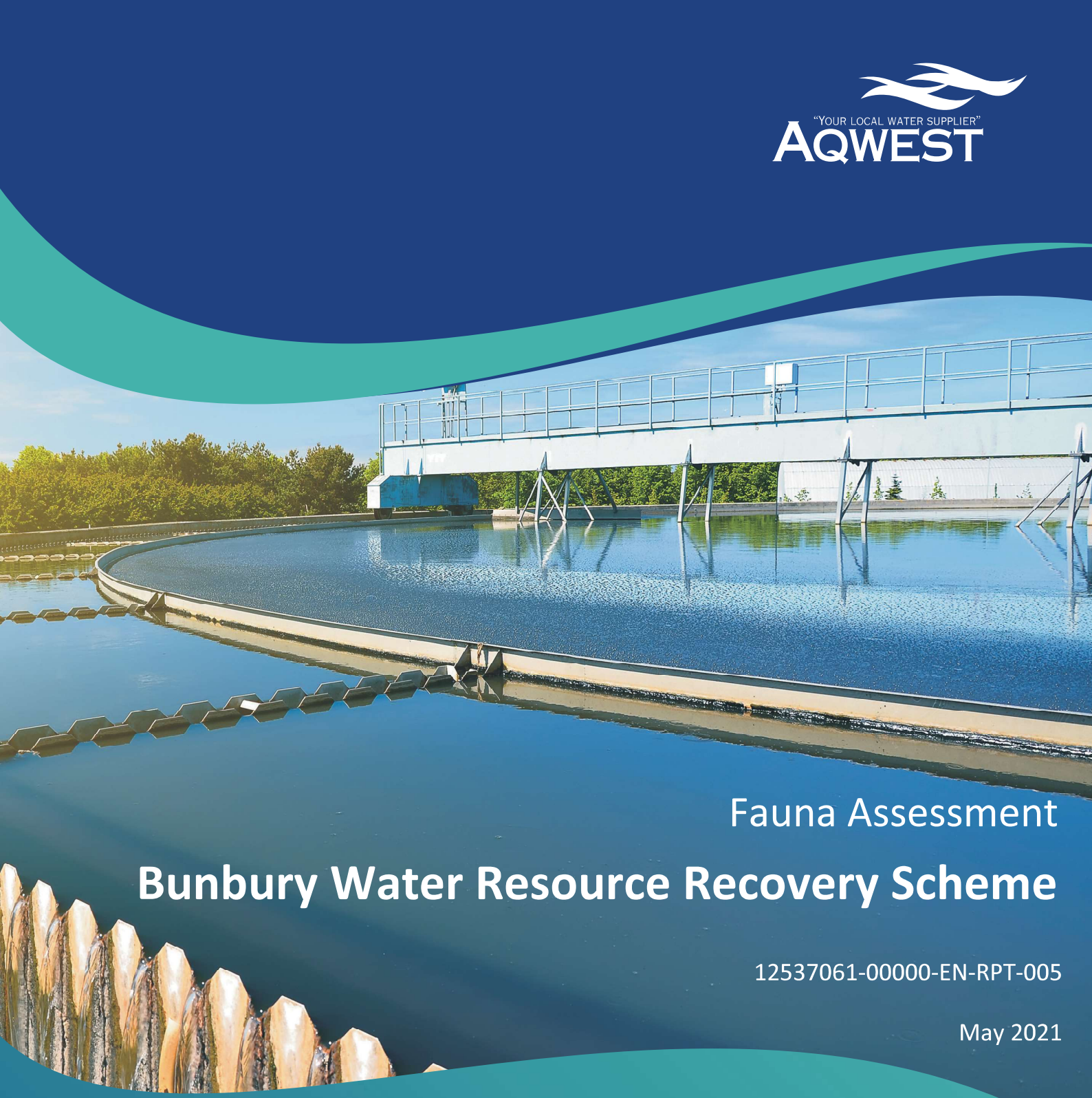

Fauna Assessment

Bunbury Water Resource Recovery Scheme

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May 2021

Biota Environmental Sciences

Bunbury Water Resources Recovery Scheme Fauna Assessment

Prepared for GHD

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Bunbury WWRS Pipeline Fauna

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1.0 Executive Summary

1.1 Introduction

Aqwest is proposing to construct and operate a recycled water treatment plant and a pipeline to provide recycled water for the irrigation of existing open spaces (Hay Park, Hands Oval and Forrest Park), and to provide the construction water requirements for the Bunbury Outer Ring Road project.

Biota Environmental Sciences (Biota) was commissioned to undertake a desktop study, fauna habitat mapping, and a targeted field survey for the following conservation significant species listed under the WA *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Western Ringtail Possum (Critically Endangered);
- Carnaby's Black Cockatoo (Endangered);
- Baudin's Black Cockatoo (Endangered); and
- Forest Red-tailed Black Cockatoo (Vulnerable).

Furthermore, the likelihood of occurrence was to be assessed for the following conservation significant species:

- Chuditch (Vulnerable); and
- Wambenger Brush-tailed Phascogale (hereafter the Brush-tailed Phascogale) (Conservation Dependent Fauna under the BC Act).

1.2 Methods

The study area was 72.7 ha and generally comprised a 25 m buffer on the planned pipeline routes as well as development within the waste-water treatment plant, the only exception being the Mosedale Ave section, which had a 20 m buffer. A larger 50 m buffer was used for the survey of Western Ringtail Possum where the study area intersected a fragment of Tuart Peppermint woodland, resulting in a larger species-specific study area of 84.8 ha.

The field work was undertaken at three times (i) 5 to 9 October 2020, (ii) 24 – 26 February 2021 and (iii) 14 April 2021. There were additions to the study area during the second and third phases of survey taking it from an original size of 61.8 ha to 72.7 ha. The entirety was subject to basic survey and targeted work for Western Ringtail Possum and black cockatoo species. The original October 2020 study area was resurveyed for the Western Ringtail Possum in February in 2021, providing a second estimate of abundance. The February and April 2021 additions to the study area, around the waste-water treatment plant and Mosedale Ave, were surveyed once for the Western Ringtail Possum.

Spotlighting for Western Ringtail Possums was completed using a strip-sampling technique which aimed to record all individuals. Strips of 25 m width were pre-loaded onto map imagery and displayed on tablets with a GPS accuracy typically within 1.5 m. A zoologist searched each 25 m wide strip for the Western Ringtail Possum at night using a high-powered head torch.

Fauna habitat mapping and specific habitat for black cockatoos was assessed by foot-traversing the study area. In larger vegetation fragments, a systematic approach was applied, whereby transects of 25 m spacing were overlain on the survey area in GIS. A zoologist then walked down the middle of the 25 m strip and recorded black cockatoo habitat trees. This was continued until the entire fragment had been searched. In small fragments, for example, in roadside reserves or where there were singular trees, transects were discarded in favour of walking between individual trees. For any tree supporting hollow/s, details of the hollows were taken, and a high accuracy

GPS was used to record the tree location. A telescopic fibreglass pole mounted with a camera was deployed whenever possible to further investigate hollows; 14 of 28 trees could be assessed with this equipment.

1.3 Results

A total of 595 habitat trees were recorded within the study area, comprising 158 Marri, 71 Jarrah, 318 Tuart, 44 Flooded Gum and four trees of indeterminate species. A sub-set of 28 trees supported hollows considered to warrant follow-up assessment of breeding suitability. Fourteen of these trees could be assessed with the pole-camera, although in one case, one of two hollows on the tree was inaccessible. Of the 14 trees assessed with the pole-camera, hollows on nine were not suitable for breeding. Five trees were found to have potentially suitable breeding hollows, although no evidence of black cockatoo breeding was recorded.

A total of 91 individual (61 observations) Western Ringtail Possums were recorded during the first (October) round of sampling while fewer were recorded in February, with 69 individuals from 49 observations. One Brush-tailed Phascogale was recorded within the study area during the February round of survey. Within the Mosedale Avenue section added to the study area in April 2021, three Western Ringtail Possum individuals were recorded outside the previous study area, while two individuals were recorded where the Mosedale Avenue section overlapped the original study area.

In addition to the four target conservation significant species, the following nine species were considered to have some potential to occur within the study area based on habitat availability and previous records in the local area:

- Southern Brown Bandicoot, Quenda (Department of Biodiversity, Conservation and Attractions (DBCA) Priority 4) – Likely to occur;
- Brush-tailed Phascogale (BC Act Conservation Dependent Fauna) – Likely to occur;
- Peregrine Falcon (BC Act Other specially protected fauna) – May occur (foraging visitor);
- Coastal Plains Skink (DBCA Priority 3) – May occur;
- Swan Coastal Plain shield-backed trapdoor spider (DBCA Priority 3) – May occur;
- Western Brush Wallaby (DBCA Priority 4) – May occur (visitor);
- Blue-billed Duck (DBCA Priority 4) – May occur (visitor to artificial and ephemeral habitats);
- Common Sandpiper (EPBC Act Marine/Migratory, BC Act Migratory) – May occur (visitor to artificial pond); and
- Wood Sandpiper (EPBC Act Marine/Migratory, BC Act Migratory) – May occur (visitor to artificial pond).

2.0 Introduction

2.1 Background

Aqwest is proposing to construct and operate a recycled water treatment plant and a pipeline to provide recycled water for the irrigation of existing open spaces (Hay Park, Hands Oval and Forrest Park), and to provide the construction water requirements for the Bunbury Outer Ring Road (BORR) project. This proposed project comprises two stages:

- Stage 1: The irrigation of existing open spaces (Hay Park, Hands Oval and Forrest Park) with a direct supply of treated wastewater (TWW) from the Bunbury Waste-Water Treatment Plant (WWTP). This option provides the benefit of allowing reallocation of existing groundwater use for drinking water purposes.
- Stage 2: The BORR project is being delivered by Main Roads Western Australia and consists of approximately 30 km of new freeway-standard dual-carriageway and associated infrastructure connecting the existing Forrest Highway to Bussell Highway. Road construction requires water for several key aspects, including concrete production, earthworks and dust suppression. It is understood that construction will commence on the northern and central sections of BORR as early as January 2021 and will likely be completed by early 2024.

The project will engineer, construct and commission a water treatment plant receiving the currently treated waste stream from the Water Corporation (WC) as infeed to a new WWTP. It is proposed to build the new WWTP on the WC site adjacent to the existing WWTP. The new WWTP will feed either the Stage 1 or Stage 2 delivery points as required by their needs. The project is located entirely with the City of Bunbury.

This project is referred to herein as the Bunbury Water Resources Recovery Scheme (WRRS). The location of the study area is shown in Figure 2.1.

2.2 Objectives of the Study

Biota Environmental Sciences (Biota) was commissioned to undertake a basic survey, comprising fauna habitat description and an assessment of likelihood of conservation significant fauna, together with additional targeted survey work for the Western Ringtail Possum and black cockatoo species. Specific requirements included:

- completion of a desktop study;
- identification and mapping of fauna habitats, with a particular focus on the following conservation significant species: Western Ringtail Possum, black cockatoos and Brush-tailed Phascogale;
- targeted nocturnal field survey for the Western Ringtail Possum;
- black cockatoo habitat assessment, including the identification and mapping of habitat trees (those with a diameter at breast height (DBH) >500 mm) and potential cockatoo nest trees with hollows; and
- reporting on survey findings, including the mapping of habitats, field results and an assessment of the likelihood of conservation significant fauna occurring in the study area.

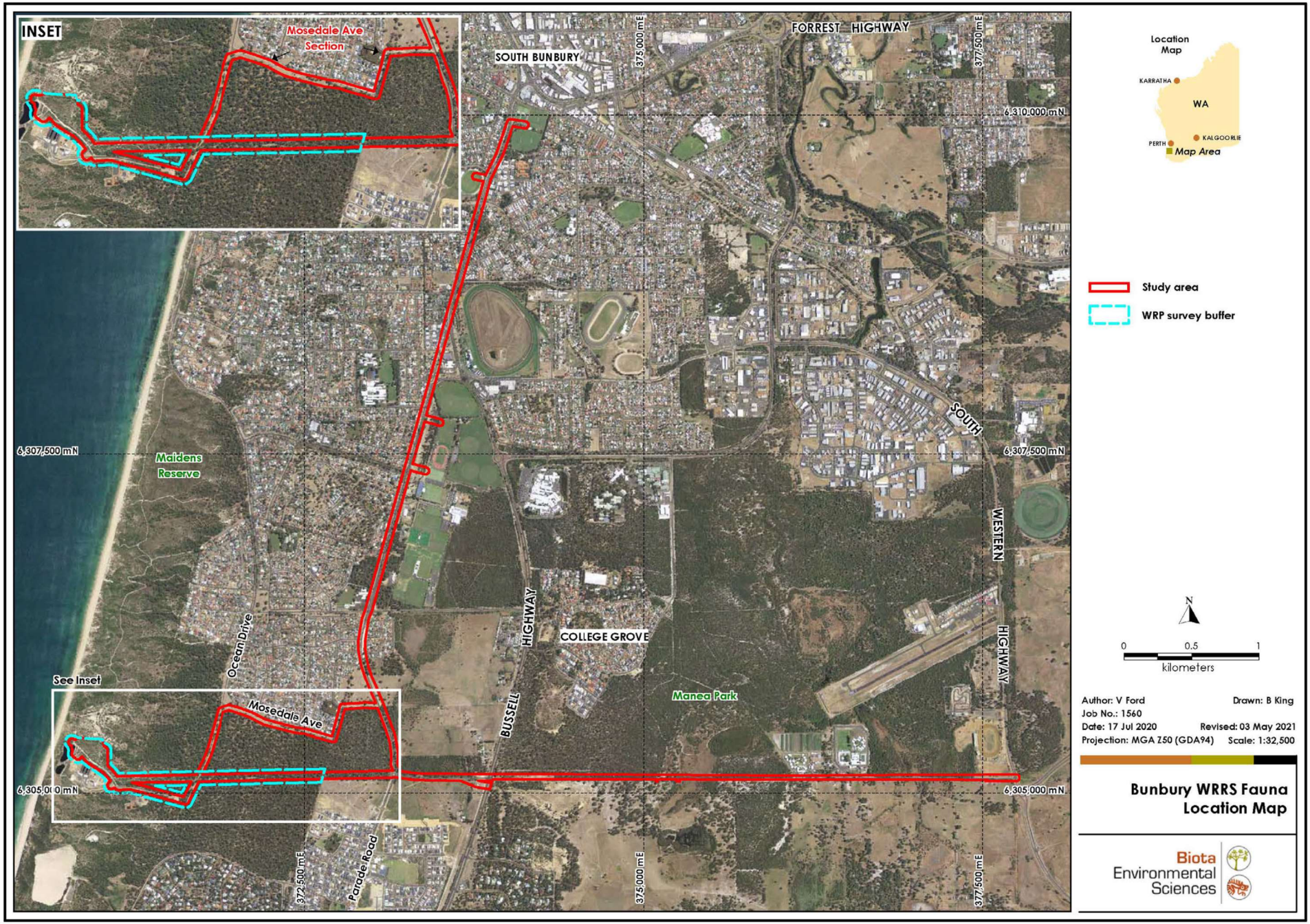


Figure 2.1: Location of the study area.

3.0 Methods

3.1 Desktop Study

3.1.1 Literature Review

Numerous targeted black cockatoo and Western Ringtail Possum surveys have been undertaken in the local area as part environmental impact assessment (EIA) studies for proposed developments. Table 3.1 presents some examples of those that have been conducted within 5 km of the study area.

Recently, targeted survey work for the Western Ringtail Possum has been undertaken at a regional scale, with distance sampling at 40+ sites across the entirety of the species' range (Biota 2020a). Manea Park, immediately north and adjacent to the Stage 2 study area, was sampled as part of that regional study; and further south along the coast, sampling within the Tuart Ludlow Forest, which provides an example of similar habitat to the woodland habitat occurring between Ocean Road and Parade Road of the Stage 2 route. In addition, intensive bi-monthly repeated strip-sampling has been undertaken over a two-year span as part of EIA of the proposed BORR. This includes areas immediately adjacent to and partially overlapping the study area, as well as two relatively large reference sites within 5 km; Reserve 23,000 in the Shire of Capel, and Lot 2 Boyanup-Picton Road (Biota 2019a, 2020b).

With regards to black cockatoo occurrence and roosts, the most significant database is the annual Great Cocky Count, where known roost locations across some 379 sites in the southwest are censused one night per year; this programme commenced in 2010 for white-tailed black cockatoos, with Forest Red-tailed Black Cockatoos incorporated from 2014 onward. Results are reported annually, most recently in Peck et al. (2019), and are also databased by BirdLife Australia (see Section 3.1.2). Much less information is available with regard to breeding sites for black cockatoos on the Swan Coastal Plain, as this is rarely recorded, however there are sites on the scarp east of Perth including Wungong Gorge where all three species have been recorded breeding (Johnstone and Kirkby 2011), and the greater Bunbury area (particularly in the Ludlow Tuart Forests) is mapped as a known breeding area (DSEWPaC 2012). A detailed list of the preferred foraging plants of each species may be found in several resources, including the current and draft revised EPBC Act Referral Guidance (DSEWPaC 2012, DotEE 2017), and numerous studies have investigated foraging behaviour on the Swan Coastal Plain, particularly for Carnaby's Black Cockatoo (Weerheim 2008, Groom 2015).

3.1.2 Database Searches

The following databases were searched to assist in the determination of the likely faunal assemblage of the study area, particularly in relation to fauna of conservation significance:

1. NatureMap (https://naturemap.dbca.wa.gov.au) is a joint project of the DBCA and the WA Museum. This database represents the most comprehensive source of information on the distribution of Western Australia's fauna, comprising records from the WA Threatened and Priority Flora and Fauna Databases, the Fauna Survey Returns Database (all managed by the DBCA), the WA Museum Specimen Database, and the BirdLife Australia Atlas of Australian Birds. NatureMap was searched to identify the likely assemblage and records of conservation significant fauna known from the study area. The search was conducted using a 10 km buffer around a point central to the survey area (-33.392778, 115.717778).
2. The EPBC Act Protected Matters Search Tool (PMST) was used to identify fauna species and other matters of national environmental significance (MNES) that may occur in the study area. The search was conducted using a 12 km buffer around the point central to the survey area (-33.392778, 115.717778).
3. Local black cockatoo data were obtained from BirdLife Australia, including location, type and birds recorded at confirmed roosts and nesting locations within a 12 km radius of a point central to the survey area (-33.392778, 115.717778).

Table 3.1: Previous studies reviewed in relation to the study area.

Report / Survey	Survey Description	Records
Bunbury Outer Ring Road Northern and Central Section Targeted Fauna Assessment (Biota 2019a)	Basic and targeted black cockatoo surveys and repeated bimonthly strip-sampling for Western Ringtail Possums.	Between 15 – 22 Western Ringtail possums each phase of sampling; 711 black cockatoo habitat trees, 2 with hollows potentially suitable for breeding; Carter's Freshwater Mussel recorded.
Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment (Biota 2020b)	Basic and targeted black cockatoo surveys and repeated bimonthly strip-sampling for Western Ringtail Possums.	Between 53 – 79 Western Ringtail Possum each phase of sampling; 1109 black cockatoo habitat trees, 5 with hollows potentially suitable for breeding; four Brush-tailed Phascogale recorded.
A regional survey of the Western Ringtail Possum (Biota 2020a)	Targeted survey for the Western Ringtail Possum across 40+ selected large remnant sites in the Southwest.	Manea Park (immediately adjacent to study area): 103 Western Ringtail Possums from 20.36 km of transect walked.
Lot 1 Wallrodt Road, Picton Environmental Values Assessment (GHD 2010).	Site inspection searching for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black cockatoo species confirmed.
Shire of Dardanup Waterloo Urban and Industrial Expansion Flora and Fauna Survey (GHD 2015).	Black cockatoo and Western Ringtail Possum habitat assessment, and searches for evidence of Western Ringtail Possum and cockatoos (scats, dreys, nut chews, sightings).	Western Ringtail Possum and black cockatoo species confirmed.
Targeted Fauna Survey: Lots 267, 268 and 153 Ducane Road, Gelorup (Biota 2019b).	Black cockatoo habitat assessment and Western Ringtail Possum survey.	1,243 black cockatoo habitat trees, with 133 hollows, and secondary foraging evidence; 41 Western Ringtail Possums.
Targeted Fauna Survey: Lot 269 Ducane Rd Gelorup (Biota 2019) (Biota 2019c).	Black cockatoo habitat assessment and Western Ringtail Possum survey.	85 black cockatoo habitat trees, with 41 hollows; 24 Western Ringtail Possums.
Fauna Assessment Harris Road (SLK 0.00 to 1.65), Picton East (Harewood 2019).	Basic survey, black cockatoo habitat description, and Western Ringtail Possum survey.	Small number of Western Ringtail Possum individuals; some black cockatoo foraging evidence.

3.2 Field Survey

3.2.1 Study Area, Survey Timing and Personnel

The study area for the habitat mapping and black cockatoo targeted work was generally defined by the indicative pipeline route and WWTP with a 25 m buffer each side, with the exception of the Mosedale Ave Section which had a narrower 20 m buffer (see Figure 2.1). There was also a section of pipeline buffer that fell on the private land south of Centenary Road and east of the Bussell Highway, which could not be accessed but this has not been mapped as part of the study area. A larger 50 m buffer was used for the survey of Western Ringtail Possum where the study area intersected a fragment of Tuart Peppermint woodland. The standard study area for habitat assessment and black cockatoo targeted work was 72.7 ha while the Western Ringtail Possum study area was 84.8 ha.

The field work was undertaken at three times (i) 5 to 9 October 2020, (ii) 24 – 26 February 2021 and (iii) 14 April 2021. There were additions to the study area during the second and third phases of survey, namely around the WWPT and the addition of the Mosedale Avenue section, taking the study area from an original size of 61.8 ha to 72.7 ha. The entirety was subject to basic survey and targeted work for Western Ringtail Possum and black cockatoo species. The original October 2020 study area was resurveyed for the Western Ringtail Possum in February in 2021, providing a second estimate of abundance over 74.1 ha of the species specific study area. The February and April 2021 additions to the study area, namely at the WWTP and the Mosedale Ave section, were surveyed once for the Western Ringtail Possum.

The first phase was undertaken by Biota zoologists Brandon King, Nathan Beerkens and Joshua Keen. All three staff have conducted numerous targeted surveys for black cockatoos and the Western Ringtail Possum in the local area. The second phase was undertaken by two of the same staff; Joshua Keen and Nathan Beerkens, and the third by Brandon King casual staff member Mark Teale.

In relation to the timing of typical black cockatoo presence on the Swan Coastal Plain, Baudin's Black Cockatoo and Carnaby's Black Cockatoo are most commonly found as foraging visitors from February through to September, while the timing of Forest Red-tailed Black Cockatoo presence is more flexible. The timing of the survey in October provided less opportunity to record foraging individuals, particularly with regard to white-tailed black cockatoos. However, it was possible to search for secondary foraging evidence, which will generally persist in the landscape, particularly Marri nuts, which can be useful in identifying species due to the distinctive chew marks left by each of the three species.

While not a typical breeding stronghold for any of the three black cockatoo species, the Bunbury area is listed as a known breeding area for both Carnaby's Black Cockatoo and Baudin's Black Cockatoo, and also occurs within the known breeding range for Forest Red-tailed Black Cockatoo (DSEWPaC 2012). The timing of breeding in Carnaby's and Baudin's Black Cockatoos is generally from July/August to December. Timing is more flexible for the Forest Red-tailed Black Cockatoo, with some indications that breeding on the Swan Coastal Plain peaks in November/December (Johnstone and Kirkby 2011). The large majority of the black cockatoo habitat assessment was undertaken in October, timing that would have been generally suitable for the detection of breeding activity.

3.3 Black Cockatoo Habitat Assessment

The field survey methodology used was designed in accordance with Commonwealth referral guidelines for the threatened black cockatoo species occurring in the south-west of Western Australia (DSEWPaC 2012, DotEE 2017).

3.3.1 Breeding Habitat Assessment

The field assessment aimed to determine whether suitable breeding habitat for black cockatoos was present within the study area. The Commonwealth *Referral guideline for three black-cockatoo species* (DSEWPaC 2012) defines breeding habitat as species of trees known to support breeding within the range of the black cockatoo species, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow (being greater than 50 cm DBH for most Eucalypts, or 30 cm in the case of Wandoo and Salmon Gum).

The aim was to assess, as far as practicable, all potential breeding trees within the study area. Two approaches were taken:

1. Larger areas of continuous vegetation were identified from aerial imagery and overlain with 25 m spaced transects in GIS. Using a GPS, a biologist walked up the middle of each 25 m wide transect, assessing all trees within it.
2. In smaller treed areas (e.g. roadside verges and paddocks containing singular trees), a biologist would maintain a GPS track file while using aerial imagery to visit as many trees as possible.

All individual trees of species with the potential to form hollows (primarily Jarrah, Marri, Flooded Gum and Tuart) and with sufficient diameter to be considered breeding habitat trees (i.e. DBH >50 cm) were recorded using a GPS with accuracy equivalent to that of a differential GPS (i.e. accurate to within 1.5 m).

The following parameters were scored:

- DBH in centimetres (approximately 1.3 m above the ground);
- tree height using a laser rangefinder;
- tree species;
- the number and height above the ground of any observed hollows;
- the entrance diameter of the hollow/s;
- suitability of entry/egress angle of the hollow/s;
- hollow connected to suitably large branch or trunk;
- signs of cockatoo use (including wear around hollows, nut chews, scarring, scratch marks on trunks and branches, secondary evidence of feeding sites and moulted feathers); and
- photographs were also taken as a visual reference and to aid future identification of the tree.

While the Swan Coastal Plain is not a typical breeding stronghold for any of the three black cockatoo species, Johnstone et al. (2010) have noted a shift in breeding distribution, particularly in relation to Carnaby's Black Cockatoo, further west and south to include Tuart Forests on the Swan Coastal Plain. A number of Carnaby's Black Cockatoo nests and probable nest hollows were located in the Lake Clifton and Bunbury region in August 2016 (Johnstone and Kirkby 2017).

Black cockatoos breed in large hollow-bearing trees, generally within woodlands and forests (Johnstone et al. 2010). Hollow formation results from a number of processes including fungal infection, termite activity and fire, and propensity for hollow formation varies between eucalypt species (Whitford and Williams 2002). Studies on hollow formation in Jarrah/Marri forests identified a minimum tree age of 130 years before a tree would be suitable for hollow-dependent fauna (Whitford and Williams 2002). Habitat destruction, and the subsequent loss of suitable breeding hollows, has been identified as a process leading to population decline of black cockatoos (Johnstone and Kirkby 2008). Furthermore, increased competition with both native and introduced species (e.g. ducks, Galahs and European Honey Bees) continues to reduce the availability of such trees for breeding sites (Johnstone et al. 2013).

Studies of the breeding behaviours of the three threatened black cockatoo species have identified variation between the tree species and characteristics of hollows chosen for nesting

(Table 3.2). For example, hollows formed in Jarrah are typically smaller than those in Marri, and Forest Red-tailed Black Cockatoos breed predominantly in Marri in the Jarrah-Marri forest of the Southwest of Western Australia (Johnstone et al. 2013). Breeding records of Carnaby's Black Cockatoo on the Swan Coastal Plain indicate that the majority of their nests are in Tuart (Johnstone et al. 2010).

Wherever possible, hollows that appeared suitable from ground level were further examined using a GoPro camera on a telescoping fibreglass pole. While not all hollows were accessible with this equipment, it did allow an assessment of 14 of the 28 trees with hollows that were considered to warrant further inspection.

Table 3.2: Breeding habitat for the three Threatened black cockatoo species.

	Baudin's	**Carnaby's**	**Forest Red-Tailed**
Specific breeding habitat for the three black cockatoo species	Nest in hollows in live or dead trees of Karri, Marri, Wandoo and Tuart.	Nest in hollows in live or dead trees of Salmon Gum, Wandoo, Tuart, Jarrah, Flooded Gum, York Gum, Powderbark, Karri and Marri.	Nest in hollows in live or dead trees of Karri, Marri, Bullich, Swan River Blackbutt, Tuart and Jarrah.
Hollow Characteristics			
Aspect	No preference. Does not affect nesting success (Saunders 1979).	No preference. Does not affect nesting success (Saunders 1979).	–
Depth	Ranges from 0.1 to 2.5+ m (Johnstone and Kirkby 2011).	Majority between 0.5 and over 2.0 m, average just over 1 m (Saunders 1979).	1.0 - 5.0 m (Johnstone and Kirkby 2011).
Height above ground	No preference (Serventy and Whittell 1976).	No evidence that higher hollows are preferenced (Saunders 1979).	No preference (Johnstone and Kirkby 2011).
Living or dead	No preference (Saunders 1979).	No preference (Saunders 1979).	No preference (Saunders 1979).
Entrance diameter	–	–	>12 cm (Johnstone and Kirkby 2011).

3.3.2 Foraging Habitat Assessment

Foraging habitat is defined as areas including plants of species known to support foraging within the range of each cockatoo species. Marri and Jarrah woodlands are particularly important to Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo, while proteaceous heaths (i.e. shrublands dominated by *Banksia, Hakea* and *Grevillea* species) are also important to Carnaby's Black Cockatoo (DSEWPaC 2012), as in some areas, introduced pine species, particularly on the Swan Coastal Plain (Johnstone and Kirkby 2011).

In defining the quality of black cockatoo foraging habitat, the criteria detailed in both the current referral guideline (DSEWPaC 2012) and the draft revised referral guideline (DotEE 2017) were incorporated. These include foraging plant composition and density, the provision of continuity to wider areas of foraging habitat, foraging evidence, proximity to known roosting areas and breeding areas.

While conducting the assessments of breeding habitat, foraging habitat and foraging evidence were also recorded.

3.3.3 Roosting Habitat Assessment

Black cockatoos will often form communal roosts in a suitable tree or group of tall trees, usually close to an important water source, and within an area of quality foraging habitat (DSEWPaC 2012). Mostly outside of the breeding season, black cockatoos will fly to foraging areas each day before returning to the night roost. Night roosts are typically located in the tallest trees in an area and may vary nightly or weekly (DSEWPaC 2012).

During the field survey, searches were conducted for evidence of roosting (e.g. significant piles of scats or feeding debris). Following the survey, those areas supporting the largest trees were considered in the context of nearby water sources, foraging habitat and proximity to known roosting locations (Peck et al. 2018, 2019, Barrett 2019).

3.4 Western Ringtail Possum Targeted Survey

Strips of 25 m-width were pre-loaded onto map imagery and displayed on tablets with high-accuracy GPS capability (generally to within 1.5 m). A strip-width of 25 m was chosen based on modelling of distance data (Biota 2020a) accumulated from over 3,000 detections of Western Ringtail Possums; this indicates a probability of detection of greater than 90% up to a distance of 10 m from a transect. It is therefore assumed that the number of Western Ringtail Possums counted when using this approach approximates the real abundance within the study area, although it is likely to represent a slight underestimate.

A zoologist walked down each 25 m-wide strip spotlighting for the Western Ringtail Possum using a high-powered head torch. Surveys generally commenced half an hour after sunset and were completed by 2 AM.

In areas of scattered trees (e.g. paddocks and road reserves), searching of individual trees was undertaken in favour of searching a strip. In addition to the Western Ringtail Possum, observations of any other fauna were also recorded.

The following information was recorded with every Western Ringtail Possum observation:

- species;
- observer;
- animal location using a high-accuracy GPS, taken while standing directly beneath;
- time;
- number of individuals;
- age class: subadult independent, adult, adult with young at heel, or female with young on back;
- cue: seen (eyeshine), seen (no eyeshine), or heard;
- drey or hollow at observation point; and
- dominant habitat at observation point.

3.5 Fauna Habitat Description and Opportunistic Searching

In the process of conducting the black cockatoo habitat assessment, general fauna habitat descriptions were made wherever a distinct junction in habitat types was noted. Habitat elements recorded included landscape type, soil type, surface material, landform, any notable microhabitats present, any disturbance (e.g. fire, weeds, grazing, evidence of introduced fauna), broad vegetation characteristics and representative photographs. Site descriptions were then considered in the context of the detailed vegetation mapping descriptions as provided by Ecoedge botanical consultants.

For those conservation significant species identified through the desktop study as potentially occurring in the study area, an assessment of habitat suitability was made. For each species, where habitat was available it was classified as either:

- “core”, equivalent to “habitat critical to the survival of the species” as per Department of the Environment (2013) – this comprised habitat considered to potentially contain roosting, denning or breeding sites, primary foraging areas, or refugia during drought, fire or other stress; or

- "secondary" – habitat which may be used on a transitory, dispersing or occasional basis, but does not represent core habitat.

Opportunistic observations of fauna or their secondary evidence (tracks, scats, burrows, diggings etc.) were also recorded.

3.6 Assessment of Likelihood of Occurrence

For the purposes of this report, the term 'conservation significant' has been applied to species that have been formally assigned a conservation ranking under the BC Act, EPBC Act or the DBCA list of priority species. These rankings typically recognise rare, unusual, new or poorly sampled species and are detailed in Appendix 1.

In order to determine which fauna species have the potential to occur in the study area, consideration was given to:

- the results of the database and literature searches;
- the known habitat preferences for the species, compared to those available within the study area; and
- distributions and known records for the species.

For each conservation significant species, the criteria detailed in Table 3.3 were applied to determine a likelihood of occurrence.

Table 3.3: Criteria used to assign the likelihood of occurrence of fauna of conservation significance.

Likelihood	Criteria
Recorded	1. The species was recorded in this study or has been previously recorded in the study area.
Likely to occur	1. There are existing records of the species within 10 km of the study area; and • the species is strongly linked to a specific habitat, which is present in the study area; or • the species has more general habitat preferences, and suitable habitat is present.
May occur	1. There are existing records of the species within 10 km of the study area, however • the species is strongly linked to a specific habitat, of which only a small amount is present in the study area; or • the species has more general habitat preferences, but only some suitable habitat is present. 2. There is suitable habitat in the study area, but the species is recorded infrequently in the region.
Unlikely to occur	1. The species is linked to a specific habitat, which is absent in the study area; or 2. Suitable habitat is present, however there are no existing records of the species from within 10 km of the study area despite reasonable previous search effort in suitable habitat; or 3. There is some suitable habitat in the study area, however the species is very infrequently recorded in the region.
Would not occur	1. The species is strongly linked to a specific habitat, which is absent from the study area; and/or 2. The species' range is very restricted and would not include the study area.

3.7 Compliance and Regulatory Requirements

All surveys were completed as far as practicable in accordance with relevant State and Commonwealth policy, and to a standard that would provide adequate information to assess the project against principles and environmental aims relating to the environmental factor 'Terrestrial Fauna' (EPA 2016). Table 3.4 provides a summary of the most important and relevant legislation, policy and guidelines relating to this study.

Table 3.4: State and Commonwealth legislation, policy and guidelines of most relevance to this study.

Legislation, Guideline or Policy	Application to this Study	Agency
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act).	Legislates species considered to be of national environmental significance.	Department of Agriculture, Water and the Environment
Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DotE 2013).	Defines matters of national environmental significance and what constitutes a significant impact.	Department of Agriculture, Water and the Environment
Significant impact guidelines for the vulnerable western ringtail possum (*Pseudocheirus occidentalis*) in the southern Swan Coastal Plain, Western Australia (DEWHA 2009)	Details ecology including habitat requirements.	Department of Agriculture, Water and the Environment
EPBC Act referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (DSEWPaC 2012)	Details distribution, ecology and recommended survey methodology.	Department of Agriculture, Water and the Environment
Western Australia		
Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020)	Identifies appropriate methodologies and standard of effort required for vertebrate fauna sampling in Western Australia	Environmental Protection Authority
Biodiversity Conservation Act 2016 (BC Act) and Biodiversity Conservation Regulations 2018	Western Australia's biodiversity protection legislation. Replaces the *Wildlife Conservation Act 1950*. Provides for species, subspecies or populations of native animals (fauna) to be listed as Specially Protected, Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in Western Australia.	Department of Biodiversity, Conservation and Attractions
Environmental Factor Guideline: Terrestrial Fauna (EPA 2016).	Overall aim of the study is to provide adequate information to assess the project against the EPA's objective for the environmental factor Terrestrial Fauna; stated to be "To protect terrestrial fauna so that biological diversity and ecological integrity are maintained".	Environmental Protection Authority
Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58 (DPaW 2017a)	Details ecology of the species and priority survey objectives.	Department of Biodiversity, Conservation and Attractions

4.0 Results

4.1 Fauna Assemblage Based on the Desktop Study

The desktop study returned a total of 202 vertebrate species as having been recorded previously in the local area (within 10 km of the study area; see Appendix 2). The assemblage comprised 17 mammals (including seven introduced species), 153 birds (including five introduced species), 22 reptiles and 10 frogs.

The 10 km radius used for the desktop study encompasses habitat types that do not occur within the study area, particularly marine and freshwater habitats. Specialist species restricted to these habitat types would not be expected to be reliant on habitats within the study area, and in some cases, would not occur at all. A number of obligate marine species, including dolphins, albatross and petrels, were returned from the EPBC Act PMST search; these have not been included in the potential assemblage of the study area given the complete absence of such habitat. The EPBC Act PMST places a large buffer around species records and therefore does not return precise information on species occurrence. The complete list of species returned from the EPBC PMST search is provided in Appendix 3.

Similarly, a number of shorebirds and water birds were returned from the desktop study due to the study area's proximity to habitat areas such as the Leschenault Inlet, Preston River, Collie River and Big Swamp, in which the vast majority of records of these types of species were located. The study area does not intersect any core habitat for water birds or shorebirds, but includes marginal habitat in the WWTP ponds and some dampland areas that may provide temporary habitat following significant rainfall.

Table 4.1: Summary of the total number of vertebrate fauna species returned from 10 km radius of study area*.

Fauna Group	Number of Species: Native (introduced)	Number of Conservation Significant Species
Mammals	10 (7)	7
Birds	148 (5)	30
Reptiles	22	0
Amphibians	10	0

* 'Marine' EPBC Act listed species completely reliant on marine habitats have been excluded from consideration.

4.2 Habitat Mapping

Approximately 39.1 ha of the 72.7 ha study area represents land that has been historically cleared for agriculture, housing, roads, and WWTP infrastructure; 33.6 ha of predominantly native vegetation remains. Ground-truthing and habitat mapping was conducted over the large majority of the study area to ensure that all potential black cockatoo habitat trees were captured. The broad fauna habitats of the study area are described in Table 4.2, while their distribution over the study area is illustrated in Figure 4.1 and Figure 4.2.

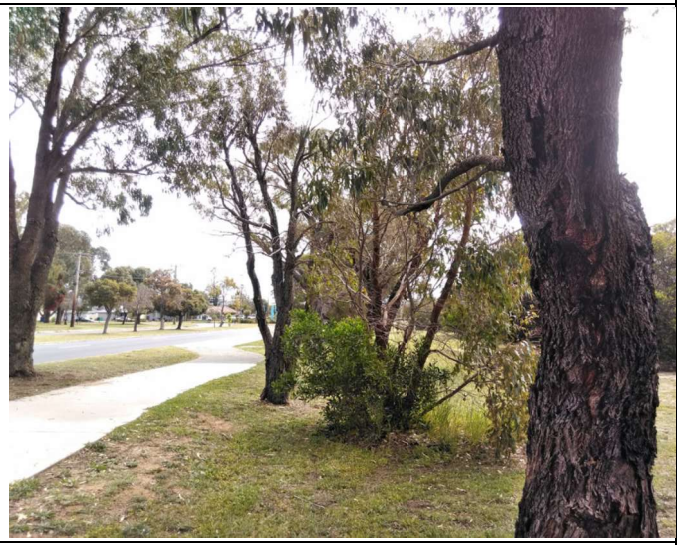
The Stage 1 route running along Parade Road comprises largely cleared road verge with occasional scattered trees or small groups of trees at the edge of parkland or a woodland remnant that runs outside the study area (e.g. Katherine Chauhan Reserve).

The Stage 1 – 2 shared section between the WWTP facility and Parade Road intersects an area of Tuart/Peppermint woodland that is relatively undisturbed, with the exception of some walking tracks. The remainder of the Stage 2 study area, east of Parade Road, is a mosaic of vegetation types and cleared paddocks along the edge of Centenary Road. Mixed woodland and dampland areas alternate.

Table 4.2: Broad fauna habitats of the study area, listed from most common to least.

Broad Fauna Habitat	Example Photographs
Tuart/Peppermint woodland Tuart (*Eucalyptus gomphocephala*) tall woodland over Peppermint (*Agonis flexuosa*) low forest. Lower strata usually dense shrubs but occasionally sedges and grasses only. Grey brown sand or loamy sand. 15.3 ha	 
Peppermint and scrub on dunes Scattered low Peppermint (*Agonis flexuosa*) over low open scrub dominated by *Acacia* and sedges at the westernmost extent. Some Tuarts (*Eucalyptus gomphocephala*) emergent in the east as this habitat type transitions from dune slope to plain. Dense shrub and heath layers. White to yellow sand. 5.0 ha	 

Broad Fauna Habitat	Example Photographs	
Mixed Marri/*Eucalyptus* woodland Mixed woodland of Jarrah (*Eucalyptus marginata*), Tuart (*Eucalyptus gomphocephala*), Marri (*Corymbia calophylla*) over Banksia and/or Peppermint (*Agonis flexuosa*) over shrublands and open sedgelands. Grey sands and sandy loam substrates. 3.9 ha		
***Melaleuca* shrubland and/or woodland** Shrubland or woodland of *Melaleuca*, typically Moonah (*Melaleuca preissiana*) or Swamp Paperbark (*M. rhaphiophylla*), typically over sedges or introduced grasses in dampland areas. Emergent Flooded Gum (*Eucalyptus rudis*) or Marri (*Corymbia calophylla*). Substrates of sandy clay or clay. 3.9 ha		

Broad Fauna Habitat	Example Photographs
Marri/*Eucalyptus* in paddocks and road reserves Typically occurring as widely spaced trees or occasionally as small stands in paddocks and road reserves; comprising a mosaic of scattered trees of Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), Tuart (*Eucalyptus gomphocephala*), Flooded Gum (*Eucalyptus rudis*) and typically an understorey of introduced grasses. 3.9 ha	 
Coastal Heath Low open scrub (including *Acacia cochlearis, Alyxia busifolia* and *Diplolaena dampieri*) over herbs (*Acanthocarpus preissii, Calandrinia brevipetala, Conostylis aculeata subsp. preissii*), grasses (*Austrostipa flavescens*) and sedges (*lepidosperma*) on calcareous bleached sand. 1.6 ha	

Broad Fauna Habitat	Example Photographs
Waste Water Treatment Plant Pond Artificial water body. Very little 'shore' standing area along the edge. 0.1 ha	

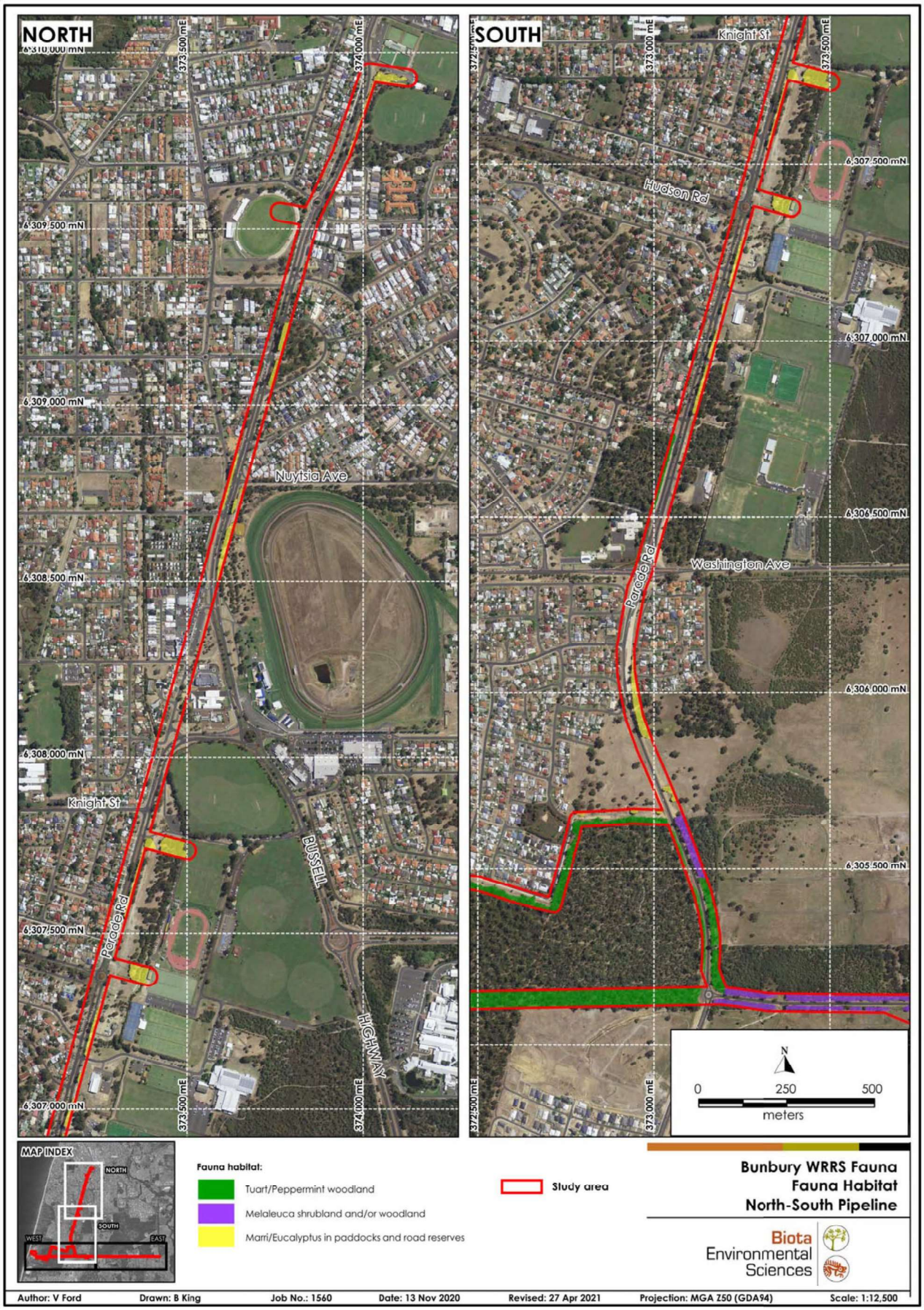


Figure 4.1: Distribution of broad fauna habitats over the study area, map 1 of 2.

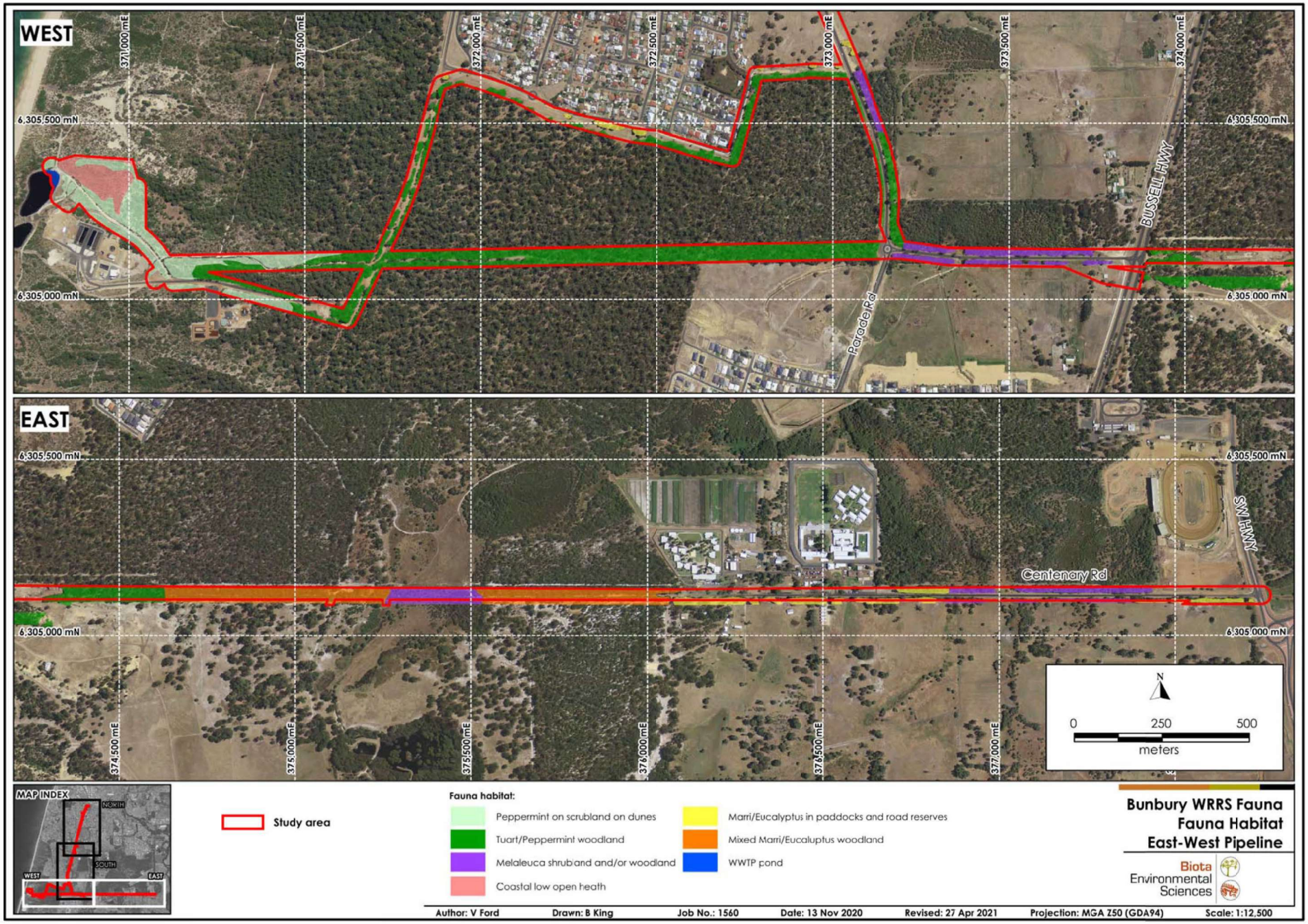


Figure 4.2: Distribution of broad fauna habitats over the study area, map 2 of 2.

4.3 Black Cockatoos

4.3.1 Observations

Three Forest Red-tailed Black Cockatoo were heard within the Tuart/Peppermint woodland west of Parade Road, and one feather of the species was recorded within the Parade Road reserve. Five Carnaby's Black Cockatoo were observed flying over Parade Road.

4.3.2 Breeding Habitat Assessment

Black cockatoo breeding habitat trees were considered to be those of relevant species with a DBH of 50 cm or greater as defined in the Commonwealth Referral guidelines (DSEWPaC 2012). A total of 595 habitat trees were recorded within the study area, comprising 158 Marri, 71 Jarrah, 318 Tuart, 44 Flooded Gum and four trees of indeterminate species. The survey extent and locations of all trees with DBH greater than 50 cm are shown in Figure 4.3.

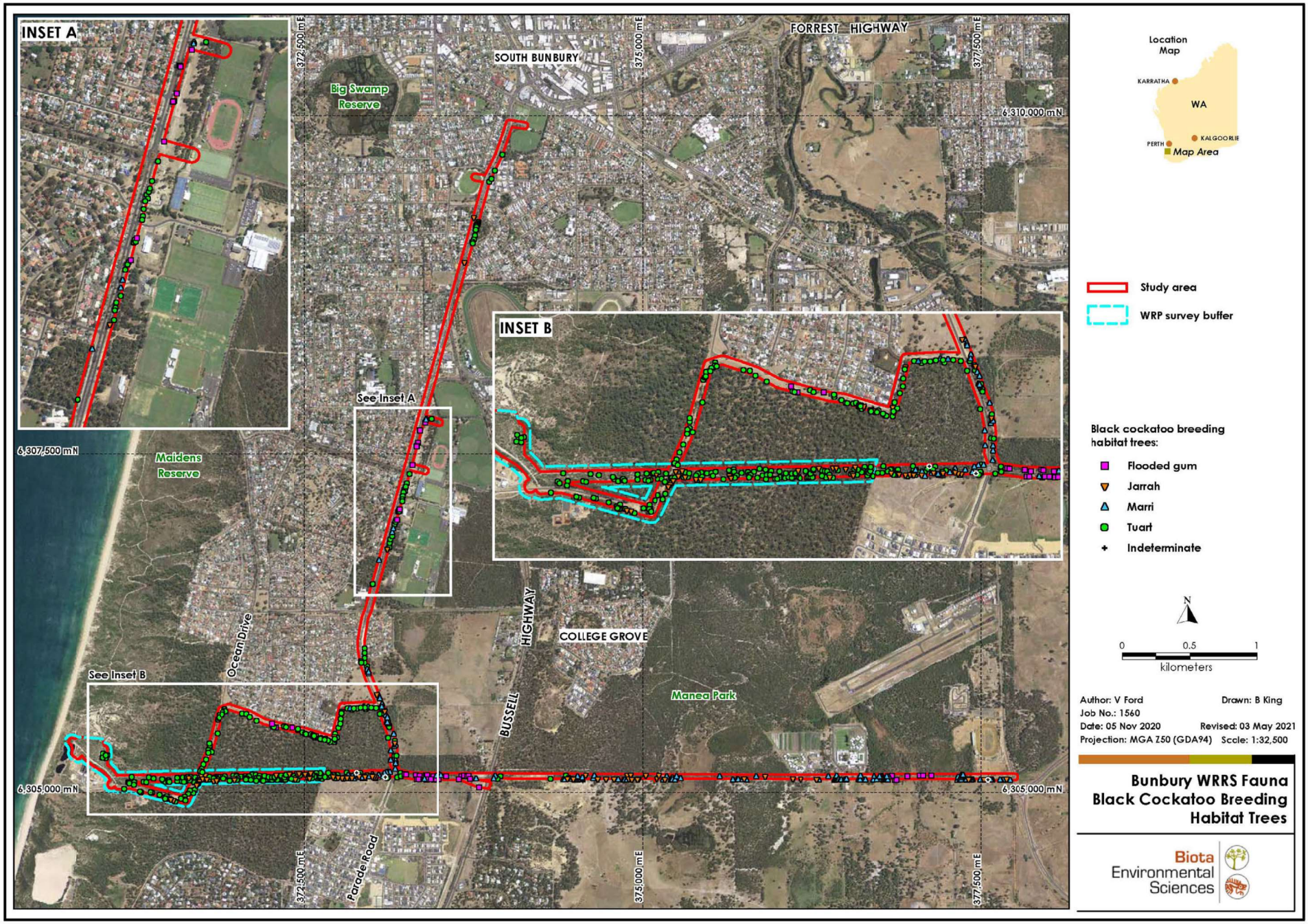


Figure 4.3: Trees of hollow-forming species with DBH >50 cm recorded within the study area

Of the 595 habitat trees recorded, a subset of 28 trees supported hollows considered to warrant follow-up assessment of breeding suitability. Fourteen of these trees could be assessed with the pole-camera, although in one case, only one of two hollows on the tree was accessible. Of the 14 trees assessed with the pole-camera, hollows on nine were not suitable for breeding. Five trees (four Tuart and one Jarrah) were found to have potentially suitable breeding hollows, however, no evidence of black cockatoo breeding was recorded.

Fourteen of the trees that had hollows warranting follow-up could not be assessed with the pole-camera due to restrictions of height and angle of access to the hollow and so additional methods would be required to conclusively determine suitability. Figure 4.4 displays the location and status of hollows.

A nest of three unfeathered chicks was recorded with the pole-camera (Plate 4.1). The nest was not consistent with black cockatoos, given the appearance of the birds, especially the bill shape; the clutch size (black cockatoos generally 1 – 2 eggs) (Johnstone and Storr 1998); and the absence of nesting material or external chews. Laughing Kookaburras were observed in the area.

Plate 4.1: Three hatchlings observed with the pole-camera (not black cockatoos).

BirdLife Australia provided a general description of a potential Carnaby's Black Cockatoo breeding location at Gelorup (only approximate locations are provided for protection of nesting habitat). A further two breeding locations in the Ludlow Tuart Forest, approximately 20 km south of the study area, are captured in the DBCA layer presented at data.wa.gov.au.

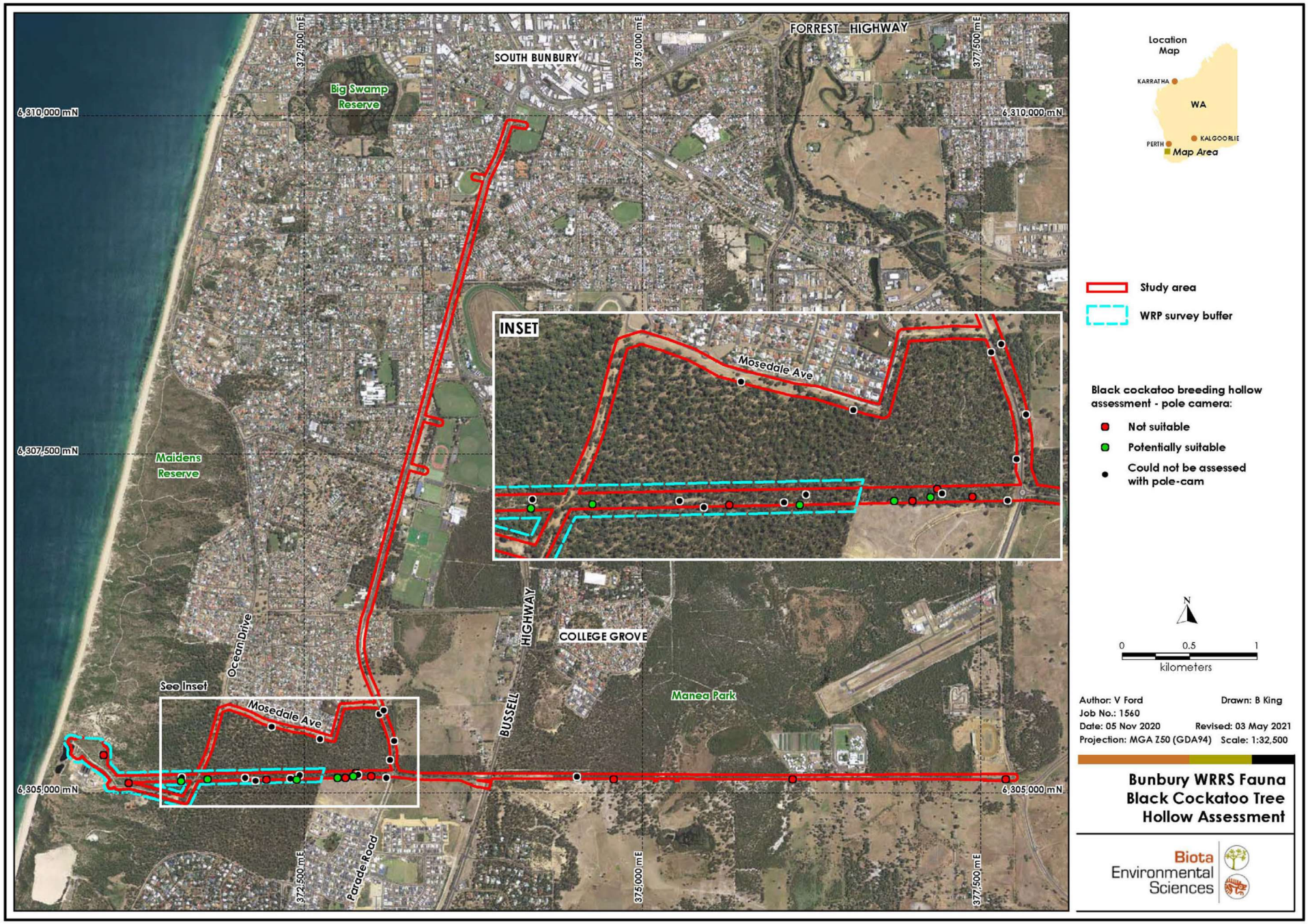


Figure 4.4: Location of trees with hollows that were either assessed with the pole-camera or appeared from ground-level to be potentially suitable for nesting.

4.3.3 Foraging Habitat Assessment

The 72.7 ha study area included 39.1 ha of cleared land, which is devoid of black cockatoo foraging, breeding or roosting habitat. The study area included a total of 8.7 ha of potential black cockatoo foraging habitat; 3.9 ha was assessed as being high quality and 4.8 ha as moderate quality. High quality foraging habitat was defined as areas within native vegetation types that were dominated by foraging plants and were in good to excellent vegetation condition. Within the study area, this was restricted to habitat in the easterly extent of the Stage 2 study area (east of Parade Road) and comprised areas of mixed Jarrah, Tuart, Marri woodland, particularly where there was a mid-storey of *Banksia*. Marri is utilised by all three species of black-cockatoo, Jarrah by Baudin's Black-Cockatoo and Forest Red-tailed Black Cockatoo, and *Banksia* and *Hakea* by Carnaby's and Baudin's Black Cockatoo.

Moderate quality foraging habitat was defined as areas of scattered foraging plants based on the vegetation descriptions and mapping of Ecoedge botanical consultants. This method is likely to result in an overestimate of moderate quality foraging habitat, as in some cases only one particular species of plant represented a foraging plant (e.g. *Hakea varia*) but the total area of these vegetation units was included as moderate quality. Similarly, in the case of the scattered trees in paddocks and road reserves, not all such trees represented foraging trees (e.g. Flooded Gum and Tuart are not preferred foraging plants, although they are used on occasion). However, taking a conservative approach, the entirety of the habitat type with scattered trees was included as moderate quality foraging habitat.

Examples of black cockatoo foraging evidence recorded during the survey are illustrated in Plate 4.2. These are most consistent with Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo.

Plate 4.2: Black cockatoo foraging evidence recorded within the study area.

The black cockatoo foraging habitat within the study area has been considered in the context of wider habitat availability in Figure 4.5 by mapping the occurrence of each Swan Coastal Plain (SCP) vegetation complex (DPaW 2017b), both within the study area and out to a 12 km radius. This radius was chosen as it represents the typical maximum distance that black cockatoos will fly from roosting locations to forage.

Four vegetation complexes occur within the study area (SCP Veg. 42, 49, 55 and 56); each is defined in Table 4.3, along with their occurrence (in hectares) both within the study area and out to a 12 km radius.

The Southern River Complex (SCP Veg. 42) and Karrakatta Complex-Central and South (SCP Veg. 49) are broadly aligned with the areas mapped as foraging habitat within the study area, although . The combined area of these two complexes within the study area represents 0.4% of their extent within a 12 km radius. The occurrence of these vegetation types within the study area is continuous with larger extents immediately adjacent, particularly within the Manea Park reserve, as shown in Figure 4.5. It must be noted however, that this vegetation mapping is not necessarily accurate at a fine, for example, we found that this mapping tends to overestimate the occurrence of SCP Veg. 49 (mixed eucalypt woodland) and underestimate SCP Veg. 56 (Tuart Peppermint woodland) within the study area.

Table 4.3: Occurrence of the Swan Coastal Plain vegetation complexes (DPaW 2017b) within the study area and vegetation fragments within a 12 km radius.

SCP Veg.	Complex Name	Complex Definition	Area in Study Area (ha)	Amount Remaining Within 12 km (ha)
49	Karrakatta Complex – Central and South	Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* - Banksia species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River.	16.6	2,262.9
55	Quindalup Complex	Coastal dune complex consisting mainly of two alliances - the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* (Rottnest Teatree) - *Callitris preissii* (Rottnest Island Pine), the closed scrub of *Acacia rostellifera* (Summer-scented Wattle) and the low closed *Agonis flexuosa* (Peppermint) forest of Geographe Bay.	7.09	1216.1
56	Yoongarillup Complex	Woodland to tall woodland of *Eucalyptus gomphocephala* (Tuart) with *Agonis flexuosa* in the second storey. Less consistently an open forest of *Eucalyptus gomphocephala* - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). South of Bunbury is characterized by *Eucalyptus rudis* (Flooded Gum) - *Melaleuca* species open forests.	2.4	291.8
42	Southern River Complex	Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - *Banksia* species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.	2.3	1,999.2

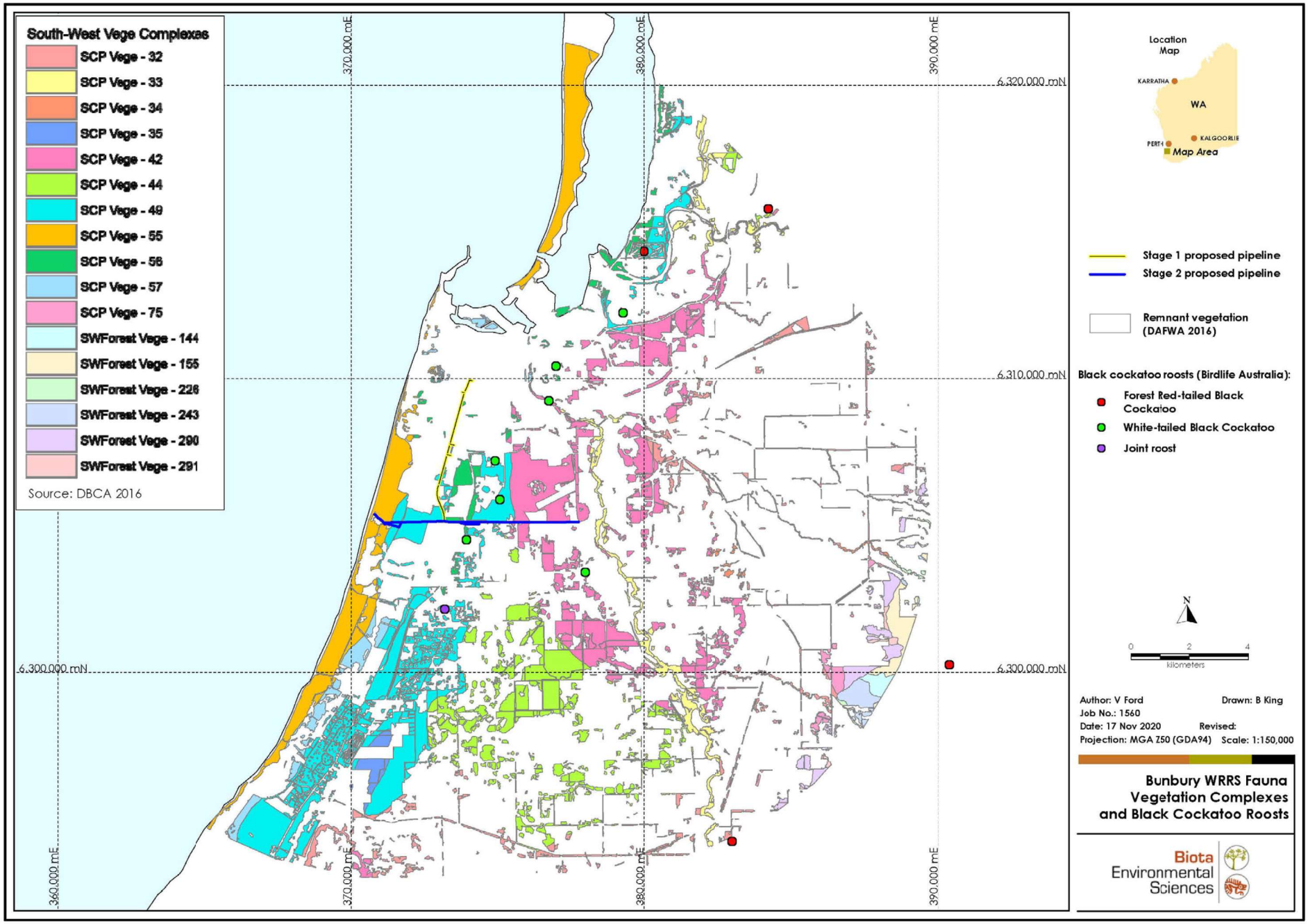


Figure 4.5: Black cockatoo foraging habitat within the study area and records of foraging evidence.

4.3.4 Roosting Habitat Assessment

Figure 4.5 displays the known roosting locations returned from BirdLife Australia's database of Great Cocky Count results. No evidence of roosting was recorded within the study area, although there are a number of records in the local area (within 10 km). The closest of these is a roost in Manea Park (700 m north of Stage 2), where three white-tailed black cockatoos (Carnaby's and/or Baudin's) were recorded in 2017, representing the most recent positive record; with another in Sleaford park (approximately 600 m south of Stage 2), where four white-tailed black cockatoos were recorded in 2016.

A high degree of variability in the use of the roosts is evident in the local annual counts; e.g. only two of the 12 roosts within 12 km of the study area had positive counts in both 2018 and 2019. The most consistently used roosts in the area are a white-tailed roost located 3 km north on the Picton River, where 24 – 79 birds have been recorded in 2017 – 2019; and a joint roost 3 km south of the study area, again in riparian habitat on a tributary of the Murchison River, where 2 – 89 birds were recorded in 2017 – 2019.

Within the study area, the best potential roosting habitat is represented by the areas of highest quality foraging habitat; that is, the Mixed Marri/Eucalypt woodland habitat, both due to the presence of stands of trees in foraging habitat but also proximity to water sources, albeit ephemeral.

4.4 Western Ringtail Possum

During the October survey a total of 91 Western Ringtail Possum individuals were recorded from 61 observations (31 observations were of single adults and 30 observations were of an adult together with a subadult). Fewer individuals were recorded in the February survey; 69 individuals were recorded from 59 observations (49 observations were of single adults, three were of adult pairs and seven were observations of an adult together with a subadult). The observation of more adult/subadult pairs in October and lower numbers in February is generally consistent with our internal database from surveys of the Western Ringtail Possum in the Bunbury area over the last three years. Peak ringtail numbers have been recorded in spring (October) and early summer (December) with pouch young emerging. The consistent drop in the number of ringtails recorded in February may reflect high mortality as juveniles disperse

The location of Western Ringtail Possums observed within the study area is shown in Figure 4.6 (October 2020) and Figure 4.7 (February 2021). The localities where the Western Ringtail Possum were observed was consistent between the two sampling rounds. The Tuart/Peppermint woodland habitat type found at the western end of the Stage 2 route accounted for the majority of individuals recorded in both rounds; 53 of 91 in October and 37 of 69 in February. It should be noted, however, that this area also incorporated a larger 50 m buffer on the pipeline and so received more survey effort. Although not in as high densities recorded within the Tuart/Peppermint woodland at the western end of the Stage 2 route, Western Ringtail Possums were recorded along much of the Centenary Road, east of Parade Road, portion of the Stage 2 buffer. Intact native vegetation is adjacent-north of much of this route (e.g. Manea Park) and fragments remain within the agricultural land to the south.

The occurrence of Western Ringtail Possum within the Stage 1 buffer, was very similar across the two rounds of sampling; with ringtails consistently recorded at the following three localities (i) trees adjacent the sports grounds at the corner of Blaire St and Biesiot St (ii) Parade Road segment adjacent Lions park and (iii) Parade Road segment south of Floyd Crossing. This pattern may reflect consistent use by the same individuals occupying their home ranges.

Within the Mosedale Avenue section added to the study area in April 2021, three Western Ringtail Possum individuals were recorded outside the previous study area, while two individuals were recorded from where the Mosedale Avenue section overlapped with the original study area (Figure 4.7).

One Wambenger Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*, BC Act listing Conservation Dependent) was observed during the February phase of survey located within the Tuart Peppermint woodland habitat type (Figure 4.7).

Three Common Brushtail Possums were observed during the October 2020 sampling round, five during February 2021, and one from the Mosedale Ave section of April 2021.

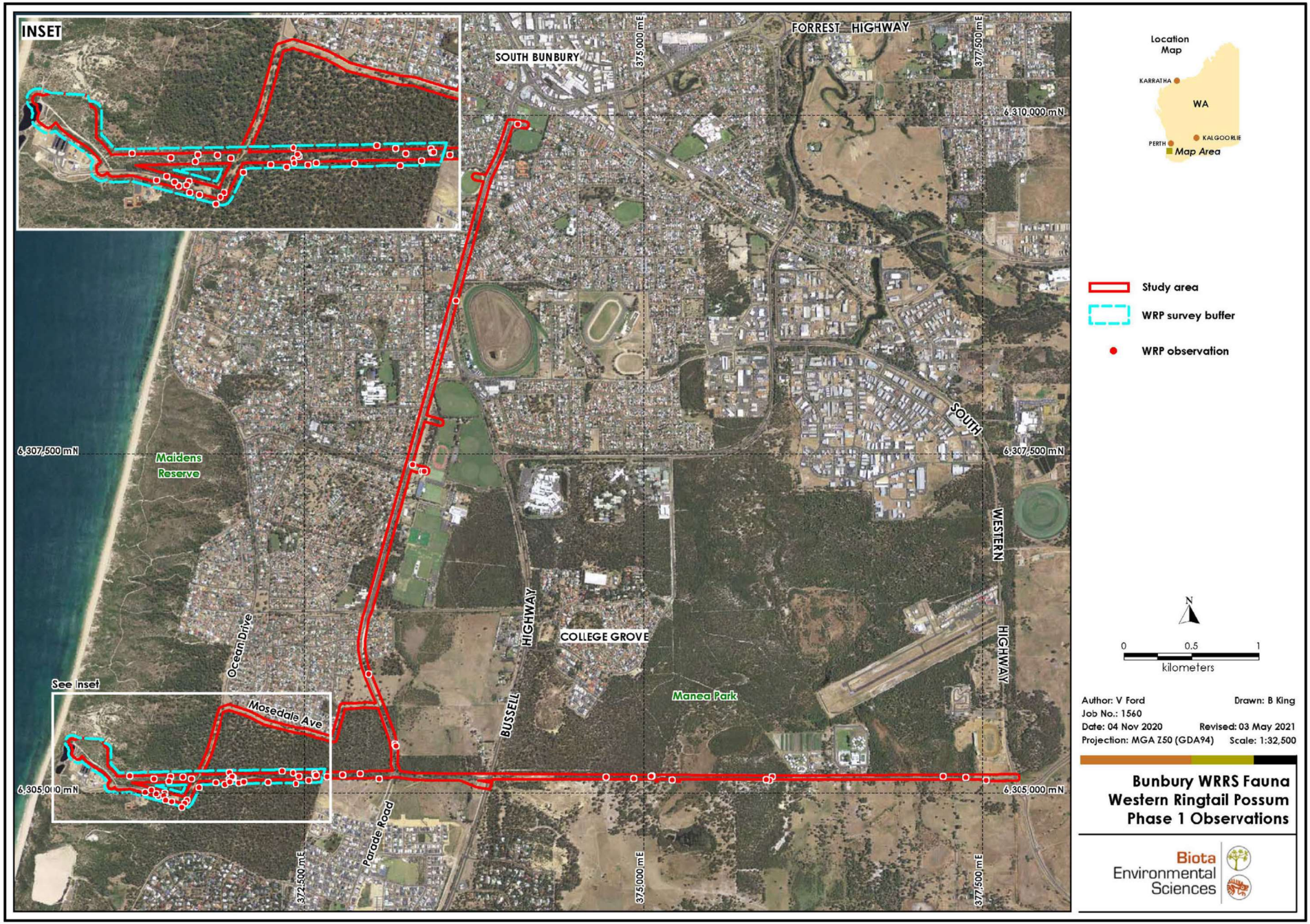


Figure 4.6: Records of Western Ringtail Possums from strip transects across the study area in October 2020.

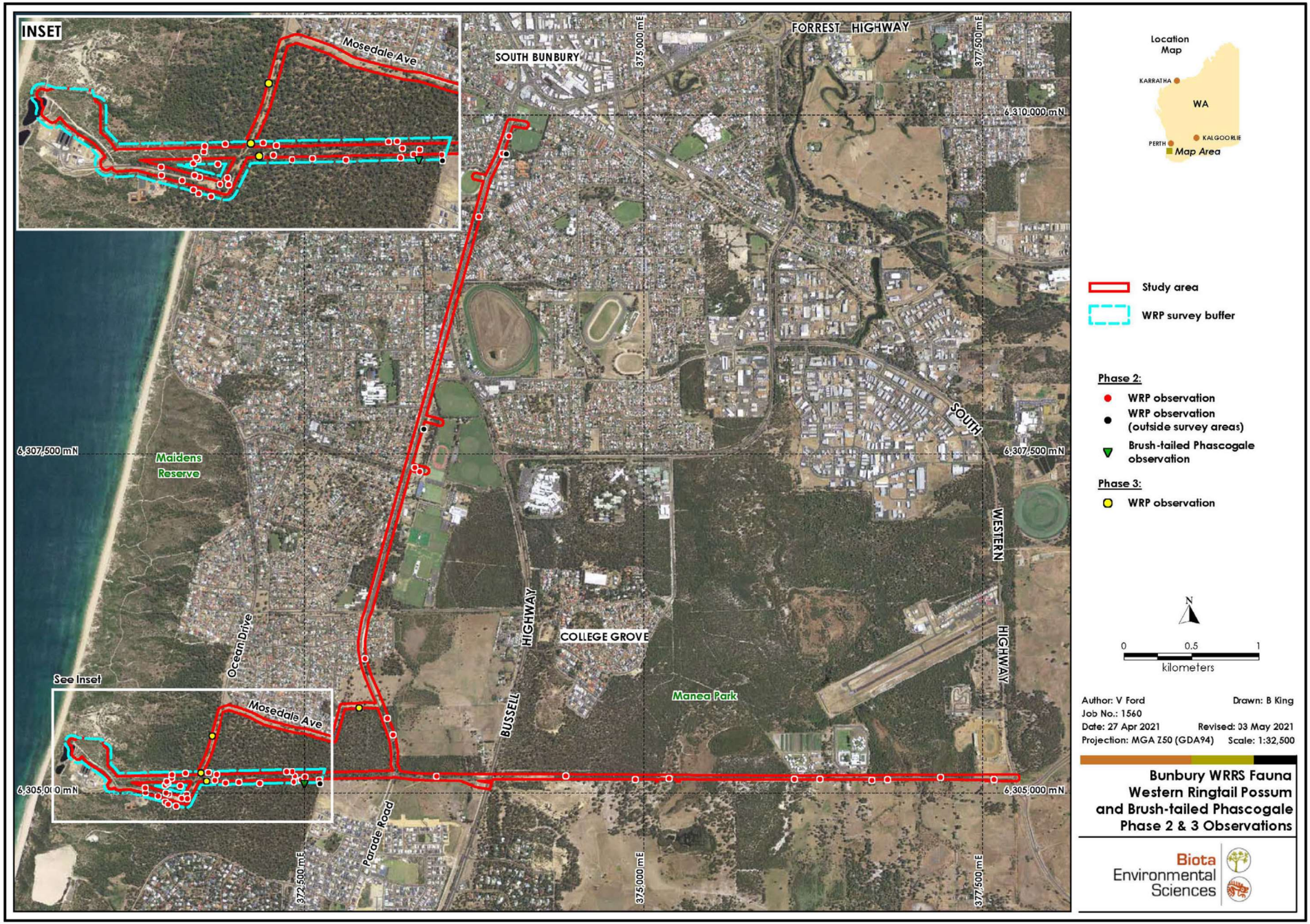


Figure 4.7: **Records of Western Ringtail Possums from strip transects across the study area in February 2021 and Mosedale Ave addition April 2021.**

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5.0 Conservation Significant Fauna

5.1 Conservation Significant Fauna with Potential to Occur

This section provides assessment and descriptions of those conservation significant species that have been considered to have some potential to occur in the study area. Those species assessed to have no potential to occur are described, with reasoning, in Section 5.2.

As defined in Section 3.6, the assessment of likelihood of occurrence for each species has been made based on availability of suitable habitat, whether such habitat is core or secondary, as well as records of the species during the current survey or past studies included in the desktop study. Conservation significant is used to describe species listed under the EPBC Act, BC Act or the DBCA list of priority species. Appendix 1 details categories of conservation significance recognised under these three frameworks.

Table 5.1 summarises the likelihood assessment for each conservation significant species returned from the desktop study. Further species information is provided in Section 5.1.1 to Section 5.1.11.

Table 5.1: Conservation significant fauna returned from the desktop study and their likelihood of occurrence within the study area.

Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap	EPBC PMST	Closest record (date), No. of Records within 10 km	Notes	Likelihood of Occurrence
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CR		•	•	This study, 1489	Resident.	Occurs
Calyptorhynchus latirostris	Carnaby's Black Cockatoo	EN	EN		•	•	350 m (2008), 82	Foraging visitor, potential breeding.	Occurs
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	VU	VU		•		50 m (1999), 9	Foraging visitor, potential breeding.	Occurs
Calyptorhynchus baudinii	Baudin's Black Cockatoo	EN	EN		•	•	200 m (2018), 7	Foraging visitor, potential breeding.	Likely to occur
Isoodon fusciventer	Southern Brown Bandicoot, Quenda			P4	•		150 m (1999), 8	Resident.	Likely to occur
Phascogale tapoatafa wambenger	Brush-tailed Phascogale		CD		•		800 m (2019), 7	Requires multiple canopy strata.	Occurs
Falco peregrinus	Peregrine Falcon		OS		•		3.6 (2006), 1	Potential foraging visitor. No breeding habitat available.	May occur (foraging visitor)
Ctenotus ora	Coastal Plains Skink			P3	•		4.5 km (1982), 2	Lack of species records precludes definitive assessment.	May occur
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider			P3			80 m (1987), 12	Few recent records.	May occur
Notamacropus irma	Western Brush Wallaby			P4	•		1.4 km (2015), 7	Recorded within Manea Park/College Grove in recent years. Possible visitor.	May occur (visitor)
Oxyura australis	Blue-billed Duck			P4	•		1 km (2002), 86	Visitor following significant rainfall or to artificial habitats.	May occur (visitor)
Actitis hypoleucos	Common Sandpiper	MI/ MA	MI				1.5 km (2017), 44	Artificial pond only.	May occur (visitor)
Tringa glareola	Wood Sandpiper	MI/ MA	MI				1.5 km (2014),1	Artificial pond only.	May occur (visitor)
Setonix brachyurus	Quokka	VU	VU		•	•	3.4 km (1972), 2	Prefers dense understorey with water nearby. Only one extant record on the SCP.	Unlikely to occur

5.1.1 Western Ringtail Possum

The Western Ringtail Possum or Ngwayir (*Pseudocheirus occidentalis*) is listed as Critically Endangered under the BC Act, a classification that indicates that it is rare or is likely to become extinct. The species is also listed as Critically Endangered under the EPBC Act and is thereby significant in a national context.

The Western Ringtail Possum is a medium-sized arboreal marsupial, endemic to south-western Western Australia. The species is exclusively folivorous, feeding on leaves of myrtaceous species, predominantly Peppermint, but also Marri and Jarrah. During the day, possums rest in tree hollows or dreys (nests constructed from vegetation, which are generally in the canopy but can occasionally be found at ground level). Home range size varies with the productivity of the habitat but is generally less than 5 ha, although densities of up to 20 individuals per hectare have been recorded in Peppermint woodland near Busselton (DPaW 2017a). Some populations breed throughout the year, but on the southern Swan Coastal Plain females give birth to one young (more rarely up to three) in autumn (April-June); these are weaned and independent at six to seven months (DPaW 2017a).

The species was once widely distributed across southern and south-western Western Australia but due to habitat clearing and fragmentation for agricultural and urban development, it is now restricted to three areas: the southern Swan Coastal Plain, the Jarrah forests near Manjimup and the south coast between Albany and Walpole (DPaW 2017a). Habitat loss and fragmentation continue to represent the major threat to the species, while other threats include predation by introduced carnivores, climate change, logging, fire and competition for nest hollows (DBCA 2017).

Likelihood of occurrence: The Western Ringtail Possum was recorded within the study area, most commonly in the Tuart/Peppermint woodland and Marri/Eucalyptus woodland habitat types, both being examples of core habitat for the species. Secondary habitat, from which the species was also recorded within the study area, included scattered Marri/Eucalyptus in paddocks and road reserves, and Peppermint over scrubland on dunes where this habitat was adjacent Tuart/Peppermint woodland.

Intensive survey work targeting the Western Ringtail Possum has been undertaken in the local area providing context for the occurrence within the study area, as illustrated in Figure 5.1.

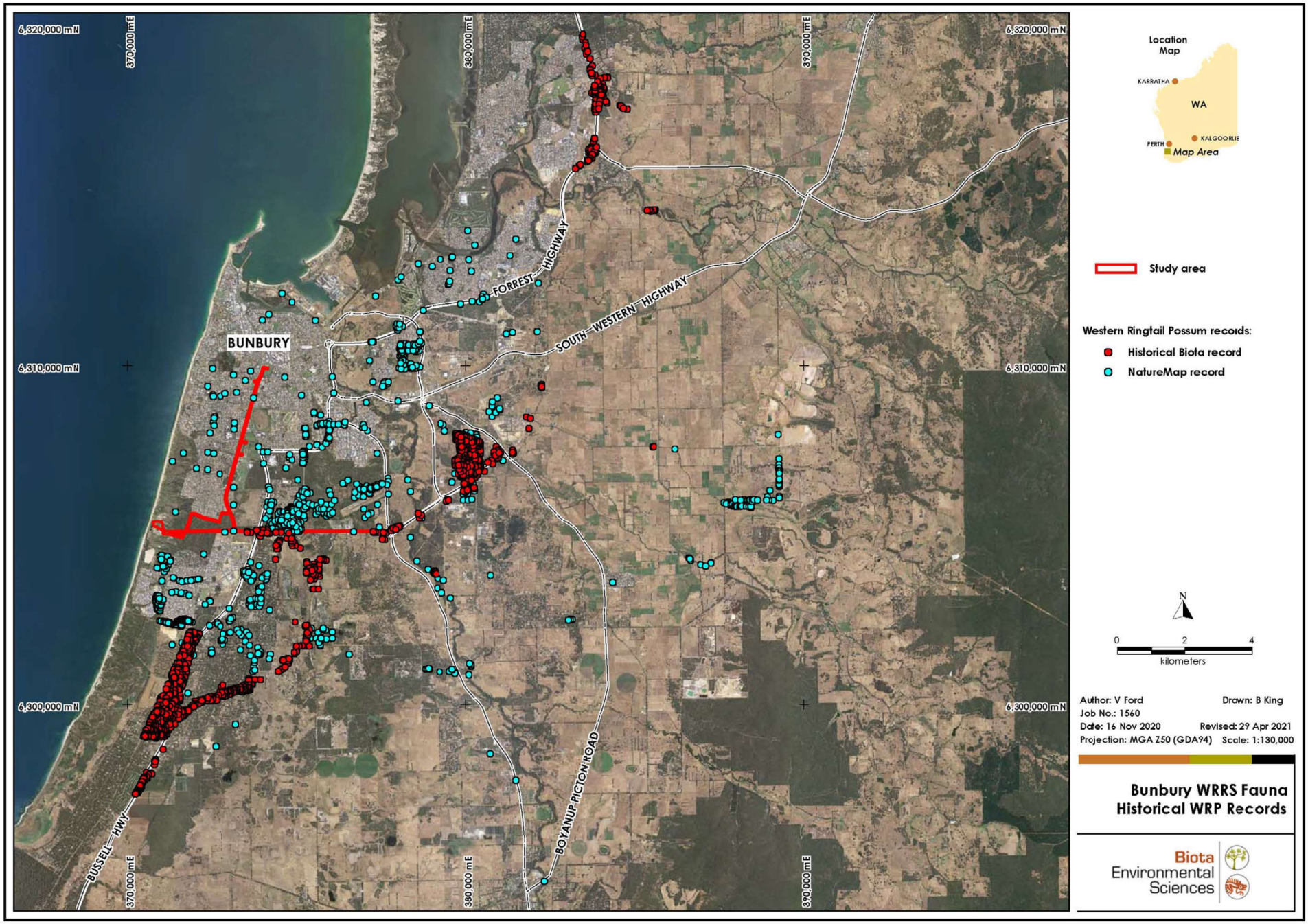

Figure 5.1: Location of the study area in the context of Western Ringtail Possum records from NatureMap and recent Biota records within 10 km.

5.1.2 Black cockatoos

Three species of black cockatoo in the south-west of Western Australia have documented breeding areas overlapping the study area, however it is only located in the typical breeding distribution of the Forest Red-tailed Black Cockatoo (Johnstone and Storr 1998, DSEWPaC 2012). Black cockatoos require tree hollows with suitable dimensions for nesting and breeding, which typically occur in larger trees over 200 years old (DSEWPaC 2012). As such, breeding habitat trees are defined in the Commonwealth Referral guidelines as any tree with a DBH equal to or greater than 50 cm (DSEWPaC 2012). Activities such as logging and deforestation for agriculture have contributed to a decline in abundance and range of black cockatoos, hence their listing as conservation significant species.

5.1.2.1 Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black Cockatoo is listed as Endangered under the BC Act and EPBC Act.

This species is distributed from Kalbarri to Esperance. During the breeding season, between July and November, they have been historically concentrated in the Wheatbelt region (Johnstone and Storr 1998, Saunders et al. 2014b) where they primarily nest in Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*). However, elsewhere the species is also known to nest in Tuart, Marri, Red Morrel (*E. longicornis*) and York Gum (*E. loxophleba*) (Johnstone and Storr 1998).

The Swan Coastal Plain has historically been more important as a foraging area than for breeding, with the birds moving into the area after breeding, and occurring in the autumn and winter months. However, the species' breeding stronghold in the Wheatbelt has been moving onto the Swan Coastal Plain more recently (DSEWPaC 2012). Expansion in the breeding range further south and west towards the Jarrah-Marri forests of the Darling Scarp and Tuart forests of the Swan Coastal Plain (including near Bunbury) has occurred in the past 10 to 30 years (Johnstone et al. 2010).

Long-term studies show that Carnaby's Black Cockatoos utilise hollows ranging from 10 – 65 cm in diameter (average 26 cm) and approximately 130 cm deep (Saunders et al. 2014a, 2014b). They also frequent coastal areas outside of the breeding season where they forage in large flocks (Saunders et al. 2011), feeding on the seeds of *Banksia*, and *Eucalyptus* species such as Jarrah, Marri and Karri (*E. diversicolor*).

Likelihood of occurrence: Occurs; foraging evidence was recorded within the study area. Numerous records in the local area (Figure 5.2). Core habitat represented by Tuart/Peppermint woodland as potential breeding habitat and Mixed Marri/Eucalyptus woodland as high quality foraging habitat.

5.1.2.2 Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The Forest Red-tailed Black Cockatoo is listed as Vulnerable under the BC Act and EPBC Act.

This species occurs from Gingin in the north across to near Albany in the south (Johnstone and Storr 1998). It typically nests in Marri, Jarrah and Karri tree hollows with entrance diameters ranging from 12 – 150 cm (average 34 cm) and depths of 100 – 500 cm (average 144 cm) (Johnstone and Storr 1998, Johnstone et al. 2013). Females lay eggs between October and November and incubation is approximately 29 – 31 days, during which time the female stays with the egg and is fed by the male (Johnstone and Storr 1998). They feed mainly on Jarrah and Marri seeds but also Sheoak (*Allocasuarina fraseriana*), Snottygobble (*Persoonia longifolia*) and Swan River Blackbutt (*Eucalyptus patens*) (Johnstone et al. 2010).

Likelihood of occurrence: Occurs. Forest Red-tailed Black Cockatoo were recorded adjacent to the study area by observation of feeding individuals, and within the study area secondarily via feeding evidence. Core habitat represented by Tuart/Peppermint woodland as potential breeding habitat and Mixed Marri/Eucalyptus woodland as high quality foraging habitat.

5.1.2.3 Baudin's Black Cockatoo (*Calyptorhynchus baudinii*)

Baudin's Black Cockatoo is listed as Endangered under the BC Act and EPBC Act.

The species occurs in the humid and subhumid areas of the southwest, distributed from Gidgegannup in the north to Naturaliste National Park and Augusta, also occurring in the Stirling and Porongurup Ranges and east along the south coast to Waychinicup (Johnstone and Storr 1998). Between March and September, the majority of the population migrates north from the cooler Karri forest to the central and northern Darling Range and eastern Swan Coastal Plain (Johnstone et al. 2010). They feed mainly on the seeds of Marri trees, as well as various species of *Banksia* and *Hakea* (Johnstone and Storr 1998).

Although the breeding requirements of this species are still poorly known, breeding has been recorded in the southwest north to Serpentine and east to Kojonup and Albany (Johnstone et al. 2010). Baudin's Black Cockatoo nest mainly in hollows of Karri, Marri and Wandoo trees. Breeding typically occurs between March and October, but egg laying has also been reported less frequently in November and December (Johnstone and Storr 1998, Johnstone et al. 2010). Specific dimensions of hollows used for breeding have not previously been studied for Baudin's Black-Cockatoo, but they are likely to be similar to those hollows used by Carnaby's Black Cockatoo.

Bunbury represents a known breeding area for Baudin's Black Cockatoo (DSEWPaC 2012).

Likelihood of occurrence: Likely to occur, based on nearby records. Core habitat represented by Tuart/Peppermint woodland as potential breeding habitat and Mixed Marri/Eucalyptus woodland as high quality foraging habitat.

5.1.3 Southern Brown Bandicoot, Quenda (*Isoodon obesulus fusciventer*)

The Southern Brown Bandicoot is listed as a Priority 4 species by the DBCA (see DBCA 2018).

It is patchily distributed, occurring along the Swan Coastal Plain and in Jarrah and Karri forests from just north of Perth to east of Esperance. It occurs in habitats with sandy soil supporting dense vegetation in the lower stratum. Along the Swan Coastal Plain, the species is often associated with wetlands (van Dyck and Strahan 2008, van Dyck et al. 2013).

The Quenda is a medium-sized ground-dwelling marsupial that is territorial. Breeding in this species is opportunistic, beginning in winter and peaking in spring, and lasting 6 – 8 months. The species constructs a nest of ground litter over a shallow depression next to or under logs, shrubs or debris piles. It is mostly nocturnal, but is sometimes active during the day when it searches for invertebrates, fungi and subterranean plant material (van Dyck and Strahan 2008, van Dyck et al. 2013).

Likelihood of occurrence: Likely to occur. Scattered NatureMap records place the species in close proximity to the study area and there is suitable habitat within it. Core habitat includes areas with a dense understorey including Peppermint over scrubland on dunes and Melaleuca shrubland.

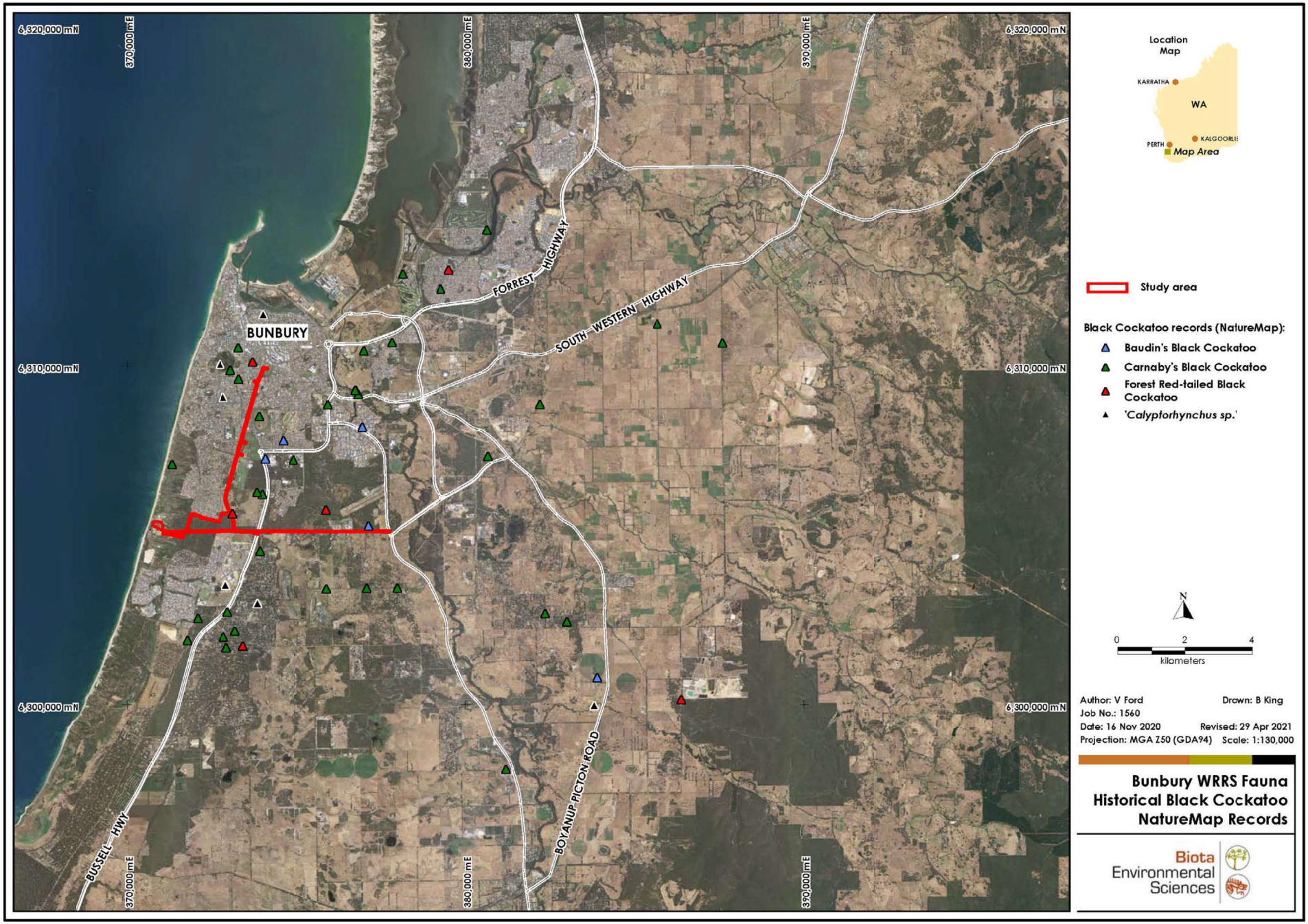

Figure 5.2: Records of black cockatoo species within the study area and NatureMap records out to 10 km

5.1.4 Wambenger Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*)

The Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) is listed as Conservation Dependent Fauna under the BC Act.

Populations of the Brush-tailed Phascogale occur at the extreme coastal extents of Australia and are threatened across most of their range. The south-west population was described as a distinct subspecies in 2015 (Aplin et al. 2015) and is distributed between Perth and Albany. It occurs at low densities in the northern Jarrah forest, with the highest densities occurring in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DBCA 2012).

The *wambenger* subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. Records from wetter forests are less common. Brush-tailed Phascogales are nocturnal arboreal carnivores that forage for food under the bark of trees (van Dyck and Strahan 2008). This feeding mode and the use of tree hollows for shelter results in a preference for large trees, particularly Jarrah and Marri with DBH over 95 cm (Rhind 1996).

Brush-tailed Phascogales are short-lived, with all males dying at the end of the breeding season and a small number of females living up to 2.5 years, long enough to produce a litter in their second year (Rhind and Bradley 2002). They maintain relatively large territories (over 20 ha) and female territories are exclusive; as a result, densities tend to be low.

Likelihood of occurrence: Occurs. One individual was recorded from Tuart/Peppermint woodland. Biota's internal database includes several records of the Brush-tailed Phascogale from near the study area, particularly within the Shire of Capel Reserve 23,000. Core habitat within the study area is represented by woodland both Tuart/Peppermint woodland and Mixed Marri/Eucalyptus woodland habitat types.

5.1.5 Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is listed as Other Specially Protected Fauna under the BC Act.

The Peregrine Falcon has an almost cosmopolitan distribution across Australia, but is absent from most deserts and the Nullarbor Plain (Johnstone and Storr 1998).

This species inhabits a wide range of habitats including forest, woodlands, wetlands and open country (Pizzey and Knight 2007). The Peregrine Falcon, like other birds of prey, is a relatively long-lived species, with low reproductive rates and low population density. These factors, combined with the fact that they are a top-end predator and limited by their prey, make them particularly vulnerable to human impact.

Likelihood of occurrence: Possible as a foraging visitor. Although the study area lacks the preferred nesting habitat for the species, it is possible it would forage within it at times.

5.1.6 Coastal Plains Skink (*Ctenotus ora*)

The Coastal Plains Skink is listed as a Priority 3 species by the DBCA (see DBCA 2018).

This species is relatively newly described, having been grouped with *Ctenotus labillardieri* prior to 2012 (Kay and Keogh 2012). Records of the species are sparse but it is described as inhabiting open eucalypt woodland over banksia, and low vegetation on sandy coastal plains and dunes.

Likelihood of occurrence: Possible. Records of the skink have been largely coastal to date but include one record from Eaton. Given the paucity of data, a conservative approach has been taken and this species is considered as a possible resident given the presence of suitable habitat.

5.1.7 Swan Coastal Plain Shield-backed Trapdoor Spider (*Idiosoma sigillatum*)

The Swan Coastal Plain Shield-backed Trapdoor Spider *Idiosoma sigillatum* is listed as Priority 3 by the DBCA.

Distribution and habitat: *Idiosoma sigillatum* has a widespread distribution throughout the Swan Coastal Plain, from Dalyellup north to at least Ledge Point (including Rottnest Island and Garden Island). However, over much of this range, and particularly in the Perth metropolitan area, clearing for urban expansion has resulted in local extinctions from the species' previous range. The spider is restricted to *Banksia* woodland and heathland on sandy soils (Rix et al. 2018).

Ecology: The spider forms a burrow with a door surrounded by a 'moustache-like' arrangement of twig-lines. Males wander in search of females during the cool winter months.

Likelihood of occurrence: May potentially occur. There are scattered and dated records of the spider from very nearby (within 80 m of the study area). It may occur in areas of Banksia within the study area.

5.1.8 Western Brush Wallaby (*Notamacropus irma*)

The Western Brush Wallaby is listed as a Priority 4 species by the DBCA (see DBCA 2018).

This species is endemic to the south-west of Western Australia, where it is distributed from north of Kalbarri to near Cape Arid. It inhabits a wide range of habitats, including open forest and woodland, mallee, heathland, low open grasslands and thickets (Woinarksi and Burbidge 2016). It is absent from Karri forests with dense undergrowth.

Breeding occurs between April and May, with young emerging from the pouch from October to November. Historically, population declines were caused by poachers trading skins, the introduction of the fox, and clearing of habitat for agriculture. Foxes are still a threat to the survival of this species, with juveniles most at risk of predation.

Likelihood of occurrence: May potentially occur as a visitor. The Western Brush Wallaby is not commonly recorded in the Bunbury area (based on NatureMap records), however, the species has recently been recorded from the Manea Park/College Grove area. Given that the habitat in the study area is contiguous, it is possible that the species may visit.

5.1.9 Blue-billed Duck (*Oxyura australis*)

The Blue-billed Duck is listed as a Priority 4 species by DBCA (see DBCA 2018).

In Western Australia, the Blue-billed duck occurs predominantly in the southwest, with their range extending from Lake Pinjarrega in the north and east across to Esperance (Johnstone and Storr 1998). They are almost exclusively aquatic, with preferred habitat including deep freshwater swamps or lakes and occasionally saltwater lakes or estuaries inundated with fresh water.

Breeding occurs from early August to the end of March; nests are made from trampled bulrushes 10–30 cm above water (Johnstone and Storr 1998).

Likelihood of occurrence: Possible visitor. The species has been recorded commonly at Big Swamp (within 1 km of the study area) and the Leschenault Inlet. Although no core habitat for the species is present in the study area, it may occasionally occur within it when the ephemeral wetland areas support water.

5.1.10 Common Sandpiper (*Actitis hypoleucos*) and Wood Sandpiper (*Tringa glareola*)

Both species are listed as Migratory/Marine under the EPBC Act and Migratory under the BC Act.

When in Australia, both the Common Sandpiper and Wood Sandpiper generally use coastal or inland wetlands, both saline and fresh. They are mainly found on muddy edges or rocky shores. While the large majority of wading bird species are considered to have no likelihood of occurrence in the study area, as detailed in Section 5.2, these two particular species are known to frequent treatment ponds and so have been included as potential visitors to the WWTP area.

5.1.11 Quokka (*Setonix brachyurus*)

The Quokka is listed as Vulnerable under the BC Act and EPBC Act.

The Quokka occurs in isolated populations on Rottnest Island, Bald Island and fragmented areas of the mainland between the Hunter Valley and Jarrah forests south of Perth. The Quokka has specific habitat requirements, preferring dense understorey vegetation or a complex vegetation structure (comprising at least three layers) that provides ample protection from predators. The Quokka also requires water to be nearby and is often found in swampy or riparian areas. Critical habitat in both the northern and southern extent of its range is described as patches of varying fire age, with some areas more recently burnt. This may reflect their preference to feed on new growth vegetation in recently burnt areas.

Historically, disease and the introduction of the Red Fox have been responsible for major population declines. Current threats include uncontrolled fox populations and loss of habitat through inappropriate fire regimes. The Quokka is also indirectly affected by dieback disease, which has the potential to severely alter vegetation structure.

Likelihood of occurrence: Unlikely to occur. The nearest record of the species is from swampland near Stratham (<5 km from the Study area), however this represents the only known remaining population on the Swan Coastal Plain and it appears to be restricted to that particular swamp.

5.2 Conservation Significant Species that are Erroneously Listed or Would Not Occur

5.2.1 Erroneous Listings

A total of 27 bird species returned from the desktop study are erroneously listed as 'Marine' under the EPBC Act, although they do not utilise marine habitats at all and/or certainly do not rely upon them for survival (Garnett 2013). These species were not considered of genuine conservation concern in the context of this report. Examples of these species include the Silvereye, Magpie-lark, and Black-faced Cuckoo-shrike; all such species are indicated within Appendix 2.

5.2.2 Shorebirds and Aquatic Birds

The following conservation significant shorebirds and aquatic birds were returned from the desktop study but in the local area have been recorded from the Leschenault Inlet area only:

- Pacific Golden Plover, *Pluvialis fulva* (EPBC Act and BC Act Migratory/Marine);
- Grey Plover, *Pluvialis squatarola* (EPBC Act and BC Act Migratory/Marine);
- Greater Sand Plover, *Charadrius leschenaultia* (EPBC Act and BC Act Vulnerable/Migratory/Marine);
- Eurasian Whimbrel, *Numenius phaeopus* (EPBC Act and BC Act Migratory/Marine);
- Black-tailed Godwit, *Limosa limosa* (EPBC Act and BC Act Migratory/Marine);
- Ruddy Turnstone, *Arenaria interpres* (EPBC Act and BC Act Migratory/Marine);

- Red Knot, *Calidris canutus* (EPBC Act and BC Act Endangered/Migratory/Marine);
- Terek Sandpipe, *Xenus cinereus* (EPBC Act and BC Act Migratory/Marine;
- Grey-tailed Tattler, *Tringa brevipes* (EPBC Act and BC Act Migratory);
- Marsh Sandpiper, *Tringa stagnatilis* (EPBC Act and BC Act Migratory/Marine);
- Greater Crested Tern, *Thalasseus bergii* (EPBC Act and BC Act Migratory/Marine);
- Common Tern, *Sterna hirundo* (EPBC Act and BC Act Migratory/Marine); and
- Flesh-footed Shearwater, *Ardenna carneipes* (EPBC Act and BC Act Migratory).

These species are considered to have no likelihood of occurring within the study area, based on absence of suitable habitat, even at the artificial treatment ponds.

5.2.3 Carter's Freshwater Mussel (*Westralunio carteri*)

Carter's Freshwater Mussel is listed as Vulnerable under the BC Act and the EPBC Act.

The only freshwater mussel in south-west Western Australia, Carter's Freshwater Mussel was added to both State and Federal conservation listings in 2018 following recognition of its declining distribution, thought to be primarily caused by increasing salinity and drying of its habitat. Comparing historical and current records indicates that the species is likely to have undergone a 49% reduction in its distribution in three generations (Klunzinger et al. 2015). Once distributed from Moore River in the north to King George Sound in the south and inland to the Avon River, the species now only occurs within freshwater streams, rivers, reservoirs and lakes within 50 – 100 km of the coast, from Gingin Brook southward to the Kent River, Goodga River and Waychinicup River. Locally, Carters Freshwater Mussel occurs in the Preston River and in a tributary of the Collie River, north of the study area (Biota 2019d, WRM 2019).

The life-history of the species contributes to its vulnerability, with an age at sexual maturity of 3–6 years and complex maturation stages, including a parasitic larval stage where glochidia must attach to the gills of host fish (Klunzinger et al. 2014).

The species is patchily distributed in sandy/muddy sediments of freshwater lakes, rivers and streams, with greatest densities associated with exposed submerged tree roots of Flooded Gums (*Eucalyptus rudis*), *Melaleuca* spp. and others, woody debris, and overhanging riparian vegetation near stream banks and edges of lakes/dams. Precise habitat requirements and quantification within habitat types are in the early stages of study for this species. Juveniles may require specific micro-habitats and are difficult to locate in the wild.

Likelihood of occurrence: Would not occur. There is no permanent watered habitat suitable for the species in the study area.

5.2.4 Chuditch (*Dasyurus geoffroii*)

The Chuditch (*Dasyurus geoffroii*) is listed as Vulnerable under the BC Act and EPBC Act.

Chuditch were previously known from most of Australia, occurring in every mainland state and territory. The species was relatively abundant until European settlement, when it underwent a drastic decline and range contraction. The species went extinct in New South Wales in the 1940s, Victoria in the 1950s, and in Queensland between 1880 and 1910. It is now largely restricted to the southwest of Western Australia, with small numbers in the Midwest, Wheatbelt and South Coast regions where continuous forest or suitable fragments remain. Historically, Chuditch inhabited a wide range of habitats, but today this species predominantly occurs in Jarrah (*Eucalyptus marginata*) forest, wet and dry sclerophyll forest, and mallee remnants in Western Australia (Menkhorst and Knight 2011).

Chuditch are seasonal breeders, with mating occurring in late April – early July (Menkhorst and Knight 2011). Chuditch utilise hollow logs and burrows as dens or refuges, and occur in Eucalypt forests, dry woodlands and mallee shrublands (Strahan 1995).

The Chuditch faces a number of threats, including predation and competition with the Red Fox and the Feral Cat, altered fire regimes, direct mortality as a result of road trauma, habitat loss and degradation (Morris et al. 2003).

Likelihood of Occurrence: Would not occur. The Chuditch was not recorded within the study area, and has not been recorded from the Bunbury area despite the intensive spotlighting effort associated with the BORR and the regional Western Ringtail Possum survey work over the course of the past two years. Furthermore, there is only one NatureMap record of the species within 10 km of the study area.

5.2.5 Water Rat (*Hydromys chrysogaster*)

The Water Rat or Rakali is listed as a Priority 4 species by the DBCA (see DBCA 2018).

The Water Rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh or brackish water habitats in the southwest of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands (Strahan 1995).

The Water Rat is an opportunistic predator, feeding on large aquatic insects, fish, crustaceans, mussels, frogs, lizards, small mammals, fresh carrion and water birds (van Dyck and Strahan 2008). The Water Rat is not entirely nocturnal; it is most active around sunset but may forage during the day. Breeding occurs throughout the year, but most young are born between spring and late summer (van Dyck and Strahan 2008).

The Water Rat faces predation by the Feral Cat (*Felis catus*) and European Red Fox (*Vulpes vulpes*), and as such faces the threat of population decline via direct mortality. Swamp reduction and flood mitigation have also removed habitat, and salinity and degradation of waterways have caused significant declines in southwest populations (van Dyck and Strahan 2008).

Likelihood of occurrence: It was assessed that the Water Rat would not occur in the study area due to the lack of any drainages or water bodies.

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Appendix 1

Framework for Conservation Significance Ranking of Species in WA

1. Western Australian *Biodiversity Conservation Act 2016,* and Priority Species Classification

In Western Australia, 'Threatened', 'Extinct' and 'Specially Protected' fauna and flora species are protected under the *Biodiversity Conservation Act 2016* (the BC Act), making it an offence to take or disturb these species without Ministerial approval. The definition of 'take' is broad, and includes killing, injuring, harvesting or capturing fauna, and gathering, cutting, destroying, harvesting or damaging flora.

Such species are classified within a framework of several categories.

Species of the highest conservation significance are designated as Threatened species and are protected under sections 19(1)(a), 19(1)(b) and 19(1)(c) of the BC Act. Species are listed within one of three categories:

- Critically endangered (CR), Endangered (EN), or Vulnerable (V), representing those species listed in Schedules 1 to 3 respectively of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* or the *Wildlife Conservation (Rare Flora) Notice 2018*.

Presumed extinct species are protected under sections 24 and 25 of the BC Act and are listed in one of two categories:

- Extinct (EX), representing those species listed in Schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* or the *Wildlife Conservation (Rare Flora) Notice 2018*; or
- Extinct in the wild (EW); there are currently no listed species under this category.

Specially protected species are protected under section 13(1) of the BC Act, and include species of special conservation interest, migratory species, cetaceans, species subject to international agreement, or species otherwise in need of special protection. Of these:

- Migratory species (MI) are those listed under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*;
- Species of special conservation interest (conservation dependent fauna) (CD) are those listed under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*; and
- Other specially protected fauna (OS) are those listed under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*;

In addition to the species formally designated as protected under the BC Act, the WA Department of Biodiversity, Conservation and Attractions (DBCA) also maintains a list of 'Priority species'.

Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of three Priority categories (Priority 1 to Priority 3), while species that are adequately known but require regular monitoring are assigned to Priority 4.

Note that of the above classifications, only 'Threatened', 'Extinct' and 'Specially Protected' species have statutory standing. The Priority flora and fauna classifications are employed by the WA DBCA to manage and classify their database of species considered potentially rare or at risk, but these categories have no legislative status.

Further explanations of the categories is provided in more detail in the following pages.

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

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

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

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

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

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

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

CR **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

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

EX Extinct species

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 *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

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

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

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

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

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

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

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

[1] The definition of flora includes algae, fungi and lichens
[2]Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

2. Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Fauna species of national environmental significance are listed under the Commonwealth *EPBC Act*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'lower risk', which are consistent with IUCN categories.

Critically Endangered (CR): a taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

Endangered (EN): a taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

Vulnerable (VU): a taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

Lower Risk (LR): a taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (CD).** Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
2. **Near Threatened (NT).** Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. **Least Concern (LC).** Taxa which do not qualify for Conservation Dependent or Near Threatened.

Migratory species are also protected under the *EPBC Act* as species of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. The list of migratory species consists of those species listed under the following international conventions:

1. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
2. China-Australia Migratory Bird Agreement (CAMBA);
3. Japan-Australia Migratory Bird Agreement (JAMBA); and,
4. Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Marine species are also protected under the *EPBC Act*, and are listed to ensure the long-term conservation of the species. Marine species include all Australian sea snakes, seals, crocodiles, dugongs, marine turtles, seahorses and seabirds that naturally occur in the Commonwealth marine area.

2. Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

Fauna species of national environmental significance are listed under the Commonwealth *EPBC Act*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'lower risk', which are consistent with IUCN categories.

Critically Endangered (CR): a taxon is Critically Endangered when it is facing an extremely high risk of extinction in the wild in the immediate future.

Endangered (EN): a taxon is Endangered when it is not Critically Endangered but is facing a very high risk of extinction in the wild in the near future.

Vulnerable (VU): a taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

Lower Risk (LR): a taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Taxa included in the Lower Risk category can be separated into three subcategories:

1. **Conservation Dependent (CD).** Taxa which are the focus of a continuing taxon-specific or habitat-specific conservation program targeted towards the taxon in question, the cessation of which would result in the taxon qualifying for one of the threatened categories above within a period of five years.
2. **Near Threatened (NT).** Taxa which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
3. **Least Concern (LC).** Taxa which do not qualify for Conservation Dependent or Near Threatened.

Migratory species are also protected under the *EPBC Act* as species of national environmental significance. Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. The list of migratory species consists of those species listed under the following international conventions:

1. Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention);
2. China-Australia Migratory Bird Agreement (CAMBA);
3. Japan-Australia Migratory Bird Agreement (JAMBA); and,
4. Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Marine species are also protected under the *EPBC Act*, and are listed to ensure the long-term conservation of the species. Marine species include all Australian sea snakes, seals, crocodiles, dugongs, marine turtles, seahorses and seabirds that naturally occur in the Commonwealth marine area.

Appendix 2

Potential Vertebrate Fauna Species List Compiled from the Database and Literature Searches

A2.1: Mammals

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Dasyuridae	*Dasyurus geoffroii*	Western Quoll, Chuditch	VU	VU		•	
Dasyuridae	*Phascogale tapoatafa wambenger*	Wambenger Brush-tailed Phascogale		CD		•	
Peramelidae	*Isoodon fusciventer*	Quenda			P4	•	
Burramyidae	*Cercartetus concinnus*	Western Pygmy-possum, Mundarda				•	
Pseudocheiridae	*Pseudocheirus occidentalis*	Western Ringtail Possum	CR	CR		•	•
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum				•	
Macropodidae	*Macropus fuliginosus*	Western Grey Kangaroo				•	
Macropodidae	*Notamacropus irma*	Western Brush Wallaby			P4	•	
Macropodidae	*Setonix brachyurus*	Quokka	VU	VU		•	•
Muridae	*Hydromys chrysogaster*	Water-rat			P4	•	
Muridae	*Mus musculus**	House Mouse				•	
Muridae	*Rattus rattus**	Black Rat				•	
Leporidae	*Oryctolagus cuniculus**	Rabbit				•	
Canidae	*Vulpes vulpes**	Red Fox				•	
Felidae	*Felis catus**	Cat				•	
Suidae	*Sus scrofa**	Pig				•	
Bovidae	*Bos taurus**	European Cattle				•	

A2.2: Birds

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Casuariidae	*Dromaius novaehollandiae*	Emu					
Phasianidae	*Coturnix pectoralis*	Stubble Quail	Marine[1]			•	
Anatidae	*Cygnus atratus*	Black Swan				•	
Anatidae	*Stictonetta naevosa*	Freckled Duck				•	
Anatidae	*Tadorna tadornoides*	Australian Shelduck				•	
Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck				•	
Anatidae	*Chenonetta jubata*	Maned Duck				•	
Anatidae	*Spatula rhynchotis*	Australasian Shoveler				•	
Anatidae	*Anas superciliosa*	Pacific Black Duck				•	
Anatidae	*Anas platyrhynchos*	Mallard				•	
Anatidae	*Anas gracilis*	Grey Teal				•	
Anatidae	*Anas castanea*	Chestnut Teal				•	
Anatidae	*Aythya australis*	Hardhead				•	

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Anatidae	*Oxyura australis*	Blue-billed Duck			P4	•	
Anatidae	*Biziura lobata*	Musk Duck	Marine[1]			•	
Podargidae	*Podargus strigoides*	Tawny Frogmouth				•	
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	Marine[1]			•	
Columbidae	*Columba livia*	Rock Dove*				•	
Columbidae	*Spilopelia chinensis*	Spotted Dove*				•	
Columbidae	*Spilopelia senegalensis*	Laughing Dove*				•	
Columbidae	*Phaps chalcoptera*	Common Bronzewing				•	
Columbidae	*Phaps elegans*	Brush Bronzewing				•	
Columbidae	*Ocyphaps lophotes*	Crested Pigeon				•	
Rallidae	*Gallirallus philippensis*	Buff-banded Rail				•	
Rallidae	*Porzana tabuensis*	Spotless Crake	Marine[1]			•	
Rallidae	*Porphyrio melanotus*	Australasian Swamphen	Marine[1]			•	
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen				•	
Rallidae	*Fulica atra*	Eurasian Coot				•	
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe				•	
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe				•	
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe				•	
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher				•	
Recurvirostridae	*Himantopus leucocephalus*	Pied Stilt	Marine[1]			•	
Recurvirostridae	*Cladorhynchus leucocephalus*	Banded Stilt				•	
Recurvirostridae	*Recurvirostra novaehollandiae*	Red-necked Avocet	Marine[1]			•	
Charadriidae	*Vanellus tricolor*	Banded Lapwing				•	
Charadriidae	*Pluvialis fulva*	Pacific Golden Plover	Migratory/Marine	MI		•	
Charadriidae	*Pluvialis squatarola*	Grey Plover	Migratory/Marine	MI		•	
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover	Marine[1]			•	
Charadriidae	*Charadrius leschenaultii*	Greater Sand Plover	Vulnerable/Migratory/ Marine	VU; MI		•	
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel				•	
Scolopacidae	*Numenius phaeopus*	Eurasian Whimbrel	Migratory/Marine	MI		•	
Scolopacidae	*Numenius madagascariensis*	Far Eastern Curlew	Critically Endangered/ Migratory/Marine	CR; MI		•	•
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	Migratory/Marine	MI		•	•
Scolopacidae	*Arenaria interpres*	Ruddy Turnstone	Migratory/Marine	MI		•	

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Scolopacidae	*Calidris tenuirostris*	Great Knot	Critically Endangered/ Migratory/Marine	CR; MI		•	
Scolopacidae	*Calidris canutus*	Red Knot	Endangered/Migratory/ Marine	EN; MI		•	•
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper	Migratory/Marine	MI		•	•
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	Critically Endangered/ Migratory/ Marine	CR; MI		•	•
Scolopacidae	*Calidris ruficollis*	Red-necked Stint	Migratory/Marine	MI		•	
Scolopacidae	*Calidris melanotos*	Pectoral Sandpiper	Migratory/Marine	MI			•
Scolopacidae	*Xenus cinereus*	Terek Sandpiper	Migratory/Marine	MI		•	
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	Migratory/Marine	MI		•	•
Scolopacidae	*Tringa brevipes*	Grey-tailed Tattler	Migratory	MI	P4	•	
Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	Migratory/Marine	MI		•	
Scolopacidae	*Tringa glareola*	Wood Sandpiper	Migratory/Marine	MI		•	
Scolopacidae	*Tringa nebularia*	Common Greenshank	Migratory/Marine	MI		•	•
Laridae	*Chroicocephalus novaehollandiae*	Silver Gull	Marine			•	
Laridae	*Larus pacificus*	Pacific Gull	Marine			•	
Laridae	*Hydroprogne caspia*	Caspian Tern	Migratory	MI		•	
Laridae	*Thalasseus bergii*	Greater Crested Tern	Migratory/Marine	MI		•	
Laridae	*Sternula nereis*	Fairy Tern	Vulnerable	VU		•	
Laridae	*Sterna hirundo*	Common Tern	Migratory/Marine	MI		•	
Procellariidae	*Ardenna carneipes*	Flesh-footed Shearwater	Migratory	VU; MI		•	
Sulidae	*Morus serrator*	Australasian Gannet	Marine			•	
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant				•	
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant				•	
Phalacrocoracidae	*Phalacrocorax fuscescens*	Black-faced Cormorant	Marine			•	
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant				•	
Phalacrocoracidae	*Phalacrocorax varius*	Australian Pied Cormorant				•	
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant				•	
Anhingidae	*Anhinga novaehollandiae*	Australasian Darter				•	
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	Marine[1]			•	
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	Migratory/Marine	MI		•	
Threskiornithidae	*Platalea regia*	Royal Spoonbill				•	
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill				•	

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron	Marine			•	
Ardeidae	*Bubulcus coromandus*	Eastern Cattle Egret	Marine			•	
Ardeidae	*Ardea pacifica*	White-necked Heron				•	
Ardeidae	*Ardea alba*	Great Egret	Marine			•	
Ardeidae	*Egretta novaehollandiae*	White-faced Heron				•	
Ardeidae	*Egretta garzetta*	Little Egret	Marine[1]			•	
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	Marine			•	
Pandionidae	*Pandion cristatus*	Eastern Osprey	Migratory/Marine	MI		•	•
Accipitridae	*Elanus axillaris*	Black-shouldered Kite				•	
Accipitridae	*Hieraaetus morphnoides*	Little Eagle				•	
Accipitridae	*Aquila audax*	Wedge-tailed Eagle				•	
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	Marine[1]			•	
Accipitridae	*Accipiter cirrocephalus*	Collared Sparrowhawk				•	
Accipitridae	*Circus approximans*	Swamp Harrier	Marine[1]			•	
Accipitridae	*Haliastur sphenurus*	Whistling Kite	Marine[1]			•	
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea Eagle	Marine			•	
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra*				•	
Alcedinidae	*Todiramphus sanctus*	Sacred Kingfisher	Marine[1]			•	
Meropidae	*Merops ornatus*	Rainbow Bee-eater	Marine[1]			•	
Falconidae	*Falco cenchroides*	Nankeen Kestrel	Marine[1]			•	
Falconidae	*Falco longipennis*	Australian Hobby				•	
Falconidae	*Falco berigora*	Brown Falcon				•	
Falconidae	*Falco peregrinus*	Peregrine Falcon		OS		•	
Cacatuidae	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	Vulnerable	VU		•	1
Cacatuidae	*Calyptorhynchus baudinii*	Baudin's Black Cockatoo	Endangered	EN		•	1
Cacatuidae	*Calyptorhynchus latirostris*	Carnaby's Black Cockatoo	Endangered	EN		•	1
Cacatuidae	*Cacatua pastinator*	Western Corella				•	
Cacatuidae	*Cacatua sanguinea*	Little Corella				•	
Psittaculidae	*Polytelis anthopeplus*	Regent Parrot				•	
Psittaculidae	*Purpureicephalus spurius*	Red-capped Parrot				•	
Psittaculidae	*Platycercus icterotis*	Western Rosella (Green-backed)				•	
Psittaculidae	*Barnardius zonarius*	Australian Ringneck				•	

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Psittaculidae	*Barnardius zonarius*	Australian Ringneck				•	
Psittaculidae	*Neophema elegans*	Elegant Parrot				•	
Psittaculidae	*Trichoglossus moluccanus*	Rainbow Lorikeet*				•	
Maluridae	*Malurus elegans*	Red-winged Fairywren				•	
Maluridae	*Malurus splendens*	Splendid Fairywren				•	
Maluridae	*Stipiturus malachurus*	Southern Emu-wren				•	
Meliphagidae	*Acanthorhynchus superciliosus*	Western Spinebill				•	
Meliphagidae	*Epthianura albifrons*	White-fronted Chat				•	
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater				•	
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater				•	
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater				•	
Meliphagidae	*Melithreptus brevirostris*	Brown-headed Honeyeater				•	
Meliphagidae	*Anthochaera lunulata*	Western Wattlebird				•	
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird				•	
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote				•	
Pardalotidae	*Pardalotus striatus*	Striated Pardalote				•	
Acanthizidae	*Smicrornis brevirostris*	Weebill				•	
Acanthizidae	*Sericornis maculatus*	Spotted Scrubwren				•	
Acanthizidae	*Gerygone fusca*	Western Gerygone				•	
Acanthizidae	*Acanthiza apicalis*	Inland Thornbill				•	
Acanthizidae	*Acanthiza inornata*	Western Thornbill				•	
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill				•	
Artamidae	*Artamus cinereus*	Black-faced Woodswallow				•	
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow				•	
Artamidae	*Gymnorhina tibicen*	Australian Magpie				•	
Artamidae	*Cracticus torquatus*	Grey Butcherbird				•	
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird				•	
Artamidae	*Strepera versicolor*	Grey Currawong				•	
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckooshrike	Marine[1]			•	
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella				•	
Falcunculidae	*Falcunculus frontatus*	Crested Shriketit				•	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler				•	
Pachycephalidae	*Colluricincla harmonica*	Grey Shrikethrush				•	

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail				•	
Rhipiduridae	*Rhipidura rufiventris*	Northern Fantail				•	
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail				•	
Monarchidae	*Grallina cyanoleuca*	Magpie-lark	Marine[1]			•	
Corvidae	*Corvus coronoides*	Australian Raven				•	
Petroicidae	*Quoyornis georgianus*	White-breasted Robin				•	
Petroicidae	*Petroica boodang*	Scarlet Robin				•	
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	Marine[1]			•	
Hirundinidae	*Petrochelidon nigricans*	Tree Martin	Marine[1]			•	
Acrocephalidae	*Acrocephalus australis*	Australian Reed Warbler				•	
Locustellidae	*Poodytes gramineus*	Little Grassbird				•	
Zosteropidae	*Zosterops lateralis*	Silvereye	Marine[1]			•	

[1]: Species is listed as 'Marine' under the EPBC Act but does not utilise marine habitats.

A2.3: Reptiles

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Gekkonidae	*Christinus marmoratus*	Marbled Gecko				•	
Pygopodidae	*Lialis burtonis*					•	
Agamidae	*Pogona minor*					•	
Agamidae	*Pogona minor minor*	Western Bearded Dragon				•	
Scincidae	*Acritoscincus trilineatus*					•	
Scincidae	*Cryptoblepharus buchananii*					•	
Scincidae	*Ctenotus australis*					•	
Scincidae	*Ctenotus impar*					•	
Scincidae	*Ctenotus labillardieri*					•	
Scincidae	*Ctenotus ora*	Coastal Plains Skink			P3	•	
Scincidae	*Egernia kingii*	King's Skink				•	
Scincidae	*Egernia napoleonis*					•	
Scincidae	*Hemiergis quadrilineata*					•	
Scincidae	*Lerista distinguenda*					•	
Scincidae	*Lerista elegans*					•	
Scincidae	*Menetia greyii*					•	
Scincidae	*Morethia lineoocellata*					•	
Scincidae	*Tiliqua rugosa*					•	
Elapidae	*Elapognathus coronatus*	Crowned Snake				•	
Elapidae	*Notechis scutatus*	Tiger Snake				•	
Elapidae	*Parasuta gouldii*					•	
Elapidae	*Pseudonaja affinis affinis*					•	

A2.4: Amphibians

Family	Species Name	Common Name	EPBC Act	BC Act	DBCA Priority	NatureMap 10 km	EPBC PMST 12 km
Myobatrachidae	*Crinia georgiana*	Quacking Frog				•	
Myobatrachidae	*Crinia glauerti*	Clicking Frog				•	
Myobatrachidae	*Crinia insignifera*	Squelching Froglet				•	
Myobatrachidae	*Crinia pseudinsignifera*	Bleating Froglet				•	
Myobatrachidae	*Geocrinia leai*	Ticking Frog				•	
Limnodynastidae	*Heleioporus eyrei*	Moaning Frog				•	
Limnodynastidae	*Heleioporus inornatus*	Whooping Frog				•	
Limnodynastidae	*Limnodynastes dorsalis*	Western Banjo Frog				•	
Pelodryadidae	*Litoria adelaidensis*	Slender Tree Frog				•	
Pelodryadidae	*Litoria moorei*	Motorbike Frog				•	

Appendix 3

Results of Search Using EPBC Act Protected Matters Search Tool

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

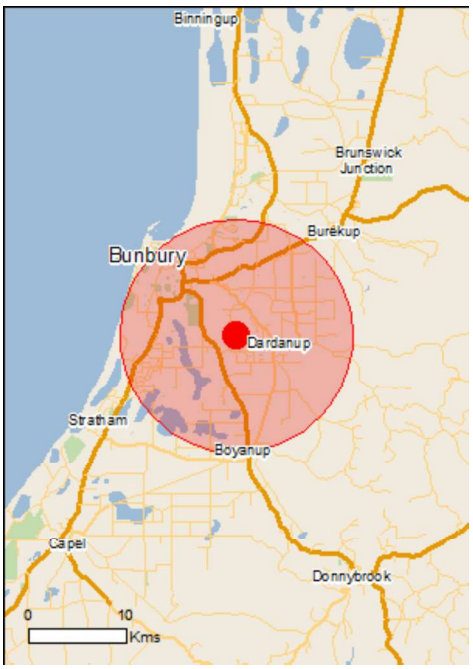
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/09/20 18:05:32

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

Caveat
Acknowledgements



Coordinates
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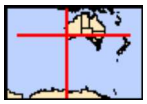

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	64
Listed Migratory Species:	42

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	13
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	10
Regional Forest Agreements:	1
Invasive Species:	31
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Mammals		
[Balaenoptera musculus](#) Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Breeding known to occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Breeding known to occur within area
[Setonix brachyurus](#) Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
[Westralunio carteri](#) Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
[Austrostipa bronwenae](#) [87808]	Endangered	Species or species habitat known to occur within area
[Austrostipa jacobsiana](#) [87809]	Critically Endangered	Species or species habitat known to occur within area
[Banksia nivea subsp. uliginosa](#) Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
[Banksia squarrosa subsp. argillacea](#) Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
[Brachyscias verecundus](#) Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
[Caladenia huegelii](#) King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
[Chamelaucium sp. S coastal plain (R.D.Royce 4872)](#) Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
[Diuris drummondii](#) Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat known to occur within area
Synaphea sp. Pinjarra Plain (A.S. George 17182) [86878]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat likely to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

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

Name
Commonwealth Land - Defence - BUNBURY TRAINING DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area

Name	Threatened	Type of Presence
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		

Name	Threatened	Type of Presence
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area

Name	Status	Type of Presence
Tursiops aduncus		
Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str.		
Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Dardanup	WA
Leschenault Peninsula	WA
Morangarel	WA
NTWA Bushland covenant (0022)	WA
NTWA Bushland covenant (0107)	WA
NTWA Bushland covenant (0146)	WA
NTWA Bushland covenant (0150)	WA
Unnamed WA40552	WA
Unnamed WA46108	WA
Unnamed WA49857	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis		
Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

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

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-33.39278 115.71778

Acknowledgements

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

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

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

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

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