Bunbury Outer Ring Road – Southern Section

MNES Fauna Management Plan

July 2022

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July 2022

Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
A	June 2022	Review Draft	All
0	July 2022	Final for Approval	All
1	July 2022	Revised final for Approval	All
1a	July 2022	Revised final for Approval	All

EXECUTIVE SUMMARY

Bunbury Outer Ring Road Project

The BORR Southern Section (BORR South/the Proposal) includes the construction and operation of 10.5 km of new freeway standard dual carriageway, associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs. The Proposal is located approximately 200 km south of Perth and, at its closest point, approximately six km south-east of Bunbury.

The Proposal will be constructed within the 200 ha Development Envelope (Figure 1) which is located within the City of Bunbury and Shire of Capel. Approximately 62% of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

Construction of the Proposal is anticipated to commence in 2022 and continue for a period of 2-3 years. Once BORR South is constructed and open for public use, operation of the Proposal will be ongoing.

Purpose of this FMP

This MNES Fauna Management Plan (FMP) has been prepared to meet approval conditions of the EPBC Act approval for EPBC 2019/8543. This document sets out the environmental management actions to manage, monitor and mitigate the direct and potential indirect impacts of the Proposal during clearance, construction and operation of the Proposal, on the following fauna taxa:

- Western Ringtail Possum (*Pseudocheirus occidentalis*) (WRP) (Critically endangered)
- Black-stripe Minnow (*Galaxiella nigrostriata*) (BSM) (Endangered)
- Carnaby's Cockatoo (Calyptorhynchus *latirostris*) (Endangered)
- Baudin's Cockatoo (Calyptorhynchus *baudinii*) (Endangered)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (Vulnerable).

The three Cockatoo species are collectively referred to herein as Black Cockatoos.

This FMP has been prepared consistent with the following guidance documentation:

- Department of the Environment (DotE) (2014) Environmental Management Plan Guidelines
- Department of the Environment and Energy (DoEE) (2019) Action Management Plan Criteria
- Environmental Protection Authority (EPA) Template for Environmental Protection Act 1986 Part IV Environmental Management Plans.

The FMP structure and content has been prepared to align to DotE (2014). The content has been extended to incorporate the additional criteria as outlined by DoEE (2019). Management matrices and risk assessments for the MNES covered under this plan are summarised in Appendix B.

This plan should be read in conjunction with the Habitat Fragmentation Plan, Vegetation Management Plan, Offset Strategy and Offset Management Plan required under conditions 10, 12, 14 and 18 respectively of the EPBC Act approval.

The plan will achieve its objective primarily through implementation of the following actions:

- Sensitive clearing protocols designed to prevent direct impacts to listed threatened fauna (WRP, BSM and Black Cockatoo) and minimise impacts to their habitat, during clearing
- Surface water, groundwater abstraction, hygiene (weed and pathogen), hydrocarbon and fire management to maintain the baseline condition of listed threatened fauna (WRP, BSM and Black Cockatoo) habitat adjacent to the Development Envelope
- Installation of fauna crossing structures for WRP and culverts and fish-pathways for BSM to maintain connectivity of habitat areas adjacent to the Development Envelope
- Implementing an adaptive management and monitoring program that provides early warning of risks of the plan not meeting its objective, and contingency and corrective actions should those risks be anticipated or realised.

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Definitions

Term	Definition
Baseline Levels	The values present immediately prior to the activity undertaken to identify potential direct and indirect impacts for which the baseline is being gathered.
Biannual	Taking place twice a year
Biennial	Taking place every two years
Bi-monthly	Taking place every two months
Control Area	The predator control area includes the whole of the development envelope and accessible adjacent habitat areas
Daylight hours	According to EPBC Act approval for EPBC 2019/8543, daylight hours means any time after sunrise and before sunset on the same day. Specifically for the Proposal, it refers to the period from one hour after sunrise to one hour prior to sunset, consistent with Geoscience Australia astronomical definitions for sunrise / sunset (Geoscience Australia, 2022).
Development Envelope	The Development Envelope (Figure 1) is located within the City of Bunbury and Shire of Capel, at its closest point approximately six km south-east of Bunbury and 200 km south of Perth. The Development Envelope extends 10.5 km between South Western Highway and Bussell Highway. The Development Envelope covers 200 hectares (ha) and includes existing road reserves, agricultural land and native vegetation. The BORR South will be constructed within the Development Envelope. The Development Envelope is the Proposal Area as defined in Part C of approval EPBC 2019/8543.
Fauna spotter-catcher	A person who has a relevant lawful authority under the *Biodiversity Conservation Act 2016* to detect, capture, care for, assess and release Black Cockatoos and / or Western Ringtail Possum disturbed by vegetation clearance activities, as defined in EPBC Act approval for EPBC 2019/8543.
Main Roads	Main Roads Western Australia
Monitoring Period	The monitoring event occurring at a defined timeframe (e.g., monthly, bi-monthly, biannual, annual, biennial) for each respective monitoring aspect.
Prior to Clearing	Prior to clearing is a trigger for a range of management measures. For clarity, prior to clearing relates to the clearing of a specific area/stage, rather than the commencement of the proposals clearing, i.e not only the first-time clearing commences for the proposal.
Proposal	Main Roads proposes to construct the Bunbury Outer Ring Road (BORR) Southern Section from South West Highway (north) to Bussell Highway (south), at its closest point approximately six km from East Bunbury, in the South West Region of Western Australia (WA) (referred to as the Proposal)
Receival sites	Western Ringtail Possum Habitat outside the Development Envelope that contains home-ranges of residential western ringtail possums intersecting or

Term	Definition
	adjoining Western Ringtail Possum habitat where displaced individuals from inside the Development Envelope relocated into; or are moved or released into by a fauna-spotter catcher.
Reference sites	Lot 2 Boyanup Picton Road and Reserve 23000. The two WRP reference sites comprise Western Ringtail Possum habitat in the vicinity of but separate to the Development Envelope that has been included in the bi-monthly surveys and is known to contain WRP populations.
Standard construction management	Measures that have been applied successfully by Main Roads to other large scale projects that are considered appropriate in minimising the environmental impacts. These measures ensure that clearing is implemented properly, that erosion does not occur, and that spills are minimised and managed appropriately.

Acronyms / Abbreviations

Acronym	Definition
ANZECC	Australian and New Zealand Environment and Conservation Council
BC Act	*Biodiversity Conservation Act 2016*
BORR	Bunbury Outer Ring Road
BORR IPT	Bunbury Outer Ring Road Integrated Project Team
CEMP	Construction environmental management plan
DCCEEW	Department of Climate Change and Energy, the Environment and Water (previously the Department of Agriculture, Water and the Environment)
DBH	Diameter Breast Height
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority of Western Australia
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FMP	MNES fauna management plan
MNES	Matters of National Environmental Significance
MS	Ministerial Statement
WA	Western Australia
WoNS	Weeds of National Significance
WRP	Western Ringtail Possum

COVER PAGE AND DECLARATION OF ACCURACY

- **EPBC number**: 2019/8543
- **Project name**: Bunbury Outer Ring Road Southern Section
- **Action management plan title**: Bunbury Outer Ring Road Southern Section (EPBC 2019/8543) MNES Fauna Management Plan
- **Proponent /approval holder and ACN or ABN**: Main Roads Western Australia, ABN 50860676021
- **Proposed / approved action**: Construction and operation of the Southern Section of the Bunbury Outer Ring Road (BORR) project
- **Location of the action**: South Western Highway to Bussell Highway, within the City of Bunbury and Shire of Capel
- **Date of preparation of the action management plan:** July 2022
- **Person accepting responsibility for the action management plan**: Martine Scheltema, Manager Environment, Main Roads Western Australia

Declaration of accuracy

I declare that to the best of my knowledge, all the information contained in, or accompanying this document is complete, current and correct. I am duly authorised to sign this declaration on behalf of the proponent/approval holder. I am aware that:

a) giving false or misleading information is a serious offence under section 137. 1 of the *Criminal Code Act 1995* (Cth)
b) section 137.2 of the *Criminal Code Act 1995* (Cth) makes it an offence for a person to produce a document to another person in compliance or purported compliance with a law of the Commonwealth where the person knows that the document is false or misleading;
c) section 490 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence for an approval holder to provide information in response to an approval condition where the person is reckless as to whether the information is false or misleading; and
d) section 491 of the EPBC Act makes it an offence for a person to provide information or documents to specified persons who are known by the person to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth) (EPBC Regulations) where the person knows the information or document is false or misleading.

Signed: Martine Schelt
Full name: Martine Scheltema, Manager Environment
Organisation: Main Roads Western Australia (ABN 50 860 676 021)
Date 20/07/2022

1 PROPOSAL DESCRIPTION

BORR South includes the construction and operation of 10.5 km of new freeway standard dual carriageway, associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs. The Proposal is located approximately 200 km south of Perth and, at its closest point, approximately six km south-east of Bunbury.

The Proposal will be constructed within the 200 ha Development Envelope (Figure 1), which is located within the City of Bunbury and Shire of Capel. Approximately 62% of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

Construction of the Proposal is anticipated to commence in 2022 and continue for a period of 2-3 years. Once BORR South is constructed and open for public use, operation of the Proposal will be ongoing.

1.1 Environmental assessment

1.1.1 Commonwealth assessment

The Proposal was formally referred to the then Commonwealth Department of the Environment and Energy (DoEE) in September 2019 (EPBC Act referral 2019/8543) as a potential Controlled Action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to impacts on Matters of National Environmental Significance (MNES) (BORR IPT, 2020a).

EPBC Act approval for EPBC 2019/8543 was granted on 29 June 2022.

1.1.2 State assessment

In September 2019, Main Roads referred the Proposal to the Environmental Protection Authority (EPA) of Western Australia (WA) for assessment under Section 38 of the Environmental Protection Act 1986 (EP Act). The referral included an Environmental Referral Supporting Document (BORR IPT, 2019a) which describes the receiving environments, potential impacts and mitigation strategies to address the identified impacts. The Proposal was advertised for a seven day public comment period during September 2019. In October 2019, the EPA determined that the Proposal would be subject to an environmental assessment at the level of Referral Information, with additional information required under Section 40(2)(a) of the EP Act.

On 28 April 2020, the EPA consented under Section 43A of the EP Act to a change in the Proposal that will result in an overall reduction of 100 ha from the Development Envelope from 300 ha to 200 ha. The change to the Proposal also resulted in an overall reduction of remnant native vegetation being cleared from 98 ha to 76 ha.

On 9 August 2021, Main Roads submitted a request to the EPA to, under Section 43A of the EP Act, to change the Proposal to document improvements to the Proposal to improve social and ecological connectivity, minimise the potential environmental impacts to flora and vegetation and fauna and substantially expand the scale and nature of the Offset Strategy. The changes include avoidance and management measures including:

- Establishing Clearing Exclusion Areas within the Development Envelope (Figure 1). Three Clearing Exclusion Areas have been established within Gelorup that will avoid:
    - 2.61 ha of Western Ringtail Possum (WRP), Black Cockatoo and Brushtail Phascogale habitat.
    - 10 Suitable Diameter at Breast Height (DBH) trees, of which two contained hollows that were suitably sized (no known use).
    - 1.47 ha of Banksia Woodland Threatened Ecological Community (TEC).
    - Reducing the overall amount of WRP habitat to be cleared by 1.9 ha through design modifications, with Main Roads committing to clearing no more than 71.5 ha of native vegetation and no more than 60.9 ha of WRP habitat.
- Inclusion of additional rope bridges and a dedicated fauna bridge approximately 300 m east of Yalinda Drive.

On 19 October 2021, the EPA published Report 1714, setting out the assessment findings. Following appeal, the Project was approved by the EPA under Ministerial Statement 1191 (MS 1191) on 31 May 2022.

1.2 Relevant listed threatened fauna

This MNES Fauna Management Plan (FMP) has been prepared to manage, monitor and mitigate direct and indirect impacts to the following Threatened fauna MNES:

- Western Ringtail Possum (*Pseudocheirus occidentalis*) (Critically endangered)
- Black-stripe Minnow (*Galaxiella nigrostriata*) (Endangered)
- Carnaby's Cockatoo Calyptorhynchus *latirostris* (listed as 'Endangered' (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) EPBC-E, Western Australian *Biodiversity Conservation Act 2016 (WA)* (BC Act) BC-E))
- Baudin's Cockatoo Calyptorhynchus *baudinii* (listed as 'Endangered' (EPBC-E, BC-E))
- Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* (listed as 'Vulnerable' (EPBC-V, BC-V)).

The key management and monitoring measures and corrective actions proposed in this MNES FMP align with best available practice as they have been collaboratively developed by subject matter experts, have been workshopped several times with key regulators and agencies and have been subject to several lengthy periods of public and government consultation. In addition to Main Roads extensive experience, the experienced consultants engaged to assess and manage potential impacts, and the vast agency and public consultation that has been undertaken regarding WRP management, the following conservation advices, standards and guidelines were also utilised to help develop the plan's key management and monitoring measures and corrective actions:

- Department of Parks and Wildlife (2017). *Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58.* Department of Parks and Wildlife, Perth, WA
- Threatened Species Scientific Committee (2018). *Conservation Advice* Pseudocheirus occidentalis *Western Ringtail Possum*. Canberra: Department of the Environment and Energy
- Threatened Species Scientific Community (TSSC) (2018a). Conservation Advice *Galaxiella nigrostriata* Black-stripe Minnow. Canberra: Department of the Environment and Energy

- Department of Environment and Conservation (DEC) (2008). *Forest Black Cockatoo (Baudin's Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan*
- Department of Parks and Wildlife (DPaW) (2013). *Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). *Referral guidelines for three species of Western Australian black cockatoos.*
- *Guidance Statement No. 6 Rehabilitation of Terrestrial Ecosystems* (EPA, 2006) (to inform rehabilitation actions, monitoring methodology and completion criteria)
- *Environmental Guidelines Vegetation Placement within the Road Reserve* (Main Roads Western Australia, 2016a) (to inform rehabilitation methodology) Environmental Guidelines Revegetation Planning and Techniques (Main Roads Western Australia, 2016b) (to inform rehabilitation actions, monitoring methodology and completion criteria)
- ANZECC & ARMCANZ water quality guidelines (ANZECC & ARMCANZ, 2000) (to inform ground and surface water monitoring methodology and completion criteria)
- *Phytophthora* Dieback Management Manual (DBCA, 2017) (to inform hygiene measures).

Additional references have been provided throughout the plan where relevant.

This plan should be read in conjunction with the Habitat Fragmentation Plan, Vegetation Management Plan, Offset Strategy and Offset Management Plan required under conditions 10, 12, 14 and 18 respectively of the EPBC Act approval.

1.3 Listed threatened fauna descriptions

1.3.1 Western Ringtail Possum

1.3.1.1 Species description

The Western Ringtail Possum (WRP) is a medium sized arboreal marsupial, endemic to the south-west of Western Australia. WRP were once widely distributed across the south and south-west of the state (from north of Perth to east of Albany) but are now restricted to three key management zones: the Swan Coastal Plain (SCP), the Southern Forests and the South Coast. Although primarily arboreal, WRPs are known to move on the ground (DPaW, 2017).

The major threats to the species include habitat loss and fragmentation. Other threats include predation by introduced carnivores, climate change, logging, fire, competition for nest hollows, habitat tree decline and disease (DPaW, 2017). In addition to these threats, the Commonwealth Conservation Advice also lists groundwater depletion and altered hydrology, increasing temperature, tree decline and insect outbreaks, domestic dogs, ravens, (potentially in future) Myrtle rust mortality due to vehicle strike and unregulated relocation of orphaned or injured rehabilitated WRP (TSSC, 2018a).

1.3.1.2 Habitat within and adjacent to Development Envelope

WRP have been recorded throughout and adjacent to the Development Envelope as shown in Figure 2. The Development Envelope, excluding Clearing Exclusion Areas, contains approximately 60.9 ha of WRP habitat (Biota, 2020).

Shedley and Williams (2014) devised a habitat quality classification for WRP habitat based on estimates of WRP density[1]. The area of habitat in each habitat quality class within the Development Envelope as mapped by Shedley and Williams (2014) is shown in Table 1-1. Baseline habitat quality and / or condition data for known WRP habitat areas (i.e. receival sites) adjacent to the Development Envelope will be recorded prior to clearing.

Table 1-1. Development Envelope WRP habitat extent by quality class, excluding Clearing Exclusion Areas

Habitat quality class	Extent within Development Envelope in Ha (percent of total)
A ('Very High' quality)	0
B ('High' quality)	7.0 ha (11.5 %)
C ('Medium' quality)	31.9 ha (52 %)
D ('Low' quality)	0.3 ha (< 1 %)
Not Assessed	21.6 ha (35.5 %)

1.3.2 Black-stripe Minnow

1.3.2.1 Species description

The Black-stripe Minnow (BSM) is a small (up to 48 mm) freshwater fish species endemic to south-western Australia. It most commonly occurs in shallow ephemeral waterbodies of peat flats (WRM, 2020a).

BSM is short lived (one year) and able to survive dry summer conditions by aestivating (burrowing) into moist soils. Dispersal is understood to be linked to climatic conditions with the species emerging from aestivation following rainfall (WRM, 2020a).

1.3.2.2 Habitat within and adjacent to Development Envelope

During field surveys conducted for the Proposal (WRM, 2020a), BSM were recorded from one sampling site within the Development Envelope and one site outside of the Development Envelope (Figure 8).

Within the Development Envelope, the area of habitat likely to be suitable for BSM is approximately 5.5 ha. Baseline habitat quality information is being collected at potential BSM habitat sites adjacent to the Development Envelope and at one identified reference area (Manea Park). This includes an assessment of water quality parameters, hydrological connectivity and the presence of erosion and or sedimentation.

Sites where BSM were recorded were relatively unaltered wetlands, with intact fringing vegetation. Due to the high mobility of the species and connectivity between wetlands in wetter years, it is possible that BSM migrate between wetlands within the local area. Maintaining connectivity between wetlands that provide suitable habitat is an important consideration in drainage design for the Proposal.

[1] Estimated WRP densities: Class A - >10/ha, Class B – 5-10/ha, Class C – 2-5/ha, Class D – 0.5-2/ha.

1.3.3 Black Cockatoos

1.3.3.1 Species description

Carnaby's Cockatoo is a large white-tailed cockatoo, endemic to the south-west of Western Australia. It is listed 'Threatened' under both the Commonwealth EPBC Act and the State BC Act at the level of 'Endangered' (EPBC-E, BC-E) as assessed under the criteria of the IUCN (2012).

Baudin's Cockatoo is a large white-tailed cockatoo, endemic to the south-west of Western Australia. It is listed 'Threatened' fauna under both the Commonwealth EPBC Act and the State BC Act at the level of 'Endangered' (EPBC-E, BC-E) as assessed under the criteria of the IUCN (2012).

Forest Red-tailed Black Cockatoo is a large red-tailed cockatoo, endemic to the south-west of Western Australia. It is listed 'Threatened' fauna under both the Commonwealth EPBC Act and the State BC Act at the level of 'Vulnerable' (EPBC-V, BC-V) as assessed under the criteria of the IUCN (2012).

In this FMP, where appropriate the three species are collectively referred to as Black Cockatoos.

1.3.3.2 Habitat within and adjacent to Development Envelope

The Development Envelope is located in what is generally considered to be the typical breeding distribution of the Forest Red-tailed Black Cockatoo, however, all three cockatoo species have breeding areas overlapping the Development Envelope (Biota, 2020a).

All trees and areas of potential Black Cockatoo habitat within the Development Envelope were included in field surveys (Figure 3 to Figure 4). Evidence of foraging by all three species was recorded within and adjacent to the Development Envelope, and either Baudin's or Carnaby's cockatoo were observed flying overhead during field surveys (Biota, 2020a). All three species were identified as occurring within the Development Envelope with 65.4 ha of suitable habitat for foraging and potentially breeding identified in targeted surveys (Biota, 2020a).

Within the Development Envelope, two mapped habitat types: 'Marri / Eucalyptus woodland' and 'Marri / Eucalyptus in paddocks and road reserves' provide Black Cockatoo foraging habitat shown in Figure 5.

2 PURPOSE AND OBJECTIVES

2.1 Purpose

The purpose of this FMP is to ensure that Main Roads manages the Proposal so that impacts to the Protected Matters listed in Section 1.2 meet the requirements of Condition 8 of EPBC Act approval for EPBC 2019/8543.

This FMP sets out the environmental management actions proposed to manage, monitor and mitigate the direct and potential indirect impacts of the Proposal on the Protected Matters listed in Section 4.3. It includes the environmental management of activities to be undertaken by Main Roads, its employees and contractors during the clearing, construction and operation phases of the Proposal.

Relevant guidelines such as recovery plans, interim recovery plans, conservation advice and threat abatement plans have been taken into consideration during the preparation of this FMP. The FMP has been prepared consistent with the following guidance documentation:

- Department of the Environment (DotE) (2014) *Environmental Management Plan Guidelines*
- Department of the Environment and Energy (DoEE) (2019) *Action Management Plan Criteria*
- Environmental Protection Authority (EPA) *Template for Environmental Protection Act 1986 Part IV Environmental Management Plans*.

A Construction Environmental Management Plan (CEMP) will be prepared by the Construction Contractor and include the management actions detailed in this FMP and Main Roads 'business as usual' environmental management measures. The CEMP will be prepared prior to construction, and implemented to minimise and manage impacts to the above-listed Protected Matters.

2.2 Objective

The objective of this FMP is to ensure the potential impacts of the Proposal (listed in Section 4.3) to listed threatened fauna, during clearing, construction and operation, are avoided, mitigated and managed.

This FMP presents a combination of outcome and management-based provisions to be implemented during Proposal construction and operation. Management measures within this FMP are specific to the Proposal, and include management actions that are 'over and above' standard environmental management practises, for example 14 fauna crossing structures are proposed to be installed within a 2.5 km section of the development envelope.

2.3 Condition requirements

This FMP has been prepared inclusive of the requirements of Condition 8 of EPBC Act approval for EPBC 2019/8543. Condition 8 requires Main Roads to prepare a MNES Fauna Management Plan (FMP) to specify measures to avoid and mitigate impacts of the action on listed threatened species during clearance, construction and operation of the Proposal (Table 2-1).

Table 2-1. Condition 8 of approval for EPBC 2019/8543

Condition no.	Condition	Applicable Section
8.	The approval holder must submit a MNES Fauna Management Plan to the **Department** for the **Minister's** approval. The MNES Fauna Management Plan must specify measures to avoid and mitigate **impacts** of the action on **listed threatened species** during **clearance, construction** and **operation**, to the satisfaction of the **Minister** and be consistent with the **Environmental Management Plan Guideline**s. The MNES Fauna Management Plan must:	This Plan
a.	be prepared by a **suitably qualified ecologist**;	
b.	specify the **low-risk clearing timeframe** for **Western Ringtail Possum** applicable to **clearing** in Western Ringtail Possum Habitat.	5.1.1.1
c.	specify **Western Ringtail Possum receival sites** adjacent the areas to be **cleared** into which resident **Western Ringtail Possum displaced** by **clearing** can be safely relocated and which have capacity for them to survive,	Figure 12
d.	specify **clearing** protocols to be implemented prior to **clearing** and daily during **construction** including:	5.1.2, Table 5-2
i.	**passive relocation management actions** to be implemented prior to and during **clearing** that ensures **Western Ringtail Possum** can freely and safely move from locations of **clearing** and into adjacent **clearing exclusion areas** and **receival sites** and;	5.1.2, Table 5-2
ii.	ensures any tree occupied by **Western Ringtail Possum** within the area being **cleared** is not disturbed for 48 hours or until a **fauna-spotter catcher** has confirmed that the animal has vacated the tree.	5.1.2, Table 5-2
e.	specify monitoring that includes a **pre-clearance survey**, based on advice of **DBCA**, to be undertaken within thirty (30) days prior to **clearing** (or if **clearing** is to be staged, prior to each **clearing** stage) to determine the number of **Western Ringtail Possum** individuals present within the **proposal area** and at **receival sites**.	5.1.2, Table 5-2
f.	detail measures that will be undertaken in the **proposal area** to avoid, mitigate and manage impacts to **protected matters** and their habitat during **clearance, construction** and **operation**, including but not limited to:	N/A
i.	ensuring there is no mortality or injury of **Black Cockatoos** and **Western Ringtail Possum** as a result of **clearing** or **construction**,	5.1.2, Table 5-2
ii.	completing within 5 **business days** prior to **clearing** (or if **clearing** is staged, prior to each **clearing** stage) a **pre-clearance survey** to confirm the number of **Western Ringtail Possum** and **Black Cockatoo** within the areas to be **cleared**,	
iii.	ensuring that **clearing** and any movement and/or disturbance of **clearing** stockpiles is restricted to daytime hours.	5.1.2, Table 5-2
iv.	ensuring that a **fauna spotter-catcher** is present during all **clearing**, with the authority to cease **clearing** if the **fauna spotter-catcher** considers that one or more **listed threatened species** may be injured or killed.	5.1.2, Table 5-2

Condition no.	Condition	Applicable Section
g.	specify monitoring that records whether any **listed threatened species** is encountered during **clearing**, and reports to the **Department** within twenty **business days** after **clearing** (or each **clearing** stage) on the number of **Western Ringtail Possum** in the **proposal area** and at **receival sites**;	3.2, 5.1.2, 5.3, Table 5-2
h.	evaluate the suitability, adequacy and effectiveness of **passive relocation management actions** at reducing impacts to **Western Ringtail Possum** individuals displaced by clearing from **Western Ringtail Possum habitat**;	5.3.1
i.	evaluate **impacts** to resident **Western Ringtail Possum** individuals at **receival sites** after clearing; and	5.3.1
j.	use monitoring methods including, but not limited to, radio telemetry with robust sample sizes (the minimum number of tagged animals to be determined in consultation with **DBCA**).	5.3.1
k.	identify and spatially define the study area(s) and reference sites proposed for monitoring and evaluation and provide rationale for the selection of these sites;	5.1.1, Figure 13, Figure 14
l.	specify management actions; management targets; monitoring locations, methodologies, indicators and timing; and actions and investigations in the event of any failure to meet a management target.	5.1, 5.3
m.	specify measures to reduce, to below **baseline survey** levels, the number and prevalence of weeds and feral animals recognised as threats to **Black Cockatoos** and **Western Ringtail Possum**,	5.1.1.2, 5.1.1.5
n.	specify monitoring capable of detecting, within 24 hours, any **reduction in habitat quality** for **Black-stripe Minnow habitat** outside of the **proposal area** resulting from any **clearing** and **construction**, and	5.3.3
o.	The approval holder must not **commence the action** unless the **Minister** has approved the MNES Fauna Management Plan in writing. The approval holder must implement the approved MNES Fauna Management Plan from the date of its approval until the **completion of the action**.	N/A

This FMP sets out the environmental management actions proposed for the Proposal in relation to EPBC Act approval for EPBC 2019/8543 condition 8. It includes the environmental management of activities to be undertaken by Main Roads, its employees and contractors.

3 REPORTING AND ACCOUNTABILITY

3.1 Roles and responsibility

This FMP identifies the environmental management of activities to be undertaken by Main Roads or its delegate in implementation of the Proposal. Main Roads acknowledges that the environmental management actions contained within this FMP are legal requirements to be met by Main Roads.

The Manager Environment at Main Roads will maintain responsibility for implementation of the management actions specified in this FMP, on behalf of Main Roads' Managing Director. Management actions may be undertaken by employees and / or contractors of Main Roads on behalf of Managing Director.

Where management actions are undertaken by employees and / or contractors of Main Roads, these will be communicated and documented to the relevant personnel through relevant environmental training and contractual arrangements (refer to Section 3.3).

3.2 Reporting

Main Roads will report to DCCEEW and DWER on the implementation of this FMP as part of the Environmental Performance report and annual compliance reporting under the conditions of the EPBC Act approval.

Where compliance audits undertaken by Main Roads identify that the environmental management actions and / or the environmental objectives are not being achieved (non-compliance or an environmental incident), Main Roads will notify DCCEEW and DWER as soon as practicable and no later than within seven days of the non-compliance being known. Consistent with standard document control procedures, Main Roads will maintain copies of all reports submitted to DCCEEW and DWER.

The reporting requirements for this FMP are identified in Table 3-1. A template for the annual compliance report is included in Appendix D.

Table 3-1. Reporting requirements

Aspect	Report from	Report to	Reporting frequency
Implementation of FMP	Manager Environment	DCCEEW	Annually (as part of annual compliance reporting)
WRP relocation	Manager Environment	DCCEEW	Report within thirty days after clearing (or each clearing stage) on the number of WRP relocated
Non-compliance with FMP or Environmental Incident	Manager Environment	DCCEEW	As soon as practicable but not more than seven days

The format and content of annual reporting will be in accordance with the requirements of the annual reporting conditions. The format and content of reporting of a non-compliance event or an environmental incident will be subject to the nature of the non-compliance/incident and will

include all requested information from DCCEEW. In consideration of this, specific templates for reporting these are not provided as part of this FMP.

3.3 Environmental training

Main Roads will ensure that all personnel undertaking works for the Proposal, including visitors, have undertaken a site induction training program, or are escorted to the site. Main Roads will evaluate all personnel undertaking the site induction training program to ensure that all personnel have an understanding of the environmental requirements for the Proposal.

Where it is identified that personnel have not undertaken the works in accordance with the environmental requirements for the Proposal, Main Roads will as a minimum require such personnel to repeat the site induction training program.

The general content of the site induction training program for the Proposal is outlined in Table 3-2.

Table 3-2. Site induction training program content

Aspect	Site induction training program content
Site induction training program	Awareness of Main Roads' Environmental Policy
	Identification of the environmental values in the area of the Proposal
	Identification of key environmental risks associated with the Proposal, and the identification of management requirements to control such risks
	Roles and responsibilities of all personnel in the protection and management of the environment, including identification of key personnel that have specific roles or responsibilities
	Awareness of importance of compliance with the environmental requirements (including penalties for non-conformance with the environmental requirements)
	Pegging of the area of works, and other pegging types (for example, trees to be retained)
	Clearing of native vegetation and management of topsoil
	Hygiene procedures for *Phytophthora* Dieback management and weed management
	Appropriate disposal of wastes
	Environmental incidents, including the requirements for management and reporting
	The environmental benefits of improved personal performance

3.4 Emergency contacts and procedures

Emergency contact details will be signposted at appropriate locations within the area of the Proposal, to enable immediate contact and response in the event of an emergency / environmental incident observed by Main Roads' personnel, contractors or the public.

Emergency response procedures will be followed in the event of an emergency / environmental incident.

Main Roads general and emergency contacts for the Proposal are provided in Table 3-3.

Table 3-3. Emergency contact details

Aspect	Contact details
General contact	Main Roads Head Office Address: Don Aitken Centre, Waterloo Crescent, EAST PERTH WA 6004 Mail: PO Box 6202, EAST PERTH WA 6002 Email: enquiries@mainroads.wa.gov.au Phone: 138 138 Main Roads South West Region Address: Robertson Drive, BUNBURY WA 6231 Mail: PO Box 5010, EAST PERTH WA 6231 Email: enquiries@mainroads.wa.gov.au Phone: 138 138 / (08) 9724 5600
Emergency contact	Manager Environment, Main Roads Email: Martine.Scheltema@mainroads.wa.gov.au Phone: (08) 9323 4614 Regional Manager, Main Roads South West Region Email: robert.barnsley@mainroads.wa.gov.au Phone: (08) 9724 5600

4 POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

4.1 Threats to Protected Matters

A summary of key threats to each listed threatened fauna taxa included in this FMP is provided below. More detailed information is contained within *BORR Southern Section Additional Information for Preliminary Documentation* (BORR IPT, 2020a) and *BORR Southern Section Updated Environmental Referral Document and Additional Information* (BORR IPT, 2020b).

4.1.1 Western Ringtail Possum

The major threats to the species include habitat loss and fragmentation. Other threats include predation by introduced carnivores, climate change, logging, fire, competition for nest hollows, habitat tree decline and disease (DPaW, 2017). In addition to these threats, the Commonwealth Conservation Advice also lists groundwater depletion and altered hydrology, increasing temperature, tree decline and insect outbreaks, domestic dogs, ravens, (potentially in future) Myrtle rust, mortality due to vehicle strike and un-regulated relocation of orphaned or injured rehabilitated WRP (TSSC, 2018a).

4.1.2 Black-stripe Minnow

Habitat destruction through continued urban development and other clearing is a key threatening process for the BSM (TSSC, 2018b; WRM, 2020a). Other threats include climate change resulting in reduced rainfall and loss of habitat (drying of wetlands and lowering of groundwater levels), and predation and competition by invasive fish species (including *Gambusia holbrooki*) (TSSC, 2018b).

4.1.3 Black Cockatoos

The *EPBC Act referral guidelines for three threatened black cockatoo species* (DSEWPaC, 2012) identifies the key threats to the Black Cockatoo taxa as comprising:

- Habitat loss and habitat degradation - loss of foraging habitat, nesting hollows, habitat connectivity and habitat quality
- Interactions with humans - vehicle strikes, agriculture protection measures, disturbance from noise / light, unauthorised taking (poaching)
- Invasive species - competition for nest hollows with European honey bees and bird invading taxa, injury / death from European honey bees.

Conservation advice, standards and guidelines do not list weeds and feral predators as key threats to the Black Cockatoo taxa however project management measures have been included in Table5-4 and are consistent with the predator control measures applied for protecting WRP.

4.2 Key assumptions and uncertainties

This FMP has been prepared on the basis of information provided in the environmental surveys for the Proposal (Table 4-1), and based upon knowledge of Main Roads' construction and operation of similar linear infrastructure works. The key assumptions and uncertainties relevant to the Proposal are:

- The relevant studies and surveys have accurately recorded the presence of all listed threatened fauna species within the Development Envelope.

- Environmental survey reports have not been independently verified. These surveys were undertaken by suitably qualified individuals experienced in fauna ecology and habitat identification and are therefore assumed to have accurately recorded the presence and locations of habitat (including breeding habitat such as nest hollows, where relevant). It is acknowledged that fauna survey results may change over time, for example, not all suitable hollows are actively used in all years.
- The Proposal may have the potential for an indirect impact to listed threatened fauna individuals and habitat.
- All significant direct and indirect impacts to listed threatened fauna that may result from the Proposal have been identified.
- Direct impacts to fauna during construction are limited to habitat loss and mortality during construction activities (clearing and plant movement).
- Mobile fauna will disperse in front of clearing activities.
- Road reserve boundary fencing will exclude fauna from the road during construction and operations limiting the potential for mortality of these species.
- Fauna underpasses and fauna bridges are effective in maintaining ecological linkages.
- Possum fencing (combined with noise and screen walls) will exclude WRP from the road during construction and operations limiting the potential for mortality of these species.
- Existing cleared areas within the Development Envelope do not contain habitat for or known records of listed threatened fauna.
- Listed threatened fauna are not expected to occur within areas cleared of native vegetation, therefore these areas do not require management during the construction of the Proposal to meet the environmental objectives.
- If any listed threatened fauna species assumed not to occur in the Development Envelope are subsequently recorded, the proposed management actions would ensure there are no additional impacts.
- The proposed management actions detailed in this plan will be successful in achieving the objective stated in condition 8 of EPBC Act approval for EPBC 2019/8543.

More information on the key assumptions and uncertainties are provided in the appendices of the *Bunbury Outer Ring Road Southern Section Environmental Referral Supporting Document* (BORR IPT, 2019a), the *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information* (BORR IPT, 2020b) and the *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020a).

4.3 Potential impacts

A summary of potential impacts of the Proposal to each listed threatened fauna taxa included in this FMP is provided below. A complete assessment for each taxa, and impacts to other matters protected under Part 3 of the EPBC Act, is contained within *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020a) and *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information* (BORR IPT, 2020b).

Potential direct and indirect impacts of the proposal on listed threatened fauna have been informed through targeted environmental surveys undertaken for the Proposal. These are outlined in Table 4-1. Targeted fauna surveys and the aquatic fauna survey were (and where relevant, continue to be) undertaken in accordance with relevant guidelines.

Table 4-1. Environmental surveys relevant to this FMP

Survey / report name	Location / extent in survey area	Methodology
Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment (Biota, 2020)	Targeted habitat survey encompassing the 200 ha Development Envelope and approximately 97 ha buffering context area	Targeted field surveys conducted in five phases over the course of spring and summer 2018, and winter 2019 for Black Cockatoos and WRP
Bunbury Outer Ring Road Southern Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2020a)	Targeted aquatic fauna survey within seasonal wetlands and creeks within the Development Envelope	Winter (19 - 23 August 2019) targeted conservation significant aquatic fauna survey
***Bunbury Outer Ring Road (Southern Section) WRP Surveys 2019* – ongoing (Biota unpublished survey results)**	BORR Southern Section alignment and two reference sites	Targeted field surveys conducted over the surveyed area commencing October 2019-current, consistent with EPA Technical Guidance (EPA, 2020). These surveys will be on-going during 2022.
***Western Ringtail Possum: Pseudocheirus occidentalis Regional Surveys* (Biota, 2019)**	Local vicinity of BORR Northern, Central, and Southern Section alignments and buffering context area	Focussed regional surveys from December of 2019 through December 2020. Surveys including radio tagging for home range assessments, trapping and survey of potential offset areas and other local context sites to better define local movement of populations.
Bunbury Outer Ring Road Southern Section Vegetation and Flora Study (BORR IPT, 2020c)	Flora and vegetation survey to identify vegetation types and vegetation condition for the Proposal	Field surveys in accordance with relevant State survey guidelines
Phytophthora Dieback Survey Bunbury Outer Ring Road South (GSBL, 2020)	*Phytophthora* dieback survey of the Bunbury Outer Ring Road southern section alignment	Survey undertaken in accordance with DBCA guideline
***BORR Southern Section Drainage Strategy* (BORR IPT, 2019b)**	BORR Northern and Central sections alignment	Outlines broad strategies for management of surface water throughout the Development Envelope, including flood mitigation and maintaining surface water flows to wetlands and agricultural land

4.3.1 Western Ringtail Possum

The potential impacts to WRP associated with the implementation of the Proposal are summarised in Table 4-2 and discussed further below.

Table 4-2. Environmental impacts of the Proposal to WRP

Impact	Description
Direct impacts	
Clearing of native vegetation	Clearing of up to 60.9 ha of WRP habitat, comprising 49 to 72 WRP individuals home ranges
WRP injury or mortality	Potential WRP injury or mortality as a consequence of construction activity and / or road operation
Potential indirect impacts	
Incremental loss of WRP habitat	Loss of WRP habitat resulting from reduced connectivity, barrier effects and edge effects
Displacement of WRP	Displacement of WRP due to traffic noise exposure and light spill from street lighting and traffic
Predation	Increased predation impacts due to WRP displacement and that some WRP may need to establish new or extend existing home ranges

Clearing of native vegetation

As outlined by BORR IPT (2020a; 2020b) and summarised in Section 1.3.1, implementation of the Proposal will result in clearing of up to 60.9 ha of WRP habitat within the 200 ha Development Envelope. The habitat to be cleared is currently fragmented, dissected by existing roads, easements and cleared agricultural land.

The habitat to be cleared for the Proposal is a typical example of low density (less than 2 WRP/ha) WRP habitat that is widespread in the area. WRP density within the Development Envelope is 0.93 WRP/ha. The region's critically important WRP habitat values are principally associated with retained habitat to the west and north of the Development Envelope (Jones, 2022), which will not be impacted by the Proposal.

WRP records accumulated between 2013-21 describe a widespread population that has been using an extensive area of retained woodland remnants south of Bunbury. Distance sampling surveys undertaken in 2018-19 confirmed that seven larger mixed woodland blocks within 6 km of the Development Envelope carried a total of 1,755 WRP on 1,076 ha at the time of the survey (Biota, 2020c). Other 2013-21 records from the wider Bunbury area confirm that the Bunbury WRP population was not restricted to the native woodland habitat but also used moderately modified domestic habitat (e.g. within the Gelorup subdivision), and even heavily modified 'urban' habitat (Bunbury suburbs).

BORR South impacts are concentrated in <61 ha of low density, modified mixed woodland habitat. According to the field data, of this <61 ha, 45 ha was regularly used by one or more WRP on most nights (Clearing Category 1[2] (Figure 2), indicating the presence of settled resident WRP. The habitat fragments that make up the remaining 16 ha of the Development Envelope habitat (Clearing

[2] Clearing areas in which resident and transient WRP are expected to be encountered during clearing.

Categories 2[3] and 3[4] (Figure 2) had more nights without WRP detections than nights with one or more detections. Patches of habitat that are often without WRP on repeat surveys represent marginal WRP habitat that is infrequently used by the local WRP. Habitat without a pattern of consistent and regular detections is probably unsuited to use by settled resident animals but adequate for wandering or dispersing WRP to feed and rest in for a few nights or weeks before moving to other areas. Therefore, clearing the habitat fragments in this 16 ha would present only minor population disturbance.

For the remaining 45 ha with settled residents, the bi-monthly survey (commencing October 2019 and continuing to present) results imply that for a probable upper limit of 40 settled WRP home ranges, up to 10 WRP could be likely to have retained no part of their former home range if clearing had been conducted during the period when WRP counts were low in 2020 or 2021. For these 'immediately displaced' animals, clearing means they must immediately move on to nearby trees and would join the transient portion of the population. Most of these animals would have been transients before they became residents. The 45 ha with settled residents includes 26.9 ha within the Gelorup section of the Development Envelope (from Jilley Road to the east edge of Bussell Highway) that would be cleared from patches 7 and 8a due to the Proposal (Figure 2, Map 2).

The area to be cleared represents up to 0.97 % of habitat in the Bunbury management zone of Shedley and Williams (2014)[5]. It is estimated that between 49 and 72 WRPs within the Development Envelope will potentially have their home ranges disturbed[6] by the Proposal, which is between 0.5 % and 0.74 % of the 2019 estimated WRP population within the Southern SCP Management Zone as identified by Biota (2019) (of up to 9,270 individuals).

WRP mortality

With implementation of management measures outlined in this FMP no WRP mortalities are likely to result directly from the Proposal. Sensitive clearing protocols have been designed for the Proposal and are presented in detail in this Plan.

Indirect impacts

Historical clearing combined with incremental reduction in habitat has restricted the distribution of WRP within the Development Envelope. It is generally accepted that as habitat is cleared, patch sizes decrease and the impact of 'edge effect' increases with likely introduction of weeds and dieback, ultimately changing the species composition of the vegetation community and reducing suitability of habitat for local fauna species, including WRP.

WRP may relocate to other habitat areas in order to move away from very noisy and brightly lit areas (pers comm. Barbara Jones), however WRP have adapted to urban and semi-urban environments and are often found in high densities in these areas (Shedley & Williams, 2014). This indicates that they are able to adjust to developed areas and impacts from light and noise levels in the medium to long term are limited.

[3] Habitat patches that were not often utilised. Not considered suitable for resident WRP but may be used by a transient animal for the short term. High probability no WRP encountered during clearing.

[4] Other WRP habitat - small areas of isolated remnant vegetation and paddock trees. Unsuitable for resident WRP but may be used by a transient animal for the short term. Very high probability no WRP encountered during clearing

[5] The majority of Proposal Area WRP habitat was included in the mapping of Shedley and Williams (2014).

[6] based on data available during the assessment phase.

Risks from predation have the potential to increase as a result of clearing due to fragmented populations (more vulnerable to predation due to their smaller size), an increase in predator numbers (predators may increase in abundance along roads and in areas of disturbance), and from altered behaviour by WRP (individuals spending more time close to or on the ground).
Predation is not expected to increase as a result of the Proposal. This is due to the low density of the Gelorup WRP population (1 WRP/ha), the likelihood that, for the majority of WRP to be impacted by Proposal clearing, portions of their home range will be retained to which they can relocate to after clearing, and the substantial extent of habitat available for transient / displaced WRPs. The bi-monthly survey results confirmed that the Gelorup WRP population has a high proportion (almost 26 %) of transient WRPs (Jones, 2022). This indicates that these individuals have a history of persisting in the wider Gelorup habitat despite predation threats. However, predation remains a potential threat for displaced WRPs, especially considering that up to ten WRPs could be likely to have retained none of their former home range (if clearing had been conducted during the period when WRP counts were low in 2020 or 2021), and would therefore need to join the transient population or establish new home ranges.

4.3.2 Black-stripe Minnow

As detailed by BORR IPT (2020a; 2020b) and summarised in Table 4-3, implementation of the Proposal will result in clearing of up to 5.5 ha of potential BSM habitat. The location and extent of BSM habitat within and near to the Development Envelope is shown in Figure 8.

Table 4-3. Environmental impacts of the Proposal to BSM

Impact	Description
Direct Impacts	
Clearing of native vegetation	Clearing of up to 5.5 ha of potential BSM habitat
Indirect Impacts	
Loss of connectivity	Potential loss of connectivity between areas of habitat
Changes to hydrology	Potential changes in hydrology (water regime) of habitat through altered surface water flows and/or groundwater abstraction (during construction)
Impacts to water quality	Potential impacts through sedimentation, erosion and spills

Clearing associated with the proposal will result in disturbance to approximately 5.5 ha of BSM habitat. Clearing and disturbance of BSM habitat will be carefully managed throughout construction.

The Proposal may impact local BSM populations by reducing the connectivity between sections of habitat and reducing the overall areas of seasonal wetlands. To reduce the potential indirect impacts on BSM, the BORR Drainage Strategy (BORR IPT, 2019b) will be implemented to minimise the potential for impacts to wetlands and waterways (including as habitat for BSM) during and following construction, and therefore during operation, of the Proposal.

Impacts to existing hydrology will be mitigated through the implementation of the Drainage Strategy which aims to maintain hydrological conditions as far as possible, and connectivity

between habitats through use of suitable drainage design e.g. culvert design and construction to allow movement of fish (BORR IPT, 2019b).

The risk of other potential impacts, such as contamination of waterways through spills and impacts to habitat from bushfires, will also be managed through implementation of appropriate procedures to be included in the CEMP. The proposed drainage related monitoring that will be undertaken for BSM is detailed in section 5.3.2.

4.3.3 Black Cockatoos

Targeted fauna surveys conducted for the Proposal identified evidence of foraging by all three species of Black Cockatoo both within and adjacent to the area of the Proposal, and either Baudin's Cockatoo or Carnaby's Cockatoo were observed flying overhead during field surveys (Biota, 2020). All three species were identified as likely to occur within the area of the Proposal with suitable foraging habitat and potential breeding habitat (trees containing a suitably-sized hollow(s) for nesting) present (Biota, 2020).

Potential impacts to Black Cockatoos are outlined in BORR IPT (2020b), and summarised in Table 4-4. Potential impacts from the Proposal are restricted to direct impacts resulting from the loss of habitat and area discussed further below. These have been informed through targeted environmental surveys undertaken for the Proposal. No indirect impacts to Black Cockatoos are expected.

Table 4-4. Environmental impacts of the Proposal to Black Cockatoos

Impact	Description
Direct Impacts	
Loss of habitat	Clearing of native vegetation comprising: • 60.9 ha of foraging habitat • 1,088 trees with a DBH ≥ 500 mm • Eleven trees of the 1,088 trees with a DBH ≥ 500 mm that contain a potentially suitable nesting hollow(s).

Implementation of the Proposal will result in clearing of up to 60.9 ha of Black Cockatoo foraging habitat within the 200 ha Development Envelope, which represents < 1 % of the recorded 8,000 ha of locally available foraging habitat (based on suitable remnant vegetation within a 12 km radius of the Development Envelope) (Figure 3).

The Development Envelope includes eleven potential nesting trees with a diameter at breast height (DBH) of ≥ 500 millimetres that contain a hollow(s) assessed as potentially suitable for nesting by Black Cockatoos. Two of these indicated some evidence of potential nesting use, however no direct signs of Black Cockatoo breeding were observed (Biota, 2020). The Development Envelope contains 1,077 large (suitable DBH) trees without suitable hollows that will be removed by the Proposal. The location and extent of Black Cockatoo habitat, large (potential nesting) trees and large trees with suitable nesting hollows within the Development Envelope are shown in Figure 6 and Figure 7 respectively (Appendix A).

The environmental surveys also identified habitat quality and vegetation condition (BORR IPT, 2020c; Biota, 2020), which establish the baseline habitat health condition prior to implementation of the Proposal.

4.4 Risk assessment

The DotE (2014) and DoEE (2019) identify a requirement for a risk assessment to assess the likelihood and consequence of each potential impact in order to ensure that risks are translated into controls, mitigation and management actions.

Main Roads applies a standard risk assessment matrix to its operations, whereby the 'likelihood' and 'consequence' of events is considered, with monitoring and management actions identified to control the level of risk.

Main Roads completed a risk assessment for each of the relevant listed threatened fauna taxa in preparation of this FMP. The likelihood and consequence assessment, with the resulting 'risk outcome', have been based upon the residual risk levels after management and monitoring activities are implemented. The assessments have applied the definitions for both likelihood and consequence as prescribed within DoEE (2019)(Appendix B), and are presented in Table 4-5 and Table 4-6.

Related management actions and monitoring activities can be found in Section 5.

Table 4-5. WRP risk assessment

Objective: To ensure that impacts to WRP are avoided, mitigated and managed during clearing, construction and operation of the Proposal. Key environmental values: WRP individuals and habitat				
Environmental objective	**Risk**	**Post control risk assessment**	**Management approach**	**Monitoring approach**
Minimise impacts to WRP	Injury or death of WRP individuals during Proposal implementation	Likelihood: Likely Consequence: Moderate Risk outcome: Medium	Management during construction for risk of impact to WRP individuals	Pre-construction, construction and post-construction monitoring of WRP mortality
Minimise area of WRP habitat cleared during construction	Clearing or disturbance of WRP habitat exceeds approved clearing limits	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Standard construction management to control construction clearing (not specific to FMP)	Standard construction monitoring to verify progress and extent of construction clearing (not specific to FMP)
No significant indirect impacts to WRP habitat adjacent to the Proposal attributable to Proposal implementation	Reduction in WRP habitat quality / condition (function and value) adjacent to the Proposal	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Implement WONS, Declared Plant, surface water, and Phytophthora dieback management measures within the Development Envelope vegetation / revegetation and receival sites (Figure 12) Standard construction management to control construction clearing	Pre-construction, construction and post-construction monitoring to assess habitat quality / condition (function and value) adjacent to the Proposal Monitoring to verify efficacy of weed and pathogen management measures
	Increased predation of WRP adjacent to the Development Envelope	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Implement predator control management measures within Development Envelope and receival sites (Figure 12) and at fauna crossing structures access and egress points	On-going monitoring to verify efficacy of measures to minimise predation

Objective: To ensure that impacts to WRP are avoided, mitigated and managed during clearing, construction and operation of the Proposal. Key environmental values: WRP individuals and habitat				
Environmental objective	**Risk**	**Post control risk assessment**	**Management approach**	**Monitoring approach**
	Bushfires generated as a result of Proposal construction	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Standard construction management to control potential ignition sources construction clearing (not specific to FMP)	Standard construction monitoring to verify management of potential ignition sources and fire response during construction clearing (not specific to FMP)
	Groundwater drawdown impacts on or changes in hydrology of WRP habitat adjacent to the Proposal	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control groundwater abstraction consistent with WA Government water supply approvals (not specific to FMP)	Standard construction monitoring to verify groundwater water abstraction consistent with WA Government water supply approvals (not specific to FMP)
	Engineered movement structures not installed and / or ineffective	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Installation of engineered movement structures as per specification and responsive management	On-going monitoring to verify effectiveness of structures
	Landholder access approval for monitoring not granted	Likelihood: Possible Consequence[7]: Moderate Risk outcome: Medium	Ongoing liaison with landholders	The wide variety of monitoring approaches included for Proposal minimises impact of this risk

[7] Consequence is on ability to conduct monitoring, not on the species or habitat.

Table 4-6. BSM risk assessment

Objective: To ensure that impacts to BSM are avoided, mitigated and managed during construction and operation of the Proposal. Key environmental values: BSM individuals and habitat				
Environmental objective	**Risk**	**Post control risk assessment**	**Management approach**	**Monitoring approach**
Minimise area of BSM habitat cleared during construction	Clearing of BSM habitat exceeds approved clearing limits	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Standard construction management to control construction clearing (not specific to FMP)	Standard construction monitoring to verify progress and extent of construction clearing (not specific to FMP)
No significant indirect impacts to BSM habitat adjacent to the Proposal attributable to Proposal implementation	Impacts to water quality in BSM habitat adjacent to the Proposal	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Management to control sedimentation and erosion during construction Management of hydrocarbon storage during construction	Pre-construction, construction and post-construction monitoring to assess water quality
	Impacts to water levels in BSM habitat adjacent to the Proposal	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Implement design as per Drainage Strategy to maintain existing hydrology Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals (not specific to FMP)	Pre-construction, construction and post-construction monitoring to assess water levels Standard construction monitoring to verify groundwater water abstraction consistent with WA Government water supply approvals (not specific to FMP)
	Disruption of habitat connectivity	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Management to maintain habitat connectivity for BSM Implement design as per Drainage Strategy to maintain existing hydrology	Pre-construction, construction and post-construction monitoring to assess habitat connectivity

Objective: To ensure that impacts to BSM are avoided, mitigated and managed during construction and operation of the Proposal. Key environmental values: BSM individuals and habitat				
Environmental objective	**Risk**	**Post control risk assessment**	**Management approach**	**Monitoring approach**
	Bushfires generated as a result of Proposal construction	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Standard construction management to control potential ignition sources construction clearing (not specific to FMP)	Standard construction monitoring to verify management of potential ignition sources and fire response during construction clearing (not specific to FMP)

Table 4-7. Black Cockatoo risk assessment

Objective: To ensure that impacts to Black Cockatoos are avoided and minimised as far as practicable during the construction and operation of the Proposal. **Key environmental values: Black Cockatoo individuals and foraging / breeding (nesting) habitat**				
Environmental objective	**Risk**	**Post control risk assessment**	**Management**	**Monitoring**
Minimise impacts to Black Cockatoos	Injury or death of Black Cockatoos during Proposal construction	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Nil risk of impact to mature individuals Management required during construction for risk of impact to nesting adults / young	Pre-construction monitoring of nest hollows to check for presence of Black Cockatoos
Minimise the area of Black Cockatoo foraging habitat cleared during construction	Clearing or disturbance of Black Cockatoo habitat exceeds the approved clearing limits	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control construction clearing (not specific to this FMP)	Standard construction monitoring of progress and extent of construction clearing (not specific to this FMP)
No significant indirect impacts to Black Cockatoo habitat adjacent to the Proposal attributable to Proposal implementation	Reduction in function and value of adjacent habitat	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Implement WoNS, Declared Plant, surface water, and *Phytophthora* dieback management measures within Development Envelope vegetation / revegetation, and receival sites (Figure 12) Standard construction management to control construction clearing	Monitoring to verify presence and effectiveness of control of erosion, WoNS and / or Declared Plants, implementation of Hygiene Management Plan and Drainage Strategy

Objective: To ensure that impacts to Black Cockatoos are avoided and minimised as far as practicable during the construction and operation of the Proposal. **Key environmental values: Black Cockatoo individuals and foraging / breeding (nesting) habitat**				
Environmental objective	**Risk**	**Post control risk assessment**	**Management**	**Monitoring**
No significant indirect impacts to Black Cockatoo habitat adjacent to the Proposal attributable to Proposal implementation	Bushfire occurrence as a result of Proposal construction resulting in loss of adjacent Black Cockatoo habitat	Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Standard construction management to control potential ignition sources construction clearing (not specific to this FMP)	Standard construction monitoring to verify management of potential ignition sources and fire response during construction clearing (not specific to this FMP)
	Groundwater drawdown impacts on, or changes in hydrology of, Black Cockatoo habitat	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low	Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals (not specific to this FMP)	Standard construction monitoring to verify groundwater water abstraction consistent with WA Government water supply approvals (not specific to this FMP)
Re-establish Black Cockatoo habitat in identified rehabilitation areas as per design specifications	Failure to establish foraging habitat to design specifications	Likelihood: Unlikely Consequence: Minor Risk outcome: Low	Management to establish and maintain rehabilitation to design specifications	Field survey by suitably experienced personnel bi-annually once rehabilitation works are completed

5 ENVIRONMENTAL MANAGEMENT MEASURES

In order to comply with relevant environmental legislation and manage impacts to the local environment, Main Roads has defined objectives, outcomes and management actions to ensure that impacts to listed threatened fauna are avoided, mitigated and managed during implementation of the Proposal. The requirements with respect to management measures are detailed in EPBC Act approval for EPBC 2019/8543 condition 8, are repeated in Section 2.3.

5.1 Environmental management activities, controls and performance targets

Main Roads has taken a 'hierarchical approach' to the mitigation of potential impacts associated with the Proposal, and in the first instance, has sought to avoid areas of listed threatened fauna habitat through route selection and design refinement. Where impacts cannot be avoided, Main Roads has designed the Proposal to reduce the intensity and / or extent of impacts on listed threatened fauna individuals and habitat.

Risk-based management actions have been identified and prioritised to achieve the environmental objective detailed in Section 2.2. The management actions focus the greatest management effort on reducing habitat and ecological connectivity loss and impact to individual listed threatened fauna. These management actions were specifically developed to ensure that impacts are minimised as far as practicable during the final design, construction and operation of the Proposal. They have been informed by the results of field studies (Table 4-1), best practice and recent experience on similar road projects in Western Australia.

Based on the controls identified above and these management actions, Main Roads has developed performance targets / outcomes for each listed threatened fauna taxa to identify the outcomes sought from the management actions. These, along with the proposed management actions, are identified in Table 5-2, Table 5-3, and Table 5-4.

All proposed management actions, monitoring, performance indicators, triggers, thresholds and corrective actions are aligned with the performance targets / outcomes identified for each listed threatened fauna taxa.

Whilst the management actions have been defined as a risk-based protocol for minimising adverse impacts on WRP from the Proposal, unforeseen situations and risks may occur during construction. **Accordingly, fauna spotter-catchers with legal authority are empowered to implement alternative management actions where strictly implementing the plan would result in poor outcomes and/or direct impacts for individual animals. Licenced fauna spotter-catchers have, for example, authority to cease clearing if they consider that one or more listed threatened species may be injured or killed during clearing or construction activities.** Such situations should be used, as applicable, to refine and / or amend this plan, as allowed under EPBC Act approval for EPBC 2019/8543.

5.1.1 WRP information to guide the management approach

The approach to WRP management during clearing operations is focused on:

- Results from bi-monthly fauna surveys of the Development Envelope conducted since late 2019.
- Pre-clearing surveys.

- Timing of low-risk clearing (when WRP density is at / near expected seasonal low).
- Sensitive clearing practises.
- Staged clearing operations to encourage WRP to move into adjacent habitat beyond the clearing area.
- WRP monitoring during clearing works.

Allowing WRP to self-relocate to adjacent habitat of their own accord prioritises WRP welfare and avoids the need for translocation and minimises handling of animals.

A pre-clearing behaviour study of WRP in relation to the addition of water points, artificial dreys and canopy connections was conducted to inform WRP management. WRP behaviour will be assessed using a combination of remote cameras and GPS collars (of the type used in the recently completed movement study (Biota, in Prep.). The behaviour study will continue during clearing to see how individual animals respond to clearing and examine whether animals can be encouraged to leave the clearing footprint prior to clearing using strategically placed water points and canopy connections. Post clearing, collared animals will continue to be monitored using a combination of GPS collars and a mark-resight study.

5.1.1.1 Low risk clearing

Monitoring of WRP (October 2019 – February 2022) within the greater Bunbury area (Biota, 2019; Biota, 2020) highlights a period of February – August (inclusive) with lower or much lower WRP counts than peak season counts in October – December, as described in *Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum,* Pseudocheirus occidentalis (Jones, 2022), Appendix A.

WRP habitat clearing protocols, including the delineation of clearing categories, have been developed based on WRP site surveys and observations, and the lower risk clearing timeframes for WRP occurrence based on the WRP monitoring data. Clearing of Category 1 habitat areas will be conducted during the period 1 March to 30 August**.** An authorised terrestrial fauna spotter, contracted under the Bunbury Outer Ring Road Southern Project, is empowered by the Authorisation Holder under the Construction Fauna Management Plan, to cease clearing based on fauna spotter observations that indicate clearing would be in contradiction to the definition of low-risk clearing timeframe for western ringtail possum (as per Ministerial Statement 1191).

Habitat clearing categories are shown in Figure 2 and clearing protocols for each category are detailed in Table 5-1. Based on the habitat clearing categories, WRP surveys and habitat extent, proposed clearing staging is defined in accordance with Figure 9. Where it would be beneficial to do so in terms of outcomes for WRP, the proposed clearing staging and / or direction may be modified. **Any such decision is to be determined at the sole discretion of the fauna spotter-catchers based on observations of WRP.**

Fauna spotter-catchers will be present for clearing of all WRP habitat, regardless of category. Where animals are observed in Category 2 or 3 habitat during pre-clearing surveys, a 24-hr time separation between clearing of adjoining Category 3 and Category 2 areas, or Category 2 and Category 1 areas, may be required. **Application of this management measure is to be determined at the sole discretion of the fauna spotter-catcher(s) based on observations of WRP.**

In order to accommodate the low risk clearing timeframe, clearing may be required to be conducted in stages over two consecutive years. Management actions will be implemented for each stage of clearing should clearing be undertaken at different times. It is anticipated that a proportion of clearing will be undertaken in 2022 with the remainder being undertaken in 2023.

Category 2 or 3 areas that meet the following criteria will be cleared prior to a category 1 area:

- With 500m of category 1 area
- Scheduled to be cleared within 4 weeks of a category 1 area; and
- WRP habitat is continuous

For example, a Category 2 area that is scheduled to be cleared 6 months' after a Category 1 area, does not need to be cleared prior to the Category 1 area. Another example is where Category 2 habitat occurs on the opposite side of the road and the habitat is therefore not continuous the Category 2 habitat does not need to be cleared prior to the Category 1 habitat.

Table 5-1. WRP habitat clearing categories

Habitat clearing category	Clearing management
Category 1 **Resident and transient WRP expected to be encountered during clearing**	• Clearing shall be conducted during the period of 1 March to 30 August • Temporary supplementary watering points shall be installed in receival sites, clearing exclusion areas and other areas where appropriate (at a minimum of two per hectare) at least six weeks prior to the commencement of clearing • Temporary dreys shall be installed in receival sites, clearing exclusion areas and other areas where appropriate (at a minimum of two per hectare) at least six weeks prior to clearing • There will be one clearing front with a single machine only at any time in each continuous Clearing Category 1 patch • Maximum clearing area of one hectare per day per Habitat Clearing Category 1 patch with a maximum total of five hectares of Category 1 clearing per week • Habitat Clearing Category 2 and 3 areas that are within 500 m of Habitat Clearing Category 1 areas, and that will be cleared during the same clearing stage, shall be cleared prior to clearing Habitat Clearing Category 1 areas • Two fauna spotter-catchers are present per machine during clearing operations • Clearing to be conducted as per the Proposal Clearing and Clearing Staging Plans.
Category 2 **Habitat patches that were not often utilised. Not considered suitable for resident WRP but may be used by a transient animal for the short term.**	• Same stage continuous habitat Clearing Category 2 areas to be cleared prior to clearing Habitat Clearing Category 1 areas (with a potential 24-hr temporal separation between clearing of adjoining Category 2 and Category 1 areas)

Habitat clearing category	Clearing management
High probability no WRP encountered during clearing	• Clearing to occur year round • One fauna spotter-catcher per machine conducting clearing operations.
Category 3 **Other WRP habitat - small areas of isolated remnant vegetation and paddock trees. Unsuitable for resident WRP but may be used by a transient animal for the short term. Very high probability no WRP encountered during clearing**	• Same stage continuous habitat Clearing Category 3 areas to be cleared prior to clearing Habitat Clearing Category 1 and 2 areas (with a potential 24-hr temporal separation between clearing of adjoining Category 3 and Category 2 areas) • Clearing to occur year round • One fauna spotter-catcher per machine conducting clearing operations.

5.1.1.2 Predator control

The WRP Recovery Plan (DPaW, 2017) identifies predation as a key risk to WRP. Predator control measures have been developed for the Proposal, as described below.

The objectives of the predator control program are to minimise the impacts from predation on WRP that are exacerbated by the proposal and reduce the number and prevalence of feral animal WRP predators within the Development Envelope and receival sites to below baseline levels. Associated targets and completion criteria for the program are set out in Table 5-2.

Timeframes and location

To minimise risks of predation to dispersing WRP, one month prior to clearing, targeted predator control will be undertaken within the clearing area (for each stage of clearing). To maintain reduced predator numbers, predator control will be maintained within the Development Envelope and receival sites during construction. Predator control actions will continue post-construction, as detailed in the Proposal Habitat Fragmentation Plan.

Approach

To minimise impacts on non-target species, predator control will be undertaken using soft-jaw traps. Traps will be left in place for a minimum of three nights, and longer if required (until the targeted animal is caught). Traps will be checked and cleared daily following deployment.

Trap density

Trap density will be sufficient to achieve the stated completion criteria of reducing predator (fox and cat) numbers by at least 50 % within control areas (Table 5-6). Density within the control areas will be dynamic, based on bi-monthly assessment of the following factors:

- The level of predator activity (determined via observations of foxes or evidence of fox presence e.g. scats, tracks)
- Predator movement patterns
- Landforms
- Vegetation type and density
- Adjoining landuse and activity

Trap deployment frequency

Traps will be deployed at least once prior to and during the 30-day period prior to construction commencing with adaptive management of traps as required to manage predators in the Development Envelope and receival habitats. During construction, traps will be deployed bi-monthly, based on the outcomes of site assessments and the ongoing efficacy of the trapping program. Post-construction, traps will be deployed bi-annually at crossing access and egress points, once in each of the autumn and spring seasons. This timeframe maximises opportunities to capture roaming animals looking for mates during the mating season and young dispersing from the den, and also optimises the benefit of the control program to dispersing WRPs.

Trap deployment will be adaptively conducted (i.e. trap density and frequency of deployment) throughout the duration of application in response to predator abundance within the control areas.

The predator control monitoring program is included in Table 5-9.

5.1.1.3 Water points, artificial dreys, protective natural structures and tree-canopy connections

Temporary water points will be introduced to the remnant vegetation adjacent to clearing during construction where access is granted. Artificial water points shall be installed on wooden planks. The water points will be made using automatic refilling poultry lubing cups attached to a 2-litre bottle of water, placed on wooden planks adjacent to an artificial drey that is similar in design to a standard Sheffield cage trap. These shall be located in receival sites, exclusion areas and other areas at a minimum density of two per hectare, and installed at least six weeks prior to the commencement of clearing. The water points will remain in place during clearing and for six weeks post-clearing.

To increase the value of habitat for relocating WRPs, artificial dreys will be installed in receival sites outside the development envelope, clearing exclusion areas and other areas where appropriate at least 6 weeks prior to the commencement of clearing.

Protective natural structures (such as logs) will be placed in cleared or degraded areas of receival site habitat outside the development envelope and in the clearing exclusion areas at a density of at least 2 per ha.

In Category 1 clearing areas, tree-canopy connections comprising of ropes will be installed prior to clearing to connect habitat within the Development Envelope to receival site habitat outside of the clearing areas. Tree canopy connections will be installed where WRP habitat in receival sites is dense and where natural tree canopy connections are present. The density of tree canopy tree connections will be determined based on WRP densities recorded during the bi-monthly surveys..

5.1.1.4 Fauna fencing

Temporary fencing of WRP habitat areas may be undertaken during construction where beneficial to minimise impacts to WRP, noting that such fencing may preclude WRP self-relocating to receival sites. **The requirement for temporary fencing during clearing and construction activities will be determined by the fauna spotter-catcher(s) prior to and during clearing operations**.

To minimise impacts during construction and operation, a combination of permanent and temporary fencing will be installed adjacent to known habitat areas to prevent WRP moving into construction areas or onto the road. The fencing will be 1.5 m high and constructed to prevent possums being able to climb over or dig under it, as shown in Figure 10. Locations for Possum exclusion fencing have been identified based on the Habitat Clearing Categories, targeted WRP surveys and adjacent habitat patches, as shown in Figure 2. The possum exclusion fencing will be constructed in addition to noise and screen walls, which will also exclude possum movement from adjacent habitat onto the road carriageway. Temporary Possum fencing will be removed 5 years post-construction. Possum exclusion fencing, noise wall and screen wall locations are included in Figure 11.

5.1.1.5 Weeds

In accordance with condition 8(m) of the EPBC Act Approval for EPBC 2019/8543, the number and prevalence of weeds within the Development Envelope (including clearing exclusion areas) and receival sites, will be reduced over baseline levels.

Measures to reduce the prevalence of weeds within the Development Envelope and receival sites include:

- Implementation of hygiene management protocols (*Phytophthora* Dieback management and weed management) in the CEMP and associated Hygiene Management Plan
- Control of WONS and Declared plants within the Development Envelope and receival sites through weed control programs
- Bi-annual and opportunistically weed monitoring

For further details see Tables 5-2, Table 5-6 and Table 5-9 below, and section 5.1.1.1 of the Vegetation Management Plan.

5.1.1.6 Revegetation

Revegetation associated with the Proposal is considered to be a post-construction activity and thus is addressed in the Habitat Fragmentation Plan and not repeated here.

5.1.2 Management actions and performance targets

Performance targets / outcomes and proposed management actions for each listed threatened fauna taxa, are identified in Table 5-2, Table 5-3, Table 5-4.

All proposed management actions, monitoring, performance indicators, triggers and corrective actions are aligned with the performance targets / outcomes identified for each listed threatened fauna taxa.

Table 5-2. WRP management actions and performance targets

Timing	Management actions	Performance targets / outcomes
Prior to clearing / construction	• Refine Proposal design to minimise area of WRP habitat required to be cleared • Prior to clearing, the road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area • At least six (6) weeks prior to clearing, install artificial dreys, artificial watering points and protective natural structures in receival sites outside the development envelope and exclusion areas (refer to Section 5.1.1.3) • At least six (6) weeks prior to clearing, install arboreal ropes where practical[8] to provide connections from habitat inside the development envelope to receival sites outside the development envelope to minimise the need for WRP to go to ground (refer to Section 5.1.1.2) • Within thirty (30) days prior to clearing (or if staged, prior to each clearing stage) survey for WRP and BTP shall be undertaken to confirm presence / absence and number individuals within the development envelope and at receival sites[9] (refer to Section 5.3.1) • Deploy soft-jaw traps within the Development Envelope and receival sites during the 30-day period prior to the clearing based on field observations (refer to Section 5.1.1.2) • Prior to clearing, control WONS and Declared plants within the Development Envelope, • All WRP habitat that is to be retained within the development envelope will be surveyed and delineated with temporary fencing prior to site works to ensure it is conserved • Clearing of vegetation shall be during daylight hours[10] only • Cleared vegetation will be chipped the same day (i.e. not stockpiled) or transported the same day, during daylight hours, to at least 100 m from WRP habitat before further processing during daylight hours on a subsequent day. • All buildings requiring demolition for the Proposal will be inspected for WRP for two days prior to demolition works	• No direct impacts to WRP individuals • Maintain pre-construction condition rating in adjacent WRP receival habitat through pre and post construction condition monitoring • Preclude use of refuge sites within the Development Envelope prior to construction • Reduce predator population within the Development Envelope and adjacent habitat compared to baseline survey results • No increase in predator observations when compared to baseline survey results, prior to

[8] Tree canopy connections will be installed where WRP habitat in receival sites is dense and where natural tree canopy connections are present.
[9] Prepared and undertaken on advice of DBCA sought during preparation of this plan.
[10] The period from one hour after sunrise to one hour prior to sunset, using Geoscience Australia astronomical definitions for sunrise/sunset (Geoscience Australia, 2022)

Timing	Management actions	Performance targets / outcomes
	• Where WRP are observed, or suspected, to be in any building to be demolished attempts shall be made to capture the animal prior to the demolition works commencing • An fauna-spotter with legal authority will be on-site at all times during the demolition of buildings suspected or observed to house WRP. • Machinery operators will maintain radio communication with their spotter • Any pest animal baits used in buildings to be demolished will be in bait stations and disposed of prior to demolition.	construction commencing.
During construction	**Sensitive clearing protocols** • Patches of WRP habitat to be cleared will be delineated prior to clearing • Clearing timeframes for Category 1, 2 and 3 Habitat Clearing Categories (Table 5-1) shall be followed • Spotlighting of potential WRP habitat will be undertaken by a suitably experienced person for two nights within the five (5) business days prior to clearing of each stage. Trees containing WRP will be tagger and checked during pre-clearing fauna searches • Pre-clearing fauna searches shall be conducted immediately prior to (i.e. on day of) and during clearing operations and will include hollows, dreys, ground debris, dense ground-level vegetation, fallen timber and logs • Control and monitor WONS and Declared plants within the Development Envelope and receival sites • Clearing will be conducted congruent with the habitat clearing categories as detailed in Table 5-1 shown in Figure 2. • Vacant dreys will be removed and hollows blocked prior to clearing where deemed appropriate and safe • If WRP are observed during clearing operations, the tree containing the animal shall be left for a minimum of 48hrs, so as to allow two consecutive nights for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied after this period, the animal will be coerced / moved to a safe area outside of the clearing footprint by the fauna spotter-catcher with legal authority. • Artificial dreys may be installed within or near trees known to contain WRP prior to clearing, as WRP appear to preferentially move into artificial dreys. Entrances of inhabited dreys will be safely blocked,	• No direct impacts to WRP individuals • Clearing is within approved clearing limits • Maintain pre-construction condition rating in adjacent WRP receival habitat through pre and post construction condition monitoring • Weed numbers and prevalence below Development Envelope and receival site baseline survey results • Restore and maintain connectivity between

Timing	Management actions	Performance targets / outcomes
	and both the drey and WRP will be securely relocated into nearby receival site habitat, as has been successfully implemented in other local clearing projects (Dr. Mike Bamford, pers. comm.). Alternatively, where practical, the hollow may be cut from the tree with the WRP in situ, and relocated to nearby receival habitat, as has been successfully implemented in other local clearing projects (Dr. Mike Bamford, pers. comm.) • In situations where connections to adjacent receiving habitat have been reduced by ongoing clearing or potentially cause stress or take of the animal, a fauna spotter-catcher (with legal authority) may coerce / move the animal to a safe area outside of the clearing footprint. Where practical, WRP will be encouraged to move along the branches of one tree to the next, into receival site habitat. Experience shows that WRP will also step onto a net and allow themselves to be carried on the net to trees in receival habitat (Dr. Mike Bamford, pers. comm.). • Felled trees with hollows will be checked immediately for fauna after felling (by fauna spotter-catcher) and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate. If the animal is still present, a fauna spotter-catcher (with legal authority) may coerce / move the animal to a safe area outside of the clearing footprint. • Habitat clearing is to be staged, commencing from existing edge lines / roads and progressing towards habitat that will be retained to direct WRP towards these areas as per the proposed clearing staging (Figure 9) • Vacant dreys within felled trees will be destroyed immediately to prevent animals re-entering them • A post-clearing survey shall be undertaken (by fauna spotter-catcher) immediately following each day's clearing operations and the following morning to identify the presence of any injured animals **Terrestrial fauna handling** • Fauna handling will only be conducted by fauna spotter-catchers with legal authority • Any WRP showing signs of injury or illness will be caught, bagged and taken to an experienced wildlife veterinarian • If an injured WRP has not already been captured, then the appointed fauna-spotter must attempt to capture the animal for the purposes of veterinary assessment and treatment	known WRP habitat areas, through installing crossing structures and subsequent utilisation monitoring.

Timing	Management actions	Performance targets / outcomes
	• All treatment of injured fauna will be undertaken by a veterinarian • Where clearing operations abut existing roads, in addition to standard traffic management measures, visual message boards will be installed to warn drivers of the potential for fauna to cross the road during clearing operations.	
During construction	• Post-clearing, possum fencing (temporary and permanent) will be installed adjacent to known habitat areas to exclude WRP moving onto the road (Figure 11). The fencing will be 1.5 m high and be constructed to prevent possums being able to climb it or dig under it. Possum exclusion fencing shall take account of and complement noise and screen walls in excluding fauna from moving onto the road • Deploy soft-jaw traps bi-monthly within the Development Envelope and receival sites during construction based on the outcomes of site assessments **Loss of ecological connectivity** • Construct two fauna bridges at Yalinda Drive and 350 m to the east, at least 5 m in width • Install permanent possum rope bridges / underpasses at key location(s) to enable fauna including WRP to move between retained habitat areas, see Figure 12 • Install tree-canopy connections to all crossing structures • The size and design of all movement devices will be based on MRWA Design of Fauna Underpasses (MRWA, 2010), topography at the site, expert advice (Barbara Jones, pers. comm.), information from relevant studies and reports (QDMR, 2000; Harper, M., Mccarthy, M. & van der Ree, R., 2008) and in line with the concept designs (Figure 10) • Underpass dimensions will be based on the fauna recorded or expected to occur in the vicinity • The final underpass designs will incorporate the following features known to encourage use by fauna and reduce the risk of predation: o Connection to nearby habitat via overhead rope hawsers and poles (minimum 2.5 m high) (Plate 1) o Objects for fauna to shelter on, under or in (furniture) will be locally sourced and will include sand, mulch, logs and rocks	

Timing	Management actions	Performance targets / outcomes
	o Revegetation using fast growing species at underpass entrances to provide cover for animals approaching, entering and leaving the underpasses o Natural flooring such as sand or gravel o Dual-use underpasses will have a concrete substrate and will not contain furniture (furniture would be washed away by drainage flows) • The Development Envelope boundary will be fenced according to the detailed design to restrict pedestrian and vehicular access to retained WRP habitat **Drainage, weeds and fire** • Implement Proposed Drainage Strategy and ground and surface water management measures to avoid impacts to adjacent WRP habitat • Implement control of WONS and Declared Plant within the Development Envelope, clearing exclusion areas and receival sites bi-annually and opportunistically based on monitoring results • Implement surface water and Phytophthora dieback management measures (as per the Dieback Management Plan) within Development Envelope vegetation / revegetation to prevent potential indirect impacts to WRP habitat • As part of the CEMP, the construction contractor has prepared a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire	
Post construction	• Deploy soft-jaw traps bi-annually at fauna crossing structure access and egress points (once in each of the spring and autumn seasons) for five years post-construction based on the outcomes of the site assessments Also refer to Proposal *Habitat Fragmentation Plan* for post-construction management actions.	• Restore and maintain connectivity between known WRP habitat areas, through installing crossing structures and subsequent utilisation monitoring.

Table 5-3. BSM management actions and performance targets

TIMING	MANAGEMENT ACTIONS	PERFORMANCE TARGETS / OUTCOMES
Prior to construction	• Refine Proposal design to minimise area of BSM habitat required to be cleared • The Construction contractor has prepared a Spill Response Procedure capable of detecting within 24 hrs any potential impact to BSM habitat outside of the Development Envelope resulting from clearing and construction activities, including suspended sediment, oil, chemical or hazardous material discharge or spill events, and to ensure any discharge or spill is contained and remediated appropriately and efficiently with approved materials..	• Not applicable
During construction	• BSM habitat to be cleared within Development Envelope will be demarcated in the field to ensure clearing only occurs within the approved clearing area • Where practicable, initial earthworks in BSM habitat will occur during summer months (October to April) or when wetlands are dry and water levels are at their lowest • A clear span bridge with footings outside of the bed and banks of the channel will be installed at Five Mile Brook to maintain habitat connectivity and hydrology for BSM • Install silt fences and / or curtains as required at, up and downstream of the Five Mile Brook bridge construction area • Prior to any interruption of current surface water flows or fish pathways, culverts will be installed • Long term hydrocarbon storage (i.e. hydrocarbons which shall not be used that day or not stored within equipment waiting to be used) or re-fuelling of equipment (with the exception of stationary plant) will not be permitted within 50 m of BSM habitat • Through detailed design, maintain hydrologic connections between BSM habitat areas to enable fish movement • Design and construction of drainage in accordance with Drainage strategy to maintain surface water flows and groundwater regimes consistent with the pre-disturbance condition (baseline) as far as practicable • As part of the CEMP, the construction contractor has prepared a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire.	• No clearing outside the approved footprint • Maintain connectivity between potential BSM habitat areas • Maintain water quality levels within specified guidelines (see Section 5.3.3) or commensurate with those of upstream reference sites • Hydrology baseline functions and values are maintained
Post construction	• Not applicable (monitoring and as-needed corrective action activities only)	• Not applicable

Table 5-4. Black Cockatoo management actions and performance targets

Timing	Management actions	Performance targets
Prior to construction	• Design refinement to minimise area of Black Cockatoo habitat needed to be cleared for the Proposal • Habitat to be cleared within the area of the Development Envelope will be demarcated in the field to ensure clearing only occurs within the approved clearing area • The final design will avoid trees with suitable nest hollows where possible • Where any of the eleven trees with suitable nest hollows for Black Cockatoo will require clearing for the Proposal, the hollow will be visually inspected were safe and practicable. Where not in use the hollow will be 'blocked' to prevent use for breeding • Where blocking of the nest hollows cannot be undertaken (e.g. timing, access), a pre-clearing fauna assessment will be undertaken by a suitably experienced person to determine if the hollows are being used by Black Cockatoos • Deploy soft-jaw traps within the Development Envelope and receival sites during the 30-day period prior to the clearing based on field observations (refer to Section 5.1.1.2) • Any pest animal baits used in buildings to be demolished will be in bait stations and disposed of prior to demolition.	• No direct impacts to Black Cockatoos • Clearing is within approved clearing limits • Reduce clearing of Black Cockatoo habitat to the extent practicable in final design • Reduce predator population within the Development Envelope and adjacent habitat compared to baseline survey results • No increase in predator observations when compared to baseline survey results, prior to construction commencing.
During construction	• Assessment of potential Black Cockatoo nesting hollows will be undertaken by a suitably experienced person for two nights within the seven five (5) business days prior to clearing. Trees containing Black Cockatoo nestlings will be tagged and checked during pre-clearing fauna searches. • Where suitable nest hollows within the area of the Proposal have not been blocked and the pre-clearing fauna assessment identifies Black Cockatoo occupation of the nest hollow (which may include chicks), the tree with the nest hollow will not be cleared until after the chick/s have left the nest. No	• No direct impacts to Black Cockatoos • Clearing is within approved clearing limits • Avoid abandonment of breeding hollows within the Development Envelope • Reduce predator population within the Development Envelope and adjacent

Timing	Management actions	Performance targets
	vegetation within 10 m of the tree will be cleared until after the hollow is vacant • A suitably experienced zoologist / environmental scientist will be on-site at all times during clearing of breeding habitat for Black Cockatoos and must maintain radio communication with machinery operators • Where a suitable nest hollow within the area of the Proposal has been blocked prior to the Black Cockatoo breeding season, the tree may be felled as part of the standard vegetation clearing process • Where a suitable nest hollow within the area of the Proposal has not been blocked and the pre-clearing fauna assessment has not identified Black Cockatoo occupation of the nest hollow, prior to clearing the tree, the tree will be 'bumped gently' with a machine with the machine operator and zoologist then to wait and observe the tree for a short time after. If no Black Cockatoo appears to be present, then the tree may be pushed over slowly to minimise risk of injury to any undetected animal (if present) • Any Black Cockatoos observed within the Development Envelope showing signs of injury or illness will be promptly taken to an experienced wildlife veterinarian or approved wildlife rehabilitation facility • A post-clearing survey shall be undertaken to ensure no injured Black Cockatoo individuals are present • Implement Proposal Drainage Strategy and ground and surface water management measures to avoid impacts to adjacent Black Cockatoo habitat • Implement WoNS and Declared Plant control, and surface water and *Phytophthora* dieback management measures within Development Envelope, clearing exclusion areas and receival sites to prevent potential indirect impacts to Black Cockatoo habitat • As part of the CEMP, the construction contractor has prepared a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire.	habitat compared to baseline survey results • No increase in predator observations when compared to baseline survey results, prior to construction commencing.

Timing	Management actions	Performance targets
	• Deploy soft-jaw traps bi-monthly within the Development Envelope and receival sites during construction based on the outcomes of site assessments	
Post construction	• Deploy soft-jaw traps bi-annually at fauna crossing structure access and egress points (once in each of the spring and autumn seasons) for five years post-construction based on the outcomes of the site assessments Also refer to Proposal *Habitat Fragmentation Plan* for post-construction management actions.	• Restore and maintain connectivity between known WRP habitat areas, through installing crossing structures and subsequent utilisation monitoring.

5.1.3 SMART performance standards

The DoEE (2019) *Action Management Plan Criteria* identifies the application of 'SMART' (Specific, Measurable, Achievable, Relevant and Time-bound) performance standards to be applied to Action Management Pans, including this FMP, in addition to the management and monitoring actions identified within the DotE (2014) guideline.

In their Instructions on how to prepare EP Act Part IV Environmental Management Plans (EPA, 2018), the EPA specifies the inclusion of performance indicators, trigger criteria and contingency actions for management-based plans.

SMART performance standards have been developed for this FMP to address the requirements of both the EPA and DCCEEW. Relevant terminology from both formats is included where relevant. SMART performance standards are intended to relate to measurable (numerical) values which can be applied to a Proposal (rather than qualitatively measured management / monitoring actions), and may include measurements such as 'performance indicators', 'corrective actions' and 'completion criteria'. Terms used in the SMART performance standards in this plan are defined in Table 5-5.

Table 5-5 Smart performance standard term definitions

Term	Definition
Performance target / Outcome	• Proposal-specific measurable target defined to assess whether the management actions are effective in achieving the environmental objective
Performance indicator	• The aspect of monitoring that provides a quantifiable parameter to measure performance over time to assess whether the target/outcome will be achieved/has been maintained.
Trigger / Early warning indicator	• Values specified for the performance indicator that provide for early warning of potential impacts or plan not meeting plan objective/s (reach of which is determined through monitoring)
Contingency / corrective action	• Actions to be undertaken should a trigger value be reached or exceeded
Completion criteria	• Proposal-specific indicators designed to demonstrate the environmental objective is being or has been met (criteria for success)

In relation to listed threatened fauna, Main Roads has prepared SMART performance standards directly related to the measurable impacts of the Proposal on each taxa. The proposed SMART performance standards for the Proposal are identified in Table 5-6, Table 5-7, and Table 5-8. These SMART performance standards are aligned to the management actions and performance targets identified in Table 5-2 to Table 5-4, the monitoring actions identified in Table 5-9 to Table 5-11 and the corrective actions identified in Table 5-6, Table 5-7, and Table 5-8.

The 'trigger criteria' and 'completion criteria' are considered to be achievable, with the risk potential of not achieving the proposed SMART performance standards captured by the risk assessment presented Section 4.4 and Appendix B.

As the proposed SMART performance standards for 'trigger criteria' and 'completion criteria' relate to physical measures which can be readily controlled through standard construction management processes[11], it is considered the proposed SMART performance standards have a low level of uncertainty, with additional margins for safety not required.

The SMART performance standards do not require detailed statistical analysis to determine if the 'trigger criteria' and 'completion criteria' have been met, nor require statistical power to detect change (for example, seasonal or climatic variability) at control or reference sites (for comparative purposes).

5.1.4 Contingency and corrective actions

Potential contingency and corrective actions to be undertaken should a trigger value be reached or exceeded are listed but not limited to those outlined in Table 5-6, Table 5-7 and Table 5-8. Monitoring (parameters, data collection method, location of sites, frequency and timing) and reporting of corrective actions will follow the methodologies described in Section 5.3.

[11] Measures that have been applied successfully to other large scale projects that are considered appropriate in minimising the environmental impacts. These measures ensure that clearing is implemented properly, that erosion does not occur, and that spills are minimised and managed appropriately.

Table 5-6. SMART performance standards for WRP

Environmental objective: ensure the potential impacts of the Proposal to WRP during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
During construction				
Avoid direct impacts to WRP individuals **Preclude use of refuge sites within the Development Envelope prior to construction**	• Unexpected observation of WRP on site • Live individual identified within hollow of a felled tree (despite pre-clearing fauna survey of hollows)	WRP injured or killed	• Stop works (temporary) within 50 m of the individual • Engage a suitably fauna handling specialist with legal authority to remove individuals and if injured transport the individual to a veterinarian • Record environmental incident • Modify pre-clearing fauna survey methodology (if appropriate) • Improve training and education for all personnel • Restart clearing within habitat area and monitor outcomes.	No WRP mortalities as a consequence of construction activity
	• Injured WRP individual within Development Envelope with injury suspected to be a consequence of construction activity		• All clearing and / or construction within the habitat area is immediately to cease • Investigate cause of injury or loss • Main Roads to consult with DBCA, and advise DCCEEW of the incident occurring • Revise clearing and construction measures for minimising impacts to WRP in consultation with DBCA to reduce likelihood of further WRP injury / mortality before work recommences • Improve training and education for all personnel • Restart clearing within habitat area and monitor outcomes.	

Environmental objective: ensure the potential impacts of the Proposal to WRP during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
Reduce predator population within the Development Envelope and adjacent habitat	Predator observations[12] do not decrease more than 25 % against baseline survey results within 3 months of initiation or increase to within 25 % of baseline during construction	Predator survey observations throughout the Development Envelope	• Investigate cause and develop remedial actions with predator control contractor • Monitor outcomes of corrective actions.	Predator observations decrease by at least 50 % against baseline survey results
No clearing outside of the approved footprint **Reduce clearing of WRP habitat to the extent practicable in current design** **Minimise indirect impacts on adjacent receival habitat**	Clearing of WRP habitat at 75 % of approved limit	Amount of WRP habitat cleared	• Review clearing program progress against design to confirm clearing of WRP habitat will not exceed the approved limit	Not more than 60.9 ha of WRP habitat cleared
	Clearing or disturbance of WRP habitat outside of the approved works area Unauthorised clearing of WRP habitat within the approved Development Envelope or exclusion areas		• Stop works (temporary) • Investigate cause and record environmental incident • Update environmental training of personnel (if appropriate) • Report incident to DBCA and DCCEEW • Undertake remediation works (if appropriate, following consultation with DCCEEW and DBCA / DWER) • Monitor outcomes of corrective actions • Review Offset Strategy with regard to the additional area cleared.	

[12] Includes direct sightings as well evidence of, such as tracks and scats

Environmental objective: ensure the potential impacts of the Proposal to WRP during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
Post construction				
Minimise or avoid indirect impacts on WRP in adjacent receival habitat	WRP abundance trends at monitored receival sites more than 10 % lower than reference sites as determined via prediction interval and / or breakpoint analysis	WRP density (individuals / ha) at monitored receival sites and comparative reference sites	• Investigate cause to determine whether the impact is project attributable • If the impact is project attributable, consult with DBCA and / or DCCEEW within 4 weeks of the change in abundance trends being detected to identify preventative and remedial actions • Implement corrective actions which may include: – Review practicality and relevance of management measures – Repair / alter design of fencing to block vehicular access if required – Install additional signage to restrict access • Monitor outcomes of corrective actions.	WRP abundance trends at potential impact sites commensurate with (i.e. not significantly different to) those at reference sites, with regard to preclearance data, within 15 years
Maintain or improve condition rating in adjacent WRP receival habitat	10 % decline in condition across more than 5 % of adjacent receival habitat in a single monitoring period	Quality / condition (function and value) of known WRP habitat adjacent to the Development Envelope	• Investigate cause to determine whether the impact is project attributable, including assessment of project indirect impact mechanisms (e.g. changes to surface water hydrology) against regional trends (e.g. climate / drying). • If the cause of the condition decline is not considered project attributable, agreement will be sought from DWER and DCCEEW regarding the decline and its cause. • If the impact is project attributable, consult with DBCA and / or DCCEEW within 4 weeks of the condition	Quality / condition of WRP habitat adjacent to the Development Envelope is maintained at baseline or any change is commensurate with (i.e. not significantly different to) that at reference site habitat

Environmental objective: ensure the potential impacts of the Proposal to WRP during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
			decline being detected to identify preventative and remedial actions • Implement corrective actions which may include: - Improve and implement increased measures / controls as necessary to protect remaining habitat and remediate impact areas beyond the Development Envelope - Repair / alter design of drainage structures - Implement weed control and or other management in receival sites, where access is allowed - Monitor the outcomes of corrective actions through bi-annual aerial 3D surveys	
	WONS and Declared weeds within the Development Envelope, and receival sites remain at or above baseline survey levels	Extent of WONS and Declared weeds within the Development Envelope	• Investigate cause and develop remedial actions with weed control contractor • Modify review schedule if required • Monitor outcomes of corrective actions.	WONS and Declared weeds within the Development Envelope are below baseline survey levels
Restore and maintain connectivity between known WRP habitat areas	Failure to install WRP bridges / underpasses as per specification	Number and design of installed structures	• Investigate cause and raise an incident report • Implement corrective actions which may include: – Review practicality and relevance of management measures – Improve training and education for all personnel – Improve and implement increased protective measures/controls	Installation of engineered movement structures as per specification

Environmental objective: ensure the potential impacts of the Proposal to WRP during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
			– Review monitoring frequency and method • Monitor outcomes of corrective actions.	
Minimise predation at crossing structures	Predator observations at monitored crossings increase by 25% over prior monitoring period	Predator observations at monitored crossings	• Investigate cause to determine whether the impact is project attributable • If the impact is project attributable, develop remedial actions with predator control contractor • Implement remedial actions which may include: – Increase trap density in key areas where observations remain at baseline – Review resource availability • Monitor outcomes on weekly basis until below trigger	Predator observations decrease by at least 50 % against baseline survey results

Table 5-7. SMART performance standards for BSM

Environmental objective: ensure the potential impacts of the Proposal to BSM during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger/ early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
No clearing outside the approved footprint	Clearing of BSM habitat at 75 % of approved limit	Amount of BSM habitat cleared	• Review clearing program progress against design to confirm clearing of BSM habitat will not exceed the approved limit	Not more than 5.5 ha of BSM habitat cleared
	Clearing of BSM habitat exceeds 5.5 ha		• Investigate cause and record environmental incident • Update environmental training of personnel (if appropriate) • Report incident to DCCEEW and DWER • Undertake remediation works (if appropriate, following consultation with DCCEEW and DBCA / DWER) • Monitor outcomes of corrective actions • Review Offset Strategy with regard to the additional area cleared.	
Maintain connectivity between potential BSM habitat areas	Culvert blocked or ineffective five days after initial detection	Presence / absence of damage or blockage	• Investigate cause and raise an incident report • Implement corrective actions which may include: – Unblocking the culvert – Review practicality and relevance of management measures – Revision of maintenance and weed control program to ensure culvert remains free of debris and other matter – Preventative actions such as modifications to infrastructure and additional engineering post-construction to prevent further non-compliance – A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence – Review monitoring frequency and method	Connectivity between potential BSM habitat areas is maintained

Environmental objective: ensure the potential impacts of the Proposal to BSM during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger/ early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
			• Monitor outcomes of corrective actions.	
	Clear span bridge not installed at Five Mile Brook	Bridge not within design specification	• Investigate cause and raise an incident report • Implement corrective actions which may include: – Review practicality and relevant of management measures – Improve training and education for all personnel – Improve and implement increased protective measures/controls – Review monitoring frequency and method • Monitor outcomes of corrective actions.	Installation of bridge as per specification
Maintain water quality levels within specified guidelines	ANZECC-ARMCANZ guidelines Vol 1 standard[13] triggers on two occasions and / or significant difference from baseline conditions in two monitoring periods	Water quality levels	• Investigate cause to determine whether the impact is project attributable and raise an incident report if necessary • Review results from baseline monitoring and comparison with reference sites for the same period. • Remedial action controls will be undertaken if required – to be determined based on likely cause e.g. spills, sedimentation or erosion • A review will be conducted of management measures and / or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence • Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance. • Monitor outcomes of corrective actions.	Water quality levels are maintained within specified guidelines or are commensurate with those of upstream reference sites
	Erosion / sedimentation	Number of days before	• Investigate cause to determine whether the impact is project attributable and raise an incident report if necessary	

[13] ANZECC & ARMCANZ (2000) guidelines (waterquality.gov.au)

Environmental objective: ensure the potential impacts of the Proposal to BSM during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger/ early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
	cause has not been remediated within 8 days of detection	erosion / sedimentation is remediated after detection	• If the impact is project attributable, remedial action controls will be undertaken immediately to repair damage if required • Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken to prevent further non-compliance. These may include: – Application of fill / mulch – Installation of gabion cages – Installation of jute matting to secure bank • A review will be conducted of management measures and/or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence • Monitor outcomes of corrective actions.	
Avoid changes in hydrology from baseline conditions	Change in hydrology from baseline conditions (quantum to be determined based on baseline monitoring)	Surface water flows and groundwater levels	• Investigate cause to determine whether the impact is project attributable and raise an incident report if necessary. Include consideration of results from baseline monitoring and comparison with reference sites for the same period. • If the impact is project attributable, remedial action controls will be undertaken if required – to be determined based on likely cause, and may include: – Installation of gabion cages – Modification of culverts or other drainage structures • Conduct review of management measures and / or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence	Hydrology baseline functions and values are maintained

Environmental objective: ensure the potential impacts of the Proposal to BSM during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger/ early warning indicator**	**Performance indicators**	**Corrective / contingency actions**	**Completion criteria**
			• Preventative actions such as modifications to infrastructure and additional engineering post-construction will be implemented where necessary to prevent further non-compliance • Monitor outcomes of corrective actions.	
Avoid indirect impacts to BSM in adjacent habitat	BSM absent from known habitat areas (where previously recorded) adjacent to the Development Envelope	BSM presence / absence in known habitat areas where previously recorded adjacent to the Development Envelope	• Investigate cause to determine whether the impact is project attributable and raise an incident report if necessary. Include consideration of environmental conditions (eg. hydrology and seasonal conditions), results from baseline monitoring and comparison with reference sites for the same period. • If the impact is project attributable, remedial action controls will be undertaken if required – to be determined based on likely cause e.g. spills, sedimentation or erosion • Conduct review of management measures and / or further education of staff / contractors to ensure that all possible steps are taken to prevent any reoccurrence • Preventative actions such as modifications to infrastructure and additional engineering post-construction will be taken where necessary to prevent further non-compliance. • Monitor outcomes of corrective actions.	BSM presence in known habitat areas (where previously recorded) adjacent to the Development Envelope is maintained

Table 5-8. SMART performance standards for Black Cockatoo

Environmental objective: ensure the potential impacts of the Proposal to Black Cockatoos during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective actions**	**Completion criteria**
No direct impacts to Black Cockatoos **Preclude potential breeding within Development Envelope prior to construction**	• Injured Black Cockatoo individual within Development Envelope with injury suspected to be a consequence of construction activity • Live individual identified within hollow of a felled tree (despite pre-clearing fauna survey of hollows)	Black Cockatoos injured or killed	• Stop works (temporary) within 50 m of the injured/live individual • Engage a suitably experienced fauna handling specialist to remove individual and transport the individual to a native fauna care facility • Investigate cause • Update environmental training of personnel (if appropriate) • Modify pre-clearing fauna survey methodology (if appropriate) • Record environmental incident • Monitor outcomes of corrective actions.	No Black Cockatoos mortalities as a consequence of construction activity
No clearing outside the approved footprint	• Clearing of Black Cockatoo habitat and / or suitable DBH trees at 75% of approved limit	Amount of Black Cockatoo foraging habitat cleared	• Review clearing program progress against design to confirm clearing of Black Cockatoo habitat will not exceed the approved limit	Not more than 60.9 ha of Black Cockatoo foraging habitat

Environmental objective: ensure the potential impacts of the Proposal to Black Cockatoos during clearing, construction and operation, are minimised and managed				
Performance target / outcome	**Trigger / Early warning indicator**	**Performance indicators**	**Corrective actions**	**Completion criteria**
Reduce clearing of Black Cockatoo habitat to the extent practicable in final design	• Clearing of Black Cockatoo habitat exceeds 60.9 ha / 1,088 suitable DBH trees / 11 suitable DBH trees that contain a potentially suitable nesting hollow(s)	Number of suitable DBH trees cleared Number of suitable DBH trees that contain a potentially suitable nesting hollow(s) cleared	• Report incident to DCCEEW and DWER • Undertake remediation works (if appropriate, following consultation with DCCEEW and DBCA / DWER) • Monitor outcomes of corrective actions • Review Offset Strategy with regard to the additional area cleared.	and 1,088 suitable DBH trees cleared Not more than 11 suitable DBH trees that contain a potentially suitable nesting hollow(s) cleared

5.2 Environmental maps and diagrams

- Figure 1 identifies the Proposal Action Area
- Figure 2 identifies WRP observations and habitat clearing categories
- Figure 3 identifies Regional Black Cockatoo Foraging Habitat, 12 km Radius
- Figure 4 identifies the Black Cockatoo Foraging Habitat Survey Area
- Figure 5 identifies the Black Cockatoo Foraging Habitat Survey Area (sectional maps)
- Figure 6 identifies Black Cockatoo Large Trees (DBH ≥ 500 mm) with Nest Hollows in the Survey Area
- Figure 7 identifies Black Cockatoo Large Trees (DBH ≥ 500 mm) with Nest Hollows in the Survey Area (sectional maps)
- Figure 8 identifies BSM records within and adjacent to the Development Envelope
- Figure 9 shows the Clearing staging plans
- Figure 10 shows the Possum fence concept plans
- Figure 11 shows the locations of fauna crossing structures, possum fencing, noise walls and screen walls
- Figure 12 identifies receival sites adjacent to the Development Envelope
- Figure 13 identifies BORR South WRP reference sites
- Figure 14 identifies the WRP telemetry study area

See Appendix A for figures.

5.3 Environmental monitoring

Main Roads has identified key actions to monitor the potential impacts of the Proposal to listed threatened fauna individuals and habitat during and post construction. These encompass monitoring of both direct and indirect impacts of the Proposal.
Main Roads will liaise with DCCEEW, DWER and DBCA as required to refine proposed triggers and corrective actions and submit a revised management plan under the respective conditions of approval (in accordance with EPBC 2019/8543 conditions 34 to 39).

Monitoring will be undertaken by suitably qualified individuals for the methodology type specified. For example, the visual assessment of dreys and hollows will be undertaken by a zoologist / environmental scientist.

The proposed monitoring methodologies and programs for each listed threatened fauna taxa are presented below.

5.3.1 WRP monitoring program

The WRP monitoring program is presented in Table 5-9. The objectives of the monitoring program are to:

- Detect WRP death or injury, and determine whether that is as a result of the action
- Evaluate the suitability, adequacy and effectiveness of the passive relocation management actions at reducing impacts to WRPs displaced by clearing from WRP habitat
- Evaluate impacts (if any) to resident WRP individuals within the Development Envelope or in receival sites.

Main Roads has identified key actions to monitor the potential direct and indirect impacts of the Proposal to WRP individuals and habitat prior to, during and post construction. The WRP monitoring program will assess the effectiveness of management actions implemented to achieve the performance targets specified in Table 5-2 and Table 5-6 and completion criteria specified in Table 5-6. It will also enable determination of whether trigger values have been reached or exceeded (Table 5-6).

The proposed monitoring program is presented in Section 5.3.1 and summarised in Table 5-9, and comprises:

- Pre-clearing WRP survey of the Development Envelope, receival sites and reference sites
- Recording of WRP encounters, deaths and injuries during clearing activities and construction
- Post-clearing WRP surveys of the receival and reference sites as part of on-going bi-monthly survey
- Mark-resight study using passive integrated transponder (PIT) tags of WRP within the Development Envelope and receival sites
- Telemetry study using GPS collars on up to fifty WRP and monitoring these animals for up to 3 months
- A genetic relatedness study of WRP with an expected fifty (50) samples DNA sequenced.

Except for the recording of WRP encounters during clearing operations, all the above-listed surveys contribute to Main Roads ability to assess achievement of condition 8 of EPBC Act approval for EPBC 2019/8543. Baseline values will be recorded or collections made (for DNA samples) for all surveys.

In order to accommodate the low risk clearing timeframe, clearing may be required to be conducted in stages over two consecutive years. Management and monitoring measures outlined in this plan will be applied during all clearing operations.

5.3.2 WRP habitat surveys

WRP habitat within the Development Envelope, at receival sites and at reference sites will be monitored prior to, during and after clearing and construction via assessment of aerial 3D imagery. The methodology and timing of this aspect of Proposal monitoring is detailed in the corresponding HFMP and is not repeated in this plan.

5.3.2.1 Bi-monthly surveys

WRP presence, abundance and distribution are based on advice from DBCA and will be monitored via the bi-monthly survey method adopted for the project, that commenced in October 2019. The bi-monthly surveys involve strip sampling of WRP habitat along transects spaced 20 m apart. These strips will be pre-loaded onto map imagery and displayed on tablets (UniStrong UT 10) with a GPS accuracy typically to within 1.5 m. Each strip will be surveyed by an appropriately experienced zoologist walking centrally through the strip at a slow steady pace (typically at between 1 and 2 km/hr), using a high-powered head torch to detect animals.

All observations of WRPs, BTPs, Common Brushtail Possum and any feral species within each survey will be recorded. In addition to species level identity, the following will be recorded:

- Number of individuals in each detection event.
- Age class of each individual (where possible).

- Sex of individuals (where possible).
- Reproduction status of females (where possible).
- Tree species in which the animal was detected.
- Presence of dreys or hollows.

As well as providing insight into WRP distribution and use of habitat areas, the bi-monthly sampling also captures seasonality and timing of peak fauna activity, which have been used to inform management measures. The longitudinal nature of the study enables detection of WRP abundance (density) trends.

Monitoring will be conducted prior clearing to establish baseline values and enable assessment of changes that may occur as a result of clearing. A baseline survey will be undertaken within thirty (30) days prior to clearing (or if staged, prior to each clearing stage) to confirm presence / absence and number of WRP individuals within the Development Envelope and receival sites (Figure 12).

The bi-monthly surveys are and will continue to be undertaken consistent with monitoring methods that have been implemented for the BORR bi-monthly monitoring program and the BORR North and Central construction management. Category 1 WRP habitat within the Development Envelope will be included in the bi-monthly surveys until it is cleared.

Two reference sites (Figure 13) will be surveyed as part of the on-going bi-monthly monitoring. The reference sites (Reserve 23000 and Lot 2 Boyanup Picton Road) were identified based on their proximity to the Development Envelope and the similarity of their habitat to that of the Development Envelope. Both reference sites have been included in the bi-monthly surveys since October 2019.

Post-clearing surveys

Post-clearing monitoring will be conducted in receival sites adjacent to Category 1 habitat as part of the on-going bi-monthly survey, with the timing amended to be as close after clearing has been completed as possible. Bi-monthly monitoring of receival sites and reference sites will continue for a minimum of 12 months after clearing is completed, after which time, monitoring frequency will reduce to bi-annually unless results indicate more frequent monitoring is required.

For the purposes of monitoring, receival sites are considered to extend one home-range width from the edge of the Development Envelope, estimated to be approximately 100 m. The 100 m width has been determined based on previous WRP home range assessment studies conducted within the Gelorup section of the Development Envelope (Biota, in Prep.).

For Category 1 habitat areas in Gelorup, where the greatest number of WRP individuals and area of WRP habitat occur within the Development Envelope, additional monitoring is proposed, as described in Sections 5.3.2.3, 5.3.2.4 and 5.3.2.5 below. This additional monitoring cannot be applied to areas of the Development Envelope that contain WRP habitat areas that are only sparsely populated by WRP. Data collected through the bi-monthly surveys since October 2019 provides comprehensive information on WRP abundance, distribution and persistence within and adjacent to the Development Envelope. Based on this data, Main Roads considers that the bi-monthly survey method is adequate to 'evaluate the suitability, adequacy and efficacy of passive relocation management actions at reducing impacts to western ringtail possum individuals displaced by clearing from Category 1 Clearing Areas' and 'evaluate impacts to residential western

ringtail possum individuals at receival sites' outside of Gelorup, as required under condition 5-2(3)(c) and 5-2(3)(d), respectively.

A report summarising the findings of the surveys will be provided annually, as part of annual compliance reporting. The report will document all records of Threatened and Priority fauna consistent with condition 5-2(3b).

5.3.2.2 During clearing survey

In accordance with EPBC Act approval for EPBC 2019/8543 condition 8(g), records will be maintained during clearing operations regarding sightings of WRP (and other Threatened or Priority fauna) encountered during clearing. A report summarising the number of individuals encountered and / or impacted during clearing and relocated (following protocols set out in Table 5-2) in accordance with any requirements of the lawful authority obtained under the BC Act will be provided to DCCEEW within twenty (20) days after clearing (or each clearing stage).

5.3.2.3 Mark-resight study

The targeted monitoring of WRP will incorporate a mark-resight study that will include uniquely identifying individuals via inserting PIT tags. The mark-resight study will commence prior to clearing and continue on a bi-monthly basis into the post construction period as necessary to meet the objectives of the Habitat Fragmentation Management Plan (HFMP) required under condition 10 of EPBC Act approval for EPBC 2019/8543. Results of this aspect of the monitoring program will be reported annually as part of annual compliance reporting.

The study will be concentrated within and adjacent to the Development Envelope between Jilley Road and Bussell Highway (Patches 7 and 8a (as shown in Figure 2)), which is the only substantial part of the Development Envelope with extensive habitat and numerous WRP home ranges adjacent to, extending into or within the clearing footprint. The key objectives of the mark-resight program are to:

- Uniquely identify as many WRP as possible within the Development Envelope and receiving habitat
- Provide permanent identification of WRP
- Provide a mechanism to confirm that any WRP reported as deceased by members of the public or by contractors originated in the Development Envelope
- Identify the sex and age class (adults versus young) of as many WRP as possible from within the Development Envelope and receiving habitat
- Provide insight into the proportion of the population that might be considered transient.

Using PIT tags to uniquely identify most WRP likely to be within and adjacent to patches 7 and 8a at clearing will allow for monitoring of individual movement patterns before, during and after clearing via a resighting program. This requires capturing as many WRP as possible from within patches 7 and 8a and their likely receiving habitat (at least one home range wide from the Development Envelope – 100 m) prior to clearing, using either traps or by hand (as per approved ethics application AEC 19-6-26).

The mark-resight study can also help inform the genetic relatedness study (see section 5.3.2.5) by calibrating the degree of genetic relatedness across different familial relationships. The nature of

familial relationships and degree of integration / overlap of home ranges may provide insights into the behaviour of displaced WRP.

Re-sightings would generally be undertaken in conjunction with on-going bi-monthly surveys and / or the pre-clearing surveys.

The mark-resight study will be initiated as early as practicable in the period leading up to clearing. It is proposed that the program would initially commence concurrent with the June 2022 bi-monthly survey.

WRP will predominantly be hand-captured, using long poles to direct individuals into trees where they can be captured. Targeted cage trapping may also be used, with cages strapped securely onto tree branches and cleared within two hours of sunrise (Biota 2022, AEC 19-6-26).

Upon capture each animal will be weighed, aged, sexed and measured and a pit-tag (Virbac BackHome Bioglass Mini Transponder) inserted under the skin between the scapulae. It is estimated that between 50 and 70 animals may be PIT tagged, but the final number will be determined by the population size. A pole mounted reader connected to a receiver via an 8 m cable will be used to scan accessible WRP for PIT tags.

5.3.2.4 Telemetry study

GPS collars record and store the location of an animal according to a pre-programmed schedule. Collars with Radio Frequency (RF) communication permit data to be downloaded remotely (up to a distance of 200 – 300 m depending on obstacles) and allow for remote upload of different recording schedules. GPS collars therefore represent the ideal tool for monitoring WRP prior to, during and after clearing activities.

Collars will be fitted to animals prior to clearing, with data anticipated to be received from the collars for up to 199 days from deployment. Results of this aspect of the monitoring program will be reported annually as part of annual compliance reporting.

The Telemetry study will be focused on the Gelorup section (between Jilley Road and Bussell Highway) (Patches 6, 7 and 8a) of the BORR South Development Envelope as indicated in Figure 14. Figure 14 shows both the application area (i.e. the Development Envelope and receival sites) and the search area (i.e. the area within which a signal is expected to be detected) for the Telemetry study. This section (combined with Patch 6, the isolated habitat patch to the east) represents the only portion of the Development Envelope where the WRP population is large enough to collar a suitable number of animals and where there is extensive adjacent receiving habitat. A minimum of 20 and up to 50[14] animals will be fitted with radio collars for the telemetry study. The Telemetry study is designed as a longitudinal study, where the home range of WRP individuals will be modelled from a number of GPS locations for a period of at least 3 months (ideally six weeks is required to model the home range).

The key objectives of the Telemetry study are to:

[14] Plan provided to DBCA June 2022. DBCA provided comment which was subsequently discussed during a workshop held on 28 June 2022. At the workshop, it was agreed by DBCA that the Telemetry and PIT tagging sample sizes were sufficient. It was further agreed that, where collars detach from an animal or a collared animal dies, the collar will be retrieved (if possible) and attached to a new individual to maintain the study sample size.

- Estimate home range size for WRP before, during and after clearing of an agreed section of the Gelorup section (Jilley Road to Bussell Highway) and an isolated habitat patch (Patch 6) as indicated in Figure 14
- Determine the fate of displaced WRP
- Determine the extent to which displaced WRP are able to establish new home ranges within adjacent habitat
- Determine the extent to which these new home ranges overlap with pre-existing home ranges
- Determine whether genetic relatedness influences the likelihood of WRP successfully sharing home ranges
- Determine whether artificial den sites, canopy connections, water sources and dens continue to be utilised post-clearing.

Consistent with previous studies for the Proposal, (Biota, in Prep.), the study will use Lotek LiteTrack 30 collars. The collars have a measured weight of 35 g which represents less than 4 % of the body weight of the smallest target adult animals (900 g) and potentially as little as 3.4 % of the larger animals (1,050 g). Initially, the collars will record at least six fixes in a 24-hour period and are fitted with a radio frequency (RF) and a VHF transmitter to permit additional fixes, ultimate retrieval of the collar and remote upload and download of data. The current battery life is estimated at 199 days based on the six GPS fixes and four hours of VHF Beacon and RF communication per day, potentially allowing for multiple deployments. This schedule would typically yield an estimated lifespan of 199 days in an average case scenario. The lifespan of the battery could be reduced or extended by adjusting the number of night-time fixes remotely via the RF communication. GPS schedules may be adjusted if required for short-term on-ground management during the clearing stage.

WRP will be captured using the standard and accepted techniques utilised previously (Biota, in Prep.), AEC 19-6-26)). WRP will predominantly be hand-captured, using long poles to direct individuals into trees where they can be captured. Targeted cage trapping may also be used, with cages strapped securely onto tree branches and cleared within two hours of sunrise. Females with obvious pouch young or dependent young will not be targeted for capture. Only adults heavier than 900 g will be considered for collaring. The animal must be adult so that it cannot outgrow the collar circumference during the life of the survey and of sufficient weight to accommodate the collar. The collaring team will include a wildlife veterinarian on-call during all capture sessions, and animals will be released at point of capture if they are highly stressed and difficult to handle. It should be noted however, that during the 2020 study, no captured WRP displayed signs of acute stress and all proved easy to handle and collar.

Upon capture, each WRP will have general health measurements recorded, including weight, sex, and an appraisal of tooth wear. Prior to fitting the collars, all animals will be scanned for microchips, and if none are present, will be injected with a PIT tag to permit unique identification in the future. The animal will then be fitted with a collar (GPS and VHF enabled), a small ear-clip will be taken for genetic testing, and the WRP will be released at point of capture.

Based on the results of the 2020 collaring project at the same site, application of collars across the estimated 199-day battery-life period is not anticipated to result in negative effects on survivorship. To assist with the retrieval of collars, a VHF beacon will be utilised that permits collars to be located using standard telemetry approaches. The VHF beacon has a mortality function whereby the VHF pulse rate doubles after a user defined period of inactivity. The VHF has a lifespan of approximately one week after the GPS ceases to record locations (expected to be on average 199 days).

The same techniques listed above for initial WRP capture (hand-capture with long pole assistance, and targeted cage trapping) will be used for recapturing WRP to retrieve their collars, along with the following variation of the targeted cage trapping technique. This technique involves replacing actively-used artificial den sites with cage traps overnight the WRP is foraging, and thus capturing the animal upon its return in the early morning. These traps would be checked within two hours of sunrise. Following capture and collar retrieval, the artificial den site would be reinstalled, and the WRP released inside it, where it is expected to stay and return to sleep until nightfall (B. Jones, pers. comm. 2021).

Data can be downloaded from the collars remotely and new schedules uploaded should the data indicated a schedule change is warranted. Over the anticipated three-month period that collars are attached, there will be considerable on-ground tracking of the animals, especially throughout the clearing process where the fauna spotter-catcher (with legal authority) will be onsite to ensure that the collared animals are appropriately shepherded from the clearance corridor and into adjacent habitat. During this period, the data schedule may be changed to best align with on-ground works.

Whilst tracking, the monitoring will aim to assess how well an animal is coping with the collar and carefully consider any significant changes to their pattern of movement from the data that may indicate distress.

To ensure the sample size remains robust, any collars that become detached from an individual or that are retrieved from deceased animals, and that are still in good working order, will be fitted to another individual within the study area. Testing for predator DNA will be conducted on the carcass of and / or collars retrieved from deceased animals.

5.3.2.5 Genetic relatedness study

Intuitively, animals dispersing into adjacent and familiar habitat should have a higher probability of survival than those relocated to entirely new locations even if these sites are relatively close by. Survival may also be enhanced if WRP disperse into the home ranges of WRP they are genetically related to, as opposed to being relocated into the home ranges of unrelated possums. This genetics hypothesis is untested and will be incorporated into the FMP. All animals captured from within the Development Envelope and receiving habitat will have a small ear clip taken which will be used for subsequent genetic analyses of the population and relational dynamics of WRP within the Development Envelope.

It is expected that a minimum of twenty (20) and up to fifty (50) animals will be sampled and their DNA sequenced as part of this study. Samples will eb collected during application of PIT tags (refer to Section 5.3.2.3) and / or collars (5.3.2.4).

Results of this aspect of the monitoring program will be reported annually as part of annual compliance reporting.

5.3.2.6 Installed temporary habitat features

Monitoring of WRP use of temporary artificial dreys, protective natural structures and water points will be undertaken prior to clearing, during clearing and for six weeks post-clearing. WRP behaviour will also be assessed using a combination of remote cameras and GPS collars through the Telemetry study described in Section 5.3.2.4.

Table 5-9. Proposed WRP monitoring program

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
No direct impacts to WRP individuals	Injury or death of WRP	• Low risk clearing protocol in Category 1 Habitat (Table 5-1) • Pre-clearing and post-clearing walkover inspection of all Category 1, 2 and 3 habitat cleared areas and fallen trees for listed threatened fauna species • Pre-demolition visual assessments • Pre-removal visual checks of vegetation stockpile areas	During construction: Daily prior to and after each clearing and demolition event and opportunistically during clearing	• Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring • Main Roads to consult with DBCA of the WRP injury or mortality occurring • Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger • Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
		• Post-construction visual assessment for road-strike	Post construction: In accordance with Main Roads standard road network maintenance program and opportunistically for the period of approval or otherwise agreed by the Minister for the Environment	• Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
	WRP encountered and relocated	• Low risk clearing protocol in Category 1 Habitat	During clearing and / construction: Daily	• Relocation of WRP recorded by construction contractor and reported to DCCEEW within twenty (20) days after clearing (for each clearing stage).
Reduce clearing of WRP habitat to the extent practicable in current design	Clearing area (ha) of WRP habitat within design specification	• Pre-clearing: Assessment of current design against approved clearing area • During construction: Construction area assessment to visually check / review clearing boundaries and assess vegetation clearing	During construction: Prior to clearing and daily Post construction: Not applicable	• Area of WRP habitat cleared recorded by construction contractor and reported to Manager Environment monthly • Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger • Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
Preclude use of refuge sites within the Development Envelope prior to construction	WRP access to potentially suitable refuge sites	• Visual inspection of potentially suitable refuge sites	During construction: Pre-clearing	• Number of potentially suitable refuge sites blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly
Restore and maintain connectivity between known	Engineered movement structures included	• Review of design reports and drawings at 50 % design and IFC (issued for construction) to ensure	Pre-construction	• Report annually as part of annual compliance reporting or in

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
WRP habitat areas through installing crossing structures and subsequent utilisation monitoring	in design specification	WRP bridges / underpasses are designed and incorporated into Proposal		response to exceedance of an approved trigger
	Engineered movement structures installed within specification	• Visual assessment of constructed / in construction WRP movement structures to confirm these are as per detailed design	During construction: Bi-annually	
	WRP monitored using rope bridge or underpass	• Use motion sensor IR cameras to assess utilisation (visual assessment of footage)	Post construction: For minimum of four weeks annually for up to fifteen (15) years post-construction or until demonstrated evidence of use is observed for two consecutive monitoring periods	
		• Mark-resight Study • Telemetry Study	During construction: Pre-clearing and bi-monthly Post construction: Bi-annually for years 1-2, annually for years 3-10	
	Rehabilitation success	• Visual inspection of rehabilitation installed around engineered movement structure locations (refer to Habitat Fragmentation Plan)	Post construction: Biannually for three years. Annual monitoring thereafter for the period of approval or otherwise agreed by the Minister for the Environment	

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
Minimise indirect impacts to WRP in adjacent receival habitat	WRP presence/ absence, abundance and distribution	• Nocturnal visual assessment for WRP in receival sites and reference sites (Lot 2 Boyanup Picton Road and Reserve 23000 Bussell Highway)	Prior to construction: Bi-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Bi-monthly strip sampling surveys (continuation of those commenced in October 2019) Post construction: Bi-annually for three years	• Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger • Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
	WRP tracking into adjacent habitat during clearing WRP use of installed habitat features	• Mark-resight study and Telemetry study	During construction: Pre-clearing and bi-monthly Post construction: Bi-annually for years 1-2, annually for years 3-10	
	Genetic relatedness study Predator DNA on deceased WRP carcass / retrieved collar(s)	• DNA scat analysis • DNA sample analysis	During construction: bi-monthly Post-construction: Bi-annually for at least three years	

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
	Possum fence installation within specification Possum fence condition	• Visual inspection of constructed / in construction possum fences • Visual inspection of possum fence for damage	During construction: Bi-annually Post construction: Biannually for the period of approval or otherwise agreed by the Minister for the Environment	
Maintain pre-construction condition rating in adjacent WRP receival habitat through pre and post construction condition monitoring	Quality / condition (function and value) of receival site habitat adjacent to the Development Envelope	• Analysis of aerial 3D footage and visual assessment of habitat quality	Prior to construction: Once (baseline monitoring) During construction: Bi-annually Post construction: Biannually for the period of approval or otherwise agreed by the Minister for the Environment	• Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger • Summary of achievement of annual compliance against performance measures and contribution of measures to achievement of the environmental objective
	WONS and Declared weeds within the Development Envelope and receival sites	• Development Envelope, and, receival sitesweed survey	Prior to construction: Once (baseline monitoring) During construction: Bi-annually	
Reduce predator population within the Development Envelope and adjacent habitat	Predator control efficacy, based on feral predator presence within DE and receival sites.	• Visual inspection for evidence / estimate of abundance of predators within Development Envelope and receival sites	Pre-construction: once one month prior to clearing for each clearing stage During construction: Bi-monthly based on site assessments	• Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
			Post construction: Bi-annually for at least five years	

5.3.3 BSM monitoring program

5.3.3.1 Objective

The objective of the monitoring program is to monitor the potential direct and indirect impacts of the Proposal to BSM habitat during and post construction. Monitoring will be conducted in areas of retained habitat adjacent to the Development Envelope and compared with data collected from reference sites. The BSM monitoring program will assess the effectiveness of management actions implemented to achieve the performance targets specified in Table 5-3 and Table 5-7 and completion criteria specified in Table 5-7. It will also enable determination of whether trigger values have been reached or exceeded (Table 5-7).

5.3.3.2 Reference sites and potential impact sites

The BSM monitoring program is presented in Table 5-10**.** Monitoring for impacts to BSM will be conducted at a reference site and two potential impact sites (Five Mile Brook at the southern extent of the Development Envelope). The reference site has been established for the purposes of providing comparative species and population trend data. Monitoring results from sites monitored as part of the BORR Northern and Central Proposal will also be used for comparison. Monitoring will comprise targeted fish and water quality sampling and visual assessment, and will include photo monitoring. Monitoring will be conducted by a suitably experienced zoologist / environmental scientist.

Baseline data collection at the reference site commenced in 2020 and will be used as a reference for ongoing monitoring. Any changes in conditions at potential impact sites will be compared with those in reference sites. This will enable determination of the likelihood of impacts having resulted from Proposal implementation to ensure surface water flows are maintained during implementation of the Proposal.

5.3.3.3 Photo point design

Photo points will be used in assessing erosion (bank stability), sedimentation and the function of culverts, and will be established prior to construction commencing. Where possible, photo points will be marked permanently with a stake and their locations will be recorded using a handheld GPS. All photographs will be taken from the top of the stake. Photo point monitoring will form part of each monitoring event.

5.3.3.4 Hydrological monitoring

Hydrological monitoring will be undertaken during and following construction to assess potential impacts to the hydrological regime in black stripe minnow habitat. This will include annual monitoring of the effectiveness of culverts in regard to maintenance of habitat connectivity, and of quarterly monitoring groundwater and surface water (when surface water is present).

5.3.3.5 Data analysis

Data analysis will consist of the following:

Water quality

Assessment of change in key parameters likely to be critical to BSM (see table 5-9) against baseline conditions, reference site conditions, and comparison with ANZECC guideline values.

Presence / absence

Assessment of BSM presence / absence data and trends between monitoring periods and between potential impact sites and reference sites.

Hydrology

Assessment against baseline conditions and reference site conditions.

Table 5-10. Proposed BSM monitoring program

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
No clearing outside the approved footprint	Clearing area (ha) of BSM habitat is within design specification	Pre-clearing: Assessment of design against approved clearing area During construction: Construction area assessment to visually check / review clearing boundaries and assess vegetation clearing	During construction: Prior to clearing and daily	Area of BSM habitat cleared recorded by construction contractor and reported to Manager Environment monthly Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger
Maintain connectivity between potential BSM habitat areas	Culverts and / or fish pathways within design specification Culverts effective (i.e. not blocked) (see Section 5.3.3.4)	Visual inspection for damage to or blockage of BSM habitat and / or fish pathways	During construction: Annually in winter Post construction: Annually in winter for the period of approval or otherwise agreed by the Minister for the Environment	Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger
Maintain water quality levels within specified guidelines	Surface water quality parameters critical to BSM survival (including TN, TP, temperature, pH, oxidation-reduction potential, conductivity and turbidity) (see Section 5.3.3.4)	Sampling using appropriate water quality meters and / or laboratory analysis Location: Upstream and downstream of the Five Mile Brook site and reference sites.	Prior to construction: Quarterly During construction: Quarterly Within 24 hours of any reportable spill event within 50 m of Five Mile Brook Post construction: Bi-annually the period of approval or otherwise agreed by the Minister for the Environment	Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger

Performance target / outcome	Parameter to be monitored	Methodology	Frequency	Recording and reporting
	Bank stability including evidence of erosion or sedimentation of BSM habitat (see Section 5.3.3.3), and visual evidence of contamination such as spills	Visual inspection, Spill Response Procedure	During construction: Opportunistic and weekly Post construction: Bi-annually for three years	
Avoid changes in hydrology from baseline conditions	Surface water and groundwater levels in known BSM habitat (see Section 5.3.3.4)	Manual water level sampling and / or measurement of waterbody depth	During construction: Quarterly (where able e.g. winter / spring only for surface water) Post construction: Biannually for the period of approval or otherwise agreed by the Minister for the Environment	Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid indirect impacts to BSM in adjacent habitat	Presence /absence of BSM in known habitat areas where previously recorded adjacent to the Development Envelope	Visual inspection of known habitat areas (where previously recorded) and at least one reference area	During construction: Annually Post construction: Annually for the period of approval or otherwise agreed by the Minister for the Environment	Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger

5.3.4 Black Cockatoo monitoring program

Main Roads has identified key monitoring actions to monitor the potential direct impacts of the Proposal to Black Cockatoo individuals and habitat during and post construction (revegetation).

The proposed monitoring program for the Proposal is identified in Table 5-11. The Black Cockatoo monitoring program will assess the effectiveness of management actions implemented to achieve the performance targets specified in Table 5-4 and Table 5-8 and completion criteria specified in Table 5-8. It will also enable determination of whether trigger values have been reached or exceeded (Table 5-8).

Monitoring will be undertaken by suitably qualified individuals for the methodology type specified. For example, the visual assessment of suitable nest hollows will be undertaken by a zoologist / environmental scientist.

Table 5-11 Proposed Black Cockatoo monitoring program

Performance target(s)	Parameter to be monitored	Methodology	Frequency	Recording and reporting
No direct impacts to Black Cockatoos	Injury or death of Black Cockatoos	• Pre-clearing fauna surveys • Pre-clearing and post-clearing walkover inspection of all Category 1, 2 and 3 habitat (which is also Black Cockatoo habitat) cleared areas and fallen trees for listed threatened fauna species • Pre-demolition visual assessments • Pre-removal visual checks of vegetation stockpile areas	Pre-clearing During construction: Post each clearing event and opportunistically Post construction: Not applicable	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW as part of annual compliance reporting
Reduce clearing of Black Cockatoo habitat to the extent practicable in final design	Clearing area (ha) of Black Cockatoo foraging habitat and number of suitable DBH trees cleared	Field survey of cleared areas with comparison to approved clearing area and mapped Black Cockatoo habitat areas	During construction: Daily inspection of clearing area demarcation; weekly assessment against approved clearing areas Post construction: Not applicable	Area of Black Cockatoo habitat and number of suitable DBH trees cleared recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW as part of annual compliance reporting

Performance target(s)	Parameter to be monitored	Methodology	Frequency	Recording and reporting
Clearing is within approved clearing limits	Number of trees with a DBH ≥ 500 mm containing a potentially suitable nesting hollow(s) cleared	Field survey of cleared areas with comparison to approved clearing area and known Black Cockatoo nest hollow locations	During construction: Daily inspection of clearing area demarcation; weekly assessment against approved clearing areas Post construction: Not applicable	Number of suitable DBH trees cleared recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW as part of annual compliance reporting
Preclude potential breeding within Development Envelope prior to construction	Black Cockatoo access to potentially suitable nesting hollow(s)	Visual inspection of potentially suitable nesting hollow(s)	Pre-clearing and opportunistically prior to clearing	Number of potentially suitable nesting hollow(s) blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly

6 ADAPTIVE MANAGEMENT, AUDIT AND REVIEW

The adaptive management approach aims to reduce impacts by embedding a cycle of monitoring, reporting and implementing change (where required). Main Roads will apply the principles of adaptive management through monitoring, adaptive management actions and implementing changes necessary to effectively meet the environmental objective. The FMP is intended to be dynamic and will be updated to reflect changes in management practices over the life of the Proposal. This will also allow flexibility to respond to new environmental impacts and adopt new technologies / management measures. The FMP may also be revised to address learnings from the implementation of corrective actions, should this occur. Adaptive management has been embedded throughout this document, with the key management processes described below.

In addition, auditing and review schedules are necessary to embed a formal process to identify and consider any need to update the FMP in order to achieve improved environmental performance (which may not otherwise be triggered by management or monitoring outcomes).

After completion of the construction contract, the BORR will be managed in line with Main Roads operational management procedures for the maintenance of roads.

6.1 Environmental auditing

This FMP will be audited annually by Main Roads during construction for the Proposal to ensure the implementation of the management and monitoring measures, and to confirm the management measures specified are achieving the environmental outcomes.
The proposed auditing schedule for this FMP is identified in Table 6-1.

Table 6-1. Environmental audit schedule

Timing	Action	Schedule
Pre-construction	Review of construction procedures to ensure FMP management / monitoring actions are incorporated within works procedures	Prior to construction (single event)
Construction	Inspections by site environmental personnel during the clearing of Habitat Category 1 areas	Daily
	Inspections by site environmental personnel to identify compliance with FMP	Periodic (generally weekly)
	Independent 'third-party' audit for assessment of compliance with FMP	Annually (once per calendar year)
Post construction	Independent 'third-party' audit for assessment of compliance with FMP	Annually (once per calendar year) for the period of approval or otherwise agreed by the Minister for the Environment

The results of the construction and post construction independent 'third-party' audit findings will be reported by Main Roads to DCCEEW and DWER as part of annual compliance reporting as outlined within Section 3.

6.2 Environmental review

Main Roads proposes to review this FMP annually in order to consider:

- The management and monitoring actions
- Opportunities for an improvement in environmental performance (for example, changes to construction methodology or timing)
- Identify a need to update this FMP to capture changes to the management and/or monitoring actions
- Identify any general need to update this FMP (for example, to capture new information on Black-stripe Minnow knowledge or management).
- Main Roads acknowledge that a revision to this FMP may trigger a need for additional approval by DCCEEW and / or DWER prior to implementing any changes to the specified management or monitoring actions.
- The proposed FMP review schedule for the Proposal is identified in Table 6-2.

Table 6-2. FMP review schedule

Timing	Action	Schedule
Construction	Review of the FMP management actions and monitoring results from year 1 to ascertain learnings and identify if a revised CFMP is required.	Prior to clearing recommencing following a 12-month break triggered by low risk clearing timeframes
Pre-construction, Construction and Post construction	Review of FMP management and monitoring actions Review of opportunities to improve environmental performance Revise FMP (if appropriate) and seek EPBC Act approval of revised FMP	Annually (once per calendar year)
*** In the event a non-compliance is identified in any post construction review, the subsequent review would be required annually until such time that no non-compliance is identified before the three-year period can be resumed.**		

6.3 Data management

Main Roads will maintain records on the implementation of this FMP in accordance with Main Roads' corporate standard document control procedures.

Data will be provided to DCCEEW in accordance with condition 21 of EPBC Act approval for EPBC 2019/8543.

The retention of records held by Main Roads will be maintained and managed in accordance with the Western Australian *State Records Act 2000* (WA).

7 STAKEHOLDER CONSULTATION

7.1 Stakeholder consultation

Main Roads has consulted with a range of stakeholders on the Proposal. These consultations have assisted to inform the preparation of this FMP.

A list summary of the stakeholders consulted on the Proposal (for which the environmental impact and management of listed threatened fauna taxa were discussed) is identified in Table 7-1.

Table 7-1. Stakeholder consultation

Type	Stakeholder	Consultation issues
Community	BORR Southern Community Reference Group	Proposal design to minimise impact to fauna habitat and wetland habitat Residual direct and potential indirect impacts to fauna habitat Management and monitoring of listed threatened fauna taxa Environmental assessment processes relevant to listed threatened fauna taxa.
Government	Western Australian Department of Water and Environment Regulation (EPA Services), Western Australian Department of Biodiversity, Conservation and Attractions	Proposal design to minimise impact to listed threatened fauna taxa habitat Residual direct and potential indirect impacts to listed threatened fauna taxa habitat Preparation / implementation of an FMP for the management and monitoring of impacts to listed threatened fauna taxa.
	DBCA and EPA services	Workshop held 28 June 2022 to discus and resolved DBCA comments on draft CFMP and HFMP, including advice regarding pre-clearing baseline survey for WRP that has been incorporated into this FMP.
Scientific Community / Industry	Biota Environmental Sciences (Mr. Roy Teale)	Provided advice regarding monitoring and management of WRP that has been incorporated into the development of this FMP.
	Wetland Research and Management	Provided advice regarding monitoring and management of CFM and BSM that has been incorporated into the development of this FMP.
	Ms. B. Jones	Provided advice regarding monitoring and management of WRP that has been incorporated into the development of this FMP.
	SW Environmental	Provided advice regarding management of WRP that has been incorporated into the development of this FMP.

7.2 External communications and complaints

The Construction Contractor will develop and maintain a complaints register to record all complaints. Complaints will be recorded by the person who receives the complaint (at the time it is received). Records to be obtained about a complaint include:

- Contact details for the person making the complaint (name and phone number as a minimum)
- Approximate location that the issue was identified by complainant
- Date, time and issues that the complaint relates to.

8 REFERENCES

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9 APPENDICES

Appendix	Title
Appendix A	Figures
Appendix B	Species Management Matrices and Risk Assessments
Appendix C	Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, *Pseudocheirus occidentalis* (Jones, 2022)
Appendix D	Annual compliance report template

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Figure 4. Black Cockatoo Foraging Habitat – Survey Area

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Figure 10. Possum fence concept plans

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Figure 12. Receival sites adjacent to the Development Envelope

Figure 13. BORR South WRP reference sites

Figure 14. BORR South WRP telemetry study area

WITHERS
COLLEGE GROVE
South Western Highway
DALYELLUP
GELORUP
STRATHAM
Bussell Highway
SLIP

LEGEND
Proposal Area
Major Road

HARVEY
BUNBURY
CAPEL
BUSSELTON

Paper Size ISO A3
0 250 500 750 1,000
Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Proposal Area

Project No. 61-37041
Revision No. 0
Date 4/06/2020

FIGURE 1

\\ghdnet\GHD\AU\Perth\Projects\61\37041\19_0_GIS\Maps\Working\BORRSouth_ARIFigures\Black Cockatoo AMP\6137041_001_BORRSouthProposalArea_Rev0.mxd
Print date: 04 Jun 2020 - 11:07

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200604; BORR: Proposal Area - 20191212. Created by: slei

Bussell Hwy

LEGEND

Proposal Area

Retention Vegetation Areas

Clearing Exclusion Areas

Clearing category

1

2

3

Pseudocheirus occidentalis Observation

Year 2019

August 2019

September 2019

October 2019

November 2019

December 2019

Year 2020

February 2020

April 2020

June 2020

July 2020

August 2020

1

2

SLIP

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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WRP habitat clearing categories

Project No. 61-37041
Revision No. 4
Date 20/08/2021

FIGURE 2

G:\61\37041\119_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_002_WRPClearingCategories_Rev4.mxd
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Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: *Pseudocheirus occidentalis* Habitat - 20200220; Landgate: Roads - 20180501, Imagery - WA Now accessed 20210820; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Western Ringtial Possum Observations - 20200130, Clearing categories - 20200317. Created by: slei

LEGEND

Proposal Area

Retention Vegetation Areas

Clearing Exclusion Areas

Clearing category

1

2

3

Pseudocheirus occidentalis Observation

Year 2019

August 2019

September 2019

October 2019

November 2019

December 2019

Year 2020

February 2020

April 2020

June 2020

July 2020

August 2020

1

2

Bussell Hwy

SLIP

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road Southern Section

WRP habitat clearing categories

Project No. 61-37041
Revision No. 4
Date 20/08/2021

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_002_WRPClearingCategories_Rev4.mxd
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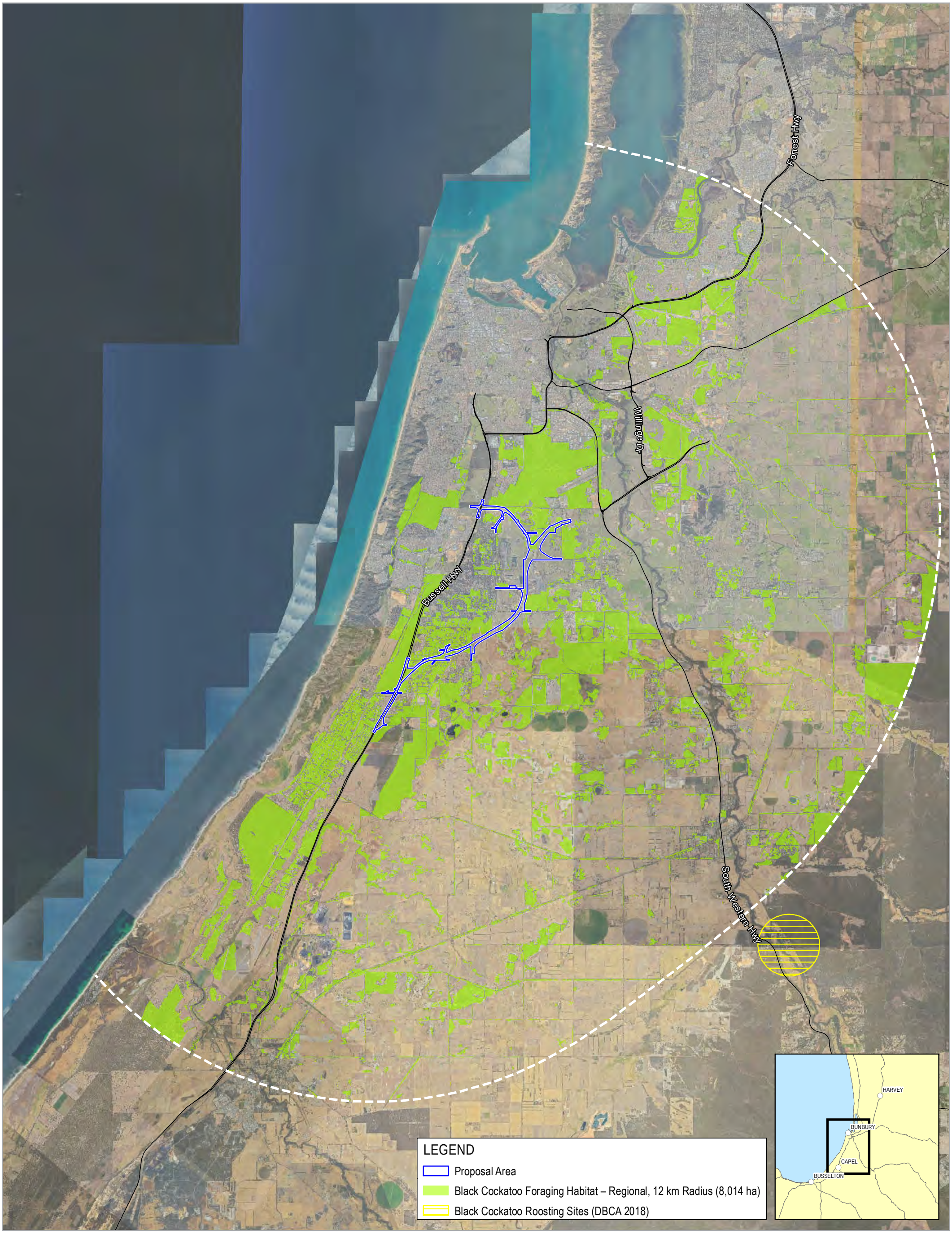
Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: *Pseudocheirus occidentalis* Habitat - 20200220; Landgate: Roads - 20180501, Imagery - WA Now accessed 20210820; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Western Ringtial Possum Observations - 20200130, Clearing categories - 20200317. Created by: slei



SLIP

Paper Size ISO A3

0 1 2 3 4

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road Southern Section

Black Cockatoo Foraging Habitat and Roosting Sites within 12 km of the Proposal Area

Project No.	61-37041
Revision No.	2
Date	2/10/2020

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\BORR South EPBC ARI\6137041_009_BORRSouthBC_Rev1.mxd
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Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: Black Cockatoo Foraging Habitat, Roosting Sites, Breeding Sites - 2019; Landgate: Roads - 20180501, Imagery - WA Now accessed 20201002; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214. Created by: bmorgan

Bussell Hwy

Bussell Hwy

SLIP

LEGEND

- Proposal Area
- Black Cockatoo Foraging Habitat – Regional, 12 km Radius (8,014 ha)
- Black Cockatoo Foraging/Breeding Habitat – Survey Area (128 ha)

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Black Cockatoo Foraging Habitat – Survey Area

Project No. **61-37041**
Revision No. **0**
Date **4/06/2020**

FIGURE 4

\\ghdnet\GHD\AU\Perth\Projects\61\37041\19_0_GIS\Maps\Working\BORRSouth_ARIFigures\Black Cockatoo AMP\6137041_003_BORRSouthBCForagingHab_SurveyArea_Rev0.mxd
Print date: 04 Jun 2020 - 11:10

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: Black Cockatoo Foraging Habitat - 2019; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200604; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Black Cockatoo Foraging/Breeding Habitat - 20200220. Created by: slei

Bussell Hwy

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2

LEGEND

- Proposal Area
- Black Cockatoo Foraging Habitat – Regional, 12 km Radius (8,014 ha)
- Black Cockatoo Foraging/Breeding Habitat – Survey Area (128 ha)

SLIP

Paper Size ISO A3

0 100 200 300 400

Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Black Cockatoo Foraging Habitat – Survey Area (sectional maps)

Project No. **61-37041**
Revision No. **0**
Date **4/06/2020**

FIGURE 5

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Print date: 04 Jun 2020 - 11:11

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; DBCA: Black Cockatoo Foraging Habitat - 2019; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200604; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Black Cockatoo Foraging/Breeding Habitat - 20200220. Created by: slei

Bussell Hwy

1

2

LEGEND

- Proposal Area
- Black Cockatoo Foraging Habitat – Regional, 12 km Radius (8,014 ha)
- Black Cockatoo Foraging/Breeding Habitat – Survey Area (128 ha)

SLIP

Paper Size ISO A3

0 100 200 300 400

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Black Cockatoo Foraging Habitat – Survey Area (sectional maps)

Project No. **61-37041**
Revision No. **0**
Date **4/06/2020**

FIGURE 5

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LEGEND

- Proposal Area

Black Cockatoo Observations

- White-tailed Black Cockatoo *C. latirostris* (EPBC E, BC E) or *C. baudinii* (EPBC E, BC E)
- Forest Red-tailed Black Cockatoo *C. banksii naso* (EPBC V, BC V)

Large Trees (DBH >500mm)

- Suitable Nest Hollow (38 trees)
- No Suitable Nest Hollow (2,477 trees)

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Bunbury Outer Ring Road Southern Section

Black Cockatoo Large Trees (DBH ≥ 500 mm) with Nest Hollows – Survey Area

Project No. **61-37041**
Revision No. **1**
Date **30/07/2020**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\BORRSouth_ARIFigures\Black Cockatoo AMP\6137041_005_BORRSouthBCTrees_SurveyArea_Rev1.mxd
Print date: 30 Jul 2020 - 12:16

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200730; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Black Cockatoo records, Large trees (DBH>500mm) - 20200403. Created by: slei

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1

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LEGEND

- Proposal Area

Black Cockatoo Observations

- White-tailed Black Cockatoo *C. latirostris* (EPBC E, BC E) or *C. baudinii* (EPBC E, BC E)
- Forest Red-tailed Black Cockatoo *C. banksii naso* (EPBC V, BC V)

Large Trees (DBH >500mm)

- Suitable Nest Hollow (38 trees)
- No Suitable Nest Hollow (2,477 trees)

SLIP

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Black Cockatoo Large Trees (DBH ≥ 500 mm) with Nest Hollows

Project No. **61-37041**
Revision No. **1**
Date **30/07/2020**

Figure 7

G:\61\37041\19_0_GIS\Maps\Working\BORRSouth_ARIFigures\Black Cockatoo AMP\6137041_006_BORRSouthBCTrees_Rev1.mxd
Print date: 30 Jul 2020 - 12:20

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200730; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Black Cockatoo records, Large trees (DBH>500mm). Created by: slei

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1

2

LEGEND

- Proposal Area

Black Cockatoo Observations

- White-tailed Black Cockatoo *C. latirostris* (EPBC E, BC E) or *C. baudinii* (EPBC E, BC E)
- Forest Red-tailed Black Cockatoo *C. banksii naso* (EPBC V, BC V)

Large Trees (DBH >500mm)

- Suitable Nest Hollow (38 trees)
- No Suitable Nest Hollow (2,477 trees)

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

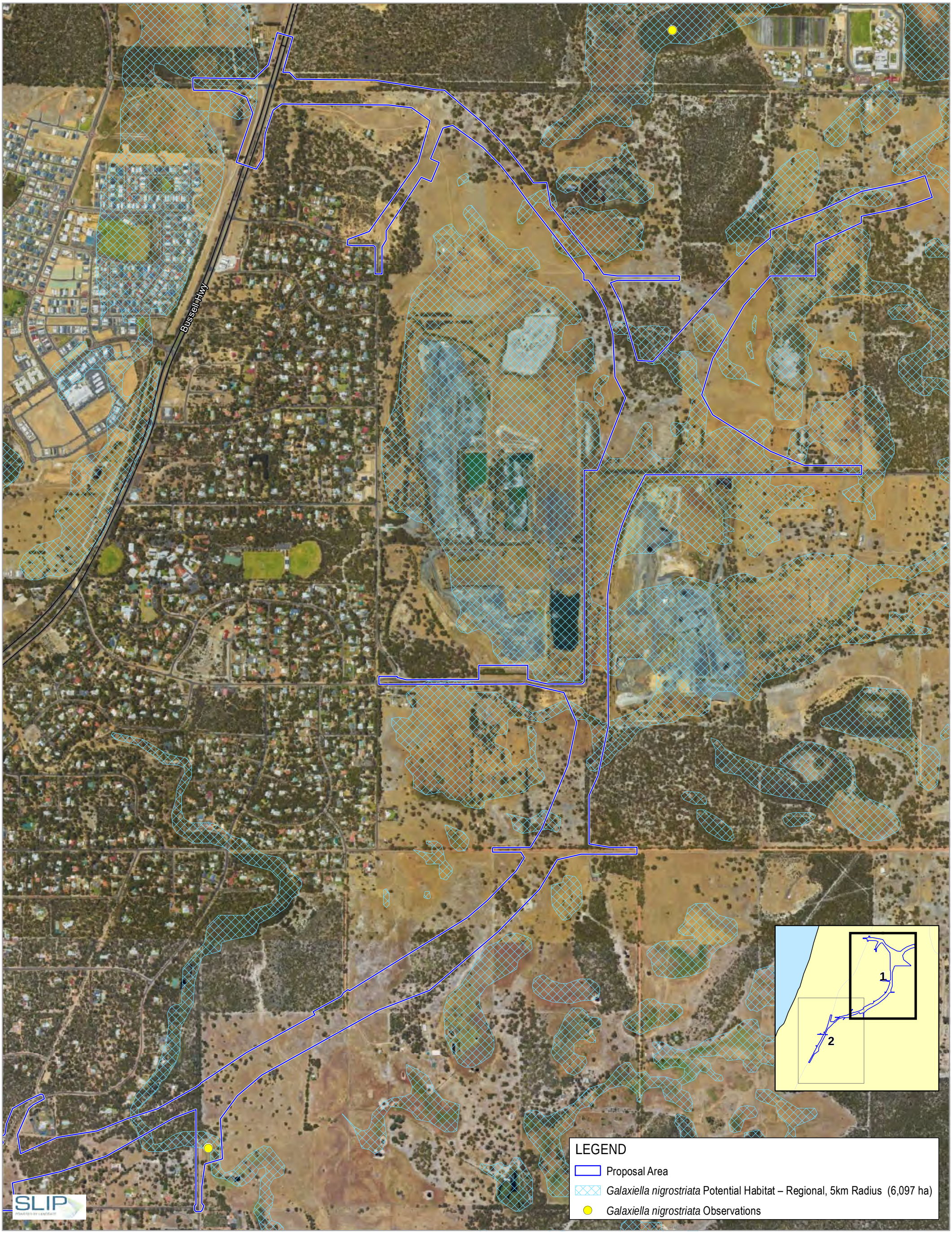
Black Cockatoo Large Trees (DBH ≥ 500 mm) with Nest Hollows

Project No. **61-37041**
Revision No. **1**
Date **30/07/2020**

Figure 7

G:\61\37041\19_0_GIS\Maps\Working\BORRSouth_ARIFigures\Black Cockatoo AMP\6137041_006_BORRSouthBCTrees_Rev1.mxd
Print date: 30 Jul 2020 - 12:20

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200730; BORR: Proposal Area - 20191212, Environmental Survey Area - 20200214; Biota: Black Cockatoo records, Large trees (DBH>500mm). Created by: slei



Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Black-stripe Minnow observations and habitat extent within and adjacent to the Proposal Area

Project No. 61-37041
Revision No. 1
Date 12/05/2020

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\BORR South s40(2)(a)\Fauna EMP\6137041_008_BORRSouthBlackStripe_Multipage_Rev1.mxd
Print date: 12 May 2020 - 15:35

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200512; BORR: Proposal Area - 20191212, *Galaxiella nigrostriata* Potential Habitat - 20200313; WRM: *Galaxiella nigrostriata* Record - 2020. Created by: slei

Bussell Hwy

1

2

LEGEND

Proposal Area

Galaxiella nigrostriata Potential Habitat – Regional, 5km Radius (6,097 ha)

Galaxiella nigrostriata Observations

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Black-stripe Minnow observations and habitat extent within and adjacent to the Proposal Area

Project No. 61-37041
Revision No. 1
Date 12/05/2020

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\BORR South s40(2)(a)\Fauna EMP\6137041_008_BORRSouthBlackStripe_Multipage_Rev1.mxd
Print date: 12 May 2020 - 15:35

Data source: Geoscience Australia: GeoData Topo 250k Series III - 2006; Landgate: Roads - 20180501, Imagery - WA Now accessed 20200512; BORR: Proposal Area - 20191212, *Galaxiella nigrostriata* Potential Habitat - 20200313; WRM: *Galaxiella nigrostriata* Record - 2020. Created by: slei

LEGEND

Proposed direction of clearing

Major road

BORR Southern Section Referral Boundary

USHER

COLLEGE GROVE

DAVENPORT

DALYELLUP

Bussell Hwy

General direction of clearing

NORTH BOYANUP

General direction of clearing

GELORUP

1

2

3

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
Environmental Management Plan

Proposed Clearing and Clearing Staging

Project No. 61-37041
Revision No. 2
Date 20/08/2021

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_003_WRPClearingStaging_Rev2.mxd
Print date: 20 Aug 2021 - 11:53

Data source: BORR team: South referral boundary - 20191212, Clearing stages, directions - 20200317; Biota: WRP Observations - 2020; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20200317. Created by: slei

LEGEND

- Proposed direction of clearing
- Major road
- Retention Vegetation Area
- Clearing Exclusion Areas
- BORR Southern Section Referral Boundary

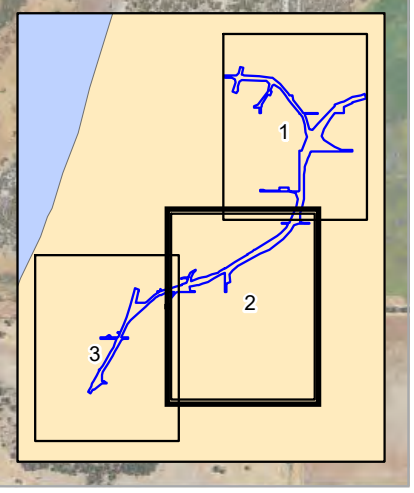
General direction of clearing

General direction of clearing

General direction of clearing

NORTH BOYANUP

GELORUP



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
Environmental Management Plan

Proposed Clearing and Clearing Staging

Project No. 61-37041
Revision No. 2
Date 20/08/2021

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_003_WRPClearingStaging_Rev2.mxd
Print date: 20 Aug 2021 - 11:53

Data source: BORR team: South referral boundary - 20191212, Clearing stages, directions - 20200317; Biota: WRP Observations - 2020; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20200317. Created by: slei

LEGEND

- Proposed direction of clearing
- Major road
- Retention Vegetation Area
- Clearing Exclusion Areas
- BORR Southern Section Referral Boundary

DALYELLUP

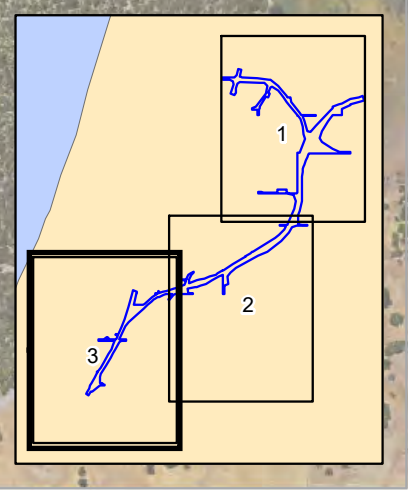
General direction of clearing

GELORUP

General direction of clearing

Bussell Hwy

STRATHAM



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Metres

Map Projection: Transverse Mercator
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Grid: GDA 1994 Perth Coastal Grid 1994

N

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section
Environmental Management Plan

Proposed Clearing and Clearing Staging

Project No. 61-37041
Revision No. 2
Date 20/08/2021

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_003_WRPClearingStaging_Rev2.mxd
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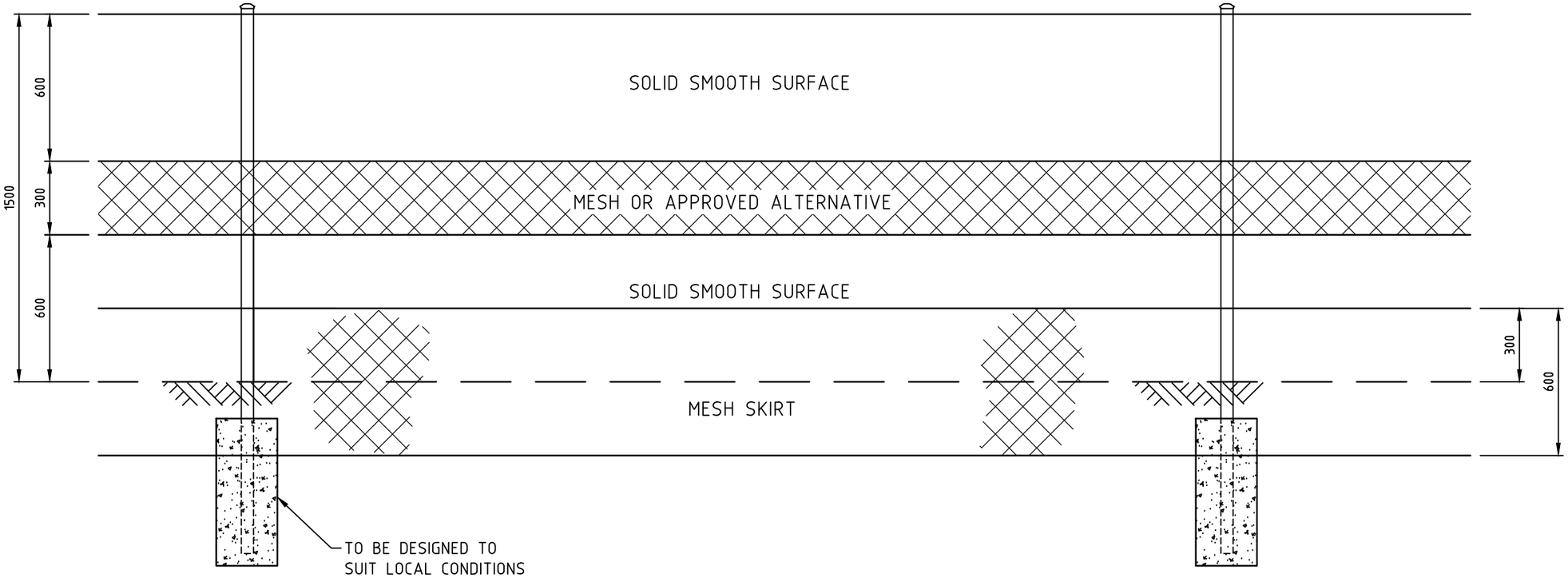
Data source: BORR team: South referral boundary - 20191212, Clearing stages, directions - 20200317; Biota: WRP Observations - 2020; Landgate: Roads - 201805, Localities - 20180319, Imagery - WA Now accessed 20200317. Created by: slei



AMENDMENTS

No.	DATE	DESCRIPTION	APPROVED

NOTES

1. SOLID MATERIAL TO BE CONTINUOUS METAL.
2. ANY POSTS TO BE ON ROADSIDE OF FENCE.
3. SUITABLE END TREATMENTS/STRAINER ASSEMBLIES TO BE DESIGNED TO SUIT LOCAL CONDITIONS.
4. REFER TO MRWA DRG No. 202002-0220 FOR MESH SKIRT DETAILS.

FIGURE 10

METADATA

GROUND SURVEY STANDARD:
DATE OF CAPTURE:
MAPPING SURVEY STANDARD:
DATE OF CAPTURE:
MAIN ROADS PROJECT ZONE:
HEIGHT DATUM:

mainroads WESTERN AUSTRALIA
METROPOLITAN & SOUTHERN REGIONS DIRECTORATE
SOUTH WEST REGION
ROBERTSON DRIVE BUNBURY 6230
Telephone(08) 9724 5600 Fax (08) 9724 5656

SCALE NOT TO SCALE

A3

FILE NUMBER 18/3958

DESIGNED / DRAWN A. SZELIGA 30/03/2020

VERIFIED

APPROVED

BUNBURY OUTER RING ROAD (H058)
FORREST HWAY (H057) TO BUSSELL HWAY (H009)
NORTHERN AND SOUTHERN SECTIONS
POSSUM FENCE CONCEPT PLAN

LOCAL AUTHORITY (211, 208, 206) SHIRE OF HARVEY, DARDANUP & CAPEL

MRWA DRAWING NUMBER 202002-0251

AMENDMENT

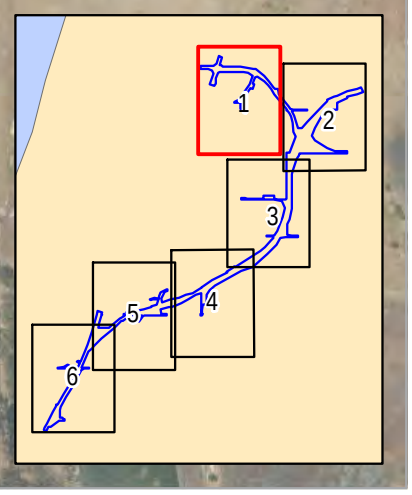
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Dual Use Culvert
- Fauna Rope Bridge
- Retaining Wall
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing

C31-



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Paper Size ISO A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. 61-37041
Revision No. 5
Date 30 Jun 2022

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:05

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

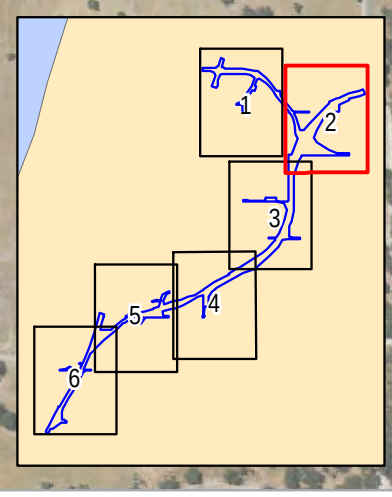
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Dual Use Culvert
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing

C31-024B
C31-024A
C31-023
C31-012A
C31-013A
C31-014A
C31-012B
C31-013B
C31-014B



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Grid: GDA 1994 MGA Zone 50

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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. 61-37041
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Date 30 Jun 2022

FIGURE 11

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Print date: 30 Jun 2022 - 14:05

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

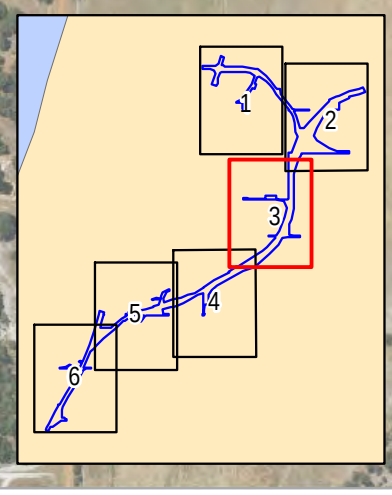
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Fauna Underpass (Box)
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing
- Possum Exclusion Fencing (Temporary)

C31-007



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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. 61-37041
Revision No. 5
Date 30 Jun 2022

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
Print date: 30 Jun 2022 - 14:05

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LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary
- Retention Vegetation Areas
- Clearing Exclusion Areas

Fauna Connectivity Structures

- Dual Use Culvert
- Fauna Land Bridge
- Fauna Rope Bridge (Under Bridge)
- Fauna Underpass (Arch)
- Fauna Underpass (Box)
- Noise Walls
- Retaining Wall
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing
- Possum Exclusion Fencing (Temporary)

UP9499

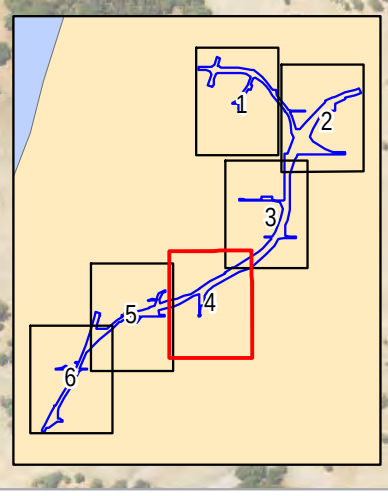
C32-003

C32-002

C31-002

C31-00X

BR1916



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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

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FIGURE 11

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Print date: 30 Jun 2022 - 14:05

Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary
- Retention Vegetation Areas
- Clearing Exclusion Areas

Fauna Connectivity Structures

- Fauna Land Bridge
- Fauna Rope Bridge
- Fauna Rope Bridge (Under Bridge)
- Fauna Underpass (Box)
- Noise Walls
- Screen Walls
- Retaining Wall
- Combined Possum and Kangaroo Exclusion Fencing
- Kangaroo Exclusion Fencing
- Possum Exclusion Fencing

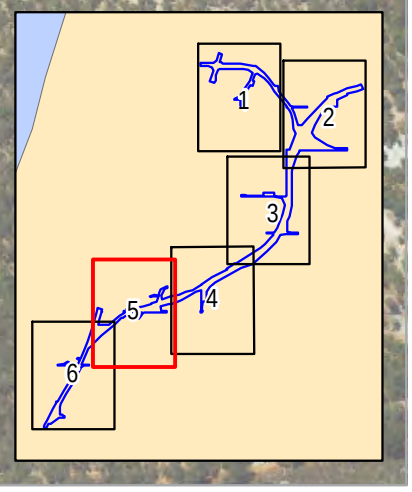
C3

C32-006

C32-005

C32-004

BR1916



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Grid: GDA 1994 MGA Zone 50

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Fauna Crossing Provisions and Exclusion Fencing Plan

Project No. 61-37041
Revision No. 5
Date 30 Jun 2022

FIGURE 11

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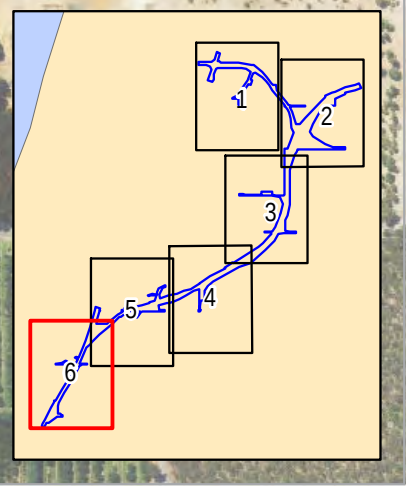
LEGEND

- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

- Fauna Rope Bridge
- Fauna Underpass (Box)
- Noise Walls
- Retaining Wall
- Possum Exclusion Fencing



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

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Bunbury Outer Ring Road Southern Section

Fauna Crossing Provisions and Exclusion Fencing Plan

Project No.	61-37041
Revision No.	5
Date	30 Jun 2022

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\BORR South Referral Update\Fauna EMP Update\6137041_004_PossumExclusionFencing_Rev4.mxd
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Data source: BORR team: North design - 201908, North referral boundary - 20191016, Possum Exclusion Fencing Structure - 20210222; Biota: Western Ringtail Possum Records - 20200327, Possum habitat - 201910; Landgate: Imagery - WA Now accessed 20220630. Created by: bmorgan

Patch 1

Patch 2

Patch 3

Patch 4

BUSSELL HIGHWAY

Lillydale Road

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

LEGEND

- BORR South development envelope
- BORR South category 1 clearing areas
- WRP receiving sites

N

0 400

metres

Author: R Teale Drawn: P Sawers Job No.: 1660

Date: 23 Mar 2022 Revised: 1 July 2022

Projection: MGA Z50 (GDA94) Scale: 1:7,250 @ A3

Figure 12
BORR South - Map 1
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Patch 5

Ducane Road

Marchetti Road

Lot 301 Marchetti Road

Patch 6

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

LEGEND

BORR South development envelope

BORR South category 1 clearing areas

WRP receiving sites

N

0 400

metres

Figure 12
BORR South - Map 2
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Author: R Teale | Drawn: P Sawers | Job No.: 1660 | Date: 23 Mar 2022 | Revised: 1 July 2022 | Projection: MGA Z50 (GDA94) | Scale: 1:7,000 @ A3

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

Lot 301 Marchetti Road

Yalinda Drive

Eucalypt Drive

Patch 7

Woods Road

Patch 8b

Patch 8a

Brockway Drive

BUSSELL HIGHWAY

LEGEND

- BORR South development envelope
- BORR South category 1 clearing areas
- WRP receiving sites

N

0 300

metres

Author: R Teale | Drawn: P Sawers | Job No.: 1660

Date: 23 Mar 2022 | Revised: 1 July 2022

Projection: MGA Z50 (GDA94) | Scale: 1:9,250 @ A3

Figure 12
BORR South - Map 3
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Jaymon Road

Patch 9

BUSSELL HIGHWAY

Map Index

MAP 1

MAP 2

MAP 3

MAP 4

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

LEGEND

BORR South development envelope

BORR South category 1 clearing areas

WRP receiving sites

N

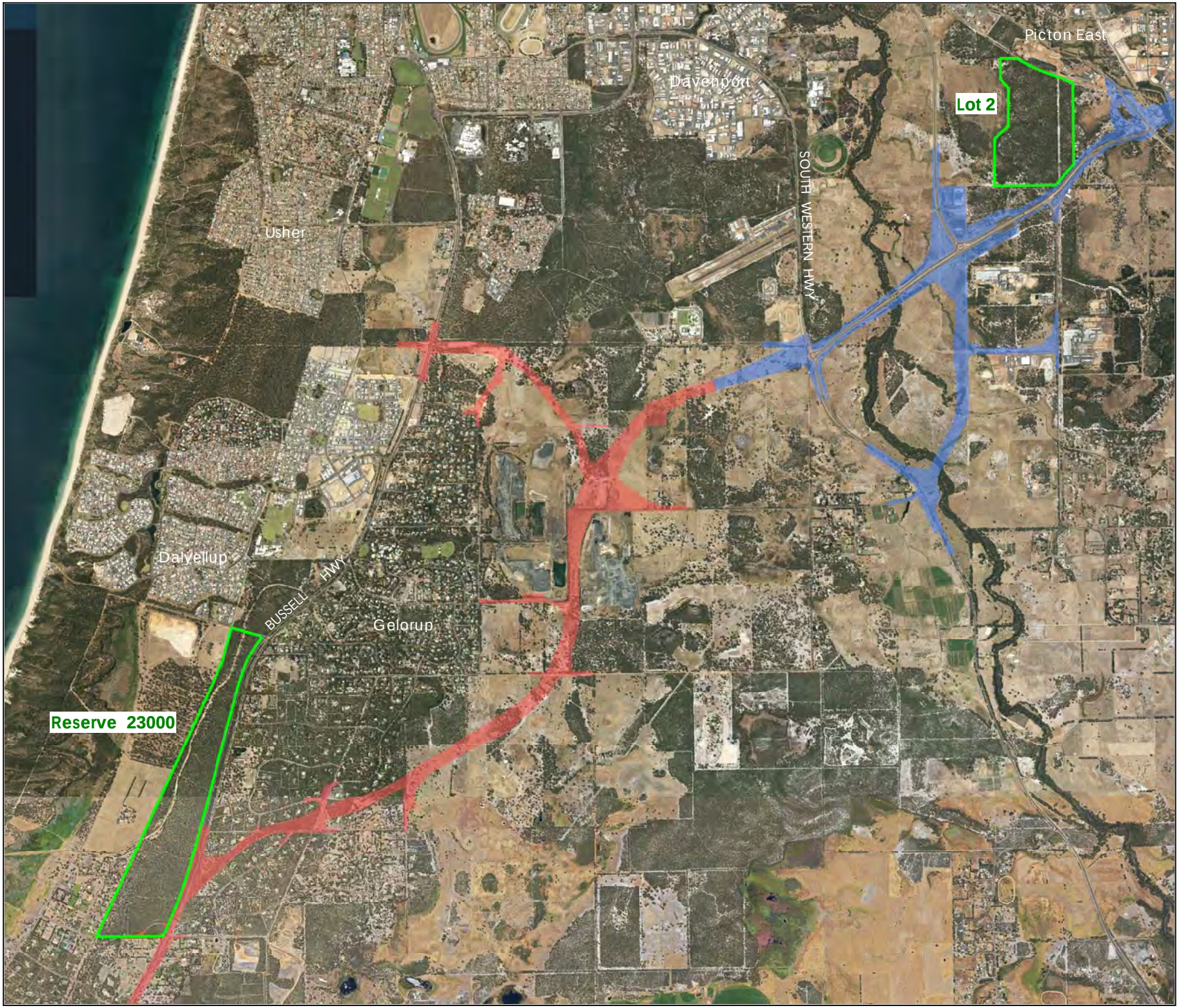
0 400

metres

Figure 12
BORR South - Map 4
Category 1 Clearing Areas
WRP Receiving Sites

Biota Environmental Sciences

Author: R Teale | Drawn: P Sawers | Job No.: 1660 | Date: 23 Mar 2022 | Revised: 1 July 2022 | Projection: MGA Z50 (GDA94) | Scale: 1:3,500 @ A3



LEGEND

- BORR South
- BORR Northern and Central Section
- Reference sites

N

0 2

kilometres

Author: Biota **Drawn: P Sawers**
Job No.: 1660
Date: 20 May 2022 **Revised: 2 June 2022**
Projection: MGA Z50 **Scale: 1:50,000 @ A4**

Figure 13
BORR WRP Reference Sites

Biota Environmental Sciences

Location Map

KARRATHA

W A

KALGOORLIE

PERTH

Map Area

Ducane Road

Marchetti Road

Yalinda Drive

Gelorup Rise

HIGHWAY

BUSSELL

Patch 6

Patch 7

Eucalypt Drive

Woods Road

Patch 8b

Patch 8a

Brockway Drive

Manea Road

Jilley Road

Lakes Road

Calinup Road

LEGEND

WRP Targeted for Collars

- BORR South category 1 clearing areas
- WRP receiving habitats
- Development envelope
- Search areas for collars
- Roads that can be used to locate collars (others will be used as required)

N

0 300

meters

Author: R Teale Drawn: P Sawers Job No.: 1660

Date: 16 May 2022 Revised: 20 May 2022

Projection: MGA Z50 (GDA94) Scale: 1:13,500 @ A3

Figure 14
BORR South Gelorup WRP Receiving Habitat & Telemetry Study

Biota Environmental Sciences

Appendix B: Management Matrices and Risk Assessment

Risk Matrix
(taken from Department of the Environment Environmental Management Plan Guidelines (DotE, 2014)

RISK MATRIX	
Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management activities are implemented)	
Highly Likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances
Qualitative measure of consequences (what will be the consequence/result if the issue does occur)	
Minor	Minor incident of environmental damage that can be reversed (*e.g. short-term delays to achieving plan objectives, implementing low-cost, well-characterised corrective actions*)
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts (*e.g. short term delays to achieving plan objectives, implementing well-characterised, high-cost/effort corrective actions*)
High	Substantial instances of environmental damage that could be reversed with intensive efforts (*e.g. medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions*)
Major	Major loss of environmental amenity and real danger of continuing (*e.g. plan objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies*)
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage (*e.g. plan objectives are unable to be achieved, with no evidenced mitigation strategies*)

		Consequence				
		Minor	Moderate	High	Major	Critical
Likelihood	Highly Likely	Medium	High	High	Critical	Critical
	Likely	Low	Medium	High	High	Critical
	Possible	Low	Medium	Medium	High	Critical
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Management matrix for Western Ringtail Possum (WRP)

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
For more information on the proposed management of potential impacts to WRP, refer to the MNES Fauna Management Plan									
Prior to construction									
Avoid: **Design refinement to minimise area of WRP habitat needed to be cleared for the Proposal**	Detailed design	Within Development Envelope	Minimise amount of WRP habitat requiring clearing	Amount of WRP habitat required to be cleared	Not more than 60.9 ha of WRP habitat cleared	Not applicable	Not applicable	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	Within Development Envelope	Avoid clearing outside the approved footprint	Extent of clearing of WRP habitat required	Not more than 60.9 ha of WRP habitat cleared	Not applicable	Not applicable	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **All WRP habitat to be retained within the development envelope will be surveyed and delineated with temporary fencing prior to site works to ensure it is conserved**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	Within Development Envelope	Avoid clearing outside the approved footprint Reduce clearing of WRP habitat to the extent practicable in current design	Clearing of WRP habitat outside of approved clearing area	Not more than 60.9 ha of WRP habitat cleared	Demarcation damaged or ineffective resulting in clearing of WRP habitat outside of approved clearing area	Daily inspection during clearing operations	Parameters: Clearing area (ha) of WRP foraging habitat Methodology: Field survey of cleared areas with comparison to approved clearing area and mapped WRP habitat areas Frequency: During construction: Daily inspection of demarcation; weekly assessment against approved clearing area Post construction: Not applicable	Area of WRP habitat cleared recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
During construction									
Avoid: **Clearing of vegetation shall be confined to daylight hours**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Timing of clearing operations	No night time clearing operations undertaken	Not applicable	Not applicable	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Cleared vegetation will be chipped immediately or transported at least 100 m from WRP habitat before further processing**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals Preclude use of refuge sites within the Development Envelope prior to construction	Presence of unchipped cleared vegetation within 100 m of WRP habitat	No unchipped cleared vegetation within 100 m of WRP habitat	Cleared vegetation not chipped or removed	Review and / or revise management procedures Update training of relevant personnel	Parameters: Injury or death of WRP Timing of clearing stockpile movement / disturbance Methodology: Visual assessment Frequency: During construction: After each clearing event and opportunistically during clearing Post construction:	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Main Roads to consult with DBCA of the WRP injury or mortality occurring

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
								Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **All buildings requiring demolition for the Proposal will be inspected for WRP for two days prior to demolition works**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Pre-demolition inspections undertaken	All buildings requiring demolition are inspected for two days prior to demolition works	Inspections not undertaken Inspections fail to identify WRP present	Engage suitably experienced zoologist / environmental scientist Review and / or revise management procedures Update training of relevant personnel Sensitive clearing protocols	Parameters: Injury or death of WRP Methodology: Visual assessment Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Daily for two days prior to each demolition event Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Main Roads to consult with DBCA of the WRP injury or mortality occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Where WRP are observed or suspected to be in any building to be demolished, attempts shall be made to capture the animal prior to the demolition works commencing**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Animals not able to be captured	Engage suitably experienced zoologist / environmental scientist Sensitive clearing protocols		
Avoid: **An experienced zoologist / environmental scientist / fauna-spotter will be on-site at all times during the demolition of buildings suspected or observed to house WRP**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Presence of suitably experienced zoologist / environmental scientist during WRP habitat clearing operations	Not applicable	Suitably experienced zoologist / environmental scientist not available	Early engagement Alternative personnel identified	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Machinery operators will maintain radio communication with their spotter**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Consistency of radio communications	Not applicable	Radio contact not or not able to be maintained	Radio equipment maintained Update training of relevant personnel	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Any pest animal baits used in buildings to be demolished will be in bait stations**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	All pest animal baits used in buildings to be demolished are in bait stations	Bait stations not used	Review and / or revise management procedures Update training of relevant personnel	Parameters: Presence of bait not in bait stations Methodology: Visual assessments Frequency: During construction: Daily during demolition activities Post construction: Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Spotlighting of potential**	Sensitive clearing protocols in accordance with MNES FMP	Within Development	Avoid direct impacts to WRP	Pre-clearing spotlighting of	Potential WRP habitat inspected	Spotlighting not undertaken	Engage suitably experienced	Parameters: Injury or death of WRP	Injury or death of WRP recorded by

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
WRP habitat will be undertaken by a suitably experienced person for two nights immediately prior to clearing (component of sensitive clearing protocols)	(this Plan)	Envelope	individuals	potential WRP habitat undertaken	via spotlighting for two nights immediately prior to clearing	Inspections fail to identify WRP present	zoologist / environmental scientist Review and / or revise management procedures Update training of relevant personnel Sensitive clearing protocols	Methodology: Visual assessment via spotlighting Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Daily for two days immediately prior to each clearing event of WRP habitat Post construction: Not applicable	construction contractor and reported to Manager Environment within 24 hours of incident occurring Main Roads to consult with DBCA of the WRP injury or mortality occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Pre-clearing fauna searches shall be conducted immediately prior to and during clearing operations and will include hollows, dreys, ground debris, dense ground-level vegetation, fallen timber and logs (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Pre-clearing fauna searches are undertaken	Potential WRP habitat is searched immediately prior to and during clearing operations	Searches not undertaken Inspections fail to identify WRP present	Engage suitably experienced zoologist / environmental scientist Review and / or revise management procedures Update training of relevant personnel Sensitive clearing protocols	Parameters: Injury or death of WRP Methodology: Visual assessment Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: immediately prior to and during each clearing event of WRP habitat Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Main Roads to consult with DBCA of the WRP injury or mortality occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Clearing will be conducted congruent with the habitat clearing categories as detailed in Appendix M of the Southern Section Additional Information for Preliminary Documentation**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Clearing activities in relation to identified habitat clearing categories	Clearing is conducted congruent with identified habitat clearing categories	Clearing not congruent with habitat clearing categories	Review and / or revise management procedures Update training of relevant personnel	Parameters: Clearing activities in relation to identified habitat clearing categories Methodology: Visual assessment Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Post each clearing event and opportunistically Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid:	Sensitive clearing protocols in	Within	Avoid direct	Number of WRP	No WRP	Drey not able to	Pre-clearing fauna	Parameters:	Injury or death of WRP

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
Vacant dreys will be removed prior to clearing where they are accessible (component of sensitive clearing protocols)	accordance with MNES FMP (this Plan)	Development Envelope	impacts to WRP individuals Preclude use of refuge sites within the Development Envelope prior to construction	injured or killed	mortalities as a consequence of construction activity	be inspected Drey not able to be blocked Blocking of drey ineffective	assessment	WRP access to dreys within clearing area Methodology: Visual assessment Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of accessible vacant dreys blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Vacant tree hollows suitable for WPR will be removed or blocked prior to clearing where they are accessible (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Preclude use of refuge sites within the Development Envelope prior to construction	Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Hollow not able to be inspected Hollow not able to be blocked Blocking of hollow not effective	Pre-clearing fauna assessment	Parameters: WRP access to hollows within clearing area Methodology: Visual assessment Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of potentially suitable hollow(s) blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **If WRP are observed during clearing operations, the tree containing the animal shall be left for up to 48 hours to allow for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	WRP present are not able to be coerced / moved Inspections fail to identify WRP present	Daily inspection during clearing operations Engage suitably experienced zoologist / environmental scientist	Parameters: WRP presence in tree(s) within clearing area Methodology: Visual assessment Frequency: During construction: Pre-clearing and post each clearing event and opportunistically	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of potentially suitable hollow(s)

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
after 48 hours, the animal will be coerced / moved to a safe area outside of the clearing footprint by the appointed zoologist / environmental scientist / fauna spotter-catcher (component of sensitive clearing protocols)								Post construction: Not applicable	blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Trees, as noted above, that are observed to support WRP and / after 48 hours will be 'bumped gently' with a machine prior to felling. The operator and spotter will wait and observe the tree for a short time. If the animal remains in the tree it shall be pushed over slowly onto vegetation within the clearing area that is yet to be cleared. The 'soft felling' of habitat trees will provide a 'cushion' for the vegetation being felled, minimising the risk of injury to the animal and allowing any WRP present with the opportunity to safely vacate (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of trees with potentially suitable hollows 'bumped gently' prior to felling Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Trees with resident WRP present not identified prior to clearing or not clearly demarcated in the field WRP present are not able to be coerced / moved Inspections fail to identify WRP present	Daily inspection during clearing operations Engage suitably experienced zoologist / environmental scientist Review and / or revise management procedures Update training of relevant personnel Sensitive clearing protocols	Parameters: WRP access to potentially suitable nesting hollow(s) Methodology: Visual inspection Frequency: During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Felled trees with hollows will be checked immediately for fauna after felling and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of felled trees checked for resident fauna Number of felled trees left on the ground overnight Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Inspections fail to identify WRP present	Engage suitably experienced zoologist / environmental scientist Review and / or revise management procedures Update training of relevant personnel	Parameters: WRP presence in felled trees Methodology: Visual inspection Frequency: During construction: Post each clearing event and opportunistically Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Habitat clearing is to be staged, commencing from existing edge lines / roads**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Implementation of clearing staging process	No WRP mortalities as a consequence of construction	Clearing staging process not implemented	Review and / or revise management procedures Update training of	Parameters: Implementation of clearing staging process Methodology:	Injury or death of WRP recorded by construction contractor and

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
and progressing towards habitat that will be retained to direct WRP towards these areas as detailed in Appendix M of the Southern Section Additional Information for Preliminary Documentation					activity		relevant personnel	Visual inspection Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Prior to, during and post each clearing event and opportunistically Post construction: Not applicable	reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Vacant dreys within felled trees will be destroyed immediately to prevent animals re-entering them**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals Preclude use of refuge sites within the Development Envelope prior to construction	Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Vacant dreys within felled trees are not destroyed	Review and / or revise management procedures Update training of relevant personnel	Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **A post-clearing survey shall be undertaken immediately following each day's clearing operations and the following morning to identify the presence of any injured animals (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Post-clearing survey not undertaken Survey fails to identify injured WRP	Review and / or revise management procedures Engage suitably experienced zoologist / environmental scientist	Parameter: Presence of injured WRP in cleared area Methodology: Visual assessment Frequency: During construction: After each clearing event of WRP habitat Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Possum fencing (temporary and permanent) will be installed adjacent at known habitat areas to exclude WRP moving onto the road as detailed in Appendix M of the Southern Section Additional Information for Preliminary Documentation. The fencing will be 1.5 m high and be constructed to**	Sensitive clearing protocols in accordance with MNES FMP (this Plan) and in accordance with CEMP	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	No WRP mortalities as a consequence of construction activity	Possum fence not installed Possum fence ineffective	Review and / or revise fence design and / or construction Review and / or revise management procedures Update training of relevant personnel	Parameters: Presence and effectiveness of possum fence Methodology: Visual assessment Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
prevent possums being able to climb it or dig under it (component of sensitive clearing protocols)								During construction: After installation of possum fence Post construction: Not applicable	or in response to exceedance of an approved trigger
Mitigate: **Fauna handling will only be conducted by a suitably experienced persons i.e. zoologist / fauna spotter-catcher (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Handling of fauna	All fauna handling conducted by suitably experienced persons	Fauna handled by inexperienced persons Suitably experienced persons not available	Review and / or revise management procedures Update training of relevant personnel Early engagement Alternative personnel identified	Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **Any WRP showing signs of injury or illness will be caught, bagged and taken to an experienced wildlife veterinarian or approved wildlife rehabilitation facility (component of sensitive clearing protocols)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	All injured and ill WRP are taken to an experienced wildlife veterinarian or approved wildlife rehabilitation facility No WRP mortalities as a consequence of construction activity	Suitably experienced wildlife veterinarian not available	Early engagement Alternative personnel identified	Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **If an injured WRP has not already been captured, then the appointed fauna-spotter must attempt to capture the animal for the purposes of veterinary assessment and treatment**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	Veterinary assessment and treatment is undertaken for all injured WRP No WRP mortalities as a consequence of construction activity	Injured WRP are not able to be captured	Engage suitably experienced zoologist / environmental scientist	Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **All treatment of injured fauna will be undertaken by a veterinarian**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Number of WRP injured or killed	All injured and ill WRP are taken to an experienced wildlife veterinarian or approved wildlife	Suitably experienced wildlife veterinarian not available	Early engagement Alternative personnel identified	Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
					rehabilitation facility No WRP mortalities as a consequence of construction activity				hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **Where clearing operations abut existing roads, in addition to standard traffic management measures, visual message boards will be installed to warn drivers of the potential for fauna to cross the road during clearing operations**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to WRP individuals	Presence of visual message boards	Visual message boards are installed where clearing operations abut existing roads No WRP mortalities as a consequence of construction activity	Visual message boards not installed Drivers fail to heed visual message board	Review and / or revise management procedures, including traffic management Update training of relevant personnel	Parameters: Presence and effectiveness of visual message boards Methodology: Visual assessment Frequency: During construction: During clearing when operations abut existing roads Post construction: Not applicable	Injury or death of WRP recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **Install permanent possum rope bridges / underpasses at key location(s) to enable fauna including WRP to move between retained habitat areas, as detailed in Appendix M of the Southern Section Additional Information for Preliminary Documentation**	In accordance with MNES FMP (this Plan) and CEMP	Within Development Envelope	Avoid direct impacts to WRP individuals Maintain connectivity between known WRP habitat areas	Presence of possum rope bridges / underpasses	Installation of possum rope bridges / underpasses as per specifications	Possum rope bridges / underpasses are not installed Possum rope bridges / underpasses are ineffective	Review and / or revise management procedures, including rope bridge / underpass design, installation and connectivity to surrounding habitat Update training of relevant personnel	Parameters: Presence and effectiveness of possum rope bridges / underpasses WRP scat presence / absence WRP filmed using rope bridge or underpass Methodology: Visual assessment, motion sensor cameras Frequency: Prior to construction: two-monthly baseline monitoring to determine pre-construction conditions including WRP abundance and distribution During construction: Bi-annually after installation of possum rope bridges / underpasses Post construction: Visual assessment: Quarterly for five years Motion sensor camera: Intermittently for five years	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Mitigate: **The size and design of all movement devices will be based on MRWA Design of Fauna Underpasses (MRWA,**	In accordance with MNES FMP (this Plan) and CEMP	Within Development Envelope	Avoid direct impacts to WRP individuals Maintain connectivity	Engineered movement structures are effective	Installation of engineered movement structures as per specification	Engineered movement structures are ineffective	Review and / or revise management procedures, including rope bridge / underpass	Parameters: Presence and effectiveness of engineered movement structures WRP scat presence / absence	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
2010), topography at the site, expert advice (Barbara Jones, pers. comm.), information from relevant studies and reports (QDMR, 2000; Harper, M., Mccarthy, M. & van der Ree, R., 2008) and in line with the concept designs. Refer to Appendix M of the Southern Section Additional Information for Preliminary Documentation			between known WRP habitat areas				design, installation and connectivity to surrounding habitat Update training of relevant personnel	WRP filmed using rope bridge or underpass Methodology: Visual assessment, motion sensor cameras Frequency: During construction: Bi-annually after installation of engineered movement structures Post construction: Visual assessment: Quarterly for five years Motion sensor camera: Intermittently for five years	exceedance of an approved trigger
Mitigate: **Underpass dimensions will be based on the fauna recorded or expected to occur in the vicinity, as detailed in Appendix M of the Southern Section Additional Information for Preliminary Documentation**	In accordance with MNES FMP (this Plan) and CEMP DCCEEW / DWER	Within Development Envelope	Avoid direct impacts to WRP individuals Maintain connectivity between known WRP habitat areas	Presence of underpasses suitable for use by recorded fauna taxa	Installation of underpass structures as per specification	Underpass structures are ineffective	Review and / or revise management procedures, including rope bridge / underpass design, installation and connectivity to surrounding habitat Update training of relevant personnel	Parameters: Presence and effectiveness of underpass structures WRP scat presence / absence WRP filmed using rope bridge or underpass Methodology: Visual assessment, motion sensor cameras Frequency: During construction: Bi-annually after installation of underpass structures Post construction: Visual assessment: Quarterly for five years Motion sensor camera: Intermittently for five years	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **The final underpass designs will incorporate the following features known to encourage use by fauna and reduce the risk of predation:** **Connection to nearby habitat via overhead rope hawsers and poles (minimum 2.5 m high)** **Objects for fauna to shelter on, under or in (furniture) will be locally sourced and will include sand, mulch, logs and rocks** **Revegetation using fast growing species at underpass entrances to provide cover for animals approaching, entering and leaving the underpasses** **Natural flooring such as sand**	In accordance with MNES FMP (this Plan) and CEMP	Within Development Envelope	Avoid direct impacts to WRP individuals Maintain connectivity between known WRP habitat areas	Presence of underpasses incorporating the stated features	Installation of underpass structures as per specification	Underpass structures are ineffective	Review and / or revise management procedures, including rope bridge / underpass design, installation and connectivity to surrounding habitat Update training of relevant personnel	Parameters: Presence and effectiveness of underpass structures WRP scat presence / absence WRP filmed using rope bridge or underpass Methodology: Visual assessment, motion sensor cameras Frequency: During construction: Bi-annually after installation of underpass structures Post construction: Visual assessment: Quarterly for five years Motion sensor camera: Intermittently for five years	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
or gravel **Possum fencing to direct fauna towards the underpass entrance** **Dual-use underpasses will have a concrete substrate and will not contain furniture (furniture would be washed away by drainage flows)**									
Mitigate: **The Proposal Area boundary will be fenced according to the detailed design to restrict pedestrian and vehicular access to retained WRP habitat**	In accordance with MNES FMP (this Plan) and CEMP	Within Development Envelope	Avoid direct impacts to WRP individuals	Presence of Development Envelope boundary fence	Pedestrian and vehicular access to retained WRP habitat is restricted	Fence not installed Fence ineffective	Review and / or revise management procedures, including fence design and installation Update training of relevant personnel	Parameters: Presence and effectiveness of Development Envelope boundary fence Methodology: Visual assessment Frequency: During construction: After installation of Development Envelope boundary fence Post construction: Visual assessment: Bi-annually for five years	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **Implement WONS and Declared Plant control to reduce prevalence and number accordingly, and surface water and *Phytophthora* dieback management measures within Development Envelope vegetation to prevent potential indirect impacts to WRP habitat**	In accordance with CEMP and Hygiene Management Plan	Within Development Envelope	Avoid indirect impacts to WRP in adjacent habitat	WRP presence/ absence, abundance and distribution	Quality / condition (function and value) of WRP habitat adjacent to the Development Envelope is maintained at baseline or any change is commensurate with that at reference site habitat	Reduction in habitat function and value	Review and / or revise management procedures Review and / or revise management measures	Parameters: Number and prevalence of weeds, Hectares of dieback infestation. Methodology: Visual assessment Frequency: During construction: Bi-annually Post construction: Bi-annually for three years	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **As part of the CEMP, the construction contractor has prepared a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire**	Standard construction protocols in accordance with CEMP and Fire Management Plan	Within Development Envelope	Avoid indirect impacts to WRP in adjacent habitat	Preparation of Fire Management Plan	Fire Management Plan prepared	Fire Management Plan not prepared Fire Management Plan not implemented or effective	Review and / or revise management procedures Update training of relevant personnel	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Implement Drainage Strategy and ground and surface water management measures to avoid impact to adjacent WRP habitat**	In accordance with CEMP, Drainage Strategy and Hygiene Management Plan	Within and adjacent to Development Envelope	Avoid indirect impacts to adjacent WRP habitat	WRP habitat quality / condition (function and value)	Quality / condition (function and value) of WRP habitat adjacent to the Development Envelope is	Groundwater drawdown impacts on, or changes in hydrology of, WRP habitat	Review and / or revise management procedures including modification of drainage infrastructure as required	Parameters: WRP habitat quality / condition (function and value) Methodology: Visual assessment Frequency: During construction: Bi-annually	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
					maintained at baseline or any change is commensurate with that at reference site habitat			Post construction: Bi-annually for three years	
Post construction									
Mitigate: **Post construction, undertake targeted rehabilitation and install design features at engineered movement structure locations (adjacent to the Development Envelope) to ensure access to water is maintained, and to make utilisation of the structures attractive and effective for WRP**	In accordance with CEMP and MNES FMP (this Plan)	Adjacent to Development Envelope	Maintain connectivity between known WRP habitat areas Avoid direct impacts to WRP individuals	Rehabilitation provides effective connectivity between habitat and engineered movement structure access points	Habitat and engineered movement structure access points are effectively connected for WRP use	Failure of rehabilitation	Refine species lists and methodologies Update training of relevant personnel Repeat rehabilitation works or conduct infill planting in failed areas	Parameters: Success of rehabilitation Effective connectivity between rehabilitation / vegetation and engineered movement structures Methodology: Visual assessment Frequency: Post construction: Bi-annually for three years after rehabilitation	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger

Risk assessment for WRP

Objective: To ensure that impacts to WRP are avoided and minimised as far as practicable during construction and operation of the Proposal
Key environmental values: WRP individuals and habitat

For more information on the proposed management of potential impacts to WRP, refer to the Conservation Significant Fauna Action Management Plan (Appendix M of the Southern Section Additional Information for Preliminary Documentation)

ENVIRONMENTAL OBJECTIVE	PERFORMANCE TARGET / OUTCOME	POTENTIAL IMPACT	NATURE OF IMPACT	PRE-CONTROL RISK			MANAGEMENT (see the *Conservation Significant Fauna Action Management Plan* (BORR IPT 2020))	POST CONTROL RISK			CONFIDENCE LEVEL
				LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME		LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME	
Minimise impacts to WRP	Avoid direct impacts to WRP individuals Preclude use of refuge sites within the Development Envelope prior to construction	Injury or death of WRP individuals during Proposal implementation	Known, predictable, irreversible	Possible	Moderate	Medium	Management during construction for risk of impact to WRP individuals Pre-construction survey of suitable refuge sites and ongoing monitoring Preclude access to refuge sites prior to clearing Installation of Possum fence as per specification	Unlikely	Moderate	Low	High
Minimise area of WRP habitat cleared during construction	Reduce clearing of WRP habitat to the extent practicable in current design Avoid clearing outside the approved footprint	Clearing or disturbance of WRP habitat outside of the approved clearing area	Known, predictable, irreversible	Possible	Moderate	Medium	Standard construction management to control construction clearing	Unlikely	Minor	Low	High
No significant indirect impacts to WRP habitat adjacent to the Proposal attributable to Proposal implementation	Avoid indirect impacts to WRP in adjacent habitat	Reduction in WRP habitat quality / condition (function and value) adjacent to the Proposal	Known, predictable, reversible (irreversible for *Phytophthora* dieback)	Possible	Moderate	Medium	Implement WONS, Declared Plant, surface water, and *Phytophthora* dieback management measures within Development Envelope vegetation / revegetation Standard construction management to control construction clearing	Unlikely	Minor	Low	High
		Bushfire occurrence as a result of Proposal construction resulting in loss of adjacent WRP habitat	Known, unpredictable, irreversible	Possible	Moderate	Medium	Standard construction management to control potential ignition sources during construction	Possible	Moderate	Medium	High
		Groundwater drawdown impacts on or changes in hydrology of adjacent WRP habitat	Known, predictable, reversible	Unlikely	Moderate	Low	Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals	Unlikely	Moderate	Low	High
	Maintain connectivity between known WRP habitat areas Avoid indirect impacts to WRP in adjacent habitat	Engineered movement structures not installed and / or ineffective	Known, predictable, reversible	Possible	Moderate	Medium	Installation of engineered movement structures as per specification, on-going monitoring and responsive management Targeted rehabilitation and maintain access to water at engineered movement structure locations adjacent to the Development Envelope to make utilisation of structures attractive and effective for WRP	Possible	Moderate	Medium	High

Management matrix for Black-stripe Minnow (BSM)

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	RESPONSIBLE AGENCY	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
Prior to construction										
Avoid: **Design refinement to minimise area of BSM habitat needed to be cleared for the Proposal**	Detailed design	DCCEEW / DWER	Within Development Envelope	Minimise amount of BSM habitat requiring clearing	Amount of BSM habitat required to be cleared	Not more than 5.5 ha of BSM habitat cleared	Not applicable	Not applicable	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
During construction										
Avoid: **BSM habitat to be cleared within Development Envelope will be demarcated in the field to ensure clearing only occurs within the approved clearing area**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Avoid clearing outside the approved footprint	Amount of BSM habitat cleared	Not more than 5.5 ha of BSM habitat cleared	Demarcation damaged or ineffective resulting in clearing of BSM habitat outside of approved clearing area	Daily inspection during clearing operations	Parameters: Clearing area (ha) of BSM habitat Methodology: Field survey of cleared areas with comparison to approved clearing area and mapped BSM habitat areas Frequency: During construction: Daily inspection of demarcation; weekly assessment against approved clearing area Post construction: Not applicable	Area of BSM habitat cleared recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Through detailed design, maintain hydrologic connections between BSM habitat areas to enable fish movement**	In accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain connectivity between potential BSM habitat areas Avoid changes in hydrology from baseline conditions Avoid indirect impacts to BSM in adjacent habitat	Specification of BSM habitat connectivity measures in detailed design	Connectivity of BSM habitat is maintained Hydrology baseline functions and values are maintained	Detailed design omits specifications for BSM habitat connectivity	Review of detailed design with revision as required Update training of relevant personnel	Parameters: Inclusion of specifications for BSM habitat connectivity Maintenance of connectivity Presence of BSM in adjacent habitat Methodology: Visual assessment Frequency: Prior to construction: Quarterly baseline monitoring to determine pre-construction conditions During construction: Weekly for maintenance of hydrologic connections, Annually for presence of BSM in adjacent habitat Post construction: Bi-annually for three years post construction to assess post-construction conditions	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Where possible, initial earthworks in BSM habitat will occur during summer months (Oct-April) when wetlands are dry and water levels are at their lowest**	Clearing protocols in accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain water quality levels within specified guidelines or commensurate with those of upstream reference sites Avoid changes in hydrology from	Timing of initial earthworks	Disturbance of BSM habitat during winter (high water level months) is minimised	Initial earthworks unable to be undertaken during summer months Unexpected / unseasonable rainfall and resulting	Construction schedule management Daily inspection during clearing operations Review and /	Parameters: Water levels Methodology: Visual assessment Frequency: Prior to construction: Quarterly baseline monitoring to determine pre-construction conditions During construction: Weekly	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	RESPONSIBLE AGENCY	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
				baseline conditions Avoid indirect impacts to BSM in adjacent habitat			inundation of construction area	or revise management procedures	Post construction: Bi-annually for three years post construction to assess post-construction conditions	
Avoid: **A clear span bridge with footings outside of the bed and banks of the channel will be installed at Five Mile Brook to maintain habitat connectivity and hydrology for BSM**	In accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain connectivity between potential BSM habitat areas Maintain water quality levels within specified guidelines or commensurate with those of upstream reference sites Avoid changes in hydrology from baseline conditions Avoid indirect impacts to BSM in adjacent habitat	Installation of clear span bridge Water quality levels Surface water flows and groundwater levels	Connectivity of BSM habitat is maintained	Bridge not installed to specifications	Review and / or revise management procedures Modification of infrastructure and additional engineering post-construction	Parameters: Presence of clear span bridge Water quality parameters Water levels Methodology: Visual assessment Frequency: Prior to construction: Quarterly baseline monitoring to determine pre-construction conditions During construction: Weekly after installation of clear span bridge Post construction: Bi-annually for three years post construction to assess post-construction conditions	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Install silt fences and / or curtains as required at, up and downstream of the Five Mile Brook bridge construction area**	In accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain water quality levels within specified guidelines or commensurate with those of upstream reference sites Avoid indirect impacts to BSM in adjacent habitat	Installation of silt fences and / or curtains per specifications Water quality levels	Water quality levels are maintained within specified guidelines or	Silt fences and / or curtains not installed to specifications Silt fences and / or curtains ineffective Unexpected / unseasonable rainfall and resulting inundation of construction area	Daily inspection during clearing operations Review and / or revise management procedures Modification of silt fences and / or curtains Update training of relevant personnel	Parameters: Presence and effectiveness of silt fences and / or curtains Water quality parameters Methodology: Visual assessment Frequency: Prior to construction: Quarterly baseline monitoring to determine pre-construction conditions During construction: Opportunistically and weekly after installation of silt fences and / or curtains Post construction: Bi-annually for three years post construction to assess post-construction conditions	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Design and construction of drainage to maintain surface water flows and groundwater regimes consistent with the pre-disturbance condition (baseline) as far as practicable**	In accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain connectivity between potential BSM habitat areas Maintain water quality levels within specified guidelines or commensurate with those of upstream reference sites Avoid changes in hydrology from baseline conditions Avoid indirect	Detailed design specifies drainage related infrastructure and construction methods to maintain BSM habitat connectivity Surface water flows and groundwater levels	Connectivity of BSM habitat is maintained Hydrology baseline functions and values are maintained	Detailed design omits drainage related infrastructure and construction method specifications to maintain BSM habitat connectivity	Review of detailed design with revision as required Update training of relevant personnel	Parameters: Inclusion of drainage related infrastructure and construction method specifications for BSM habitat connectivity Water quality parameters Water levels Methodology: Visual assessment Frequency: Prior to construction: Quarterly baseline monitoring to determine pre-construction conditions During construction: After clear span bridge installation	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	RESPONSIBLE AGENCY	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
				impacts to BSM in adjacent habitat					Post construction: Bi-annually for three years post construction to assess post-construction conditions	
Avoid: **Prior to any interruption of current surface water flows or fish pathways, culverts will be installed**	In accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain connectivity between potential BSM habitat areas Avoid indirect impacts to BSM in adjacent habitat	Installation of culverts per specifications Surface water flows and groundwater levels	Connectivity of BSM habitat is maintained Hydrology baseline functions and values are maintained	Culverts not installed to specifications Silt fences and / or curtains ineffective	Review and / or revise management procedures Modification of culvert Update training of relevant personnel	Parameters: Presence and effectiveness of culverts Presence of BSM in adjacent habitat Methodology: Visual assessment Frequency: During construction: Frequency: Prior to construction: Quarterly baseline monitoring to determine pre-construction conditions During construction: Weekly after culvert installation for maintenance of hydrologic connections, Annually for presence of BSM in adjacent habitat Weekly after culvert installation Post construction: Annually for three years post construction to assess post-construction conditions	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Avoid: **Long term hydrocarbon storage (i.e. hydrocarbons which shall not be used that day or not stored within equipment waiting to be used) or re-fuelling of equipment (with the exception of stationary plant) will not be permitted within 50 m of BSM habitat**	In accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain water quality levels within specified guidelines or commensurate with those of upstream reference sites Avoid indirect impacts to BSM in adjacent habitat	Water quality levels	Water quality levels are maintained within specified guidelines Hydrology baseline functions and values are maintained	Hydrocarbon storage or re-fuelling occurs within 50 m of BSM habitat Hydrocarbon contamination of BSM habitat	Review and / or revise management procedures Update training of relevant personnel	Parameters: Hydrocarbon storage and re-fuelling locations Methodology: Visual assessment Frequency: During construction: Weekly and opportunistically Post construction: Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **The Construction contractor has prepared a Spill Response Procedure capable of detecting within 24 hrs any spill potentially resulting in impact to BSM habitat for oil, chemical or hazardous material spill events, and to ensure any spill is contained effectively and cleaned up appropriately and efficiently with approved materials**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	DCCEEW / DWER	Within Development Envelope	Maintain water quality levels within specified guidelines or commensurate with those of upstream reference sites Avoid indirect impacts to BSM in adjacent habitat	Preparation of Spill Response Procedure	Spill Response Procedure prepared	Spill Response Procedure not prepared Spill Response Procedure not implemented or effective	Review and / or revise management procedures Update training of relevant personnel	N/A	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate:	Standard	DCCEEW /	Within	Avoid indirect	Preparation of	Fire	Fire	Review and /	N/A	Report annually to

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	RESPONSIBLE AGENCY	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
As part of the CEMP, the construction contractor has prepared a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire	construction protocols in accordance with CEMP and Fire Management Plan	DWER	Development Envelope	impacts to BSM in adjacent habitat	Fire Management Plan	Management Plan prepared	Management Plan not prepared Fire Management Plan not implemented or effective	or revise management procedures Update training of relevant personnel		DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger

Risk assessment for BSM

Objective: To ensure that impacts to BSM are avoided and minimised as far as practicable during construction and operation of the Proposal Key environmental values: BSM individuals and habitat											
ENVIRONMENTAL OBJECTIVE	PERFORMANCE TARGET / OUTCOME	POTENTIAL IMPACT	NATURE OF IMPACT	PRE-CONTROL RISK			MANAGEMENT (see the *Conservation Significant Fauna Action Management Plan* (BORR IPT 2020))	POST CONTROL RISK			CONFIDENCE LEVEL
				LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME		LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME	
Minimise area of BSM habitat cleared during construction	Reduce clearing of BSM habitat to the extent practicable in final design Avoid clearing outside the approved footprint	Clearing or disturbance of WRP habitat outside of the approved clearing area	Known, predictable, irreversible	Possible	Moderate	Medium	Standard construction management to control construction clearing (not specific to this AMP)	Unlikely	Minor	Low	High
No significant indirect impacts to BSM habitat adjacent to the Proposal attributable to Proposal implementation	Avoid indirect impacts to BSM in adjacent habitat Maintain water quality levels within specified guidelines Hydrology baseline functions and values are maintained	Impact to water quality in BSM habitat adjacent to the Proposal	Known, predictable, reversible	Possible	Moderate	Medium	Management to control sedimentation and erosion during construction Management of hydrocarbon storage during construction	Unlikely	Minor	Low	High
		Impact to water levels in BSM habitat adjacent to the Proposal	Known, predictable, reversible	Possible	Moderate	Medium	Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals (not specific to AMP)	Unlikely	Minor	Low	High
	Maintain connectivity between potential BSM habitat areas Avoid indirect impacts to BSM in adjacent habitat	Disruption of habitat connectivity	Known, predictable, reversible	Possible	Moderate	Medium	Management to maintain habitat connectivity for BSM, including installation of culverts	Unlikely	Minor	Low	High
	Avoid indirect impacts to BSM in adjacent habitat	Bushfire occurrence as a result of Proposal construction resulting in loss of adjacent WRP habitat	Known, unpredictable, irreversible	Possible	Moderate	Medium	Standard construction management to control potential ignition sources during construction (not specific to AMP)	Possible	Moderate	Medium	High

Management maxtrix for Black Cockatoos

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
Prior to construction									
Avoid: **Design refinement to minimise area of Black Cockatoo habitat needed to be cleared for the Proposal**	Detailed design	Within Development Envelope	Minimise amount of Black Cockatoo habitat requiring clearing	Amount of Black Cockatoo habitat required to be cleared	Not more than 65.4 ha of Black Cockatoo foraging habitat cleared	Not applicable	Not applicable	Not applicable	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Avoid: **Black Cockatoo habitat to be cleared within Development Envelope will be demarcated in the field to ensure clearing only occurs within the approved clearing area**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos Avoid clearing outside the approved footprint Reduce clearing of Black Cockatoo habitat to the extent practicable in final design	Clearing of Black Cockatoo habitat outside of approved clearing area	Not more than 65.4 ha of Black Cockatoo foraging habitat cleared	Demarcation damaged or ineffective resulting in clearing of Black Cockatoo habitat outside of approved clearing area	Daily inspection during clearing operations	Parameters: Clearing area (ha) of Black Cockatoo foraging habitat Number of trees with a DBH ≥ 500 mm containing a potentially suitable nesting hollow(s) cleared Methodology: Field survey of cleared areas with comparison to approved clearing area, mapped Black Cockatoo habitat areas and known Black Cockatoo nest hollow locations Frequency: During construction: Daily inspection of demarcation; weekly assessment against approved clearing area Post construction: Not applicable	Area of Black Cockatoo habitat cleared recorded by construction contractor and reported to Manager Environment monthly Number of suitable DBH trees cleared recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Avoid: **The final design will avoid trees with suitable nest hollows where possible**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos Reduce clearing of Black Cockatoo habitat to the extent practicable in final design	Number ≥ 500 mm DBH trees containing a potentially suitable nesting hollow(s) cleared	Not more than 13 large trees (DBH 500 mm) which contain a potentially suitable nesting hollow(s) cleared				
Avoid: **Where any of the thirteen trees with suitable nest hollows for Black Cockatoo will require clearing for the Proposal, the hollow will be visually inspected where safe and practicable. Where not in use the hollow will be 'blocked' to prevent breeding**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Preclude potential breeding within Development Envelope prior to construction	Number of Black Cockatoos injured or killed	No Black Cockatoo mortalities as a consequence of construction activity	Hollow not able to be inspected Hollow not able to be blocked Blocking of hollow not effective	Pre-clearing fauna assessment	Parameters: Black Cockatoo access to potentially suitable nesting hollow(s) Methodology: Visual inspection Frequency: During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of potentially suitable nesting hollow(s) blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Avoid: **Where blocking of the nest hollows cannot be undertaken (e.g. timing, access), a pre-clearing fauna assessment will be undertaken by a suitably experienced person to determine if the hollows are being used by Black Cockatoos**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Preclude potential breeding within Development Envelope prior to construction	Number of Black Cockatoos injured or killed	No Black Cockatoo mortalities as a consequence of construction activity	Pre-clearing fauna assessment fails to identify Black Cockatoos present	Sensitive clearing protocols		
During construction									

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
Avoid: **A suitably experienced zoologist / environmental scientist will be on-site at all times during clearing of breeding habitat for Black Cockatoos and must maintain radio communication with machinery operators**	Clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos	Presence of suitably experienced zoologist / environmental scientist during BC habitat clearing operations Consistency of radio communications	N/A	Suitably experienced zoologist / environmental scientist not available Radio contact not or not able to be maintained	Early engagement Alternative personnel identified Radio equipment maintained Deliver appropriate training	N/A	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Avoid: **Where a suitable nest hollow within the area of the Proposal has been blocked prior to the Black Cockatoo breeding season, the tree may be felled as part of the standard vegetation clearing process**	Standard construction protocols in accordance with CEMP and MNES FMP (this Plan)	Within Development Envelope	Avoid clearing outside the approved footprint	Number of potential nest hollows blocked	No Black Cockatoo mortalities as a consequence of construction activity	Blocking of hollow not effective	Pre-clearing fauna assessment	Parameters: Black Cockatoo access to potentially suitable nesting hollow(s) Methodology: Visual inspection Frequency: During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of potentially suitable nesting hollow(s) blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Avoid: **Where a suitable nest hollow within the area of the Proposal has not been blocked and the pre-clearing fauna assessment has not identified Black Cockatoo occupation of the nest hollow, prior to clearing the tree, the tree will be 'bumped gently' with a machine with the machine operator and zoologist then to wait and observe the tree for a short time after. If no Black Cockatoo appears to be present then the tree may be pushed over slowly to minimise risk of injury to any undetected animal (if present)**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos	Number of trees with potentially suitable hollows 'bumped gently' prior to felling	No Black Cockatoo mortalities as a consequence of construction activity	Trees with potentially suitable hollows not identified prior to clearing or not clearly demarcated in the field	Daily inspection during clearing operations	Parameters: Black Cockatoo access to potentially suitable nesting hollow(s) Methodology: Visual inspection Frequency: During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of potentially suitable nesting hollow(s) blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
Avoid: **Where suitable nest hollows within the Development Envelope have not been blocked and the pre-clearing fauna assessment identifies Black Cockatoo occupation of the nest hollow (which may include chicks), the tree with the nest hollow will not be cleared until after the chick/s have left the nest. No vegetation within 10 m of the tree will be cleared until after the hollow is vacant.**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos Avoid abandonment of breeding hollows within the Development Envelope	Chick presence in nest Maintenance of 10 m clearing exclusion zone around active nest	No clearing of trees with active nest hollows No clearing within 10 m of an active nest hollow No Black Cockatoo mortalities as a consequence of construction activity	Black Cockatoo presence not detected	Weekly inspection during clearing operations	Parameters: Black Cockatoo access to potentially suitable nesting hollow(s) Black Cockatoo nesting activity Methodology: Visual inspection Frequency: During construction: Pre-clearing and post each clearing event and opportunistically Post construction: Not applicable	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Number of potentially suitable nesting hollow(s) blocked prior to construction recorded by construction contractor and reported to Manager Environment monthly Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Mitigate: **Any Black Cockatoos observed within the Development Envelope showing signs of injury or illness will be promptly taken to an experienced wildlife veterinarian or approved wildlife rehabilitation facility**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos	Where injured or ill Black Cockatoos are taken to	All injured and ill Black Cockatoos are taken to an experienced wildlife veterinarian or approved wildlife rehabilitation facility	Suitably experienced wildlife veterinarian not available	Early engagement Alternative personnel identified	N/A	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger
Mitigate: **A post-clearing survey shall be undertaken to ensure no injured Black Cockatoo individuals are present**	Sensitive clearing protocols in accordance with MNES FMP (this Plan)	Within Development Envelope	Avoid direct impacts to Black Cockatoos	Number of Black Cockatoos injured or killed	No Black Cockatoo mortalities as a consequence of construction activity	Post-clearing survey not undertaken Survey fails to identify injured Black Cockatoos	Review and / or revise management procedures Engage suitably experienced zoologist / environmental scientist	Parameter: Presence of injured Black Cockatoos in cleared area Methodology: Visual assessment Frequency: During construction: After each clearing event of Black Cockatoo habitat Post construction: Not applicable	Injury or death of Black Cockatoos recorded by construction contractor and reported to Manager Environment within 24 hours of incident occurring Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Mitigate: **Implement WoNS, Declared Plant, surface water, and *Phytophthora* dieback management measures within Development Envelope**	In accordance with CEMP and Hygiene Management Plan	Within Development Envelope	Avoid indirect impacts to adjacent Black Cockatoo habitat	Black Cockatoo habitat quality / condition (function and value)	Quality / condition (function and value) of Black Cockatoo habitat adjacent to the	Reduction in habitat function and value	Review and / or revise management procedures	Parameters: Black Cockatoo habitat quality / condition (function and value) Methodology: Visual assessment	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or

MANAGEMENT ACTIONS	RELEVANT PROTOCOLS	LOCATION	PERFORMANCE TARGET / OUTCOME	PERFORMANCE INDICATOR	COMPLETION CRITERIA	POTENTIAL RISKS / THREATS	RISK MITIGATION	MONITORING	REPORTING
vegetation					Development Envelope is maintained at baseline or any change is commensurate with that at reference site habitat			Frequency: During construction: Bi-annually Post construction: Bi-annually for three years	threshold
Mitigate: **As part of the CEMP, the construction contractor has prepared a Fire Management Plan to minimise risk of ignition from construction activities and effectively manage any resulting fire / wildfire**	Standard construction protocols in accordance with CEMP and Fire Management Plan	Within Development Envelope	Avoid indirect impacts to adjacent Black Cockatoo habitat	Preparation of Fire Management Plan	Fire Management Plan prepared	Fire Management Plan not prepared Fire Management Plan not implemented or effective	Review and / or revise management procedures Update training of relevant personnel	N/A	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Avoid: **Implement Drainage Strategy and ground and surface water management measures to avoid impact to adjacent Black Cockatoo habitat**	In accordance with CEMP, Drainage Strategy and Hygiene Management Plan	Within and adjacent to Development Envelope	Avoid indirect impacts to adjacent Black Cockatoo habitat	Black Cockatoo habitat quality / condition (function and value)	Quality / condition (function and value) of Black Cockatoo habitat adjacent to the Development Envelope is maintained at baseline or any change is commensurate with that at reference site habitat	Groundwater drawdown impacts on, or changes in hydrology of, Black Cockatoo habitat	Review and / or revise management procedures including modification of drainage infrastructure as required	Parameters: Black Cockatoo habitat quality / condition (function and value) Methodology: Visual assessment Frequency: During construction: Bi-annually Post construction: Bi-annually for three years	Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold
Post construction									
Mitigate: **Where space and access allows, revegetation and landscaping of cleared areas within the Development Envelope with suitable endemic native species will be undertaken to provide foraging habitat for Black Cockatoos (excluding 10 m buffer from nearest traffic lane).**	In accordance with CEMP and MNES FMP (this Plan), Main Roads Road Reserve Revegetation Guidance (MRWA, 2016a; MRWA, 2016b)	Within Development Envelope	Rehabilitation provides suitable Black Cockatoo foraging habitat within 10 years of completion	Presence of Black Cockatoo foraging habitat in identified rehabilitation areas	Provision of suitable Black Cockatoo foraging habitat within 10 years of completion	Failure of rehabilitation	Refine species lists and methodologies Update training of relevant personnel Repeat rehabilitation works or conduct infill planting in failed areas	Parameter: Presence / absence and quality of foraging habitat available in rehabilitated areas Methodology: Field survey by suitably experienced personnel Frequency: Post construction: Bi-annually after rehabilitation	Recorded by construction contractor and reported to Manager Environment bi-annually once rehabilitation works are completed Report annually to DCCEEW and DWER as part of annual compliance reporting or in response to exceedance of an approved trigger or threshold

Risk assessment for Black Cockatoos

Objective: To ensure that impacts to Black Cockatoos are avoided and minimised as far as practicable during the construction and operation of the Proposal
Key environmental values: Black Cockatoo individuals and foraging / breeding (nesting) habitat

ENVIRONMENTAL OBJECTIVE	PERFORMANCE TARGET / OUTCOME	POTENTIAL IMPACT	NATURE OF IMPACT	PRE-CONTROL RISK			MANAGEMENT	POST CONTROL RISK			CONFIDENCE LEVEL
				LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME		LIKELIHOOD	CONSEQUENCE / SCALE	RISK OUTCOME	
Minimise impacts to Black Cockatoos	Avoid direct impacts to Black Cockatoos Preclude potential breeding within Development Envelope prior to construction	Injury or death of Black Cockatoos during Proposal implementation	Known, predictable, irreversible	Possible	Moderate	Medium	Nil risk of impact to mature individuals Management required during construction for risk of impact to nesting adults / young Preconstruction survey of suitable hollows and ongoing monitoring Preclude access to hollows prior to breeding season	Unlikely	Minor	Low	High
Minimise the area of Black Cockatoo foraging habitat cleared during construction	Reduce clearing of Black Cockatoo habitat to the extent practicable in final design Avoid clearing outside the approved footprint	Clearing or disturbance of Black Cockatoo habitat outside of the approved clearing area	Known, predictable, irreversible	Possible	Moderate	Medium	Standard construction management to control construction clearing	Unlikely	Moderate	Low	High
No significant indirect impacts to Black Cockatoo habitat adjacent to the Proposal attributable to Proposal implementation	Avoid indirect impacts to Black Cockatoo habitat adjacent to the Development Envelope	Reduction in function and value of adjacent habitat	Known, predictable, reversible (irreversible for *Phytophthora* dieback)	Possible	Moderate	Medium	Implement WoNS, Declared Plant, surface water, and *Phytophthora* dieback management measures within Development Envelope vegetation / revegetation Standard construction management to control construction clearing	Unlikely	Minor	Low	High
		Bushfire occurrence as a result of Proposal construction resulting in loss of adjacent Black Cockatoo habitat	Known, unpredictable, irreversible	Possible	Moderate	Medium	Standard construction management to control potential ignition sources during construction	Possible	Moderate	Medium	High
		Groundwater drawdown impacts on or changes in hydrology of adjacent Black Cockatoo habitat	Known, predictable, reversible	Unlikely	Moderate	Low	Standard construction management to control groundwater water abstraction consistent with WA Government water supply approvals	Unlikely	Moderate	Low	High

Appendix C: Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, *Pseudocheirus occidentalis* (Jones, 2022)

Progress report: a monitoring record for part of the Bunbury population of the Western Ringtail Possum, *Pseudocheirus occidentalis*

Prepared for MRWA and Biota by Barbara Jones in April 2022

1. Background

The Western Ringtail Possum (WRP, *Pseudocheirus occidentalis*) is a threatened marsupial that is now relatively common in numerous parts of the west coastal strip between Dawesville and East Augusta. In the period 1970-1990 this possum was absent or very rare in most of this west-coastal strip, and common only in a limited area between Peppermint Grove Beach and Yallingup. During the period 2010-20 clear evidence was emerging and accumulating of scattered population increases from the 1970-1990 levels, particularly in the south, in the Margaret River area and township, and within the Augusta township, and further north around Australind and Bunbury, around Myalup and Binningup, and also between Dawesville and Martins Tank.

Main Roads Western Australia (MRWA) and Biota Environmental Services commenced a Bunbury WRP monitoring project in late 2019. The project aimed to track the seasonal and ongoing population trends for the southeastern part of the Bunbury WRP population in each of two substantial woodland remnants (of 146 ha and 88 ha, where the vegetation was expected to persist in a natural state) and in the occupied woodland patches within the nearby BORR Southern Section development envelope. This 290 ha monitoring footprint was recounted in alternate months. This brief summary describes population trends evident in the largest available WRP sample over the first 15 counts (spanning 29 months, October 2019 to February 2022) of this ongoing monitoring sequence. At this stage, it is envisaged that this bimonthly count schedule will continue into 2023.

All WRP counts used a 20 m wide strip sampling approach. These strips were pre-loaded onto map imagery and displayed on tablets (UniStrong UT 10) with a typical GPS accuracy of 1.5 m. An appropriately experienced zoologist walked centrally through the strip at a steady pace (typically 1-2 km/hr) using a high-powered head torch to detect animals.

The monitoring sequence shows population peaks associated with seasonal recruitment, and identifies those months of each year when counts were lower. The seasonal lows are of major interest for the management of habitat clearing, since these identify a regular part of each year when most WRP are mature and WRP numbers are lowest.

2. Population peaks and lows

In each of the two years with complete counts (2020, 2021), the lowest counts were in August (Table 1).

Table 1. WRP counts in 290 ha of Bunbury mixed woodland counted 15 times since October 2019

Count #	Year	Month	WRP counted	% down after each peak count
1	2019	October	365	
		November		
2		December	422	100%
	2020	*January*		
3		February	315	25%
		March		
4		April	294	30%
		May		
5		June	301	29%
		July		
6		August	270	36%
		September		
7		October	348	100%
		November		
8		December	296	15%
	2021	*January*		
9		February	255	27%
		March		
10		April	223	36%
		May		
11		June	211	39%
		July		
12		August	209	40%
		September		
13		October	295	100%

Count #	Year	Month	WRP counted	% down after each peak count
		November		
14		December	284	4%
	2022	*January*		
15		February	186	37%

In 2020 and 2021, the August minimum was followed by a peak count in October. In 2019, the peak count was in December. These observations suggest that WRP counts would have started rising in September, and peaked sometime within the two-month period October-November.

By the February counts (2020, 2021, 2022), WRP numbers were 25-35% lower than they had been on the recent peak count (October or December). By the August counts (2020, 2021), WRP numbers were 35-40% lower than they had been on the previous year's peak.

Figure 1 shows the WRP numbers averaged for two counts in each of three seasonal periods: a spring recruiting peak (Oct-Dec), and for autumn (Feb-Apr) and winter (Jun-Aug). The overall decline in WRP numbers evident in Figure 1 is discussed later, in Section 5.

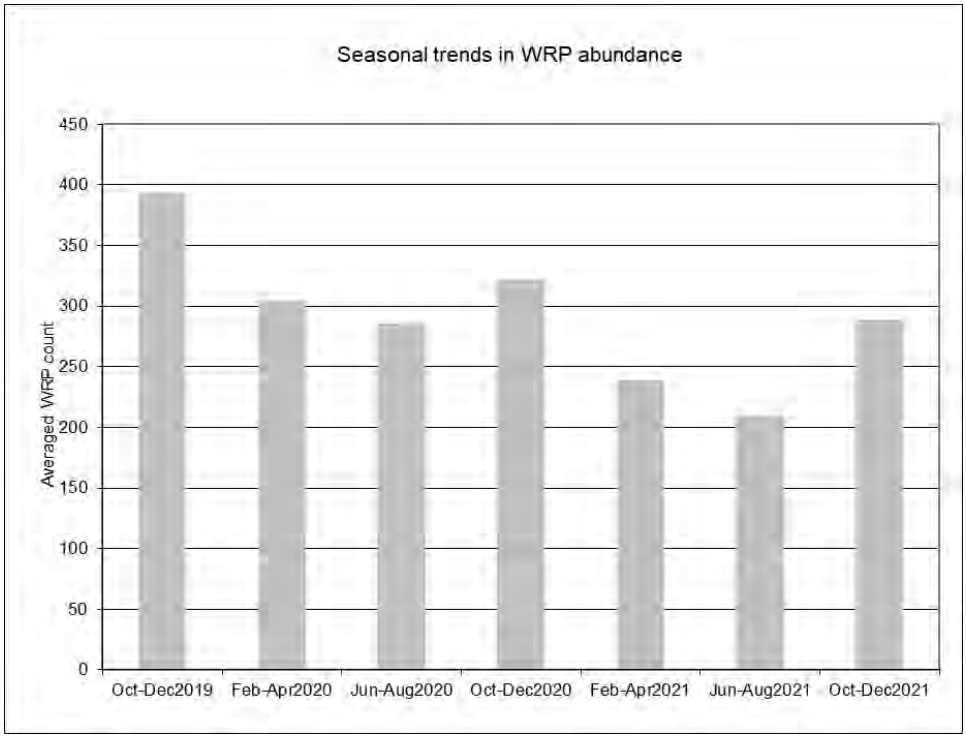


Figure 1. Seasonal trends in WRP abundance

3. Seasonal recruitment

The seasonal trends (Table 1) imply that, in the monitored habitat, most young were emerging from their mother's pouch after August, mostly during October, but also during September. However, the late 2019 counts peaked in December, confirming that, in some years, pouch young were still emerging during November. It is important to note that despite the strong October-December peak evident in this monitoring sequence (Figure 1), some females may not be strictly synchronized with the main peak.

Limited data from multiple sources (mostly Jones *et al* 1994, Ellis and Jones 1992, WRP Care Manual 2010 and Jones unpublished) relating to west-coastal WRP (mostly Ludlow & Busselton) suggests most young WRP can be expected to take about 10-12 weeks (after emergence) to reach their expected weaning weight of about 500-600 g. Hence, young that emerged around mid-September would be expected to be weaning in November, and young that emerged around mid-November would be weaning in January. By the time young WRP have reached 600 g, they are, in night counts, essentially indistinguishable from adults (body weights > 850 g).

In summary, the available monitoring record and the expected (west-coastal) post-emergent growth rates indicated that, between the months of September and January, immature WRP (< 500 g) were relatively common in the Bunbury habitat. By February, most surviving young from the previous seasonal peak would have been weaned, and be at, or approaching, adult weight (≥ 850-900 g).

Limited data suggests young WRP spend about 12-14 weeks in the pouch before they first emerge at around 100-120g. Weight records from WRP pouch young being fed on an artificial diet and regularly weighed (by wildlife carers) indicate that (uninjured) pouch young usually grow from about 60g to 110g in the last 3-4 weeks of their pouch life (WRP Care Manual 2010).

From my own field experience (Barbara Jones) the pouch remains tightly closed when a healthy female is carrying a pouch young smaller than about 65g (about 9-10 weeks old), even when these females are temporarily stressed by hand capture or diurnal shepherding. However, when females have older and heavier pouch young (> 85g) the pouch can open much more easily. Based on these considerations, and the available monitoring results, even in early August, most of the females in the monitoring sequence would have had pouch young that were less than, or much less than, 60g.

4. Clearing window for occupied BORR Southern Section WRP habitat

The monitoring sequence revealed that the period February – August (inclusive) had lower or much lower WRP counts than the peak season counts.

The monitoring sequence suggests that in autumn, most pouches would have been empty. By late May and June very small pouch young would have been present, but by late July the older pouch young would have still been smaller than 60-65g. By late August, some early females with a pouch young ready to emerge around mid-September would have had the heavier pouches that make these females more vulnerable to unusual disturbance.

These conclusions indicate that clearing of occupied (BORR S) WRP habitat should not be scheduled for the period of 24 weeks between mid August and the end of January. This prohibition protects each year's main recruiting effort. This leaves a period of 28 weeks from February 1st through to August 15 when WRP numbers are lower or lowest (mostly down by 25-35% versus the previous peak), and most animals are at or near adult body weight. During this 28-week period clearing could occur with predictably lower numbers of WRP within an approved clearing footprint.

5. Monitored decline

In the monitored habitat, the sharp declines highlighted by comparing the February counts with the December counts (Table 1) are consistent with an assumption that seasonal

conditions were contributing to a discernable level of WRP mortality during summer. The three February counts that are currently available (for 2020, 2021 and 2022) indicate an overall decline with about 20% of the Feb 2020 count gone by Feb 2021, and about 40% of the Feb 2020 count gone by February 2022.

WRP have long been known to be sensitive to dehydration, prolonged periods of higher temperatures, and SW rainfall deficits 2001-2015 (e.g. see details in Shedley and Williams 2014). These sensitivities have led to the conclusion that the SW's changing climate trends are likely to present serious impacts for distinctive populations, or for the species as a whole, either sooner or later. The monitored part of the Bunbury population is one of the driest parts of the species distribution. Weather records for the Bureau of Meteorology' Bunbury Station (9965) cover the years 1995-2022, and inform this discussion.

An examination of the seasonal heat loads for the three summer seasons within the monitoring sequence and for the 21 summer seasons prior to mid 2016 (Table 2) revealed some striking trends likely to be of substantial significance to the local WRP population. The three summers within the WRP monitoring period all started with unusual December heat, with 6-7 days ≥ 35°. During the previous 24 Decembers, 22 had fewer than 5 days ≥ 35°, and 11 had 0-1 days ≥ 35°. Prior to 2019 no Decembers had 7 days ≥ 35°, and only one December had 6 days ≥ 35°. In contrast to the unusually hot Decembers of the last three summers, the three Decembers preceding the start of the monitoring sequence (2016/17, 2017/18, 2018/19) were much milder, each with only 1 day ≥35°.

Table 2. Cumulative tally of days ≥ 35°C each summer (Bunbury BOM stn 9965).

Period	Year	Days ≥35 to Dec 31	Days ≥35 to Jan 31	Days ≥35 to Feb 28
1	1995/6	0	2	8
2	1996/7	1	6	7
3	1997/8	2	5	7
4	1998/9	1	2	6
5	1999/2000	5	10	11
6	2000/1	3	5	5
7	2001/2	0	1	2

Period	Year	Days ≥35 to Dec 31	Days ≥35 to Jan 31	Days ≥35 to Feb 28
8	2002/3	6	10	12
9	2003/4	1	2	5
10	2004/5	4	6	8
11	2005/6	0	1	4
12	2006/7	0	5	6
13	**2007/8**	2	7	14
14	2008/9	2	8	9
15	2009/10	4	10	16
16	**2010/11**	2	7	16
17	2011/12	2	10	13
18	2012/13	2	4	10
19	2013/14	2	8	9
20	2014/15	0	7	12
21	**2015/16**	2	5	11
22	2016/17	1	5	7
23	2017/18	1	2	2
24	2018/19	1	2	4
25	2019/20	**7**	9	13
26	2020/21	**7**	**13**	15
27	2021/22	6	**14**	**20**

Note: Shaded entries indicate record heatloads achieved after 2018.

The December-January periods of the summers of 2020/21 and 2021/22 also had more sustained heat loads than previous summers, with bimonthly totals of 13 and 14 days ≥35°. The previous 25 December-January periods had no more than 10 days ≥ 35°, and the 2019/2020 December-January period had 9 days ≥ 35°. Given the presence of young WRP in September-December, the December-January period would normally be important for weaning young and recently weaned young. These individuals can be expected to be especially vulnerable to unusually hot conditions.

An examination of the difference between the monthly average of the daily maximum temperature and the monthly median temperature (for 1996-2021) for the months of December, January and February (Figure 2) further highlights the unusual pattern of summer heat loads that prevailed during the monitoring period. The three summers 2016/17,

2017/18, and 2018/19 were unusually cool compared to the three summers of the monitoring period. It is reasonable to postulate that this provided the local population with three successive summers with adequate or good summer conditions for weaning and post-weaning young, contributing to the higher WRP numbers during 2019.

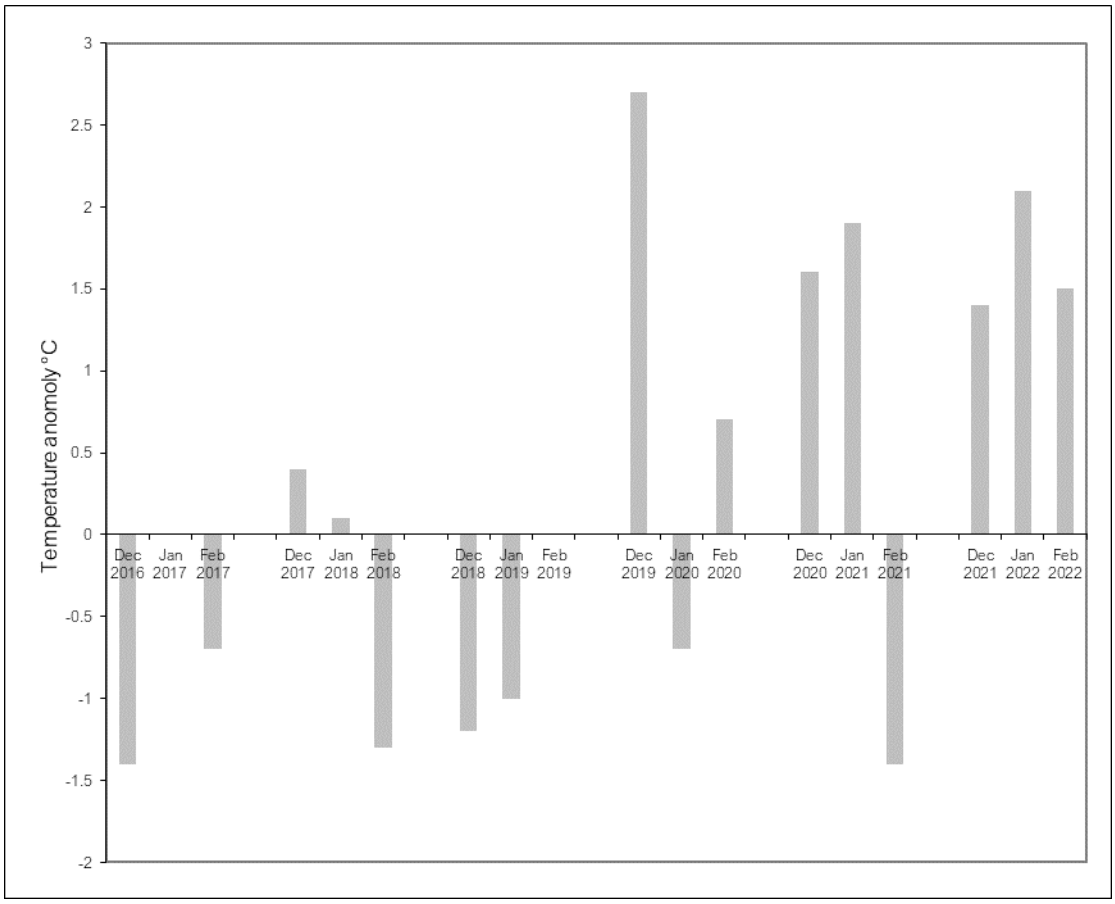


Figure 2. The monthly temperature anomaly [(monthly average maximum) - (the 1996-2021 median)] for BOM stn 9965 showing the three summers before WRP monitoring started and the three summers with WRP monitoring counts.

Disconcertingly, the three summers of the monitoring period appear to have been incrementally hotter for longer (Figure 2). If this trend continues, higher summer heat loads will challenge the seasonal recruitment patterns in Bunbury woodland remnants that had been suitable for adequately successful spring-summer recruitment up to 2020.

6. References

Care Manual Rehabilitation of Western Ringtail Possums. 2010. Possum Centre Busselton Inc 2010.

Ellis M and Jones B (1992) Observations of captive and wild western ringtail possums *Pseudocheirus occidentalis*. The Western Australian Naturalist 19:1-10

Jones BA, How RA and Kitchener DJ (1994) A field study of *Pseudocheirus occidentalis* (Marsupialia: Petauridae). II. Population studies. Wildlife Research, 21:189-201.

Shedley E and Williams K (2014) An assessment of habitat for western ringtail possum (*Pseudocheirus occidentalis*) on the southern Swan Coastal Plain. Unpublished report for the Department of Parks and Wildlife, Bunbury, Western Australia.

Appendix D: Annual compliance report template

We're working for Western Australia.

EPBC 2019/8543
Annual Compliance Report

Bunbury Outer Ring Road
Southern Section
Month/Year

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1. Introduction

Main Roads Western Australia (Main Roads) is proposing to construct and operate the Southern Section of the Bunbury Outer Ring Road (BORR) project. BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed project will provide a high standard route for access to the Bunbury Port, improve road user safety and facilitate proposed development to the east of the City of Bunbury. BORR provides an effective bypass of Bunbury for inter-regional traffic. The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway (an existing four km section which was completed in May 2013, along with a three km extension of Willinge Drive southwards to South Western Highway)
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

BORR South includes the construction and operation of 10.5 km of new freeway standard dual carriageway, associated bridges, interchanges and other road infrastructure including, but not limited to, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs. The Proposal is located approximately 200 km south of Perth and, at its closest point, approximately six km south-east of Bunbury.

The Proposal will be constructed within the 200 ha Development Envelope (Figure 1) which is located within the City of Bunbury and Shire of Capel. Approximately 62 % of land within the Development Envelope is cleared. The Development Envelope comprises 76 ha of native vegetation and 124 ha of cleared agricultural land.

Construction of the Proposal is anticipated to commence in 2022 and continue for a period of 2-3 years. Once BORR South is constructed and open for public use, operation of the Proposal will be ongoing.

1.1 Approval under the Environment Protection and Biodiversity Conservation Act 1999

The Proposal was formally referred to the then Commonwealth Department of the Environment and Energy (DoEE) in September 2019 (EPBC Act referral 2019/8543) as a potential Controlled Action under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) due to impacts on Matters of National Environmental Significance (MNES) (BORR IPT, 2020a).

Under Commonwealth government reforms announced in December 2019, DoEE was consolidated with the Department of Agriculture to form the new Department of Agriculture, Water and Environment (DAWE), effective 1 February 2020. DAWE is the Commonwealth Department with primary EPBC Act regulatory authority. DAWE provided advice in February 2020 that the Proposal is considered a Controlled Action and that it would be assessed by preliminary documentation with additional information provided to support the assessment (DAWE, 2020a).

The Additional Information Request for Preliminary Documentation was submitted to DAWE for assessment in October 2020 and subsequently advertised for public comment for four weeks

commencing 20 November 2020 and ending 18 December 2020. Commonwealth Approval Notice 2019/8543 under the EPBC Act was granted on Day Month 2022 and included a number of conditions that Main Roads Western Australia (Main Roads) is required to fulfil.

1.2 Purpose of this Report

Construction of the Project commenced on Day/Month/Year. This compliance report has been produced as required by Condition X of EPBC approval 2019/8543. Table 1 of this report outlines the compliance with each approval condition over the past 12 month period, Day/Month/Year to Day/Month/Year. The clearing area of TEC vegetation is shown in Figure 1 and that of conservation significant fauna habitat in Figure 2.

2. Key risk management

Table 2: Year - Year compliance with EPBC Approval 2019/8543

Key risk	Management Measure	Monitoring	Adaptive Implementation Outcome(s)

3. Compliance

Table 2: Year - Year compliance with EPBC Approval 2019/8543

Condition Number	Condition Description	Status

Figure 1 Total Clearing of TEC vegetation from Project Area

Figure 2 Total clearing of conservation significant fauna habitat from Project Area

4. Attachments

Attachment	Title
Attachment 1	
Attachment 2	
Attachment 3	
Attachment 4	
Attachment 5	
Attachment 6	
Attachment 7	

Attachment 1:

Attachment 2:

Attachment 3:

Attachment 4:

Attachment 5:

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