Smith's Beach Coastal Tourism Village
Western Ringtail Possum Assessment

Firebreak across the Site of the Proposed Tourism Village (Photo: A Bamford)

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Executive Summary

Introduction

JBS&G, on behalf of Smiths 2014 Pty Ltd (the proponent), has commissioned Bamford Consulting Ecologists (BCE) to conduct a targeted fauna assessment for the Western Ringtail Possum (WRP) in relation to their proposed development of a tourist village at Smith's Beach in Yallingup. The scope of this assessment includes a desktop review and site visit in order to determine the *status quo* of the Western Ringtail Possum in the proposed project area and adjacent area. Likely population density and distribution will be estimated from the literature and interpretation of vegetation. The current report presents the results from the desktop review and site visit, along with predicted impacts to WRP and recommendations for mitigation of potential impacts.

Project area description

The project area is located in the west of the South-West region of Western Australia approximately 3 km south-west of the town of Yallingup. This is within the Southern Jarrah Forest (JAF02) subregion of the Jarrah Forest IBRA region. The development envelope is approximately 40 ha in size, and it is proposed that almost half (c. 17 ha) of this be ceded to the Crown as an extension to the Leeuwin-Naturaliste National Park, sections of which are located immediately to the south of the project area and < 500 m to the north-east. The remaining c. 23 ha will be subject to a variety of developments to create a sensitively designed tourist village. The proposal includes features such as hotel accommodation, a campground, holiday homes, a community hub and Cape to Cape Welcome Centre, the latter of which may provide an educational opportunity to showcase the significant fauna (such as the WRP) which inhabits the project area.

Results

Western Ringtail Possum regional records

Database search results and previous studies show that the Western Ringtail Possum is known from the project area and immediate surrounds. The Protected Matters Search tool states that breeding is known to occur within the project area. There are no recent records (from the DBCA threatened and priority fauna database) within or close to the project area, but this is likely to reflect a lack of survey effort and a lag in incorporation of more recent observations, as private consultants have recorded WRP within the project area and in remnant vegetation nearby.

Fauna habitats and WRP in the project area

Based on vegetation mapping provided by the lead consultant, the project area contains a variety of forest, woodland, and shrubland habitats that are likely to be of varying value for Western Ringtail Possum. Most possum and drey observations (by BCE in the current survey and other consultants in previous surveys) were made in open forest of Peppermint trees, and this is therefore considered the core habitat for breeding, foraging and movement of WRP. Areas of woodland and forest with other dominant tree species (including Marri, *Banksia* spp. and *Melaleuca* spp.) are considered secondary habitat but are still of importance for WRP in the project area. Observations of WRP by BCE showed that this species is concentrated in the northern part of the core habitat. It is unclear what is underlying this uneven distribution of WRP in the core habitat of the project area. It is thought that

this may reflect subtle effects of topography, loss of connectivity by the installation of several large firebreaks across the site, and/or the influence of the existing development to the north (WRP may be attracted to the existing development in order to obtain anthropogenic resources including food, water, and shelter).

Summary of recommendations

In the current report, the proposed development has been reviewed in relation to key threatening processes that are often considered during environmental impact assessment, as well as specific outcomes identified in the WRP recovery plan. Overall, these reviews highlight the importance of retention of canopy connectivity where possible, as well as retention of habitat trees that provide sites for drey construction and/or high-quality foliage for foraging. It should be noted that while the area to be ceded will provide important habitat and connectivity for other vulnerable species such as the Quokka *Setonix brachyurus*, it is mostly low, coastal vegetation and is unlikely to provide connectivity for WRP, so this will need to be provided within the proposed development envelope to maintain connectivity of the population between the conservation areas to the north-east and south. In order to minimise the potential impact on WRP, strategic clearing of trees is recommended, whereby the clearing footprint of the development is planned around retaining functional canopy connectivity. It is not only overall canopy cover that is important, but the functional connectivity of this canopy in allowing WRP to move through and into and out of the project area. Where vegetation cannot be retained or replanted, structures such as artificial dreys, possum bridges and other infrastructure have the potential to replace connectivity and shelter that is lost through clearing. In addition, connectivity could be increased in the southern area where large firebreaks have fragmented the area.

Key recommendations include:

- Planning development footprint and proposed vegetation to be cleared based on retention of canopy connectivity;
- Retention of habitat trees where possible, particularly when they provide canopy connectivity and/or high-quality foliage for foraging;
- Considering fire regulations when determining the development footprint, including the proposed areas to be retained and enhanced for habitat and connectivity, to ensure that further clearing is not required post-approval;
- Provision of possum bridges and other raised infrastructure between pockets of vegetation (including over Smith's Beach Road);
- Provision of artificial dreys;
- Revegetation with high-nitrogen plants to provide quality foraging resources for WRP;
- Provision and maintenance of at least six above-ground water sources;
- Control and/or management of feral and domestic cats and dogs. Consider restrictions regarding pets living in and/or visiting the tourist park (e.g. do not allow pets (particularly cats), or strictly enforce containment of pets to properties);
- A detailed survey be conducted to determine the locations and numbers of WRP throughout the site, to inform design and management decisions. This will need to be repeated just prior to works commencing, if the development receives approval;

- A fauna management plan be developed and implemented, to minimise negative impacts and maximise positive design features for WRP.

The fauna management plan should include detailed procedures for managing WRP during works, and must include the cooperation of everyone on site, from construction workers to senior management. Pre- and post- development monitoring should be undertaken to assess the success of the management plan and to allow for adaptive management if required.

This development has the potential to result in a net benefit to WRP, if planned with WRP habitat requirements as a priority. Strategic clearing of trees, via planning of the clearing footprint in order to retain canopy connectivity, is a crucial consideration to minimise potential impacts on WRP. This development also represents an opportunity to highlight to the public the status of the WRP and provides opportunities for the public to learn about and have positive interactions with WRP. This needs to be carefully managed as there is also the potential for negative outcomes for WRP, such as injury or death from pets and vehicles, and illness or disease caused by inappropriate diet.

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1 Introduction

1.1 Introduction

JBS&G, on behalf of Smiths 2014 Pty Ltd (the proponent), has commissioned Bamford Consulting Ecologists (BCE) to conduct a targeted fauna assessment for the Western Ringtail Possum (WRP) in relation to their proposed development of a tourist village at Smith's Beach in Yallingup. As discussed and agreed upon with JBS&G, the scope of this assessment includes a desktop review and site visit in order to determine the *status quo* of the Western Ringtail Possum in the proposed project area and adjacent area. Likely population density and distribution will be estimated from the literature and interpretation of vegetation. The scope also includes a written report to present the results from the desktop review and site visit, along with predicted impacts to WRP and recommendations for mitigation of potential impacts. Details are as follows:

a) A desktop review of database records and literature including previous on-site studies, nearby studies, publications on the biology of the species, BCE records, and a study of WRP density estimates across the south-west (Biota, 2020). A site visit is required to ground-truth the desktop review. This will allow BCE personnel to verify vegetation types and assess the likely value for WRP, check for dreys, and conduct two nights of head-torching to detect WRP individuals.
b) Effects/impacts can be predicted based upon expected population density/distribution and habitat description from the desktop/site inspection. The key threatening processes (see Appendix 3) relevant to the WRP will be reviewed and discussed in the context of the proposed development.
c) In response to the review of threatening processes, recommendations will be made with the aim of no or minimal impact on the WRP population in the area.

1.2 Project area

The project area is located in the west of the South-West region of Western Australia (DBCA, 2024a), approximately 3 km south-west of the town of Yallingup (Figure 1-1). This is within the Southern Jarrah Forest (JAF02) subregion of the Jarrah Forest IBRA region (DCCEEW, 2023a). This subregion is characterized by Jarrah-Marri forest on laterite gravels, with eluvial and alluvial deposits supporting *Agonis* (Peppermint) shrublands (Kearn *et al.*, 2002). The dominant land uses in this subregion are grazing and dry-land agriculture, forestry (native forests) and conservation (Kearn *et al.*, 2002). Soil-landscape mapping (DPIRD, 2023) shows that the majority of the project area overlaps with the Wilyabrup exposed slopes phase, described as "low slopes (gradients generally 5-10%) exposed to strong winds off ocean". The western and north-western edges of the project area overlap with the Wilyabrup granitic headland phase (Areas on the west coast dominated by granitic outcrop), while smaller sections along the southern boundary overlap with the Gracetown exposed slopes phase (Moderate slopes (gradients 10-15%) on the west coast exposed to prevailing wind directly off the ocean, with deep and shallow yellow brown siliceous sands over limestone (i.e. Spearwood Sands)) and Wilyabrup gentle slope phase (Gradients 5-10%). The project area is predominantly within the Wilyabrup vegetation complex of the Leeuwin-Naturalist Coast (ID293), with small amounts overlapping with the Gracetown Complex of the Leeuwin-Naturalist Coast and Wilyabrup complex of

the Margaret River Plateau (ID 288). Vegetation complex information is from Mattiske and Havel (1998).

Wilyabrup (Leeuwin-Naturaliste Coast, ID 293): Low woodland and woodland of *Corymbia calophylla-Eucalyptus marginata subsp. marginata* with some *Banksia* spp. on exposed slopes in hyperhumid to humid zones.

Gracetown (Leeuwin-Naturaliste Coast, ID 126): Closed heath of *Olearia axillaris-Rhagodia baccata-Agonis flexuosa* on seaward slopes in hyperhumid to humid zones.

Wilyabrup (Magaret River Plateau, ID 288): Open forest of *Corymbia calophylla-Allocasuarina decussata-Agonis flexuosa* on deeply incised valleys in perhumid and humid zones.

The development envelope is approximately 40 ha in size, and it is proposed that almost half (c. 17 ha) of this be ceded to the Crown as an extension to the Leeuwin-Naturaliste National Park, sections of which are located immediately to the south of the project area and < 500 m to the north-east (Figure 1-2). The remaining c. 23 ha will be subject to a variety of developments to create a sensitively designed tourist village. The proposal includes features such as hotel accommodation, a campground, holiday homes, a community hub and Cape to Cape Welcome Centre, the latter of which may provide an educational opportunity to showcase the significant fauna (such as the WRP) which inhabits the project area.

The initial referral prepared by Strategen JBS&G identified potential impacts to Western Ringtail Possum based on the loss or modification of 12.37 ha of WRP habitat, comprised of 4.64 ha to be fully cleared and 7.74 ha to be partially modified.

A range of terms is used through this report to refer to the spatial environment including and around the Smith's Beach project area; these are defined below and illustrated in Figure 1-2:

- Project area – the project area boundary was provided by the client. It is the area to which the results of the desktop analysis are directed and the area within which field investigations were conducted. For the current report, project area is synonymous with development envelope.
- Study area – the outermost boundary of the desktop assessment area that is almost always a specified buffer distance (see Section 2.1.1 below) around the *project area*. The study area thus encompasses the *project area* but includes the area from which database records are sourced for the desktop assessment. For the current report, this is a 20 km radius around the project area (see Figure 1-1).

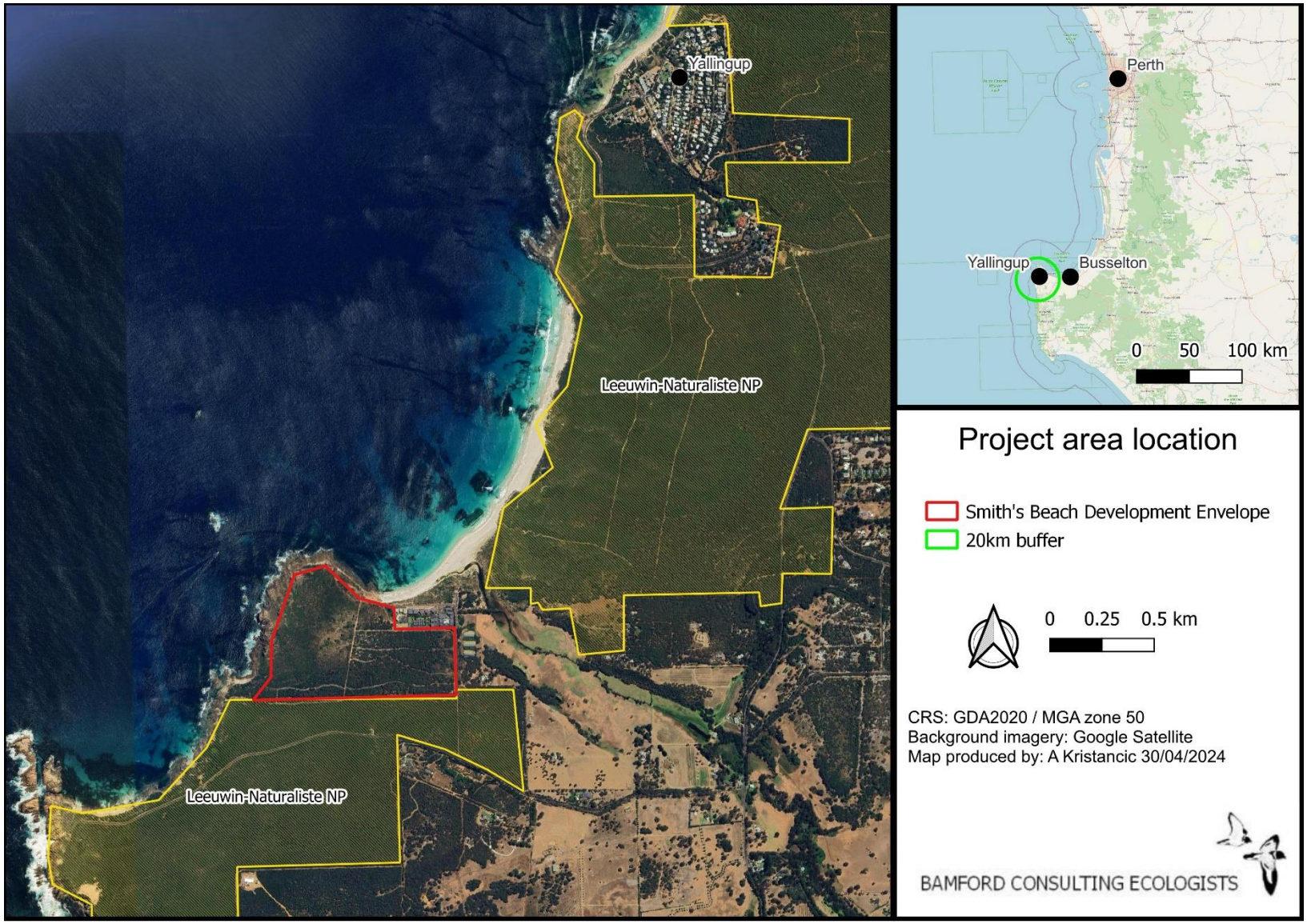

Figure 1-1. Location of project area.

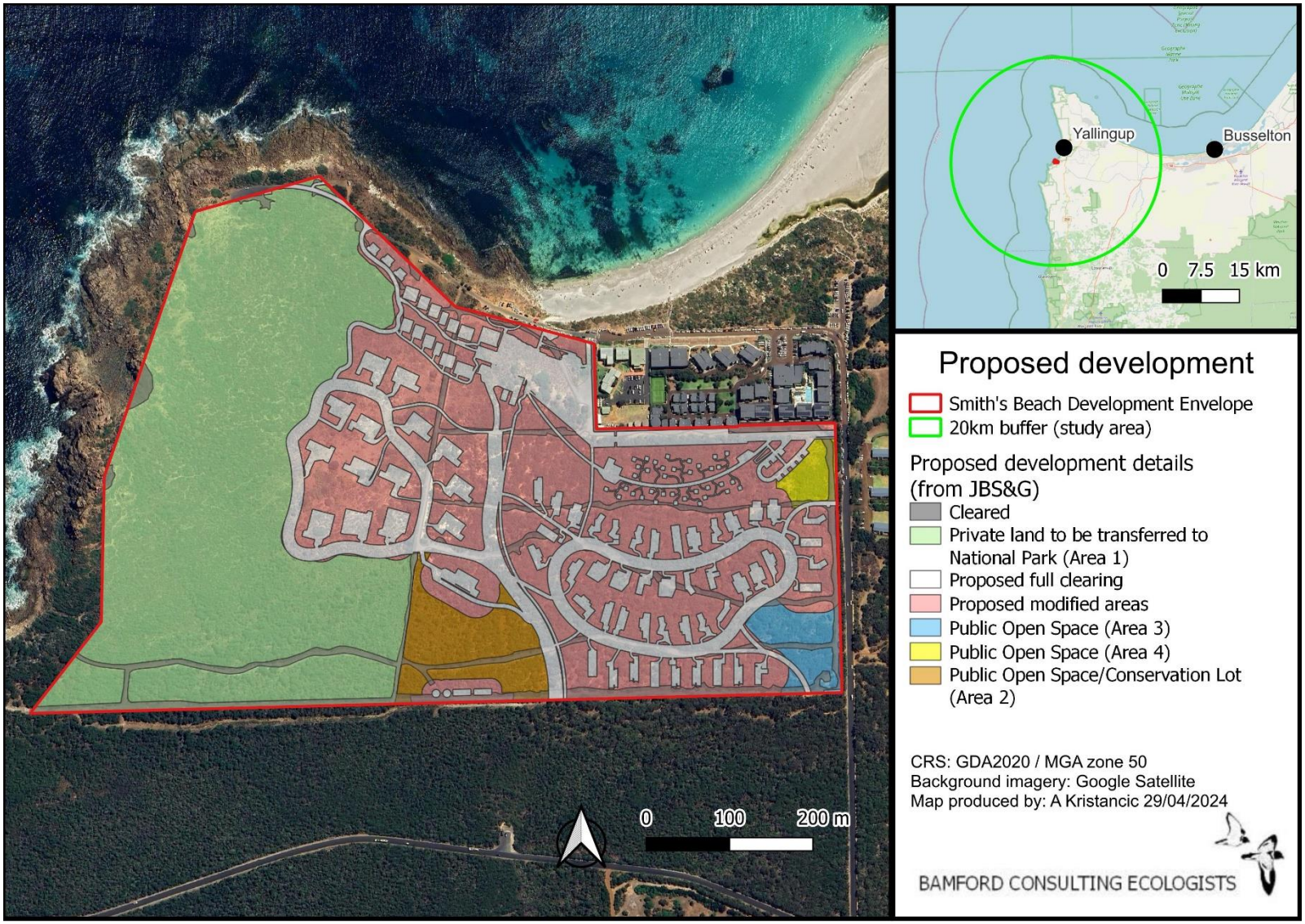

Figure 1-2. Details of proposed development for the Smith's Beach Tourist Village. Inset map shows study area (20 km radius around project area).

1.3 Western Ringtail Possum

The Western Ringtail Possum (WRP) is a small, arboreal marsupial endemic to south-western Australia. It is a leaf-eating herbivore, characterised by a long, thin prehensile tail with a white tip. This species has suffered a substantial reduction (up to 90%) in range since colonial settlement (DPaW, 2017). The WRP is currently listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999* (EPBC Act) and falls under Schedule 2 Division 1 (Critically Endangered) of the Western Australian *Biodiversity Conservation Act 2016* (BC Act). See Appendix 1 and 2 for conservation significance categories and descriptions. The species is known to occur in the project area and in surrounding areas, and is expected to occur as a resident, meaning that there is a population permanently present in the project area. In addition, juveniles will move between the project area and the surrounding woodland as they become independent and disperse.

1.3.1 General distribution and abundance information

Historically, the WRP was widespread in forests in the south-west of Western Australia. Declines are largely attributed to land clearing and introduced predators (Menkhorst & Knight, 2011), and the current distribution of the WRP is along the south-west coast of WA, from Perth in the north to Albany in the south (Figure 1-3)(DCCEEW, 2023d). However, in reality the species' distribution is severely fragmented and the species is considered to be largely restricted to isolated and fragmented patches of mature Peppermint forest (TSSC, 2018). The WRP is currently considered to occur in five subpopulations that may be subject to different combinations of threatening processes. Based on genetic analyses, it appears that these populations were connected historically, and that they have become isolated due to the habitat clearing and fragmentation that has occurred since colonial settlement (DPaW, 2017).

It has been confirmed that in terms of abundance and population density, Western Ringtail Possums are not evenly distributed across available habitats, due to differences in habitat quality that influence how many individuals can be supported by a particular area (DPaW, 2017). For example, there are estimates of 20 possums per hectare in Peppermint stands near Busselton, compared to four possums per hectare in Jarrah Forest (DPaW, 2017). This is reflected in estimated home ranges in different habitats as home range tends to be smaller in higher quality habitats, since a smaller area is required to provide the necessary resources for an individual. For example, the home ranges of WRP in Peppermint dominated habitat are reported to be on average 0.4 ha for females and 0.3 ha for males, while the home range estimates for WRP living in Jarrah Forest are higher and average 2.7 ha (DPaW, 2017).

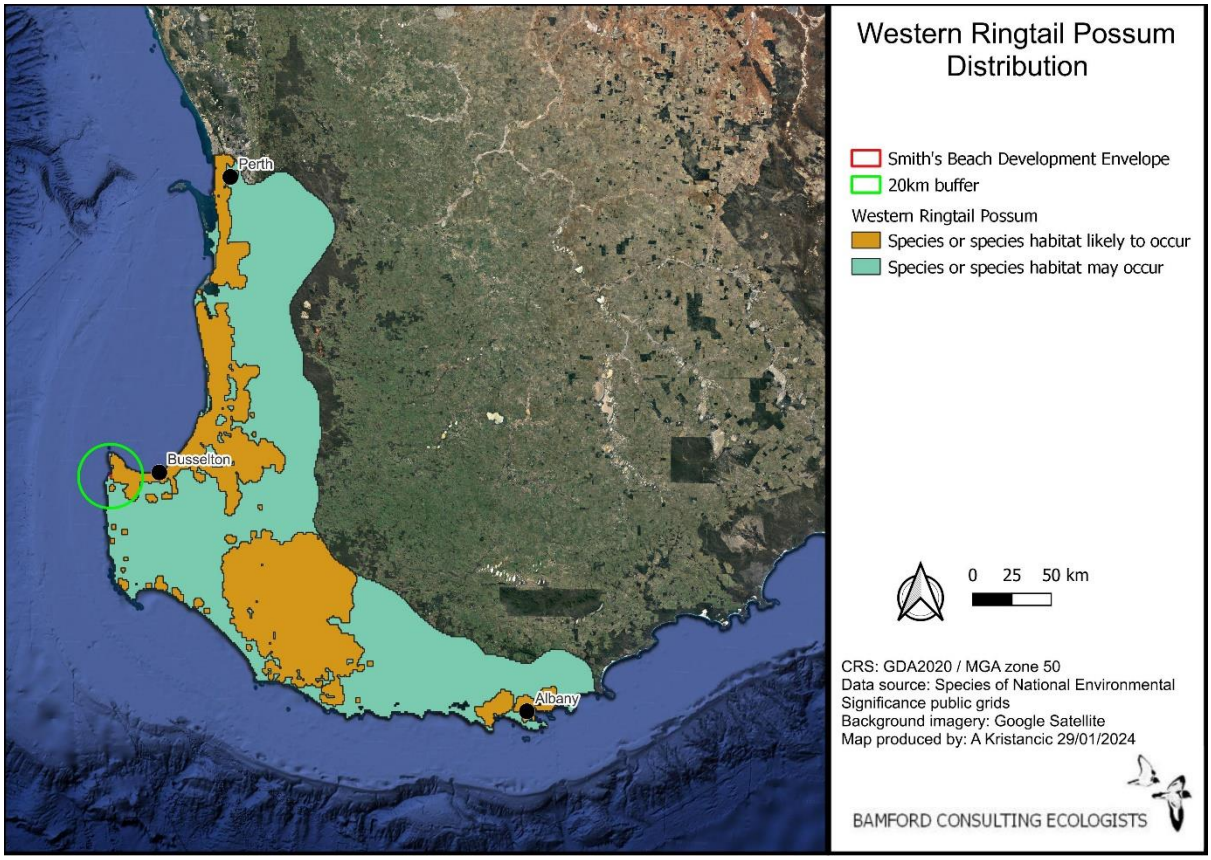

Figure 1-3. Current distribution of Western Ringtail Possum.

1.3.2 Habitat requirements

According to the Western Ringtail Possum recovery plan (DPaW, 2017) and recent research regarding WRP diet, habitat critical to the survival of WRP and persistence of WRP populations has the following general characteristics:

- High nutrient availability for food, with a diet comprised of Peppermint, marri and jarrah leaves as well as a range of other high nitrogen food plants (Mathieson *et al.*, 2020)
- Suitable structures for protection and nesting
- Continuity of the canopy to avoid/escape predation and other threats.

Also critical to the survival of the species are linkages between suitable habitat patches. Several vegetation communities have been identified as being critical to the survival of the species, and any habitat where this species is found to occur naturally is considered critical and worthy of protection (DPaW, 2017). Critical vegetation communities of relevance to the proposed development include (but are not limited to):

- mature remnants of *Agonis flexuosa* (Peppermint) woodland, with high canopy continuity and high nutrient value of foliage
- Jarrah/Marri forests with limited human disturbance, intensive fox-baiting, and low levels of fragmentation

The WRP recovery plan puts a strong emphasis on Peppermint as a critical food source and there is evidence that this is the preferred food when it is present; some researchers have found that in locations where Peppermint is present, 79-100% of the diet of WRP is comprised of Peppermint leaves,

regardless of whether Peppermint made up 50% or 100% of the trees present (B. A. Jones et al., 1994). These authors reported that the diet of WRP included small amounts of other plants but the species were not identified (B. A. Jones et al., 1994). More recent research has provided further evidence that the diet of WRP is flexible and includes a variety of nitrogen rich plants, some of which are canopy species and others which form the understorey and midstorey (Mathieson et al., 2020). Mathieson et al. (2020) determined the diet of WRP based on leaf fragments in scats collected from several sites within the Albany area. They found that across all scat samples at least 15 plant species were being consumed by WRP, including Peppermint (*Agonis flexuosa*), Sheoak (*Allocasuarina fraseriana*), Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), Woollybush (*Adenanthos sericeus*), *Banksia attenuata, Banksia grandis, Banksia ilicifolia, Eucalyptus megacarpa, Eucalyptus staerii, Gastrolobium bilobum*, *Hakea eliptica, Hakea varia*, *Nuytsia floribunda* and *Spyridium globulosum*. BCE personnel have observed WRP feeding on *Acacia saligna Melaleuca and Kunzea* (A. Bamford, pers. comm.); these and a number of additional species are believed to be consumed by WRP, including leaves and/or flowers/fruits of *Acacia cyclops*, *Callistemon glaucus, Calothamnus quadrifidus, Melaleuca viminea, Melalecua huegelli, Paraserianthes lophantha, Agonis flexuosa nana, Billardiera fusiformis* (Nature Conservation Margaret River Region, n.d.).

1.3.3 Key threats and management of WRP

The main threat affecting all populations of WRP is climate change and the associated decrease in rainfall. The drying climate associated with climate change in the south-west of Australia is likely to negatively impact WRP due to their specialised dietary requirements of leaves. To obtain sufficient and good quality nutrition, necessary for survival and reproduction, WRP need access to sufficient quantities of suitable foliage, including leaves containing a high level of nitrogen (discussed above). New growth is essential as older leaves contain a build-up of toxins which when ingested in large quantities can impact the health of the individual WRPs (TSSC, 2018). Climate change is also of concern as WRP are susceptible to heat stress (TSSC, 2018). Heat stress can result in direct mortality or in predation as WRP will sometimes shelter in cool vegetation at ground level, leaving them vulnerable to predators (DBCA 2017, Nature Conservation Margaret River n.d., A. Bamford, pers.obs.).

Other significant threats, as detailed in the Conservation Advice for WRP (TSSC, 2018), include land clearing and habitat fragmentation, predation by feral and native predators, fire, tree declines, competition for nest hollows, logging, domestic dogs, vehicle strike, and inappropriate management of rehabilitated WRPs.

Three key management zones have been identified for the WRP; comprising areas that have the potential to support large numbers of WRP. These zones are considered to contain the most important extant populations of WRP, and are as follows (from DPaW, 2017):

1) Swan Coastal Plain: the Peppermint woodlands and Peppermint/Tuart forests on the southern extremity of the Swan Coastal Plain, extending from north of Bunbury to Augusta, but principally around Busselton.
2) Southern Forest: Jarrah forests near Manjimup where Peppermint is generally absent.

3) South Coast: a diverse range of vegetation types between Walpole and Cheyne's Beach, but principally in near-coastal limestone heath, jarrah marri thicket woodland and forest, riparian, Peppermint woodland and karri forest vegetation.

These zones have been established with the intent that recovery actions should treat populations within these zones with highest priority, as this is where management actions are likely to be most effective (DPaW, 2017).

The Smith's Beach project area is within the southern part of the Swan Coastal Plain management zone, and therefore in one of the priority areas for management of WRP for long-term persistence of this species. Within this zone, critical habitat that is thought to support optimal densities of WRP is likely to comprise "long unburnt mature remnant Peppermint woodlands with high canopy continuity and high nutrient foliage with minimal periods of summer moisture stress, and habitat connecting patches of remnants" (page 8, DPaW, 2017).

The approved conservation advice (TSSC, 2018) estimated that in 2015 there were 500 mature individuals in the Cape to Cape area, and the following threats were of relevance to this sub-population: land clearing, predation, fire, competition for hollows, tree decline, road mortality, drying climate and groundwater depletion and altered hydrology. The following are included as suggested management actions for the Cape to Cape sub-population (from TSSC, 2018, p. 13):

- Assess development proposals and negotiate offsets where relevant;
- Conduct predator control;
- Implement fire management strategies, and exclude core habitat from prescribed burning;
- Implement disease/pathogen/insect management strategies and employ hygiene protocols where relevant;
- Conduct habitat restoration activities/programs;
- Raise awareness within the community; and
- Conduct climate change modelling specific to WRP habitat and changes in foliage nutrition.

Although habitat critical to survival of WRP is considered to be intact, mature Peppermint forest/woodland, a growing body of research suggests that the WRP can thrive in urban areas (Busschots *et al.*, 2021; Van Helden *et al.*, 2021) and that WRP consume a wide variety of plant species (Mathieson et al., 2020). Therefore, there is strong potential for a well-managed development to be of net benefit in terms of habitat quality for WRP, as compared to some other species which would be unable (or unwilling) to utilise areas of suitable habitat that were subject to frequent disturbance by humans. There is also a strong case for *in situ* management of WRP in development areas (see Thompson & Thompson, 2009) rather than translocations of individuals to another area as translocations are not usually successful. Although WRP appear to live happily in disturbed environments such as developed areas that retain tree canopy, it should be kept in mind that there are also risks associated with urban developments, such as pets, vehicle strike and inappropriate food resources. These also need to be managed to minimise negative impacts to WRP.

1.4 Scope

The scope of this assessment includes a desktop review and site visit in order to determine the *status quo* of the Western Ringtail Possum in the proposed project area and adjacent area. Likely population density and distribution will be estimated from the literature and interpretation of vegetation. The scope also includes a written report to present the results from the desktop review and site visit, along with predicted impacts to WRP and recommendations for mitigation of potential impacts.

2 Methods

As per the scope outlined in Section 1.1, a desktop review and site visit were conducted to determine the status quo of the WRP in the project area and adjacent areas. Detailed methodology for these assessments is provided below.

2.1 Desktop review

2.1.1 Sources of information

Information on Western Ringtail Possums was drawn from a range of sources including databases, literature, previous studies and previous BCE surveys (as listed in Table 2-1). The WRP is known from the project area and surrounding areas, and therefore the aim of the desktop review was not to determine the likelihood of occurrence, but to access location records to estimate population density and distribution within the project area and adjacent landscape. Therefore, broad databases such as Naturemap, which give only presence/absence information for an area were not queried for this desktop review.

Table 2-1. Databases searched for the desktop review; accessed January 2024.

Database	Type of records held in database	Area searched
BCE Database	Fauna recorded by BCE in the vicinity of the project area and region.	Within 10 km of Yallingup
Atlas of Living Australia (ALA, 2023)	Fauna records from Australian museums and conservation/research bodies.	20 km buffer around boundary
DBCA Threatened and Priority Fauna (DBCA, 2023)	Records from the DBCA Threatened and Priority species database.	40 km buffer around boundary.
EPBC Protected Matters Search Tool (DCCEEW, 2023c)	Records on MNES protected under the EPBC Act.	20 km buffer around central coordinates.
Index of Biodiversity Surveys for Assessment (IBSA) (DWER, 2023)	Flora and fauna data contained in EIA biodiversity survey reports.	20 km buffer around central coordinates.

Table 2-2. Relevant vertebrate fauna studies found during desktop review.

Note: studies in italics indicate those for which no resources (report or data) were publicly available via IBSA (these are not included in the reference list).

Author	Title	Source	WRP info available?	Location relative to project area
Bamford Consulting Ecologists (Bamford *et al.*, 2023)	Monitoring of the Western Ringtail Possum following Clearing along the Vasse Diversion Drain, Busselton. Unpublished Report – Water Corporation.	BCE database	Yes - Methods for displacement/translocation, provision of artificial habitat (dreys and rope bridges), and monitoring	n/a
Biota (2020)	Western Ringtail Possum, *Pseudocheirus occidentalis*, Regional Surveys. Unpublished report prepared for Main Roads Western Australia	Provided by client	Yes – estimates of density/abundance of WRP at various sites. Summarised in results.	Varies; closest site immediately south of project area
ATA Environmental (2007)	*Vertebrate Fauna Assessment Smiths Beach, Yallingup.* Unpublished report prepared for Canal Rocks Pty. Ltd.	EPA website	Summarised in results	Same project area
Emerge Associates (2020)	Basic Fauna and Targeted Black Cockatoo Assessment - Lot 32 (no.325) Tom Cullity Drive, Wilyabrup EP20-088(02)-004A MS, Version A	IBSA	Summarised in results	17 km south
Emerge Associates (2021)	Targeted Western Ringtail Possum Assessment - Lot 32 (No. 325) Tom Cullity Drive, Wilyabrup, EP20-088(11)—014 MS, Version A.	IBSA	Summarised in results	17 km south
Terrestrial Ecosystems Pty Ltd (2020)	Survey of Western Ringtail Possums and their dreys in Armstrong Reserve, Dunsborough (November 2020)	IBSA	Summarised in results	10 km northeast
Terrestrial Ecosystems Pty Ltd (2021)	Survey of Western Ringtail Possums and their dreys in Armstrong Reserve, Dunsborough – March 2021	IBSA	Summarised in results	10 km northeast

Author	Title	Source	WRP info available?	Location relative to project area
Ecosystem Solutions (2020)	Significant Fauna Assessment (2020), Lot 27 Shallows Loop, Yallingup, prepared for Lachlan Guthrie.	IBSA	Summarised in results	5 km east
Ecoscape (2012)	Armstrong Reserve Level Two Fauna Survey. Unpublished report for Ray Village Aged Services	IBSA	Summarised in results	10 km northeast
Ecosystem Solutions (2014)	City of Busselton Road Widening, Level 1 Fauna and Level 2 Flora/Vegetation Assessment. Unpublished report prepared for City of Busselton.	IBSA	Summarised in results	10-30 km east
NGH Environmental (2015).	*Level 2 Fauna Survey: Meelup Regional Park. Unpublished report prepared for City of Busselton.*	*IBSA*	*n/a*	*10 km northeast*
Ecosystem Solutions (2018).	*Reconnaissance Flora, Vegetation and Fauna Survey: Lot 40 Caudalie Way, Quindalup. Unpublished report prepared for Amy Molloy & Shannon O'Donahue.*	*IBSA*	*n/a*	*7 km east*

2.2 Field investigations

2.2.1 Overview

The project area was visited from the 19th to 21st November 2023. The site visit involved two BCE personnel walking across as much of the project area as possible, conducting investigations as required. GPS tracks are indicated on Figure 2-1. Within the project area, field investigations that were conducted included:

- ground-truthing of vegetation information from desktop assessment;
- targeted Western Ringtail Possum assessment (see Section 2.2.3); and
- opportunistic fauna observations (birds and other fauna, including signs such as diggings, scats and tracks).
- Unbaited camera deployed to record movements of possums between the project area and the existing development (Smith's Beach Resort) located immediately adjacent to the north-east boundary of the project area.

Personnel involved in the field investigations and report preparation (including desktop review) are listed in Table 2-3.

Table 2-3. Personnel involved in the field investigations and report preparation.

Personnel	EIA/Wildlife Survey Experience	Field Investigations	Report Preparation
Dr Mike Bamford *BSc. Hons (Biology), PhD (Biology)*	40 years		+
Mandy Bamford *BSc. Hons (Zoology)*	35 years	+	+
Jake Bamford *BCI*	3 years	+	
Dr Amanda Kristancic *BSc (Zoology/Biochemistry), Hons (Zoology), PhD (Parasitology)*	3 years		+

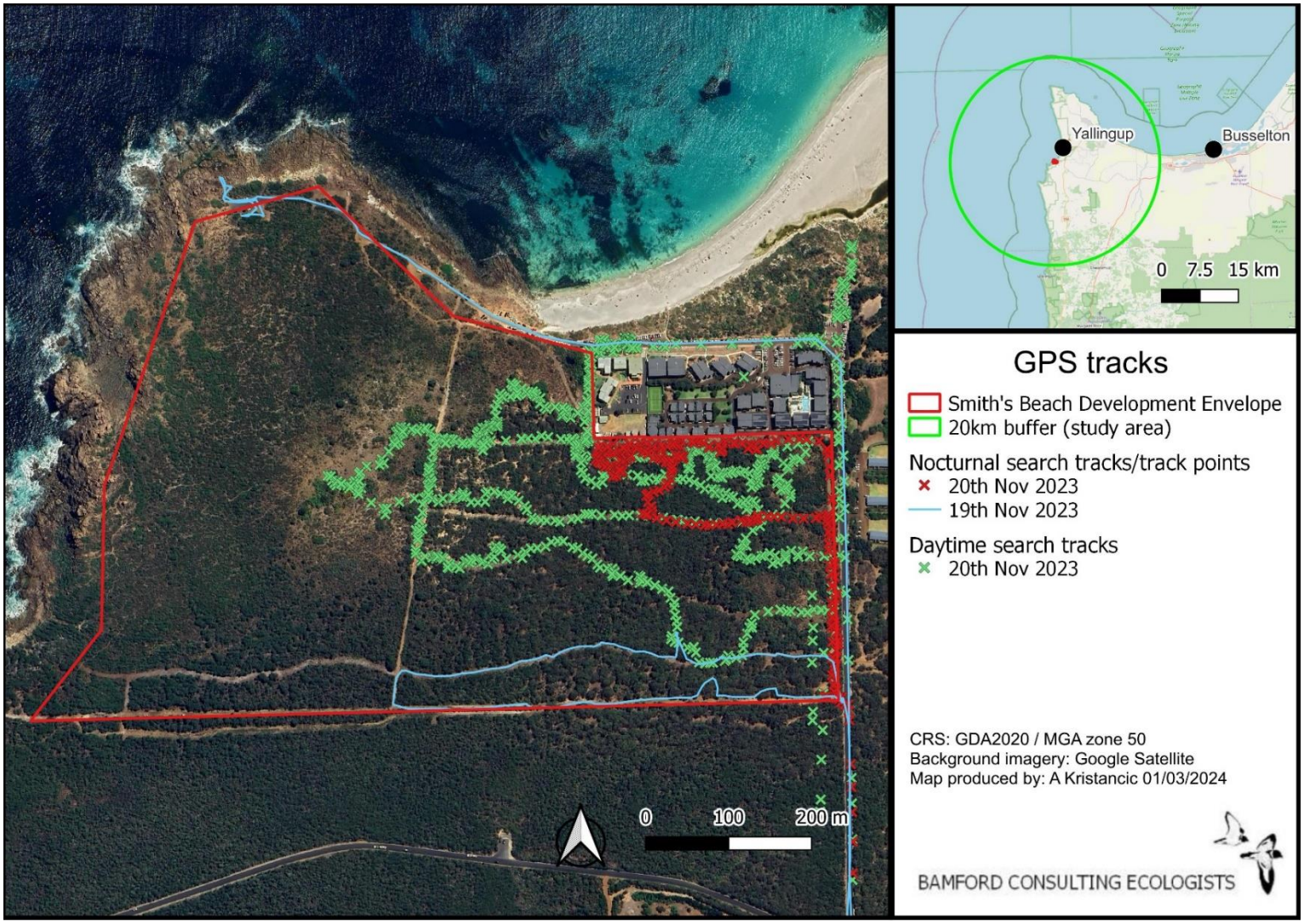

Figure 2-1. GPS tracks of BCE personnel during the field investigations within the project area boundary. Note that a second observer (not tracked) traversed the project area approximately 50m from the tracked observer. A reconnaissance was also undertaken on 19 Nov 2023 (not tracked).

2.2.2 Ground-truthing of WRP habitat in the project area

Information regarding the vegetation types in the project area was available from JBS&G. During the site inspection, this information was ground-truthed with particular focus on the suitability of the available habitat for WRP.

2.2.3 Western Ringtail Possum assessment

2.2.3.1 Guidelines

The Western Ringtail Possum assessment was conducted with reference to published guidelines for survey methods for threatened mammals (DSEWPaC, 2011) and the recovery plan (DPaW, 2017) and conservation advice (TSSC, 2018) for this species, combined with the consultants' previous experience with WRP.

The field component of this assessment consisted of indirect detection (daytime searches for signs of activity, notably scats and dreys) concurrent with assessment of habitat, as well as direct detection via nocturnal spotlighting. A motion sensitive camera was also deployed to capture movement of WRP from the project area to the adjacent existing development.

2.2.3.2 Day-time surveys

During daylight hours on 19 – 21 November, scat and drey searches were conducted within and outside the project area. This involved a reconnoitre from 1600 – 1700hrs, then 1800 – 1920hrs on the 19th November. On the 20th November, transects were walked from 0830 – 1230hrs then from 1335 – 1800hrs, along with an investigation of the area to the north-east of the site, on the eastern side of Smith's Beach Road. On the 21st November a reconnoitre was carried out by road of the surrounding areas to assess the degree of connectivity. The locations traversed during daytime searches on the 19th November are shown on Figure 2-1. Note that only one GPS recorded tracks, so the second observer's track is not shown on this figure. The second observer traversed approximately 50 metres from the tracked observer. Tracks are also not shown for the reconnoitres on 19th and 21st November. Overall survey effort for day-time searches totalled approximately 22 person-hours (11 hours by two people).

2.2.3.3 Nocturnal surveys

Two nocturnal surveys were conducted – on the 19th and 20th of November. On each night, two BCE personnel traversed parts of the project area and searched vegetation using torchlight. Eye-shine of WRP was used to detect potential locations of WRP, and ID was then confirmed using binoculars. The number of individuals observed was recorded, as well as the GPS location of the observation. The habitat in which the WRP was observed was also recorded for each observation. The locations traversed during nocturnal surveys are shown on Figure 2-1. Note that only one GPS recorded tracks, so the second observer's track is not shown on the Figure. The second observer traversed approximately 50 metres from the tracked observer.

Spotlighting took place from 1920 – 2030 on the 19th November and from 1920 – 21.30 on the 20th November. The overall survey effort for nocturnal spotlighting was approximately 6.5 person hours (3 hours and 20 minutes by two people).

2.3 Survey limitations

The EPA Guidance Statement 56 (2004) and the EPA (2020) outline a number of limitations that may arise during field investigations for Environmental Impact Assessment. These survey limitations are discussed in the context of the BCE investigation of the project area in Table 2-4. No limitations were identified.

Table 2-4. Survey limitations as outlined by EPA (2020).

EPA Survey Limitations	BCE Comment
Availability of data and information	Sufficient information from databases and previous studies (see Section 2.1.1). Not a limitation.
Competency/experience of the survey team, including experience in the bioregion surveyed	The ecologists have had extensive experience in conducting desktop reviews and targeted field investigation and site inspections, and extensive experience with Western Ringtail Possum assessments. The ecologists have undertaken a number of studies within the region. Not a limitation.
Scope of the survey (e.g. were faunal groups excluded from the survey)	The survey focused on Western Ringtail Possums only, as per the scope of this report. Not a limitation.
Timing, weather and season	Daytime searches are suitable for observing dreys, assessing habitat, and looking for secondary signs such as scats. Two nocturnal surveys were conducted to provide opportunities for direct observation of WRP. There were no adverse weather events that would have affected survey adequacy. WRP are sedentary and detectable (directly and indirectly) throughout the year at a site where they are present. Not a limitation.
Disturbance that may have affected results	None. Not a limitation.
The proportion of fauna identified, recorded or collected	All fauna observed were identified. Not a limitation.
Adequacy of the survey intensity and proportion of survey achieved (e.g. the extent to which the area was surveyed)	The site was adequately surveyed to the level appropriate for a targeted assessment. Fauna database searches covered at least a 20 km radius around the project area. The targeted assessment was completed. Not a limitation.
Access problems	There were no access problems encountered. Not a limitation.
Problems with data and analysis, including sampling biases	There were no data problems. Not a limitation.

3 Results and Discussion

This section presents the results of the desktop and field investigations and includes, as per the scope:

- The status quo of the WRP in the project area and adjacent to the area;
- Predicted impacts of the development on WRP, by reviewing the key threatening processes and how these interact with the proposed development; and
- Recommendations for how to mitigate the effects of relevant threatening processes with the aim of no or minimal impact on the WRP population in the area.
- Recommendations for pre-disturbance and ongoing monitoring to detect changes in WRP abundance/distribution and evaluate the effectiveness of the recommended mitigation measures, in order to inform ongoing adaptive management.

3.1 Status quo of Western Ringtail Possum

3.1.1 Regional records

Database search results and previous studies show that the Western Ringtail Possum is known from the project area and immediate surrounds. Database records and results from previous studies are summarised in Table 3-1 (database records), Table 3-2 (previous studies in the region) and Table 3-3 (previous studies in the project area). As part of a large study to determine WRP abundance across its range, Biota (2020) surveyed eight sites within the Cape to Cape area, including two very close to the current project area (Canal Rocks and Yallingup) and four within 15 km. Within this Cape to Cape area, they reported a general trend of a decrease in observations from the northern sites (Yallingup and Big Rock) to the southern sites. This indicates that, based on the available information, the area within which the project area sits is an area of high WRP abundance, in a regional context. In the two sites closest to the project area, Biota estimated a density of 3 possums per hectare (Yallingup site) and 2.5 possums per hectare (Canal Rocks site).

The conservation advice for WRP (TSSC, 2018) states that mapped locations of WRP from "10-20 years ago" (therefore prior to about 2006) are probably inaccurate due to recent severe declines. To gain a better understanding of the recent records of WRP, DBCA records were filtered to remove records prior to 2006, and a subset of data from only the last 5 years was also examined. The DBCA database shows clusters of records around urbanised areas such as Yallingup, Dunsborough and Busselton; this may simply represent an increased chance of observations in populated areas (e.g. effectively an increased survey effort in these areas) but may reflect the growing evidence that WRP do well in urban areas (Busschots *et al.*, 2021; Van Helden *et al.*, 2021). Looking at the most recent records, there are no WRP records in the DBCA database within the project area or within the areas of national park to the north and south of the project area (see Figure 3-1 and Figure 3-2). The closest recent record is from 2019 and is about 1.5 km from the project area. The lack of recent records in the DBCA database reflects that this database does not include all surveys that have been conducted in the area. Several previous studies within 5-17 km of the current project area, including the Biota (2020) study mentioned above, have documented evidence of WRP and contribute to the general conclusion that the species is present in the region (these are summarised in Table 3-2). Recent surveys have recorded WRP residing in the project area (Biologic 2020 and BCE, current survey) and detected WRP individuals in the national parks nearby (Biota, 2020). A study by ATA Environmental in 2007 also found

substantial evidence of WRP in the project area, although this is less reliable than newer surveys, given the age of these records and the decline of the species in the south-west. Therefore, despite the lack of recent nearby records in the DBCA database, it should be assumed that WRP occur in all suitable habitat surrounding the project area. It is expected that movement of WRP between the project area and surrounding suitable habitats will be occurring as a natural part of the population dynamics of the WRP population in this region.

Table 3-1. Summary of database records for WRP

Source	Occurrence of WRP	Comments in relation to proposed development
PMST	Breeding known to occur in project area	Project area is significant for WRP populations.
DBCA TPF database	No recent records in project area or NP to north, one record in NP to south (dead specimen)	Lack of recent records likely due to recent survey results not yet being incorporated into the database (multiple consultants have observed WRP in project area and NP in last 5 years)
ALA	51 records within 20km buffer, 10 km uncertainty applied so location of records not precise.	Indicates species occurs in local area.

Table 3-2. Summary of WRP observations from previous studies within 20 km of the project area.

Author/Title	WRP info	Distance to site
Emerge Associates 2020a Basic Fauna and Targeted Black Cockatoo Assessment - Lot 32 (no.325) Tom Cullity Drive, Wilyabrup EP20-088(02)-004A MS, Version A	Drey observed, unsure whether currently being used. Targeted survey suggested.	17 km
Emerge Associates 2021 Targeted Western Ringtail Possum Assessment - Lot 32 (No. 325) Tom Cullity Drive, Wilyabrup, EP20-088(11)—014 MS, Version A.	WRP individual observed in the western part of this survey area. Conclusion is that WRP abundance is low.	17 km
Terrestrial Ecosystems Pty Ltd (2020) Survey of Western Ringtail Possums and their dreys in Armstrong Reserve, Dunsborough (November 2020)	WRP were recorded on both nights of spotlight; 9 on the first night and 5 on the second night. Population persists in this location.	10 km
Terrestrial Ecosystems Pty Ltd (2021) Survey of Western Ringtail Possums and their dreys in Armstrong Reserve, Dunsborough – March 2021	Seven WRP were recorded on each of two nights of spotlighting. Population persists in this location.	10 km

Author/Title	WRP info	Distance to site
Ecosystem Solutions (2020) Significant Fauna Assessment (2020), Lot 27 Shallows Loop, Yallingup, prepared for Lachlan Guthrie.	Old WRP scats were found. No WRP individuals or dreys were observed. Conclusion was that WRP are likely to visit occasionally and they may use tree hollows instead of dreys.	5 km
Ecoscape (2012) Armstrong Reserve Level Two Fauna Survey. Unpublished report for Ray Village Aged Services	WRP were observed: 14 dreys and 10 direct sightings.	10 km
Ecosystem Solutions (2014) Level 1 Fauna and Level 2 Flora/Vegetation Assessment. Unpublished report prepared for City of Busselton.	WRP individuals and/or dreys were observed at all sites.	10-30 km
Biota (2020) Western Ringtail Possum *Pseudocheirus occidentalis* Regional Surveys	Northern part of Cape to Cape area was highest WRP abundance, and it decreased further south. Project area is in area of regionally high WRP abundance.	regional

Table 3-3. Summary of previous studies of WRP within the current project area.

Author/Title	WRP information	Comment regarding proposed development
Biologic (2020) Lot 4131 Smiths Beach Road, Yallingup. Detailed Terrestrial Vertebrate Fauna Survey.	49 records of WRP (including dreys, scats and direct observation of individuals). WRP records were concentrated in the north-east, in open Peppermint forest close to the existing development and scattered throughout open Peppermint forest further south and in open Banksia forest.	WRP observations concentrated in areas designated for campground, and eastern holiday homes.
ATA Environmental (2007)	50 dreys were recorded, mostly in Peppermint/Eucalypt woodland: in Peppermint, *Melaleuca* spp., Marri, *Banksia* spp., *Hakea oleifolia*, *Spyridium globulosum*, and on the ground. Eight WRP observations were observed over 4 nights of spotlighting.	WRP observations scattered throughout most of core habitat but absent from north-east corner (where BCE found a concentration of records). Older records such as these may not be reliable due to widespread declines or changes in the maturity of vegetation. These observations were also made before the large E-W firebreaks were added to the site (Compare Figure 3-5 and Figure 3-6)

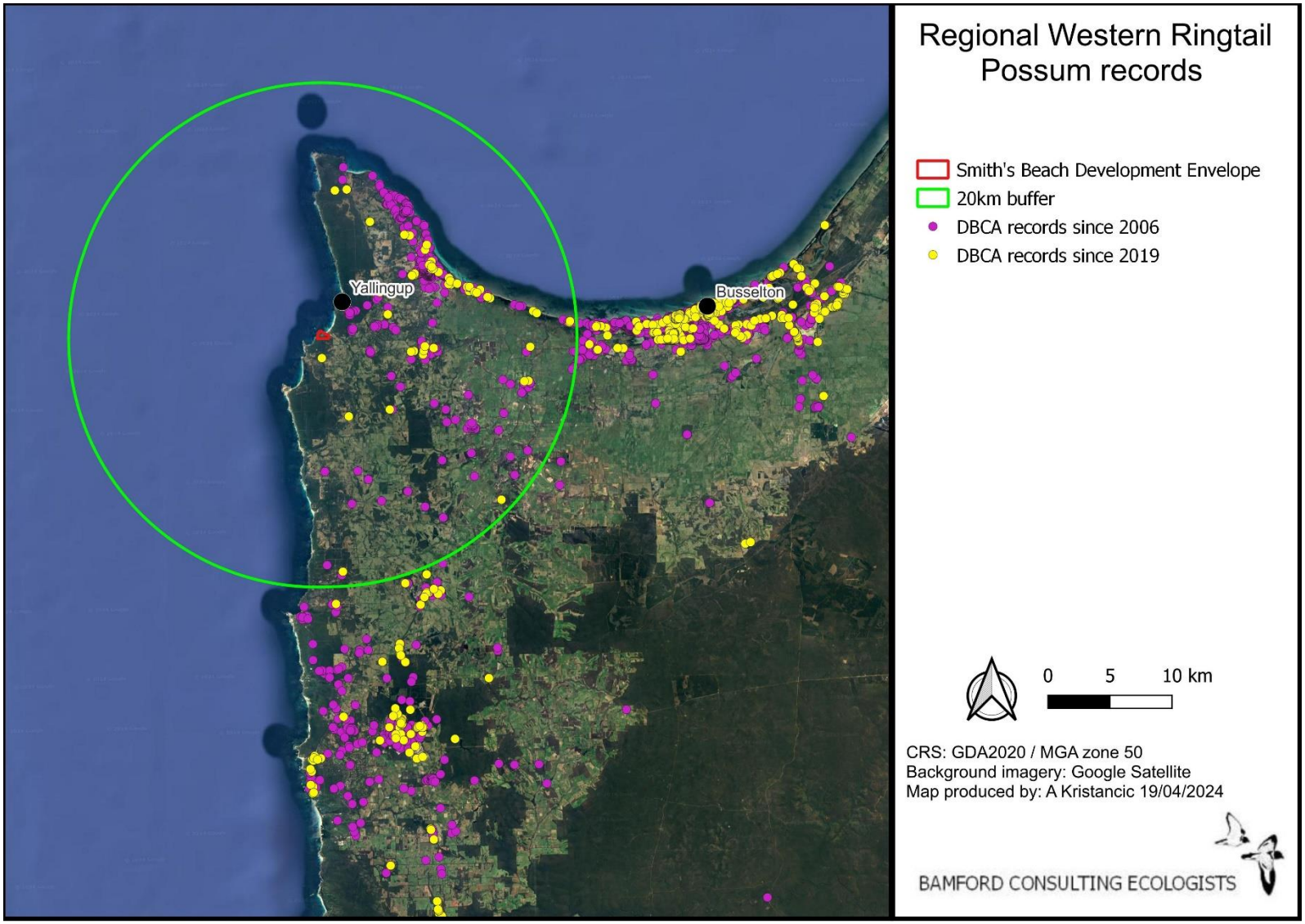

Figure 3-1. Western Ringtail Possum records (DBCA records since 2006) in the broad region surrounding the project area.

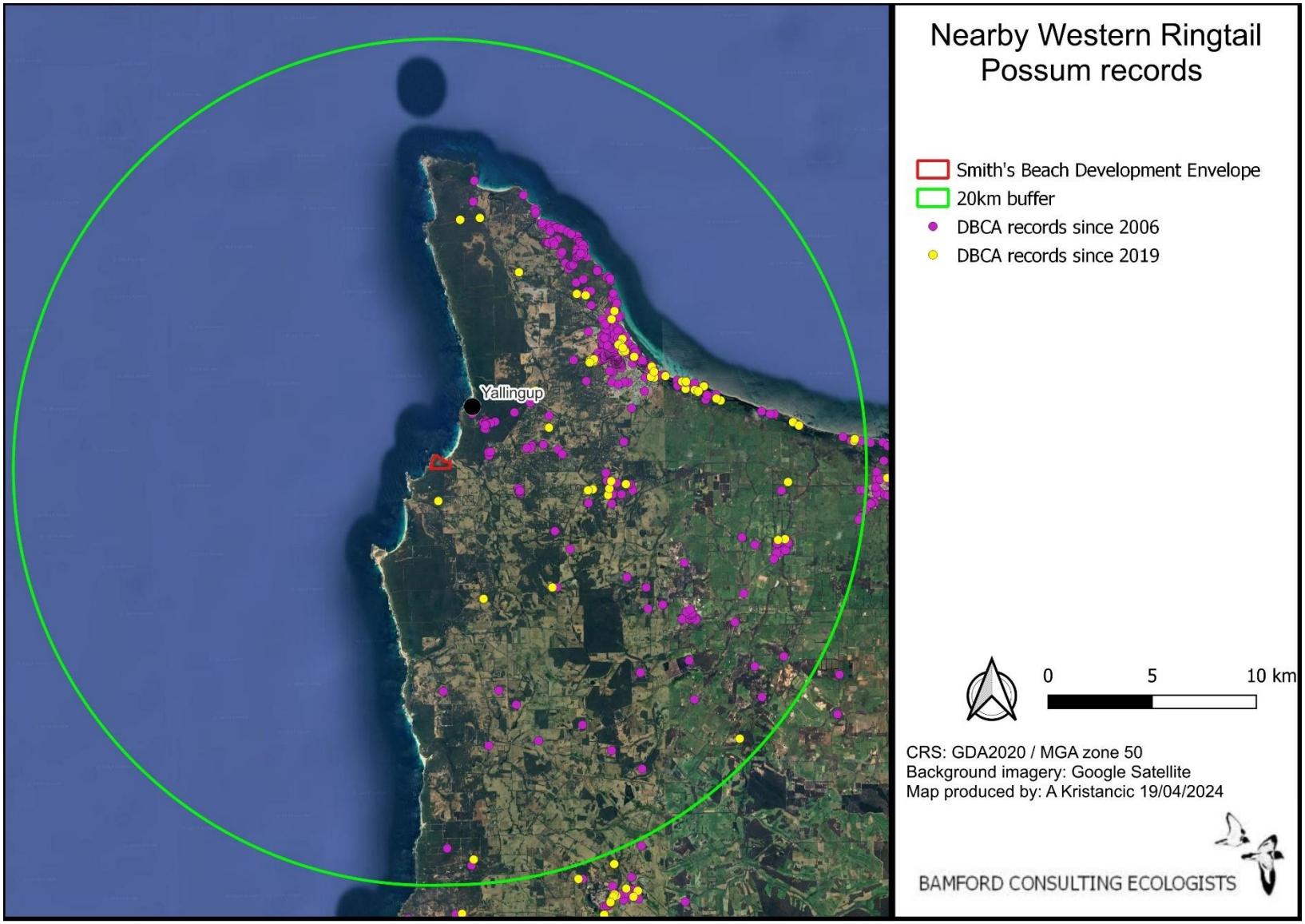

Figure 3-2. Western Ringtail Possum records (DBCA records since 2006) in the local area surrounding the project area.

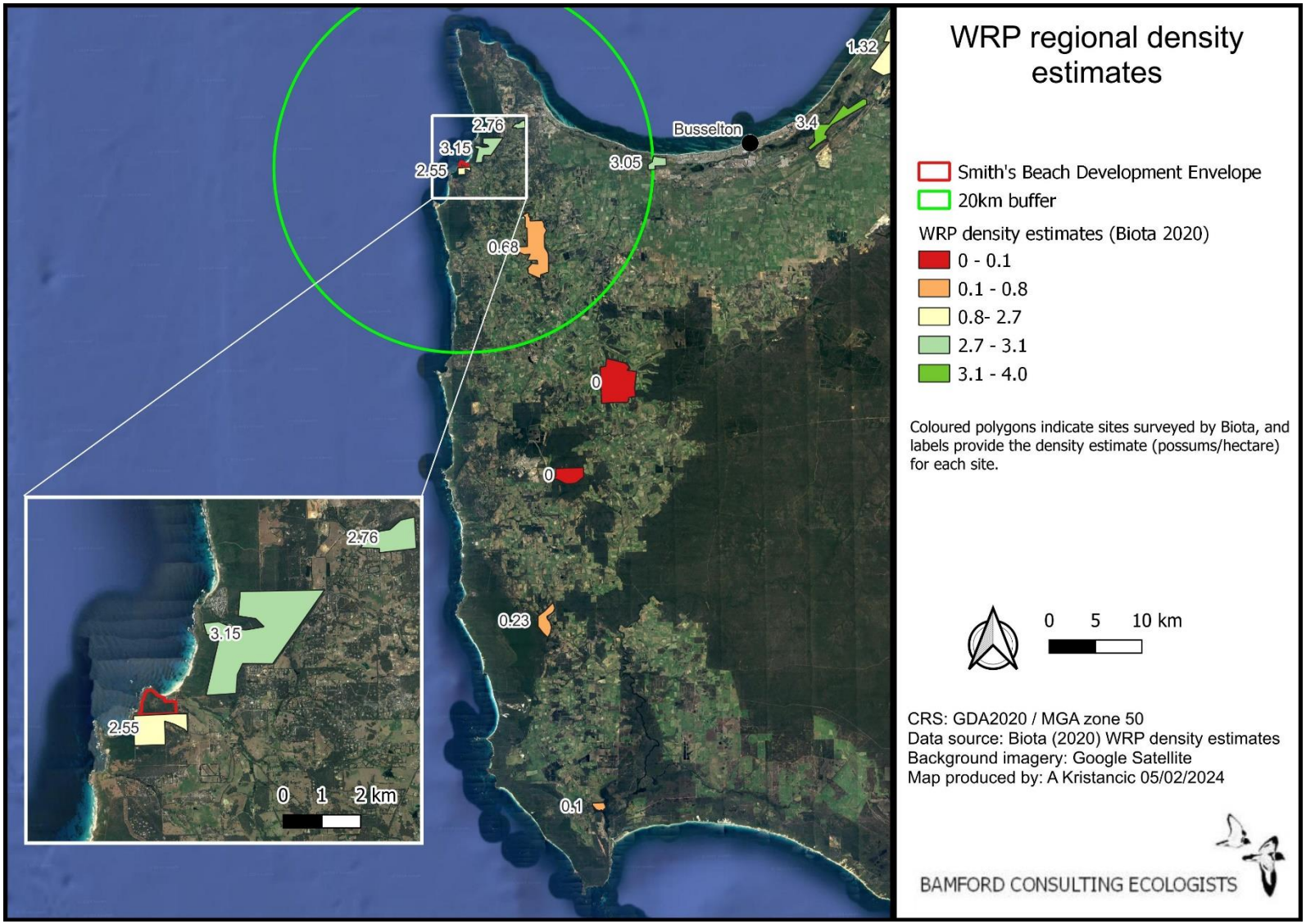

Figure 3-3. Western Ringtail Possum regional density estimates in Cape to Cape area (and some sites near Busselton), based on distance sampling surveys undertaken by Biota (2020).

3.1.2 Distribution and density in project area

The site visit in November 2023 allowed BCE personnel to ground truth relevant information from the desktop such as the location and condition of existing WRP habitat. Nocturnal surveys confirmed that WRP are present in the project area. The survey methodology conducted by BCE, whereby the area was traversed on foot, at a relatively even pace, while looking for signs of WRP, allows a comparison of the relative density of WRP at different locations within the project area. The results of the nocturnal spotlighting surveys and daytime searches are shown in Table 3-4. It was found that observations of both WRP individuals and dreys were concentrated in the north-east portion of the project area (Figure 3-4). This area is proposed to be developed for campgrounds. BCE personnel observed that the preferred habitat for WRP appeared to be areas with an overstorey of *Agonis flexuosa* (WA Peppermint) and an understorey of *Hakea* and Basketbush *Spyridium globulosum*. This corresponds to the 'open Peppermint forest' defined as "core breeding, foraging and dispersal habitat' by Biologic (2020), which is where the majority of records of WRP individuals, dreys and scats were found by Biologic in a survey in 2020 (shown Figure 3-5). This same area has also been defined by BCE as core habitat, as indicated in Figure 3-7 and described in more detail in Section 3.2. Biologic (2020) also found scattered observations of WRP throughout other parts of the 'open Peppermint forest' and in open Banksia forest (shown in Figure 3-5); these correspond to areas proposed for "eastern holiday homes". During the site visit in November 2023, there was evidence of use by WRP of *Banksia* spp. and *Corymbia calophylla* (Marri) at the site. A drey was recorded in a Marri tree within the core habitat of Peppermint forest and is shown in Plate 2. WRP scat was also recorded in Peppermint forest within the project area, and an example is shown in Plate 3.

ATA Environmental conducted daytime searching and four nights of spotlighting within and adjacent to the current project area. They found a total of 100 dreys, 50 of which were within the current project area. WRP were also observed within the current project area, scattered throughout the area now categorised as open forest of Peppermint and considered core WRP habitat. The figure from this report has been extracted and shown here as Figure 3-6. Interestingly, records of WRP dreys and individuals from this survey were not concentrated within the north-east portion of this habitat but tended to be more evenly spread out throughout the area, and conspicuously absent from the north-east portion where WRP now appear to be concentrated. This survey was conducted before the large east-west firebreaks were installed (compare Figs 3.5 and 3.6). The maturity and therefore structure of the vegetation may also have changed between 2007 and more recent studies.

The regional study by Biota (2020) indicated that distribution of WRP within a remnant can be patchy; the authors calculated quite different encounter rates on different transects within the same study site. This is consistent with the observations of both Biologic and BCE in the project area, where WRP observations are concentrated in the north-east part of the project area. It is not clear what factors may underly this uneven distribution however it may be due to the proximity of the area to human habitation, or due to the fragmentation of the southern sections by the wide firebreaks that would require WRP to go to the ground to traverse them.

Overall, 13 active dreys and at least 10 individuals were observed during field investigations by BCE. Six of these active dreys were identified as maternity dreys, probably containing WRP mothers and

joeys. An additional eight dreys that were old or had fallen were observed. Locations of observations made by BCE are shown in Figure 3-4.

Table 3-4. Details of dreys and possums observed during daytime searches and nocturnal spotlighting.

Date	Latitude	Longitude	Waypoint	Dreys	Possums	Notes
20/11/2023	-33.662399	115.011746	973	old drey		Agonis/basketbush
20/11/2023	-33.662563	115.011492	974	-		photo point
20/11/2023	-33.6640174	115.0132038	N/A	drey		Drey in Marri tree
20/11/2023	-33.66346	115.014079	975	-		echidna diggings
20/11/2023	-33.662853	115.015167	976	occupied drey	1	
20/11/2023	-33.662963	115.014636	977	large maternity drey	1+	Maternity drey
20/11/2023	-33.662868	115.014583	978	old drey		disused
20/11/2023	-33.66276	115.014557	979	fallen drey		
20/11/2023	-33.662746	115.014494	980	large maternity drey	1+	maternity drey
20/11/2023	-33.662757	115.014503	981	small drey		looks used but no new material
20/11/2023	-33.662758	115.014483	982	old drey		sparse
20/11/2023	-33.662713	115.014387	983	large maternity drey	1+	maternity drey
20/11/2023	-33.662711	115.014184	984	old drey		
20/11/2023	-33.66276	115.014202	985	large maternity drey	1+	maternity drey
20/11/2023	-33.662781	115.014216	986	medium drey	1	
20/11/2023	-33.662901	115.014231	987	old drey		disused
20/11/2023	-33.662767	115.014132	988	large maternity drey	1+	female left drey and then returned. likely joey in drey - maternity drey
20/11/2023	-33.662746	115.014109	989	new drey	1	
20/11/2023	-33.662775	115.014008	990	old drey	-	
20/11/2023	-33.662714	115.01379	991	newish drey	1	
20/11/2023	-33.662731	115.013625	992	large newish maternity drey	1+	possible maternity drey
20/11/2023	-33.662797	115.013164	993	old drey		unoccupied
20/11/2023	-33.662721	115.013143	994	-		possum scat
20/11/2023	-33.663149	115.014576	995	drey	1	has been used recently, or possibly occupied, some debris below
20/11/2023	-33.66268	115.014014	996	-	1	spotlighted in Agonis 2004hrs
20/11/2023	-33.662919	115.013356	997	-	1	spotlighted in Banksia
20/11/2023	-33.662772	115.014157	998	-	1	spotlighted in Agonis
20/11/2023	-33.663321	115.013751	999	-	1	spotlighted in Agonis

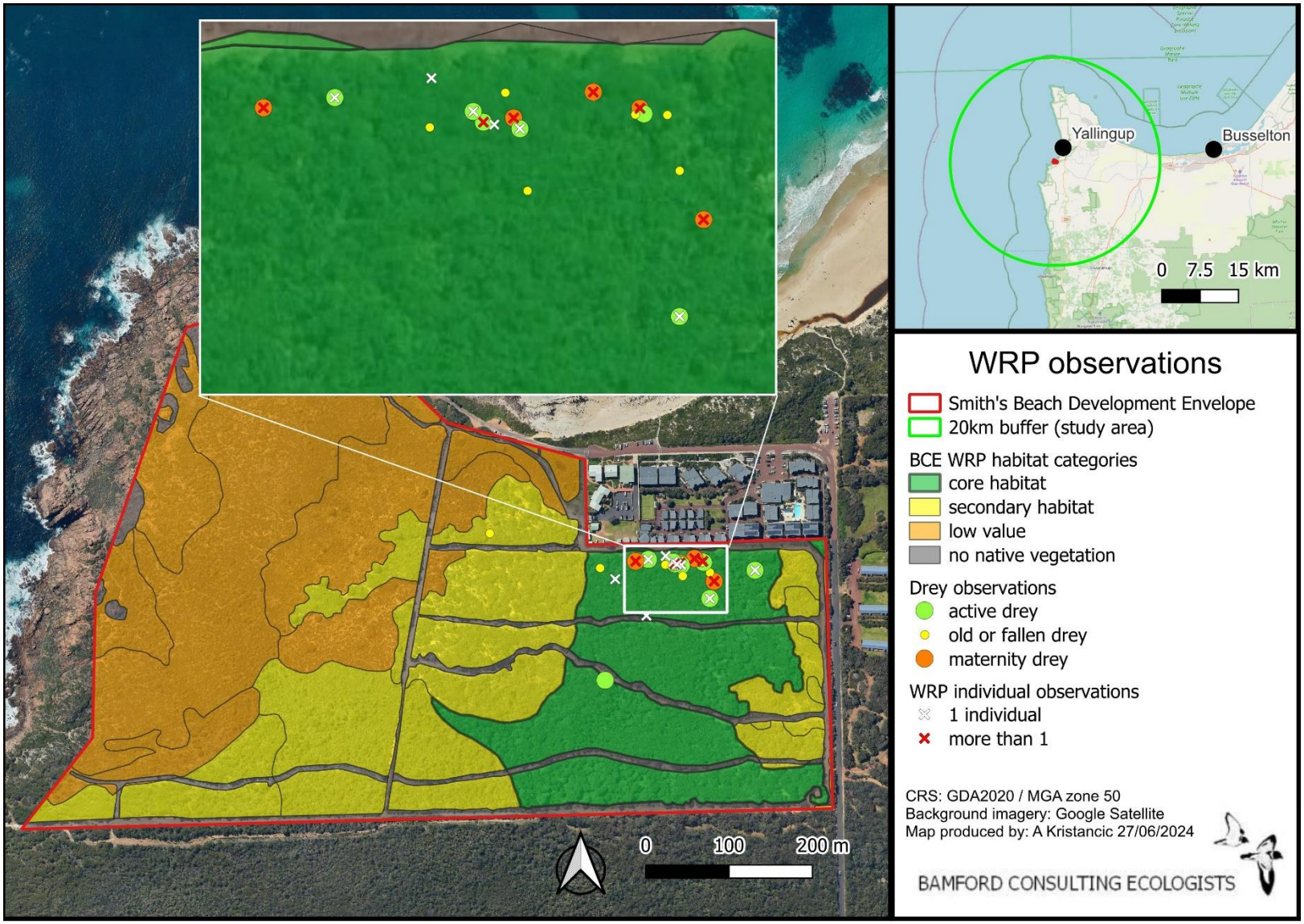

Figure 3-4. Observation of WRP individuals and dreys made by BCE during field investigations, overlaid on WRP habitat categories.

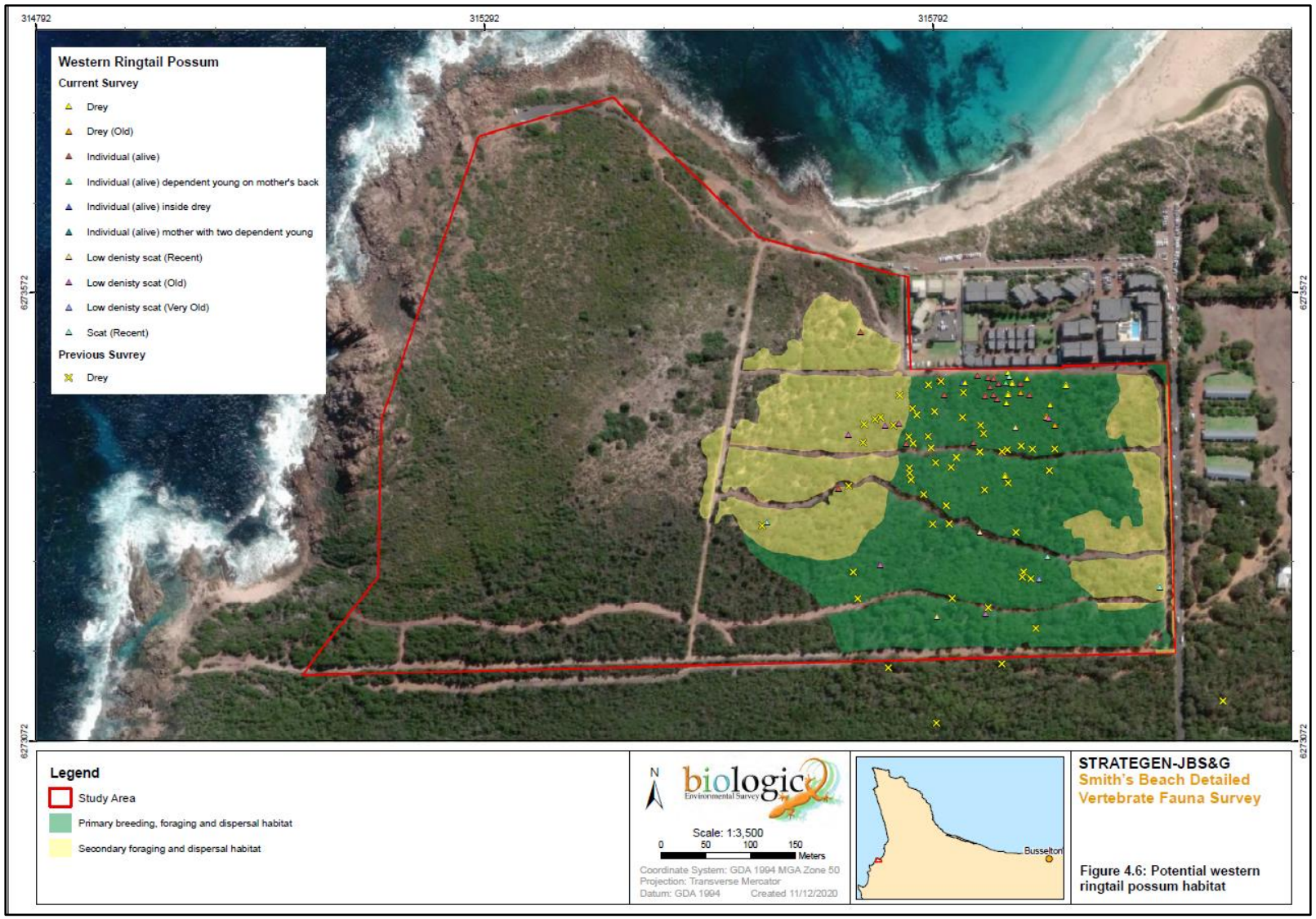

Figure 3-5. Location of previous WRP observations in the project area. From Biologic (2020). Yellow crosses here indicated dreys observed during surveys in 2001 and 2007, and reported in ATA Environmental (2007)

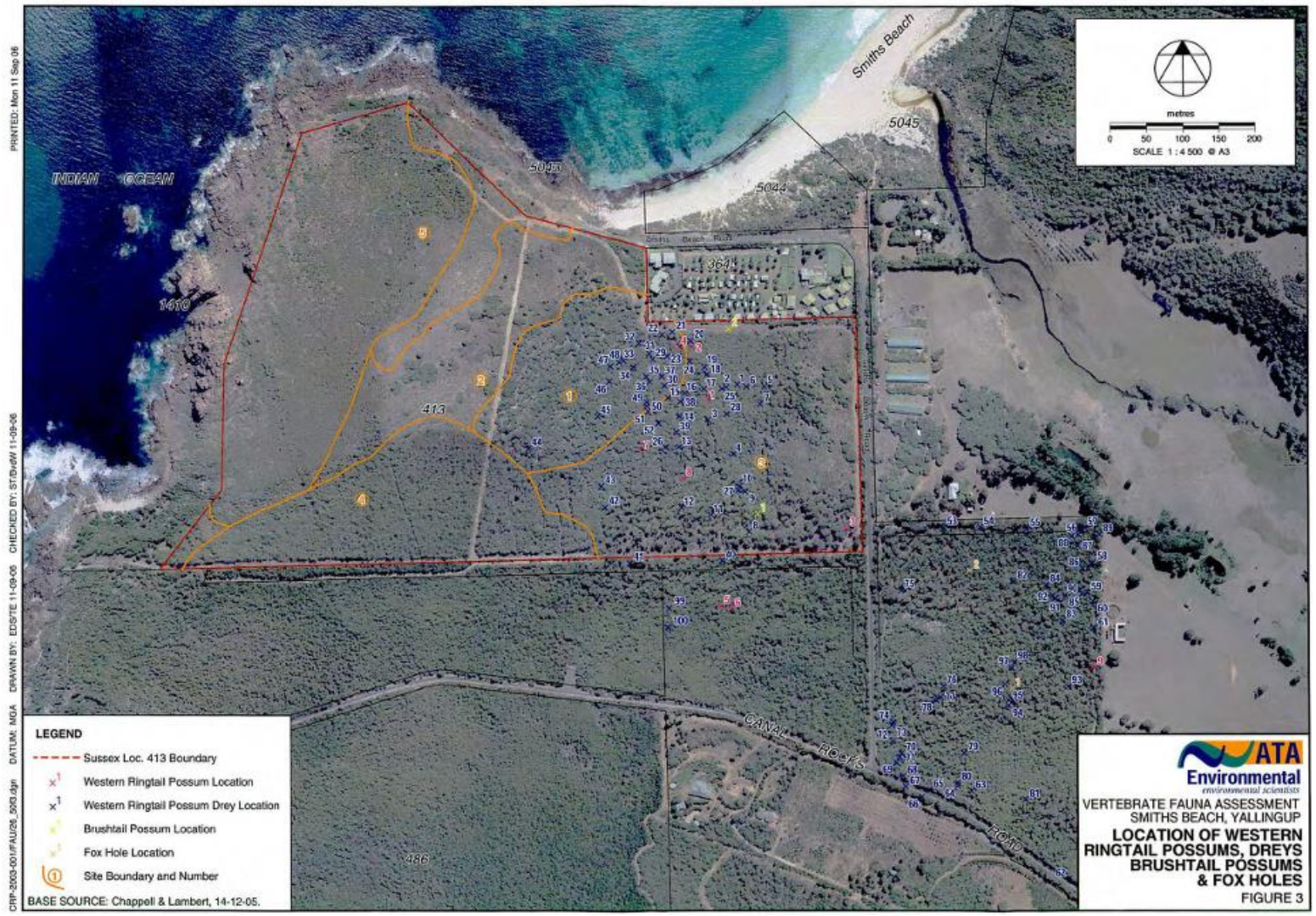

Figure 3-6. Location of dreys (black cross and number) and individual WRP (red cross and number) within and in the vicinity of the current project area. From ATA Environmental (2007).

Based on BCE field observations, it is estimated that at least 15-20 individuals are currently living in the project area, which would equal a density of at least 1.8-2.5 individuals per hectare, averaged over the entire area of Peppermint forest in the project area. This is considerably lower than estimates of 20 possums per hectare quoted in the recovery plan (DPaW, 2017), in stands of good quality Peppermint habitat in Busselton (a known stronghold for the species). However, it is comparable to the estimates by Biota for the two sites closest to the project area; Yallingup (c. 1km to the north-east) and Canal Rocks (immediately south) (Figure 3-3).

Given the concentration of WRP observations in only a small proportion of the area identified as core habitat, it is likely that this area of core habitat could support a higher abundance of possums if more of the core habitat was utilised. It is unclear why possums appear to be concentrated in the northern part of this core habitat, but the existing firebreaks that dissect the core habitat may present a barrier to possums moving from the northern area of high density into these other areas. These firebreaks do not appear to have been present in 2007 (ATA Environmental, 2007) when WRP were more evenly spread over the site. Possum bridges to allow safe movement across these firebreaks may assist WRP to more evenly utilise the area, allowing the area to support a larger WRP population. The provision of additional aboveground water points as part of the development may also increase WRP use of the area, however the effects of both possum bridges and water points on the WRP population, as well as the effects of the development itself, could only be verified by monitoring, if the development receives approval.

3.2 WRP habitat in the project area

Ground-truthing of the habitat within the project area confirmed that the vegetation types identified by Emerge Associates (2019) were an accurate representation of the existing habitat within the project area. These vegetation types were interpreted by BCE in terms of their value for WRP. This is based on the core habitat for WRP being comprised of open forest of Peppermint (*Agonis flexuosa*) trees; this is considered to provide high value breeding, foraging, and dispersal habitat. An example of high quality Peppermint forest habitat is shown in Plate 1. As discussed by Biologic (2020), WRP also utilise areas where Jarrah, Marri, *Banksia* spp. and/or *Melaleuca* spp. dominate; therefore forest or woodland vegetation types dominant in these species were defined as secondary habitat for WRP. Individuals may use this habitat for foraging and dispersal, but it is of lower value compared to habitat with a high density of Peppermint trees. The vegetation assessment shows that these forest and woodland vegetation types contain plant species that have been found in the diet of WRP (Mathieson et al., 2020), such as Moodjar *Nuytsia floribunda,* Marri *Corymbia calophylla,* Basketbush *Spyridium globulosum* and *Hakea* spp. It is likely that these species would be ideal candidates for revegetation to provide WRP foraging opportunities (discussed in Section 3.3 and 3.4 below). An example of secondary habitat for WRP is shown in Plate 4, and a stand of Moodjar (*Nuytsia floribunda*) in an area where vegetation is proposed to be 'modified' shown in Plate 7. Large stands of Moodjar such as that shown in Plate 7 should be retained and linked by bridges. These areas are important to retain as Moodjar can be slow to revegetate, so existing large stands – which may well be suckers from one plant – are an important resource for WRP, as well as having considerable aesthetic value. Vegetation types consisting of shrubland were considered of low value for WRP and defined accordingly, as WRP tend not to forage in shrubland in the absence of canopy cover and no evidence of WRP use was found in these areas, although some of these vegetation types did contain species known to be consumed by WRP (based on Mathieson et al., 2020). Examples of low vegetation of limited value for WRP are shown in Plate 5 and Plate 6. *Acacia saligna* and *Spyridium globulosum* are present in shrubland in the western section of the project area, and these are species that are consumed by WRP in other locations, so may also be ideal species for revegetation. The distribution of WRP habitat across the project area is shown in Figure 3-7 and the level of overlap between core habitat and the proposed development is shown in Figure 3-8. This is discussed further in Section 3.2.1.

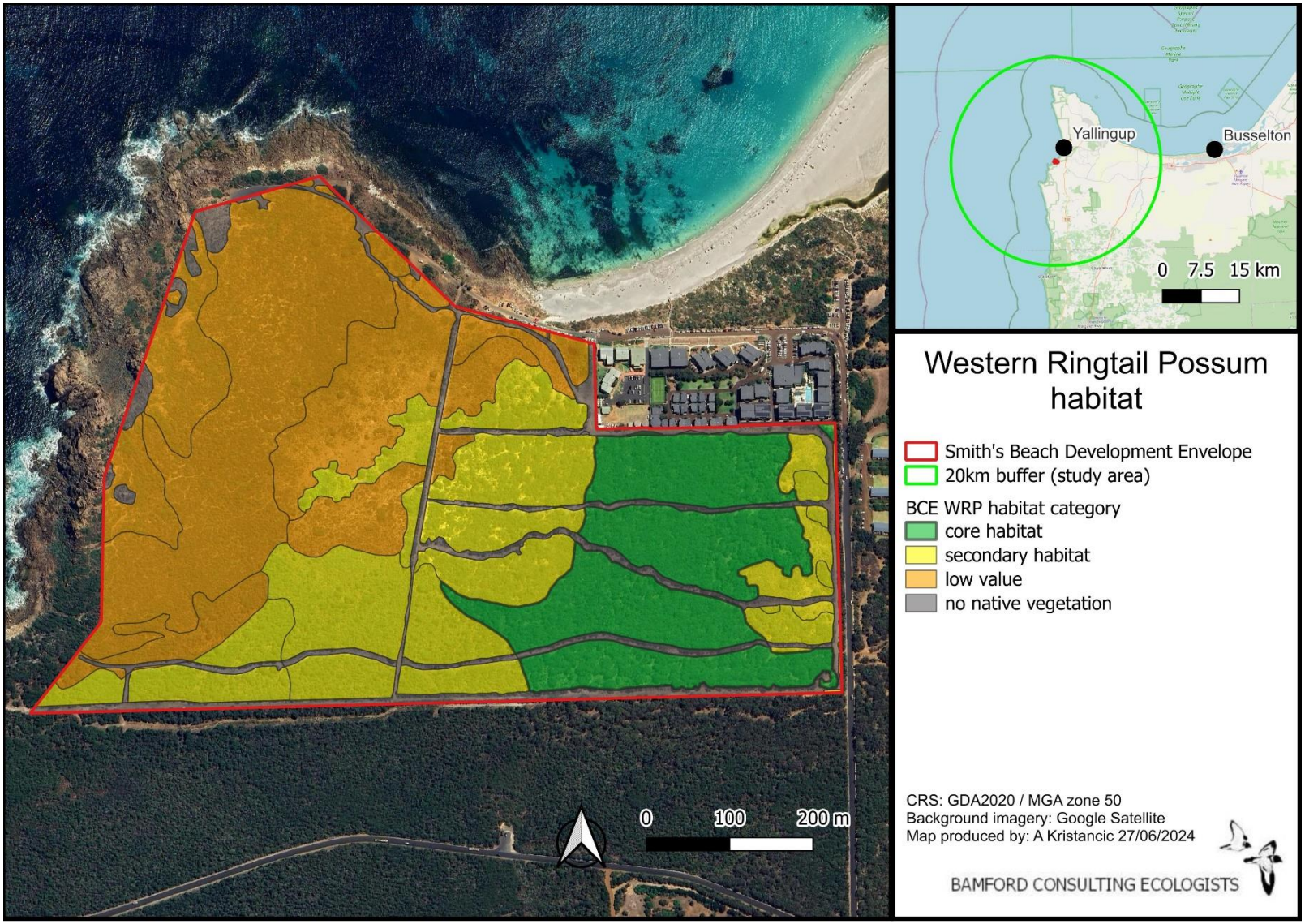

Figure 3-7. Distribution of Western Ringtail Possum habitat categories across the project area.

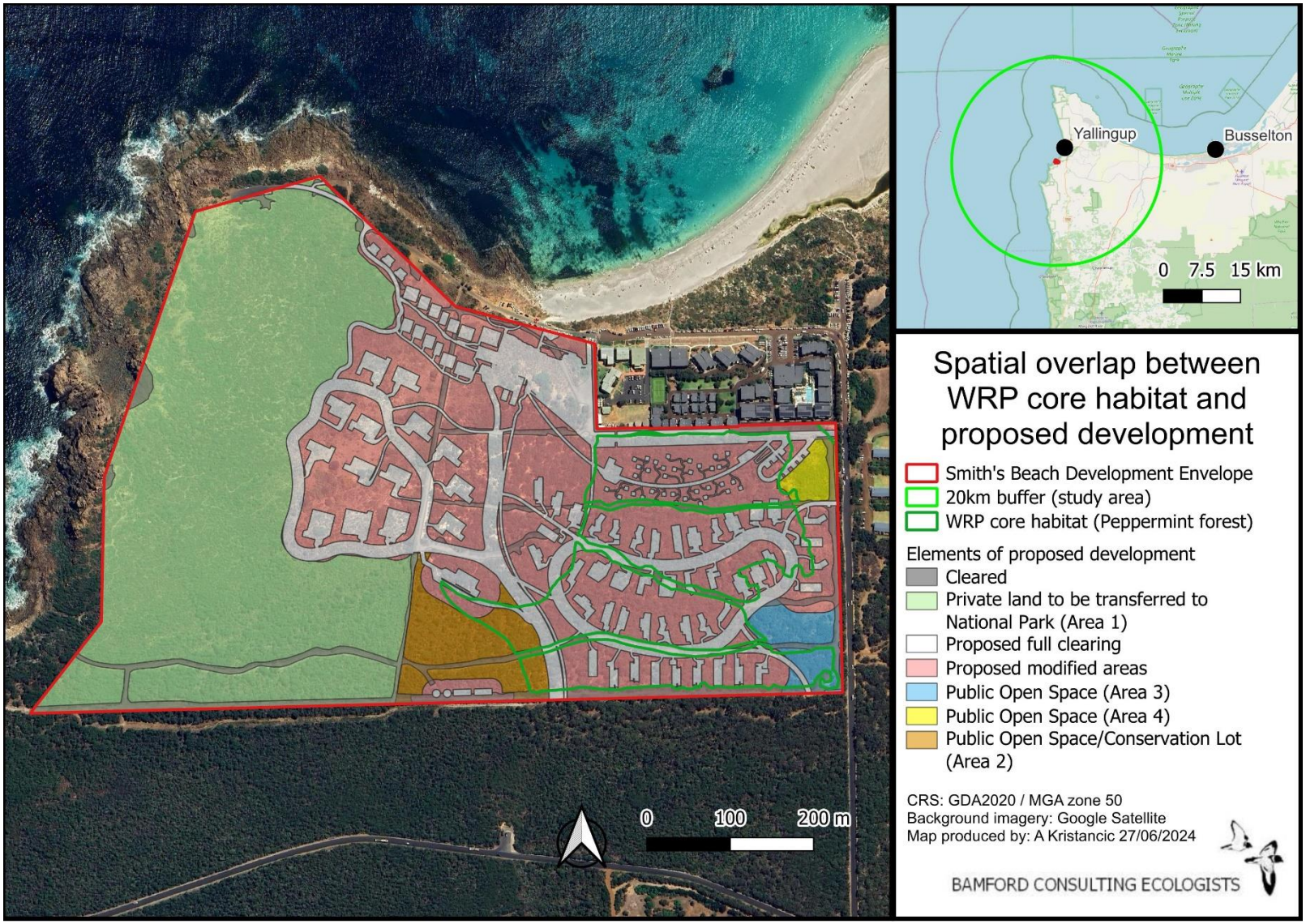

Figure 3-8. Overlap between core habitat for WRP and the proposed development.

3.2.1 Core habitat and movement corridors in project area

As discussed above, core habitat for WRP is likely to consist of open forest of Peppermint trees and it is therefore not surprising that this is where the majority of observations were made during the current study. Observations of dreys and WRP individuals are shown in Figure 3-4, overlaid on the map of WRP habitat. As shown, the majority of observations of dreys and individuals were made within the Peppermint forest likely to represent the core habitat. One old drey was observed in Banksia forest (with occasional Peppermint) and one drey was recorded in a Marri in the centre of the site (Plate 2) indicating that habitat outside the core habitat, and species other than Peppermint are still of importance to the species. The concentration of observations in the north of the area of core habitat may be due to the position of the area in the landscape. It is in a slight valley, so is sheltered from prevailing winds. There may also be resources such as water and high nutrient vegetation available for these possums in the existing development between the proposed development and the beach. WRP are known to take advantage of anthropogenic sources of food, water and shelter, and such resources may be present in this existing development. A motion sensitive camera was deployed for two nights along the firebreak between the proposed development site and the existing development during the site visit, however no possums were recorded crossing the firebreak or climbing the fence on either of the nights.

Another explanation for the low number of WRP utilising the southern section of the site is the installation of large E-W firebreaks that cross the site. These may limit the movement of possums into the southern section of the site and /or they may increase predation if WRP choose to go to the ground to cross the firebreaks.

The level of overlap between WRP core habitat and elements of the proposed development is shown in Figure 3-8. If it is assumed that the core habitat for WRP in the development envelope is the entire extent of open Peppermint forest (as mapped by Emerge Associates, 2019), there is c. 8 ha of core habitat for WRP within the development envelope. Of this, c. 3 ha (c. 38%) is proposed to be fully cleared to allow for campgrounds and the eastern holiday homes. A very small portion (c. 0.3 ha) is proposed to be incorporated into "Public Open Space/Conservation Lot (Area 2)", and the remaining 4.7 ha (c. 59%) is proposed to be modified due to the proposed developments. This modification will entail removal of up to 40% of the canopy cover and thinning of the understorey and midstorey for bushfire management and aesthetic purposes. The vast majority (96%) of the core WRP habitat within the development envelope will therefore be impacted in some way by the proposed development, with only about 4% left within the conservation area of "Area 2". The proposed development also overlaps with areas of 'secondary habitat' that, while not expected to be as crucial as the core habitat, are still expected to be important for WRP in the project area.

BCE consider that clearing and modification of vegetation may be able to be achieved without a negative impact on WRP, if critical habitat requirements for this species are considered as a priority. Within the core habitat of Peppermint forest, it appears that WRP are not equally distributed – instead they are concentrated in the north portion which is proposed to be developed as a campground. This is beneficial as development for a campground is likely to be of lower impact to WRP compared to the level of development required for the eastern holiday homes in the southern portion of the

Peppermint forest. If clearing for the campground is restricted to understorey, the resultant retention of larger trees is likely to maintain canopy connectivity necessary for WRP. Retention of canopy cover should be a priority when planning clearing in all parts of the core habitat area, and in surrounding areas of secondary habitat. Large trees that make up the canopy cover should be retained wherever possible. In the event that complete canopy connectivity cannot be maintained, appropriate movement corridors in areas likely to be used by WRP should be identified and retained, and supplemented with possum bridges as required.

It should be assumed that all existing areas of continuous canopy cover in the core habitat of Peppermint forest, as well as canopy in areas of 'secondary habitat' provide movement corridors for WRP individuals when moving through the project area. In addition, any existing continuous canopy that links the project area with other patches of suitable habitat should be considered a movement corridor. Such habitat connectivity likely exists along the south south-eastern edge of the project area, linking the area with the Leeuwin-Naturaliste National Park. However, several wide, east-west firebreaks were installed across the site between 2007 and 2019 (compare aerial photos in Figures 3-5 and 3-6), reducing connectivity north to south within the project area. This may explain the reduction in use by WRP of the southern section of the site in recent years as WRP may not try to access the southern section, or may be predated if they go to the ground to cross the firebreaks. Improving connectivity across the whole site will be important in management of WRP at the site and could potentially reduce predation rates and increase usage of this southern section of the site, and movement between the National Park to the south and the project area.

It does not appear that canopy connectivity currently exists between the project area and the national park to the north, as the area between these two sites is intersected by barriers such as roads, farmland and Gunyulgup Brook.

Plate 1. Example of high quality core habitat of Peppermint forest, typical of the habitat where most WRP individuals were recorded by BCE.

Plate 2. Possum drey in Marri tree within Peppermint forest habitat.

Plate 3. WRP scat found in high quality Peppermint forest habitat at the northern edge of the site, just south of the existing resort at GPS point 994 (See Table 3-4).

Plate 4. Example of secondary habitat for WRP (e.g. *Banksia* woodland).

Plate 5. Example of low shrubland vegetation that is of little value to WRP.

Plate 6. View looking west across the north-western corner of the site, showing low vegetation near the ocean which does not provide any canopy connectivity for WRP.

Plate 7. Example of large stand of Moodjar, *Nuytsia floribunda,* in one of the 'proposed modified' areas of the development. This species is a known food plant of WRP and should be retained in the development. Improving connectivity between remnant high quality habitat such as this will be important for supporting WRP living at the site. This stand of Moodjar occurs outside the Peppermint forest identified as core habitat, however features such as this should be identified and retained to maximise the quality of remaining habitat in the development.

Plate 8. Photograph showing example of wide east-west firebreaks that were installed across the site between 2007-2009.

3.3 Review of key threatening processes and recommendations for mitigation

The following section provides a general review of threatening processes regularly considered during environmental impact assessment, and how these interact with the proposed development in the context of WRP. For each threatening process, suggestions are also provided for mitigation of potential impacts. The predicted impact categories used in this section are defined in Table 3-5. and were quantified on the basis of predicted population change. Population change can be the result of direct habitat loss and/or impacts upon ecological processes.

The significance of population change is contextual. The EPA (2004) suggests that the availability of fauna habitats within a radius of 15km can be used as a basis to predict low, moderate or high impacts. In this case, a high impact is where the impacted environment and its component fauna is rare (<5% of the landscape within a 15km radius or within the Bioregion), whereas a low impact is where the environment is widespread (10% of the local landscape). In the case of the current project area, which is small and surrounded by fragmented habitat, a 15km radius is not appropriate for context. Instead, the context can be set by asking if the fauna values maintained by the landuse existing in the area will be impacted by the proposed development. In this case, the contextual area is the mosaic of housing, reserves and the surrounding farmland. In the following criteria (Table 3.5), the significance of impacts is based upon percentage population decline within the immediate area of the surrounding housing and reserves (approximately 1-2km from the project area), and upon the effect of the decline upon the conservation status of WRP (recognisably discrete genetic population, sub-species or species). Note that percentage declines can usually only be estimated on the basis of distribution of a species derived from the extent of available habitat.

Table 3-5. Assessment criteria for impacts upon fauna.

Impact Category	Observed Impact
Negligible	Effectively no population decline; at most few individuals impacted and any decline in population size within the normal range of annual variability.
Minor	Population decline temporary (recovery after end of project such as through rehabilitation) or permanent, but < 1% within the immediate area. No change in viability or conservation status of taxon.
Moderate	Permanent population decline 1-10% within the immediate area. No change in viability or conservation status of taxon.
Major	Permanent population decline >10% within thee immediate area. No change in viability or conservation status of taxon.
Critical	Taxon extinction within the immediate area and/or change in viability or conservation status of taxon.

Following this review of general threatening processes, the proposed development is also reviewed in relation to seven key outcomes that may result in a significant impact to WRP, as specified in the WRP recovery plan (DPaW, 2017).

1) Habitat loss leading to population decline

Predicted impact if no mitigation *Major*

About 38 % of the core habitat (Peppermint forest) for WRP in the project area is proposed to be fully cleared, meaning that all vegetation will be removed for the purposes of earthworks and construction. About 59% of this core habitat is proposed to be modified, involving the removal of up to 40% of the canopy cover. The removal of canopy trees and other species that that provide foliage and shelter will result in a loss of foraging habitat and shelter resources, theoretically resulting in an area that cannot support as many WRP. This will contribute to a local decline in population size, and potentially a decrease in regional population size if displaced possums are unable to travel to and/or find suitable resources in the surrounding areas, and therefore unable to survive.

Suggested mitigation/s

Field investigations showed that WRP are concentrated in the north section of the core habitat of Peppermint woodland, in the area proposed for a campground. Clearing in this area should be minimal and established trees should be retained, in order to maintain canopy connectivity as this is crucial for supporting the resident WRP population. Where canopy connectivity cannot be maintained, possum bridges and other structures may assist in providing artificial connectivity. To allow for continued juvenile dispersal (part of the normal population dynamics), connectivity must be retained or created between the project area and nearby patches of suitable WRP habitat, such as the areas of national park to the north-east and south. In addition, nitrogen-rich understorey

plants should be maintained or planted to increase the quality of forage in remaining areas. Recommended species to be retained and/or used for revegetation are summarised in Appendix 5.

Monitoring will be important to determine the overall impact on the WRP population of the proposed development with mitigation measures.

Predicted impact with mitigation *Minor - Moderate*

2) Habitat loss leading to population fragmentation

Predicted impact if no mitigation *Major*

Currently, it must be assumed that individual possums are moving through the landscape in and out of the project area via areas of intact canopy cover where possible. WRP move through the canopy if it is connected but are known to descend to the ground more frequently in fragmented landscapes (DEWHA, 2009) putting them at greater risk of ground-based predators. Therefore, clearing of trees that would reduce the current canopy connectivity would result in fragmentation of habitat and possibly to either isolation of the resident WRP population from other nearby populations, or to increased predation if the animals choose to come to the ground to move between areas.

Suggested mitigation/s

To mitigate the impact of habitat loss and fragmentation (and resulting fragmentation of populations) large trees that contribute to canopy connectivity should be retained. It should be noted that while the area to be ceded will provide important habitat and connectivity for other vulnerable species such as the Quokka *Setonix brachyurus*, it is mostly low, coastal vegetation and is unlikely to provide connectivity for WRP, so this will need to be provided within the proposed development envelope to maintain connectivity of the population between the conservation areas to the north-east and south. If it is not feasible to retain all trees, development should occur based on retention of as much canopy *connectivity* as possible; it is not only overall canopy cover that is important but the functional connectivity of this canopy in allowing WRP to move through and into and out of the project area. Where connectivity is compromised, possum bridges and other raised structures may assist in providing artificial connectivity. Previous research and monitoring has shown these to be used willingly by WRP (Bamford *et al.*, 2023, Yokochi & Bencini, 2015).

Predicted impact with mitigation *Minor*

3) Degradation of habitat due to weed invasion leading to population decline

Predicted impact if no mitigation *Negligible*

There is potential for development to increase the spread of weeds, which can result in degradation of habitat. It is not expected that the spread of weeds would have a significant impact on WRP habitat, as the former usually impacts the understorey which is of less importance for WRP.

Suggested mitigation/s

Standard hygiene measures are likely to be in place to reduce the spread of weeds. No additional mitigation measures are suggested.

Predicted impact with mitigation *Negligible*

4) Degradation of habitat due to plant disease/pathogens

Predicted impact if no mitigation *Moderate*

There is potential for development to increase the spread of plant pathogens such as dieback *Phytophthora cinnamomi* or polyphagous shot-hole borer *Euwallacea fornicates* which can result in degradation and loss of habitat. This could potentially have a significant impact on WRP as plant pathogens can result in the death and loss of mature trees.

Suggested mitigation/s

Hygiene measures should be implemented to prevent dieback and other plant pathogens being introduced to the project area or spread throughout the project area. Guidance on these mitigation measures is provided by DBCA (2024b), and involves thorough cleaning of 'carriers' prior to entering natural areas, and when exiting natural areas. 'Carriers' are anything that can pick up soil (that may contain pathogens), such as machinery, vehicles, equipment and footwear.

Predicted impact with mitigation *Minor*

5) Mortality during clearing and construction

Predicted impact if no mitigation *Moderate*

Clearing of trees containing WRP individuals and/or dreys would put individuals at a significant risk of mortality.

Construction may negatively impact WRP if they are forced to come to the ground (due to lack of connectivity or high ambient temperature) and are therefore susceptible to injury or mortality from vehicles or construction equipment.

Suggested mitigation/s

BCE have successfully displaced and/or translocated WRP prior to clearing of habitat, during other projects such as the widening of the Vasse Diversion Drain in Busselton (Bamford *et al.*, 2023). For this project, clearing was minimal and localised to only certain areas, therefore possums were able to be displaced (with no or minimal handling) into nearby trees immediately prior to the time of active clearing. No direct mortality of WRP occurred during clearing, and evidence from monitoring suggests that the displacement and disturbance has not had a long-term impact on the abundance of WRP in the area (note that provision of artificial dreys and possum bridges is likely to also be associated with the subsequent success of this population in persisting in this area). Possum bridges and artificial dreys should be installed before work commences. Individuals need to be located and decisions made on the management of each animal. If individuals need to be relocated to another area during clearing and construction, the associated trapping and handling may cause significant stress. Staggered clearing may allow displacement (rather than relocation) of individuals to nearby intact vegetation for a short time, minimising disturbance to individuals and maximising the chance of successful persistence of the population. Experience on the Vasse Diversion Drain project for the Water Corporation was that individual animals would remain in their drey, even close to works, provided they remained connected to remaining parts of their home range.

Ensuring construction personnel are aware of the presence of WRP will help mitigate the risk of mortality during construction. Possum management personnel need to be on site at all times when works are to take place adjacent to or in trees that contain possums. Timing construction to occur during cooler weather, as well as maintaining as much canopy connectivity as possible, will help

mitigate risks associated with WRP travelling along the ground, as they will be able to remain in the canopy. If an animal 'goes to ground' under a vehicle or fallen vegetation, work must stop until the following day, to enable the possum to move away overnight. Felled vegetation must be cleared each day and not stockpiled on site, where animals can shelter and therefore be at risk from machinery. The success of this method depends on the expertise and cooperation of machinery operators and support of senior management.

Predicted impact with mitigation *Minor*

6) Ongoing mortality from operations

Predicted impact if no mitigation *Major*

Potential causes of mortality of WRP during operations of the tourist village may include:

- vehicle strike as visitors and staff move through the village.
- Pet attacks, particularly from dogs and cats.

Mortality from operations will impact WRP if they need to come to the ground. This can occur when there is decreased canopy connectivity, or when the ambient temperature is high and individuals will come to the ground to seek respite from the heat (DPaW, 2017). Therefore, even with mitigations to retain canopy connectivity, WRP may come to the ground during the summer months. The risks associated with mortality from operations are therefore likely to vary depending on the season. This may be able to be taken into account when deciding on management practices.

Suggested mitigation/s

- vehicle strike – this risk could be decreased by implementing speed limits (10 kph) and using signage, especially in areas of higher WRP density. Retention of canopy connectivity and provision of possum bridges over areas of high traffic will also mitigate this impact, as WRP will be less likely to come to the ground.
- Pet attacks – this would be mitigated if pets were excluded from the tourist village, especially from areas known to have high densities of WRP. If it is intended that the entire tourist village be pet-friendly, signage, education and strict pet management strategies may mitigate this impact. Both pet dogs and cats may have an impact. Pets should be restricted to properties and not allowed to roam freely, to reduce the impact they have on WRP as well as other fauna in the project area.

WRP will be more likely to come to the ground in summer, so mitigation measures should take this into account. For example, increased signage during summer, the provision of fresh water above-ground for WRP and pet management measures that vary seasonally may be suitable options.

Predicted impact with mitigation *Minor*

7) Disease

Predicted impact if no mitigation *Moderate*

The WRP recovery plan states that exposure to exotic species and pathogens can cause WRP to be at greater risk of disease. For example, toxoplasmosis can be spread to wildlife via contamination of the environment with oocysts excreted by cats (in their faeces), and this parasite is mentioned in the WRP recovery plan as a potential concern. It is unclear whether toxoplasmosis infection is likely to cause severe symptoms of disease in free-ranging WRP as

there are few robust studies of toxoplasmosis in free-ranging marsupials (Hillman et al., 2016). Toxoplasmosis has been associated with poor outcomes in captive marsupials (details in Hillman et al., 2016).

Suggested mitigation/s

To reduce the likelihood of WRP having increase exposure to parasites and pathogens that may cause disease, the following recommendations are suggested:

- Domestic cats should not be permitted in the village and feral cats should be trapped and removed. Food waste should be carefully managed to avoid attracting feral animals such as cats and rats.
- If pets are allowed in the tourist village, strict containment of pet cats and dogs to properties, to prevent domestic species spreading diseases into the environment.
- Education of visitors and residents on safe disposal of cat litter, to prevent contamination of the environment.
- Prevent human visitors from feeding WRP, as this can introduce diseases or increase the chance of transmission of disease between WRPs (if feeding is occurring at a shared feeding station, for example).
- Maintain cleanliness of artificial water-sources to prevent growth of bacteria or other pathogens that may cause disease.

Predicted impact with mitigation *Minor*

8) Species interactions including feral and overabundant native species

Predicted impact if no mitigation *Moderate*

Predation by feral predators (particularly foxes) will already be having an impact on the WRP population in the project area. However, development can increase densities of feral predators due to new roads facilitating increased movement of predators, and anthropogenic resources available in areas of development providing food and attracting predators.

Native predators of the WRP include the Wedge-tailed Eagle, Masked Owl, Chuditch and South-west Carpet Python (DPaW, 2017), and these species may all be impacting the WRP in the project area. It is not considered likely that the proposed development will increase predation from these species as they are likely to be negatively impact by the proposed development.

Suggested mitigation/s

Fox trapping may assist by reducing fox numbers but is thought to lead to concurrent increases in other predators such as cats and native predators. Therefore, the potential benefit of fox-baiting may be outweighed by an increase in predation by other species. Trapping of feral cats should be undertaken concurrently. Appropriate management of food waste will reduce the numbers of foxes and feral cats in the area.

The most effective way to minimise predation risk to WRP is to retain existing shelter and canopy connectivity, so that individuals do not need to come to the ground to move throughout the project area. Therefore, it is recommended that large trees that contribute to canopy connectivity are retained and possum bridges are installed where required to create connectivity.

Predicted impact with mitigation *Minor*

9) Hydrological change

Predicted impact if no mitigation *Negligible*

Altered hydrology can impact water available to trees, and therefore indirectly impact WRP via a decrease in quality and abundance of the foliage they rely on for survival. However, it is not expected that the proposed development will have a significant impact on local hydrology. It is possible that some minimal watering may occur to establish seedlings during revegetation. Given the low rainfall during 2023-24, this may even assist the survival of existing vegetation in retained areas, which may in turn benefit the WRP and provide a minor recharge of the water table.

Suggested mitigation/s

N/A

10) Altered fire regimes

Predicted impact if no mitigation *Minor*

Due to safety concerns for human inhabitants of the proposed development, any changes to fire regimes are likely to be in the form of less frequent fires, which would be of benefit to WRP rather than cause any negative impact. However, clearing required for fire safety (firebreaks and other asset protection zones) may negatively impact WRP if valuable foraging, shelter, or connectivity is compromised. The previous installation of firebreaks at the site may already have contributed to the reduction of the population in the southern section of the project site (see Plate 8).

Suggested mitigation/s

Consider connectivity for WRP when developing fire management plans. Ensure that connectivity and critical vegetation for food and shelter are maintained. This may include installation of fireproof possum bridges across firebreaks.

Predicted impact with mitigation *Negligible*

11) Disturbance (dust, light, noise)

Predicted impact if no mitigation *Minor*

WRP appear to have adapted fairly well to urbanisation (Busschots *et al.*, 2021; Van Helden *et al.*, 2021) and are unlikely to be negatively affected by dust, light and noise associated with operations once construction is complete.

Dust, light and noise during construction may impact possums if it is excessive, although construction activity will be during daylight hours when WRP are usually asleep. If noise levels are > 65 dB, WRP may be disturbed, however noise at this level would also disturb nearby humans, requiring mitigation. If trees containing possums are physically shaken or knocked by construction equipment, the possums may leave their dreys. Excessive lighting can increase predation pressure by making the animals more visible to predators such as Masked Owls and foxes.

Suggested mitigation/s

Aim to determine locations of all WRP prior to work commencing. Most animals will be able to be located, however animals sheltering in hollows may escape detection, so a fauna spotter must be onsite and observing at all times when vegetation is being cleared. Dust should be controlled in line with human occupational health and safety guidelines. Noise levels should remain below 65dB. Vehicles must avoid excessive vibration or bumping adjacent trees when working in an area. In the event that a WRP is flushed from a tree, it must be located and determined to be in a safe location by the specialist fauna spotter before work can recommence (as described in Item 5 above). Lighting to be installed in the village should be the minimal level to provide safety for residents and should either be_LPS (Low Pressure Sodium) or filtered / shielded LED with UV and infrared being removed, as marsupials can detect UV. Low wavelength (violet and blue) light should be avoided.

Predicted impact with mitigation *Negligible*

The WRP recovery plan lists seven outcomes that may result in a 'significant impact' (as per the EPBC Act) to WRP. Actions within habitat critical to the survival of WRP that result in these outcomes "may have a significant impact on the WRP" (DPaW, 2017, p. 31), therefore the proposed development has been reviewed in relation to these specific outcomes, and this is summarised below. Note that there is some overlap between these outcomes and the general threatening processes discussed above.

1) Impact/outcome: Clearing/loss of WRP habitat

Comment in relation to proposed development

Complete clearing of 3 ha of core habitat (Peppermint forest) for WRP will likely result in an area that can support fewer WRP and therefore an impact on this species. Strategic clearing, whereby mature habitat trees (that provide food and refuge sites) are retained, combined with re-vegetation of some areas with species that provide high quality forage, would help to mitigate this impact on WRP. Revegetation must commence as soon as possible to minimise the lag time between clearing and replacement of food resources. A mixture of advanced plants and seedlings should be used. The advanced plants would provide immediate food resources while the seedlings would establish strong root systems and be more likely to have long-term viability.

Removal of up to 40% of canopy cover in areas proposed to be modified may also result in an area that can support fewer WRP individuals, as these canopy cover trees are likely to also be habitat trees for WRP (providing shelter and food as well as connectivity). Loss of WRP habitat can be mitigated to some extent by installation of possum bridges to maintain canopy connectivity, and revegetation with nitrogen rich plants to increase food resources. The retention of mature trees and key foraging species should be prioritised wherever possible, to minimise the loss of habitat for WRP. Priority species for retention and recommended species for revegetation are summarised in Appendix 5.

2) Impact/outcome: Decrease in canopy connectivity and canopy condition in WRP habitat

Comment in relation to proposed development

Clearing of trees that contribute to canopy connectivity is likely to have a significant impact on WRP via decreased ability to move safely within the project area, and decreased ability to disperse (into or out of) the project area. Clearing required for fire mitigation could contribute to the loss of canopy connectivity.

It should be noted that while the area to be ceded will provide important habitat and connectivity for other vulnerable species such as the Quokka *Setonix brachyurus*, it is mostly low, coastal

vegetation and is unlikely to provide connectivity for WRP, so this will need to be provided within the proposed development envelope to maintain connectivity of the population between the conservation areas to the north-east and south.
Loss of canopy connectivity and condition could be mitigated by strategic clearing whereby mature trees that contribute to the canopy are prioritised and retained. Fire mitigation measures and need to be carefully considered to ensure natural canopy connectivity is maximised and that further clearing is not required post-approval that would affect canopy condition and connectivity for WRP. Where natural canopy connectivity is compromised, fireproof possum bridges may be able to be used to create artificial connectivity. However, retention of trees should be the priority and possum bridges a last resort.

3) Impact/outcome: Decrease in food availability

Comment in relation to proposed development
Complete clearing of trees that provide food resources (primarily the Peppermint forest core habitat and associated food plant species) will result in a decrease in food availability. This could be mitigated by strategic clearing whereby mature Peppermint trees are retained (preferable), and understorey areas are strategically revegetated with high quality forage plants. The latter will be less effective in terms of mitigation if the understorey is less than 1 metre as WRP will need to forage lower down or on the ground which puts them at increased risk of predation. Suggested plant species for revegetation are summarised in Appendix 5.

4) Impact/outcome: Decrease in refuge site availability

Comment in relation to proposed development
Loss of mature trees, particularly those containing, or capable of containing dreys and hollows, will result in a decrease in refuge site availability. Strategic clearing, where mature trees and trees containing dreys or hollows are retained, will be the most effective mitigation measure. Provision of artificial dreys can assist with replacing lost refuge sites or increasing refuge site availability (if additional artificial dreys are added without loss of existing dreys). Artificial dreys have been used successfully by BCE for WRP in other locations (Bamford *et al.*, 2023), where prior to clearing of trees containing dreys, twice the number of artificial dreys were installed as were to be cleared. This provided the animals with known shelters that they could relocate to, in the event that one of the natural shelters in their home range was removed.
Dense understorey areas are likely to provide refuge sites during the heat of summer if WRP come to the ground. Revegetation with suitable species (such as sedges) may provide valuable shelter and refuge at ground level (see Appendix 5).

5) Impact/outcome: Increased likelihood of predation on the WRP

Comment in relation to proposed development
Predation by feral predators (particularly foxes) will already be having an impact on the WRP population in the project area. However, development can increase densities of feral predators due to new roads facilitating increased movement of predators, and anthropogenic resources available in areas of development providing food and attracting predators.

The loss of connectivity would also increase WRPs' exposure to feral predators as they would need to go to the ground to move between trees.

Native predators of the WRP include the Wedge-tailed Eagle, Masked Owl, Chuditch and South-west Carpet Python (DPaW, 2017), and these species may all be impacting the WRP in the project area. It is not considered likely that the proposed development will increase predation from these species as they are likely to be negatively impacted by the proposed development. If Masked Owls are present,

they may attempt to hunt WRP on exposed sites such as bridges, so minimising the length of bridges or ensuring that there is some shelter along them, would mitigate this risk. Masked Owls are also a conservation significant species, so some predation of WRP by these birds would not be of concern.

Fox trapping may assist by reducing fox numbers but is thought to lead to concurrent increases in other predators such as cats and native predators. Therefore, the potential benefit of fox-baiting or trapping may be outweighed by an increase in predation by other species. Trapping of feral cats should also be undertaken.

The most effective way to minimise predation risk to WRP is to retain existing shelter and canopy connectivity and provide aboveground water sources (see Appendix 11), so that individuals do not need to come to the ground to move throughout the project area. Therefore, it is recommended that large trees that contribute to canopy connectivity are retained (see Appendix 5 for priority species for retention), possum bridges are installed where required to create connectivity and at least six above-ground water sources be provided so that WRPs do not need to come to the ground to drink.

6) Impact/outcome: Increased likelihood of competition of the WRP with other fauna

Comment in relation to proposed development
Loss of trees that provide shelter (in the form of hollows or dreys) will result in increased competition for remaining shelters. This could be mitigated by retaining trees that provide shelter (preferred), and providing artificial shelter options to more than replace any that are lost, eg. twice the number of shelters as are to be removed. These artificial shelters should be installed at least a week before natural shelters are removed.

7) Impact/outcome: Reduced ability of the WRP to disperse

Comment in relation to proposed development
Canopy connectivity is key to allowing WRP to disperse from the project area into adjacent areas of suitable habitat. Clearing of mature trees that contribute to the canopy may result in a reduced ability of the WRP to disperse. To mitigate this, large trees that contribute to canopy connectivity should be retained. If it is not feasible to retain all trees, development should occur based on retention of as much canopy *connectivity* as possible; it is not the amount of canopy cover alone that is important but also the functional connectivity of this canopy in allowing WRP to move through and into and out of the project area. Where connectivity is compromised, possum bridges may assist in providing artificial connectivity. Previous research and monitoring has shown these to be readily used by WRP (Yakochi and Bencini, 2015, Bamford *et al.*, 2023).

3.4 Summary of recommendations for mitigation of threats and improvement of WRP habitat

As discussed by Thompson and Thompson (2009), *in situ* management of WRP in development areas is likely to have a better conservation outcome for WRP compared to translocation of individuals to another area of remnant vegetation. This is because WRP appear to cope fairly well in developed areas, and translocations are often unsuccessful (e.g. individuals do not survive). Given this, and based on the above general review of threatening processes and review of the development against outcomes identified in the WRP recovery plan, the following mitigation measures have emerged as crucial measures to reduce the impact of the proposed development on WRP:

- Retention of habitat trees where possible, particularly when they provide canopy connectivity, hollows, dreys and/or high-quality foliage for foraging.
    - This provides mitigation against several potential impacts, including loss of WRP habitat, loss of connectivity between WRP populations/reduced dispersal, loss of refuge sites, decrease in food availability, mortality during operations, mortality due to predation and competition with other fauna.
    - Priority tree species for retention include Peppermint, Marri, any old trees with hollows, Nuytsia (particularly large, mature clumps), Banksia, Myrtaceous shrubs and Casuarina species.
- Provision of possum bridges or other raised structures such as pergolas, fences and lattices at least 2 metres high between pockets of vegetation within the site, as well as a bridge over Smith's Beach Road, in the north-eastern corner. The area to be ceded is unlikely to provide connectivity for WRP as it is mostly low, coastal vegetation so connectivity must be provided within the development.
    - Connectivity between the project area and suitable surrounding habitat should be maintained as much as possible. Artificial connectivity may be able to be created by possum bridges, as achieved in Busselton (Bamford *et al.*, 2023, Yokochi and Bencini 2015, and see Appendices 7 - 9).
    - Possum bridges in the form of rope bridges are readily used by WRP (Yokochi & Bencini, 2015) and can be used to maintain canopy connectivity within the site if large trees are removed (although retention of trees is preferable). WRP will use anything from a simple 40 – 50mm gauge rope to more elaborate, robust structures. Some examples of rope bridges used by WRP in Busselton are provided in Appendices 7 – 9.
    - Rope bridges require ongoing maintenance and this needs to be factored into the design. Ongoing maintenance will be required unless tree canopy will eventually be reinstated. In some situations, permanent structures such as pergolas, fencing and lattice 'possum highways' may be preferred. A well-designed blend of rope bridges, vegetation and permanent structures (>2m high) could provide connectivity for WRP and may work well within the development.
    - Guidance on construction of a variety of possum bridges can be found in Appendices 7-9.
    - Materials used to construct possum bridges should consider fire mitigation; non-flammable rope may be required in some areas.
    - Addition of possum bridges may simply replace connectivity that is lost due to clearing, or (depending on the number of bridges and other structures installed) could also increase existing connectivity and result in a net benefit to WRP in the southern part of the site.
    - Possum bridges over Smith's Beach Road and over the firebreaks throughout the core habitat of Peppermint forest and connecting to the National Park to the south may benefit the WRP population currently living in the project area and possibly allow additional WRP to utilise the area, possibly resulting in a net benefit to WRP.
    - The exact location of additional possum bridges cannot be advised at this stage as it depends on the location and extent of canopy connectivity that will be lost, and how many habitat trees can be retained. A detailed on-ground survey of the current locations of WRP and recording of significant trees will be required as a first step.

Once the significant trees and corridors are identified, a detailed map of proposed trees to be removed could be generated by the client. Once this is provided, the exact locations of possum infrastructure can be determined in consultation with the client.

- Provision of artificial dreys
    - Loss of large trees will reduce the amount of shelter available for WRP, and this can be partially mitigated by providing artificial dreys.
    - A variety of artificial dreys/shelters were used by BCE in Busselton (Bamford et al., 2023), including relocation of existing dreys, relocation of natural tree hollows, domes constructed from hanging baskets wired together, single hanging baskets installed as a cup, and plastic buckets – all types of shelter were used to some extent by WRP. Further details are provided in Appendix 8.
    - The exact numbers of artificial dreys to be installed cannot be advised at this stage as it depends on how many habitat trees are lost, how many dreys and hollows are lost and where these losses occur. A detailed survey recording each drey, as well as spotlighting at night to locate animals that may be sheltering in hollows will be required. These locations will need to be checked again immediately prior to clearing to ensure that animals haven't created new dreys in different locations. In previous projects, the proponent was required to install twice the number of dreys as were removed. Depending on the number of dreys installed, this may result in a net benefit to WRP in the area.
    - The locations of artificial dreys should be determined by the locations of the natural dreys to be removed. Artificial dreys should be located in the closest trees to be retained, provided they have good canopy cover. The exact locations are best determined on site on a case-by-case basis.
    - All artificial dreys should be installed in advance (at least a week) prior to removal of a tree taking place.
- Careful monitoring and management of the population prior and during development
    - Dreys and possum activity needs to mapped across the site with the aim of locating all WRP on the site. This will be approximate, as some animals may be concealed within hollows, or may enter or leave the area before development occurs, however a thorough, recent survey is needed to confirm current numbers and locations. This will help guide detailed decisions such as the positions of possum bridges.
    - A detailed fauna management plan needs to be developed outlining the procedures required to minimise the risk of injury to WRP or unnecessary damage to their environment.
    - If the development proceeds, the survey will need to be repeated just prior to clearing commencing so that each possum is located and can be managed safely. Clearing should happen sequentially, so that animals have adjacent shelter to move to.
    - All workers on the site need to be briefed on the importance of protecting WRP, and the need to follow the protocols set out in the fauna management plan.
    - If an animal 'goes to ground' then work must stop until the following day, allowing the animal to move away overnight.
    - Planting should commence as soon as possible, ideally in advance of clearing, if this can be managed.

    - Possum infrastructure should also be installed as soon as possible, and at least one week prior to development to allow WRP time to become familiar with the infrastructure and avoid unnecessary exposure to predation when clearing commences.
- Revegetation with high-nitrogen plants to provide quality foraging resources for WRP.
    - Depending on the level of habitat loss associated with the development, planting of high nutritional value vegetation may mitigate the impacts of loss of foraging habitat or may even increase the amount of foraging habitat and result in a net benefit to WRP.
    - Recommended plants for revegetation are summarised in Appendix 5. This list includes species that are expected to grow well in the project area, as well as provide foraging opportunities and/or refuges for WRP.
    - The benefits of revegetation will be realised sooner if some more advanced plants are used for revegetation (as discussed in Thompson & Thompson, 2009), although planting of seedlings may result in superior root growth and higher long-term survival. Given this, a mix of advanced and small seedlings is recommended.
    - Revegetation should commence as soon as possible, and ideally clearing should occur sequentially to allow effective management of the WRP population and all individuals to locate alternative food sources nearby. Planting some advanced stock in these areas would provide 'instant' high quality food while smaller seedlings establish.
- Provision of above-ground water sources to allow WRP to remain above ground and therefore at lower risk of predation or mortality during construction and operations.
    - Above-ground water sources within the southern portions of the core habitat of peppermint forest, combined with possum bridges to provide connectivity over firebreaks, may allow WRP to utilise more of this core habitat.
    - Above-ground water sources could be constructed similarly to "Cockitrough" bird-waterers, details of which are given in Appendix 11.
    - As a rough guide, we would recommend installation of at least six above-ground water sources throughout the development area. The exact locations will depend on where habitat and connectivity are being retained or created.
    - These water sources need to be maintained to ensure clean fresh water is available, and to prevent them becoming a source of disease for WRP and other fauna that may utilise them. The 'Cockitrough' design provided in Appendix 11 is connected to mains water and automatically flushes. If the site will have access to scheme water, this would be an ideal, low maintenance solution. In addition to the automatic flushing, it is recommended that the possum waterers be monitored in the first year of operation and a periodic cleaning regime implemented at the frequency determined by monitoring – likely once per week. Cleaning, if required, can be done using a solution of vinegar or sodium bicarbonate and a scrubbing brush, then thoroughly flushed to remove any residue. Any build-up of leaves should be removed.
- Control of feral and domestic cats and dogs
    - The most effective way to reduce injury or predation of WRP is to retain or create canopy connectivity so that WRP individuals do not need to come to the ground. However, individuals may come to the ground during hot weather.

- To protect WRP individuals on the ground, it is crucial to appropriately manage pet dogs and cats, and control of feral predators such as cats and foxes may be important.
- Examples of pet management that may be suitable include restricting pets from entering the tourist park and holiday homes, or ensuring pet owners keep pets contained to their own property and pet waste disposed of appropriately, in order to protect wildlife.
- Control and management actions may be seasonally dependent, as WRP individuals will be more likely to come to ground during hot weather.
- Design of human dwellings on the site should consider co-existence with WRP. Roof spaces should be sealed so that they cannot be accessed by WRP or rats (to reduce the risk of people resorting to rodenticides and putting native wildlife including WRP at risk). Facilities for waste management should be secure and adequate to ensure that WRP, rats, cats and foxes cannot access them. Construction materials such as fences and pergolas should avoid pale colours that can be prone to staining, prompting complaints from residents.

If designed and managed appropriately, the proposed development has the potential to result in a net benefit to WRP in the area, if habitat loss is minimised, canopy connectivity is prioritised, supplementary habitat (possum bridges, artificial dreys, revegetation, water sources) provided to enhance what is currently available and detrimental anthropogenic behaviours such interactions such as incorrect feeding, inadequate control of feral and domestic animals are addressed. The proposed development also has the opportunity to contribute towards key objectives of the WRP recovery plan, which include (from DPaW, 2017):

1. Habitat critical for survival for WRP is identified and protected in each key management zone;
2. Threatening processes that are constraining the recovery of WRP are mitigated in each key management zone;
3. An evidence-based approach is applied to the management and recovery of WRP;
4. The management of displaced, orphaned, injured and rehabilitated WRP aids the conservation outcome for the species; and
5. Increased awareness of the status of WRP and support behaviour change to mitigate anthropogenic threatening processes.

This development presents an opportunity to showcase the WRP and increase awareness of this species amongst the public, thus contributing to objective 5 of the recovery plan. It will be essential to engender a positive attitude towards WRP among residents and visitors to the development. They will need to feel protective towards them so community attitudes will need to be carefully managed by education, and regulation where required. Increased awareness of the WRP and their needs may be achieved via interpretive signage around the tourist park, and/or through presentations and displays at the proposed Community Hub and/or Cape to Cape Welcome Centre. Although increased awareness can have benefits for the conservation of WRP, there is also the potential for this to lead to negative interactions between humans and possums (human-wildlife conflict). For example, guests may attempt to attract possums by providing food, which can result in several negative consequences for individual possums (increased risk of predation, illness and disease caused by inappropriate diet). Therefore, information should be provided regarding appropriate ways for the public to observe and protect the possum population, with the aim of reducing the likelihood of negative interactions that

may harm WRP. Care should be taken to ensure residents and guests appropriately manage their pets (via containment to their own property) and take steps to prevent possums from accessing human or pet food resources. Information should also be provided to residents and guests on how to co-exist with WRP, what to do if they find an injured animal, or an animal that has found its way inside or in an unsafe location.

In order to successfully manage the proposed development with respect to impacts on WRP, it is recommended that a fauna management plan be developed and implemented to guide works. In order for this to be implemented successfully, contractors involved in clearing and construction must be briefed on and be supportive of the management plan. Suggested management actions would include:

- retention of habitat where possible, particularly high value foraging trees and trees that contribute to canopy connectivity;
- Installation of possum bridges, artificial dreys and above ground water sources (which must be regularly flushed to ensure water does not spread disease). Possum bridges and dreys should be installed prior to clearing of trees;
- A thorough survey immediately prior to any clearing, to determine locations of individual possums and allow for targeted translocation or displacement of individuals prior to clearing;
- Carefully managed displacement (this is preferred as no handling is required) or translocation (via trapping and handling, secondary option if displacement isn't possible) of individuals prior to any clearing, following methods successfully used by BCE in Busselton (Bamford *et al.*, 2023). *In situ* management of WRP (whereby individuals are temporarily displaced to protect them from injury during clearing, but not moved to a completely different site) is recommended as translocations are believed to often be unsuccessful (discussed in Thompson & Thompson, 2009). This will only be possible if sufficient habitat and connectivity is retained and enhanced within the development.
- Interpretive signage and/or educational material and presentations provided throughout the site and the community hub.

To determine the success of the fauna management plan, and to highlight any need for adaptive management, ongoing monitoring of WRP in the project area is crucial. This has been implemented by BCE as part of a development located in Busselton (Bamford *et al.*, 2023). At this site, individual WRP were displaced prior to clearing of habitat, and then populations were monitored every 2 months for the first year, to determine short-term impacts, and will be monitored twice per year for the following 9 years, to assess long-term trends. Each session of monitoring for the Busselton project entails checking all natural and artificial dreys with binoculars or a pole-camera to determine occupancy, and additional opportunistic observations of WRP individuals or new natural dreys are recorded. In addition to checking dreys, monitoring of possum bridges is undertaken using motion sensitive cameras, to determine whether they are being used. Opportunistic searching for WRP scats under possum bridges is also undertaken. Monitoring such as that used in Busselton should be conducted at the Smith's Beach site, as well as keeping a record of adverse events such as mortality of WRP (e.g. via predation or vehicle strike) and instances of human-wildlife conflict (such as possums entering houses, and other interactions with humans or pets).

3.5 Conclusions

In summary, key considerations to maintain and improve habitat quality for WRP in conjunction with the Smith's Beach development proposal include maintaining and increasing connectivity of the canopy, planting nitrogen-rich understorey plants, providing water sources off the ground, designing the human dwellings and infrastructure to minimise conflict and support persistence of WRP and provision of possum bridges and artificial dreys as required. Several of these mitigations (retaining trees, provision of connectivity by structures such as possum bridges and artificial dreys) have been shown to be successful at maintaining WRP population size at a Busselton site at least in the short term (Bamford *et al.*, 2023). In fact, monitoring at the Busselton site suggests that the WRP population size in this area has increased, possibly due to the increased number of refuge sites (artificial dreys) available, the increased connectivity and improved food resources due to revegetation. Minimising clearing, maximising connectivity and the speed and effectiveness of revegetation, as well as considering fire regulations, will be crucial to supporting WRP at the site and the surrounding area. Pet management and raising public awareness of and support for the presence and significance of this species are important when considering the potential impact of human-wildlife interactions. Increasing connectivity across Smith's Beach Rd and across existing firebreaks would also help the population long term, by providing more connectivity between the project area and the national park to the north-east and south, noting that this connectivity for WRP will not be provided by the area to be ceded to the national park and will need to be provided within the development It is recommended that if the project receives approval, a fauna management plan be developed and implemented in order to manage potential impacts to WRP. Ongoing monitoring is recommended to assess the success of the management plan and enable adaptive management, should it be required.

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5 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

Vegetation and substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.*, 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relictual or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

VSA assessment was made with reference to the key attributes provided by (EPA, 2020):

- soil type and characteristics
- extent and type of ground surfaces and landforms
- height, cover and dominant flora within each vegetation stratum
- presence of specific flora or vegetation of known importance to fauna
- evidence of fire history including, where possible, estimates of time since fire
- evidence and degree of other disturbance or threats, e.g. feral species
- presence of microhabitats and significant habitat features, such as coarse woody debris, rocky
- outcrops, tree hollows, water sources and caves
- evidence of potential to support significant fauna
- function of the habitat as a fauna refuge or part of an ecological linkage.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, three broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

<u>Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts</u>.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN, 2012), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The *Wildlife Conservation Act 1950* uses a series of seven Schedules to classify conservation status that largely reflect the IUCN categories (IUCN, 2012).

Conservation Significance (CS) 2: Species listed as Priority by DBCA but not listed under State or Commonwealth Acts.

In Western Australia, DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the *Wildlife Conservation Act 1950* but for which DBCA feels there is cause for concern.

Conservation Significance (CS) 3: Species not listed under Acts or in publications, but considered of at least local significance because of their pattern of distribution.

This level of significance has no legislative or published recognition and is based on interpretation of distribution information, but is used here as it may have links to preserving biodiversity at the genetic level (EPA, 2002). If a population is isolated but a subset of a widespread (common) species, then it may not be recognised as threatened, but may have unique genetic characteristics. Conservation significance is applied to allow for the preservation of genetic richness at a population level, and not just at a species level. Species on the edge of their range, or that are sensitive to impacts such as habitat fragmentation, may also be classed as CS3, as may colonies of waterbirds. The Western Australian Department of Environmental Protection, now DBCA, used this sort of interpretation to identify significant bird species in the Perth metropolitan area as part of the Perth Bushplan (Dell & Banyard, 2000).

Marine-listed species

Some conservation significant species may also be listed as 'Marine' under the EPBC Act. This listing protects these species in 'Commonwealth areas' which include "marine areas beyond the coastal waters of each State and the Northern Territory, and includes all of Australia's Exclusive Economic Zone (EEZ)" (DEH, 2006). The EEZ extends to 200 nautical miles (approximately 350 kilometres) from the coast (DEH, 2006). This may mean that the 'Marine' listing does not apply to the project/project area (depending on its location). Therefore, when a species is otherwise protected (under the EPBC Act or BC Act) or priority-listed (by the DBCA) then the Marine listing is also noted but it does not have site-specific relevance. In cases where a species is solely Marine-listed (for a list see DEH, 2000) and a project/project area is not within a Commonwealth area then it is treated like all other fauna.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) also fall within the CS3 category, as they have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda (freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey, 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes and conditions that apply to the existing environment and that affect and maintain fauna populations in an area. As such they are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project area may be affected and effectively determined by processes such as:

- fire regime.
- landscape patterns (such as extent of existing habitat, fragmentation and/or linkage).
- the presence of feral species.
- hydrology.

Appendix 2. Categories used in the assessment of conservation status.

IUCN (International Union for the Conservation of Nature) categories, as outlined by IUCN (2012), and as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Biodiversity Conservation Act 2016*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Biodiversity Conservation Act 2016, updated 2023*

Schedule 1	Specially protected fauna Division 1 – Species of special conservation interest (S1D1) Division 2 – Migratory species (S1D2) Division 3 – Species otherwise in need of special protection (S1D3)
Schedule 2	Threatened species Division 1 – Critically endangered species (S2D1) Division 2 – Endangered species(S2D2) Division 3 – Vulnerable species (S2D3)
Schedule 3	Extinct species (S3)

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature and under the EPBC Act, in which threatening processes are listed (see Appendix 4). Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

Note that the terms direct and indirect impacts are used by the DotE (2013), DSEWPaC (2013) and EPA (2016), but there is some inconsistency in how these are defined. The federal guidance does not define direct impact but has a very broad definition of indirect, and makes the statement (DotE, 2013) '*Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action*.' Indirect impacts therefore can even include what the DotE (2013) calls facilitated impacts, which are the result of third party actions triggered by the primary action. In contrast, the EPA (2016) defines direct impacts to '*include the removal, fragmentation or modification of habitat, and mortality or displacement of individuals or populations.*' This document then lists as indirect impacts what in many cases are the consequences of the removal, fragmentation or modification of habitat. For example, '*disruption of the dispersal of individuals required to colonise new areas inhibiting maintenance of genetic diversity between populations'* is a consequence of habitat fragmentation. Impacts of light, noise and even roadkill are defined as indirect but they are clearly the result of the action and in control of the person taking the action. Roadkill is as direct a form of mortality as can be observed, but it is considered as an indirect impact in the context of a development presumably because it is not directly linked to land clearing. The EPA (2016) makes a strong distinction between removal of vegetation (direct impact) and the consequences of such clearing and other aspects of a development (indirect impacts). It is not obvious how this distinction between direct and indirect impacts is helpful in the EIA process, as the key aim is to ensure that all impacts that result from a project are addressed in this assessment process. Interestingly, Gleeson and Gleeson (2012), in a major review of impacts of development on wildlife, do not use the terms direct or indirect. In the following outlines of threatening processes that can cause impacts, the emphasis is upon interpreting how a threatening process will cause an impact. For example, loss of habitat (threatening process) can lead to population decline and to population fragmentation, which are two distinct impacts, with population decline considered a direct impact and fragmentation an indirect impact by the EPA (2016).

Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation (Gleeson & Gleeson, 2012; Soule *et al.*, 2004). Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

Degradation of habitat due to weed invasion leading to population decline

Weed invasion, such as through introduction by human boots or vehicle tyres, can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

Increased mortality

Increased mortality can occur during project operations; for example from roadkill, animals striking infrastructure and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty, 1989; M. E. Jones, 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Clevenger & Waltho, 2000; Jackson & Griffin, 2000; Scheick & Jones, 1999).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent the feral Cat (Burbidge & McKenzie, 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Similarly, Read *et al.* (2015) found a decline in some bird species but an increase in others in the vicinity of active mines and concluded this was due to the mine attracting large and aggressive species that displaced other species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and

altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major.

Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed, 1998), which may impact on a range of fauna associated with this vegetation type.

Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Fox, 1982; Gill *et al.*, 1981; Letnic *et al.*, 2004). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge & McKenzie, 1989). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land, including managers of mining tenements.

Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich & Longcore, 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M. Bamford pers. obs). The abundance of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich & Longcore, 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al.*, 2004) :

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 22 key threatening processes listed by the federal Department of Climate Change, Energy, the Environment, and Water (DCCEEW, 2023b) :

- Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners (Manorina melanocephala).
- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Fire regimes that cause declines in biodiversity.
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.
- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.

- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant).

General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, the federal Department of Agriculture, Water and the Environment (DAWE) produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?
- Will the proposed action disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action interfere with the recovery of the species?

Appendix 5. Priority plant species to retain and recommendations for revegetation.

Summary list of locally occurring plant recommended for revegetation based on their likely attractiveness to possums, according to Mathieson et al. (2020), Nature Conservation Margaret River Region (n.d.), A Bamford (pers. obs) and listed in the flora and vegetation report by Emerge (2019). Latin names in **bold** indicate species that are known to be used by WRP and are also local to the project area. These species should be a high priority for protection and revegetation.

Latin Name	Common Name/s	Relevance for WRP	Comments
N/A	Old trees with hollows	Provide shelter for WRP, and large trees are likely to contribute to canopy cover/connectivity.	Retain where possible. If isolated, use possum bridge to increase connectivity.
Agonis flexuosa	Wanil/WA Peppermint	WRP habitat trees – high quality foliage, sites to build dreys, canopy connectivity	Retain where possible. If isolated, use possum bridge to increase connectivity. Use for revegetation
Corymbia calophylla and ***Eucalyptus marginata***	Marri, Jarrah	WRP habitat trees – new growth and flowers provide food, trees provide sites to build dreys and canopy connectivity. Height of trees provides good protection from predators.	Retain where possible. If isolated, use possum bridge to increase connectivity. Use for revegetation.
Casuarina and Allocasuarina spp. ***Allocasuarina fraseriana*** *Allocasuarina humilis*	Quell / Sheoaks	Contribute to canopy connectivity and provide sites for dreys, also a food plant.	Retain where possible. If isolated, use possum bridge to increase connectivity. Use for revegetation.
Melaleuca lanceolata ***Melaleuca huegelii*** *Melaleuca systena* *Melaleuca viminea*	Melaleuca/Paperbark	Building dreys, protection from predators, flowers provide food.	Retain where possible. If isolated, use possum bridge to increase connectivity. Although only M. huegelii is the only locally occurring species recorded as a food plant for WRP, they almost certainly feed on all these species. Use for revegetation.
Nuytsia floribunda	Moodjar or Christmas Tree	Known food plant, large trees also contribute to shelter and connectivity.	Retain where possible. These are slow growing so large stands of Moodjar on the site are

Latin Name	Common Name/s	Relevance for WRP	Comments
			an important resource for WRP and should be retained. If isolated, use possum bridge to increase connectivity.
Banksia attenuata *Banksia bipinnatifida* *Banksia dallanneyi* ***Banksia sessilis var. cordata*** **(P4)**	Banksias	Shelter, connectivity, some provide food for WRP	Retain large trees where possible. If isolated, use possum bridge to increase connectivity. Use all species for revegetation (particularly *B. attenuata* and *B. sessilis var. cordata* which is Priority 4 species)
Hakea eliptica *Hakea varia* *Hakea oleifolia* *Hakea prostrata* *Hakea trifurcata* *Persoonia longfolia* *Petrophile linearis*	Hakea, Persoonia, Petrophile	Likely to provide food for WRP, large trees may contribute to canopy connectivity. Smaller species could be used as understorey	Use for revegetation
Acacia saligna *Acacia alata* ***Acacia cyclops*** *Acacia littorea* *Acacia pulchella* *Acacia rostellifera*	Wattles	Known and likely food plants for WRP, large trees may contribute to canopy connectivity.	***A. saligna*** and ***A. cyclops*** high priority for revegetation *A. rostellifera* is probably also a food plant and could be used for revegetation.
Gastrolobium ebracteolatum		Likely food plant for WRP.	Use for revegetation.
Calothamnus sanguineus		Provides food for WRP.	Use for revegetation. *Calothamnus sanguineus* is almost certainly a food plant and is locally occurring, so should be used for revegetation.
Kunzea ciliata *Kunzea glabrescens*		Kunzea sp. is used for food and shelter by WRP in Busselton	Use for revegetation
Spyridium globulosum	Basketbush	Known food plant for WRP.	High priority for revegetation
Clematis linearifolia	Old Man's Beard – the local species	Provides dense shelter for possums	Decorative climber.

Latin Name	Common Name/s	Relevance for WRP	Comments
Hardenbergia comptoniana	Native Wisteria	Offers a dark, protected place for WRP to sleep	Priority to use for revegetation.
Lepidosperma gladiatum *L. squamata* *L. calcicola*	Coastal Sword Sedge	Offers refuge if WRP come to ground in the heat of summer.	All three species are locally occurring and could be used for revegetation of understorey.

Additional, non-locally occurring south-western plant species that have been recorded as WRP food plants, based on information from Mathieson et al. (2020), Nature Conservation Margaret River Region (n.d.), A Bamford (pers. obs) and Emerge (2019).

These species could also be used for revegetation and as garden plants, if suitable.

Latin Name	Common Name/s	Relevance for WRP	Comments
Agonis flexuosa nana	Dwarf Willow Peppermint	WRP habitat trees – high quality foliage, sites to build dreys, canopy connectivity	Used by WRP elsewhere. Would be suitable to include in revegetation where low, neat vegetation is required.
Eucalyptus megacarpa *Eucalyptus staerii* *Eucalyptus patens*	Bullich Albany Blackbutt Tuart	WRP habitat trees – new growth and flowers provide food, trees provide sites to build dreys and canopy connectivity. Height of trees provides good protection from predators.	Used by WRP elsewhere. Would be suitable to include in revegetation if appropriate.
Melaleuca viminea	Melaleuca/Paperbark	Building dreys, protection from predators, flowers provide food.	Used by WRP elsewhere. Would be suitable to include in revegetation species recorded as a food plant for WRP, they almost certainly feed on all these species. Use for revegetation.
Banksia grandis *Banksia ilicifolia*	Banksias	Shelter, connectivity, some provide food for WRP	Used by WRP elsewhere. Would be suitable to include in revegetation
Hakea eliptica *Hakea varia*	Hakea	Likely to provide food for WRP, large trees may contribute to canopy connectivity. Smaller species could be used as understorey	Used by WRP elsewhere. Would be suitable to include in revegetation
Paraserianthes lophantha	Cape Leeuwin Wattle or Albizzia	Flowers may provide food for WRP.	Used by WRP elsewhere. Would be suitable to include in revegetation
Callistemon glaucus		Leaves and flowers provide food for WRP.	Used by WRP elsewhere. Would be suitable to include in revegetation. Good for screening/hedging.

Latin Name	Common Name/s	Relevance for WRP	Comments
Calothamnus quadrifidus		Provides food for WRP.	Used by WRP elsewhere. Would be suitable to include in revegetation
Adenanthos sericeus	Woollybush	Known food plant for WRP.	Used by WRP elsewhere. Would be suitable to include in revegetation
Gastrolobium bilobum		Known food plant for WRP.	Used by WRP elsewhere. Local species is *G. ebracteolatum*
Billardiera fusiformis	Australian Bluebell	Provides cool, dense, protection for WRP and other animals, and fruits and flowers provide food for WRP.	Not on the species list Used by WRP elsewhere. Would be suitable to include in revegetation
Clematis pubescens	Old Man's Beard	Provides dense shelter for possums	Used by WRP elsewhere. Best to use the local species. *C. linearifolia* Decorative climber.

Appendix 6. Fauna observed during field investigations.

Latin Name	Common Name
REPTILES	
Christinus marmoratus	Marbled Gecko
Cryptoblepharus buchananii	Fence Skink (Buchanan's)
Tiliqua rugosa	Bobtail
BIRDS	
Larus novaehollandiae	Silver Gull
Thalasseus bergii	Greater Crested Tern
Phaps chalcoptera	Common Bronzewing
Ninox boobook	Southern Boobook
Barnardius zonarius	Australian Ringneck
Lichmera indistincta	Brown Honeyeater
Rhipidura albiscapa	Grey Fantail
Rhipidura leucophrys	Willie Wagtail
Corvus coronoides	Australian Raven
Zosterops lateralis	Silvereye
MAMMALS	
Tachyglossus aculeatus	Short-beaked Echidna
Pseudocheirus occidentalis	Western Ringtail Possum
Macropus fuliginosus	Western Grey Kangaroo

Appendix 7. Example of rope bridge used by researchers

A rope bridge was constructed across Caves Road near Busselton, and monitored for use by Western Ringtail Possums (Yokochi & Bencini, 2015). The bridge was constructed of netting made from marine grade rope, strung between two steel wires set 300mm apart. The bridge was about 26.5m long and supported on each side by 8.5m tall wooden poles with concrete foundation and metal stay wires. WRP started investigating the bridge while construction was occurring, and an individual made the first full crossing 36 days after installation was completed (Yokochi & Bencini, 2015). Use of the bridge increased over time during the 270 days of monitoring (Yokochi & Bencini, 2015), indicating that it is likely it is providing functional connectivity and was not just investigated as a novelty when first installed. Some photos taken from this publication are shown below (with the permission of the authors) to give an indication of construction and full details can be found via the following link: https://natureconservation.pensoft.net/article/4385/

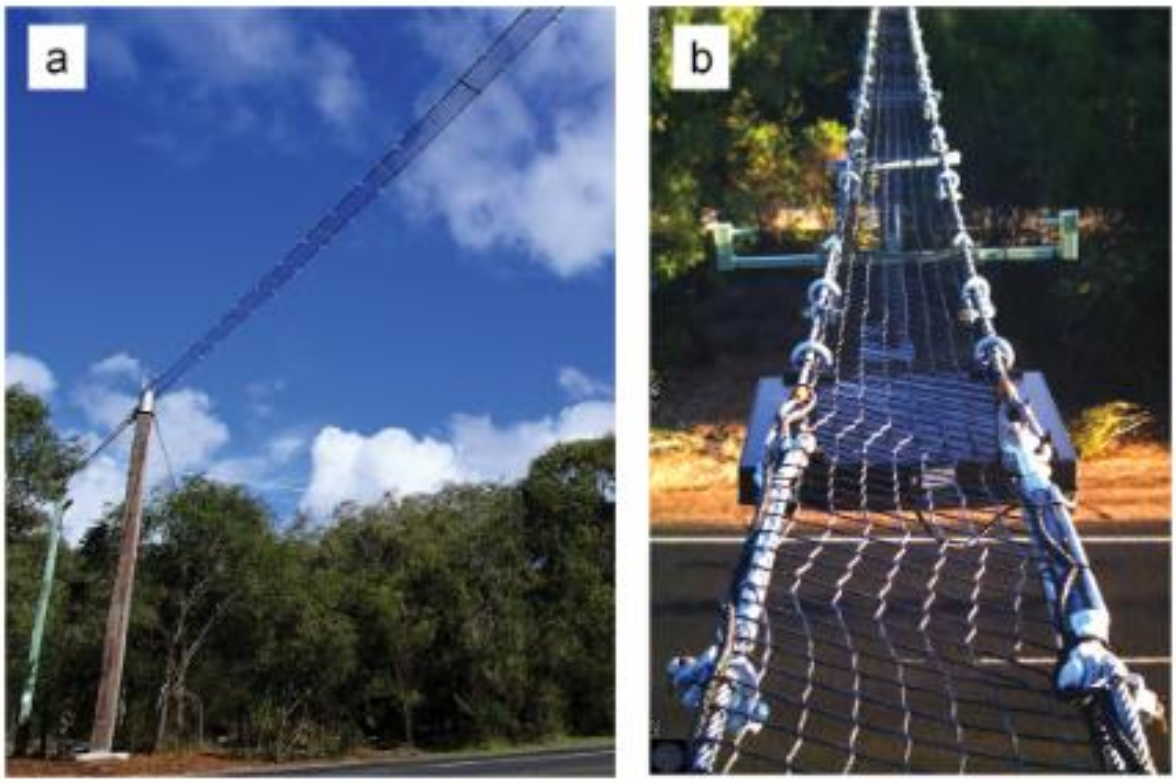

Figure 2.
A rope bridge installed on Caves Road near Busselton, Western Australia. **a** Two stay wires and a rope extending from the pole of a rope bridge to nearby trees on South side of Caves Road **b** Close up of the bridge showing one of the sensors and microchip reader on the North side (taken by an infrared camera on the bridge).

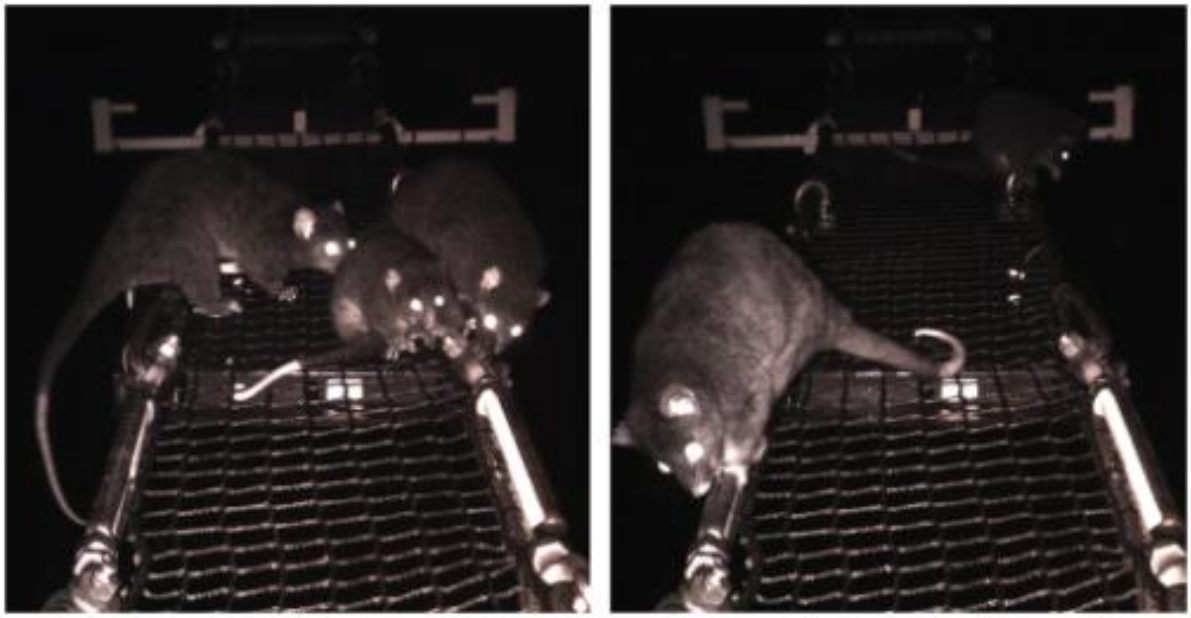

Figure 5.
Photographs of mother and young *Pseudocheirus occidentalis* crossing the road using the rope bridge near Busselton, Western Australia. The left photograph is of a mother and her young with another adult possum.

Appendix 8. Details of rope bridges used by BCE in previous work with Western Ringtail Possums

Example of natural fibre, 50mm sisal rope bridge constructed in Busselton (from Bamford et al., 2023, p. 38). Ropes were either attached and supported by tree branches or attached to steel poles. Stays were added for stability. Sustainable, biodegradable natural fibre was used in this location as the bridges are intended as temporary structures while revegetation is undertaken. In most areas, trees will provide connectivity after ten years and the ropes will be unnecessary.

Image 18. Rope Bridge along College Avenue installed by Tree Surgeons WA. Project Approvals require six rope bridges to be maintained for 10 years to help improve connectivity for possums, so they do not need to come to the ground.

Western Ringtail Possum crossing sisal natural fibre rope bridge (from Bamford et al., 2023, p. 40)

Image 21. *Western Ringtail Possum crossing the same rope bridge as shown in the previous image, adjacent to Scott St in Busselton on 17 February 2023.*

Appendix 9. Images of Abbey Possum bridge.

This is a simpler design than the bridge studied by researchers in Appendix 7, however is a still a robust design which is likely to require less maintenance than the rope bridges shown in Appendix 8. (Images courtesy of Roberta Bencini).


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Appendix 10. Details of artificial dreys used by BCE in previous work with Western Ringtail Possums.

Summary of monitoring of artificial shelters (Bamford et al., 2023, p. 21):

"Artificial shelters were adopted quickly and have been used consistently in both sampling periods in Year Two. The availability of additional shelter is likely to have supported the population of possums following displacement and may have contributed to the sustained increase in numbers of possums at the ends of the breeding seasons (45 in January 2022, 64 in February 2023) by providing additional shelter for newly independent juveniles."

Images on the following page show construction methods for artificial shelters (Bamford et al., 2023, p. 34):

***Images** 2-7. A selection of designs of Artificial Shelters: Dome – no coconut (Dom); Short Hollow (Hol); Cup with coconut (CuCo); Cup – no Coconut (Cup); Plastic Bucket (Buc); Dome with coconut (DoCo). More detailed analysis will be possible once more data has been collected.*

Appendix 11. Suggestions for above ground water sources

"Cockitroughs" have been constructed for use by black-cockatoos and other birds, and provide a permanent fresh water supply. This idea could be adapted for use by WRP by linking such structures to existing canopy via possum bridges, to allow possums to safely access water. These water sources would also be used by birds in the area, including threatened black-cockatoos, which would be an additional benefit for wildlife, and may appeal to guests as an opportunity to observe these and other bird species. "Cockitroughs" have been successfully implemented by multiple local councils in the Perth metropolitan area. More information can be found via the following link:

https://www.victoriapark.wa.gov.au/Profiles/vicpark/Assets/ClientData/Documents/Residents/Environment/Bird_waterers/TOVP_Bird_Waterer_Pamphlet_2023_DRAFTV2.pdf

Screenshot from flyer, showing structure and features of "cockitrough" bird-waterers

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