



Eighth Road Armadale

Biological Survey

Biologic Environmental Survey

Report to City of Armadale

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1 INTRODUCTION

1.1 Background

The City of Armadale (The City) plan to upgrade a section of Eighth Road between Armadale Road in the north and Gribble Avenue in the south. Eighth Road is located within the suburb of Armadale approximately 25 kilometres (km) south-east of Perth City (Figure 1.1). The section of Eighth Road to be upgraded is approximately 1.2 km in length and includes several intersections with parallel roads, namely Wollaston Avenue, Gribble Avenue, Avarad Place, Gynea Court, Tillinga Street, Wyee Place and Girraween Street (hereafter referred to as the Study Area). Eighth Road mostly supports planted vegetation with minor areas of remnant native vegetation. The Study Area is located within the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) bioregion (Figure 1.1).

The City commissioned Biologic Environmental Survey Pty Ltd (Biologic) to undertake a biological assessment of the section of Eighth Road for its potential to support significant habitat for foraging and roosting of Black Cockatoo species which are known to be present in the area and to assess the significance of any remnant native vegetation. The survey concentrated on identifying the location of native trees and shrubs, while also documenting the location of any planted or landscaped areas of vegetation. Additionally, a simplified reconnaissance flora and vegetation survey, fauna habitat survey and targeted black cockatoo habitat assessment was undertaken. The survey was designed to meet the State (EPA, 2016c, 2016d, 2016e) and Federal survey guidelines *Revised draft referral guideline for three threatened black cockatoo species Carnaby's Cockatoo (Endangered) Calyptorhynchus latirostris, Baudin's Cockatoo (Vulnerable) Calyptorhynchus baudinii, Forest Red-tailed Black Cockatoo (Vulnerable) Calyptorhynchus banksii naso* (DoEE, 2017). The results from this survey can be used to provide information on conservation significant species for any applications required under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) and/ or for a Native Vegetation Clearing Permit through the *Environmental Protection Act 1986* (EP Act).

1.2 Objectives

The overarching objective of the survey was to provide an assessment of the habitat potential for the three Threatened Black Cockatoo Species' within the Study Area, while also identifying any conservation significant flora or ecological communities within the patches of remnant native vegetation.

This objective was achieved through the following scope of works:

- Desktop assessment (including background information and results of publicly available and DBCA database searches).
- Identification and assessment of the location and species of native trees or shrubs that may be impacted by the proposed works in the Study Area.
- A black cockatoo habitat assessment within the Study Area to address the viability of any hollows found and suitability for breeding by Black Cockatoos. The assessment will also document any foraging potential and roosting viability of the Study Area in the context of knowledge of known roosting sites in the area.

Figure 1.1: The Study Area and Study Area location

1.3 Background to Protection of Flora and Fauna

Within Western Australia, native flora and fauna are protected under the *Biodiversity Conservation Act 2016* (BC Act) and at a national level under the EPBC Act. Any action that has the potential to impact on native fauna or flora needs to be approved by relevant state and/or federal departments as dictated by the state EP Act.

Some species of flora and fauna that are determined to be at risk of extinction or decline are afforded extra protection under these Acts. For the purposes of this report, these species are deemed to be of conservation significance. A summary of applicable legislation and status codes is provided in Table 1.1 and additional information on status codes is provided in (Appendix A).

The EPBC Act identifies Threatened Ecological Communities (TECs) as ecological communities at risk of extinction. The BC Act provides for the statutory listing of TECs by the WA Minister for Environment (the Minister).

For some species and ecological communities, there is insufficient information to determine their status. These species are generally considered by the Environmental Protection Authority (EPA) and the Department of Biodiversity, Conservation and Attraction's (DBCA) as being of conservation significance for all development related approvals and are listed on a 'Priority List' that is regularly reviewed and maintained by the DBCA (Table 1.1). TECs that do not meet the criteria for statutory listing by the Minister for Environment are added to DBCA's 'Priority Ecological Communities' (PECs) lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for near threatened, or that have been recently removed from the threatened list, are placed in priority 4. These ecological communities require regular monitoring (DBCA, 2019b).

Table 1.1: Definitions and terms for fauna of conservation significance

Agreement, Act or List	Status Codes
Federal	
<p><i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i></p> <p>The Department of Agriculture, Water and the Environment (DAWE)¹ lists Threatened flora and fauna, which are determined by the Threatened Species Scientific Committee (TSSC) per criteria set out in the Act. The Act lists flora and fauna that are considered to be of conservation significance under one of eight categories (listed under 'Status Codes').</p> <p>Threatened Ecological Communities (TECs) are those that are at risk of extinction.</p>	<p>Species</p> <ul style="list-style-type: none"> Extinct (EX) Extinct in the Wild (EW) Critically Endangered (CR) Endangered (EN) Vulnerable (VU) Conservation Dependent (CD) Migratory (MI) Marine (MA) <p>TECs</p> <ul style="list-style-type: none"> Critically Endangered (CR) Endangered (EN) Vulnerable (VU)
State	
<p><i>Biodiversity Conservation Act 2016 (BC Act)</i></p> <p>At a state level, native flora and fauna and TECs are protected under the BC Act. Species in need of conservation are given a ranking ranging from Critically Endangered to Vulnerable. TECs are given a ranking ranging from Vulnerable to Presumed Totally Destroyed.</p>	<p>Species</p> <ul style="list-style-type: none"> Extinct (EX) Extinct in the Wild (EW) Critically Endangered (CR) Endangered (EN) Vulnerable (VU) Migratory (MI) Conservation Dependent Fauna (CD) Other specially protected species (OS) <p>TECs</p> <ul style="list-style-type: none"> Presumed Totally Destroyed (PD) Critically Endangered (CR) Endangered (EN) Vulnerable (VU)
<p>DBCA Priority List</p> <p>DBCA produces a list of Priority species and ecological communities that have not been assigned statutory protection under the BC Act. This system gives a ranking from Priority 1 to Priority 5.</p>	<ul style="list-style-type: none"> Priority 1 (Poorly-known species/ ecological communities) (P1) Priority 2 (Poorly-known species/ ecological communities) (P2) Priority 3 (Poorly-known species/ ecological communities) (P3) Priority 4 (Rare, Near Threatened, and other species/ecological communities in need of monitoring) (P4) Priority 5 (Conservation dependent ecological communities) (P5)

1.4 Species of Interest

The Swan Coastal Plain, is recognised as a Global Biodiversity Hotspot (Hopper & Gioia, 2004). A key management focus for the region is the ongoing viability of foraging resources, particularly in Banksia woodlands, for black cockatoo particularly Carnaby's cockatoo (DoEE, 2017). Banksia Woodland Threatened Ecological Communities (TEC), Endangered under the EPBC Act (TSSC, 2016), are

¹ Previously referred to as Department of Environment and Energy (DoEE)

therefore crucial for the persistence of these species, providing important foraging resources and some small patches of breeding habitat (DoEE, 2017). Connecting corridors of vegetation between foraging resources, breeding habitat and night roosting sites are also essential to enable black cockatoos access resources across their range (DoEE, 2017). These communities are fragmented across the region, and more than 60% of this ecological community has been cleared (DoE, 2016).

1.4.1 Carnaby's cockatoo (*Calyptorhynchus latirostris*)

Carnaby's cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is endemic to southwest Western Australia, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale, 2003). The species was once common, but the population has declined significantly in the last half century (Johnstone & Storr, 1998) and is now locally extinct in some areas (Shah, 2006). The total population of Carnaby's cockatoo is currently estimated at 40,000 (Peck *et al.*, 2019). Several significant roost sites exist for Carnaby's cockatoo in the greater Perth-Peel region. Data from the Birdlife Australia Great Cocky Count 2019 (Peck *et al.*, 2019) found that the population in the Perth-Peel Coastal Plain is significant at a species scale, supporting four of the five largest known roosts in 2019. Seventy percent of the Carnaby's cockatoos recorded were associated with the Gnangara-Pinjar pine plantation, north of Perth (Peck *et al.*, 2019). Modelled distributions show the Study Area lies within the breeding range for Carnaby's cockatoo (DoEE, 2017).

Carnaby's cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants, including *Banksia* (including those previously included in the genus *Dryandra*), pine trees (*Pinus* sp.), marri, jarrah, *Grevillea*, *Allocasuarina*, and *Hakea* (Shah, 2006). For Carnaby's cockatoo, the seeds from *Banksia* seed pods and the cones of pine trees provide the highest energetic yield as Carnaby's cockatoo are less efficient at extracting marri seeds than Baudin's cockatoo (Cooper *et al.*, 2002).

Trees used as nest sites by Carnaby's cockatoo are mature, hollow bearing trees, usually with a crown containing dead limbs and a sparse canopy (Cale, 2003; Johnstone & Storr, 1998). They generally nest in hollows of smooth barked Eucalypts, especially salmon gum and wandoo, and on the Swan Coastal Plain most nests are in Tuart (Johnstone & Johnstone, 2004) however, they are said to nest in any species of Eucalypt with a suitable hollow (Cale, 2003; Saunders, 1979). Breeding has been recorded from early July to mid-December and primarily occurs in the Wheatbelt (Johnstone & Storr, 1998). On the Swan Coastal Plain, Carnaby's cockatoo are known to breed in small numbers at Regans Ford, Yanchep, Gingin, Mandurah and Bunbury (Johnstone & Storr, 2004).

1.4.2 Baudin's cockatoo (*Calyptorhynchus baudinii*)

Baudin's cockatoo is listed as Endangered under the EPBC Act and BC Act. This species is distributed through the south western humid and sub-humid zones, from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and east to Albany (Johnstone & Storr, 1998). Modelled distributions show the Study Area lies within the known foraging areas for Baudin's cockatoo (DoEE, 2017). They usually occur in small flocks of up to 30, or occasionally up to 50, or rarely in aggregations of up to 1200 (Johnstone & Kirkby, 2008a). The total population of Baudin's cockatoo is estimated to be about 12,000 birds (Peck *et al.*, 2019).

This species forages primarily in eucalypt forest, where it feeds on marri seeds, flowers, nectar and buds (Johnstone & Kirkby, 2008a). They also feed on a wide range of seeds of *Eucalyptus*, *Banksia* and *Hakea*, as well as the fruits of apples, pears, persimmons, pines, and beetle larvae from under the bark of trees (Johnstone & Kirkby, 2008a; Johnstone & Storr, 1998). For Baudin's cockatoo, the seeds from marri provide a high energetic yield because marri seeds are a high energy food and Baudin's cockatoo are able to quickly extract the seeds from the nut using their long bill (Cooper *et al.*, 2002).

Baudin's cockatoos nest in tree hollows in the deep southwest of Western Australia, with primary nesting trees being karri, marri, and wandoo (*Eucalyptus wandoo*). Baudin's cockatoo is mostly a postnuptial nomad (Johnstone & Kirkby, 2008a) and breed from around October to December. After breeding, Baudin's cockatoos leave nesting areas and amalgamate to form large foraging flocks. These flocks generally migrate north to the main non-breeding wintering area in the northern Darling Range between Collie and Mundaring (Johnstone & Kirkby, 1999).

1.4.3 Forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*)

The forest red-tailed black cockatoo is listed as Vulnerable under the EPBC Act and BC Act. This species is distributed through the humid and sub-humid southwest of Western Australia from Gingin through the Darling Ranges to the southwest, from approximately Bunbury to Albany (Johnstone & Storr, 1998). Modelled distributions show the Study Area lies within forest red-tailed black cockatoo distribution (DoEE, 2017). Population size has been estimated recently at approximately 15,000 birds (Peck *et al.*, 2019). Although not nomadic like Carnaby's and Baudin's cockatoos, the forest red-tailed black cockatoo has been known to exhibit extreme population fluctuations in response to food availability and fires (Johnstone & Storr, 1998). The forest red-tailed black cockatoo occurs in pairs or small flocks, or occasionally large flocks of up to 200 (Johnstone & Storr, 1998). They inhabit dense jarrah, karri and marri forests that receive more than 600 mm average annual rainfall (DoEE, 2017), and breed in the southwest of Western Australia between October and November, producing one or two eggs.

This species feeds primarily on marri and jarrah fruit (DoEE, 2017) and have also been known to feed on blackbutt (*Eucalyptus patens*), Albany backbutt (*Eucalyptus staeri*), karri, sheoak (*Allocasuarina fraseriana*) and snottygobble (*Persoonia longifolia*). Forest red-tailed black cockatoo can obtain energy faster when feeding on marri and jarrah than other food sources (Cooper *et al.*, 2002), and these two plant species make up 90% of their diet (Johnstone & Storr, 1998).

2 ENVIRONMENT

2.1 Biogeography

The Study Area is located approximately 25 km south-east of Perth within the Swan Coastal Plain IBRA bioregion (Figure 1.1). The Swan Coastal Plain bioregion is a low lying plain, mostly covered with woodlands. It is dominated by Banksia (*Banksia* spp.) or Tuart (*Eucalyptus gomphocephala*) on sandy soils, *Casuarina obesa* on outwash plains and paperbark (*Melaleuca* spp.) in swampy areas (Mitchell *et al.*, 2002). Within the Swan Coastal Plain bioregion, the Study Area occurs within the Perth subregion.

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. Heath and/or Tuart woodlands occur on limestone, Banksia and jarrah (*Eucalyptus marginata*)-Banksia woodlands on Quaternary marine dunes, and marri (*Corymbia calophylla*) on colluvial and alluvial soils (Mitchell *et al.*, 2002). This includes a complex series of seasonal wetlands.

The Swan Coastal Plain bioregion is part of the South West Botanical Province which has a very high degree of species diversity. Within the bioregion there are areas of relatively high ecosystem or species diversity, particularly on the eastern side of the coastal plain. The bioregion supports several Threatened Ecological Communities (TEC), as well as a large number of rare and threatened species (Mitchell *et al.*, 2002).

2.2 Climate

The climate of the subregion is characterised by cool wet winters, and warm, relatively dry summers. The nearby weather station likely to accurately document the long-term average rainfall and temperature for the Study Area is the Bureau of Meteorology (BoM) Gosnells City Station (number 9106) (BoM, 2020). Average annual rainfall recorded from this station is 804.3 mm (BoM 2020; length of record 1961-2020) (Figure 2.1). Average monthly rainfall peaks from late autumn throughout winter (May-August), with the highest average rainfall occurring in June (164.8 mm). The highest average daily maximum temperature occurs in January and February (33°C), with the lowest average minimum temperature experienced in July (8.8°C) (BoM, 2020; length of record from 1905-2019) (Figure 2.1).

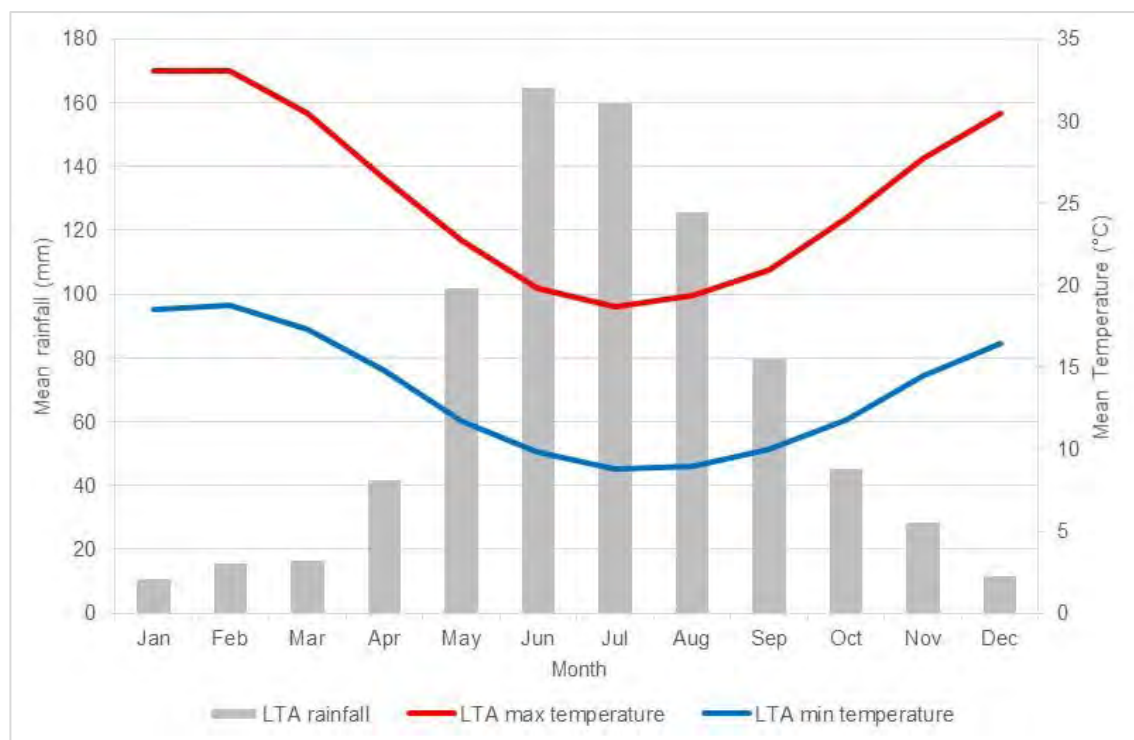


Figure 2.1: Long-term climatic averages (LTA) for monthly rainfall and temperature in the vicinity of the Study Area (station no. 9581; BoM, 2020).

2.3 Landforms, Geology and Soils

The Swan Coastal Plain is the terrain of sand, limestone, and fluvial deposits that form a coastal strip between the Darling Scarp and the Indian Ocean. The Swan Coastal Plain extends from near Geraldton in the north to Dunsborough in the south. It is bounded by the Darling Fault to the east, in the north by a fault extending from north-west from Bullsbrook and by the Collie-Naturaliste scarp in the south (McArthur & Bettenay, 1974).

The Swan Coastal Plain is formed from the deposition of sediments, from either fluvial or aeolian activity. The pattern of deposition of these sediments forms a series of geomorphic entities which are subparallel to the coastline (McArthur & Bettenay, 1974). The Ridge Hill Shelf, a series of laterite covered spurs, is the most easterly feature of the plain and forms the foothills of the Darling Scarp. The relatively flat Pinjarra Plain stretches approximately 13 km from the foot of the Ridge Hill Shelf where it terminates in a series of coastal sand dunes in the west. There are three generations of dunes commencing with the Bassendean System in the east, followed by the Spearwood System and the Quindalup System which fringes the coastline (McArthur & Bettenay, 1974).

The Quaternary sedimentary units that underlie the Swan Coastal Plain have been formally named as geological formations. The Study Area is located within the Guildford Formation which comprise alluvial sediments on the eastern part of the Plain (Semeniuk, 2009). The Guildford formation outcrops over much of the eastern Perth region and overlies Jurassic and Cretaceous rocks, Kings Park Formation, Ascot Formation or Yoganup Formation. It is a fluvial mud deposit.

The Atlas of Australian Soils (Northcote *et al.*, 1960-1968) was compiled by CSIRO (Commonwealth Scientific and Industrial Research Organisation) in the 1960s to provide a consistent national description of Australia's soils. It comprises of a series of ten maps and associated explanatory notes and is published at a scale of 1:2,000,000, but the original compilation was at scales from 1:250,000 to 1:500,000. The Study Area is located within one broad soil landscape unit, TCb38 (Northcote *et al.*, 1960-1968). This unit consists of sandy dunes with intervening sandy and clayey swamp flats. Chief soils are leached sands and sometimes with a clay D horizon below 1.5 m, on the dunes and sandy swamps.

2.4 Hydrology and Hydrogeology

On the Swan Coastal Plain, surface run-off and groundwater discharge contribute to the flows within the rivers and their tributaries. The major rivers and some tributaries are perennial, having greater flows in winter than in summer, but some rivers and tributaries are also fed by drainage corridors all year round (DPaW, 2016). A major component of the summer flows is from groundwater discharge (Davidson 1995). The wetlands, such as lakes and swamps, have formed along the boundaries of the dune systems, though some wetlands occur within the dune systems (McArthur & Bettenay 1974, Davidson 1995). Many of these wetlands are dependent on groundwater.

An understanding of surface water and groundwater flows is essential for management of these wetlands, some of which also contain declared rare flora, threatened fauna and TECs.

Twenty per cent (by area) of wetlands across the Swan Coastal Plain retain high ecological values, making them the highest priority for conservation (conservation management category). However, approximately 72 per cent of wetlands have been degraded to the extent that they are not a priority for conservation (multiple use management category) (DBCA, 2018).

The wetlands on the Swan Coastal Plain have been evaluated, and assigned a management category which provide guidance on how they should be managed and protected (DBCA, 2019d). The Study Area lies on the boundary of the Armadale Palusplain (Unique Feature Identifier 15797; flat, seasonally waterlogged) which is classified as "Multiple use wetlands" (DBCA, 2019d). The wetland is categorised as Multiple Use due to the historic clearing and disturbances, resulting in the degradation of the wetland. The Armadale Palusplain extends from Champion Lakes in the north to beyond Byford in south, covering a straight line distance of approximately 14 km north to south (Figure 2.2).

A review of the Perth Groundwater Atlas indicates that groundwater depth and associated data is not available for the Study Area (DoW, 2019). The nearest known depth to groundwater is located west on Armadale Road, which indicates that the depth to the watertable from the natural surface is 4.5 m (DoW, 2019). The natural surface contours are not mapped within the Perth Groundwater Atlas in the Study Area. However, the water table is inferred to be at between 25 m Australian Height Datum (AHD) and 28 m AHD (DoW, 2019). Assuming that the natural surface is relatively flat through the Study Area, the depth to the watertable is inferred to be between 3 m in the west and potentially at the natural surface level in the east.

Figure 2.2: Hydrology of the Study Area

2.5 Flora and Vegetation Background

2.5.1 Vegetation Complexes

The vegetation complexes of the Swan Coastal Plain are those defined by Heddle *et al.* (1980) at the scale of 1:250,000. The Study Area lies wholly within the Guildford vegetation complex (System 6 code #32). This is described as a mixture of open forest to tall open forest of *Corymbia calophylla* (marri) - *Eucalyptus wandoo* (wandoo) - *Eucalyptus marginata* (jarrah) and woodland of *Eucalyptus wandoo* (wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) - *Melaleuca raphiophylla* (Swamp Paperbark) (DBCA, 2020e).

The Government of Western Australia reports annually on the statistics of the pre-European and current extent for the vegetation complexes of the south-west of Western Australia. The updated statistics provide details on the progress towards achieving a conservation reserve system that is comprehensive, adequate and representative (CAR Reserve) and the statistics for each local government area (LGA; City of Armadale). This vegetation complex extends across eighteen LGAs. The City of Armadale contains 1.59% of the Guildford vegetation complex extent (Table 2.1).

Table 2.1: Pre-European and current extent of vegetation complexes occurring in the Study Area

Vegetation Complex & Code	Scale	Pre-European Extent (ha)	Current Extent remaining (ha)	Extent remaining (%)	Current extent remaining on DBCA lands (%)
Guildford Complex (#32)	LGA	1436.09	25.65	1.79	
	Total	90,494.49	4,607.18	5.09	0.32

Source: Government of Western Australia (2019).

2.5.2 Introduced Taxa

Weeds of National Significance

The Commonwealth of Australia, in collaboration with the states and territories, has identified 32 Weeds of National Significance (WoNS) based on an assessment process that prioritises these weeds according to their invasiveness, potential for spread and environmental, social and economic impacts. A list of 20 WoNS was endorsed in 1999 and a further 12 were added in 2012.

Landowners and land managers at all levels are responsible for managing WoNS. State and territory governments are responsible for legislation, regulation and administration of weeds. The WoNS were selected as they require coordination among all levels of government, organisations and individuals with weed management responsibilities.

Weed Prioritisation

In 2008 Parks and Wildlife developed and implemented an integrated approach to weed management on Parks and Wildlife-managed lands in WA, the Weed Prioritisation Process. It was updated in 2013 and further revised in 2016. Parks and Wildlife prioritised weeds in each region, based on their:

- invasiveness;

- ecological impact;
- potential and current distribution; and
- feasibility of control.

The resulting priorities focus on weeds considered to be high impact, rapidly invasive and still at a population size that can feasibly be eradicated or contained to a manageable size. This means that weed species that are already widespread may not be ranked as a high priority.

3 METHODOLOGY

3.1 Compliance

This assessment was carried out in a manner consistent with documents developed by the Western Australian Environmental Protection Authority (EPA) and the Department of Agriculture, Water and the Environment (DAWE), formerly the Department of Environment and Energy (DoEE) and Department of Sustainability, Water, Population, and Communities (DSEWPaC), as outlined below in Table 3.1.

Table 3.1 Guidelines, technical guidelines and procedures for the field survey

Survey component		Guidance documents
Flora and Fauna	EPA (2018) Statement of Environmental Principles, Factors and Objectives	
	DoE (2013) Significant Impact Guidelines 1.1: Matters of National Environmental Significance.	
Flora	Flora and Vegetation survey	EPA (2016c) <i>Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment</i> .
		EPA (2016a) <i>Environmental Factor Guideline: Flora and Vegetation</i> .
Fauna	Level 1 fauna survey	EPA (2016e) <i>Technical guidance: Terrestrial fauna surveys</i>
		EPA (2016d) <i>Technical Guidance: Sampling Methods for Terrestrial Vertebrate Fauna</i>
		DEWHA (2010b) <i>Survey Guidelines for Australia's Threatened Birds</i> .
		DEWHA (2010a) <i>Survey Guidelines for Australia's Threatened Bats</i>
		DSEWPaC (2011a) <i>Survey Guidelines for Australia's Threatened Mammals</i>
		DSEWPaC (2011b) <i>Survey Guidelines for Australia's Threatened Reptiles</i>
		EPA (2016b) <i>Environmental Factor Guideline: Terrestrial Fauna</i> .
	Black cockatoo habitat assessment	DoEE (2017) <i>Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo</i>
		DSEWPaC (2012b) <i>EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species: Carnaby's Cockatoo (endangered) <i>Calyptorhynchus latirostris</i>, Baudin's Cockatoo (vulnerable) <i>Calyptorhynchus baudinii</i>, Forest Red-tailed Black Cockatoo (vulnerable) <i>Calyptorhynchus banksii naso</i></i>

3.2 Desktop Assessment

3.2.1 Database Searches

Database searches were undertaken to generate a list of vascular flora and vertebrate fauna taxa previously recorded within, and near, the Study Area, including introduced species and taxa of conservation significance. The database searches also identified ecological communities/ vegetation types of conservation significance that occur, or may occur, within, and near, the Study Area. Conservation codes for flora, fauna and vegetation of conservation significance are provided in Appendix A.

Four database searches were conducted for flora species and ecological communities of conservation significance previously recorded within and surrounding the Study Area (Table 3.2). Four databases were searched to obtain information on fauna species previously recorded within the Study Area (Birddata, NatureMap and Threatened and Priority Fauna Search) and conservation significant species likely to occur within the Study Area (Protected Matters Database) (Table 3.2).

Table 3.2: Details of database searches conducted

Provider	Reference	Database	Parameters
Flora			
Department of Biodiversity, Conservation and Attractions [DBCA]	Main Roads (2019)	DBCA Database <ul style="list-style-type: none"> Threatened & Priority Flora; and Threatened and Priority Ecological Communities 	<ul style="list-style-type: none"> Circle of radius 5 km centred on the coordinates: -32.152063°, 115.988985° Circle of radius 10 km centred on the coordinates: -32.152063°, 115.988985°
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2020a)	NatureMap. Accessed 26 May 2020.	Circle of radius 2 km centred on the coordinates: -32.152063°, 115.988985°
Department of the Agriculture, Water and the Environment (DAWE)	(DAWE, 2020)	Protected Matters Database Search Tool. Accessed 1 June 2020.	Circle of radius 12 km centred on the coordinates: -32.152063°, 115.988985°
Atlas of Living Australia (ALA)	ALA (2020)	Atlas of Living Australia. Accessed 8 June 2020.	Circle of radius 5 km centred on the coordinates: -32.152063°, 115.988985°
Fauna			
Department of Biodiversity, Conservation and Attractions [DBCA]	(DBCA, 2020c)	DBCA Database <ul style="list-style-type: none"> Threatened & Priority Fauna. 	Circle of radius 10 km centred on the coordinates: -32.152063°, 115.988985°
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA (2020a)	NatureMap. Accessed 26 May 2020.	Circle of radius 10 km centred on the coordinates: -32.152063°, 115.988985°
Department of Agriculture, Water and Environment (DAWE)	DAWE (2020)	Protected Matters Database Search Tool. Accessed 1 June 2020.	Circle of radius 10 km centred on the coordinates: -32.152063°, 115.988985°
Birdlife Australia custom black cockatoo roost database (Birdlife Australia, 2020)	(Birdlife Australia, 2020)	Birdlife Australia custom black cockatoo roost review	Circle of radius 12 km centred on the coordinates: -32.152063°, 115.988985°

3.2.2 Literature review

A review of available literature relevant to the vertebrate fauna of the Study Area (> 10 km) was undertaken, utilising publicly available searches and the Index of Biodiversity Surveys for Assessment (IBSA) portal (Table 3.3). A flora and vegetation literature review was not undertaken as the vegetation present within the Study Area mostly consisted of landscaped gardens, road verges, urban environments and historically cleared bushland now mostly consisting of paddocks with occasional native trees. Furthermore, the scope of the survey was mostly centred on the identification of native trees and shrubs that may be utilised by black cockatoos. A vertebrate fauna literature review was

undertaken, with five Level 1 vertebrate fauna reports, and two Level 2 vertebrate fauna reports reviewed to compile a list of vertebrate fauna species with the potential to occur within the Study Area.

Table 3.3: Literature sources used for the review

Survey Title	Reference	Survey Type	Distance from Study Area
Flora, Vegetation and Fauna Assessment, Keane Road	ENV (2012)	Level 2 Flora and Vegetation Assessment Level 1 Fauna Assessment	~ 4.5 km west
West Piara Waters, Forrestdale, Fauna Assessment	Harewood (2018)	Level 1 Fauna and Targeted Black Cockatoo Survey	~ 7.5 km west
Armadale Road Duplication Biological Assessment	Astron (2015)	Level 1 Fauna and Targeted Black Cockatoo Survey	~ 3.5 km west
Champion Drive Level 1 fauna survey and black cockatoo assessment	Biologic (2019)	Level 1 Fauna and Targeted Black Cockatoo Survey	~ 2.5 km north
Champion Lakes Master Plan; Fauna	Bamford Consulting Ecologists (2003)	Level 2 Fauna Survey	~2.5 km north-west
Jandakot Airport Fauna Survey	ENV Australia (2009)	Level 2 Fauna Survey	~9.5km north-west
Armadale Road to North Lake Road Bridge Project	MRIA (2017)	Level 1 Fauna and Targeted Black Cockatoo Survey	~ 10.5 km northwest

3.3 Field Survey

The field survey was completed within one day by experienced Botanist Sam Coultas and Graduate Botanist Emily Eakin-Busher on 27 May 2020. The field team spent approximately 4 person hours on site sampling the flora, vegetation and fauna. The weather experienced during the survey fell within long term averages for the area, with a maximum temperature of 21.2°C and 2 mm of rainfall. The total rainfall recorded for May 2020 was 99 mm which was on par with the LTA rainfall for the same period (603.4 mm, BoM, 2020) (Figure 3.1).

The field survey undertaken within the Study Area were modified and simplified versions of a Reconnaissance flora and vegetation survey, a Level 1 fauna habitat assessment and a black cockatoo habitat assessment. Due to the highly degraded nature of the vegetation and the fact that the majority of the Study Area included landscaped gardens and street/ verge trees, surveys in accordance with the EPA and DAWE guidance (see Section 3.1) would not have been achievable.

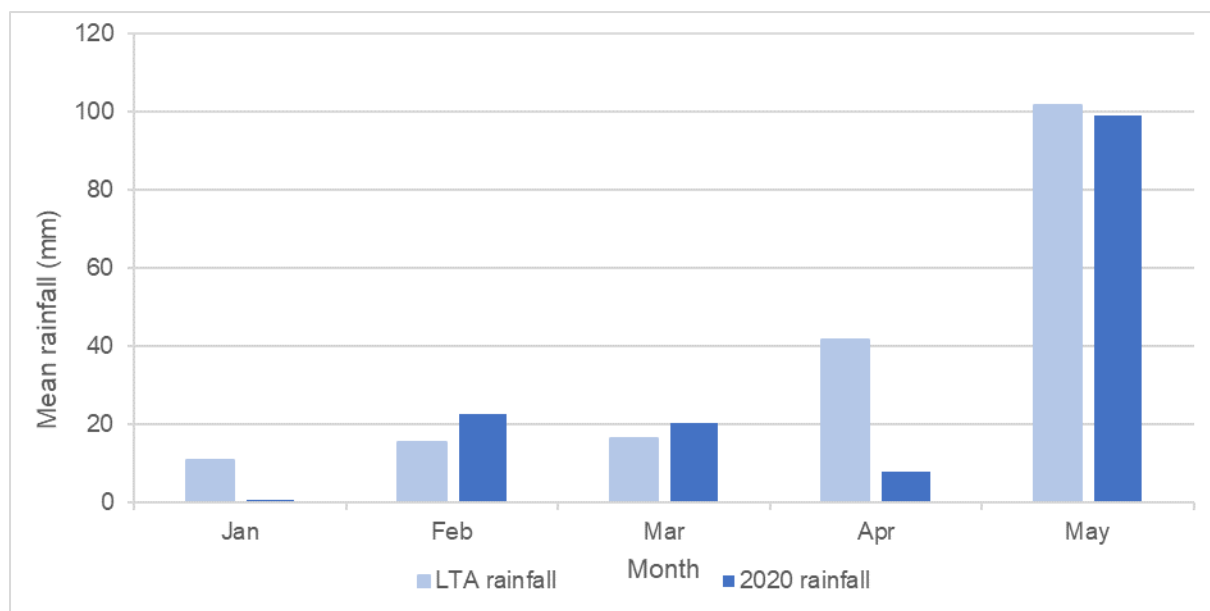


Figure 3.1: Monthly LTA rainfall and 2020 monthly rainfall totals for Gosnells City (station 9106; BoM, 2020)

3.3.1 Targeted flora searches and Habitat Assessments

Prior to the survey, a list of conservation significant flora known to, with the likelihood to, or potential to occur within the Study Area was compiled. Field personnel familiarised themselves with photographs, reference samples and descriptions of these taxa before conducting the survey.

Targeted searching was undertaken for flora of conservation significance, as identified during the desktop assessment. Taxa that were confirmed or considered very likely, likely or possible to occur within the Study Area were targeted. The presence of significant environmental weeds and Declared Plant Pests listed under Section 22 of the *Biosecurity and Agriculture Management Act 2007* was also noted during the field survey.

The meandering targeted searches while traversing the Study Area focussed on habitat considered likely to support conservation significant flora. Habitat in the Study Area was limited, with only small remnant patches located near Wollaston Avenue and across from Gynea Court. The remainder of the Study Area was cleared or consisted of landscaped gardens and street trees.

3.3.2 Opportunistic Vertebrate Fauna Records

Opportunistic records of vertebrate species encountered during the survey via direct observation, calls or secondary evidence (i.e. burrows, scratching's, diggings, scats, tracks, feathers, nests) were documented. The latest checklist of mammal, reptile and amphibian names published by the Western Australian Museum (WAM, 2020) was used as a guide to the current taxonomy and nomenclature of these groups. For birds, the current checklist of Australian birds maintained by Birdlife Australia (based on Christidis & Boles, 2008) was used in conjunction with the WAM species list (WAM, 2020).

3.3.3 Black Cockatoo Habitat Assessment

A black cockatoo habitat assessment was conducted via foot-traversed transects across the entire Study Area in line with the DoEE (2017) *Revised draft referral guideline for three threatened black cockatoo species* for potential breeding, roosting and foraging habitat within the Study Area.

Potential Breeding Trees

Breeding habitat for Black Cockatoos is defined as “trees of species known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow” (DoEE, 2017) (Table 3.4). For most tree species, suitable DBH is 500 mm, while for salmon gum and wandoo, suitable DBH is 300 mm (DoEE, 2017; DSEWPaC, 2012b). Breeding habitat for all three black cockatoo species generally consists of woodland or forest; however, breeding is also known to occur in former woodland or forest now comprising of isolated or small patches of trees (DoEE, 2017; DSEWPaC, 2012b).

Table 3.4: Known breeding trees for Black Cockatoo species

Species ¹	DBH (mm)
<i>Corymbia calophylla</i> (marri)	500
<i>Eucalyptus marginata</i> (jarrah)	
<i>Eucalyptus rudis</i> (flooded gum)	
<i>Eucalyptus camaldulensis</i> (river gum) ²	
<i>Eucalyptus diversicolor</i> (karri)	
<i>Eucalyptus patens</i> (Swan River blackbutt)	
<i>Eucalyptus megacarpa</i> (bullich)	
<i>Eucalyptus accedens</i> (powderbark wandoo)	
<i>Eucalyptus salmonophloia</i> (salmon gum)	300
<i>Eucalyptus wandoo</i> (wandoo)	

¹ List excludes species for which Study Area occurs outside the known distribution of the species, as provided in Florabase

The location and attributes of all potential black cockatoo habitat trees (as defined by DAWE) were recorded within the Study Area during the field survey. Attributes recorded included tree species (where discernible), approximate height, DBH, condition (i.e. living or dead), presence of hollows, and dimensions of hollows (where discernible).

Suitable nest hollows were considered any hollow that appeared to be deep enough with an opening large enough to be used by black cockatoos, of both natural and artificial origin. Where suitably sized hollows were recorded, further inspections were undertaken to identify the presence/absence of any known breeding signs, i.e. hollows showing evidence of wear and chew marks around the hollow entrance that may be attributed to black cockatoos. Where possible, hollow usage by fauna was also recorded, including use by introduced honeybees or rainbow lorikeets.

Potential Foraging Habitat

Foraging habitat quality was assessed throughout the Study Area using the habitat scoring tool provided by DoEE (2017) (refer to Table 3.6). In determining the quality of foraging habitat for each of the black cockatoo species, the scoring tool considers key attributes of foraging habitat for each species to give

them a score between 1–10. This includes connectivity and proximity of the foraging habitat to other foraging habitat in the area, as well as other threats that can reduce the functionality of that habitat for respective species. DoEE (2017) defines ‘high quality’ foraging habitat as habitat scoring of 7 or above, which, particularly in proximity to roosting and/or breeding sites, is considered important for the long-term survival and recovery of black cockatoos.

Any tree and shrub species known to be staple food resources for black cockatoos (i.e. *Corymbia* and *Banksia* species) or any evidence of foraging (i.e. chewed nuts or *Banksia* cones and/or flowers) within the Study Area was also documented.

Potential Night Roosting

The potential for night roosting to occur within the Study Area was interpreted and extrapolated from the identification of potential breeding trees, mapping of potential breeding habitat, proximity to suitable watering spots, and knowledge of any known roosting sites within the vicinity of the Study Area. A Birdlife Australia black cockatoo search was conducted within the 12 km of the Study Area to identify the presence of any known roosting locations (refer to Section 2.2; Table 2.1).

Any evidence of possible roosting events (i.e. clipped leaves and branches or droppings under suitable trees) recorded during the field survey was documented.

Table 3.5: Habitats used by black cockatoos for breeding, night roosting and foraging (DSEWPaC, 2012a)

	Baudin's cockatoo	Carnaby's cockatoo	Forest red-tailed Black cockatoo
Description of foraging habitat	Primarily seeds of marri and jarrah in woodlands and forest, and seeds of native proteaceous plant species (for example, <i>Banksia</i> spp., <i>Hakea</i> spp. and <i>Dryandra</i> spp.). During the breeding season feed primarily on native vegetation, particularly marri (seeds, flowers, nectar and grubs). Also, insects and insect larvae; pith of kangaroo paw (<i>Anigozanthos flavidus</i>); juice of ripe persimmons; tips of <i>Pinus</i> spp.; and seeds of apples and pears.	Native shrubland, Kwongan heathland and woodland on seeds, flowers and nectar of native proteaceous plant species (<i>Banksia</i> spp., <i>Hakea</i> spp., <i>Dryandra</i> spp., and <i>Grevillea</i> spp.), as well as <i>Callistemon</i> spp. and marri. Also seeds of introduced species including <i>Pinus</i> spp., <i>Erodium</i> spp., wild radish, canola, almonds and pecan nuts; insects and insect larvae; occasionally flesh and juice of apples and persimmons.	Primarily seeds of jarrah and marri in woodlands and forest, and edges of karri forests, including wandoo and blackbutt. Forages on <i>Eucalyptus caesia</i> , <i>E. erythrocorys</i> , Allocasuarina cones, fruits of snotty gobble (<i>Persoonia longifolia</i>) and mountain marri (<i>Corymbia haematoxylon</i>). Also, some introduced eucalypts such as river red gum (<i>E. camaldulensis</i>) and flooded or rose gum (<i>E. grandis</i>). On the Swan Coastal Plain, often feeds on introduced Cape lilac (<i>Melia azedarach</i>).
Base habitat score			
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of, successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 .	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 .	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 .
7 (High quality)	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under an RFA.	Native shrubland, Kwongan heathland and woodland dominated by proteaceous plant species such as <i>Banksia</i> spp. (including <i>Dryandra</i> spp.), <i>Hakea</i> spp. and <i>Grevillea</i> spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under an RFA.	Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under a RFA.
5 (Quality)	Pine plantation or introduced eucalypts.	Pine plantation or introduced eucalypts.	Introduced eucalypts as well as the introduced Cape lilac (<i>Melia azedarach</i>).
1 (Low quality)	Individual foraging plants or small stand of foraging plants.	Individual foraging plants or small stand of foraging plants	Individual foraging plants or small stand of foraging plants
Additions	Context adjustor - attributes improving functionality of foraging habitat	Context adjustor - attributes improving functionality of foraging habitat	Context adjustor - attributes improving functionality of foraging habitat
+3	Is within the known foraging area	Is within the Swan Coastal Plain (important foraging area).	Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+3	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.	Contains trees with suitable nest hollows.
+2	Primarily contains marri.	Primarily comprises marri.	Primarily contains marri and/or jarrah.
+2	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo).	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo).	Contains trees with potential to be used for breeding (DBH ≥ 500 mm or ≥ 300 mm DBH for salmon gum and wandoo).
+1	Is known to be a roosting site.	Is known to be a roosting site.	Is known to be a roosting site.
Subtractions	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat
-2	No clear evidence of feeding debris.	No clear evidence of feeding debris.	No clear evidence of feeding debris.
-2	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.	No other foraging habitat within 6 km.
-1	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.	Is > 12 km from a known breeding location.
-1	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.	Is > 12 km from a known roosting site.
-1	Is > 2 km from a watering point.	Is > 2 km from a watering point.	Is > 2 km from a watering point.
-1	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker).	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker).	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker).

Table 3.6 Habitat quality scoring totals for black cockatoo foraging habitat

Final habitat quality score	8 - 10	6 - 8	3 - 5	1 - 3
Habitat Quality Category	Very High Quality	High Quality	Quality	Low Quality

3.4 Assessment on Occurrence

3.4.1 Flora

Conservation significant flora species recorded from the database searches and previous reports were assessed for their likelihood of occurrence in the Study Area using a decision matrix (Table 3.7).

Table 3.7: Flora species likelihood of occurrence decision matrix

Occurrence categories	Habitat categories (within the Study Area)			
	Core/ critical habitat present	Suitable habitat present/ within known distribution	Marginal habitat present/ adjacent to known distribution	No suitable habitat present/ outside of known distribution
Recorded in the Study Area	Confirmed	Confirmed	Confirmed	Confirmed
Recorded within <2 km	Highly Likely	Likely	Possible	Possible
Recorded within 2-5 km	Likely	Possible	Possible	Unlikely
Recorded within 5 - 20 km	Possible	Possible	Unlikely	Unlikely
Recorded >20 km	Possible	Unlikely	Unlikely	Highly Unlikely
Species considered locally/ regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

3.4.2 Fauna

Species of conservation significance identified by the desktop assessment were assessed for their likelihood of occurrence within the Study Area using a decision matrix which considers the suitability of habitat within the study area and the proximity of previous records (Table 3.8). Based on this decision matrix, each species was assigned to one of six categories of likelihood of occurrence: Confirmed, Highly Likely, Likely, Possible, Unlikely, or Highly Unlikely.

The decision matrix is intended to be an indicative guide only, and the way in which it is interpreted may vary between species, depending on a given species' habitat preferences and ability to disperse, as well as the reliability and availability of contextual information. For example, considering species which have been previously recorded close to the study area, a species with a limited dispersal capability will have a reduced likelihood of occurring in the study area compared with a species with greater dispersal capability. It is also recognised that a lack of records in the vicinity of the study area may indicate limited sampling effort rather than species' absence, and that previous records may include historic or presumed erroneous information which may misrepresent a species' current distribution. Where the determination of a species' likelihood of occurrence within the study area deviates from the decision matrix, detailed justification for any variation will be presented.

Table 3.8: Fauna species likelihood of occurrence decision matrix

		Habitat suitability of study area			
		Core habitat ² present	Foraging and dispersal habitat present	Marginally suitable habitat ³ present	No suitable habitat present
Species Records ¹	Recorded in study area	Confirmed	Confirmed	Confirmed	Confirmed
	Recorded within 2 km of study area	Highly Likely	Likely	Possible	Possible
	Recorded within 2-5 km of study area	Likely	Possible	Possible	Unlikely
	Recorded within 5-20 km of study area	Possible	Possible	Unlikely	Unlikely
	Recorded >20 km of study area	Possible	Unlikely	Unlikely	Highly Unlikely
	Species considered locally/regionally extinct	Unlikely	Unlikely	Highly Unlikely	Highly Unlikely

¹Only records within the previous 50 years are considered

²Core habitat is habitat which contains elements (e.g. nest sites, roost sites, breeding season foraging locations) which are critical for the survival and reproduction of a species (Bingham & Noon, 1997), or habitat which is otherwise defined as critical habitat within relevant species recovery plans and guidelines.

³Marginally suitable habitat is habitat which is possibly used by a species for roosting or nesting, or during foraging and dispersal activities, but is unlikely to be depended upon; for example, it may be of low quality or only sporadically present

3.5 Potential Limitation and Constraints

The entirety of the Study Area was accessible by foot; thus, the sampling techniques used during this survey were unconstrained by accessibility or remoteness Table 3.9. The survey timing also fell within the recommended timing for the black cockatoo species (March to September for Baudin's cockatoo, year-round for forest red-tailed black cockatoo and January to July for Carnaby's cockatoo).

Table 3.9: Survey limitations and constraints

Potential limitation or constraint	Applicability to this survey
Experience of personnel	The botanists who undertook the survey have extensive survey experience. The lead botanist, Sam Coultas, has over 6 years' experience, with direct experience in the City of Armadale. DoEE (2017) advises that black cockatoo surveys should be done by a suitably qualified person with experience in surveys of black cockatoo habitat. Sam has also completed numerous black cockatoo habitat assessments under the guidance of experienced zoologists.
Scope (floral/ faunal groups sampled and whether any constraints affect this)	<p>The survey was conducted within the framework of the scope. The survey was undertaken within one day reducing the ability to detect some fauna, however, the Study Area is highly altered reducing the likelihood of native fauna and flora species being present.</p> <p>The black cockatoo survey was conducted within the appropriate framework. The survey timing fell within the recommended timing for the black cockatoo species (March to September for Baudin's cockatoo, year-round for forest red-tailed cockatoo and January to July for Carnaby's cockatoo).</p>

Potential limitation or constraint	Applicability to this survey
Proportion of flora and fauna identified	All observed flora and fauna were identified at the point of observation.
Sources of information (recent or historic) and availability of contextual information	<p>A significant amount of black cockatoo survey work has been undertaken in the wider local area and the surrounding region, including annual black cockatoo monitoring for the past decade, and these survey results were available for review. The Birdlife, DBCA, and DAWE database searches provided additional sources of recent information.</p> <p>Numerous flora and fauna surveys have been completed within the City of Armadale. These surveys were reviewed to assist in the development of the survey and the preparation of the report.</p>
Proportion of the task achieved	The entire Study Area was traversed on foot, with all tasks achieved within the allotted field time.
Disturbances (e.g. fire or flood)	<p>The vegetation was noted as being degraded/ disturbed with the eastern side of Eighth Road consisting of street trees and landscaped gardens, while the western side of Eighth Road has been highly altered. Weeds and clearing were the main disturbance recorded during the Survey.</p> <p>As the Study Area occurs within an urban environment and along a public road, the disturbances were not considered to constrain the survey. The disturbances have been present for a long time</p>
Intensity of survey	The entire Study Area was traversed with all native trees and shrubs recorded, while non-native or non-endemic flora were also recorded.
Completeness of survey	The survey was adequately completed to meet the requirements of a scope.
Resources (e.g. degree of expertise available)	All resources required to complete the survey were available.
Remoteness or access issues	The entire Study Area was accessed on foot and by vehicle. The Study Area is located in the suburb of Armadale with remoteness or access not a limitation.

4 RESULTS AND DISCUSSION

4.1 Database Search Results

4.1.1 Flora and vegetation of Conservation Significance

Flora of conservation significance

A total of 81 conservation significant flora taxa were identified from the database searches (within 5 km of the Study Area) (Appendix B). Of the 81 taxa, 27 are listed as Threatened flora under the BC Act and the EPBC Act.

Flora taxa of conservation significance identified by the desktop assessment were assessed and ranked on the likelihood of occurring within the Study Area (Appendix C). Due to the highly degraded nature of the vegetation present within the Study Area, not flora taxa of conservation significant flora are considered to highly likely, likely or possible to occur. Six taxa were considered unlikely to occur due to habitat preferences and location of records, while the remaining 75 taxa are highly unlikely to occur in the Study Area.

Although numerous conservation significant taxa are known to occur in close proximity to the Study Area (some within 1 km), the highly disturbed and altered vegetation is unlikely to support conservation significant flora. The eastern side of the Study Area has been cleared and now consists of landscaped gardens, hard surfaces (driveways, paths etc.) and street trees. The western side of the Study Area is mostly cleared for historical grazing and agricultural, which has subsequently been developed over the years.

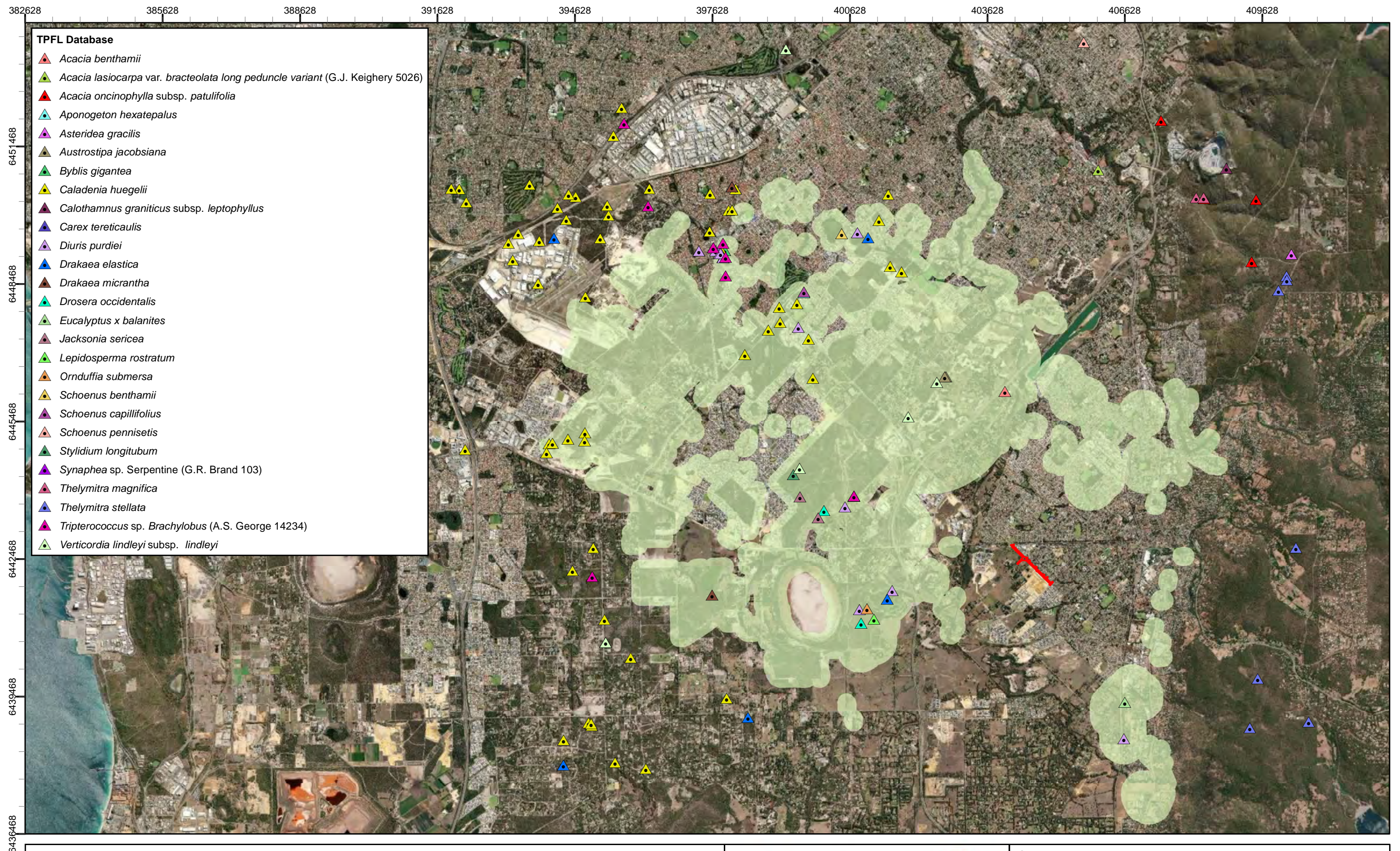
Vegetation of conservation significance

Searches of the DAWE database with regard to matters of national environmental significance as listed under the EPBC Act (DAWE, 2020) and the Threatened and Priority Ecological Communities database (DBCAs, 2020b) revealed 13 ecological communities of conservation significance within the database search radius (Table 4.1).

Table 4.1: Ecological communities of conservation significance known to occur near the Study Area

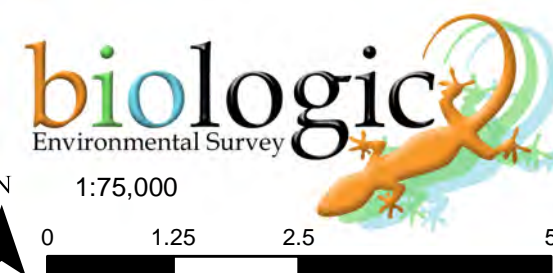
Threatened Ecological Community/ Wetlands	Status			Nearest Occurrence/ Type of Presence
	DBCA	BC Act	EPBC Act	
Banksia WL SCP <i>Banksia</i> Dominated Woodlands of the Swan Coastal Plain IBRA Region	P3	-	EN	1 km to west
Claypans with shrubs over herbs Claypans with mid dense shrublands of <i>Melaleuca lateritia</i> over herbs	P1	-	CR	6.6 km to the northwest
Muchea Limestone Shrublands and woodlands on Muchea Limestone of the Swan Coastal Plain	-	EN	EN	2 km to the north

Threatened Ecological Community/ Wetlands	Status			Nearest Occurrence/ Type of Presence
	DBCA	BC Act	EPBC Act	
SCP08 Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))	-	VU	CR	2 km to the west
SCP10a Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. (1994))	-	EN	CR	2.7 km to the west
SCP20b <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands of the eastern side of the Swan Coastal Plain (floristic community type 20b as originally described in Gibson et al. (1994))	-	EN	EN	1.5 km to the northeast
SCP21c Low lying <i>Banksia attenuata</i> woodlands or shrublands	P3	-	EN	2.4 km to the northwest
SCP22 <i>Banksia ilicifolia</i> woodlands	P3	-	EN	8.6 km to the northwest
SCP3a <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils, Swan Coastal Plain (floristic community type 3a as originally described in Gibson et al. (1994))	-	CR	EN	2.4 km south
SCP3b <i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> woodlands on sandy clay soils of the southern Swan Coastal Plain (floristic community type 3b as originally described in Gibson et al. (1994))	-	VU	-	4.5 km to the south
Clay pans of the Swan Coastal Plain	-		CR	Community likely to occur within area
<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the Swan Coastal Plain (SCP3c)	-	CR	EN	Community likely to occur within area
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain	P3	-	CR	Community likely to occur within area



Legend

- Study Area
- TEC/PEC



City of Armadale

Eight Road Biological Survey

Fig. 4.1: Conservation significant flora and ecological communities near the Study Area

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994

Size A3. Created 03/07/2020

4.1.2 Vertebrate Fauna of Conservation Significance

Based on the database searches a total of 55 vertebrate species of conservation significance have previously been recorded or have the potential to occur within 10 km of the Study Area. For some conservation significant vertebrate species, such as numbat, western ringtail possum, and quokka, the database records included historic or presumed erroneous information which do not represent the species' current distribution. As such, these species have been removed from further consideration. In total, 50 species, comprising seven mammals, 38 birds (including migratory species) and five reptiles (Table 4.2). Invertebrate fauna were not considered as part of this vertebrate fauna survey and were excluded from consideration. Fourteen (14) species are listed as Threatened, Conservation Dependent or Specially Protected under the EPBC Act and/or BC Act. Eleven species are listed as Priority by the DBCA.

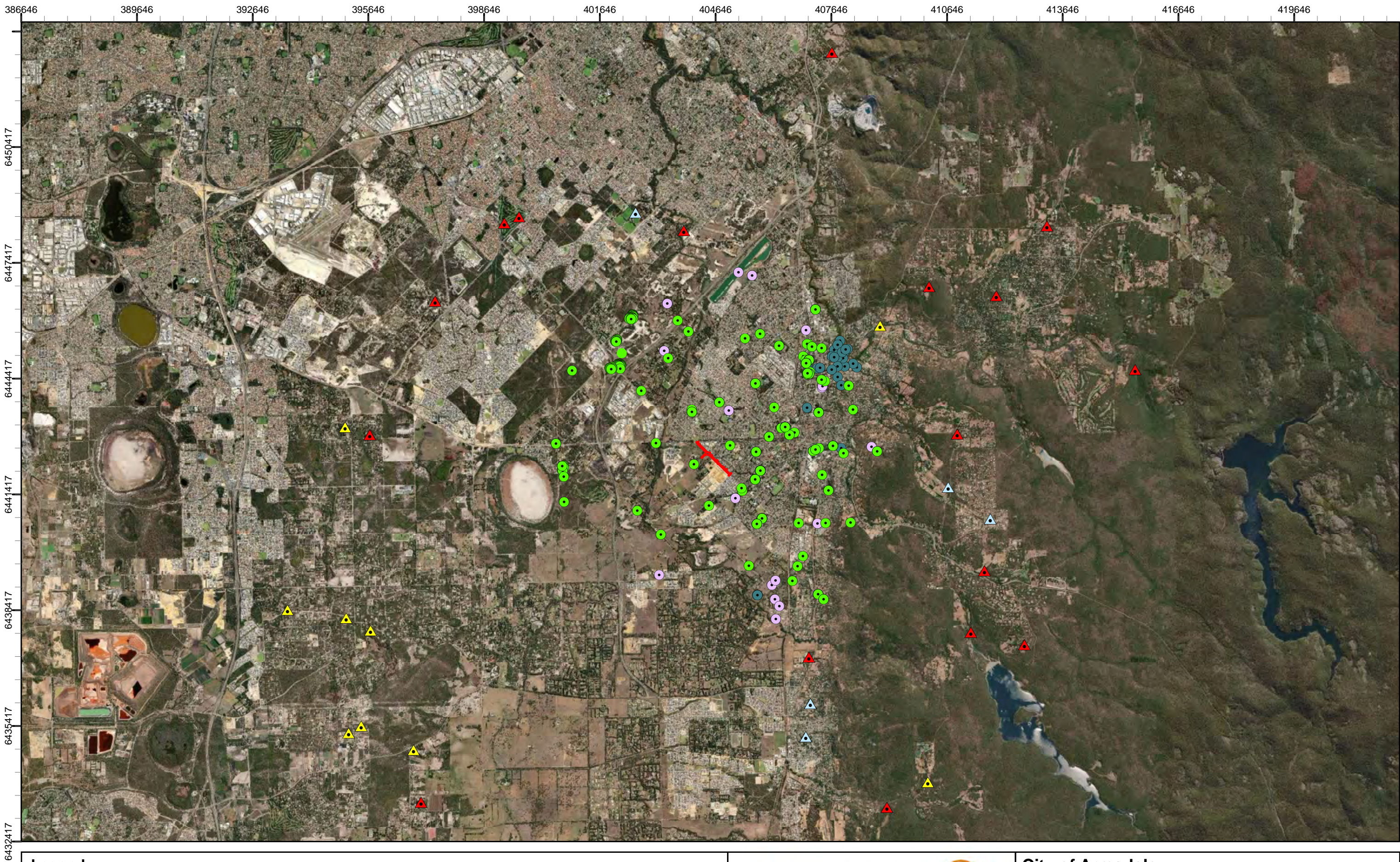
Six conservation significant species were recorded from the six fauna survey reports reviewed. Quenda were commonly observed from primary or secondary evidence, being recorded in three of these surveys (Table 4.2). Black cockatoo, either Carnaby's or forest red-tailed, were recorded from three survey reports (ENV, 2012; Harewood, 2018; MRIA, 2017). Several individuals of western brush wallaby (*Notamacropus irma*, DBCA P4) were observed foraging during the day in Banksia woodland at Jandakot by ENV Australia (2009). Two DBCA Priority 3 reptiles, Perth slider *Lerista lineata* and Black-striped snake *Neelaps calonotos*, were recorded by Bamford Consulting Ecologists (2003) at Champion Lakes.

DBCA's Threatened and Priority Fauna database (DBCA, 2019c) and BirdLife Australia's Birddata Custom Bird List (Birdlife Australia, 2020) returned no records from within the Study Area (Figure 4.2 and Figure 4.3). However records of Carnaby's cockatoo (25), forest red-tailed black cockatoo (2), one quokka, one chuditch and five records of quenda were noted in the near vicinity (3 km radius) of the Study Area (Figure 4.2 and Figure 4.3).

Table 4.2: Conservation species previously recorded within 10 km of the Study Area based on database searches. Invertebrate and marine species are not shown.

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	IUCN	NatureMap (10km) (DBCA, 2020a)	EPBC (10km) (DAWE, 2020)	DBCA (10km) (DBCA, 2020c)	Astron (2015)	Bamford Consulting Ecologists (2003)	ENV Australia (2009)	Harewood (2018)	MRIA (2017)	ENV (2012)	Biologic (2019)
REPTILES															
<i>Acanthophis antarcticus</i>	Southern death adder			P3		•		•							
<i>Ctenotus delli</i>	Dell's skink			P4		•									
<i>Ctenotus ora</i>	Coastal plains skink			P3	VU	•									
<i>Lerista lineata</i>	Lined skink			P3	EN	•		•		•					
<i>Neelaps calonotos</i>	Black-striped snake			P3		•				•					
MAMMALS															
<i>Bettongia penicillata</i>	Woylie	EN	CR			•	•								
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU			•	•	•							
<i>Phascogale tapoatafa wambenger</i>	Wambenger brush-tailed phascogale		CD			•		•							
<i>Hydromys chrysogaster</i>	Water-rat			P4		•		•							
<i>Isodon fusciventer</i>	Southern brown bandicoot			P4		•		•		•	•			•	
<i>Notamacropus irma</i>	Western brush wallaby			P4		•		•			•				
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle			P4		•									
BIRDS															
<i>Numenius madagascariensis</i>	Eastern curlew	CR/MI	CR/MI		EN		•								
<i>Calidris ferruginea</i>	Curlew sandpiper	CR/MI	CR/MI		NT	•	•								
<i>Botaurus poiciloptilus</i>	Australasian bittern	EN	EN			•	•								
<i>Calyptorhynchus baudinii</i>	Baudin's cockatoo	EN	EN			•	•	•							
<i>Calyptorhynchus latirostris</i>	Carnaby's cockatoo	EN	EN			•	•	•			•	•	•		
<i>Rostratula australis</i>	Australian painted snipe	EN	EN		EN		•								
<i>Sterna nereis nereis</i>	Fairy tern	VU	VU		VU		•								
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	VU			•	•	•	•		•		•		•
<i>Leipoa ocellata</i>	Malleefowl	VU	VU				•								
<i>Thalassarche chrysostoma</i>	Grey-headed albatross	VU	VU					•							
<i>Falco peregrinus</i>	Peregrine falcon		OS			•		•							
<i>Apus pacificus</i>	Fork-tailed swift	MIG	MIG			•	•								
<i>Arenaria interpres</i>	Ruddy turnstone	MIG	MIG			•									
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MIG	MIG			•	•	•							
<i>Calidris melanotos</i>	Pectoral sandpiper	MIG	MIG			•	•								
<i>Calidris ruficollis</i>	Red-necked stint	MIG	MIG			•	•								
<i>Calidris subminuta</i>	Long-toed stint	MIG	MIG			•	•								
<i>Charadrius dubius</i>	Little ringed plover	MIG	MIG				•								
<i>Charadrius leschenaultii</i>	Greater sand plover	MIG	MIG			•									
<i>Gallinago megala</i>	Swinhoe's snipe	MIG	MIG				•								
<i>Gallinago stenura</i>	Pin-tailed snipe	MIG	MIG				•								
<i>Hydroprogne caspia</i>	Caspian Tern	MIG	MIG			•									
<i>Limosa limosa</i>	Black-tailed godwit	MIG	MIG			•	•								
<i>Motacilla cinerea</i>	Grey wagtail	MIG	MIG				•								

Scientific Name	Common Name	EPBC Act	BC Act	DBCA	IUCN	NatureMap (10km) (DBCA, 2020a)	EPBC (10km) (DAWE, 2020)	DBCA (10km) (DBCA, 2020c)	Astron (2015)	Bamford Consulting Ecologists (2003)	ENV Australia (2009)	Harewood (2018)	MRIA (2017)	ENV (2012)	Biologic (2019)
<i>Pandion haliaetus</i>	Osprey, eastern osprey	MIG	MIG			•	•								
<i>Plegadis falcinellus</i>	Glossy ibis	MIG	MIG			•		•							
<i>Pluvialis fulva</i>	Pacific golden plover	MIG	MIG			•									
<i>Pluvialis squatarola</i>	Grey plover	MIG	MIG			•									
<i>Stercorarius longicaudus</i>	Long-tailed jaeger	MIG	MIG			•									
<i>Tringa glareola</i>	Wood sandpiper	MIG	MIG			•	•								
<i>Tringa hypoleucos</i>	Common sandpiper	MIG	MIG			•	•								
<i>Tringa nebularia</i>	Common greenshank	MIG	MIG			•	•	•							
<i>Tringa stagnatilis</i>	Marsh sandpiper	MIG	MIG			•	•								
<i>Gelochelidon nilotica</i>	Gull-billed tern	MIG	MIG			•									
<i>Numenius minutus</i>	Little curlew	MIG	MIG				•								
<i>Philomachus pugnax</i>	Ruff	MIG	MIG				•								
<i>Ixobrychus dubius</i>	Australian little bittern			P4		•									
<i>Oxyura australis</i>	Blue-billed duck			P4	NT	•		•							



Legend

— Study Area

Confirmed roost sites

▲ Confirmed roost

▲ Joint roosts

▲ Forest red-tailed black cockatoo

Species records

● Baudin's cockatoo

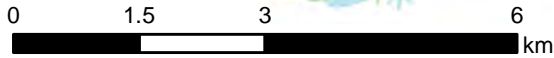
● Carnaby's cockatoo

● Forest red-tailed black cockatoo



N

1:90,000



City of Armadale

Eight Road Biological Survey

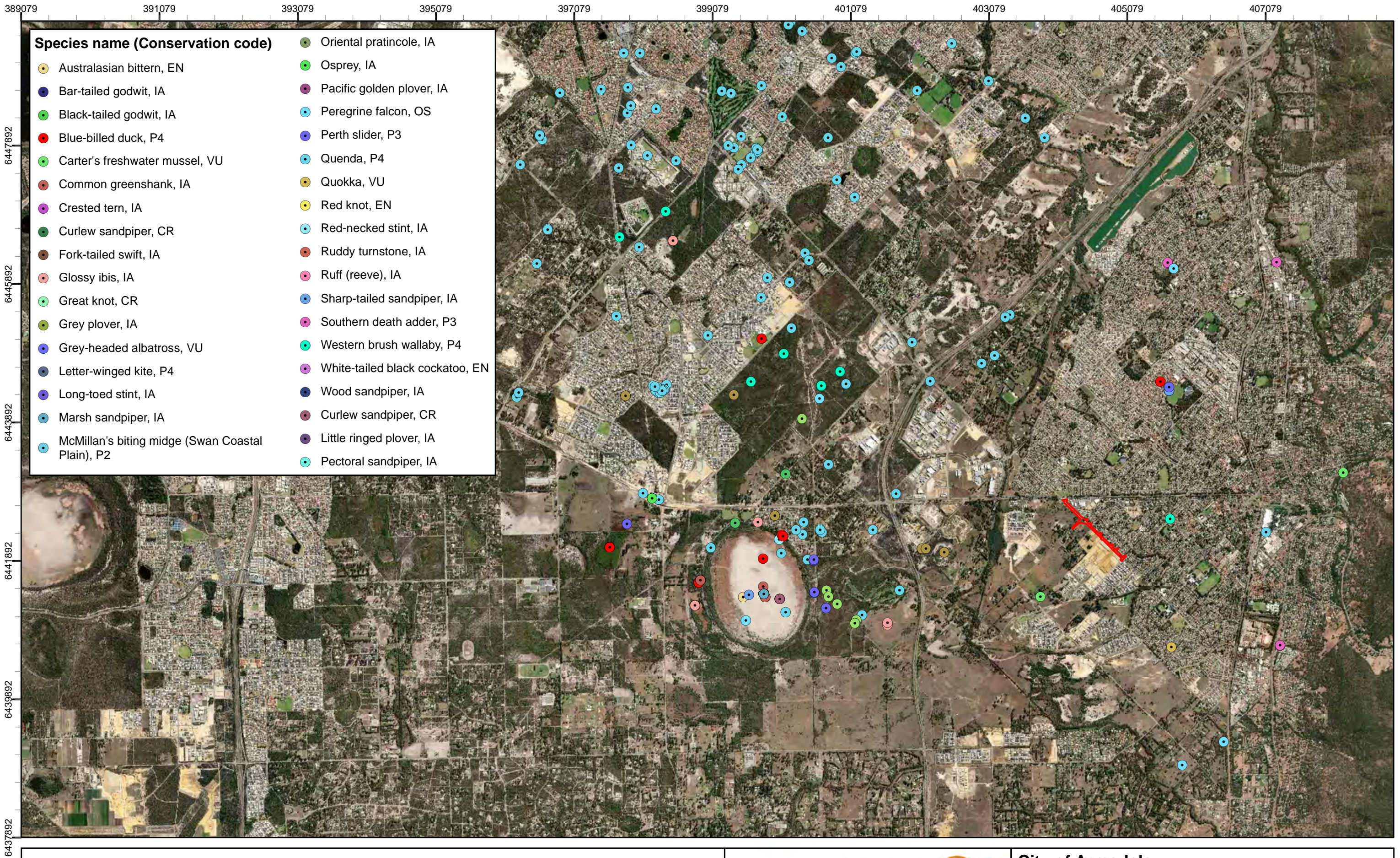
Fig. 4.2: Previous records of Black-Cockatoos in the vicinity, including roost locations

Coordinate System: GDA 1994 MGA Zone 50


Projection: Transverse Mercator

Datum: GDA 1994

Size A3. Created 03/07/2020



Legend
— Study Area



N
1:50,000
0 0.75 1.5 3 km

City of Armadale
Eight Road Biological Survey
Fig. 4.3: Other conservation significant fauna database results

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A3. Created 03/07/2020

4.2 Vegetation/ Fauna Habitats

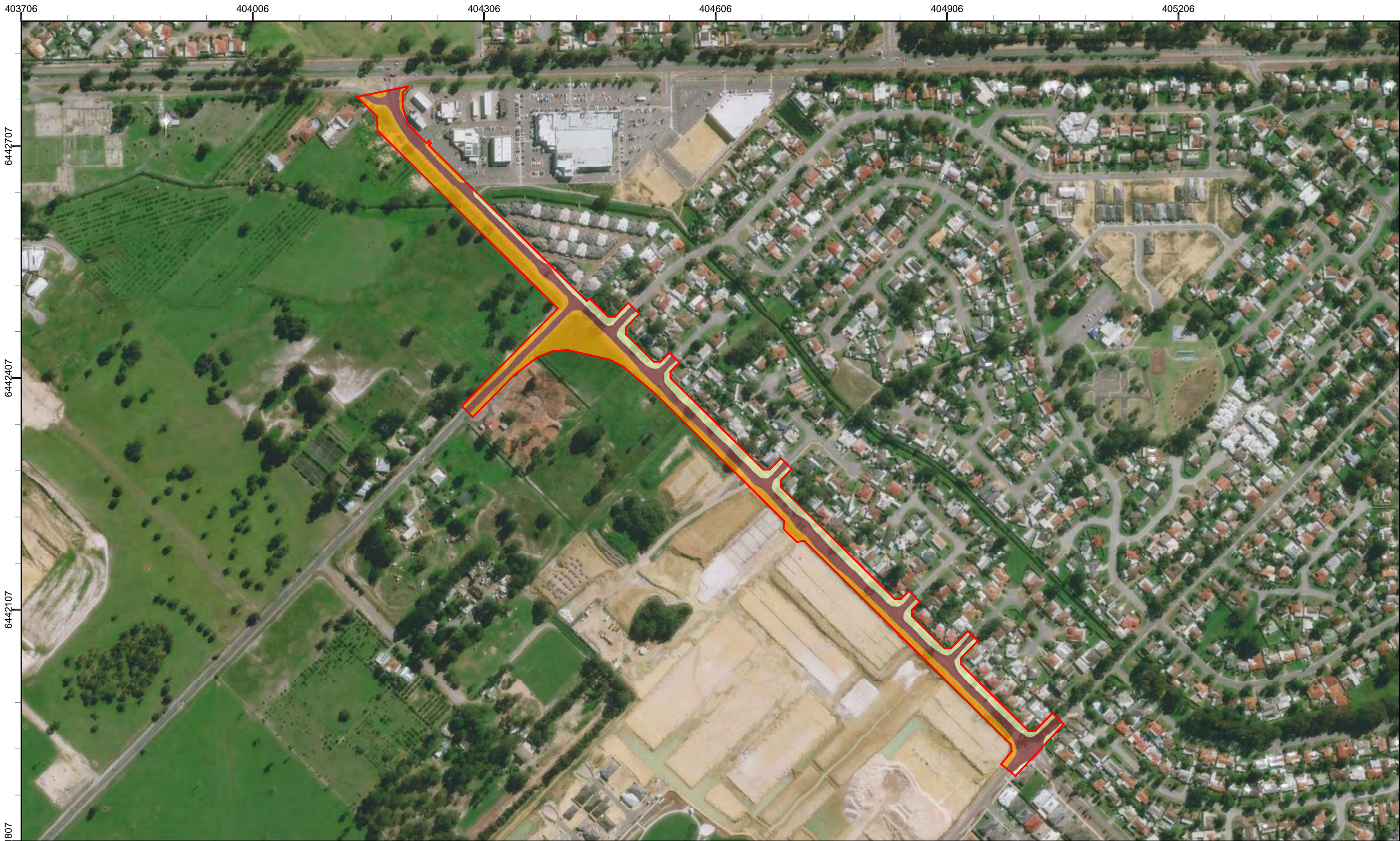
The surveyed section of Eighth Road mostly supports landscaped gardens and road verges, while native street trees (*Corymbia calophylla*) persists along the road verge. The eastern side of Eighth Road mostly supports the landscaped gardens and street trees, while the western side of Eighth Road has been mostly disturbed and cleared. The western side of Eighth Road supported isolated native trees over an introduced tussock grass and herb layer.

Three broad units were mapped (Figure 4.4) within the Study Area:

- Road – incorporates Eighth Road and adjacent roads within the Study Area, like Wollaston Avenue and Gribble Avenue. The occasional non-endemic native trees occurs within the median of Eighth Road, including *Melaleuca leucadendra*;
- Public Road Verge/ Private Landscaped Gardens – occurred on the eastern side of Eighth Road and included the council owned road verge and associated street trees, as well as the private gardens at each dwelling. The unit also includes some hard stand areas, like driveways, paths and paved yards. The majority of the trees and shrubs that occurred along the road verge included *Corymbia calophylla* (15 occurrences) *Eucalyptus marginata* (one occurrence), non-endemic trees (*Eucalyptus torquata*, *Corymbia citriodora*, *Melia azedarach*) and non-endemic shrubs (*Syzygium* cultivar, *Callistemon* cultivar).
- Road Verge with Scattered Trees/ Shrubs – occurred on the western side of Eighth Road and included highly disturbed council and private land. Scattered native trees (*Corymbia calophylla* [ten occurrences] and *Eucalyptus rudis* [three occurrences]) and shrubs (*Melaleuca raphiophylla* – two occurrence) over introduced grasses and herbs occurred along the road verge. Non-endemic shrubs (*Syzygium* cultivar and *Melia azedarach*) occurred sporadically within this unit.

The condition of the vegetation present within the Study Area was only assessed for the Road Verge with Scattered Trees/ Shrubs unit, as the two remaining units were mapped as ‘Cleared’. The condition of the Road Verge with Scattered Trees/ Shrubs unit was mapped as Completely Degraded due to the scattered native trees and the highly altered/ disturbed lower strata (mid and ground strata).

The vegetation present within the Study Area is not conservation significant and does not match any known TECs or PECs. The highly altered vegetation with only limited native overstorey does not match any TECs or PECs.



Legend

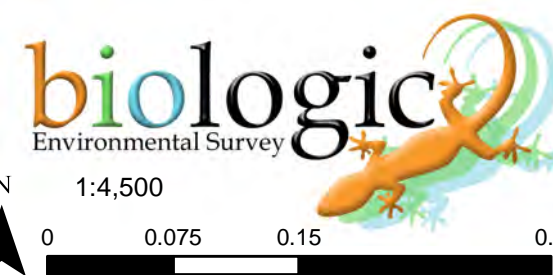
— Study Area

Vegetation/Fauna habitats

Public road verge/ Private landscaped gardens

Road

Road verge with scattered trees/ shrubs



City of Armadale

Eight Road Biological Survey

Fig. 4.4: Vegetation/ Fauna Habitats mapped in the Study Area

Coordinate System: GDA 1994 MGA Zone 50

Projection: Transverse Mercator

Datum: GDA 1994

Size A3. Created 03/07/2020

4.3 Flora

A comprehensive inventory of flora species was not collected for the Study Area due to the highly altered and cleared nature of the vegetation present. The Study Area was traversed to record the presence and location of native trees and shrubs, while also recording the presence of additional tree/shrub species that may be utilised by black cockatoos for feeding. The flora species recorded from the Study Area include:

Trees – native and non-endemic/ introduced

- Marri; *Corymbia calophylla* – recorded 30 times;
- Jarrah; *Eucalyptus marginata* – recorded once;
- Flooded gum; *Eucalyptus rudis* – recorded three times;
- Lemon-scented gum; *Corymbia citriodora* – recorded once;
- Coral gum; *Eucalyptus torquata* – recorded once;
- Swamp mahogany; *Eucalyptus robusta* – recorded three times; and
- Jacaranda; *Jacaranda mimosifolia* – recorded once; and
- Cape Lilac; *Melia azedarach* – recorded four times.

Shrubs – native and non-endemic/ introduced

- Bottlebrush; *Callistemon* sp. 'cultivar' – recorded once;
- Lilly Pilly; *Syzygium* sp. 'cultivar' – recorded five times;
- Weeping paperbark; *Melaleuca leucadendra* – recorded three times; and
- Swamp paperbark; *Melaleuca raphiophylla* – recorded two times.

None of the flora species recorded from the Study Area are listed as conservation significant on any Federal (EPBC Act), State (BC Act) or DBCA (Priority) lists. Following the field survey and review of the flora species of conservation significance as potentially occurring in the Study Area, no threatened or priority listed flora are expected to occur. The highly altered and degraded condition of the Study Area is highly unlikely to support any conservation significant flora.

4.4 Fauna recorded

During the field survey, opportunistic encounters with vertebrate fauna species were recorded. One species was recorded, the forest red-tailed black cockatoo (*Calyptrorhynchus banksii naso*), was observed on two occasions during the survey, as discussed below.

4.5 Fauna of Conservation Significance

A total of 50 species of conservation significance have the potential to occur within the Study Area, based on the results of the desktop assessment (Section 3.2.1, Table 4.2), comprising seven mammals, 38 birds (including migratory species) and five reptiles. Excluding the forest red-tailed black cockatoo recorded during the current survey, none of these species have previously been recorded within the Study Area. As described in Section 4.2, based on the mapped vegetation units and condition of vegetation within the vegetation units, fauna habitat of any value within the Study Area is limited to the Public Road Verge/ Private Landscaped Gardens and Road Verge with Scattered Trees/ Shrubs. As

such, the likelihood of occurrence of the chuditch and southwestern brush-tailed phascogale has been downgraded from Possible to Unlikely despite records in the vicinity of the Study Area.

Species confirmed within the Study Area

Forest red-tailed black cockatoo

The forest red-tailed black cockatoo *Calyptorhynchus banksii naso* is classified as Vulnerable under the EPBC and BC Act. There are 46 previous records of the species from within 10 km of the Study Area (DBCA, 2020c). The nearest record of the species exists approximately 0.8 km south of the Study Area. During the current survey, the species was recorded in a group of five individuals just outside the Study Area, approximately 100 m west of the Wollisten Road, Eighth Road intersection, all feeding in a marri tree (Table 4.3, Figure 4.5). The second sighting was of a group of five individuals feeding in a marri (*Corymbia calophylla*) tree on Wollaston Road, approximately 100 m west of Eighth Rd intersection.

The black cockatoo habitat assessment is discussed in further detail in Section 4.5.1 below.

Table 4.3 Locations of forest red-tailed black cockatoo during the current survey

Latitude	Longitude	Species record
-32.1519	115.9892	Observed flying overhead about halfway along Eighth Rd
-32.1510	115.9851	Observed on Wollisten Rd, approx 100m west of Eighth Rd intersection, all feeding in marri tree

Species Highly Likely to occur in the Study Area

Carnaby's cockatoo

Carnaby's cockatoo *Calyptorhynchus latirostris* is classified as Endangered under the EPBC and BC Act. The species is considered common within the local vicinity, with 560 previous records of Carnaby's cockatoo within 5 km of the Study Area, and an additional 76 *Calyptorhynchus* "white-tailed black cockatoo" records (DBCA, 2020c). The nearest records to the Study Area are approximately 250 metres south-west from 2003 and approximately 450 metres south-east from 2013. The Study Area contains flora species known to be Carnaby's cockatoo foraging resources (marri, jarrah, *Callistemon* sp., and jacaranda), and common breeding trees of DBH greater than 500 mm were noted within the Study Area. In consideration of the quantity and proximity of local records, and the presence of foraging and potential breeding and roosting habitat, the species is considered Highly Likely to occur within the Study Area. The black cockatoo habitat assessment is discussed in further detail in Section 4.5.1 below.

Quenda

The quenda (*Isodon fusciventer*) is classified as Priority 4 by the DBCA. The species is distributed coastal margins in Western Australia ranging from Yanchep to Cape Le Grand and inland to Wyalcatchem and Hyden (Pentland, 1999). The habitat for the species is described as jarrah forest and swamp habitats, in dense vegetation around wetland fringes and heathland (Cooper, 1998; Woinarski *et al.*, 2014). Dense vegetation surrounding waterways is preferred to provide protection and foraging opportunities.

The species has been recorded an additional 175 times within 10 km of the Study Area, with the closest record an opportunistic sighting of a dead individual approximately 700 metres south-east from 2014 (DBCA, 2020c). Quenda have been commonly recorded from primary or secondary evidence from fauna surveys undertaken in the vicinity of the Study Area (see Section 4.1). An individual was observed in a concurrent fauna survey at Reilly Road, approximately 5 km north-west of the Study Area (Biologic, in prep.). Although the fauna habitat types (Private Landscaped Garden/ Road verge with scattered trees/shrubs) within the Study Area are considered suitable to support the species; however, the habitats are not considered optimal.

In consideration of the potentially suitable habitat present in the Study Area and numerous records of the species in the near proximity, quenda are considered Highly Likely to occur.

Species Likely to occur in the Study Area

Baudin's Cockatoo

Baudin's cockatoo (*Calyptorhynchus baudinii*) is classified as Endangered under the EPBC and BC Act. The species is distributed through the south western humid and sub-humid zones, from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and east to Albany (Johnstone & Storr, 1998). Baudin's cockatoos nest in tree hollows in the deep southwest of Western Australia, with primary nesting trees being karri, marri, and wandoo (*Eucalyptus wandoo*) (Johnstone & Kirkby, 2008a).

There are 35 records of Baudin's cockatoo within 10 km of the Study Area; the nearest record (observed in 2012) of the species exists approximately 3 km north-east of the Study Area. An additional 76 *Calyptorhynchus* "white-tailed black cockatoo" records exist within the vicinity as well; however, these records date from 1977 to 1981 and are considered historic (DBCA, 2020c). Baudin's cockatoo has very similar morphological characteristics to Carnaby's cockatoo, and many early accounts of white-tailed black cockatoos did not distinguish between the two species (Chapman, 2007). In addition, the two species commonly occur together in mixed flocks (Peck *et al.*, 2019), and therefore correct identification of white-tailed black cockatoos is difficult, and it is possible that additional Baudin's cockatoo records occur in proximity to the Study Area.

The Study Area lies within the foraging distribution of the species and contains habitat types containing flora species suitable for foraging (e.g. marri, jarrah), and common breeding species trees of DBH greater than 500 mm were recorded within the Study Area (marri, jarrah, and flooded gum). In light of this, and the distribution and proximity of recent records, the species is considered Likely to occur. The black cockatoo habitat assessment is discussed in further detail in Section 4.5.1 below.

Species Possibly occurring in the Study Area

Peregrine Falcon

The peregrine falcon is classified as Other Specially Protected Fauna (OS) under the BC Act. The species typically nests on rocky ledges occurring on tall, vertical cliff faces or occasionally within tall trees occurring along major drainage lines and has occasionally been recorded nesting in human made structures providing high vantage points, such as radio-towers (Olsen & Olsen, 1989). There are 35

records of the species within 10 km of the Study Area, with the nearest record from 2013 approximately 3 km north-west in Anstey-Keane Heathland (DBCA, 2020c). Most of the records for the species occur at Forrestdale Lake.

Although the Study Area does not contain breeding habitat, the species may use the available habitats for foraging, and in consideration of records present within the vicinity of the Study Area, the peregrine falcon is considered Possible to occur.

Western Brush Wallaby

The western brush wallaby *Notamacropus irma* (DBCA Priority 4) inhabits a wide-range of habitats including low *Banksia* woodlands, jarrah/marri woodlands and moist *Melaleuca* lowlands, favouring open, grassy areas (Wann & Bell, 1997; Woinarski *et al.*, 2014). The species abundance is noted to have significantly declined until widespread fox control was implemented in state forests and conservation estates (Woinarski *et al.*, 2014). The Study Area lies within the distribution of the species. There are seven records of the species within 10 km of the Study Area, the closest of which was 1.1 km east (no date); with contemporary records from 2017 within 5 km. Several individuals of western brush wallaby (*Notamacropus irma*, DBCA P4) were observed foraging during the day in Banksia woodland at Jandakot by ENV Australia (2009).

The fauna habitat within the Study Area is considered marginally suitable for the species. In consideration of this and the contemporary records of the species in near proximity, western brush wallaby are considered Possible to occur in the Study Area.

Table 4.4: Conservation significant species likelihood assessment

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution	Distance to Nearest Record - Year	Potential Habitat within study area	Recorded Within study area	Post-survey likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
MAMMALS									
Brush-tailed bettong, woylie <i>Bettongia penicillata ogilbyi</i>	EN	CR		Woodlands and adjacent heaths with a dense understorey of shrubs particularly <i>Gastrolobium</i> sp. (Woinarski <i>et al.</i> , 2014). Species confined to two indigenous colonies in south-west and a small number of reintroduced areas (Start <i>et al.</i> , 1995).	Yes	~7.4 (E) (2006) (DBCA, 2020a)	No	No	Unlikely
Chuditch <i>Dasyurus geoffroii</i>	VU	VU		In the jarrah forest, Chuditch occur in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in Riparian vegetation (Orell & Morris, 1994).	Yes	~ 1 km east (1994) (DBCA, 2020c)	No	No	Unlikely
Wambenger, brush-tailed phascogale <i>Phascogale tapoatafa wambenger</i>		CD		Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Woinarski <i>et al.</i> , 2014).	Yes	~ 1 km east (no date) (DBCA, 2020c)	No	No	Unlikely
Water rat <i>Hydromys chrysogaster</i>			P4	Permanent bodies of fresh or brackish water, subalpine streams to lakes and farm dams and on sheltered coastal beaches, mangroves and offshore islands (Van Dyck & Strahan, 2008).	Yes	~ 1 km east (1928) ~ 3km east (2004) (DBCA, 2020c)	No	No	Unlikely
Quenda <i>Isoodon fusciventer</i>			P4	Jarrah forest and swamp habitats, preferring dense vegetation around wetland fringes and heathland (Cooper, 1998; Woinarski <i>et al.</i> , 2014).	Yes	~ 700 m south-east (2014) (DBCA, 2020c) 175 records within 10 km	Yes (marginal)	No	Highly Likely
Western brush wallaby <i>Notamacropus irma</i>			P4	The species inhabits a wide-range of habitats including low <i>Banksia</i> woodlands, jarrah/marri woodlands and moist <i>Melaleuca</i> lowlands, favours open, grassy areas (Wann & Bell, 1997; Woinarski <i>et al.</i> , 2014).	Yes	~ 900 m east (no date) (DBCA, 2020c)	Yes (marginal)	No	Possible
Western False Pipistrelle <i>Falsistrellus mackenziei</i>			P4	Tall forests and woodlands in the higher rainfall parts of the south-west, particularly karri forests but also tuart and jarrah forests (Woinarski <i>et al.</i> , 2014).	Yes	~ 4km southeast (2013) (DBCA, 2020c)	No	No	Unlikely
BIRDS									
Eastern curlew <i>Numenius madagascariensis</i>	CR/MI	CR/MI		Mainly tidal mudflats, also reef flats, sandy beaches and rarely near-coastal lakes including saltwork ponds (Johnstone & Storr, 1998).	Yes	~ 4km west (2002) (DBCA, 2020a)	No	No	Unlikely
Curlew sandpiper <i>Calidris ferruginea</i>	CR/MI	MI		Inhabits intertidal mudflats in sheltered coastal areas (i.e. estuaries, bays, inlets and lagoons) (Geering <i>et al.</i> , 2007). This rare species generally roosts on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands (Geering <i>et al.</i> , 2007).	Yes	~4.5 km west (2008) (DBCA, 2020a)	No	No	Unlikely
Australasian bittern <i>Botaurus poiciloptilus</i>	EN	EN		Beds of tall dense <i>Typha baumea</i> and sedges in freshwater swamps (Johnstone & Storr, 1998).	No (immediately adjacent to boundary)	~ 3km southwest (2012) (DBCA, 2020a)	No	No	Highly Unlikely
Carnaby's cockatoo <i>Calyptorhynchus latirostris</i>	EN	EN		Occurs in semiarid eucalypt woodlands, preferring wandoo and salmon gum. Will also inhabit proteaceous scrubland and heaths dominated by dryandra, grevillea and banksia species. Prefer coastal areas and banksia woodlands during the non-breeding season . (Johnstone & Storr, 1998).	Yes	~ 250 m southwest (2003) ~ 450 m southeast (2013) (DBCA, 2020c)	Yes Foraging/ roosting/ breeding	No	Highly Likely
Baudin's cockatoo <i>Calyptorhynchus baudinii</i>	EN	EN		Species forages primarily in humid and sub-humid Eucalypt forests, feeding on marri nuts, flowers, nectar and seeds, as well as, <i>Banksia</i> and <i>Hakea</i> species (Johnstone & Storr, 1998). Nesting trees are karri, marri, and wandoo. Species is less frequently found in wandoo, blackbutt, flooded gum and farming or urban areas (Johnstone & Kirkby, 2008b).	Yes	~ 3km northeast (2012) (DBCA, 2020c)	Yes Foraging/ roosting/ breeding	No	Likely

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution	Distance to Nearest Record - Year	Potential Habitat within study area	Recorded Within study area	Post-survey likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
Australian painted snipe <i>Rostratula australis</i>	EN	EN		Generally, occupies shallow terrestrial freshwater wetlands (i.e. temporary and permanent lakes, swamps and claypans) with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire (Johnstone & Storr, 1998).	Yes	3 records ~ 13km west (2010) (DBCA, 2020a)	No	No	Unlikely
Forest red-tailed black cockatoo <i>Calyptrorhynchus banksii naso</i>	VU	VU		Inhabits humid and subhumid eucalypts forests with an average of 600mm rainfall. They mainly inhabit dense jarrah, karri and marri forests with high rainfall. Attracted to seeding Albany blackbutt, blackbutt, karri, Snottygobble and Sheok (Johnstone & Storr, 1998).	Yes	~ 600 m south (2016) ~ 850 m north-east (2003) (DBCA, 2020c)	Yes Foraging/ roosting/ breeding	Yes	Confirmed
Malleefowl <i>Leipoa ocellata</i>	VU	VU		Inhabits semi-arid shrublands and low woodlands dominated by mallee eucalypts and/or <i>Acacias</i> with sandy loam soils (Benshemesh, 2007).	Yes	2 records ~ 13km southeast (2004) (DBCA, 2020a)	No	No	Unlikely
Australian fairy tern <i>Sternula nereis nereis</i>	VU	VU		Coastlines, estuaries, and wetlands, nesting on sheltered sandy beaches and banks (DoEE, 2019b).	No	~ 6km south (2017) (DBCA, 2020a)	No	No	Unlikely
Grey-headed albatross <i>Thalassarche chrysostoma</i>	VU	VU		Coastlines, large bays and open seas. Species nests on tussock grass, on rocks or under trees (Birdlife International, 2018).	No	~2.2 km north-east (1963) (DBCA, 2020c)	No	No	Unlikely
Peregrine falcon <i>Falco peregrinus</i>		OS		In arid areas, it is most often encountered along cliffs above rivers, ranges and wooded watercourses where it hunts birds (Johnstone & Storr, 1998). It typically nests on rocky ledges occurring on tall, vertical cliff faces between 25 m and 50 m high (Olsen <i>et al.</i> , 2004; Olsen & Olsen, 1989). The species occurs along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes nesting on cliffs, granite outcrops, quarries and in the wheatbelt, old Raven and Whistling Kite nests (Johnstone & Storr, 1998).	Yes	~ 2.2km northwest (2013) (DBCA, 2020a)	Yes (marginal)	No	Possible
Fork-tailed swift <i>Apus pacificus</i>	MI	MI		Inhabits dry/open habitats, inclusive of riparian woodlands and tea-tree swamps, low scrub, heathland or saltmarsh, as well as treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. Aerial species, which forages high above the tree canopy and rarely lower. (Johnstone & Storr, 1998).	Yes	~ 2.5km southwest (2000) (DBCA, 2020a)	No	No	Unlikely
Ruddy turnstone <i>Arenaria interpres</i>	MI	MI		Species habitat includes tidal reefs and pools, pebbly, shelly and sandy shores with stranded seaweed, weed-covered rocks, mudflats and on occasion inland shallow waters, sewage ponds, open or ploughed grounds and commercial salt fields (Pizzey & Knight, 2007).	No	2 records~ 2.8km southwest (2001) (DBCA, 2020a)	No	No	Unlikely
Sharp-tailed sandpiper <i>Calidris acuminata</i>	MI	MI		Favours flooded samphire flats and grasslands, mangrove creeks mudflats, beaches, river pools, saltwork ponds, sewage ponds and freshwater soaks (Johnstone <i>et al.</i> , 2013a). Coastal and inland areas saline and freshwater but prefers non-tidal fresh or brackish wetlands (Geering <i>et al.</i> , 2007).	Yes	2 records ~2.3 km southwest (2009) (DBCA, 2020c)	No	No	Unlikely
Pectoral sandpiper <i>Calidris melanotos</i>	MI	MI		Coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (Johnstone & Storr, 2004; Johnstone <i>et al.</i> , 2013a). It prefers wetlands with open fringing mudflats and low, emergent or fringing vegetation (Geering <i>et al.</i> , 2007).	Yes	~ 2.6km southwest (2012) (DBCA, 2020a)	No	No	Unlikely
Red-necked stint <i>Calidris ruficollis</i>	MI	MI		Lives in permanent or ephemeral wetlands of varying salinity, and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes. In Western Australia they prefer freshwater to marine environments. The species usually forages in shallow water at the edge of wetlands and roost or loaf on tidal mudflats, near low saltmarsh, and around inland swamps (Johnstone & Storr, 1998).	Yes	~ 2.8km southwest (2016) (DBCA, 2020a)	No	No	Unlikely

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution	Distance to Nearest Record - Year	Potential Habitat within study area	Recorded Within study area	Post-survey likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
Long-toed stint <i>Calidris subminuta</i>	MI	MI		They prefer shallow freshwater or brackish wetlands but are also fond of muddy shorelines, growths of short grasses, weeds, sedges, low or floating aquatic vegetation, reeds, rushes and occasionally stunted samphire. The Long-toed Stint also frequents permanent wetlands and forages on wet mud or in shallow water, often among short grass, weeds and other vegetation on islets or around the edges of wetlands. They roost or loaf in sparse vegetation at the edges of wetlands and on damp mud near shallow water. It also roosts in small depressions in the mud (Johnstone & Storr, 1998).	No	~ 2.8km southwest (2014) (DBCA, 2020a)	No	No	Unlikely
Little ringed plover <i>Charadrius dubius</i>	MI	MI		Bare or sparsely vegetated sandy and pebbly shores of shallow standing freshwater pools, lakes or slow-flowing rivers. Also found in artificial habitats including gravel pits, sewage works, industrial wastelands and rubbish tips (Birdlife International, 2016).	No	~ 11.8km northwest (1999) (DBCA, 2020a)	No	No	Unlikely
Greater sand plover <i>Charadrius leschenaultii</i>	MI	MI		In the non-breeding grounds in Australasia, the species is almost entirely coastal, inhabiting littoral and estuarine habitats (Stewart <i>et al.</i> , 2007). They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons.	No	~ 2.7km southwest (1999) (DBCA, 2020a)	No	No	Unlikely
Swinhoe's Snipe <i>Gallinago megala</i>	MI	MI		During the non-breeding season Swinhoe's Snipe occurs at the edges of wetlands, such as wet paddy fields, swamps and freshwater streams. Habitat specific to Australia includes the dense clumps of grass and rushes round the edges of fresh and brackish wetlands. This includes swamps, billabongs, river pools, small streams and sewage ponds (Higgins & Davies, 1996)	No (5 km from boundary)	~ 1075km northeast (1981) (DBCA, 2020a)	No	No	Highly Unlikely
Pin-tailed Snipe <i>Gallinago stenura</i>	MI	MI		During non-breeding period the Pin-tailed Snipe occurs most often in or at the edges of shallow freshwater swamps, ponds and lakes with emergent, sparse to dense cover of grass/sedge or other vegetation (Higgins & Davies, 1996). The species is also found in drier, more open wetlands such as claypans in more arid parts of species' range. It is also commonly seen at sewage ponds; not normally in saline or inter-tidal wetlands (Higgins & Davies, 1996)	No (5 km from boundary)	~ 17km northwest (2011) (DBCA, 2020a)	No	No	Unlikely
Caspian Tern <i>Hydroprogne caspia</i>	MI	MI		Mainly sheltered seas, estuaries and tidal creeks; occasionally near-coastal salt lakes (including saltwork ponds) and brackish pools in lower courses of rivers; rarely fresh water (Johnstone & Storr, 1998).	No	~ 12.4km west (2018) (DBCA, 2020a)	No	No	Unlikely
Black-tailed godwit <i>Limosa limosa</i>	MI	MI		Utilises coastal habitats including estuaries, lagoons, sheltered bays, intertidal sand and mud flats. Can inhabit near-coastal wetlands, with minimal inland fresh and saltwater records (DoEE, 2019b)	No	~ 2.8km southwest (2009) (DBCA, 2020a)	No	No	Unlikely
Grey wagtail <i>Motacilla cinerea</i>	MI	MI		A rare vagrant to Western Australia where it has been recorded within various habitats with open waterbodies (Johnstone & Storr, 2004).	Yes	~ 310km south (2013) (DBCA, 2020a)	No	No	Highly Unlikely
Eastern osprey <i>Pandion cristatus</i>	MI	MI		Inhabits coastal areas and wetlands. Require large bodies of fresh, brackish or saline water including reefs, bays. Beaches, mangroves, estuaries, rivers and lakes (DoEE, 2019b).	Yes	~ 2.6km southwest (2009) (DBCA, 2020a)	No	No	Unlikely
Glossy ibis <i>Plegadis falcinellus</i>	MI	MI		Freshwater wetlands, irrigated areas, margins of dams, floodplains, brackish and saline wetlands, tidal mudflats, pastures, lawns and public gardens (Johnstone <i>et al.</i> , 2013a).	Yes	~ 3 km southwest (2003) (DBCA, 2020c)	No	No	Unlikely
Pacific golden plover <i>Pluvialis fulva</i>	MI	MI		Coastal habitats and infrequently inland wetlands. Favours beaches, estuaries, lagoons mud and sand flats. Can be found in wetlands with fresh, brackish or saline water (DoEE, 2020).	No	~ 2.6km southwest (2013) (DBCA, 2020a)	No	No	Unlikely
Grey plover <i>Pluvialis squatarola</i>	MI	MI		Inhabit coastal areas including estuaries, lagoons, mudflats and salt flats. Can occur in inland wetlands, lakes and salt-lakes (DoEE, 2019b).	No	~ 2.6km southwest (2007) (DBCA, 2020a)	No	No	Unlikely
Long-tailed jaeger <i>Stercorarius longicaudus</i>	MI	MI		Little is known about their wintering habitat; they are pelagic after breeding and spend little time near the land (Andersson, 1971)	No	~ 3.5km southwest (1992) (DBCA, 2020a)	No	No	Unlikely

Species	Conservation Status			Preferred Broad Habitats	Within Current Known Distribution	Distance to Nearest Record - Year	Potential Habitat within study area	Recorded Within study area	Post-survey likelihood of Occurrence
	EPBC Act	BC Act	DBCA						
Wood sandpiper <i>Tringa glareola</i>	MI	MI		Species occurs as a non-breeding summer migrant which occurs throughout the region. Occurs mainly in river pools, sewage ponds, flooded claypans, freshwater lagoons and bore overflows (Johnstone <i>et al.</i> , 2013a). Freshwater wetlands and occasional brackish intertidal mudflats (Geering <i>et al.</i> , 2007).	Yes	~ 2.6km southwest (2009) (DBCA, 2020a)	No	No	Unlikely
Common sandpiper <i>Actitis hypoleucos</i>	MI	MI		Estuaries and deltas of streams, as well as banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans (Johnstone & Storr, 1998).	Yes	2 records ~ 4.8km northeast (2013) (DBCA, 2020a)	No	No	Unlikely
Common greenshank <i>Tringa nebularia</i>	MI	MI		Species occurs as a non-breeding summer Migrant which occurs throughout the region. Occurs mainly in Tidal mudflats, mangrove creeks, flooded samphire flats, beaches, river pools, and saltwork and sewage ponds (Johnstone <i>et al.</i> , 2013a).	Yes	~ 3 km southwest (2004) (DBCA, 2020c)	No	No	Unlikely
Marsh Sandpiper <i>Tringa stagnatilis</i>	MI	MI		Lives in permanent or ephemeral wetlands of varying salinity, and also regularly at sewage farms and saltworks. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes. In Western Australia they prefer freshwater to marine environments. The species usually forages in shallow water at the edge of wetlands and roost or loaf on tidal mudflats, near low saltmarsh, and around inland swamps (Johnstone & Storr, 1998).	No (5 km from boundary)	2 records ~ 2.6km southwest (2004) (DBCA, 2020a)	No	No	Unlikely
Gull-billed tern <i>Gelochelidon nilotica</i>	MI	MI		Shallow sheltered seas close to land, estuaries, tidal creeks; and inundated samphire flats, flooded salt lakes, claypans and watercourses in the interior (Johnstone & Storr, 1998).		~ 2.6km southwest (2009) (DBCA, 2020a)	No	No	Unlikely
Little curlew <i>Numenius minutus</i>	MI	MI				~ 46km southwest (2014) (DBCA, 2020a)	No		Highly Unlikely
Ruff <i>Philomachus pugnax</i>	MI	MI		Mainly fresh, brackish and saline wetlands with exposed mudflats. Found near lakes, swamps, pools, lagoons, tidal rivers and floodlands. Sometimes observed in sheltered coastal areas, including harbours and estuaries (DoEE, 2019b)	No (5 km from boundary)	2 records ~ 12km west (2016) (DBCA, 2020a)	No	No	Unlikely
Australian Little bittern <i>Ixobrychus dubius</i>			P4	The birds are mainly found in freshwater wetlands, where they inhabit dense emergent vegetation of reeds and sedges, and inundated shrub thickets (Marchant & Higgins, 1993).	Yes	~ 2.6km southwest (2009) (DBCA, 2020a)	No	No	Unlikely
Blue-billed duck <i>Oxyura australis</i>			P4	Mainly deep freshwater swamps and lakes; occasionally salt lakes and estuaries freshened by flood waters (Johnstone & Storr, 1998).	Yes	~ 2km northeast (2004) (DBCA, 2020c)	No	No	Unlikely
REPTILES									
Southern Death Adder <i>Acanthophs antarcticus</i>			P3	The species is typically found in woodlands, grasslands, chenopod dominated shrublands, coastal heaths, wet and dry eucalypt forests. Prefers habitats with deep leaf litter (Queensland Government, 2017)	Yes	5 records~ 3.8km northeast (No date) (DBCA, 2020c)	No	No	Unlikely
Dell's skink <i>Ctenotus delli</i>			P4	Dry sclerophyll forest on stony hills and ranges (Cogger, 2014), but otherwise undocumented.	Yes	~ 2.6km southeast (1969) ~ 16.4km southeast (2010) (DBCA, 2020a)	No	No	Unlikely
Coastal plains skink <i>Ctenotus ora</i>			P3	This species is found in open eucalypt and <i>Banksia</i> woodland on sandy coastal plain and coastal heath (Gaikhorst <i>et al.</i> , 2017b). It has only ever been found in low numbers in a small stretch of sand dunes on the Swan Coastal Plain.	Yes	~ 16.4km northeast (No date) (DBCA, 2020a)	No	No	Unlikely
Perth Slider, Lined Skink <i>Lerista lineata</i>			P3	The species is found in in coastal dune areas with deep sand including sandy heath, low scrubland, tuart open woodland and banksia woodland. Species appears to depend on substrate, preferring white to grey sandy soils and occasionally limestone outcrop (Gaikhorst <i>et al.</i> , 2017a).	Yes	~ 2km west (2017) (DBCA, 2020c)	No	No	Unlikely
Black-Striped Snake <i>Neelaps calonotos</i>			P3	The species inhabits sandy areas, <i>Banksia</i> and eucalypt woodlands (ALA, 2019).	Yes	~ 2.9km southwest (2018) (DBCA, 2020a)	No	No	Unlikely

4.5.1 Black Cockatoo Habitat Assessment

Potential Foraging Trees/ Habitat

Black cockatoos rely upon the availability of foraging resources across their range, particularly to build condition in the post-breeding period (DoEE, 2017). Black cockatoos will forage up to 12 km from breeding hollows during the breeding season and rely on this proximity of foraging resources to breeding hollows to successfully raise chicks (DoEE, 2017). Although the Study Area is located within a highly urbanised local environment; it is in the vicinity of Forrestdale Lake Nature Reserve (~3.5 km southwest) and some reserves within five kilometres (e.g. Bungendore Park – Wungong Regional Park, Champion Lakes (Bush Forever 255 and 260), Jandakot Regional Park) and such it is highly likely that the surrounding region contains additional foraging habitat for black cockatoos.

DoEE (2017) defines 'high quality' foraging habitat as habitat scoring of 6 or above, which, particularly in proximity to roosting and/ or breeding sites, is considered important for the long-term survival and recovery of black cockatoos. One assessment was made within the Study Area, which categorised the foraging quality as " Very High Quality" (score of 11) for Carnaby's cockatoo, Baudin's cockatoo, and forest red-tailed black cockatoo (Table 4.5).

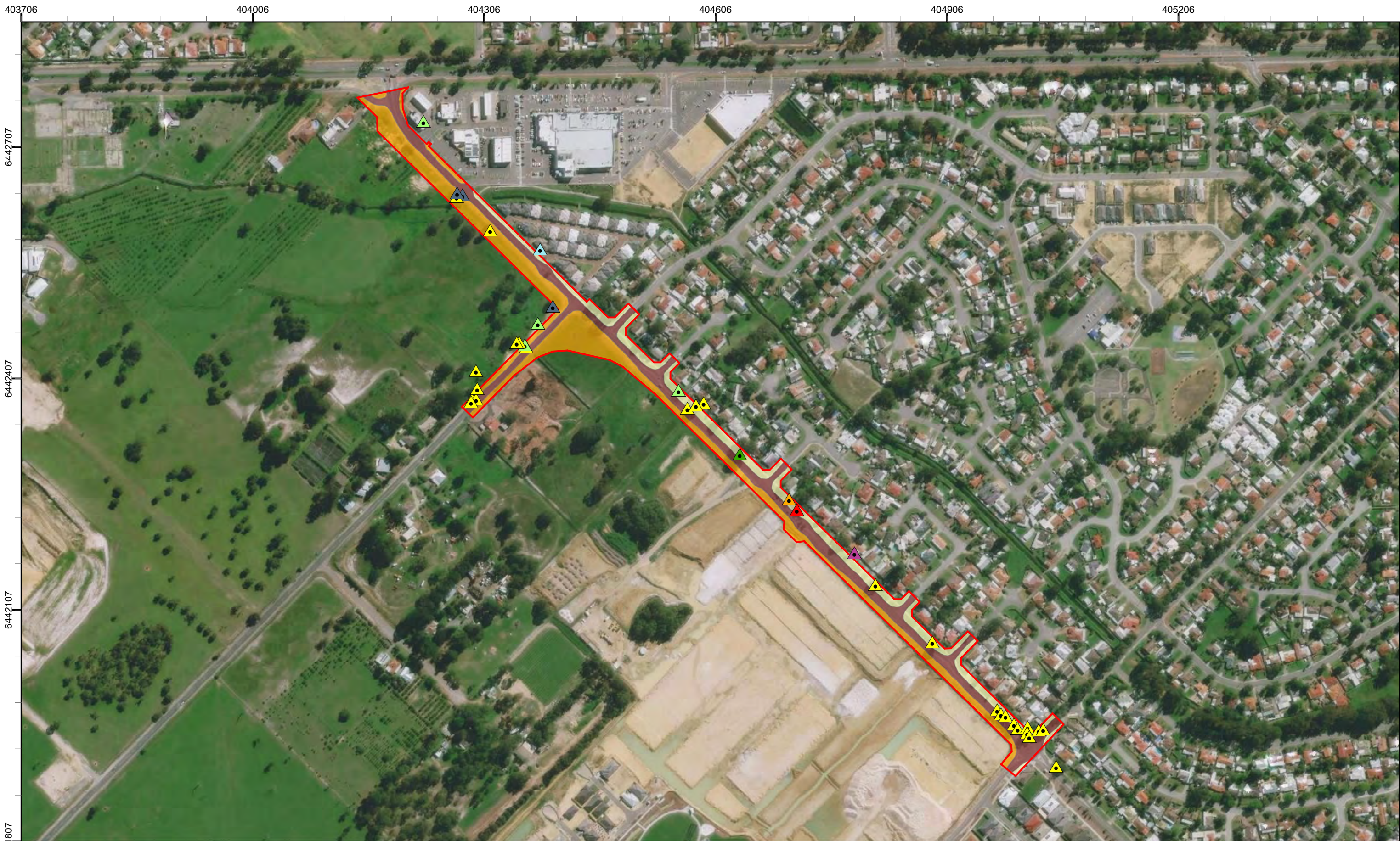
Ten *Corymbia calophylla* (marri) trees had evidence of feeding by forest red-tailed black cockatoos, with individuals either present or marri nuts showing seed extraction characteristic of the species present (Plate 4.1). In addition, four cape lilac trees were recorded, which are considered a significant food resource for the species on the Swan Coastal Plain, as well as jarrah and flooded gum (Johnstone *et al.*, 2017). Marri is also considered a major food source for both white-tailed black cockatoo species (DoEE, 2017); other significant food resources present are jarrah (Baudin's cockatoo) and *Callistemon* sp. (Carnaby's cockatoo). Significant foraging species for black cockatoo are shown on Figure 4.5.



Plate 4.1: Evidence of forest red-tailed black cockatoo feeding in the Study Area

Table 4.5 Summary of foraging habitat quality scores for the Study Area

Carnaby's cockatoo foraging score				Baudin's cockatoo foraging score				Forest red-tailed black cockatoo foraging score			
Starting score	Additions	Subtractions	Total	Starting score	Additions	Subtractions	Total	Starting score	Additions	Subtractions	Total
Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species (7)	<ul style="list-style-type: none"> Is within the Swan Coastal Plain (+3) Primarily comprises marri (+2) Contains trees with potential to be used for breeding (+2) 	<ul style="list-style-type: none"> No clear evidence of feeding debris (-2) Is > 12 km from a known breeding location (-1) 	11 (Very High Quality)	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides (7)	<ul style="list-style-type: none"> Is within the known foraging area (+3) Primarily contains marri (+2) Contains trees with potential to be used for breeding (+2) 	<ul style="list-style-type: none"> No clear evidence of feeding debris (-2) Is > 12 km from a known breeding location (-1) 	11 (Very High Quality)	Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. (7)	<ul style="list-style-type: none"> Primarily contains marri and/or jarrah (+2) Contains trees with potential to be used for breeding (+2) 	<ul style="list-style-type: none"> Is > 12 km from a known breeding location (-1) 	11 (Very High Quality)
Foraging resources present: <ul style="list-style-type: none"> Marri Jarrah <i>Callistemon</i> sp. Jacaranda 				Foraging resources present: <ul style="list-style-type: none"> Marri Jarrah 				Foraging resources present: <ul style="list-style-type: none"> Marri Cape lilac Jarrah Flooded gum 			



Legend

— Study Area

Vegetation/Fauna habitats

- Public road verge/ Private landscaped gardens
- Potential foraging habitat
- Road verge with scattered trees/ shrubs

Potential foraging habitat

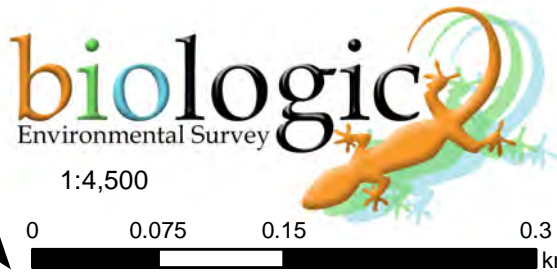
- Callistemon sp.
- Cape lilac
- Corymbia citriodora
- Eucalyptus ?torqata

Flooded Gum (Eucalyptus rudis)

Jacaranda

Jarrah (Eucalyptus marginata)

Marri (Corymbia calophylla)



City of Armadale
Eight Road Biological Survey
Fig. 4.5: Black cockatoo foraging trees/habitat

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994
Size A3. Created 03/07/2020

Potential Roosting Habitat

Roosting habitat is defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, and within an area of quality foraging habitat within the range of the black cockatoo species (DoEE, 2017). Significant roost sites exist for Carnaby's Cockatoo in the Greater Perth-Peel region (Peck *et al.*, 2019), while forest red-tailed black cockatoos have been recorded breeding in the Perth region over recent years. Database searches did not record any roost sites within the Study Area boundary; however, there are nine confirmed white-tailed black cockatoo (Carnaby's and/ or Baudin's black cockatoo) roosts, five forest-red tailed black cockatoo roosts, and seventeen joint roost sites within 12 km of the Study Area (Birdlife Australia, 2020). The nearest roosts to the Study Area are SERDARR001 (joint roost), located 5 km south-east, and ARMBEDR006 (forest red-tailed black cockatoo roost), located 5.5 km east (Birdlife Australia, 2020). ARMBEDR006 has been consistently used as a roost for the past three years (Peck *et al.*, 2019)/

Based on the habitat mapping conducted and the presence of recognised roosting species (i.e marri, jarrah, introduced eucalypt trees; DoEE, 2017; Johnstone *et al.*, 2011), potential roosting habitat was identified in the Study Area across the "Public Road Verge" and "Road Verge with Scattered Trees/ Shrubs", as shown in Figure 4.4.

Black cockatoos will favour roost sites that are within two kilometres to water sources (DoEE, 2017). There are no water sources within the Study Area, however there are numerous waterbodies within 5 km of the Study Area including Champion Lakes (~2 km northeast) and Forrestdale Lake (~3.5 km south-west).

No evidence of black cockatoo roosting activity was recorded during the field survey; however, the Study Area may still be suitable for supporting roosting habitat.

Potential Breeding Tree Records

Breeding habitat is defined in the referral guidelines as species of trees known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most species of trees, suitable DBH is 500 mm (DoEE, 2017; DSEWPac, 2012b). Modelled distributions show the Study Area lies within the breeding range for Carnaby's cockatoo, within forest red-tailed black cockatoo distribution and within the known foraging areas for Baudin's cockatoo (DoEE, 2017).

Sixteen trees identified within the Study Area boundary were of a suitable DBH and species to support black cockatoo breeding with the most common species being marri (*Corymbia calophylla*). Details of tree species recorded with greater than 500 mm DBH within the Study Area are shown in Table 4.6 and Figure 4.6 and an example of a tree of suitable size is shown in Plate 4.3.

Table 4.6: Number of trees with 500 mm or greater DBH recorded in the Study Area

Species	Scientific Name	Number of trees	DBH Range	Hollow Presence
Marri	<i>Corymbia calophylla</i>	12	880 – 500	No
Jarrah	<i>Eucalyptus marginata</i>	1	550	No
Flooded Gum	<i>Eucalyptus rudis</i>	2	720 – 570	Yes – 1 (10cm)
Introduced Eucalyptus		1	540	No
Total		16	880 – 500	1

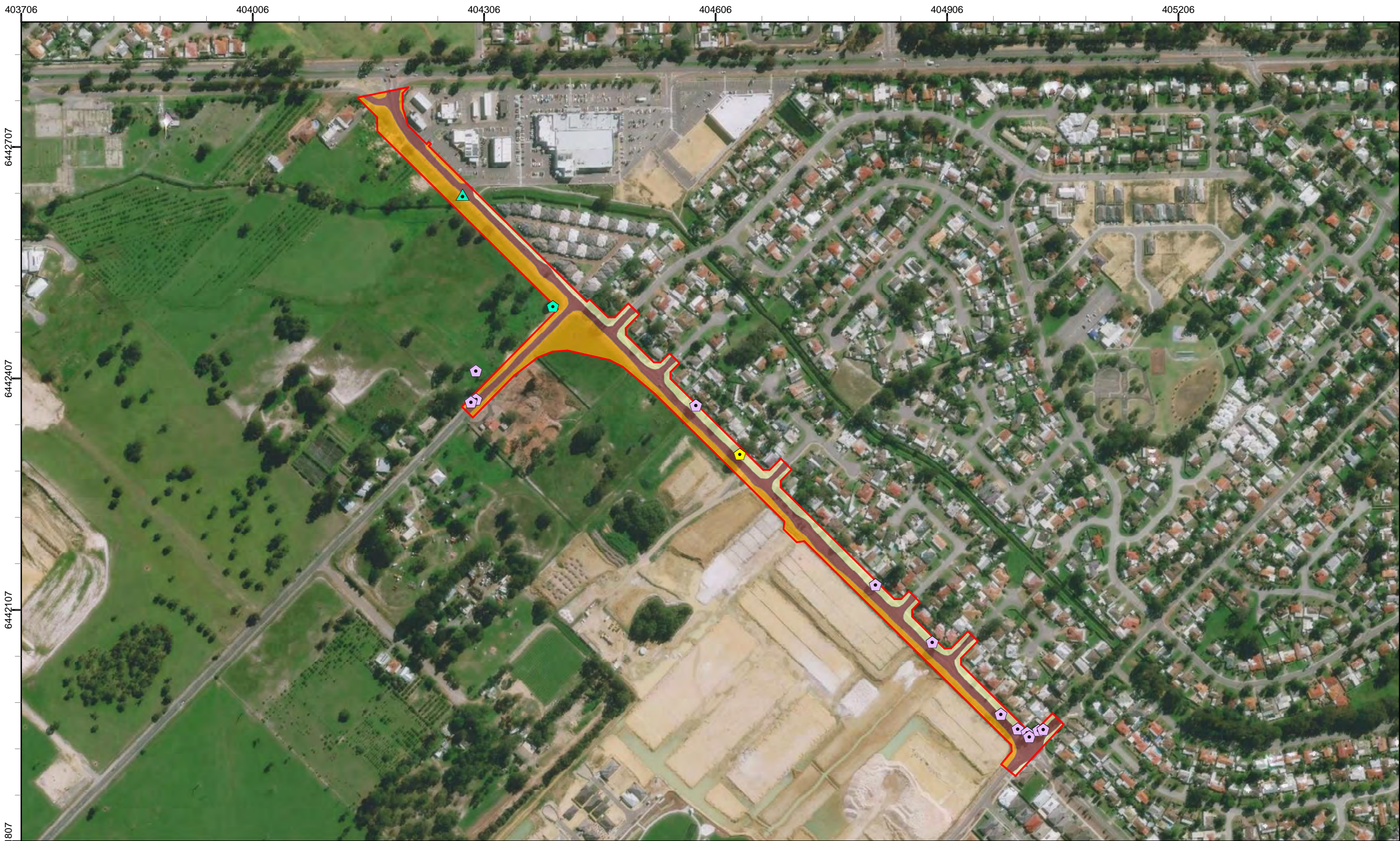


Plate 4.2: Examples of suitable breeding trees in the Study Area, as well as evidence of forest red-tailed black cockatoo visitation

One hollow was observed in a flooded gum (*Eucalyptus rudis*) located on the western side of the Study Area (Plate 4.3). The hollow was approximated as a maximum of 100 mm in diameter, and occurred along the main trunk, providing a side entrance. The hollow did not show any evidence of breeding from black cockatoos (e.g. chew marks on the margin of the hollow) or any other fauna species. Based on the size of the hollow, and its presence in a tree uncommonly used for breeding (Johnstone *et al.*, 2013b), it is unlikely to provide breeding potential for black cockatoo. Although breeding site locations are confidential, BirdLife database suggests that it is highly likely Black Cockatoo breeding occurs within the area (e.g. Bungendore Park; Birdlife Australia, 2020).



Plate 4.3: Hollow present within flooded gum with a DBH of 72 mm (same hollow, shown close up)



Legend


— Study Area

Vegetation/Fauna habitats

- Public road verge/ Private landscaped gardens
- Potential roosting/breeding habitat
- Road verge with scattered trees/ shrubs

Potential breeding tree species

- Flooded Gum (*Eucalyptus rudis*)
- Flooded Gum (*Eucalyptus rudis*) (Hollow)
- Jarraah (*Eucalyptus marginata*)
- Marri (*Corymbia calophylla*)



1:4,500

0 0.075 0.15 0.3 km

City of Armadale
Eight Road Biological Survey
Fig. 4.6: Potential roosting and breeding trees with hollows in the Study Area

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

Size A3. Created 03/07/2020

5 CONCLUSION

A simplified Reconnaissance flora and vegetation survey and Level 1 fauna survey, as well as a black cockatoo habitat assessment, was completed within the Study Area, consisting of a section of Eighth Road between Gribble Avenue in the south and Armadale Road in the north. The field survey was completed within a day, with approximately 4 person hours spent sampling the Study Area.

The vegetation present within the Study Area was highly altered and consisted of road verges, private landscaped gardens and completely degraded remnant native vegetation. No threatened or priority listed flora were recorded from the Study Area, while none are expected to occur due to the highly altered and completely degraded vegetation present. The vegetation, mostly consisting of isolated native trees and shrubs over introduced grasses and herbs, was not analogous with any TECs or PECs known to occur near the Study Area.

Although the vegetation present within the Study Area has limited value for conservation significant flora, ecological communities and fauna species, forest red-tailed black cockatoos were recorded feeding. The presence of numerous marri (*Corymbia calophylla*) trees and several other foraging resources (jarrah, cape lilac, flooded gum) suggests that the Study Area provides value for the three threatened black cockatoo species. A total of 16 trees, including one tree with a hollow, were of suitable size to potentially provide breeding habitat into the future. The majority of these trees were marri trees, while the tree with a hollow (flooded gum) was not likely of suitable size or a preferred tree species for black cockatoo breeding.

The Study Area provides minimal value for conservation significant flora and fauna species; however, the presence of potential breeding trees and foraging resources suggest that black cockatoos may infrequently utilise the vegetation in the Study Area.

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7 APPENDICES

Appendix A – Conservation Codes

International Union for Conservation of Nature

Category	Definition
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Extinct in the Wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	A taxon is Near Threatened when it 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 (LTC)	A taxon is Least Concern when it 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)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
Not Evaluated (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Environment Protection and Biodiversity Conservation Act 1999

Category	Definition
Threatened Flora Species	
Extinct (EX)	A native species is eligible to be included in the Extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	A native species is eligible to be included in the Extinct in the Wild category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CR)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation Dependent (CD)	A native species is eligible to be included in the Conservation Dependent category at a particular time if, at that time: <ul style="list-style-type: none"> (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming Vulnerable, Endangered or Critically Endangered; or (b) the following subparagraphs are satisfied: <ul style="list-style-type: none"> (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Category	Definition
Threatened Ecological Communities (TEC)	
Critically Endangered	An ecological community is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	An ecological community is eligible to be included in the endangered category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	An ecological community is eligible to be included in the vulnerable category at a particular time if, at that time: <ul style="list-style-type: none"> (a) it is not critically endangered nor endangered; and (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Threatened Fauna Species	
Extinct (EX)	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (EW)	Taxa known to survive only in captivity.
Critically Endangered (CE)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (EN)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (VU)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Migratory (MIG)	Consists of species listed under the following International Conventions: Japan-Australia Migratory Bird Agreement (JAMBA) China-Australia Migratory Bird Agreement (CAMBA) Convention on the Conservation of Migratory Species of Wild animals (Bonn Convention)

Biodiversity Conservation Act 2016

Category	Definition
Threatened Flora Species	
Critically Endangered (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”. Published under schedule 1 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.
Endangered (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”. Published under schedule 2 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.
Vulnerable (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”. Published under schedule 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for vulnerable flora.
Extinct (EX)	Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.
Extinct in the Wild (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 flora species listed as extinct in the wild.
Threatened Ecological Communities (TEC)	
Critically Endangered (CR)	An ecological community is eligible for listing in the category of critically endangered ecological community at a particular time if, at that time — (a) it is facing an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines; and (b) listing in that category is otherwise in accordance with the ministerial guidelines.
Endangered (EN)	An ecological community is eligible for listing in the category of endangered ecological community at a particular time if, at that time — (a) it is not a critically endangered ecological community; and (b) it is facing a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines; and (c) listing in that category is otherwise in accordance with the ministerial guidelines.

Category	Definition
Vulnerable (VU)	<p>An ecological community is eligible for listing in the category of vulnerable ecological community at a particular time if, at that time —</p> <p>(a) it is not a critically endangered ecological community or an endangered ecological community; and</p> <p>(b) it is facing a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines; and</p> <p>(c) listing in that category is otherwise in accordance with the ministerial guidelines.</p>
Collapsed	<p>An ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time —</p> <p>(a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or</p> <p>(b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover —</p> <p>(i) its species composition or structure; or</p> <p>(ii) its species composition and structure.</p>
Threatened Fauna Species	
Critically Endangered (Cr)	Rare or likely to become extinct, as <i>critically endangered</i> fauna.
Endangered (En)	Rare or likely to become extinct, as <i>endangered</i> fauna.
Vulnerable (Vu)	Rare or likely to become extinct, as <i>vulnerable</i> fauna.
Extinct (Ex)	Being fauna that is presumed to be extinct.
Migratory (Mi)	Birds that are subject to international agreements relating to the protection of migratory birds.
Conservation Dependent (CD)	Special conservation need being species dependent on ongoing conservation intervention. (Conservation Dependant)
Other Specially Protected Species (OS)	In need of special protection, otherwise than for the reasons pertaining to Schedule 1 through to Schedule 6 Fauna. (Other specially protected species)

Department of Biodiversity, Conservation and Attractions Priority Definitions

Category	Definition
Priority Flora and Fauna Species	
Priority 1 (P1)	<p>Poorly-known Species</p> <p>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.</p>
Priority 2 (P2)	<p>Poorly-known Species</p> <p>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.</p>
Priority 3 (P3)	<p>Poorly-known Species</p> <p>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.</p>
Priority 4 (P4)	<p>Rare, Near Threatened and other species in need of monitoring</p> <p>(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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

Category	Definition
Priority Ecological Communities (PEC)	
Priority 1 (P1)	<p>Poorly-known ecological communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤ 5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
Priority 2 (P2)	<p>Poorly-known Ecological Communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally ≤ 10 occurrences or a total area of ≤ 200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
Priority 3 (P3)	<p>Poorly-known Ecological Communities</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>

Category	Definition
Priority 4 (P4)	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>(i) Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
Priority 5 (P5)	<p>Conservation Dependent Ecological Communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

Appendix B – Flora identified from the Desktop Assessment

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Fabaceae	Alhagi maurorum						Y				Yes
Amaranthaceae	Ptilotus drummondii	X	X								
Amaranthaceae	Ptilotus sericostachyus subsp. roseus			X				P1			
Anarthriaceae	Lyginia barbata	X	X								
Anarthriaceae	Lyginia barbata/imberbis	X									
Anarthriaceae	Lyginia imberbis		X								
Apiaceae	Platysace filiformis	X	X								
Apiaceae	Schoenolaena juncea	X	X								
Basellaceae	Anredera cordifolia					X					Yes
Asparagaceae	Asparagus aethiopicus					X					Yes
Aponogetonaceae	Aponogeton hexatepalus			X	X			P4			
Asparagaceae	Asparagus asparagoides					X	X				Yes
Asparagaceae	Asparagus plumosus					X					Yes
Araliaceae	?Trachymene pilosa	X									
Araliaceae	Hydrocotyle alata	X	X								
Araliaceae	Hydrocotyle lemnoides			X				P4			
Chenopodiaceae	Atriplex prostrata	X	X								Yes
Araliaceae	Trachymene pilosa	X	X								
Asparagaceae	?Lomandra sericea	X									
Cactaceae	Austrocylindropuntia cylindrica						X				Yes
Cactaceae	Austrocylindropuntia subulata						X				Yes
Poaceae	Briza maxima	X	X								Yes
Asparagaceae	Laxmannia ramosa		X								
Asparagaceae	Laxmannia ramosa subsp. ramosa	X									

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Asparagaceae	Laxmannia squarrosa	X	X								
Asparagaceae	Lomandra ? caespitosa	X									
Asparagaceae	Lomandra caespitosa	X	X								
Asparagaceae	Lomandra hermaphrodita	X	X								
Asparagaceae	Lomandra nigricans	X	X								
Asparagaceae	Lomandra odora		X								
Asparagaceae	Lomandra preissii	X	X								
Asparagaceae	Lomandra sericea	X	X								
Asparagaceae	Thysanotus ?thyrsoideus	X									
Asparagaceae	Thysanotus arbuscula	X	X								
Asparagaceae	Thysanotus glaucus			X				P4			
Asparagaceae	Thysanotus manglesianus	X	X								
Asparagaceae	Thysanotus manglesianus/patersonii complex	X									
Asparagaceae	Thysanotus multiflorus	X	X								
Asparagaceae	Thysanotus sp. Badgingarra (E.A. Griffin 2511)			X				P2			
Asparagaceae	Thysanotus sparteus	X	X								
Asparagaceae	Thysanotus tenellus	X	X								
Asparagaceae	Thysanotus thyrsoideus	X									
Asparagaceae	Thysanotus triandrus	X	X								
Asteraceae	Asteridea gracilis			X	X			P3			
Asteraceae	Brachyscome iberidifolia		X								
Apocynaceae	Calotropis procera						X				Yes
Poaceae	Cenchrus ciliaris					X					Yes
Asteraceae	Chondrilla juncea						X				Yes

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Asteraceae	Chrysanthemoides monilifera					X					Yes
Asteraceae	Chrysanthemoides monilifera subsp. monilifera					X					Yes
Asteraceae	Cotula coronopifolia	X	X								Yes
Asteraceae	Podolepis gracilis	X									
Asteraceae	Quinetia urvillei	X									
Asteraceae	Rhodanthe citrina	X	X								
Asteraceae	Rhodanthe pyrethrum	X	X								
Asteraceae	Senecio diaschides	X	X								
Asteraceae	Siloxerus humifusus	X	X								
Apocynaceae	Cryptostegia madagascariensis						X				Yes
Cactaceae	Cylindropuntia fulgida						X				Yes
Cactaceae	Cylindropuntia imbricata						X				Yes
Cactaceae	Cylindropuntia kleiniae						X				Yes
Cactaceae	Cylindropuntia pallida						X				Yes
Cactaceae	Cylindropuntia tunicata						X				Yes
Boraginaceae	Echium plantagineum						X				Yes
Boraginaceae	Halgania corymbosa			X				P3			
Byblidaceae	Byblis gigantea	X		X	X			P3			
Poaceae	Ehrharta calycina	X	X								Yes
Poaceae	Eragrostis curvula	X	X								Yes
Rosaceae	Eriobotrya japonica	X	X								Yes
Iridaceae	Ferraria crispa	X	X								Yes
Rubiaceae	Galium aparine						X				Yes
Rubiaceae	Galium spurium						X				Yes

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Fabaceae	Genista linifolia					X					Yes
Fabaceae	Genista monspessulana					X					Yes
Fabaceae	Genista sp. X Genista monspessulana					X					Yes
Iridaceae	Gladiolus caryophyllaceus	X	X								Yes
Iridaceae	Gladiolus undulatus	X	X								Yes
Poaceae	Glyceria declinata	X	X								Yes
Poaceae	Holcus lanatus	X	X								Yes
Araliaceae	Hydrocotyle ranunculoides						X				Yes
Asteraceae	Hypochaeris glabra	X	X								Yes
Cyperaceae	Isolepis marginata	X	X								Yes
Euphorbiaceae	Jatropha gossypifolia						X				Yes
Juncaceae	Juncus capitatus	X	X								Yes
Campanulaceae	Lobelia tenuior	X	X								
Campanulaceae	Wahlenbergia preissii	X									
Casuarinaceae	Allocasuarina fraseriana	X	X								
Celastraceae	Stackhousia sp. Red-blotched corolla (A. Markey 911)			X				P3			
Celastraceae	Tripterococcus sp. Brachylobus (A.S. George 14234)			X	X			P4			
Centrolepidaceae	Aphelia cyperoides	X	X								
Centrolepidaceae	Centrolepis aristata	X	X								
Centrolepidaceae	Centrolepis drummondiana	X	X								
Verbenaceae	Lantana camara					X	X				Yes
Chenopodiaceae	Dysphania glomulifera	X	X								
Chenopodiaceae	Dysphania glomulifera subsp. glomulifera	X									

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Colchicaceae	Burchardia congesta	X	X								
Colchicaceae	Burchardia umbellata		X								
Cupressaceae	Callitris pyramidalis	X									
Cyperaceae	?Lepidosperma squamatum	X									
Cyperaceae	Bolboschoenus fluviatilis			X				P1			
Cyperaceae	Carex tereticaulis			X	X			P3			
Cyperaceae	Cyathochaeta teretifolia			X				P3			
Cyperaceae	Eleocharis acuta	X	X								
Cyperaceae	Eleocharis keigheryi			X		X		T	VUL	VUL	
Cyperaceae	Evandra pauciflora	X	X								
Fabaceae	Lotus angustissimus	X	X								Yes
Cyperaceae	Isolepis stellata	X	X								
Cyperaceae	Lepidosperma longitudinale	X	X								
Cyperaceae	Lepidosperma rostratum			X	X	X		T	EN	EN	
Cyperaceae	Lepidosperma sp.	X									
Cyperaceae	Lepidosperma sp. Brixton Street	X									
Cyperaceae	Lepidosperma sp. Brixton Street broad inflorescence	X									
Cyperaceae	Lepidosperma sp. Darling Scarp	X									
Cyperaceae	Lepidosperma squamatum	X	X								
Cyperaceae	Mesomelaena graciliceps	X	X								
Cyperaceae	Schoenus asperocarpus	X	X								
Cyperaceae	Schoenus benthamii			X	X			P3			
Cyperaceae	Schoenus capillifolius			X	X			P3			
Cyperaceae	Schoenus curvifolius	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Cyperaceae	Schoenus efolius	X	X								
Cyperaceae	Schoenus loliaceus			X				P2			
Cyperaceae	Schoenus pennisetis	X		X	X			P3			
Cyperaceae	Schoenus sp. Beaufort (G.J. Keighery 6291)			X				P1			
Cyperaceae	Schoenus subfascicularis	X	X								
Cyperaceae	Tetaria australiensis					X		T	VUL	VUL	
Dasypogonaceae	Dasypogon bromeliifolius	X	X								
Dasypogonaceae	Calectasia grandiflora			X				P2			
Dilleniaceae	Hibbertia huegelii		X								
Dilleniaceae	Hibbertia huegelii complex	X									
Dilleniaceae	Hibbertia hypericoides		X								
Dilleniaceae	Hibbertia hypericoides subsp. hypericoides	X									
Droseraceae	Drosera ? paleacea	X									
Droseraceae	Drosera ? porrecta	X									
Droseraceae	Drosera erythrorhiza	X	X								
Droseraceae	Drosera menziesii	X	X								
Droseraceae	Drosera neesii		X								
Droseraceae	Drosera occidentalis			X	X			P4			
Droseraceae	Drosera pallida	X	X								
Droseraceae	Drosera rosulata	X	X								
Ericaceae	Andersonia gracilis					X		T	VUL	EN	
Ericaceae	Andersonia sp. Blepharifolia (F. & J. Hort 1919)			X				P2			
Ericaceae	Conostephium pendulum	X	X								
Ericaceae	Leucopogon conostephioides	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Ericaceae	Leucopogon oxycedrus	X	X								
Ericaceae	Leucopogon polymorphus	X	X								
Ericaceae	Leucopogon tenuis	X	X								
Ericaceae	Styphelia filifolia			X				P3			
Ericaceae	Styphelia xerophyllum	X									
Solanaceae	Lycium ferocissimum					X					Yes
Fabaceae	Acacia benthamii			X	X			P2			
Fabaceae	Acacia horridula			X				P3			
Fabaceae	Acacia huegelii	X	X								
Fabaceae	Acacia lasiocarpa var. bracteolata long peduncle variant (G.J. Keighery 5026)			X	X			P1			
Fabaceae	Acacia oncinophylla subsp. patulifolia			X	X			P4			
Fabaceae	Acacia pulchella	X	X								
Iridaceae	Moraea flaccida	X	X				X				Yes
Fabaceae	Bossiaea eriocarpa	X	X								
Fabaceae	Euchilopsis linearis		X								
Fabaceae	Eutaxia virgata	X	X								
Fabaceae	Gastrolobium capitatum	X									
Iridaceae	Moraea miniata						X				Yes
Onagraceae	Oenothera mollissima	X	X								Yes
Oleaceae	Olea europaea					X					Yes
Fabaceae	Gompholobium tomentosum	X	X								
Fabaceae	Jacksonia furcellata	X	X								
Fabaceae	Jacksonia gracillima	X		X				P3			

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Fabaceae	Jacksonia sericea				X			P4			
Fabaceae	Kennedia beckxiana			X				P4			
Fabaceae	Kennedia prostrata		X								
Fabaceae	Latrobea tenella	X	X								
Asteraceae	Onopordum acaulon						X				Yes
Cactaceae	Opuntia elata						X				Yes
Fabaceae	Phyllota gracilis	X	X								
Cactaceae	Opuntia elatior						X				Yes
Cactaceae	Opuntia engelmannii						X				Yes
Cactaceae	Opuntia ficus-indica						X				Yes
Cactaceae	Opuntia microdasys						X				Yes
Cactaceae	Opuntia monacantha						X				Yes
Cactaceae	Opuntia polyacantha						X				Yes
Geraniaceae	Pelargonium littorale	X	X								
Goodeniaceae	Dampiera lavandulacea	X	X								
Goodeniaceae	Dampiera linearis	X	X								
Goodeniaceae	Goodenia arthrotricha					X		T	EN	EN	
Goodeniaceae	Lechenaultia floribunda	X									
Goodeniaceae	Scaevola lanceolata	X	X								
Haemodoraceae	?Haemodorum spicatum	X									
Haemodoraceae	Anigozanthos manglesii	X	X								
Haemodoraceae	Anigozanthos manglesii subsp. manglesii	X									
Haemodoraceae	Blancoa canescens	X	X								
Haemodoraceae	Conostylis aculeata	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Haemodoraceae	Conostylis festucacea		X								
Haemodoraceae	Conostylis festucacea subsp. festucacea	X									
Haemodoraceae	Conostylis juncea	X	X								
Haemodoraceae	Haemodorum paniculatum	X	X								
Haemodoraceae	Haemodorum spicatum		X								
Haemodoraceae	Phlebocarya ciliata	X	X								
Haemodoraceae	Phlebocarya filifolia	X	X								
Haemodoraceae	Phlebocarya pilosissima subsp. pilosissima			X				P3			
Haemodoraceae	Tribonanthes australis	X	X								
Haloragaceae	Gonocarpus paniculatus	X	X								
Haloragaceae	Gonocarpus pthyoides	X	X								
Haloragaceae	Meionectes tenuifolia			X				P3			
Hemerocallidaceae	?Arnocrinum preissii	X									
Hemerocallidaceae	Arnocrinum preissii	X	X								
Hemerocallidaceae	Caesia micrantha	X	X								
Hemerocallidaceae	Hensmania turbinata	X	X								
Hemerocallidaceae	Johnsonia pubescens subsp. cygnorum			X				P2			
Hemerocallidaceae	Tricoryne elatior	X	X								
Hemerocallidaceae	Tricoryne tenella	X	X								
Cactaceae	Opuntia puberula						X				Yes
Cactaceae	Opuntia spp.					X					Yes
Cactaceae	Opuntia stricta						X				Yes
Cactaceae	Opuntia tomentosa						X				Yes
Fabaceae	Parkinsonia aculeata						X				Yes

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Iridaceae	Patersonia occidentalis	X	X								
Iridaceae	Patersonia occidentalis var. occidentalis	X									
Geraniaceae	Pelargonium capitatum	X	X								Yes
Pinaceae	Pinus radiata					X					Yes
Araceae	Pistia stratiotes						X				Yes
Limeaceae	Macarthuria apetala	X	X								
Loganiaceae	Phyllangium paradoxum	X	X								
Lycopodiaceae	Phylloglossum drummondii		X								
Malvaceae	Lasiopetalum glutinosum subsp. glutinosum			X				P3			
Malvaceae	Lasiopetalum pterocarpum					X		T	CR	EN	
Menyanthaceae	Ornduffia submersa	X		X	X			P4			
Myrtaceae	?Kunzea glabrescens	X									
Myrtaceae	Astartea affinis	X	X								
Myrtaceae	Astartea scoparia	X									
Myrtaceae	Babingtonia urbana			X				P3			
Myrtaceae	Beaufortia purpurea			X				P3			
Myrtaceae	Beaufortia squarrosa	X	X								
Myrtaceae	Calothamnus accedens			X				P4			
Myrtaceae	Calothamnus graniticus subsp. leptophyllus			X	X			P4			
Myrtaceae	Calothamnus hirsutus	X	X								
Myrtaceae	Calothamnus lateralis	X	X								
Myrtaceae	Calytrix breviseta subsp. breviseta			X		X		T	CR	EN	
Myrtaceae	Calytrix flavescens	X									
Myrtaceae	Calytrix fraseri	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Myrtaceae	Calytrix simplex subsp. simplex			X				P1			
Myrtaceae	Corymbia calophylla		X								
Myrtaceae	Darwinia apiculata			X		X		T	EN	EN	
Myrtaceae	Eremaea asterocarpa	X	X								
Myrtaceae	Eremaea asterocarpa subsp. asterocarpa	X									
Myrtaceae	Eremaea pauciflora	X									
Myrtaceae	Eucalyptus sp.	X									
Myrtaceae	Eucalyptus todtiana	X	X								
Myrtaceae	Eucalyptus x balanites			X	X	X		T	CR	EN	
Myrtaceae	Kunzea glabrescens	X	X								
Myrtaceae	Melaleuca acutifolia	X	X								
Myrtaceae	Melaleuca cuticularis	X									
Myrtaceae	Melaleuca incana	X	X								
Myrtaceae	Melaleuca incana subsp. incana	X									
Myrtaceae	Melaleuca lateritia	X	X								
Myrtaceae	Melaleuca preissiana	X									
Myrtaceae	Melaleuca seriata	X									
Myrtaceae	Melaleuca teretifolia	X	X								
Myrtaceae	Melaleuca thymoides	X	X								
Myrtaceae	Melaleuca uncinata	X									
Myrtaceae	Melaleuca viminea	X									
Myrtaceae	Regelia ciliata	X									
Myrtaceae	Regelia inops	X									
Myrtaceae	Scholtzia involucrata	X									

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Myrtaceae	Verticordia lindleyi subsp. lindleyi	X		X	X			P4			
Poaceae	Polypogon tenellus	X	X								Yes
Fabaceae	Prosopis glandulosa x velutina						X				Yes
Orchidaceae	Caladenia ? flava	X									
Orchidaceae	Caladenia flava	X	X								
Orchidaceae	Caladenia huegelii	X	X	X	X	X		T	CR	EN	
Orchidaceae	Caladenia paludosa	X	X								
Orchidaceae	Caladenia saccharata		X								
Orchidaceae	Diuris brevis			X				P2			
Orchidaceae	Diuris corymbosa		X								
Orchidaceae	Diuris corymbosa/magnifica	X									
Orchidaceae	Diuris decremenda	X	X								
Orchidaceae	Diuris drummondii			X		X		T	VUL	VUL	
Orchidaceae	Diuris laxiflora		X								
Orchidaceae	Diuris micrantha					X		T	VUL	VUL	
Orchidaceae	Diuris purdiei	X		X	X	X		T	EN	EN	
Orchidaceae	Drakaea elastica				X	X		T	CR	EN	
Orchidaceae	Drakaea micrantha			X	X	X		T	EN	VUL	
Orchidaceae	Epiblema grandiflorum	X	X								
Orchidaceae	Eriochilus dilatatus		X								
Orchidaceae	Eriochilus dilatatus subsp. dilatatus	X									
Orchidaceae	Eriochilus helonomos	X	X								
Orchidaceae	Eriochilus scaber		X								
Orchidaceae	Eriochilus sp. Roleystone (G. Brockman 1140)			X				P1			

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Orchidaceae	Eriochilus tenuis		X								
Orchidaceae	Leporella fimbriata	X	X								
Orchidaceae	Lyperanthus nigricans		X								
Orchidaceae	Microtis atrata		X								
Orchidaceae	Prasophyllum drummondii	X	X								
Orchidaceae	Prasophyllum parvifolium	X	X								
Orchidaceae	Pterostylis aff. nana	X									
Orchidaceae	Pterostylis recurva	X	X								
Orchidaceae	Pterostylis sanguinea	X	X								
Orchidaceae	Pterostylis sp.	X									
Orchidaceae	Pterostylis vittata		X								
Orchidaceae	Pyrorchis nigricans	X	X								
Orchidaceae	Thelymitra ? graminea	X									
Orchidaceae	Thelymitra dedmaniarum					X		T	CR	EN	
Orchidaceae	Thelymitra magnifica			X	X			P1			
Orchidaceae	Thelymitra stellata			X	X	X		T	EN	EN	
Orchidaceae	Thelymitra vulgaris	X	X								
Philydraceae	Philydrella pygmaea		X								
Philydraceae	Philydrella pygmaea subsp. pygmaea	X									
Phyllanthaceae	Poranthera microphylla	X	X								
Phyllanthaceae	Poranthera moorokatta	X						P2			
Rosaceae	Rubus anglocandicans						X				Yes
Poaceae	?Rytidosperma occidentalis	X									
Poaceae	Amphibromus nervosus	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Poaceae	Amphipogon laguroides		X								
Poaceae	Amphipogon laguroides subsp. laguroides	X									
Poaceae	Amphipogon strictus	X	X								
Poaceae	Amphipogon turbinatus	X	X								
Poaceae	Aristida contorta	X	X								
Poaceae	Austrostipa ? compressa	X									
Poaceae	Austrostipa compressa	X	X								
Poaceae	Austrostipa flavescens		X								
Poaceae	Austrostipa jacobiana	X		X	X	X		T	CR	CR	
Rosaceae	Rubus fruticosus aggregate					X					Yes
Rosaceae	Rubus laudatus						X				Yes
Rosaceae	Rubus rugosus						X				Yes
Rosaceae	Rubus ulmifolius						X				Yes
Alismataceae	Sagittaria platyphylla					X	X				Yes
Salicaceae	Salix spp.					X					Yes
Poaceae	Lachnagrostis aemula	X	X								
Poaceae	Lachnagrostis filiformis	X	X								
Poaceae	Lachnagrostis plebeia	X	X								
Salviniaceae	Salvinia molesta					X					Yes
Poaceae	Rytidosperma occidentale	X	X								
Fabaceae	Senna alata						X				Yes
Polygalaceae	Comesperma flavum	X	X								
Polygalaceae	Comesperma rhadinocarpum			X				P3			
Polygonaceae	Persicaria prostrata	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Portulacaceae	Calandrinia sp. Kenwick (G.J. Keighery 10905)	X	X								
Proteaceae	Banksia attenuata	X	X								
Proteaceae	Banksia ilicifolia	X	X								
Proteaceae	Banksia ilicifolia/menziesii	X									
Proteaceae	Banksia kippistiana var. paenepeccata			X				P3			
Proteaceae	Banksia menziesii	X	X								
Proteaceae	Banksia mimica			X		X		T	VUL	EN	
Proteaceae	Banksia telmatiaea	X	X								
Proteaceae	Conospermum undulatum			X		X		T	VUL	VUL	
Proteaceae	Grevillea bipinnatifida		X								
Proteaceae	Grevillea bipinnatifida subsp. bipinnatifida	X									
Proteaceae	Grevillea curviloba subsp. incurva					X		T	EN	EN	
Proteaceae	Grevillea pimeleoides			X				P4			
Proteaceae	Grevillea thelemanniana					X		T	CR	CR	
Proteaceae	Hakea prostrata	X	X								
Proteaceae	Persoonia saccata	X	X								
Proteaceae	Petrophile linearis	X	X								
Proteaceae	Petrophile seminuda	X	X								
Proteaceae	Synaphea sp. Fairbridge Farm (D. Papenfus 696)			X		X		T	CR	CR	
Proteaceae	Synaphea sp. Serpentine (G.R. Brand 103)			X	X	X		T	CR	CR	
Restionaceae	Chaetanthus aristatus	X	X								
Restionaceae	Chaetanthus tenellus		X								
Restionaceae	Cytogonidium leptocarpoides	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Restionaceae	Desmocladius castaneus	X	X								
Restionaceae	Desmocladius flexuosus	X	X								
Restionaceae	Dielsia stenostachya	X	X								
Restionaceae	Hypolaena pubescens	X	X								
Restionaceae	Leptocarpus decipiens	X	X								
Rhamnaceae	Stenanthemum sublineare			X				P2			
Fabaceae	Senna obtusifolia						X				Yes
Asteraceae	Silybum marianum						X				Yes
Solanaceae	Solanum elaeagnifolium					X	X				Yes
Solanaceae	Solanum linnaeanum						X				Yes
Asteraceae	Sonchus oleraceus	X	X								Yes
Tamaricaceae	Tamarix aphylla					X	X				Yes
Fabaceae	Trifolium incarnatum		X								Yes
Fabaceae	Ulex europaeus						X				Yes
Poaceae	Urochloa mutica					X					Yes
Rutaceae	Boronia ramosa		X								
Rutaceae	Boronia ramosa subsp. anethifolia	X									
Rutaceae	Boronia tenuis			X				P4			
Rutaceae	Diplolaena andrewsii					X		T	EN	EN	
Rutaceae	Philotheca spicata	X	X								
Asteraceae	Ursinia anthemoides	X	X								Yes
Iridaceae	Watsonia meriana		X								Yes
Sapindaceae	Dodonaea hackettiana			X				P4			
Scrophulariaceae	Eremophila glabra subsp. chlorella			X		X		T	EN	EN	

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Solanaceae	Anthocercis gracilis					X		T	VUL	VUL	
Iridaceae	Watsonia meriana var. bulbilifera	X									Yes
Asteraceae	Xanthium spinosum						X				Yes
Asteraceae	Xanthium strumarium						X				Yes
Stylidiaceae	Levenhookia preissii			X				P1			
Stylidiaceae	Levenhookia pusilla		X								
Stylidiaceae	Levenhookia stipitata	X									
Stylidiaceae	Stylidium aceratum	X		X				P3			
Stylidiaceae	Stylidium araeophyllum		X								
Stylidiaceae	Stylidium araeophyllum/neurophyllum	X									
Stylidiaceae	Stylidium divaricatum	X	X								
Stylidiaceae	Stylidium guttatum	X	X								
Stylidiaceae	Stylidium longitubum	X		X	X			P4			
Stylidiaceae	Stylidium paludicola			X				P3			
Stylidiaceae	Stylidium repens	X	X								
Stylidiaceae	Stylidium roseoalatum	X	X								
Stylidiaceae	Stylidium utricularioides	X	X								
Araceae	Zantedeschia aethiopica	X	X				X				Yes
Thymelaeaceae	Pimelea imbricata		X								
Thymelaeaceae	Pimelea imbricata var. major	X									
Thymelaeaceae	Pimelea lanata	X	X								
Rhamnaceae	Ziziphus mauritiana						X				Yes
Xanthorrhoeaceae	Xanthorrhoea preissii		X								
Xanthorrhoeaceae	Chamaescilla corymbosa	X	X								

Family	Taxon	Source						Conservation Rating			Introduced
		Nature Map	ALA	WAH	TPFL	EPBC	WAOL	DBCA	BC Act	EPBC Act	
Xanthorrhoeaceae	Chamaescilla corymbosa var. corymbosa	X									
Xanthorrhoeaceae	Xanthorrhoea sp.	X									
Zamiaceae	Macrozamia fraseri	X	X								

¹A = NatureMap Search (DBCA, 2019a), B = Atlas of Living Australia Search (ALA, 2019), C = Threatened and Priority Flora Database (DBCA, 2020d), D = Western Australian Herbarium Database (WAH, 1998-), E = EPBC Act Protected Matters Search (DoEE, 2019a), F = Western Australian Organism List (DPIRD, 2019)

²See Appendix E for further information about listed introduced species

Appendix C – Assessment of Conservation Significant Flora Likelihood

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Synaphea</i> sp. Fairbridge Farm (D. Papenfus 696)	T	CR	CR	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow, Oct. Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Yes	Yes	12.3 km NW	Unlikely	Highly Unlikely
<i>Calytrix simplex</i> subsp. <i>simplex</i>	P1			Shrub, ca 0.2 m high. Fl. purple, Oct to Nov.	No	Yes	1 km E	Unlikely	Highly Unlikely
<i>Acacia horridula</i>	P3			Harsh, slender, single-stemmed shrub, 0.3-0.6(-1) m high. Fl. yellow, May to Aug. Gravelly soils over granite, sand. Rocky hillsides.	No	Yes	0.8 km E	Unlikely	Highly Unlikely
<i>Jacksonia gracillima</i>	P3			Low spreading shrub.	No	Yes	3.3 km W	Unlikely	Highly Unlikely
<i>Calothamnus accedens</i>	P4			Erect & slender shrub, to 1.8 m high. Fl. pink-red. Sandy soils over laterite. Road verge.	No	Yes	8.6 km NE	Unlikely	Highly Unlikely
<i>Jacksonia sericea</i>	P4			Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.	No	Yes	4.5 km W	Unlikely	Highly Unlikely
<i>Andersonia gracilis</i>	T	VUL	EN	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	No	Yes	13 km N	Highly Unlikely	Highly Unlikely
<i>Anthocercis gracilis</i>	T	VUL	VUL	Erect, spindly shrub, to 0.6(-1) m high. Fl. yellow-green, Sep to Oct. Sandy or loamy soils. Granite outcrops.	No	Yes	13 km N	Highly Unlikely	Highly Unlikely
<i>Austrostipa jacobsoniana</i>	T	CR	CR	Erect, perennial, caespitose grass. 1.2 m high x 0.15 m wide. Flowers green. Road sides and winter wet flats	No	No	3.6 km N	Highly Unlikely	Highly Unlikely
<i>Banksia mimica</i>	T	VUL	EN	Prostrate, lignotuberous shrub, 0.15-0.4 m high. Fl. yellow-brown, Dec or Jan to Feb. White or grey sand over laterite, sandy loam.	No	Yes	9.3 km N	Highly Unlikely	Highly Unlikely
<i>Caladenia huegelii</i>	T	CR	EN	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	No	Yes	6.9 km W	Highly Unlikely	Highly Unlikely
<i>Calytrix breviseta</i> subsp. <i>breviseta</i>	T	CR	EN	Shrub, 0.4-1 m high. Fl. purple-blue, Oct to Nov. Sandy clay. Swampy flats.	No	Yes	7.4 km N	Highly Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Conospermum undulatum</i>	T	VUL	VUL	Erect, compact shrub, 0.6-2 m high. Fl. white-other, May to Oct. Grey or yellow-orange clayey sand.	No	Yes	7.6 km N	Highly Unlikely	Highly Unlikely
<i>Darwinia apiculata</i>	T	EN	EN	Densely branched shrub, 0.4-0.5 m high. Fl. green & yellow/red, Oct. Lateritic soils.	No	Yes	9.9 km N	Highly Unlikely	Highly Unlikely
<i>Diplolaena andrewsii</i>	T	EN	EN	Erect shrub, 0.5-1 m high, inner involucre bracts glabrous, leaves broadly cordate. Fl. red, Jul to Oct. Loam, clay. Granite outcrops & hillsides.	No	No	28 km N	Highly Unlikely	Highly Unlikely
<i>Diuris drummondii</i>	T	VUL	VUL	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	No	Yes	12.7 km NW	Highly Unlikely	Highly Unlikely
<i>Diuris micrantha</i>	T	VUL	VUL	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	No	Yes	5 km N	Highly Unlikely	Highly Unlikely
<i>Diuris purdiei</i>	T	EN	EN	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.	No	Yes	1 km E	Highly Unlikely	Highly Unlikely
<i>Drakaea elastica</i>	T	CR	EN	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.	No	Yes	3.3 km W	Highly Unlikely	Highly Unlikely
<i>Drakaea micrantha</i>	T	EN	VUL	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand.	No	Yes	2.8 km SW	Highly Unlikely	Highly Unlikely
<i>Eleocharis keigheryi</i>	T	VUL	VUL	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green, Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans.	No	Yes	8.4 km N	Highly Unlikely	Highly Unlikely
<i>Eremophila glabra</i> subsp. <i>chlorella</i>	T	EN	EN	Prostrate & spreading or sprawling shrub, 0.2-1 m high. Fl. green-yellow, Jul to Nov. Sandy clay. Winter-wet depressions.	No	Yes	11.5 km NW	Highly Unlikely	Highly Unlikely
<i>Eucalyptus x balanites</i>	T	CR	EN	(Mallee), to 5 m high, bark rough, flaky. Fl. white, Oct to Dec or Jan to Feb. Sandy soils with lateritic gravel.	No	Yes Unverified	3.9 km SE	Highly Unlikely	Highly Unlikely
<i>Goodenia arthrotricha</i>	T	EN	EN	Erect perennial, herb, to 0.4 m high. Fl. blue, Oct to Nov. Gravel. Granite rocks, slopes.	No	Yes	5 km N	Highly Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Grevillea curviloba</i> subsp. <i>incurva</i> ²	T	EN	EN	Prostrate to erect shrub, 0.1-2.5 m high. Fl. white-cream, Aug to Oct. Grey sand, sandy loam. Winter-wet heath.	No	No	30 km N	Highly Unlikely	Highly Unlikely
<i>Grevillea thelemanniana</i>	T	CR	CR	Spreading, lignotuberous shrub, 0.3-1.5 m high. Fl. pink-red, May to Nov. Sand, sandy clay. Winter-wet low-lying flats.	No	Yes	12 km NE	Highly Unlikely	Highly Unlikely
<i>Lasiopetalum pterocarpum</i>	T	CR	EN	Open, multi-stemmed shrub (with distinctly winged fruit), to 1.2 m high. Fl. pink, Aug to Dec. Dark red-brown loam or clayey sand over granite. On sloping banks near creeklines.	No	No	23 km S	Highly Unlikely	Highly Unlikely
<i>Lepidosperma rostratum</i>	T	EN	EN	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay.	No	Yes	3.3 km W	Highly Unlikely	Highly Unlikely
<i>Synaphea</i> sp. Serpentine (G.R. Brand 103)	T	CR	CR	Erect compact shrub 30 cm high x 30 cm wide, adjacent to winter wet flats	No	Yes	3.9 km S	Highly Unlikely	Highly Unlikely
<i>Tetraria australiensis</i>	T	VUL	VUL	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown, Nov to Dec.	No	Yes	5 km N	Highly Unlikely	Highly Unlikely
<i>Thelymitra dedmaniarum</i>	T	CR	EN	Tuberous, perennial, herb, to 0.8 m high. Fl. yellow, Nov to Dec or Jan. Granite.	No	No	60 km E	Highly Unlikely	Highly Unlikely
<i>Thelymitra stellata</i>	T	EN	EN	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown, Oct to Nov. Sand, gravel, lateritic loam.	No	Yes	5.9 km E	Highly Unlikely	Highly Unlikely
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	P1			Shrub, 0.4-1.5 m high. Fl. yellow, May or Aug. Grey or black sand over clay. Swampy areas, winter wet lowlands.	No	No	8.5 km N	Highly Unlikely	Highly Unlikely
<i>Bolboschoenus fluviatilis</i>	P1			Tall perennial sedge. Swamps	No	No	12 km N	Highly Unlikely	Highly Unlikely
<i>Eriochilus</i> sp. Roleystone (G. Brockman 1140)	P1			Black sandy gravel in jarrah woodland	No	No	8.3 km NE	Highly Unlikely	Highly Unlikely

² Now considered to be a taxonomic synonym and is more recently known as *Grevillea curviloba* (T)

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Levenhookia preissii</i>	P1			Annual (ephemeral), herb, 0.03-0.17 m high. Fl. pink-red, Sep to Dec or Jan. Grey or black, peaty sand. Swamps.	No	No	12 km NW	Highly Unlikely	Highly Unlikely
<i>Ptilotus sericostachyus</i> subsp. <i>roseus</i>	P1			Prostrate to ascending perennial, herb. Fl. pink-white, Sep to Dec.	No	No	2.5 km E	Highly Unlikely	Highly Unlikely
<i>Schoenus</i> sp. Beaufort (G.J. Keighery 6291)	P1			Annual, grass-like or herb (sedge), ca 0.05 m high. Fl. green. Mud. Winter-wet claypans.	No	Yes	12.9 km N	Highly Unlikely	Highly Unlikely
<i>Thelymitra magnifica</i>	P1			Perennial, herb. Stony ridges.	No	Yes	2.7 km E	Highly Unlikely	Highly Unlikely
<i>Acacia benthamii</i>	P2			Shrub, ca 1 m high. Fl. yellow, Aug to Sep. Sand. Typically on limestone breakaways.	No	No	3.3 km N	Highly Unlikely	Highly Unlikely
<i>Andersonia</i> sp. <i>Blepharifolia</i> (F. & J. Hort 1919)	P2			Small spreading to upright shrub to 0.5 m in height. Darling Scarp/Ridge Hill Shelf	No	No	8 km N	Highly Unlikely	Highly Unlikely
<i>Calectasia grandiflora</i>	P2			Rhizomatous, perennial, herb (or undershrub), to 0.65 m high, without stilt roots. Fl. blue/purple, Jun to Nov. White, grey or yellow sand, sandy clay, gravel, laterite, granite. Swampy areas, rock outcrops, flats, slopes, ridges.	No	Yes	2.5 km E	Highly Unlikely	Highly Unlikely
<i>Diuris brevis</i>	P2			Flat wet area, some pools. Black peaty soil in some areas, same grey mud as others	No	No	13.1 km N	Highly Unlikely	Highly Unlikely
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	P2			Tufted perennial, herb, 0.15-0.25 m high. Fl. white-green, Sep. Grey-white-yellow sand. Flats, seasonally-wet sites.	No	Yes	3.5 km N	Highly Unlikely	Highly Unlikely
<i>Poranthera moorokatta</i>	P2			Small erect annual herb on grey sand	No	No	26 km NNW	Highly Unlikely	Highly Unlikely
<i>Schoenus loliaceus</i>	P2			Annual, grass-like or herb (sedge), 0.03-0.06 m high. Fl. Aug to Nov. Sandy soils. Winter-wet depressions.	No	Yes	13 km N	Highly Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Stenanthemum sublineare</i>	P2			Erect shrub, to 0.1 m high. Fl. green, Oct to Dec. Littered white sand. Coastal plain.	No	Yes	7.3 km N	Highly Unlikely	Highly Unlikely
<i>Thysanotus</i> sp. Badgingarra (E.A. Griffin 2511)	P2			Perennial, herb (with tuberous roots), ca 0.35 m high. Fl. blue, Dec. Grey sand with lateritic gravel.	No	Yes	4.6 km E	Highly Unlikely	Highly Unlikely
<i>Asteridea gracilis</i>	P3			Annual, herb, 0.15-0.35 m high. Fl. white-pink, Sep to Dec. Sand, clay, gravelly soils.	No	No	7.1 km N	Highly Unlikely	Highly Unlikely
<i>Babingtonia urbana</i>	P3			Open shrub to 40 cm tall and 40 cm wide with pink flowers. Grey sand and winter wet flats	No	Yes	9 km S	Highly Unlikely	Highly Unlikely
<i>Banksia kippistiana</i> var. <i>paenepeccata</i>	P3			Erect, prickly, lignotuberous shrub, 0.3-1.2 m high. Fl. yellow-cream, Oct to Nov. Lateritic gravelly soils.	No	Yes	3.8 km S	Highly Unlikely	Highly Unlikely
<i>Beaufortia purpurea</i>	P3			Erect or spreading shrub, 0.3-1.5 m high. Fl. red-purple, Oct to Dec or Jan to Feb. Lateritic or granitic soils. Rocky slopes.	No	No	9.7 km NE	Highly Unlikely	Highly Unlikely
<i>Byblis gigantea</i>	P3			Small, branched perennial, herb (or sub-shrub), to 0.45 m high. Fl. pink-purple/white, Sep to Dec or Jan. Sandy-peat swamps. Seasonally wet areas.	No	Yes	2.9 km NW	Highly Unlikely	Highly Unlikely
<i>Carex tereticaulis</i>	P3			Monoecious, rhizomatous, tufted perennial, grass-like or herb (sedge), 0.7 m high. Fl. brown, Sep to Oct. Black peaty sand.	No	Yes	12.8 km N	Highly Unlikely	Highly Unlikely
<i>Comesperma rhadinocarpum</i>	P3			Perennial, herb. Fl. blue, Oct to Nov. Sandy soils.	No	No	13.2 km N	Highly Unlikely	Highly Unlikely
<i>Cyathochaeta teretifolia</i>	P3			Rhizomatous, clumped, robust perennial, grass-like or herb (sedge), to 2 m high, to 1.0 m wide. Fl. brown. Grey sand, sandy clay. Swamps, creek edges.	No	Yes	11.7 km W	Highly Unlikely	Highly Unlikely
<i>Halgania corymbosa</i>	P3			Erect shrub, 0.35-1 m high. Fl. blue-purple, Aug to Nov. Gravelly soils, soils over granite.	No	Yes	7.4 km N	Highly Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Lasiopetalum glutinosum</i> subsp. <i>glutinosum</i>	P3			Perennial multistemmed shrub to 1 m in height. Flowers purple. Darling Scarp and ridge hill shelf	No	Yes	3.9 km NE	Highly Unlikely	Highly Unlikely
<i>Meionectes tenuifolia</i>	P3			Annual, semi aquatic herb	No	Yes	3.6 km W	Highly Unlikely	Highly Unlikely
<i>Phlebocarya pilosissima</i> subsp. <i>pilosissima</i>	P3			Shortly rhizomatous, compactly tufted perennial, grass-like or herb, 0.15-0.4 m high. Fl. cream-white, Aug to Oct. White or grey sand, lateritic gravel.	No	No	13.5 km NW	Highly Unlikely	Highly Unlikely
<i>Schoenus benthamii</i>	P3			Tufted perennial, grass-like or herb (sedge), 0.15-0.45 m high. Fl. brown, Oct to Nov. White, grey sand, sandy clay. Winter-wet flats, swamps.	No	Yes	7.9 km N	Highly Unlikely	Highly Unlikely
<i>Schoenus capillifolius</i>	P3			Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green, Oct to Nov. Brown mud. Claypans.	No	Yes	7.4 km NW	Highly Unlikely	Highly Unlikely
<i>Schoenus pennisetis</i>	P3			Tufted annual, grass-like or herb (sedge), 0.05-0.15 m high. Fl. purple-black, Aug to Sep. Grey or peaty sand, sandy clay. Swamps, winter-wet depressions.	No	Yes	4.3 km W	Highly Unlikely	Highly Unlikely
<i>Stackhousia</i> sp. Red-blotched corolla (A. Markey 911)	P3			Perennial erect shrub on granitic and lateritic soils	No	No	9.4 km E	Highly Unlikely	Highly Unlikely
<i>Stylidium aceratum</i>	P3			Fibrous rooted annual, herb, 0.05-0.09 m high, leaves spathulate. Fl. pink/white, Oct to Nov. Sandy soils. Swamp heathland.	No	Yes	5.3 km NW	Highly Unlikely	Highly Unlikely
<i>Stylidium paludicola</i>	P3			Reed-like perennial, herb, 0.35-1 m high, Leaves tufted, linear or subulate or narrowly oblanceolate, 0.5-4 cm long, 0.5-1.5 mm wide, apex acute, margin entire, glabrous. Scape mostly glabrous, inflorescence axis glandular. Inflorescence racemose. Fl. pink, Oct to Dec. Peaty sand over clay. Winter wet habitats. marri and Melaleuca woodland, Melaleuca shrubland.	No	Yes	8.4 km NW	Highly Unlikely	Highly Unlikely
<i>Styphelia filifolia</i>	P3			Small perennial shrub on flat yellow sandplains	No	Yes	7.2 km N	Highly Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Acacia oncinophylla</i> subsp. <i>patulifolia</i>	P4			Shrub, 0.5-2.5(-3) m high, 'minni-ritchi' bark, phyllodes 4-9 cm long, 3-6 mm wide. Fl. yellow, Aug to Nov or Nov to Dec. Granitic soils, occasionally on laterite.	No	Yes	7 km N	Highly Unlikely	Highly Unlikely
<i>Aponogeton hexatepalus</i>	P4			Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green-white, Jul to Oct. Mud. Freshwater: ponds, rivers, claypans.	No	Yes	4.8 km N	Highly Unlikely	Highly Unlikely
<i>Boronia tenuis</i>	P4			Procumbent or erect & slender shrub, 0.1-0.5 m high. Fl. blue/pink-white, Aug to Nov. Laterite, stony soils, granite.	No	Yes	7.5 km N	Highly Unlikely	Highly Unlikely
<i>Calothamnus graniticus</i> subsp. <i>leptophyllus</i>	P4			Erect, multi-stemmed shrub, 1-2 m high. Fl. red, Jun to Aug. Clay over granite, lateritic soils. Hillsides.	No	Yes	9.5 km NE	Highly Unlikely	Highly Unlikely
<i>Dodonaea hackettiana</i>	P4			Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	No	No	11.7 km NW	Highly Unlikely	Highly Unlikely
<i>Drosera occidentalis</i>	P4			Fibrous-rooted, rosetted perennial, herb, to 0.025 m high. Fl. pink/white, Oct to Dec or Jan.	No	Yes	3.9 km SW	Highly Unlikely	Highly Unlikely
<i>Grevillea pimeleoides</i>	P4			Non-lignotuberous shrub, 0.4-2.4 m high. Fl. yellow-orange, May to Nov. Gravelly soils over granite. Rocky hillsides.	No	Yes	9.8 km NE	Highly Unlikely	Highly Unlikely
<i>Hydrocotyle lemnoides</i>	P4			Aquatic, floating annual, herb. Fl. purple, Aug to Oct. Swamps.	No	Yes	13 km N	Highly Unlikely	Highly Unlikely
<i>Kennedia becxiana</i>	P4			Prostrate or twining shrub or climber. Fl. red, Sep to Dec. Sand, loam. Granite hills & outcrops.	No	Yes	10 km W	Highly Unlikely	Highly Unlikely
<i>Ornduffia submersa</i>	P4			Aquatic herb in swamps, claypans and creeks	No	Yes	3.8 km NW	Highly Unlikely	Highly Unlikely

Taxon	Conservation Status			Habit and Habitat	Habitat within Study Area	Within Current Known Distribution	Distance to Nearest Record	Likelihood of Occurrence	Likelihood Post-Survey
	DBCA	BC Act	EPBC Act						
<i>Stylidium longitubum</i>	P4			Erect annual (ephemeral), herb, 0.05-0.12 m high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.	No	Yes	3.2 km W	Highly Unlikely	Highly Unlikely
<i>Thysanotus glaucus</i>	P4			Caespitose perennial herb. Flowers purple on grey sand	No	Yes	2.9 km N	Highly Unlikely	Highly Unlikely
<i>Tripterococcus</i> sp. Brachylobus (A.S. George 14234)	P4			Erect, multistemmed shrub 30-50 cm high. Flowers pale yellow. Winter wet flats	No	Yes	4 km W	Highly Unlikely	Highly Unlikely
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4			Erect shrub, 0.2-0.75 m high. Fl. pink, May or Nov to Dec or Jan. Sand, sandy clay. Winter-wet depressions.	No	Yes	2.6 km SW	Highly Unlikely	Highly Unlikely

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