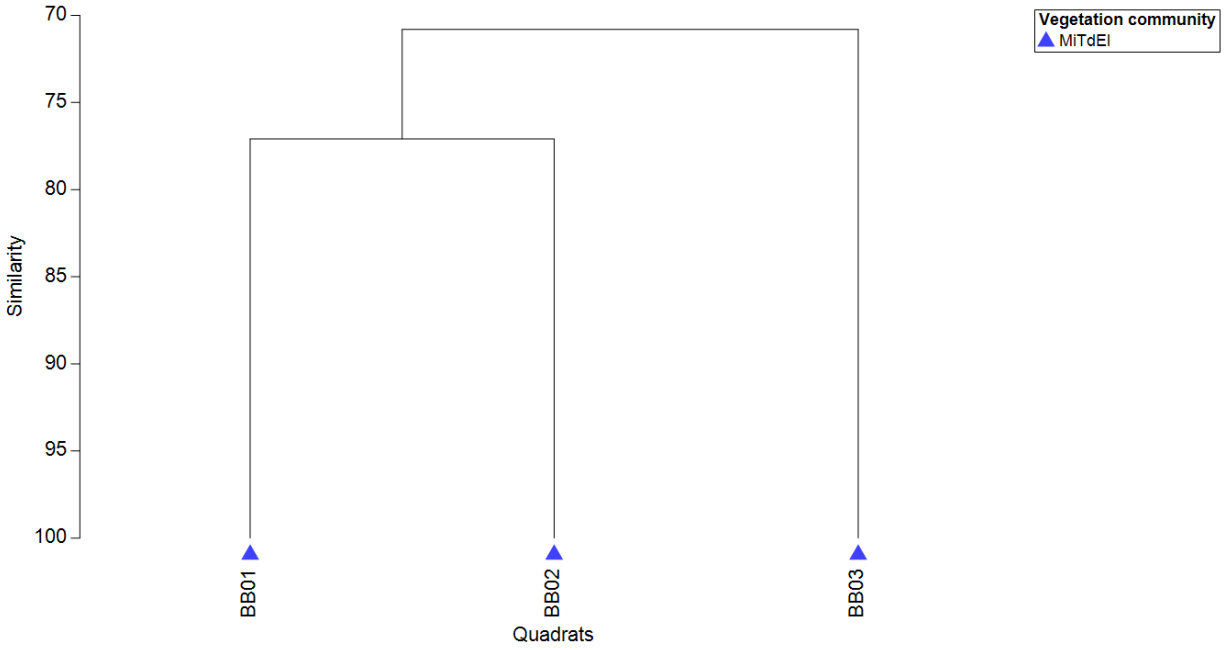
Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-stratum
**Fumaria capreolata*	0.5	G	Herbs
**Crassula glomerata*	0.05	G	Herbs
**Trachyandra divaricate*	0.1	G	Herbs
**Sonchus oleraceus*	0.2	G	Herbs
**Brassica tournefortii*	0.1	G	Herbs
Threlkeldia diffusa	0.5	G	Herbs
**Stellaria media*	0.02	G	Herbs
**Lactuca serriola*	0.1	G	Herbs
**Pelargonium capitatum*	0.2	G	Herbs
Hardenbergia comptoniana	1.2	G	Climber

Site name	Date	Site type	Observer
Burns Beach ELA03	06/09/2024	Quadrat 10 x 10m	GM, OS
Vegetation condition	**Disturbance notes**	**Age since fire (years)**	**Vegetation community**
Good	Weeds, Tracks	Old (>20)	MiTdEl
Habitat description	**Landform unit**	**Aspect**	**Slope %**
Myoporum shrubland	Dune	West	25
Soil colour	**Soil type**	**Rock type**	**Outcropping (%)**
Grey/yellow	Fine sand	Limestone	1
Easting		**Northing**	
[redacted]		[redacted]	

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-stratum
Myoporum insulare	30	M	Shrubs 1-2m
**Tetragonia decumbens*	1.5	M	Shrubs <1m
Rhagodia baccata	5	M	Shrubs <1m
**Carpobrotus edulis*	0.01	M	Shrubs <1m
Scaevola crassifolia	3	M	Shrubs <1m
Lepidosperma gladiatum	20	M	Sedges
Spinifex longifolius	0.1	G	Grasses
**Ehrharta longiflora*	15	G	Grasses
**Bromus diandrus*	3	G	Grasses

Species	Cover (%)	Stratum (U=Upper, M=Middle, G=Ground)	Sub-stratum
**Brassica tournefortii*	0.5	G	Herbs
**Lactuca serriola*	0.1	G	Herbs
**Melilotus indicus*	1.5	G	Herbs
**Trifolium campestre*	0.01	G	Herbs
**Pelargonium capitatum*	7	G	Herbs
**Crassula glomerata*	0.01	G	Herbs
**Sonchus oleraceus*	0.5	G	Herbs
Threlkeldia diffusa	0.5	G	Herbs
**Galium murale*	0.01	G	Herbs
**Stellaria media*	0.01	G	Herbs
**Lysimachia arvensis*	0.02	G	Herbs

Appendix I: Hierarchical clustering dendrogram



Appendix J: Honeymyrtle Shrubland TEC assessment

Key diagnostic characteristics (DCCEEW 2023)	Outcome
Occurs in the Perth subregion of the Swan Coastal Plain IBRA Bioregion in WA.	The survey area is located within the Perth subregion of the Swan Coastal Plain IBRA bioregion in WA and therefore meets this criterion.
Occurs on shallow to skeletal soils on the ridge slopes and tops of limestone ridges and outcrops associated with Tamala Limestone.	The survey area lies on top of deep sands on primary sand dunes, with no outcropping being observed throughout the survey area during the survey. While the survey area does occur over the Spearwood Dune land system (i.e. Tamala Limestone), the soils are not considered to be skeletal soils on ridge slopes or outcrops and therefore the vegetation within the survey area does not meet this criterion.
Occurs as shrubland, heath, or thickets; and has less than 10% canopy cover of *Eucalyptus* species or other tall trees.	The vegetation within the survey area occurs as a closed shrubland with less than 10% canopy cover of *Eucalyptus* species or other tall trees and therefore meets this criterion.
The shrub layer is dominated by *Melaleuca huegelii,* and/or *M. systena* and/or *Banksia sessilis* – commonly over *Acacia laiocarpa, Grevillea preissii,* and *Spyridium globulosum.*	The shrub layer for the MiTdEl does not contain either *M. huegelii, M. systena,* and/or *B. sessilis* and therefore does not meet this criterion.
The ground layer is typically rich with numerous herbs (including grasses) and smaller shrubs may develop a mossy ground cover.	Vegetation within the survey area lies atop deep sand dunes and the ground layer does not consist of numerous herbs or small shrubs developing a mossy ground layer. As such, the vegetation within the survey area does not meet this criterion.
Structure and diversity of Honeymyrtle shrubland may be altered by recent disturbances and cause a shift to a regenerative state. Under these circumstances the loss is likely to be a temporary phenomenon if natural regeneration is not disrupted. Recovering/regenerating areas are still included in the protected ecological community.	Vegetation within the survey area has not been altered by recent disturbances and as such this criterion is not considered applicable for this assessment.
Patch size – the minimum patch size for the community is considered to be 0.01 ha.	Vegetation within the survey area is greater than 0.01 ha in patch size and therefore meets the criterion for this assessment.

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Attachment 3: Pathogen Hygiene Procedure

City of Joondalup

City of Joondalup Staff and Contractors Pathogen Hygiene Procedure

All City staff and contractors are responsible for avoiding the spread of pathogens to protect the natural environment. This procedure is in accordance with the City of Joondalup *Pathogen Management Plan* and applies to City parks, urban landscaping areas and natural areas.

Clean-down procedures should be undertaken when conducting

- Works that disturb soil
- Tree pruning

Clean-down procedures consist of the following steps

1. Before entering the site, clean footwear, clothing, tools, equipment and vehicle to remove all soil and plant materials.
2. Conduct site activities.
3. Brush-down footwear, clothing, tools, equipment and vehicles within the site compound area or in the immediate vicinity of construction works to remove all soil and plant materials.
4. Exit the site.

Note: A vehicle washdown bay is available for use at the City of Joondalup Works Operation Centre. Contact your City representative for access.

General pathogen hygiene principles for on-site activities:

Parks and Urban Landscaping Areas

- In pathogen identified areas, avoid pruning trees during wet conditions where possible.
- Avoid damaging the trunk of trees when mowing or trimming.
- When walking on site, remain on paths and avoid bushland or vegetated areas where possible and/or practical.
- If accessing site with a vehicle, remain on formalised tracks or areas demarcated for vehicle access.
- Avoid water draining into bushland and vegetated areas.
- Use mulch that is certified pathogen free to the relevant Australian Standard (AS4454) and source plants from nurseries compliant with Nursery Industry Accreditation Scheme Australia (NIASA), where possible.

Natural Areas Bushland

- Works should commence in non-pathogen identified areas first and in known or suspected pathogen identified areas last.
- Avoid conducting works and accessing site in wet conditions, where possible.
- If accessing site with a vehicle, remain on formalised tracks or areas demarcated for vehicle access.
- When walking on site, remain on paths and avoid bushland or vegetated areas where possible and/or practical.
- In pathogen identified area, avoid pruning trees during wet conditions, where possible.
- Minimise water use in bushland and vegetated areas.
- Avoid water draining into bushland and vegetated areas.
- Use mulch that is certified pathogen free to the relevant Australian Standard (AS4454) and source plants from nurseries compliant with Nursery Industry Accreditation Scheme Australia (NIASA), where possible.

For any queries, please contact the Environmental Development Coordinator or email **enviro@joondalup.wa.gov.au**.

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10995 - LAST UPDATED FEBRUARY 2021