



## Ningana Bushland (Bush Forever Site 289) Candidate Offset Site Investigation

Yanchep Railway Extension

Prepared for  
**Public Transport Authority**

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# Contents

<b>Executive summary</b> .....	<b>v</b>
<b>1 Introduction</b> .....	<b>1</b>
<b>2 Desktop Assessment</b> .....	<b>2</b>
2.1 Regional Setting .....	2
2.2 Literature review and database searches .....	2
<b>3 Survey Methodology</b> .....	<b>5</b>
3.1 Survey team, timing and effort.....	5
3.2 Methodology .....	5
3.3 Survey limitations .....	6
<b>4 Results</b> .....	<b>8</b>
4.1 Flora.....	8
4.1.1 Vegetation.....	8
4.1.2 Condition.....	14
4.1.3 Conservation significant ecological communities .....	14
4.2 Fauna.....	18
4.2.1 Fauna habitats .....	18
4.2.2 Conservation significant fauna .....	20
<b>5 Conclusions and Recommendations</b> .....	<b>20</b>
<b>References</b> .....	<b>21</b>
<b>Appendix A Evidence of foraging by Carnaby’s Black Cockatoo</b> .....	<b>23</b>

## List of figures

Figure 1: Location of the study area.....	4
Figure 2: Vegetation types in the study area.....	13
Figure 3: Vegetation condition in the study area.....	16
Figure 4: Location of potential conservation significant ecological communities within the study area...	17
Figure 5: Fauna habitats in the study area.....	19
Figure 6: Carnaby’s Black Cockatoo habitat within the study area.....	23

## List of tables

Table 1: Limitations of the survey.....	6
Table 2: Vegetation types within the study area .....	9
Table 3: Vegetation condition within the study area.....	14
Table 4: Conservation significant communities that may occur within the study area.....	15
Table 5: Fauna habitats of the study area.....	18
Table 6: Carnaby's Black Cockatoo habitat within the study area .....	21

## Abbreviations

Abbreviation	Description
BF	Bush Forever
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
DotEE	Department of the Environment and Energy
EPA	Environmental Protection Authority
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ELA	Eco Logical Australia
ha	hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre
mm	millimetre
PEC	Priority Ecological Community
PTA	Public Transport Authority
TEC	Threatened Ecological Community
WAPC	Western Australian Planning Commission
WC Act	<i>Wildlife Conservation Act 1950</i>
YRE	Yanchep Rail Extension

# Executive summary

Eco Logical Australia was engaged by the Public Transport Authority to undertake a reconnaissance level field survey of the flora and fauna values of Bush Forever Site 289 ('Ningana Bushland') to support an assessment of its potential value as an offset. The field assessment focused on the portion of BF 289 located at Lot 105 Marmion Avenue.

A desktop review was undertaken to inform the field survey and to identify the likelihood of occurrence of conservation listed flora and fauna species and ecological communities within the study area. The field survey was conducted on 26 and 27 July 2018.

Eight broad vegetation communities were defined and mapped in the study area, namely: *Allocasuarina lehmanniana* subsp. *lehmanniana*, *Spyridium globulosum*, *Banksia sessilis* and *Acacia saligna* sparse shrubland to shrubland; *Spyridium globulosum*, *Acacia saligna*, *Olearia axillaris* and *Acacia cyclops* sparse shrubland; *Eucalyptus gomphocephala* woodland; *Banksia attenuata* open woodland; Planted *Eucalyptus*; *Eucalyptus foecunda* open mallee woodland; Pine plantation and; *Agonis flexuosa*, *Acacia saligna* and *Spyridium globulosum* open shrubland.

Floristic aspects of four significant vegetation communities were qualitatively inferred to occur within the study area, namely: *Banksia* woodlands of the Swan Coastal Plain Threatened Ecological Community (listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999*); *Banksia* dominated woodlands of the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia region Priority Ecological Community (listed as Priority 3 by Department of Biodiversity, Conservation and Attractions); Northern Spearwood shrublands and woodlands ('community type 24') Priority Ecological Community (listed as Priority 3 by Department of Biodiversity, Conservation and Attractions) and; Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain Priority Ecological Community (listed as Priority 3 by Department of Biodiversity, Conservation and Attractions). Further field assessments and statistical analysis would be required to confirm the presence and extent of these communities.

Eight broad fauna habitats were defined and mapped in the study area, namely: *Allocasuarina* shrubland; Limestone ridgeland; *Eucalyptus* woodland; Mixed *Banksia* woodland; Planted *Eucalyptus* woodland; *Eucalyptus foecunda* open mallee woodland; Pine plantation and; Mixed tall shrubland. Values supporting utilisation by Carnaby's Black Cockatoo were observed in the study area including: foraging and roosting habitat; foraging habitat, roosting habitat and; roosting supporting potential breeding habitat. Habitat values potentially supporting utilisation by conservation significant fauna species were recorded, namely: Quenda (reside/forage); Jewelled South West Ctenotus (reside/forage); Black Striped Snake (reside/forage); Peregrine Falcon (forage) and; Western Brush Wallaby (reside/forage).

# 1 Introduction

The Public Transport Authority (PTA) is in the planning stage for the extension of the northern suburbs passenger railway, the Yanchep Rail Extension (YRE) (the project). The proposed alignment will ultimately extend from Butler Railway Station to the proposed Yanchep Railway Station. The YRE project has been referred to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act) in two parts, Part 1: Butler Station to Eglinton Station and Part 2: Eglinton Station to Yanchep Station.

The PTA referred Part 1 of the YRE project to the EPA in February 2018. Part 1 includes the extension of the existing Joondalup railway line by 7.3 kilometres (km) from Butler Station to the suburb of Eglinton in the City of Wanneroo. Part 1 of the YRE project includes the proposal to construct and operate the rail extension and includes two new intermodal transit stations at Alkimos and Eglinton.

Part 2 of the YRE project is yet to be referred to the EPA or the Department of the Environment and Energy (DotEE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and includes the proposal to construct and operate the rail extension, which will include one new intermodal transit station at Yanchep. Part 2 of the YRE project includes approximately 7.2 km of track (beginning north of the proposed Eglinton Station) and a turnback facility to the north of Yanchep Station to allow for the turning and stowage of trains.

Part 2 of the YRE project traverse the northern part of Bush Forever site 289 (herein 'BF 289'), which is also known as Ningana Bushland. The PTA is expecting that impacts to BF 289 will need to be offset as part of the approval under the EP Act.

The PTA engaged Eco Logical Australia (ELA) to undertake a reconnaissance level field survey of the flora and fauna values of BF 289 to support an assessment of its potential value as an offset. The field assessment focused on the portion of BF 289 located at Lot 105 Marmion Avenue (the study area), which is land owned by the Western Australian Planning Commission (WAPC).



## 2 Desktop assessment

The Lot 105 Marmion Avenue study area is located in southern Yanchep, west of Yanchep National Park (**Figure 1**). It is within the 551.5 ha Bush Forever Site 289 (Ningana Bushland, Yanchep/Eglinton) and covers an area of approximately 437.27 ha. Ningana Bushland provides habitat for native flora and fauna species and forms an ecological linkage with Yanchep National Parks to the east. It has been recognised for its regional significance through its designation as Bush Forever Site 289.

### 2.1 Regional setting

The Interim Biogeographic Regionalisation for Australia (IBRA) recognises 89 bioregions (Department of the Environment and Energy [DotEE] 2016). The study area is located in the Swan Coastal Plain bioregion as defined by IBRA. The Swan Coastal Plain bioregion has been further subdivided into two subregions: Dandarragan Plateau (SWA1); and Swan Coastal Plain (SWA2). The study area falls within the Swan Coastal Plain sub-region, which is described by Mitchell et al. (2002) as:

- A low lying coastal plain, mainly covered with woodlands. It is dominated by *Banksia* or Tuart on sandy soils. *Casuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. The climate is Warm Mediterranean. It is composed of colluvial and Aeolian sands, alluvial river flats and coastal limestone.

Vegetation within the Perth metropolitan region has been described by Heddle et al. (1980) as 26 vegetation complexes. The vegetation of the study area crosses two vegetation complexes on the Aeolian Deposits landform, Cottesloe – North and Quindalup. The complexes are described below:

- Cottesloe Complex - North: Predominantly low open forest and low woodland of *Banksia attenuata* – *B. menziesii* – *Eucalyptus todtiana*; closed heath of the Limestone outcrops: and
- Quindalup Complex: Coastal dune complex consisting mainly of two alliances – the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* – *Callitris preissii* and the closed scrub of *Acacia rostellifera*.

### 2.2 Literature review and database searches

The following Commonwealth and State databases were searched for information relating to conservation significant flora, fauna and communities in order to compile and summarise existing data to inform the field survey:

- Commonwealth EPBC Act Protected Matters Search Tool for Threatened Species and Communities listed under the EPBC Act (DotEE 2018);
- Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Museum's NatureMap online flora and fauna database (DBCA 2007-); and
- DBCA's Threatened Flora and Priority Ecological Communities Database searches (provided by PTA).

In addition to the databases listed above, the following reports were also reviewed, as requested by the PTA:

- Yanchep Rail Extension Biological Assessment (GHD 2018a);
- Biological Factors – Additional Information (GHD 2018b);
- Biological Factors – Part 2 (GHD 2018c); and
- Bush Forever Volume 2 (Government of Western Australia 2000).

At the time of report preparation GHD were undertaking additional flora and vegetation surveys within and surrounding the Ningana Bushland development envelope. It is acknowledged that differences in vegetation mapping between the two surveys may occur, given differences in the level, intensity and extent of surveys between the GHD and ELA scopes.



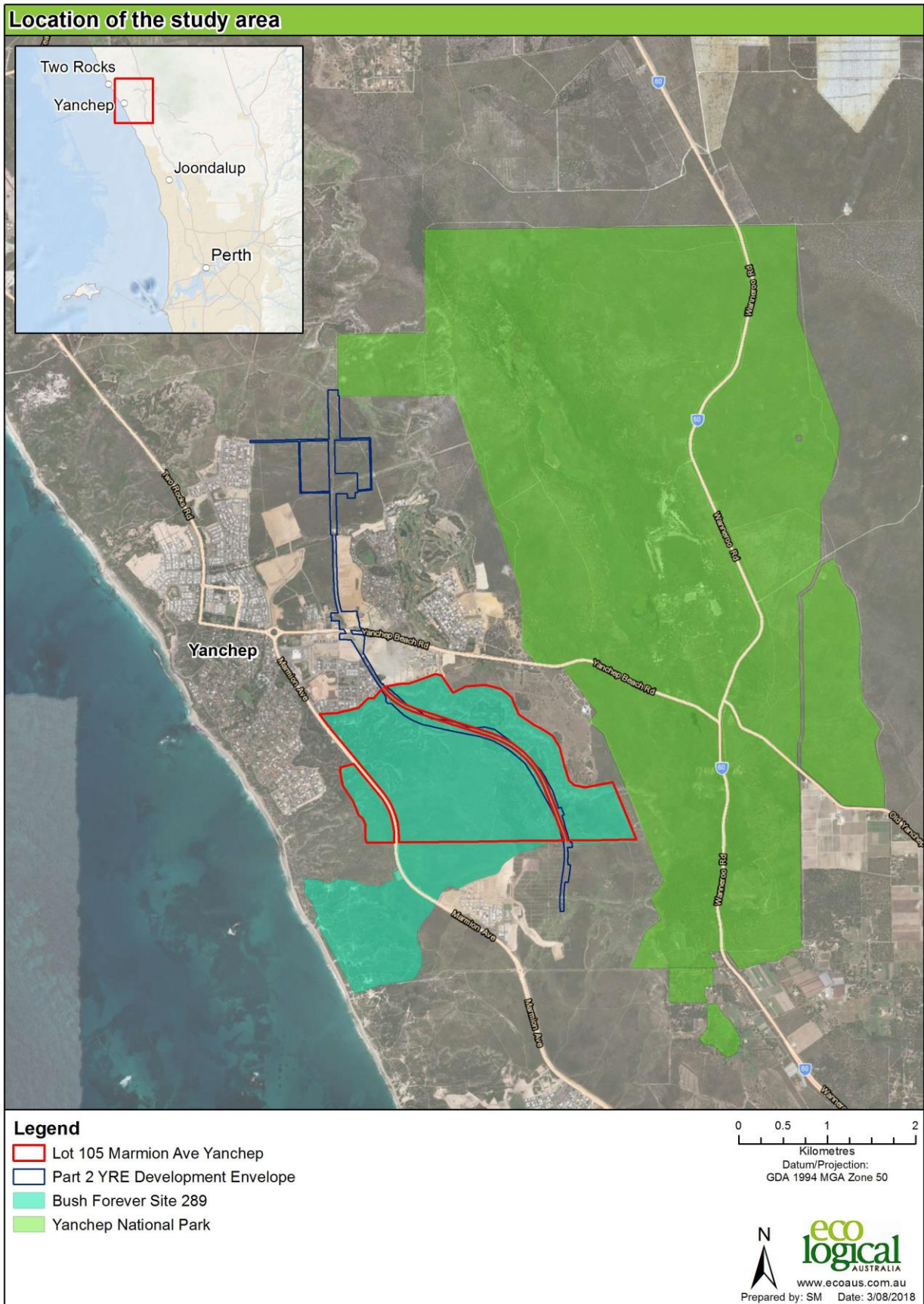


Figure 1: Location of the study area

## 3 Survey methodology

### 3.1 Survey team, timing and effort

The reconnaissance flora, vegetation and fauna field survey were undertaken by Joel Collins (Senior Botanist and Ecology Manager) on the 26<sup>th</sup> and 27<sup>th</sup> July 2018. Joel has over 15 years' experience undertaking surveys on the Swan Coastal Plain and has extensive knowledge of the conservation values of the region. He has a Bachelor of Agribusiness Horticulture (Hons) from the Curtin University of Technology (Muresk Institute). Joel operated under DBCA Scientific licence SL012090.

This survey was conducted outside of the recommended timing for this region (EPA 2016b), with annual species being early in development for some species. However, the timing was sufficient for the purposes of a reconnaissance survey.

### 3.2 Methodology

A desktop review of existing information relating to the study area was undertaken to inform the field survey. More specifically, a review of vegetation types recorded and mapped by GHD across Lot 105 was undertaken and included a qualitative assessment of the vegetation to determine any potential conservation significance (TEC/PECs). Information included, but was not limited to:

- Yanchepp Rail Extension Biological Assessment (GHD 2018a);
- Biological Factors – Additional Information (GHD 2018b);
- Biological Factors – Part 2 (GHD 2018c);
- Bush Forever Volume 2 (Government of Western Australia, 2000);
- DBCA Threatened and Priority Ecological Communities Database Searches (to be provided by PTA) as part of the GHD (2018a) Yanchepp Rail Extension Biological Assessment project;
- Aerial imagery interpretation of Lot 105 and previous mapping;
- Heddle et al. (1980) regional vegetation complexes; and
- DBCA and Western Australian Museum's NatureMap online database for conservation significant flora and fauna species previously recorded within approximate extent within Lot 105.

The reconnaissance level survey sought to verify information obtained from the desktop assessment and assess and characterise broad vegetation types and condition across Lot 105. The survey was undertaken in accordance with the EPA Technical Guide: *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

The field survey involved ground-truthing along accessible tracks across Lot 105 and undertaking transects on foot to assess the relevant values of the study area. Ground-truthing was undertaken in representative areas utilising existing information such as aerial imagery and vegetation type patterning defined by GHD (2018a). Where possible, vegetation boundaries delineated by GHD (2018a) were extrapolated during the current survey to provide a contiguous mapping layer across Lot 105.

Specific aims of the field survey were to:

- Undertake a broad vegetation type assessment based on dominant species for the three traditional strata (upper, mid and ground) and mapping extent;
- Provide a preliminary qualitative assessment of occurrence and approximate extent of potential TEC/PECs;
- Undertake broad vegetation condition mapping (EPA 2016);

- Undertake a preliminary Black Cockatoo habitat assessment to confirm the presence and approximate extent of habitat values (including foraging, breeding and roosting). Observations on breeding/roosting habitat (trees) will be recorded and mapped. Note: individual mapping of suitable DBH tree locations and habitat value scores for all broad vegetation types was not undertaken as part of this scope of works; and
- Undertake a broad habitat assessment for key conservation significant fauna species known to occur in the area, including the presence of any specific habitats (e.g. hollow logs, dense vegetation cover) to support the following species:
  - Chuditch (*Dasyurus geoffroi*)
  - Quenda (*Isoodon obesulus fusciventer*)
  - Jewelled South West Ctenotus (*Ctenotus gemmula*)
  - Black Striped Snake (*Neelaps calonotos*)
  - Rainbow Bee-eater (*Merops ornatus*)

### 3.3 Survey limitations

The EPA *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) recommends including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the reconnaissance flora and Level 1 fauna survey for the study area in **Table 1**.

**Table 1: Limitations of the survey**

Factor	Limitations
Sources of information	Flora, vegetation and fauna surveys have previously been undertaken in the YRE Part 2 development area, which is located within the study area; this information was readily available. Broad-scale vegetation mapping at a scale of 1:100,000 was also available. The information which was available was sufficient and as such sources of information were not considered a major limitation.
Scope of works	The survey requirement of a reconnaissance survey in accordance with relevant EPA and DBCA guidance documentation was met.
Completeness and intensity of survey	The study area was surveyed to the satisfaction of the scope and a Reconnaissance flora and vegetation and Level 1 fauna survey. Mapping notes were undertaken to determine the broad vegetation types and identify the potential presence of any vegetation communities of conservation significance.
Timing, weather, season, cycle	The study area is located on the Swan Coastal Plain. September – November is the recommended survey timing for this region (EPA 2016b), with many species flowering or fruiting allowing them to be readily identified during this time. The survey was conducted in late July, outside of this recommended timing. However, this timing is suitable for the purposes of a reconnaissance flora and vegetation and for the purposes of this assessment. The optimal timing for a Carnaby's Black Cockatoo assessment (DoEE 2017) for foraging habitat and night roosts is January to July; the survey was conducted during this time period.
Disturbances	Disturbances within the study area included clearing of vegetation for tracks, presence of introduced (feral) fauna species, uncontrolled vehicle and motorbike access and dumping of rubbish. Disturbances did not limit the study.

Factor	Limitations
Resources	The personnel who undertook the survey were suitably qualified to identify specimens and conduct this type of survey.
Accessibility	All relevant areas in the study area were easily accessed and surveyed.

## 4 Results

### 4.1 Flora



#### 4.1.1 Vegetation

A total of eight vegetation types were mapped within the study area:



- **AlSgBsAcSSS:** *Allocasuarina lehmanniana* subsp. *lehmanniana*, *Spyridium globulosum*, *Banksia sessilis* and *Acacia saligna* sparse shrubland to shrubland (127.44 ha or 29.14% of the study area);
- **SgAsOaAcSS:** *Spyridium globulosum*, *Acacia saligna*, *Olearia axillaris* and *Acacia cyclops* sparse shrubland (102.11 ha or 23.35% of the study area);
- **EgW:** *Eucalyptus gomphocephala* woodland (91.38 ha or 20.9% of the study area);
- **BaOW:** *Banksia attenuata* open woodland (78.28 ha or 17.90% of the study area);
- **Planted Eucalyptus** (19.11 ha or 4.37% of the study area);
- **EfOM:** *Eucalyptus foecunda* open mallee woodland (11.03 ha or 2.52% of the study area);
- **Pine plantation** (0.72 ha or 0.16% of the study area); and
- **AfAsSgOS:** *Agonis flexuosa*, *Acacia saligna* and *Spyridium globulosum* open shrubland (0.55 ha or 0.12% of the study area).

These vegetation types are described in **Table 2** and mapped in **Figure 2**. The remaining 6.65 ha of the study area (1.52%) was cleared of vegetation.




Table 2: Vegetation types within the study area


Image	Vegetation type	Description	Extent within the study area (ha)	Portion of the study area (%)
	EgW	<p><b><i>Eucalyptus gomphocephala</i> woodland:</b> <i>Eucalyptus gomphocephala</i> tall woodland over <i>Spyridium globulosum</i> and <i>Acacia cyclops</i> shrubland over *<i>Euphorbia terracina</i> sparse forbland over *<i>Ehrharta longifolia</i> spare grassland. <i>Melaleuca huegelii</i> can occur as an open shrubland in the areas along Marmion Avenue. Other common species include <i>Hardenbergia comptoniana</i>, <i>Dianella revoluta</i>, <i>Phyllanthus calycina</i>, <i>Acanthocarpus preissii</i>, <i>Xanthorrhoea preissii</i>, *<i>Trachyandra divaricata</i>, *<i>Asphodelus fistulosus</i>. Occurs in between dunes.</p>	91.38	1.52%
	AISgBsAcSSS	<p><b><i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i>, <i>Spyridium globulosum</i>, <i>Banksia sessilis</i> and <i>Acacia saligna</i> sparse shrubland to shrubland:</b> <i>Allocasuarina lehmanniana</i> subsp. <i>lehmanniana</i>, <i>Spyridium globulosum</i>, <i>Banksia sessilis</i> and <i>Acacia saligna</i> sparse shrubland to shrubland over <i>Melaleuca systema</i>, <i>Leucopogon insularis</i> and <i>L. parviflorus</i> open healthland over <i>Desmocladius flexuosus</i> sparse sedgeland over <i>Lomandra maritima</i> open forbland. Other common species include <i>Rhagodia baccata</i>, <i>Xanthorrhoea preissii</i>, <i>Acacia cyclops</i>, <i>Eremophila glabra</i>, <i>Phyllanthus calycinus</i>, <i>Acanthocarpus preissii</i>, <i>Melaleuca huegelii</i>, <i>Hardenbergia comptoniana</i>, <i>Lepidosperma</i> sp, *<i>Euphorbia terracina</i>, *<i>Pelargonium capitatum</i> and <i>Calothamnus quadrifidus</i>. Occurs on dune slopes and low rises on light brown sand.</p>	127.44	29.14%



	<p>BaOW</p>	<p><b><i>Banksia attenuata</i> open woodland:</b> <i>Banksia attenuata</i> open woodland over <i>Xanthorrhoea preissii</i>, <i>Banksia sessilis</i>, <i>Acacia saligna</i> and <i>Spyridium globulosum</i> open shrubland over <i>Mesomelaena pseudostygia</i> sparse sedgeland. Other common species include <i>Acacia pulchella</i>, <i>Allocasuarina humilis</i>, <i>Olearia axillaris</i>, <i>Hakea trifurcata</i>, <i>Hakea prostrata</i>, <i>Calothamnus quadrifidus</i>, <i>Grevillea preissii</i>, <i>Lomandra maritima</i>, <i>Jacksonia furcellata</i>, *<i>Euphorbia terracina</i>, *<i>Trachyandra divaricata</i>, *<i>Pelargonium capitatum</i> and *<i>Carpobrotus edulis</i>. Occurs on dune slopes and low rises on light brown/grey sand.</p>	<p>78.28</p>	<p>17.90%</p>
	<p>SgAsOaAcSS</p>	<p><b><i>Spyridium globulosum</i>, <i>Acacia saligna</i>, <i>Olearia axillaris</i> and <i>Acacia cyclops</i> sparse shrubland:</b> <i>Spyridium globulosum</i>, <i>Acacia saligna</i>, <i>Olearia axillaris</i> and <i>Acacia cyclops</i> sparse shrubland over <i>Melaleuca systema</i>, <i>Leucopogon parviflorus</i> and <i>Lysinema pentapetalum</i> open heathland over <i>Lomandra maritima</i> open forbland. Other common species include <i>Phyllanthus calycina</i>, <i>Leucopogon parviflorus</i>, <i>Acacia cochlearis</i>, <i>Hybanthus calycinus</i>, <i>Desmocladius flexuosus</i>, <i>Kennedia prostrata</i>, <i>Pimelea rosea</i> and <i>Anthocercis littorea</i>. Occurs on high dunes with limestone outcropping on shallow brown/grey sand.</p>	<p>102.11</p>	<p>23.35%</p>



	AfAsSgOS	<p><b><i>Agonis flexuosa</i>, <i>Acacia saligna</i> and <i>Spyridium globulosum</i> open shrubland:</b> <i>Agonis flexuosa</i>, <i>Acacia saligna</i> and <i>Spyridium globulosum</i> open shrubland over <i>*Ehrharta longiflora</i> open grassland over <i>*Euphorbia terracina</i> open forbland. Occurs on brown sand on bottom of dune and slope.</p>	0.55	0.12%
	Planted Eucalyptus	<p><b>Planted <i>Eucalyptus camaldulensis</i></b></p>	19.11	4.37%
	EfOM	<p><b><i>Eucalyptus foecunda</i> open mallee woodland:</b> <i>Eucalyptus foecunda</i> open mallee woodland over <i>Acacia saligna</i> and <i>Spyridium globulosum</i> sparse shrubland over <i>*Euphorbia terracina</i> sparse forbland</p>	11.03	2.52%

	Pine plantation	* <i>Pinus pinaster</i> plantation	0.72	0.16%
	Cleared	<b>Cleared:</b> No vegetation present	6.65	1.52%
<b>Total</b>			<b>437.27</b>	<b>100%</b>

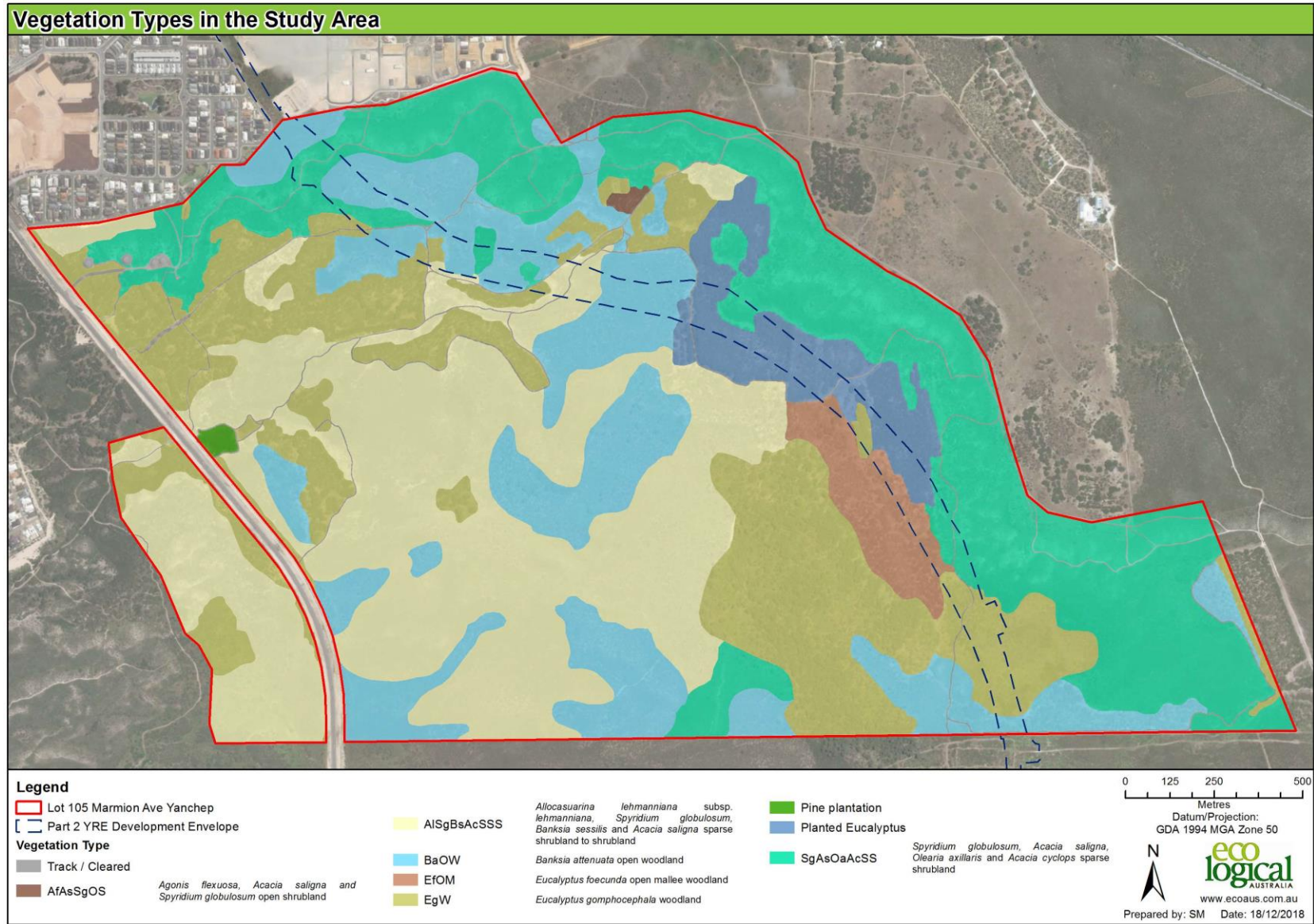


Figure 2: Vegetation types in the study area

#### 4.1.2 Condition

Vegetation condition within the study area ranged from Very Good (240.32.0 ha or 54.96% of the study area) to Completely Degraded (1.34 ha or 0.31% of the study area). The majority of the study area (80.61%) was in Very Good or Good condition. A total of 6.65 ha of the study area (1.52%) was cleared of vegetation.

**Table 3: Vegetation condition within the study area**

Condition	Area (ha)	Portion of the study area (%)
Very Good	240.32	54.96
Good	112.18	25.65
Degraded	76.79	17.56
Completely Degraded	1.34	0.31
Cleared	6.65	1.52
<b>Total</b>	<b>437.27</b>	<b>100.0</b>

#### 4.1.3 Conservation significant ecological communities

Four conservation significant ecological communities may occur within the study area (**Table 4** and **Figure 4**):

- *Banksia* woodlands of the Swan Coastal Plain TEC (listed as Endangered under the EPBC Act);
- *Banksia* dominated woodlands of the Swan Coastal Plain IBRA region PEC (listed as Priority 3 by DBCA);
- Northern Spearwood shrublands and woodlands ('community type 24') PEC (listed as Priority 3 by DBCA); and
- Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain PEC (listed as Priority 3 by DBCA).

*Banksia* dominated woodlands of the Swan Coastal Plain IBRA region PEC and Northern Spearwood shrublands and woodlands ('community type 24') PEC are components (either partially or entirely) of *Banksia* woodlands of the Swan Coastal Plain TEC; thus, have been mapped as co-occurring. Further field assessments and statistical analysis is required to confirm the presence and extent of these Priority Ecological Communities, and subsequently infer floristic composition relative to the broader *Banksia* woodlands of the Swan Coastal Plain TEC.

The Limestone ridges (SCP 26a) TEC (endorsed by the WA Minister for Environment as an Endangered community), described as '*Melaleuca huegelii* – *Melaleuca systema* (now *M. acerosa*) shrublands on limestone ridges (Gibson et al. 1994 type 26a)', is considered unlikely to occur in the study area due to a lack of *Melaleuca huegelii* occurring as part of the structural composition of the vegetation type SgAsOaAcSS occurring on the limestone ridges.

**Table 4: Conservation significant communities that may occur within the study area**

Potential conservation significant communities	Area (ha)
<i>Banksia</i> woodlands of the Swan Coastal Plain TEC / <i>Banksia</i> dominated woodlands of the Swan Coastal Plain IBRA region PEC / Northern Spearwood shrublands and woodlands (SCP24) PEC	78.28
Tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands of the Swan Coastal Plain PEC	91.38
<b>Grand Total</b>	<b>169.67</b>



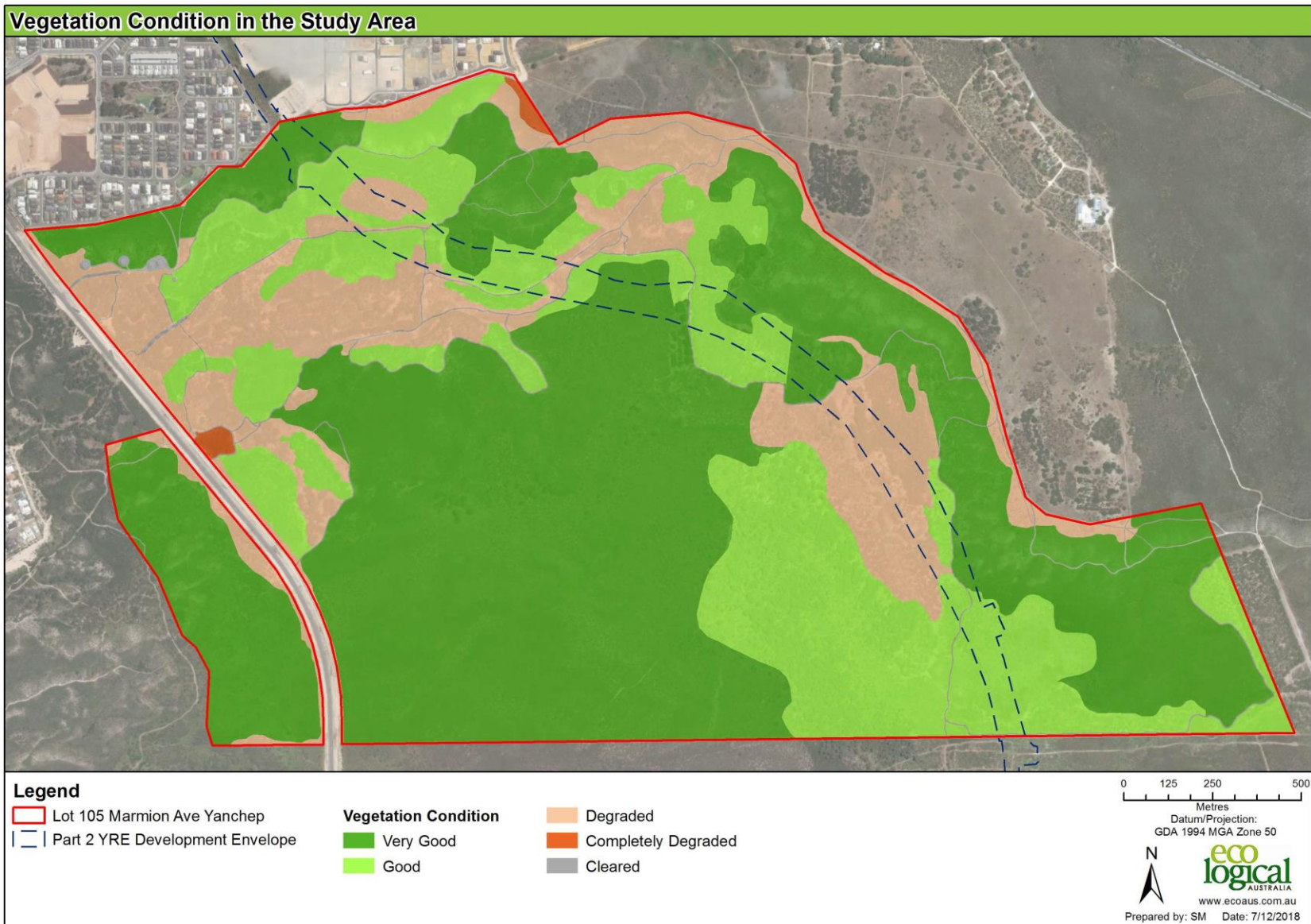


Figure 3: Vegetation condition in the study area

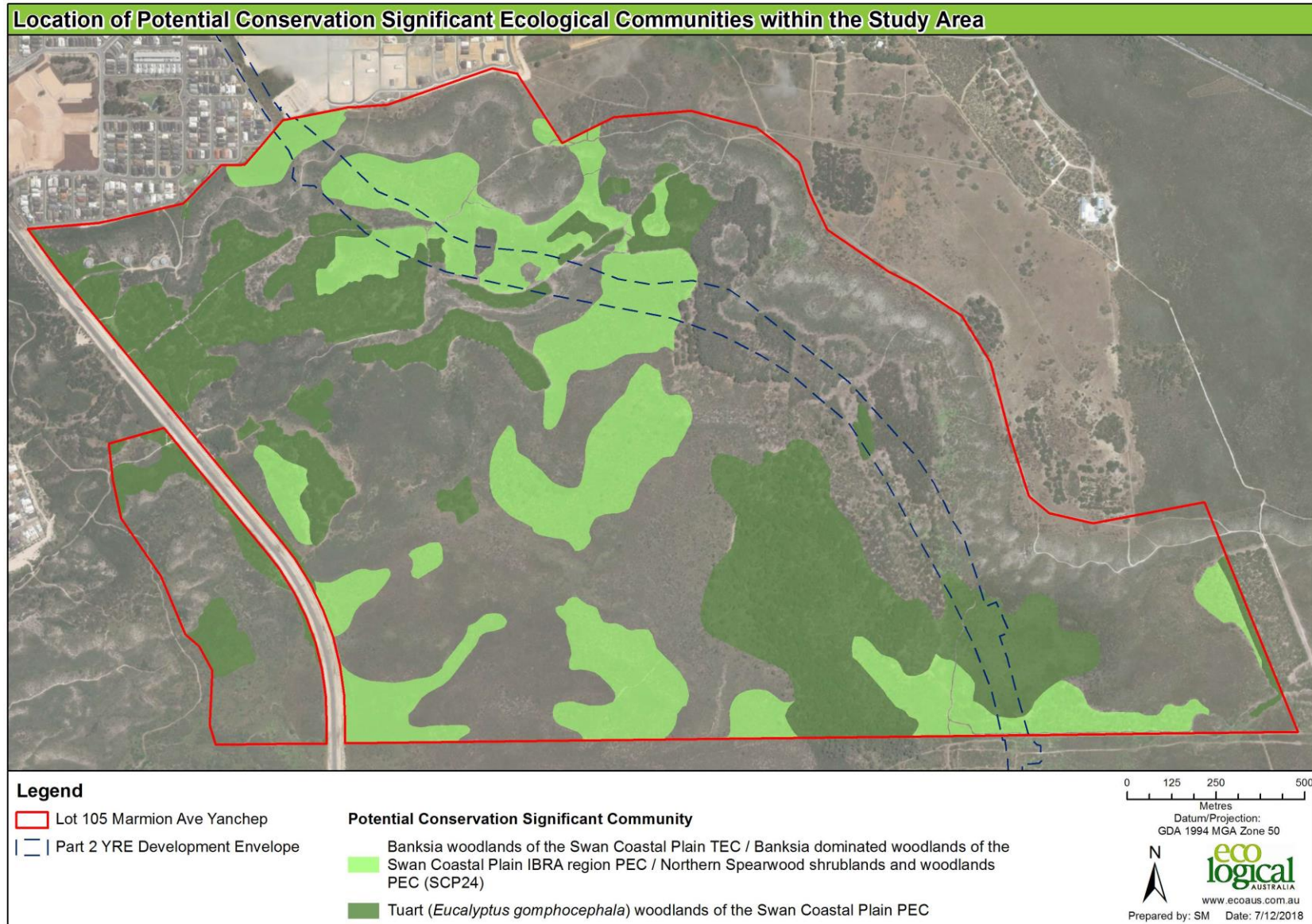


Figure 4: Location of potential conservation significant ecological communities within the study area



## 4.2 Fauna

### 4.2.1 Fauna habitats

A total of eight fauna habitats were recorded from the study area (**Table 5** and **Figure 5**):

- *Allocasuarina* shrubland (127.44 ha or 29.14% of the study area);
- Limestone ridgeland (102.11 ha or 23.35% of the study area);
- *Eucalyptus* woodland (91.38 ha or 20.90% of the study area);
- Mixed Banksia woodland (78.28 ha 17.90% of the study area);
- Planted *Eucalyptus* woodland (19.11 ha or 4.37% of the study area);
- *Eucalyptus foecunda* open mallee woodland (11.13 ha or 2.52% of the study area);
- Pine plantation (0.72 ha or 0.16% of the study area); and
- Mixed tall shrubland (0.55 ha or 0.12% of the study area).

The remaining 6.65 ha within the study area is cleared and considered not to represent fauna habitat. The fauna habitats were based on the habitats described by GHD (2018a), where present.

**Table 5: Fauna habitats of the study area**

Description	Associated vegetation type	Extent within the study area (ha)	Portion of the study area (%)
<i>Allocasuarina</i> shrubland	AlSgBsAcSSS	127.44	29.14
<i>Eucalyptus foecunda</i> open mallee woodland	EfOM	11.03	2.52
<i>Eucalyptus</i> woodland	EgW	91.38	20.9
Limestone ridgeland	SgAsOaAcSS	102.11	23.35
Mixed Banksia woodland	BaOW	78.28	17.90
Mixed tall shrubland	AfAsSgOS	0.55	0.12
Pine plantation	Pine plantation	0.72	0.16
Planted <i>Eucalyptus</i> woodland	Planted <i>Eucalyptus</i>	19.11	4.37
Cleared (no value to fauna)	N/A	6.65	1.52
<b>Total</b>		<b>437.27</b>	<b>100.0</b>

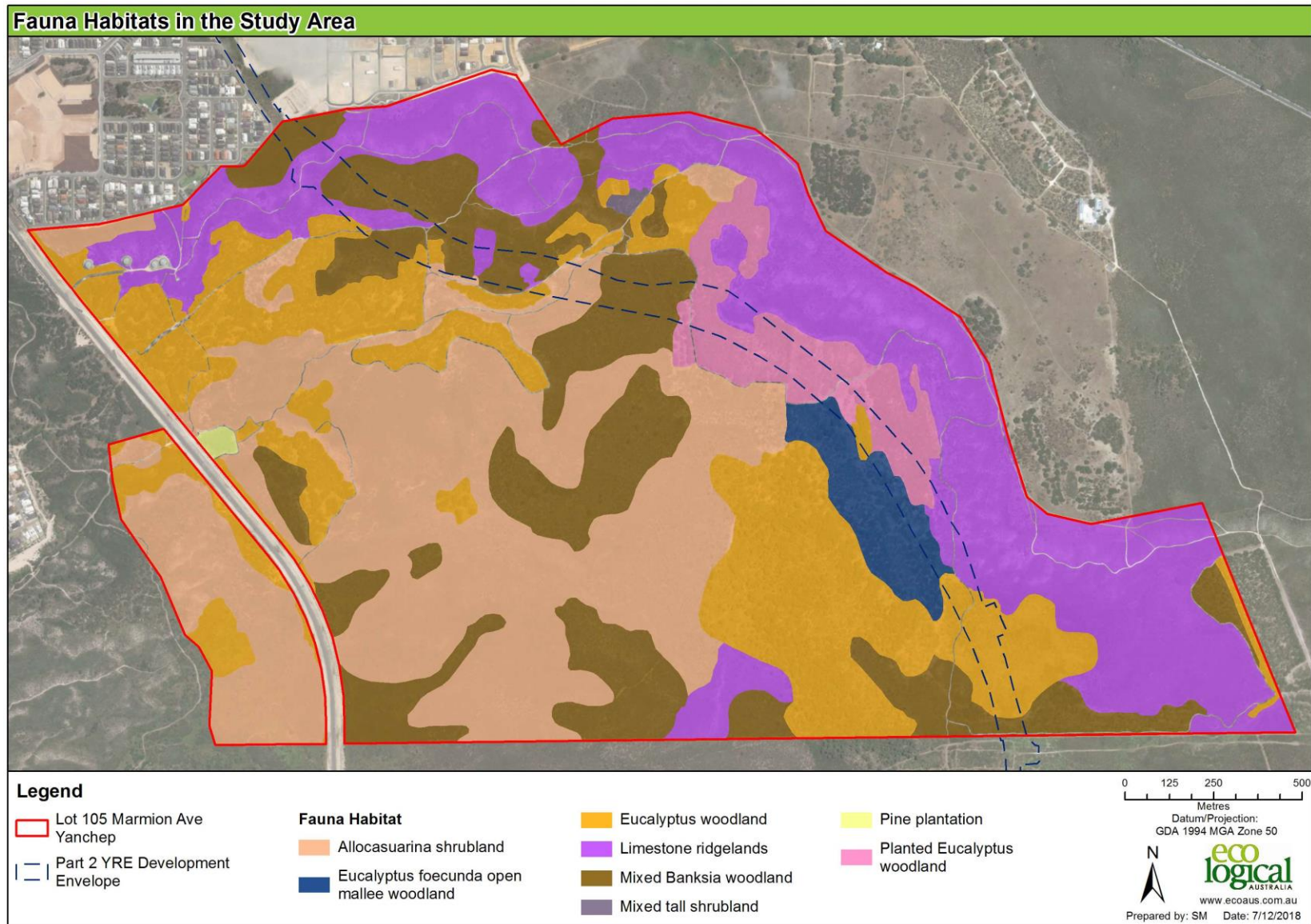


Figure 5: Fauna habitats in the study area

#### 4.2.2 Conservation significant fauna

The scope of works requested a broad habitat assessment for the key conservation significant fauna species known to occur in the study area, including the following species:

- Carnaby's Black Cockatoo (listed Endangered under EPBC Act and WC Act);
- Chuditch (listed Vulnerable under the EPBC Act and DBCA);
- Quenda (listed Priority 4 by DBCA);
- Jewelled South West Ctenotus (listed Priority 3 by DBCA);
- Black Striped Snake (listed Priority 3 by DBCA); and
- Rainbow Bee-eater.

The following two conservation significant species are also considered likely to occur:

- Peregrine Falcon (*Falco peregrinus*; listed as Other specially protected fauna (Schedule 7) under the WC Act); and
- Western Brush Wallaby (*Notamacropus irma*; listed Priority 4 by DBCA).

As of 16 January 2018, the Rainbow Bee-eater is no longer listed under State legislation as Schedule 5: Migratory birds protected under an international agreement. This species was also delisted as Migratory under the EPBC Act on 9 June 2016. Thus, it is no longer considered conservation significant, and is not discussed further in this document.

##### *Carnaby's Black Cockatoo*

Carnaby's Black Cockatoo is endemic to south-west WA with populations extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin. The species is a post-breeding nomad, tending to move west to coastal areas with its young after breeding (late spring to mid-winter), particularly to the Swan Coastal Plain. A small number of birds remain resident on the Swan Coastal Plain all year and have been recorded breeding in a number of areas including Gingin, Yanchep, Mandurah, and Bunbury. Like most cockatoo species, Carnaby's Black Cockatoo is gregarious and is usually seen in small groups and will occasionally congregate in large flocks comprised of hundreds or, exceptionally, thousands of birds. During the breeding season, adults nest as solitary pairs.

Carnaby's Black Cockatoo have been observed feeding on components of 149 plant species (Groom 2011; Lee et al. 2013; Heydenrych 2012; Johnstone et al. 2011). By far the most specious family consumed were the proteaceous plants, with 34 species of *Banksia*, 44 species of *Hakea* and 7 species of *Grevillea* recorded as food items. The majority of the remaining native species consumed were *Eucalyptus* (14 species) or *Corymbia* (3 species) species from the Myrtaceae family (17 species). They have also been recorded feeding extensively on seeds from the cones of exotic pines (*Pinus* spp.; Shah 2006). Pine plantations in the coastal zone are now considered important feeding areas in the non-breeding season (Cale 2003). The study area includes 205.72 ha of vegetation considered foraging habitat (**Table 6** and **Figure 6**). Evidence of foraging was recorded during the field survey on pine and *Banksia* cones (**Appendix A**) and Carnaby's Black Cockatoo were observed flying through the site. Additional foraging species were present across the survey area including Tuart (*Eucalyptus gomphocephala*), Grass tree (*Xanthorrhoea preissii*) and Orange Wattle (*Acacia saligna*); however, these are not considered core foraging species and occurred in vegetation types not suitable for Carnaby's Black Cockatoo.

Carnaby's Black Cockatoo nest in hollows of smooth-barked eucalypts, especially Salmon Gum (*Eucalyptus salmonophloia*) and Wandoo (*Eucalyptus wandoo*), but nests have also been found in other eucalypts, including York Gum (*Eucalyptus loxophleba*), Flooded Gum (*Eucalyptus rudis*), Tuart

(*Eucalyptus gomphocephala*) and the rough-barked Marri (*Corymbia calophylla*). On the Swan Coastal Plain, most nests are in Tuart trees (Johnstone & Storr 1998). Breeding birds forage no more than approximately 20 km from their nesting hollows during the breeding season, and therefore having sufficient foraging and water resources close to breeding areas is critical to their breeding success (Saunders 1980). The study area includes 91.38 ha of vegetation that could be potential breeding habitat (**Table 6** and **Figure 6**), however while some Tuarts had a DBH greater than 500 mm (considered suitable for breeding), these trees lacked observable tree hollows and are considered to require further development over a number of years to start to produce suitable hollows.

Carnaby's Black Cockatoo communally roost in a suitable tree or group of tall trees, usually close to a water source, and within an area of quality foraging habitat. Suitable roosting trees include *Eucalyptus* and *Corymbia* species and introduced pines. The cockatoos fly to feeding areas each day before returning to the night roost (DSEWPaC 2012). However, use of a particular night roost site may vary from daily to weekly. The study area includes 111.22 ha of vegetation considered to be suitable for roosting habitat (**Table 6** and **Figure 6**).

**Table 6: Carnaby's Black Cockatoo habitat within the study area**

Carnaby's Black Cockatoo habitat	Area (ha)	% suitable habitat
Foraging habitat	205.72	64.91
Foraging and roosting habitat	0.72	0.23
Roosting habitat	19.11	6.03
Roosting supporting potential breeding habitat	91.38	28.83
<b>Total</b>	<b>316.94</b>	<b>100.00</b>

#### *Chuditch*

The Chuditch is the largest carnivorous marsupial (family Dasyuridae) occurring in WA; at maturity it is approximately the size of a small domestic cat. This species is found in Jarrah forests and woodlands in the south-west corner of WA, and along the south coast and to the east near Ravensthorpe in woodlands, mallee shrublands and heaths (DEC 2012a).

Chuditch are considered locally extinct on the northern Swan Coastal Plain (DEC 2012a) and would not be considered to occur in the study area. The most recent NatureMap record (within 12 km) is from 1972 and consisted of a skeleton (age not identified). There have been recent sightings of Chuditch in the suburbs of Wandi (2009), Karnup (2010) and Bateman (2016) on the southern Swan Coastal Plain, the closest of which is more than 50 km from the study area.

#### *Quenda*

The Quenda is widely but patchily distributed through south-western WA, from around Guilderton to east of Esperance and inland to Hyden. This species prefers low, dense vegetation such as heath and swampy habitat and is often associated with forests, woodland, shrubland and riparian areas (Department of Environment and Conservation (DEC) 2012b). Its foraging often extends into adjacent, more open grasslands, pastures, or areas subject to regular burning (DEC 2012b). The species is nocturnal and sleeps during the day in a nest of heaped vegetation with a hollow centre. The nest is usually concealed in a depression or amongst dense vegetation or ground litter. Food is located by digging conical holes with the forefeet and probing with the snout, and includes insects and larvae, worms, bulbs, berries and small vertebrates (Menkhorst and Knight 2009).

This species is commonly recorded in suitable habitat across the Swan Coastal Plain. The Quenda would reside and/or utilise (forage) most habitats within the survey area; with *Eucalyptus* woodlands, mixed *Banksia* woodlands and mixed tall shrublands being of highest value.

#### *Jewelled South West Ctenotus*

The Jewelled South-West *Ctenotus* is endemic to Western Australia, and in the Perth Region is restricted to the Swan Coastal Plain. It is known to occur on sandplains supporting heaths in association with *Banksia* or mallee woodlands, where it shelters in leaf litter under trees and shrubs and abandoned stick-ant nests (Bush et al. 2010, Wilson and Swan 2013).

Limited population data has been documented for this species; however, it is reported to be uncommon on the Swan Coastal Plain (Bush et al. 2010). Based on available information, the Jewelled South West *Ctenotus* would reside in and/or utilise mixed *Banksia* woodlands within the survey area.

#### *Black Striped Snake*

The Black-striped Snake occurs on the coastal plain and coastal dune formations supporting low shrublands, heaths, and *Banksia* woodlands between Mandurah and Cataby (Bush et al. 2010). It feeds primarily on burrowing skinks (*Lerista* spp.). It is a seasonal breeder, like most reptiles in the south-west of WA.

Limited information has been documented on this species' ecology; however, it is known to be abundant in many bushland reserves in Perth such as Bold Park (Bush et al. 2010). Based on available information, the Black-striped snake may reside in and utilise mixed *Banksia* woodlands and mixed tall shrublands of the survey area.

#### *Peregrine Falcon*

The Peregrine Falcon is a large bird of prey. NatureMap (Parks and Wildlife 2007-2015) identifies the Peregrine Falcon as occurring throughout WA, from the south near Albany to the north near Kununurra. Whilst considered uncommon, it is widespread across Australia, and occurs across all continents (Parks and Wildlife Service Tasmania (PaWST) 2011). The Peregrine Falcon occupies a variety of habitats including inland cliffs, rocky outcrops and gorges, coastal cliffs and islands, open woodlands near water, and can also be found nesting on ledges of high city buildings (PaWST 2011).

The Peregrine Falcon would utilise several habitats within the survey area for foraging purposes, particularly the structurally more open areas. These would include *Eucalyptus* woodlands, mixed *Banksia* woodlands, mixed tall shrublands, limestone ridgelines and planted *Eucalyptus* woodlands.

#### *Western Brush Wallaby*

The Western Brush Wallaby is found in the south-west coastal region of WA where populations are particularly centralised near the Swan River and the dry sclerophyll Jarrah forests to the east of Perth (Groves 2005). The species is found in some areas of mallee and heathland but is generally uncommon in wet sclerophyll forest further south. It prefers tall open forests that supply adequate grazing and open, seasonally damp flat areas with low grasses and open scrubby brushes that allow it to move freely and speedily.

The Western Brush Wallaby is a crepuscular animal, unlike many macropod species, and is active mainly at dusk and dawn (Menkhorst and Knight 2009). It is herbivorous and feeds on many plant species, in particular on *\*Carpobrotus edulis*, *\*Cynodon dactylon*, and *Nuytsia floribunda*. Western Brush Wallabies are commonly recorded around the Swan Coastal Plain in suitable habitat. Western Brush Wallabies would utilise all habitats to varying degrees within the survey area, with *Banksia* and *Eucalyptus* woodlands providing highest value for foraging and shelter.



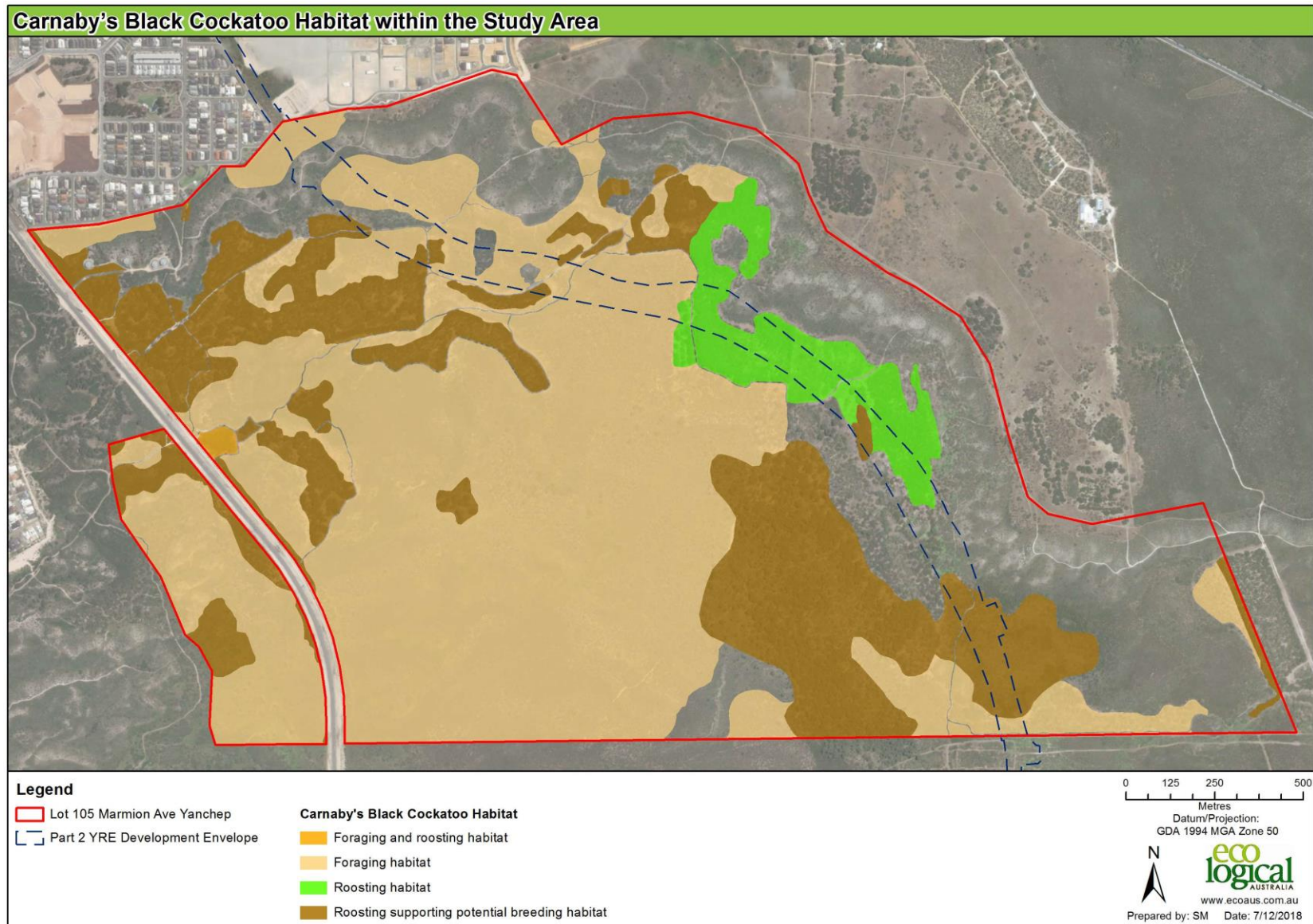


Figure 6: Carnaby's Black Cockatoo habitat within the study area

## 5 Conclusions and recommendations

For the purposes of a reconnaissance level flora and vegetation and Level 1 fauna survey, adequate information has been gathered to broadly define dominant vegetation community types and fauna habitats within the study area. Subsequently, qualitative inferences have been presented regarding the potential occurrence(s) of significant vegetation communities and specific habitat values supporting, or having the potential to support, significant fauna species.

To further determine and quantify the ecological values of Bush Forever Site 289, the following recommendations are made:

- Undertake a detailed flora and vegetation survey to refine and delineate vegetation types and floristic values present within the study area;
- To determine the presence and extent of significant vegetation communities within the study area, undertake comparative multivariate analysis to compare the detailed survey plot-based data with Floristic Community Types defined by Gibson et al. (1994), and
- Undertake a comprehensive Carnaby's Black Cockatoo assessment within the study area, including individual mapping of suitable DBH tree locations and providing habitat value scores for all broad vegetation types.



## References

- Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2010. *Field Guide to Reptiles and Frogs of the Perth Region*. University of Western Australia Press.
- Cale, B. 2003. *Carnaby's Black-Cockatoo (Calyptorhynchus Latirostris) Recovery Plan*, Department of Conservation and Land Management Western Australian Threatened Species and Communities Unit.
- Department of Environment and Conservation (DEC). 2012a. *Chuditch (Dasyurus geoffroii) Recovery Plan*. Wildlife Management Program No. 54. Department of Environment and Conservation, Perth, Western Australia.
- Department of Environment and Conservation (DEC). 2012b. *Bandicoots in the City*. Media Release, World Wildlife Fund for Nature. Perth, Western Australia.
- Department of Parks and Wildlife (Parks and Wildlife). 2007 - 2015. *NatureMap*. Department of Parks and Wildlife and WA Museum. Available: <https://naturemap.dpaw.wa.gov.au/default.aspx>
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). 2012. *EPBC Act referral guidelines for three threatened black cockatoo species*. Commonwealth of Australia.
- Department of the Environment and Energy (DotEE). 2016. *Australia's bioregions (IBRA)*. Available: <http://www.environment.gov.au/land/nrs/science/ibra>
- Department of the Environment and Energy (DotEE). 2018. EPBC Act Protected Matters Search Tool. Available: <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>
- GHD. 2018a. *Yanchep Rail Extension Biological Assessment*. Unpublished report prepared for the Public Transport Authority, January 2018.
- GHD. 2018b. *Additional information for the EPA regarding the Yanchep Rail Extension Survey & Report*. Memorandum prepared for the Public Transport Authority, April 2018.
- GHD. 2018c. *Yanchep Rail Extension Part 2 – Biological Factors*. Unpublished report prepared for the Public Transport Authority, June 2018.
- Gibson, N., Keighery, B.J., Keighery, G.J., Burbidge, A.H., and Lyons, M.N. 1994. *A Floristic Survey of the Swan Coastal Plain*. Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc).
- Government of Western Australia. 2000. *Bush Forever. Volume 2: Directory of Bush Forever Sites*. Department of Environmental Protection, Perth.
- Groom, C. 2011. *Plants Used by Carnaby's Black Cockatoo*. Department of Environment and Conservation, Perth, Western Australia.
- Groves, C. 2005. Wilson, D. E.; Reeder, D. M. eds. *Mammal Species of the World*. Baltimore: Johns Hopkins University Press.

- Hedde, E.M., Loneragan, O.W. and Havel, J.J. 1980. 'Pinjarra Sheet. Vegetation Complexes of the Darling System, Western Australia'. In: *Atlas of Natural Resources Darling System, Western Australia*. Western Australian Department of Conservation and Environment, Perth.
- Heydenrych, B. 2012. *A preliminary investigation into restoring landscapes for Carnaby's Black Cockatoos in the Fitz-Stirling area of Gondwana Link on the south coast of Western Australia*, Greening Australia, Western Australia.
- Johnstone, R.E., Johnstone, C. and Kirkby, T. 2011. *Black-cockatoos on the Swan Coastal Plain*. Report prepared for the Department of Planning, Western Australia, by the Western Australian Museum, Welshpool, Western Australia.
- Johnstone, R.E. and Storr, G.M. 1998. *Handbook of Western Australian Birds*, Volume I, Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.
- Lee, J., Finn, H. & Calver, M.C. 2013a, 'Ecology of Black Cockatoos at a Mine site in the Eastern Jarrah-Marri Forest, Western Australia', *Pacific Conservation Biology*, Vol. 19, 76–90.
- Menkhorst, P. and Knight, F. 2009. *A Field Guide to the Mammals of Australia*. Oxford University Press, Melbourne.
- Mitchell, D., Williams, K. and Desmond, A. 2002. 'SWA2 – Swan Coastal Plain subregion'. In: *A Biodiversity Audit of Western Australia's 53 Bioregional Subregions in 2002* (eds. J.E. May & N.L. McKenzie). Department of Conservation and Land Management, W.A
- Parks and Wildlife Service Tasmania (PaWST). 2011. *Peregrine Falcon, Falco peregrinus*. Available from: <http://www.parks.tas.gov.au/?base=20866>. Accessed September 2016.
- Saunders, D.A. 1980. *Food and movements of the short-billed form of the White-tailed Black Cockatoo*. Australian Wildlife Research. 7:257-269.
- Shah, B. 2006. *Conservation of Carnaby's Black-Cockatoo on the Swan Coastal Plain*, Western Australia. Birds Australia WA.
- Wilson, S and Swan, G. 2013. *A Complete Guide to Reptiles of Australia*. 4<sup>th</sup> Edition New Holland Press, Sydney.

## Appendix A Evidence of foraging by Carnaby's Black Cockatoo



Plate 1: Evidence of Carnaby's Black Cockatoo foraging on *Banksia attenuata* cones.



Plate 2: Evidence of Carnaby's Black Cockatoo foraging on *Pinus pinaster* cones.

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logical  
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