



Bunbury Outer Ring Road Southern Section

Habitat Fragmentation Management Plan

July 2022

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Western Australia.*

Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
A	May 2022	Peer Review Draft	All
B	June 2022	DBCA / DWER Review Draft	Executive Summary, 1, 1.3.4, 2.1.1, 2.4
C	June 2022	DCCEEW Review Draft	Executive Summary, Section 1
0	July 2022	Final for approval	Per DBCA and DWER response tables
0.1	July 2022	Revised Final for approval	All
1	July 2022	Revised Final for approval	All
1a	July 2022	Revised Final for approval	All

EXECUTIVE SUMMARY

The Bunbury Outer Ring Road Southern Section is a proposal to extend the Bunbury Outer Ring Road Northern and Central Sections and connect it with Bussell Highway. The proposal will have a direct impact on up to 60.9 ha of western ringtail possum (WRP) habitat.

WRP records accumulated over the period 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 Proposal Area 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 is 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 this 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 1¹), indicating the presence of settled residents. The habitat fragments that make up the remaining 16 ha of the Proposal Area habitat (Clearing Categories 2² and 3³ 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.

The area to be cleared represents up to 0.97 % of habitat in the Bunbury management zone of Shedley and Williams (2014)⁴. It is estimated that between 49 and 72 WRPs within the Development Envelope will potentially have their home ranges disturbed by the Proposal, indicating that 0.5 % to 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) could potentially be impacted through displacement.

¹ Clearing areas in which resident and transient WRP are expected to be encountered during clearing.

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. High probability no WRP encountered during clearing.

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

⁴ The majority of Proposal Area WRP habitat was included in the mapping of Shedley and Williams (2014).

The *Bunbury Outer Ring Road Southern Section Habitat Fragmentation Management Plan* (this plan) is submitted in accordance with Ministerial Statement No. 1191 condition 6 for the Bunbury Outer Ring Road – Southern Section (the Proposal) by Main Roads Western Australia.

This Habitat Fragmentation Management Plan (HFMP) has been prepared to manage, monitor and mitigate direct and indirect impacts to western ringtail possum (WRP) (*Pseudocheirus occidentalis*) (Critically endangered) as required under condition 6 of Ministerial Statement (MS) 1191, approved on 31 May 2022. The plan also fulfils the requirements of Condition 10 of EPBC Act approval for EPBC 2019/8543.

This plan should be read in conjunction with the Proposal Construction Fauna Management Plan as required under condition 5 of MS 1191, the Matters of National Environmental Significance Fauna Management Plan required under condition 8 of the EPBC Act approval for EPBC 2019/8543 and Offset (Management) Plan required under condition 9 of MS 1191 (and condition 18 of EPBC 2019/8543). These plans detail the actions to be taken during construction of the Proposal to manage, monitor and mitigate impacts to conservation significant fauna, and the package of offsets developed to counterbalance significant residual impacts to environmental values, respectively.

Additional context and background for the measures proposed herein can be found in the *Bunbury Outer Ring Road Southern Section Updated Referral Supporting Document and Additional Information* (BORR IPT, 2020a) and *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020b).

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

- Retain and re-establish habitat connectivity in the longer term through the installation of underpasses / rope bridges (fauna crossing structures) connected to adjacent habitat
- Developing and implementing a predator control program to minimise the impacts of feral fauna predation.
- Implementing a comprehensive monitoring program to evaluate the abundance and persistence of WRP at the receival sites.
- Maintaining or improving the condition of adjacent WRP receival habitat.

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Definitions

Term	Definition
Bi-annual	Twice a year
Biennial	Every two years
Bi-monthly	Every two months
Control Area	The predator control area includes the whole of the development envelope and accessible adjacent habitat areas.
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 within which the impacts of the Proposal would occur.
Fauna spotter	A person who has a relevant lawful authority under the <i>Biodiversity Conservation Act 2016</i> and as further defined in applicable licence(s) issued under the Act.
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.
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 or BORR South)
Receival sites	Habitat outside the development envelope that contains home-ranges of residential western ringtail possums intersecting or adjoining the Category 1 Clearing Areas defined in this plan where western ringtail possums from inside the development envelope are moved into, and are: <ul style="list-style-type: none"> • owned by State or Local Government; • owned by the Proponent (such as the clearing exclusion areas vegetation retention areas or nominated offset sites); and • residential private lands granting access. (As defined in Ministerial Statement 1191)
Reference sites	Lot 2 Boyanup Picton Road and Reserve 23000. The two WRP reference sites comprise WRP 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.

Term	Definition
Standard construction management	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

Acronyms / Abbreviations

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

1 CONTEXT, SCOPE AND RATIONALE

The Bunbury Outer Ring Road Southern Section (BORR South) is a proposal to extend the Bunbury Outer Ring Road Northern and Central Sections and connect it with Bussell Highway.

This Habitat Fragmentation Management Plan (HFMP) documents measures to:

- minimise the impacts of habitat fragmentation and predation on conservation significant fauna, that may occur during construction of BORR South; and
- ensure the abundance and persistence of the western ringtail possum in the receival sites returns to pre-disturbance levels within 15 years from commencement of BORR South.

The plan is a requirement of condition 6 of Ministerial Statement (MS) 1191, approved on 31 May 2022, and condition 10 of the EPBC Act approval for EPBC 2019/8543, granted on 29 June 2022⁵. The plan covers western ringtail possum (WRP) (*Pseudocheirus occidentalis*), State and Commonwealth listed as Critically endangered.

The primary impact of the Proposal is the removal of up to 60.9 ha of WRP habitat within the 200 ha Development Envelope. The fundamental assumption underlying the environmental outcome stated in condition 6-2 of MS 1191 is that WRP in habitat adjacent to the Development Envelope will be adversely affected by the Proposal through loss of connectivity and increased predation. This HFMP presents a combination of outcome and management based provisions, as defined in condition 6 of MS 1191, to document management actions required following construction of the Proposal that ensure the abundance and persistence of WRP in receival habitats adjacent to the development envelope return to pre-disturbance levels.

With regard to MS 1991, this plan should be read in conjunction with the Proposal Construction Fauna Management Plan (CFMP) required under conditions 5 MS 1191, respectively. With regard to EPBC 2019/8543, this plan should be read in conjunction with the Matters of National Environmental Significance (MNES) Fauna Management Plan (FMP), Vegetation Management Plan (VMP), Offset Strategy and Offset Management Plan required under conditions 8, 12, 14 and 18 respectively. These plans detail the actions to be taken during construction and operation of the Proposal to manage, monitor and mitigate impacts to conservation significant fauna, vegetation and habitat, and the package of offsets developed to counterbalance significant residual impacts to environmental values, respectively. Additional context and background for the measures proposed herein can be found in the *Bunbury Outer Ring Road Southern Section Updated Referral Supporting Document and Additional Information* (BORR IPT, 2020a) and *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020b).

Management measures within this HFMP are specific to the Proposal and include management actions that are 'over and above' standard environmental management practises.

1.1 Condition requirements

This plan is submitted in accordance with conditions 6-3 to 6-8 of Ministerial Statement No. 1191 (MS 1191). Condition requirements and in-plan section references are provided in Table 1-1 (for MS 1191). The plan also fulfils the requirements of Condition 10 of the EPBC Act approval for EPBC 2019/8543, as described in Table 1-2.

⁵ Noting that the Commonwealth Approval refers to the document as a Habitat Fragmentation Plan.

Table 1-1. Condition 6 of MS 1191 (Habitat Fragmentation Management Plan)

Condition No.	Condition	Section of this plan
6-1	The proponent shall ensure the implementation of the proposal achieves the following environmental objectives :	Objective of this Plan
	(1) minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum; and	
	(2) minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum.	
6-2	The proponent shall ensure the implementation of the proposal achieves the following environmental outcome :	Objective of this Plan
	(1) abundance and persistence of the western ringtail possum in the receival sites returns to pre-disturbance levels within fifteen (15) years from the commencement of construction.	
6-3	The proponent shall prepare a Habitat Fragmentation Management Plan and submit to the CEO prior to ground-disturbing activities . This Plan shall:	This plan
	(1) when implemented, substantiate and ensure that conditions 6-1 and 6-2 are being met;	This plan
6-3	<i>Fauna crossings, land-bridges and fragmentation</i>	Section 2.3.1
	(2) specify the locations, dimensions and designs of fauna crossings to reconnect terrestrial fauna habitats, including tree-canopy connections to fauna crossings for western ringtail possum (and brush-tailed phascogale);	
	(3) specify the locations and designs of a minimum of two (2) fauna land bridges , which are to be: a) a minimum width of five (5) metres at the Yalinda Drive traffic bridge; and b) between five (5) and ten (10) metres at the dedicated fauna land bridge east of Yalinda Drive (to be determined in consultation with DBCA).	Section 2.3.2
	(4) specify the revegetation and maintenance requirements of the fauna land bridges to maximise utilisation by western ringtail possums and ensure revegetation is self-sustaining or otherwise managed to ensure its ongoing survival;	Sections 2.3.2.2, 2.3.2.3
	(5) specify monitoring methodologies to evaluate the effectiveness and utilisation of fauna crossings and fauna land bridges by western ringtail possum against the objectives in condition 6-1 which must include, but not be limited to, monitoring of DNA scat analysis and camera-monitoring;	Section 2.3.3
	(6) specify monitoring methodologies to evaluate the project attributable effects of fragmentation on the demographics and genetics of the local western ringtail possum population and the effectiveness of minimisation measures to demonstrate whether the objective in condition 6-1(1) and outcome in condition 6-2 will be met;	Section 2.3.3

Condition No.	Condition	Section of this plan
	<i>Predator control</i>	
	(7) specify actions to undertake targeted predator control to reduce predation impacts to conservation significant fauna, to be implemented: a) one (1) month prior to clearing; b) during construction of the proposal; and c) at entrances/exits to fauna crossings and fauna land bridges for a minimum of five (5) years post-construction, subject to the five (5) yearly review required by condition 6-3(12);	Section 2.4
	<i>Abundance and persistence of western ringtail possum</i>	
	(8) specify monitoring methodologies to evaluate the abundance and persistence of the western ringtail possum at the receival sites to demonstrate whether the outcome in condition 6-2 will be met;	Section 2.5
	<i>Protection and enhancement of adjacent habitat</i>	
	(9) demonstrate how the habitat within the clearing exclusion areas (excluding the 'Grey Giant' Heritage Place No. 26059 site) and vegetation retention areas (defined in Figure 4) in Gelorup will be maximised for benefits to western ringtail possums and, where relevant, include provisions to establish revegetation of degraded areas;	Sections 2.6.1, 2.6.3
	(10) include provisions to monitor revegetation required by condition 6-3(9), and undertake maintenance and remedial measures as required to demonstrate it is self-sustaining and habitat is maximised for benefits to western ringtail possums;	Sections 2.6.1, 2.6.2
	(11) outline the long-term management and protection mechanism of the clearing exclusion areas and the vegetation retention areas as defined in Figure 4;	Section 2.6.2
	<i>General plan provisions</i>	
	(12) be implemented for a minimum of fifteen (15) years post-construction, or otherwise agreed to by the CEO and on advice of DBCA following review of effectiveness every five (5) years;	Section 3.2
	(13) specify management actions ; management targets ; monitoring locations, methodologies, indicators and timing; contingency actions and investigations in the event of a failure to meet a management target ; and reporting to demonstrate that the objectives in condition 6-1 and outcome in condition 6-2 will be met; and	Sections 2.1, 2.3, 2.4, 2.5, 2.6
	(14) be prepared in consultation with DBCA and in accordance with any requirements of a lawful authority obtained under the Biodiversity Conservation Act 2016.	Section 4
6-4	The proponent shall include a report of a peer review carried out by an independent person or independent persons with suitable technical experience to review the Draft Habitat Fragmentation Management Plan, required under condition 6-3, to report on the adequacy of that content to achieving the objectives and outcome specified in conditions 6-1 and 6-2.	Section 4

Condition No.	Condition	Section of this plan
6-5	<p>The proponent shall submit an Environmental Performance Report as part of the Compliance Assessment Report required by condition 12-6, following the review of effectiveness every five (5) years, required by condition 6-3(12), that shall:</p> <p>(1) outline the monitoring that was undertaken during the implementation of the Habitat Fragmentation Management Plan required in condition 6-3;</p> <p>(2) outline the results of the monitoring undertaken to report whether that the environmental objectives and outcome specified in conditions 6-1 and 6-2 was achieved;</p> <p>(3) report whether that the objectives and outcome specified in conditions 6-1 and 6-2 was achieved; and</p> <p>(4) outline any management actions undertaken during the implementation of the Habitat Fragmentation Management Plan required in condition 6-3 to meet the objectives and outcome specified in conditions 6-1 and 6-2.</p>	Section 2.7
6-6	<p>The proponent shall include a report of a peer review carried out by an independent person or independent persons with suitable technical experience to review the Environmental Performance Reports, required under condition 6-5, with the report and to report on the adequacy of that content to achieving the objectives and outcome specified in conditions 6-1 and 6-2.</p>	Section 3.2
6-7	<p>The proponent shall not commence ground-disturbing activities until the CEO has confirmed in writing that the Habitat Fragmentation Management Plan satisfies the requirements of condition 6-3.</p>	This plan
6-8	<p>The proponent shall implement the latest revision of the Habitat Fragmentation Management Plan approved by the CEO.</p>	This plan
6-9	<p>The proponent:</p> <p>(1) may review and submit proposed amendments to the Habitat Fragmentation Management Plan; or</p> <p>(2) shall review and submit proposed amendments to Habitat Fragmentation Management Plan when directed by the CEO.</p>	This plan
6-10	<p>The proponent shall continue to implement the Habitat Fragmentation Management Plan as approved by the CEO in writing, until the CEO has confirmed by written notice that the proponent has demonstrated that the environmental objectives and outcomes detailed in conditions 6-1 and 6-2 of the Habitat Fragmentation Management Plan have been achieved.</p>	This plan

Table 1-2. Condition 10 of EPBC 2019/8543

Condition	Section of this plan
<p>10. To minimise the impacts of habitat fragmentation and predation on the Western Ringtail Possum, the approval holder must submit a Habitat Fragmentation Plan to the Department for the Minister’s approval. The Habitat Fragmentation Plan must ensure that the abundance and persistence of the Western Ringtail Possum in the receival sites returns to pre-disturbance levels within 15 years from the commencement of the action to the satisfaction of the Minister and be consistent with the Environmental Management Plan Guidelines. The Habitat Fragmentation Plan must:</p>	This Plan
<p>a. be prepared by a suitably qualified ecologist;</p>	
<p>b. include the report of a peer review carried out by an independent suitably qualified ecologist prior to its submission to the Department;</p>	Section 4
<p>c. 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;</p>	Section 2 MNES FMP
<p>d. specify the locations, dimensions and designs of fauna crossings, including tree-canopy connections to reconnect Western Ringtail Possum habitat separated by clearing and construction;</p>	Section 2.3.1
<p>e. specify the locations and designs of a minimum of two fauna land bridges, which are to be:</p>	Section 2.3.2
<p>i. at least five metres wide at Yalinda Drive traffic bridge; and</p>	
<p>ii. between five and ten metres wide at the dedicated fauna land bridge east of Yalinda Drive as determined in consultation with DBCA;</p>	
<p>f. specify the revegetation and maintenance requirements of the fauna land bridges to maximise ongoing utilisation by Western Ringtail Possums;</p>	Sections 2.3.2.2, 2.3.2.3
<p>g. specify monitoring methodologies to evaluate the effectiveness and utilisation of fauna crossings and fauna land bridges by Western Ringtail Possum which must include, but not be limited to, monitoring of DNA scat analysis and camera-monitoring;</p>	Section 2.3.3
<p>h. specify monitoring methodologies to evaluate the impacts of fragmentation on the demographics and genetics of the local Western Ringtail Possum population and the effectiveness of the impact minimisation measures.</p>	Section 2.3.3
<p>i. specify targeted predator control actions to reduce predation impacts on Western Ringtail Possum, to be implemented:</p>	Section 2.4
<p>i. commencing one month prior to clearing;</p>	
<p>ii. during construction; and</p>	
<p>iii. at entrances and exits to fauna crossings and fauna land bridges for a minimum of five years post-construction, subject to the outcome of the five yearly review undertaken by an independent suitably qualified ecologist.</p>	

j. specify monitoring methodologies to evaluate the abundance and persistence of the Western Ringtail Possum at the receival sites ;	Section 2.5
k. specify measures to protect and enhance adjacent Western Ringtail Possum habitat within clearing exclusion areas , including measures to revegetate degraded areas and monitor revegetation outcomes; and include a long-term management and protection mechanism for the clearing exclusion areas ; and	Sections 2.6.1, 2.6.3
l. include evidence of how the measures and corrective actions are based on best available practices, appropriate standards, and supported by scientific evidence,	Section 2.1
m. specify that that management and remedial measures be undertaken as required to ensure that the habitat in clearing exclusion areas is maximised for benefits to the Western Ringtail Possum ;	Section 2.6.2
n. specify management actions; management targets; monitoring locations, methodologies, indicators and timing; and contingency actions and investigations in the event of any failure to meet a management target;	Sections 2.1, 2.3, 2.4, 2.5, 2.6
11. The approval holder must not commence the action unless the Minister has approved the Habitat Fragmentation Plan in writing. The approval holder must implement the approved Habitat Fragmentation Plan until the Minister advises otherwise in writing, but in any case for a minimum of 15 years post- construction . The approval holder must have an independent suitably qualified ecologist undertake a review of the effectiveness of the Habitat Fragmentation Plan and its implementation before each five year anniversary of the commencement of the action and submit the report of each review to the Department within 60 business days of that five year anniversary of the commencement of the action	Section 2.7

1.2 Proposal

BORR South (Figure 1) 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 (Figure 1).

The Proposal will be constructed within the 200 ha Development Envelope located within the City of Bunbury and Shire of Capel. Approximately 62 % of land within the Development Envelope is cleared for agriculture. 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. Some of the measures and monitoring identified in this plan represent the continuation of WRP population monitoring measures proposed for during construction and are documented in a separate Construction Fauna Management Plan (CFMP), as required under condition 5 of MS 1191, or Matters of National Environmental Significance Fauna Management Plan (MNES FMP) as required under condition of 8 the EPBC Act approval for EPBC 2019/8543.

1.3 Key Environmental Factor – Terrestrial Fauna (Western Ringtail Possum)

1.3.1 Relevant information

The key management and monitoring measures and corrective actions proposed in this HFMP align with best available practice as they have been collaboratively developed by subject matter experts, have been workshopped several times with key regulators and conservation 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 (2018a) *Conservation Advice Pseudocheirus occidentalis Western Ringtail Possum*. Canberra: Department of the Environment and Energy
- *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.

1.3.2 Species description

The 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.

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 and habitat tree decline (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, and (potentially in future) Myrtle rust (TSSC, 2018a).

1.3.3 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 density⁶. The area of habitat in each habitat quality class within the Development Envelope as mapped by Shedley and Williams (2014) is shown in Table 1-3. Baseline habitat quality and / or condition data for known WRP habitat areas adjacent to the Development Envelope will be recorded prior to construction via 3D aerial surveys, as described in Section 2.3.3.2.

Table 1-3. 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 %)

1.3.4 Potential impacts

A summary of direct and potential indirect impacts of the Proposal to WRP is provided in Table 1-4 below. A complete assessment of potential impacts to WRP is contained within *Bunbury Outer Ring Road Southern Section Updated Environmental Referral Document and Additional Information* (BORR IPT, 2020a) and the *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020b).

Table 1-4. Potential 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
Potential indirect impacts	
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 (2020b; 2020b) and summarised in Table 1-4, implementation of the Proposal will result in clearing of up to 60.9 ha of WRP habitat within the 200 ha Development

⁶ Estimated WRP densities: Class A - >10/ha, Class B – 5-10/ha, Class C – 2-5/ha, Class D – 0.5-2/ha.

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 habitat values are principally associated with retained WRP habitat to the west and north of the Development Envelope, which will not be impacted by the Proposal.

WRP records accumulated over the period 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 Proposal Area 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 is 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 this 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 1⁷ (Figure 2), indicating the presence of settled residents. The habitat fragments that make up the remaining 16 ha of the Proposal Area habitat (Clearing Categories 2⁸ and 3⁹ (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 8, Map 3).

The area to be cleared represents up to 0.97 % of habitat in the Bunbury management zone of Shedley and Williams (2014)¹⁰. It is estimated that between 49 and 72 WRPs within the

⁷ Clearing areas in which resident and transient WRP are expected to be encountered during clearing.

⁸ 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.

⁹ 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

¹⁰ The majority of Proposal Area WRP habitat was included in the mapping of Shedley and Williams (2014).

Development Envelope will potentially have their home ranges disturbed by the Proposal, indicating that 0.5 % to 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) could potentially be impacted through displacement.

WRP mortality

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 the CFMP. These include pre-clearing surveys as well as passive and / or low-impact WRP relocation to ensure animals do not remain in clearing areas. Possum exclusion fencing, along with noise walls and screen walls, have been included in the Proposal design adjacent to known habitat areas to limit WRP access to the Development Envelope. These structures will also exclude WRP from the road during operation, limiting the potential for mortality.

Indirect impacts

Historical clearing combined with incremental reduction in habitat has restricted the distribution of WRP within the Development Envelope. 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 area and are often found in high densities in these areas (Shedley & Williams, 2014). This indicates that they are able to adjust to developed areas with light and noise levels higher than would be found in undeveloped areas.

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 due to the already-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 to move into.

The bi-monthly survey results confirmed that the Gelorup WRP population has a high proportion (almost 26 %) of transient WRPs. 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, noting 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.

1.3.5 Risk assessment

The DotE (2014) and DoEE (2019) specify 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 conservation significant fauna taxa in preparation of this HFMP, see Appendix B of VMP for risk matrix. 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), and are presented in Table 1-5.

Related management actions and monitoring activities can be found in Section 3.

Table 1-5. WRP risk assessment

Objective: To minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum; and minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum. Key environmental values: WRP individuals and habitat.				
Pre control risk assessment	Risk	Management approach	Monitoring approach	Post control risk assessment
Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Reduction in WRP habitat quality / condition (function and value) adjacent to the Development Envelope	Implement WONS, Declared Plant, surface water, and <i>Phytophthora</i> dieback management measures within Development Envelope vegetation / revegetation 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 Development Envelope On-going monitoring to verify efficacy of applied control measures	Likelihood: Unlikely Consequence: Moderate Risk outcome: Low
Likelihood: Likely Consequence: High Risk outcome: High	Increased predation of WRP adjacent to the Development Envelope	Implement predator control management measures within Development Envelope and at fauna crossing structures access and egress points	On-going monitoring to verify efficacy of applied control measures	Likelihood: Unlikely Consequence: High Risk outcome: Medium
Likelihood: Possible Consequence: High Risk outcome: High	Fauna crossing structures ineffective	Installation of fauna crossing structures as per specification and responsive management	On-going monitoring to verify effectiveness of structures	Likelihood: Unlikely Consequence: High Risk outcome: Medium

Objective: To minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum; and minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum. Key environmental values: WRP individuals and habitat.				
Pre control risk assessment	Risk	Management approach	Monitoring approach	Post control risk assessment
Likelihood: Possible Consequence: Moderate Risk outcome: Medium	Landholder access approval for monitoring not granted	Ongoing liaison with landholders	The wide variety of monitoring approaches included for Proposal minimises impact of this risk	Likelihood: Possible Consequence¹¹: Moderate Risk outcome: Medium

¹¹ Consequence is on ability to conduct monitoring, not on the species.

1.4 Rationale and approach

1.4.1 Environmental outcome or management objective/s

The objective of this HFMP is to minimise project attributable adverse impacts of habitat fragmentation and predation to WRP, with the desired outcome to ensure the abundance and persistence of the WRP in the receival sites returns to pre-disturbance levels within fifteen (15) years from the commencement of construction (condition 6-2).

This HFMP presents management-based provisions required during Proposal implementation and associated monitoring to ensure that management measures contribute to achieving the outcome. Management measures within this HFMP are specific to the Proposal and include management actions that are 'over and above' standard environmental management practises.

1.5 Key assumptions and uncertainties

This HFMP has been prepared on the basis of information provided in the environmental surveys for the Proposal 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 WRP within the Development Envelope and monitored receival sites
- 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 dreys or hollows are used in all seasons or years.
- The Proposal may have the potential for an indirect impact to WRP individuals and habitat
- All significant direct and indirect impacts to WRP that may result from the Proposal have been identified
- Possum fencing (combined with noise and screen walls) will exclude WRP from the road during operation, limiting the potential for mortality
- Fauna underpasses and fauna bridges are effective in maintaining ecological linkages
- Existing cleared areas within the Development Envelope do not contain habitat for or known records of WRP
- The proposed management actions detailed in this plan will be successful in achieving the objectives stated in condition 6-1 and the outcome stated in condition 6-2 of MS 1191.

It is expected that the suite of management actions proposed in this plan (Table 2-1), and corrective actions to be undertaken in the event of trigger values being reached (Table 2-3, Table 2-4), will be sufficient to mitigate risks associated with the above-listed assumptions and uncertainties.

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, 2020a) and the *BORR Southern Section Additional Information for Preliminary Documentation* (EPBC 2019/8543) (BORR IPT, 2020b).

2 HFMP COMPONENTS

This HFMP identifies the environmental management of activities to be undertaken by Main Roads or its delegate subsequent to the construction of the Proposal. Main Roads acknowledges that the environmental management actions contained within this HFMP 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 HFMP, 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.

2.1 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 WRP habitat through design refinement. Where impacts cannot be avoided, Main Roads has designed the Proposal to reduce the intensity and / or extent of impacts on WRP individuals and habitat.

Risk-based management actions have been identified and prioritised to achieve the environmental objective detailed in Section 1.4.1. The management actions focus the greatest management effort on reducing habitat and ecological connectivity loss and impact to individual WRPs. 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, best practice, external consultation (detailed in Section 4) and recent experience on similar road projects in Western Australia.

All management actions included in this plan will contribute to achievement of either MS 1191 condition 6-1 (1) 'minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum' or 6-1 (2) 'minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum', with both contributing to the achievement of the outcome stated in condition 6-2, that 'abundance and persistence of the western ringtail possum in the receival sites returns to pre-disturbance levels within fifteen (15) years from the commencement of construction'. Management actions included in this plan will also contribute to achievement of the EPBC Act approval for EPBC 2019/8543 condition 10.

Management actions and monitoring detailed in Sections 2.3 and 2.6 relate to condition 6-1(1) while those in Section 2.4 relate to condition 6-1(2). Management actions and monitoring detailed in Section 2.5 relate to condition 6-2.

Based on the controls identified above and these management actions, Main Roads has developed performance targets to monitor attainment of plan objectives (regarding habitat fragmentation and predator control) and desired outcomes for WRP (long term abundance and persistence). These, along with the proposed management actions, are identified in Table 2-1.

All proposed management actions, monitoring, performance indicators, triggers, thresholds and corrective actions are aligned with the performance targets / outcomes for WRP.

Table 2-1. WRP management actions and performance targets

Timing	Management action(s)	Performance targets
Objective 1: Minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum (WRP)		
Prior to construction	<ul style="list-style-type: none"> Undertake pre-construction baseline 3D aerial surveys of habitat condition in Development Envelope, receival sites and reference sites to assess if pre-construction condition rating in adjacent WRP receival habitat is maintained post construction. 	<ul style="list-style-type: none"> Maintain pre-construction condition rating in adjacent WRP receival habitat (Section 2.6) through pre and post construction condition monitoring.
During construction	<ul style="list-style-type: none"> Construct two fauna bridges at Yalinda Drive and 350 meters to the east, both at least 5 meters in width. Install permanent possum rope bridges / underpasses at key location(s) (section 2.3) to enable WRP to move between retained habitat areas (Figure 3). 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 5). Underpass dimensions will be based on the WRP fauna recorded or expected to occur in the vicinity (Figure 5). The final underpass designs will incorporate the following features known to encourage use by WRP and reduce the risk of WRP predation: <ul style="list-style-type: none"> Connection to nearby habitat via overhead rope hawsers and poles (minimum 2.5 m high) Objects for WRP 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 access and egress points to provide cover for WRP approaching, entering and leaving the underpasses 	<ul style="list-style-type: none"> No significant reduction in adjacent receival habitat condition (CFMP and Section 2.6) due to indirect impacts associated with the Proposal detected through pre and post construction condition monitoring. Restore connectivity between known WRP habitat areas (Section 2.3), through installing crossing structures and subsequent utilisation monitoring. Ensure revegetation is planted to the design criteria specified in Section 2.3.2.1 and 2.3.2.2

Timing	Management action(s)	Performance targets
	<ul style="list-style-type: none"> - Natural flooring such as sand 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) • Install possum fence adjacent to known habitat areas to limit WRP access to the Development Envelope, see Figure 3. • The possum fence will be 1.5 m high and constructed to prevent WRP being able to climb over or dig under it, see Figure 4. <p>Revegetation</p> <ul style="list-style-type: none"> • Undertake targeted revegetation: <ul style="list-style-type: none"> ○ at fauna crossing structure access and egress points (adjacent to the Development Envelope) to make utilisation of the structures attractive and effective for WRP ○ on fauna land bridge decks ○ in degraded portions of vegetation retention areas and clearing exclusion areas. 	
Post construction	<ul style="list-style-type: none"> • Install design features at WRP crossing structure locations (adjacent to the Development Envelope) to ensure access to water is maintained and to encourage utilisation of the structures. • Ongoing 3D aerial surveys of habitat condition in Development Envelope, receival sites and reference sites. <p>Revegetation</p> <ul style="list-style-type: none"> • Supplement revegetation at fauna crossing structure access and egress points (adjacent to the Development Envelope) where required to achieve completion criteria (Table 2-7). 	<ul style="list-style-type: none"> • Maintain connectivity between known WRP habitat areas (Section 2.3) through installing crossing structures and demonstrating WRP usage through structure utilisation monitoring. • Revegetation meets completion criteria specified in Table 2-7.
Objective 2: Minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum		

Timing	Management action(s)	Performance targets
Prior to construction	<ul style="list-style-type: none"> Deploy soft-jaw traps, or other appropriate approach or technique, within the Development Envelope during the 30-day period prior to clearing (refer to Section 2.4.2) 	<ul style="list-style-type: none"> Reduce predator population within the Development Envelope and adjacent habitat - No increase in predator observations when compared to baseline survey results, prior to construction commencing
During construction	<ul style="list-style-type: none"> Deploy soft-jaw traps, or other appropriate approach or technique, bi-monthly within the Development Envelope during construction (refer to Section 2.4.2) 	<ul style="list-style-type: none"> Reduce predator population within the Development Envelope and adjacent habitat compared to baseline survey results
Post construction	<ul style="list-style-type: none"> Deploy soft-jaw traps, or other appropriate approach or technique, bi-annually at fauna crossing structure access and egress points (once in each of the spring and autumn seasons) for the period of EPBC Act/EP Act approvals or as otherwise agreed by the Minister/CEO (refer to Section 2.4.2) 	<ul style="list-style-type: none"> Reduce predator population within the Development Envelope and adjacent habitat compared to baseline survey results.

2.1.1 SMART performance standards

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 threshold criteria and contingency actions for outcome-based plans. DotE (2014) also specifies the inclusion of performance targets that are quantitative and auditable. SMART (Specific, Measurable, Achievable, Relevant and Time-bound) performance standards have been developed for this HFMP to address the requirements of the EPA. 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 ‘trigger criteria’, ‘performance indicators’, ‘corrective actions’ and ‘completion criteria’. Terms used in the SMART performance standards in this plan are defined in Table 2-2.

Table 2-2. Smart performance standard term definitions

Term	Definition
Performance target / Outcome	<ul style="list-style-type: none"> Proposal-specific measurable target defined to assess whether the management actions are effective in achieving the environmental objective
Performance indicator	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Value/s 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	<ul style="list-style-type: none"> Actions to be undertaken should a trigger value be reached or exceeded
Completion criteria	<ul style="list-style-type: none"> Proposal-specific indicators designed to demonstrate the environmental objective is being or has been met (criteria for success)

In relation to conservation significant fauna, Main Roads has prepared SMART performance standards directly related to the measurable impacts of the Proposal on each taxon as identified in Table 1-4 and potential indirect impacts as identified in Section 1.3.4. The proposed SMART performance standards for the Proposal are identified in Table 2-3.

These SMART performance standards are aligned to the management actions and performance targets identified in Table 2-1, the monitoring actions identified in Section 2.3.3 and the corrective actions identified in Table 2-3.

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 in Table 1-5.

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 processes¹², it is considered the proposed SMART performance standards have a low level of uncertainty, with additional margins for safety not required.

2.1.2 Corrective actions

Potential corrective actions to be undertaken should a trigger value be reached are listed but not limited to those outlined in Table 2-3.

2.1.3 Failure to achieve environmental outcome

The Proposal will clear less than 1 % (0.97 %) of WRP habitat in the Bunbury management zone of Shedley and Williams (2014)¹³.

As discussed in Section 1.3.4, the bi-monthly survey results confirmed that the Gelorup WRP population has a high proportion (almost 26 %) of transient WRPs. This indicates that these individuals have a history of persisting in the wider Gelorup habitat despite predation threats.

It is expected that the Proposal will clear the entire home ranges of up to ten WRPs (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 in adjacent habitat.

Given the low number of entire home ranges to be cleared, the transient nature of the WRP population, the predator control measures to be undertaken, the extensive monitoring proposed and the number and type of fauna crossing structures to be installed, Main Roads is very confident that abundance and persistence of the WRP in the receival sites will return to pre-disturbance levels within 15 years.

If, within 15 years, the abundance and persistence of the WRP in the receival sites does not return to pre-disturbance levels (i.e. MS 1191 condition 6-2 and the EPBC Act approval for EPBC 2019/8543 condition 10 are not met), and Main Roads is unable to demonstrate that such failure is not project attributable, as required under MS 1191 condition 9-12, Main Roads will submit a revised Offset Strategy for approval by the relevant authorities, in accordance with MS 1191 and EPBC 2019/8543, that provides additional offsets to counterbalance the additional impact to WRP in habitats adjoining the Development Envelope.

¹² 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.

¹³ The majority of Proposal Area WRP habitat was included in the mapping of Shedley and Williams (2014).

Table 2-3. SMART performance standards for WRP management objectives (Condition 6-1 / Table 2-1)

Performance target	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
Objective 1: Minimise the impacts of habitat fragmentation that are attributable to the proposal on WRP				
<p>Maintain or improve condition rating in adjacent WRP receival habitat</p>	<p>Condition decline:</p> <ul style="list-style-type: none"> 10 % decline in condition as defined in section 2.3.3.2 across more than 5 % of adjacent receival habitat in a single monitoring period 	<p>Quality & condition (function and value) of the receival site habitat</p>	<ul style="list-style-type: none"> Investigate cause to determine whether the impact is project attributable, including assessment of potential 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 DWER within 4 weeks of the condition decline being detected to identify preventative and remedial actions. Implement contingency actions which may include: <ul style="list-style-type: none"> Improve and implement increased measures / controls as necessary to protect remaining habitat 	<p>No reduction in receival site vegetation condition against pre-construction habitat survey results (Section 2.3.3.2), or any trends in condition change are consistent with changes to reference site habitat condition over the same period</p>

Performance target	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
			<ul style="list-style-type: none"> – and remediate impact areas beyond the DE – Repair / alter design of drainage structures – Implement weed control and or other management in receival sites, where access is allowed <ul style="list-style-type: none"> • Monitor the outcomes of contingency actions through bi-annual 3D aerial surveys 	
<p>Minimise or avoid indirect impacts on WRP in adjacent receival habitat</p>	<p>WRP abundance trends at monitored receival sites are less than the pre-disturbance abundance over three consecutive monitoring periods (i.e. 6 months)</p>	<p>WRP density (individuals / ha) at monitored receival sites and comparative reference sites</p>	<ul style="list-style-type: none"> • Investigate cause to determine whether the impact is project attributable • If the cause of the 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 DWER within 4 weeks of the change in abundance trends being detected to identify preventative and remedial actions • Implement contingency actions which may include: 	<p>WRP abundance and persistence trends at receival sites returns to pre-disturbance levels within 15 years from commencement of the action</p>

Performance target	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
			<ul style="list-style-type: none"> - Review practicality and relevance of management measures - Repair / alter design of fencing to block vehicular access if required - Install additional signage to restrict access - Better connecting populations. • Monitor outcomes of contingency actions through the monitoring identified in sections 2.5.2 and 2.5.3 	
<p>Restore and maintain connectivity between known WRP habitat areas</p>	<p>Bi-monthly surveys of structures do not identify use within 30 months of construction (15 monitoring periods).</p>	<p>Observations of WRP using connectivity structures derived from bi-monthly surveys, motion sensor cameras, or visual observation of scats</p>	<ul style="list-style-type: none"> • Investigate cause and consult with DBCA within 4 weeks of detection that the trigger value has been reached to identify remedial actions • Implement contingency actions which may include: <ul style="list-style-type: none"> - Assessment of bridge / underpass to determine reason for lack of utilisation - Modification of bridge / underpass structure if required. 	<p>Structures utilised within 5 years of construction</p>

Performance target	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
			<ul style="list-style-type: none"> Monitor outcomes of contingency actions through the monitoring identified in section 2.3.3 	
<p>Ensure revegetation meets design criteria</p>	<p>Revegetation not completed to specification within 18 months of completion of construction</p>	<p>As detailed in Table 2-7 for the fauna land bridges and forecourt areas and fauna crossing structure access and egress points and Table 2-10 for vegetation retention and clearing exclusion areas</p>	<ul style="list-style-type: none"> Investigate cause and raise an incident report Implement contingency actions which may include: <ul style="list-style-type: none"> Require contractor to undertake supplementary revegetation or remedial actions to meet specifications Improve and implement increased protective measures / controls (such as pest animal and weed control) as necessary Monitor outcomes of contingency actions through the monitoring identified in section 2.3.2.3 	<p>As detailed in Table 2-7 for the fauna land bridges and forecourt areas and fauna crossing structure access and egress points and Table 2-10 for vegetation retention and clearing exclusion areas</p>
<p>Ensure revegetation achieves success criteria</p>	<p>Revegetation not tracking toward completion criteria at the conclusion of Year 2 monitoring.</p>	<p>As detailed in Table 2-7 for the fauna land bridges and forecourt areas and fauna crossing structure access and egress points and Table 2-10 for vegetation</p>	<ul style="list-style-type: none"> Investigate cause and raise an incident report Implement contingency actions which may include: <ul style="list-style-type: none"> Undertake supplementary revegetation and/or weed control 	<p>Criteria as detailed in Table 2-7 for the fauna land bridges and forecourt areas and fauna crossing structure access and egress points and Table 2-10 for vegetation retention and clearing exclusion areas</p>

Performance target	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
		retention and clearing exclusion areas	<ul style="list-style-type: none"> – Improve training and education for all personnel – Improve and implement increased protective measures / controls (such as pest animal control) as necessary – Review monitoring frequency and method • Monitor outcomes of contingency actions through the monitoring identified in section 2.3.2.3 	
Objective 2: Minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum				
Reduce predator population within the DE and adjacent habitat	Predator observations ¹⁴ 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	<ul style="list-style-type: none"> • Investigate cause and develop remedial actions with predator control contractor • Implement agreed contingency actions which may include: <ul style="list-style-type: none"> – 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

¹⁴ Includes direct sightings as well evidence of, such as tracks and scats

Performance target	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
<p>Minimise predation at crossing structures</p>	<p>Predator observations at monitored crossings increase by 25% over prior monitoring period</p>	<p>Predator observations at monitored crossings</p>	<ul style="list-style-type: none"> • Investigate cause and develop remedial actions with predator control contractor • Implement agreed contingency actions which may include: <ul style="list-style-type: none"> – Increase trap density in key areas where observations remain at baseline – Review resource availability • Monitor outcomes on weekly basis until below trigger 	<p>Predator observations decrease by at least 50 % against baseline survey results</p>

Table 2-4. SMART performance standards for HFMP Outcome (Condition 6-2)

Outcome	Trigger / early warning indicator	Performance indicators	Corrective / contingency actions	Completion criteria
<p>Abundance and persistence of the western ringtail possum in the receival sites returns to pre-disturbance levels within fifteen (15) years from the commencement of construction.</p>	<p>WRP abundance at receival sites for two consecutive monitoring periods is less than pre-disturbance levels</p>	<p>WRP density (individuals / ha) at monitored receival sites (Figure 8)</p>	<ul style="list-style-type: none"> • Investigate cause to determine whether the impact is project attributable and consult with DBCA and / or DWER • Implement contingency actions which may include: <ul style="list-style-type: none"> – Review practicality, adequacy and relevance of management measures – Improve and implement increased protective measures / controls as necessary – Repair / alter design of fencing to block vehicular access if required – Install additional signage – Better connecting populations • Monitor outcomes per Section 2.5. 	<p>WRP abundance at monitored receival sites return to pre-disturbance levels.</p>

2.2 Environmental maps and diagrams

- Figure 1 identifies the location of the Development Envelope
- Figure 2 identifies the locations of WRP observations and habitat clearing categories
- Figure 3 identifies fauna crossing provisions and exclusion fencing concept plans
- Figure 4 shows the fauna crossing typical details
- Figure 5 shows exclusion fencing typical details
- Figure 6 shows a concept sketch of the fauna land bridge at Yalinda Drive
- Figure 7 shows a concept sketch of the fauna land bridge located around 350 m east of the Yalinda bridge
- Figure 8 identifies receival sites adjacent to the Development Envelope
- Figure 9 identifies reference sites relative to the Development Envelope
- Figure 10 identifies the radio telemetry study area.

2.3 Fauna crossing structures and land bridges

This chapter describes the Proposal fauna crossing structures and land bridges. The following sections identify:

- The locations, dimensions, designs and revegetation requirements of the proposed crossing structures (Section 2.3.1)
- The locations, designs, revegetation and maintenance requirements of the two proposed fauna land bridges (Section 2.3.2)
- The monitoring methodologies to evaluate the effectiveness and WRP utilisation of the crossing structures and land bridges (Section 2.3.3)
- The monitoring methodologies in relation to project attributable WRP population changes and / or habitat fragmentation (Section 2.3.3)
- Corrective actions and adaptive management to ensure management objectives, targets and completion criteria are achieved (Section 2.1.2).

Recognising the critical importance of maintaining connectivity between habitat areas and across the local landscape, Main Roads has prioritised this management aspect. Known movement pathways along waterways and remnant native vegetation have been retained through the detailed design process where possible, and suitably designed underpasses / rope bridges (engineered movement structures) have been included in the design to reconnect disrupted movement pathways between habitat areas.

Due to the high number of locations where engineered movement structures can be installed along the Proposal Area, Main Roads has taken the initiative to trial a number of different structures in order to build knowledge around WRP requirements and preferences. Designs for fauna over and underpasses and rope bridges used locally and nationwide have been researched and evaluated for application for the Proposal. Main Roads has also considered expert advice to ensure best practice in the designs proposed for the Proposal, as well as investigate how existing structures can be improved, such as installing ledges in the tops of underpasses so that WRP do not have to go to ground, and, via ropes, linking these ledges straight up into the adjacent canopy, assisting WRP to avoid predators. The Proposal includes several design options based on these improved designs and on successful designs used at Treendale (where an underpass connects the riparian zone along the Collie River in Australind) (Barbara Jones, pers. comm., 2020) and Vasse

(where substantial areas of Peppermint woodland habitat on either side of Bussell Highway are connected via rope bridges) (Yokochi & Bencini, 2015).

Habitat connectivity will be retained / re-established in the longer term through the installation of underpasses / rope bridges (fauna crossing structures) connected to adjacent habitat. Twenty nine (29) such connections are now proposed (Figure 3), as discussed further in Sections 2.3.1 and 2.3.2, including:

- Fourteen rope bridges (two associated with fauna land bridges, four under the Yalinda Drive bridge and the remainder over BORR or Bussell Highway)
- Six fauna underpasses (five box underpasses and one arch underpass)
- Seven dual use fauna culverts
- Two fauna land bridges (Section 2.3.2).

Fauna fencing will be installed adjacent to known habitat areas to exclude WRP moving 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 4. Possum fencing is proposed to be a combination of permanent and temporary fencing. Temporary fencing, which will remain in place for a minimum of five years, will be installed in several locations between Ducane Road and Jilley Road, and along Yalinda Drive between the intersections with Eucalypt Drive and Cokelup Road. All other possum fencing will be permanent. Possum fencing has been located based on the Habitat Clearing Categories, targeted WRP surveys and adjacent habitat patches as shown in Figure 8. The possum fence will be constructed in addition to noise and screen walls to exclude possum movement from adjacent habitat onto the road carriageway. Permanent fencing would include kangaroo escape gates from the Development Envelope consistent with the design used in BORR Northern and Central sections, shown in Plate 1.

KANGAROO GATE NOTES

1. ALL WELDED COMPONENTS SHALL BE SEPARATELY FABRICATED FROM UNTREATED STEEL AND THEN GALVANISED.
2. HINGE SLEEVE SHALL BE INSTALLED IN SUPPORT RAIL AND GREASED TO ENSURE SMOOTH OPERATION.

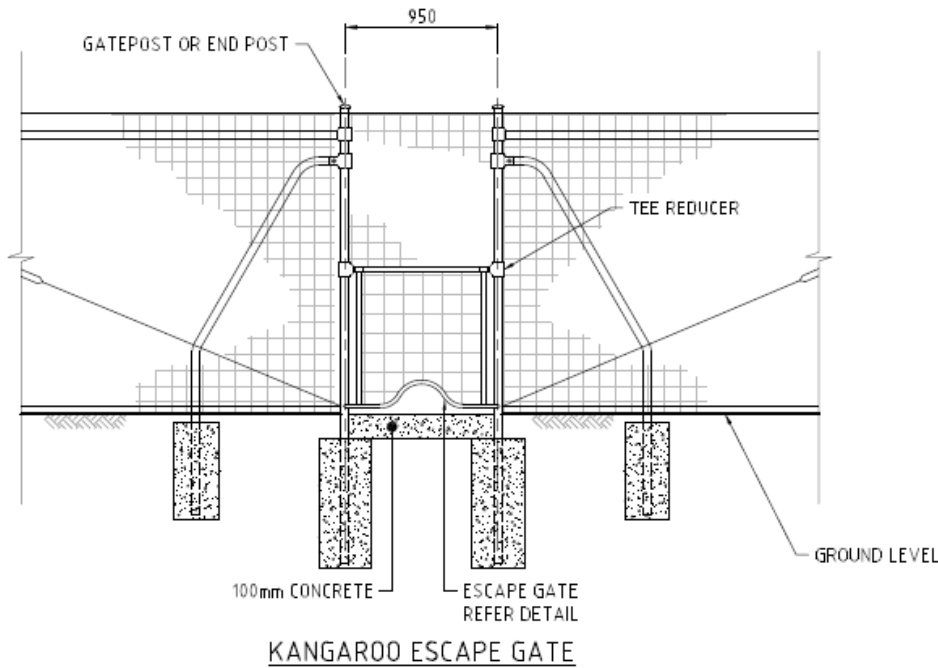


Plate 1. Kangaroo escape gate (example of design)

2.3.1 Fauna crossing structures

Five designs are proposed to be used for the WRP movement structures, as shown in Figure 5. This includes one design that has been successfully utilised for a nearby Main Roads project, where an underpass connects the riparian zones along the Collie River in Australind. This structure has a local track record of repeated WRP crossings within 2-3 years of installation, see Plate 2. This crossing structure, which is located in a low WRP density area, is the same design as is proposed for the four-way Yalinda bridge crossing structure. Another of the proposed crossing structures (culverts) has also been shown to be used by the eastern species, *Pseudocheirus peregrinus*^{15,16,17}.

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 5). The proposed monitoring detailed in Section 6.3 will assess the effectiveness / use of the different designs by WRP.

¹⁵ Taylor, B. D. and Goldingay, R. L. (2003) Cutting the carnage: wildlife usage of road culverts in north-eastern New South Wales. *Wildlife Research* **30**, 529-537.

¹⁶ Bond Amy R., Jones Darryl N. (2008) Temporal trends in use of fauna-friendly underpasses and overpasses. *Wildlife Research* **35**, 103-112.

¹⁷ van der Ree, R., Clarkson, D.T., Holland, K., Gulle, N., Budden M., 2008. *Review of Mitigation Measures used to deal with the Issue of Habitat Fragmentation by Major Linear Infrastructure*, Report for Department of Environment, Water, Heritage and the Arts (DEWHA), Contract No. 025/2006, Published by DEWHA.

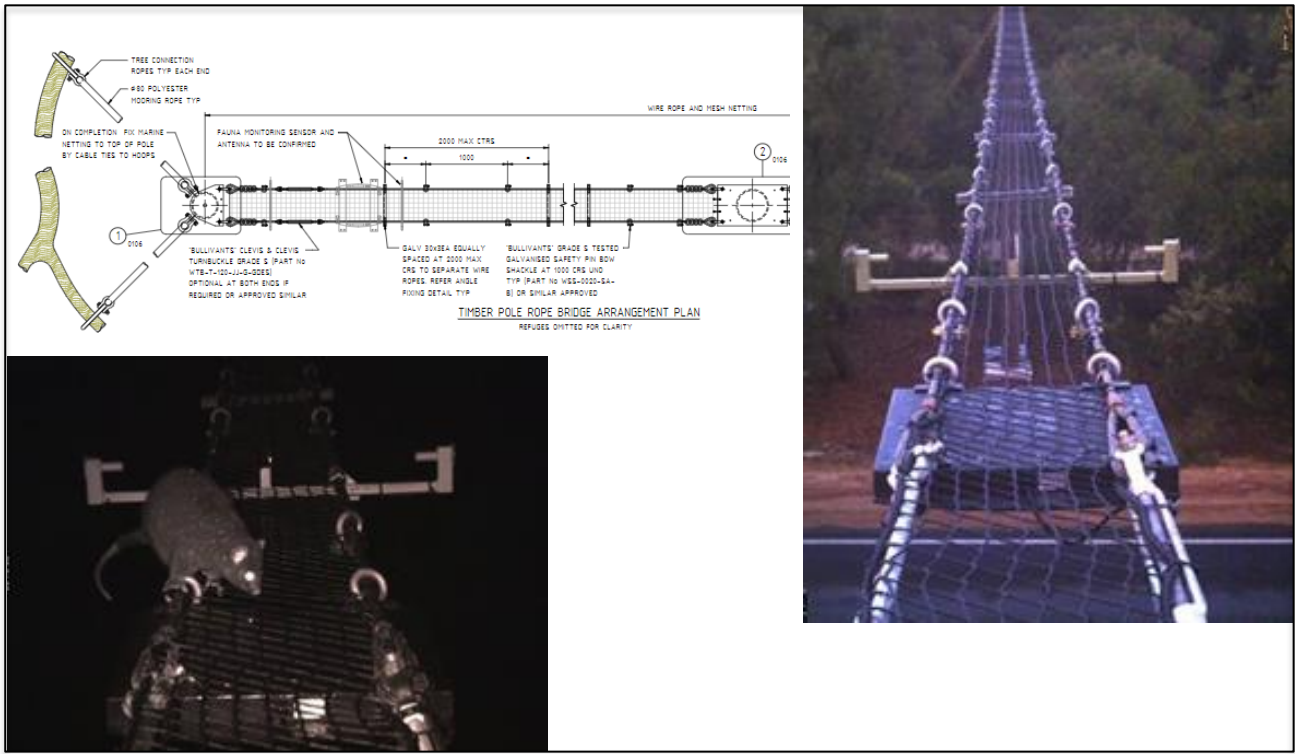


Plate 2. Proposed Rope Bridge Structure

A total of twenty nine (29) crossing structures are included in the Proposal design including thirteen (13) dual use, box or arch culverts and fourteen (14) rope bridge structures. The specifications of the proposed crossing structures are provided in Table 2-5 and their locations are shown in Figure 3. The proposed structure designs are shown in Figure 5.

Table 2-5. Fauna crossing structure specifications

Crossing structure No.	Type	Size (mm)
C31-002	Box	900 x 900
C31-007	Box	1500 x 1500
C31-012A	Box	1200 x 1200
C31-012B	Box	1200 x 1200
C31-013A	Box	1200 x 1200
C31-013B	Box	1200 x 1200
C31-014A	Box	1200 x 1200
C31-014B	Box	1200 x 1200
C31-023	Box	900 x 900
C31-024A	Box	900 x 900
C31-024B	Box	900 x 900
C31-00X	Box	2400 x 1200
UP9499	Arch	6000 x 2500
C31-002	Box	2100 x 2100
C31-003	Box	2100 x 2100
C31-005	Box	1200 x 1200
C31-006	Box	1200 x 1200

To facilitate WRP use, all structures will be connected to adjacent habitat via tree-canopy connections via overhead rope hawsers (80 mm diameter polyester ropes) and poles (minimum 2.5 m high) (see Plate 3). Tree-canopy connections will be installed after the installation of crossing structures and remain in place for the life of the project. Maintenance will involve repair / replacement of fittings, fixtures and ropes where required, with monitoring of the structure and function conducted bi-annually post-installation.

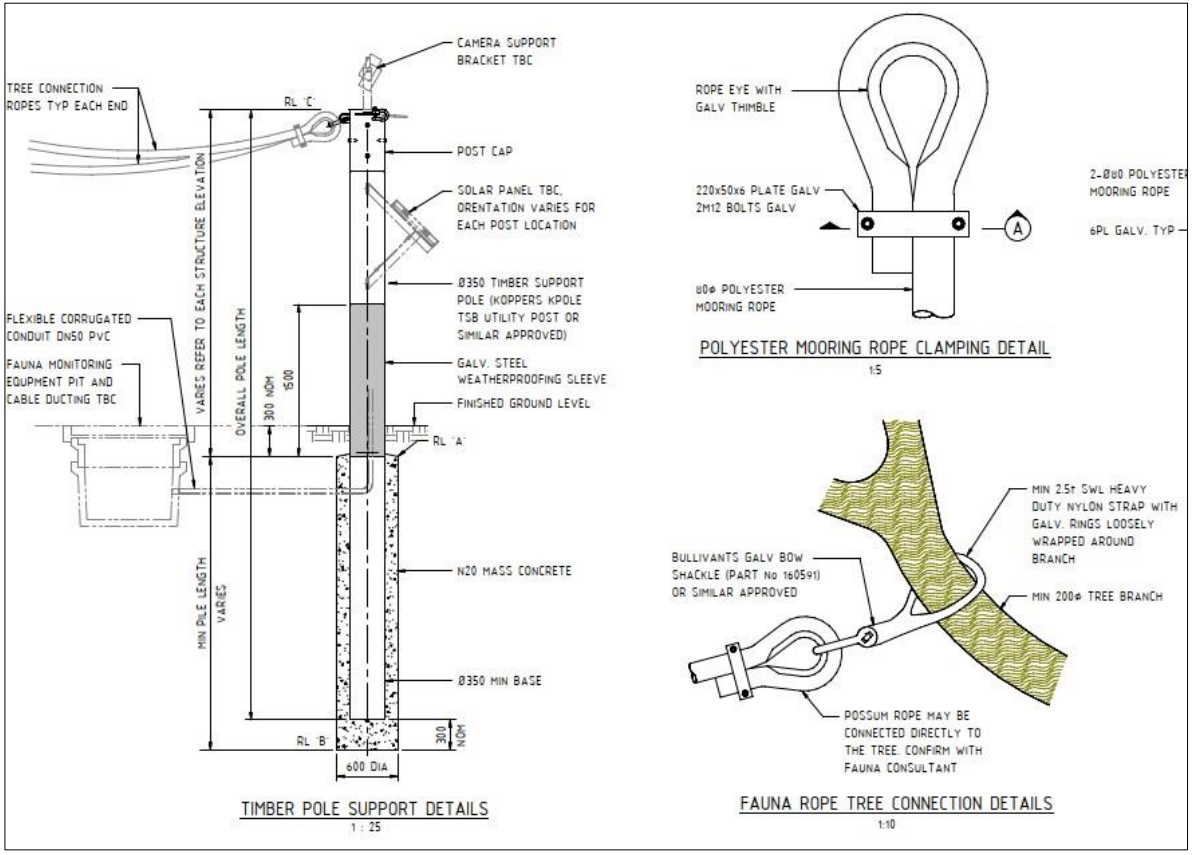


Plate 3. Tree-canopy connector rope (example of design)

Revegetation will be undertaken around access and egress points of crossing structures to make utilisation of the structures attractive and effective for WRP. Revegetation at these locations will mirror that undertaken on the fauna land bridges and bridge forecourt areas, as detailed in Sections 2.3.2.2 and 2.3.2.3.

2.3.2 Fauna land bridges

Fauna land bridges are proposed to be established at the Yalinda Drive bridge and 350 m east of the Yalinda bridge (Figure 6 and Figure 7).

The bridge at Yalinda Drive will incorporate a road formation as well as the fauna land bridge while the bridge 350 m east of the Yalinda Drive bridge is a dedicated fauna land bridge. As such the specifications of the bridges differ, however the fauna land bridge components will be the same on both structures. The fauna land bridge locations are shown in Figure 3.

2.3.2.1 Design specifications

Bridge design elements are summarised below:

- The bridges will accommodate a 5.0 m wide fauna crossing structure¹⁸
- The 1.0 m deep fauna crossing fill is retained by the precast beam walls. The concrete walls also support a screen wall with stainless steel wire ropes
- Perforated screen walls will be provided at each side of the structure extending up to the end of the wingwalls. The top of the screen is to be a minimum of 2.4 m above the finished ground level to prevent the risk of fauna and unauthorised users from falling onto the highway below. Perforation will allow for light penetration onto the growing area.
- Rainfall is anticipated to filter through the fauna crossing fill while the bridge is protected from water ingress through the provision of a waterproof membrane and corflute protection layer above the water proofing membrane
- Water on the bridge is anticipated to filter through the soil fill and is to be directed along the bridge deck via a longitudinal grade to the south.

The Yalinda Drive land bridge will include five (5) arboreal fauna rope bridge structures comprising:

- A central fauna rope bridge, at least 2 m high, comprising 80 mm diameter polyester rope
- A four-way fauna rope structure comprising 80 mm diameter polyester rope located underneath the bridge structure.

The dedicated fauna land bridge will include a central fauna rope bridge comprising 80 mm diameter polyester rope installed at a height to be determined in consultation with DBCA.

The rope bridge structures will be connected via similar polyester rope to existing tree canopy within the road reserve either side of the bridges. Once vegetation cover on the bridges is sufficient to facilitate WRP movement via the canopy, the rope bridges may be removed if there is evidence WRP are successfully utilising vegetation cover and not using rope bridges. Canopy connector ropes will be retained and reconnected where necessary.

Large logs and / or rocks (furniture) will be installed across the bridge to provide shelter for ground dwelling fauna, and to deter unauthorised off road vehicle access.

2.3.2.2 Revegetation methodology

Recreation of WRP habitat via revegetation is a recommended action in the species Recovery Plan (DPaW, 2017), however there are no recognised industry standards for revegetation of WRP habitat, and this is indicated as a knowledge gap in the species recovery plan. The revegetation proposed below meets Main Roads standards and specifications (Main Roads Western Australia, 2016a; 2016b), developed over many years of successful revegetation and recreation of WRP habitat in the vicinity of the Proposal. Completion criteria were developed congruent with the EPA's *Guidance Statement No. 6 Rehabilitation of Terrestrial Ecosystems* (EPA, 2006) and the Department of Water and Environment Regulation *Guide to preparing revegetation plans for clearing permits under Part V of the Environmental Protection Act 1986* (DWER, 2018).

¹⁸ The width of the fauna land bridges has been determined in consultation with DBCA.

The deck of the fauna land bridges and the forecourt approaches (up to 5 m surrounding the bridge approaches) will be planted with hardy species that have a suitable form to provide habitat and protection for local fauna on the bridges and their forecourts / approaches.

Considering the shallow soil profile and harsh growing conditions, some cultivars and landscaping varieties have been included in the species list to ensure the bridge vegetation provides maximum protection for ground-dwelling fauna using the bridge. *Acacia saligna* may be added to the species list for crossing structure access and egress points but due to its short life-span and high maintenance requirement, will not be planted on the land bridges.

Table 2-6 outlines the proposed species for the immediate bridge approaches and bridge decks.

Table 2-6. Proposed revegetation species list

Species	Common name	Form	Height (m)	Flower colour	Flowering
<i>Acacia pulchella</i>	Prickly Moses	Shrub	0.3 - 3	Yellow	Autumn-summer
<i>A. saligna prostrate</i>	Wattle	Prostrate	0.3	Yellow	Spring
<i>Agonis flexuosa nana</i>	Dwarf Peppermint	Shrub	3.5	White	Spring
<i>Anigozanthos manglesii</i>	Kangaroo Paw	Shrub	2	Red, green	Spring / summer
<i>Banksia sessilis</i>	Parrot Bush	Shrub, small tree	5	yellow	Winter-late spring
<i>Beaufortia squarrosa</i>	Sand Bottlebrush	Shrub	0.5 - 2	Red	Spring
<i>Billardiera fusiformis</i>	Australian Bluebell	Climber		Blue, white, pink	
<i>Callistemon phoeniceus</i>	Lesser Bottlebrush	Shrub, tree	1 - 3	Red	Spring / summer
<i>Calothamnus quadrifidus</i>	One-sided Bottlebrush	Shrub	1.5 - 3.5	Red	Spring / summer
<i>Calothamnus villosus</i>	Silky Net Bush	Shrub	0.3 - 1.5	Red	Winter / spring
<i>Carpobrotus virens</i>	Coastal Pigface	Prostrate	0.1 - 0.3	Purple, pink, white	Autumn-summer
<i>Grevillea crithmifolia</i>	Grevillea	Shrub	0.6 - 2	White, pink	
<i>Grevillea sericea</i>	Silky Grevillea	Shrub	1 - 2	Pink	Spring, autumn, winter
<i>Hardenbergia comptoniana</i>	Native wisteria	Shrub or climber		Blue, purple	Winter, spring
<i>Hemiandra pungens</i>	Snakebush	Prostrate to ascending shrub	0.05 - 1	White, blue, purple, pink	Summer
<i>Hibbertia cuneiformis</i>	Cut Leaf Hibbertia	Shrub	1 - 3	yellow	Spring / summer
<i>Jacksonia furcellata</i>	Grey Stinkwood	Shrub, small tree	0.4 - 4	Yellow, orange, red	Spring / summer
<i>Kunzea glabrescens</i>	Spearwood	Shrub	1.5 - 4	White	Spring / summer
<i>Lepidosperma gladiatum</i>	Coastal Sword sedge	Grass / herb	0.5 - 1.5	Brown	Spring / summer
<i>Myoporum insulare</i>	Blueberry Tree	Shrub, tree	0.25 - 5	White	Spring / summer

<i>Olearia oxalis</i>	Coastal daisybush	Shrub	0.5 - 3	White, cream, yellow	Spring-autumn
<i>Patersonia occidentalis</i>	Native flag		0.3 – 1.5	Purple	
<i>Rhagodia baccata</i>	Berry Saltbush	Shrub	0.3 - 1	Cream, yellow, green	Autumn
<i>Spyridium globulosum</i>	Basket Bush	Shrub	0.3 - 5	White	Autumn - spring

The BORR South road reserve will be fenced to exclude kangaroos and rabbits. As a result, grazing pressure on the revegetation works is expected to be negligible.

2.3.2.3 Revegetation monitoring and maintenance

Monitoring of the land bridge revegetation will be undertaken three times per year in the first two years (autumn, spring and summer) and annually in spring thereafter until the completion criteria (Table 2-7) are met. It is expected that the vegetation would be self-sustaining within 5 to 8 years of completion. Assessment of the completion criteria will be conducted by suitably experienced independent environmental specialists at:

- Five permanent 2 m x 2 m quadrats (approximately equidistantly spaced along the length of the bridge, staggered and offset from the centreline)
- One permanent transect over the length of the fauna land bridge.

The monitoring program is detailed in Table 2-7. Contingency actions to be implemented should revegetation targets not be met are specified in Table 2-3.

Table 2-7. Land bridge revegetation monitoring and completion criteria

Performance indicator	Completion criteria	Monitoring methodology	Frequency
Presence of fauna furniture	Installation of logs and timber (furniture), minimum 2 per ha, to provide cover for ground fauna	Visual assessment	Once prior to revegetation works
Weed cover by area based on quadrats	Weed cover within revegetation area less than 20 % by area No weed occurrence is to extend more than 50 % of the bridge deck width	Quadrat, visual assessment	Three times per year for two years, annually in spring there-after until revegetation completion criteria achieved
Bare ground cover by area based on quadrats	Bare ground cover within revegetation area no more than 10 % by area		
Plant density	Plant density equivalent to at least 20 stems per 25 m ²		
Native vegetation cover by area based on quadrats	Native vegetation cover 80 % by area across all strata		

Performance indicator	Completion criteria	Monitoring methodology	Frequency
Natural recruitment of native species	Evidence of juvenile native plant recruitment		
Presence/absence of pests	Native vegetation cover 80 % by area across all strata Evidence of juvenile native plant recruitment		
Diversity of species present	A minimum of 50 % of the range of species planted present	Transect	

Where monitoring indicates that completion criteria are not likely to be achieved, contingency actions will be implemented in order to achieve the performance targets and attain / maintain completion criteria. Contingency measures may include:

- Additional planting / infill planting
- Additional weed control
- Additional rabbit control
- Amend reticulation watering regime
- Additional access control.

2.3.3 Monitoring of connectivity / fragmentation

2.3.3.1 Objectives, targets and completion criteria

The objectives of the monitoring program are to:

- Minimise the impacts of habitat fragmentation and predation on the WRP; and
- Ascertain whether the abundance and persistence of the WRP in the receival sites has returned to pre-disturbance levels within 15 years from the commencement of the Proposal.

To achieve its objectives the monitoring program will:

- Conduct WRP surveys in areas of retained habitat. Surveys will also be conducted in reference sites to detect regional or other factors influencing WRP abundance.
- Obtain evidence of use by WRP of crossing structures
- Ascertain the population and relational dynamics of WRP within the Development Envelope and adjacent receival sites
- Detect changes in adjacent receival site habitat quality.

Main Roads has identified key monitoring actions to monitor the potential impacts of the Proposal that may result in the fragmentation of habitat for significant fauna during and post construction. These encompass monitoring of both direct and indirect impacts of the Proposal. The proposed HFMP monitoring program is presented in Table 2-8.

Main Roads will liaise with DWER, DBCA and DCCEEW where monitoring demonstrates refinement to proposed triggers, thresholds and corrective actions is required, and if so 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.

Monitoring of fauna crossing structure efficacy will be undertaken through a combination of GPS collars, a mark-resight study and motion-sensor IR cameras installed at crossing structures.

Monitoring for impacts to WRP has been and will continue to be conducted at both reference sites and receival sites. The monitoring will comprise scat counts and nocturnal surveys to be conducted by a suitably experienced zoologist / environmental scientist. WRP monitoring will also include a combination of GPS collars and a mark-resight study, as described in the CFMP.

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.).

Main Roads has commenced monitoring of two reference sites outside the Proposal Area. These are located abutting the existing BORR Stage 1 (Lot 2 Boyanup Picton Road) and abutting Bussell Highway in Gelorup (Reserve (R23000)). The reference sites were identified based on their proximity to the Development Envelope and the similarity of their habitat to that of the Development Envelope and have been included in the bi-monthly surveys since October 2019. Any reduction in WRP presence at monitored receival sites will be compared with those in the reference sites. This may enable determination of the likelihood of impacts having resulted from the Proposal. Field data will be collated and reviewed after each monitoring survey. Analysis of field data will include comparison of data and trends between seasons and years, and also between reference sites and monitored receival sites.

2.3.3.2 Pre-construction habitat condition survey

Habitat pre-construction assessments will be conducted for:

- Impacted habitat within the Development Envelope
- Receival sites habitat
- Reserve 23000 reference site
- Lot 2 Boyanup Picton Road reference site.

3D aerial footage will be utilised to assess vegetation canopy cover and structure within the Development Envelope, receival sites and reference sites. 3D Images will be used to estimate cover by subtracting a digital terrain model from a digital elevation model. The resultant raster files will then be compared against images of the same locations taken during previous flights to ascertain whether there has been a change in cover over time. The derived difference in cover (between time periods) will be matched to a change across Normalised Difference Vegetation Index (NDVI) layers over the same time period.

This data, combined with WRP density data, will enable assessment of WRP distribution and density in relation to changes in vegetation cover and structure, as well as changes (if any) in receival site

vegetation cover and structure compared with that in baseline condition surveys or at the reference sites.

2.3.3.3 Motion sensor cameras

Motion sensor IR cameras will be installed on fauna crossing structures to assist with determining crossing structure efficacy. Cameras will initially be deployed at an over / underpass once the bi-monthly surveys detect WRP in trees adjacent to that over / underpass, and / or once scats have consistently been recorded at crossing access / egress points and / or under rope bridges. Cameras will be deployed for a minimum of four weeks annually for a minimum of fifteen (15) years post-construction. Timing of deployment will be dictated by those periods when males are most active searching for mates and / or when sub-adults may be dispersing away from their natal home ranges. The location and duration of deployment (beyond the stated minimum) will be governed by the perceived or demonstrated risk of theft¹⁹.

¹⁹ At structures considered to be low-risk for theft, cameras may be left in-situ for longer than those at high-risk theft sites.

Table 2-8. Proposed WRP habitat fragmentation monitoring aspects

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
Objective 1: Minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum					
Maintain condition rating in adjacent WRP receival site habitat	Quality / condition (function and value) of receival site habitat adjacent to the Development Envelope	Receival site habitat adjacent to the Development Envelope	Analysis of 3D aerial footage	Prior to construction: Once (baseline monitoring) During construction: Bi-annually Post construction: Bi-annually for three years then annually for a minimum 12 years or as otherwise agreed by the Minister/CEO	Report annually as part of Environmental Performance Report / 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
Minimise indirect impacts on WRP in adjacent receival habitat	WRP tracking into adjacent habitat during clearing	Development Envelope and adjacent receival site habitat	Mark-resight and GPS collars	During construction: Pre-clearing and bi-monthly for both Mark-resight and GPS collars Post construction: Bi-annually for years 1-2 Annually for years 3-10 for Mark-resight only	
Restore and maintain connectivity between known WRP habitat areas	Fauna crossing structures included in design specification	Development Envelope and adjacent receival site habitat	Review of design reports and drawings at 50 % design and IFC (issued for construction) to ensure WRP bridges / underpasses are designed and	Pre-construction: once	

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
			incorporated into Proposal		
	Fauna crossing structures (including tree-canopy connections) installed within specification	Development Envelope and adjacent receival site habitat	Visual assessment of constructed / in construction WRP movement structures to confirm these are as per detailed design and provision of as constructed plans.	During construction: Bi-annually Post-construction: Bi-annually for a minimum 15 years or as otherwise agreed by the Minister/CEO	
	Possum fencing intact and effective	Development Envelope	Visual inspection of fence for damage / effective function	Post-construction: Quarterly for 5 years for temporary fencing and 15 years for permanent fencing	
	WRP recorded or filmed using rope bridge or underpass	Development Envelope and adjacent receival site habitat	Via a combination of motion sensor IR cameras, GPS collars and a mark-resight study to assess utilisation (visual assessment of footage)	Post construction: For minimum of four weeks annually for a minimum of fifteen (15) years post-construction or until demonstrated evidence of use is observed for two consecutive monitoring periods	
	WRP presence / absence (at structures)	Development Envelope and adjacent receival site habitat	Strip sampling surveys (continuation of those commenced in October 2019)	Prior to and during construction: bi-monthly Post-construction: Bi-annually for 15 years or otherwise agreed by the Minister/CEO	

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
			Visual inspection for WRP scats beneath rope bridges and in underpasses	Post construction: Bi-annually for ten years and annual for a minimum of five years or otherwise agreed by the Minister/CEO	
	WRP genetic relatedness	Development Envelope and adjacent receival site habitat	DNA scat analysis	During construction: bi-monthly Post-construction: Bi-annually for at least three years	
Ensure revegetation meets design criteria	Revegetation to design specification	Development Envelope and adjacent receival site habitat	As constructed plans and field verification of plantings	At completion of Construction period	
Ensure revegetation achieves success criteria	Revegetation success, see Section 2.6.3	Development Envelope and adjacent receival site habitat	2 x 2 m quadrats and transect Visual inspection	Post construction: Bi-annually for three years. Annual monitoring thereafter for a minimum of 12 years or otherwise agreed by the Minister/CEO	
Objective 2: Minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum					
Reduce predator population within the DE and adjacent habitat	Predator control efficacy, based on feral predator presence within DE and receival sites.	Development Envelope and adjacent receival site habitat	Visual inspection for evidence / estimate of abundance of predators within control areas	Pre-construction: once one month prior to clearing for each clearing stage at a minimum During construction: Bi-monthly at a minimum Post construction:	Report annually as part of Environmental Performance Report / compliance reporting or in response to exceedance of an approved trigger Summary of achievement of annual compliance against performance

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
				Bi-annually for at least five years and then annually a minimum of 10 years or otherwise agreed by the Minister/CEO	measures and contribution of measures to achievement of the environmental objective
Minimise predation at crossing structures	Predator control implementation schedule and field records	Various field locations	Audit of field records against implementation schedule	Post-construction: Bi-annually for at least five years and then annually a minimum of 10 years or otherwise agreed by the Minister/CEO	
Environmental Outcome					
Abundance and persistence of the western ringtail possum in the receival sites returns to pre-disturbance levels within fifteen (15) years from the commencement of construction.	WRP presence / absence, abundance and distribution	Receival site habitat adjacent to the Development Envelope	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-annually Post construction: Bi-annually for 15 years or otherwise agreed by the Minister/CEO	Report annually as part of Environmental Performance Report/ 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 presence / absence (receival habitat and reference sites)	Receival site habitat adjacent to the	Strip sampling surveys (continuation of those commenced in October 2019)	Prior to and during construction: bi-monthly Post-construction: Bi-annually for 15 years or	

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
		Development Envelope		otherwise agreed by the Minister/CEO	
	WRP genetic relatedness	Development Envelope and adjacent receiptal site habitat	DNA scat analysis	During construction: bi-monthly Post-construction: Bi-annually for 15 years or otherwise agreed by the Minister/CEO	

2.3.3.4 Radio telemetry study

The study will attempt to capture all WRP in the clearing footprint and the immediately adjacent habitat using either traps or by hand (as per the ethics application). Upon capture each animal will be weighed, aged, sexed and measured and a pit-tag inserted under the skin between the scapulae. It is proposed that capture of animals outside of but adjacent to the clearing footprint will commence during the June 2022 bi-monthly survey. PIT tagging will permit the welfare of uncollared animals (see Section 2.3.3.5 on GPS Collars below) to be followed pre- and post-clearing using a mark-sighting program. It is anticipated that a minimum of 20 and up to 50 animals will be PIT tagged. Further details regarding this study are provided in the CFMP.

Re-sightings will generally be undertaken in conjunction with the bi-monthly surveys. During and immediately post clearing activities, the intensity of re-sighting monitoring frequency can be increased (i.e. resighting conducted more frequently) to obtain finer temporal resolution if required.

2.3.3.5 GPS collars

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. The GPS collar study and search areas (estimated range of detection) are shown in Figure 10. The lifespan of a collar depends in part on the size of the battery and the recording schedule, with the former being largely determined by the desired weight of the collar. For WRPs, a collar weight of approximately 30 – 32 g (around 5 % of the body weight) is proposed. Given that WRPs show relatively small movements across most nights, five GPS fixes per night are proposed. In addition, four hours of VHF operation per day (permitting additional locations to be collected via radio telemetry) and RF communication of GPS data are proposed. This type of schedule would typically yield an estimated lifespan of 254 days in an average case scenario. Further details regarding this study are provided in the CFMP.

2.4 Predator control

The WRP Recovery Plan (DPaW, 2017) identifies predation as a key risk to WRP. This chapter describes the predator control measures to address the requirements of MS 1191 condition 6-3(7) and condition 10(i) of the EPBC Act approval for EPBC 2019/8543.

2.4.1 Objectives, targets and completion criteria

The objectives of the predator control program are to minimise the impacts from predation that are exacerbated by the proposal on WRP (condition 6-1(2)) and reduce the number and prevalence of feral animal WRP predators to below baseline levels. Associated targets and completion criteria for the program are set out in Table 2-3 (Section 2.1.1).

2.4.2 Predator control methodology

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 the respective stage of clearing. During construction, predator control will be undertaken within the Development Envelope to reduce

predator numbers. To minimise the risk of predation for any WRP utilising the crossing structures, predator control will be conducted at crossing structure (ropes, culverts and bridges) access and egress points for a minimum of five years post-construction. Dis-continuation of predator control actions is subject to the outcome of the five yearly review undertaken by an independent suitably qualified ecologist (refer to Section 3.3).

Approach

To minimise impacts on non-target species, predator control will be undertaken using soft-jaw traps, or other appropriate approach or technique. 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 2-3). Trap 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)
- 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. Adaptive management will be applied to change the frequency and intensity of predator management to respond appropriately to the level of threat or risk from predators to WRP and BTP, to be determined in consultation with DBCA.

During construction, traps will be deployed, based on the outcomes of site assessments and the ongoing efficacy of the trapping program. Post-construction, traps will be deployed bi-annually for the first five years 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. Following the first five years after construction, traps will be deployed annually.

Trap deployment will be adaptive throughout the duration of approval in response to predator abundance within the control areas.

2.4.3 Monitoring of predator abundance and control effectiveness

Monitoring will be conducted to determine achievement of completion criteria specified in Table 2-3. The objectives of the monitoring program are to:

- Obtain evidence of presence and abundance of predators at the monitored locations and thus assess the effectiveness of predator control actions
- Determine the degree of threat to WRPs utilising crossing structures from predators.

The predator control monitoring program is presented in Table 2-9.

Table 2-9. Proposed WRP predator control monitoring aspects (Condition 6-1(2))

Performance target / outcome	Parameter to be monitored	Location	Methodology	Frequency	Recording and reporting
Objective 2: Minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum					
Reduce predator population within the DE and adjacent habitat	Predator control efficacy, based on feral predator presence within DE and receival sites.	Development Envelope and adjacent receival site habitat	Visual inspection for evidence / estimate of abundance of predators within control areas	Pre-construction: once one month prior to clearing for each clearing stage at a minimum, or at greater frequency. During construction: Bi-monthly at a minimum, or at greater frequency based on site assessments Post construction: Bi-annually for at least five years and then annually for a minimum of 10 years or otherwise agreed by the Minister/CEO	Report annually as part of annual compliance reporting or in response to exceedance of an approved trigger.
Minimise predation at crossing structures	Predator control implementation schedule and field records	N/A	Audit of field records against implementation schedule	Post-construction: Bi-annually for at least five years and then annually a minimum of 10 years or otherwise agreed by the Minister/CEO	

2.5 Abundance and persistence of WRP

2.5.1 WRP abundance and persistence monitoring

A comprehensive monitoring methodology, comprising five different approaches, is proposed to evaluate the abundance and persistence of WRP at the receival sites, and determine whether EPBC Act approval for EPBC 2019/8543 condition 10 and the outcome in MS 1191 condition 6-2 will be and / or have been met.

The objectives of the monitoring program are to:

- Ascertain whether the abundance and persistence of the WRP in the receival sites returns to pre-disturbance levels within 15 years from the commencement of the action
- Obtain evidence of use by WRP of underpasses and possum rope bridges

The proposed methodology consists of:

- Baseline survey – conducted 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, at receival sites and at two reference sites (Figure 8 and Figure 9)
- Mark-resight study – uniquely identifying individuals within the Development Envelope and receival sites via inserting transponders and by fitting up to 50 animals with GPS collars. This aspect of the program would continue on a bi-monthly basis through the construction period and into the post construction monitoring.
- Radio telemetry study (see Section 2.3.3.4) – monitoring WRP prior to, during and after clearing activities within the Development Envelope and receival sites. Among other things, this aspect of the monitoring program will enable determination of the extent to which displaced WRP are able to establish new home ranges within adjacent habitat. This study is limited to the area shown in Figure 10.
- Genetic relatedness study – genetic analyses of the population and relational dynamics (degree of relatedness) of WRP within the Development Envelope and receival sites
- Bi-monthly surveys – continuation and expansion of the bi-monthly strip sampling surveys that have been conducted within the Development Envelope, receival sites and reference sites since October 2019.

Detailed information on the genetic relatedness study and bi-monthly surveys is not included in the CFMP and will be provided in Section 2.5.2 and Section 2.5.3 of this Plan respectively. For detailed information relating to the remaining three aspects of the monitoring program, refer to the CFMP.

The monitoring studies outlined above will provide a comprehensive picture of the outcome of the passive relocation of WRP during clearing operations into adjacent retained home ranges or into adjacent retained habitat with which they may be unfamiliar (as described in the CFMP). The baseline survey(s) will provide pre-clearing data on the presence / absence, distribution and density of WRP within the Development Envelope, receival sites and reference sites. The Mark-resight and Telemetry studies, which will also both commence prior to clearing, aim to capture as many WRP as possible from within the Development Envelope and the immediately adjacent habitat for collaring

and / or PIT-tagging. These studies, combined with the bi-monthly surveys, which provide WRP density data, will enable measurement of WRP abundance and persistence in receival sites and statistically robust comparison with pre-disturbance WRP abundance and persistence data. The results of the above studies will be reported and evaluated within the Environmental Performance Report on an annual basis, enabling determination of achievement of the environmental outcome prescribed in condition 6-2, until such time that it can be determined that the WRP population within receival sites has returned to pre-disturbance levels.

2.5.2 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 will be tested.

2.5.2.1 Objective

The objective of the Genetic relatedness study is to ascertain the population and relational dynamics of WRP within the Development Envelope and adjacent receival sites, to assist with determining achievement of the objective specified in condition 6-1, to 'minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum'.

2.5.2.2 Approach and methodology

Population genetic approaches provide a direct way of determining functional connectivity for a given species at the landscape scale. All animals captured will have a small ear clip taken which will be used for subsequent genetic analysis of the population and relational dynamics of WRP within the Development Envelope. Analysis of WRP scat DNA will also form part of this study, with DNA being extracted from fresh scats collected during the bi-monthly surveys or at other times, such as during monitoring of the utilisation of crossing structures.

Population genetic analysis will be conducted on microsatellite data for 12 variable and previously tested microsatellite primers (Wilson, de Torres, & Spencer, 2009; Yakochi, Kennington, & Bencini, 2016) and to be optimised SRY marker (Watson, Morgan, & Johnston, 1998). The analysis will measure levels of genetic diversity within and among populations (sites). Additional analysis programs (Raymond & Rousset, 1995; Pritchard, Stephens, & Donnelly, 2000) will also be utilized to describe additional population characteristics as well as estimates of Genetic relatedness (r_{xy}) providing an estimate of relatedness between individuals (Sugaya, Ikeda, & Taniguchi, 2002).

2.5.2.3 Limitations

The following limitations may apply to the Genetic relatedness study:

- There may be issues with the quality of DNA obtainable from the specimen, related to the age of the specimen and treatment of the specimen during collection, preservation, storage, and identification (this includes drying or lengthy exposure to light, water, and heat)
- As the samples are non-invasive, there is a high likelihood that full genotypes will not be generated for all samples. Where possible partial genotypes will be used for analysis but less information may be inferred.

- The sex-linked marker SRY has not been optimised for WRP. Due to this, the sex identification of individuals cannot be certain.

2.5.3 Bi-monthly surveys

2.5.3.1 Objective

The objective of the bi-monthly (two-monthly) surveys is to determine WRP presence / absence, distribution and density within the Development Envelope, receival sites and reference sites. This methodology has been used to determine the baseline WRP population since October 2019 and is considered sufficient to determine, statistically (i.e. based on WRP density per hectare, as specified in Table 2-4), whether the WRP abundance and persistence in the receival sites is statistically the same as pre-disturbance levels within 15 years of project commencement. Reference sites are included in the bi-monthly monitoring in order to enable determination of whether any change is project attributable.

2.5.3.2 Approach and methodology

The bi-monthly surveys involve strip sampling of WRP habitat along transects spaced 20 m apart. The surveys commenced in October 2019 and have continued since that time. 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.

2.6 Clearing exclusion and vegetation retention area habitat

This chapter describes the habitat protection and enhancement measures that will be implemented for clearing exclusion areas and vegetation retention areas²⁰ to address the requirements of condition 6-3(9-11). The areas to which these measures apply are shown in Figure 1.

2.6.1 Objective, target and completion criteria

The objective of the protection and enhancement of clearing exclusion and vegetation retention area habitat is to maximise this habitat for benefits to WRP.

Active management of habitat in the Clearing Exclusion and Vegetation Retention Areas to optimise benefits to WRP is in accordance with actions identified as contributing to Objective 1 of the species Recovery Plan (DPaW, 2017).

There are no recognised industry standards for revegetation of WRP habitat, and this is indicated as a knowledge gap in the species recovery plan. The revegetation proposed below meets Main Roads standards and specifications (Main Roads Western Australia, 2016a; 2016b), developed over many years of successful revegetation and recreation of WRP habitat in the vicinity of the Proposal.

The target and trigger values for the protection and enhancement of habitat within these areas, and corrective actions that would be implemented if these values are reached, are outlined in Table 2-3. Associated monitoring methodologies are detailed in Table 2-8. Detailed completion criteria are specified in Table 2-10.

²⁰ Excluding the 'Grey Giant' Heritage Place No. 26059 site.

2.6.2 Habitat protection mechanisms and long-term management

Main Roads has purchased the properties which comprise the vegetation retention areas and the clearing exclusion areas are located within the BORR South road reserve. As these land parcels are owned by the Commissioner of Main Roads, they are in secure tenure and will be protected in perpetuity. These habitat areas will also be added to Main Roads internal 'Sensitive Environmental Area' register.

Due to their small size and distance from other reserves, it is unlikely that the habitat in the vegetation retention areas will be incorporated into the conservation estate in the foreseeable future. Main Roads will discuss long term management options with the Shire of Capel. Until an alternative management structure is in place, Main Roads will maintain ownership and fund and manage the property for the purposes of conservation until such time as the completion criteria are met. Should the land tenure or on-going management responsibilities change, Main Roads will develop a maintenance funding agreement with the Shire of Capel (or other management body as appropriate) to address on-going management costs of the habitat within these land parcels for the period of effect of EPBC Act approval.

2.6.3 Habitat enhancement

Enhancement of habitat within the clearing exclusion and vegetation retention areas will be undertaken through a combination of access restriction, strategic weed and pest animal control and targeted revegetation of existing degraded areas. Where possible, revegetation will also be undertaken where buildings are removed.

Noting that access for maintenance of these habitat areas is required, unauthorised access will be deterred through control measures such as lockable chains or gates. Weed control will be applied in both existing vegetation and revegetation areas and will be focused on species that degrade habitat values, such as Declared plant pests, WONS and selected aggressive environmental weeds. Control of pest animals may also be undertaken as required to protect existing vegetation and revegetation areas from grazing pressure.

The revegetation methodology will mirror that detailed for the fauna land bridges in Section 2.3.2.2. As the revegetation areas are small and situated amongst existing vegetation areas, site preparation will primarily comprise of weed control and rubbish removal where necessary. The species mix used in revegetation will be the same as that proposed for the fauna land bridges and forecourt areas, including *Acacia saligna* and *Agonis flexuosa* and excluding cultivars and landscaping varieties. Additional species local to the area, particularly myrtaceous and fabaceous species, may be included if available.

Revegetation monitoring will be conducted according to the methods outlined in Section 2.3.2.3. Revegetation completion criteria are specified in Table 2-10. Both the existing vegetation and revegetation areas are and / or will be included in the bi-monthly WRP monitoring outlined in Section 2.5.3.

Table 2-10. Habitat revegetation monitoring and completion criteria

Performance indicator	Completion criteria	Monitoring methodology	Frequency
Weed cover by area based on quadrats	Weed cover less than 20 % by area based on quadrats	Visual assessment	Once prior to revegetation works
Bare ground cover by area based on quadrats	Bare ground covers a maximum of 10 % by area based on quadrats	Quadrat, visual assessment	Three times per year for two years, annually in spring there-after until revegetation completion criteria achieved
Plant density	Plant density equivalent to at least 2,500 stems / ha		
Native vegetation cover by area based on quadrats	Native vegetation cover 80 % by area, based on quadrats, across all strata		
Diversity of species present	A minimum of 50 % of the range of species planted present		
Natural recruitment of native species	Evidence of juvenile native plant recruitment		
Presence/absence of pests	Native vegetation cover 80 % by area across all strata		
	Evidence of juvenile native plant recruitment		

Areas of existing vegetation are considered to already be ‘self-sustaining’, and this will be further ensured through the pest and weed control measures detailed above. It is further considered that achievement of the completion criteria outlined in Table 2-10 will correlate with the revegetation areas also reaching ‘self-sustaining’ condition.

Where monitoring indicates that completion criteria are not likely to be achieved, contingency actions will be implemented in order to achieve the completion criteria. Contingency measures may include:

- Additional planting / infill planting
- Additional weed control
- Additional pest control.

2.7 Reporting and accountability

2.7.1 Reporting

Main Roads will report to DWER and DCCEEW on the implementation of this HFMP as part of the Environmental Performance Report to be filed with the Compliance Assessment Report required under condition 12-6 of MS 1191 and EPBC 2019/8543 condition 28. It is anticipated the EPR will

report annually on achievement of annual compliance against performance measures detailed in the CAR and contribution of measures to achievement of the environmental outcome, including metrics on the outcome derived from monitoring proposed in Table 2-8 and Section 2.5.

In accordance with condition 6-6 of MS 1191, the EPR will be peer reviewed by an independent person or persons with suitable technical experience to undertake the review, and to report on the adequacy of the EPR content to achieving the objectives and outcome specified in MS 1191 condition 6-1 and 6-2 respectively.

Where the EPR or compliance audits undertaken by Main Roads identify that the environmental management actions and / or compliance with performance targets and completion criteria are not being achieved (i.e. non-compliance or an environmental incident), Main Roads will notify DWER and DCCEEW in accordance with the timeframes specified in Table 2.8. Consistent with standard document control procedures, Main Roads will maintain copies of all reports submitted to DWER and DCCEEW. The reporting requirements for this HFMP are identified in Table 2-11.

Table 2-11. Reporting requirements

Aspect	Report from	Report to	Reporting frequency
Implementation of HFMP	Manager Environment	DWER and DCCEEW	Annually (as part of annual compliance reporting)
Non-compliance with HFMP or Environmental incident	Manager Environment	DWER	Report - As soon as reasonably practicable but not more than seven business days after becoming aware of the incident or non-compliance
		DCCEEW	Notify - As soon as reasonably practicable but not more than two business days after becoming aware of the incident or non-compliance Report - As soon as reasonably practicable but not more than 10 business days after becoming aware of the incident or non-compliance

The format and content of annual reporting will be in accordance with the requirements of conditions 6-5 and 12-6 of MS 1191. 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 DWER and / or DCCEEW. A template for the EPBC 2019/8543 annual compliance report is included in Appendix D.

2.7.2 Accountability

This HFMP identifies the environmental management of activities to be undertaken by Main Roads or its delegate prior to, during and subsequent to the construction of the Proposal. Main Roads acknowledges that the environmental management actions contained within this HFMP are legal requirements to be met by Main Roads. The Manager Environment at Main Roads will maintain responsibility for implementation of the management actions outlined within this HFMP, 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.

2.7.3 Environmental training

Main Roads will ensure that all personnel undertaking works for the Proposal, including visitors, have undertaken a site induction, 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 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 2-12.

Table 2-12. 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 Development Envelope
	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 <i>Phytophthora</i> 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

2.7.4 Emergency contacts and procedures

Emergency contact details will be signposted at appropriate locations within the Development Envelope, 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 2-13.

Table 2-13. Emergency contact details

Aspect	Contact Details
General contact	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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

3 ADAPTIVE MANAGEMENT, AUDIT AND REVIEW OF THE EMP

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 achieve the plan’s objectives, performance targets and completion criteria. The HFMP is intended to be dynamic and will be updated to reflect changes in management practices over the life of the Proposal. This will allow flexibility to respond to new environmental impacts and adopt new technologies / management measures. The HFMP 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.

3.1 Environmental auditing

This HFMP 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 plan’s objectives, performance targets and completion criteria. The proposed auditing schedule for this HFMP is identified in Table 3-1.

Table 3-1. HFMP review schedule

Timing	Action	Schedule
Pre-construction	Review of construction procedures to ensure HFMP management / monitoring actions are incorporated within works procedures	Prior to construction (single event)
Construction	Inspections by site environmental personnel to identify compliance with HFMP	Periodic (generally weekly)
Post construction	Independent ‘third-party’ audit for assessment of compliance with HFMP	Every 36 months from the date of approval

The results of the construction and post construction independent ‘third-party’ audit findings will be reported by Main Roads to DCCEE and DWER as part of annual compliance reporting as outlined within Section 2.7.1.

3.2 Peer Review

In accordance with MS 1191 condition 6-4 and EPBC 2019/8543 condition 10(b), a peer review of the draft Plan was undertaken in June 2022 by Bamford Consulting Ecologists (BCE) (Appendix C). The Plan was subsequently revised to incorporate recommendations provided by BCE.

3.3 Environmental review

In accordance with condition MS 1191 condition 6-12 and EPBC 2019/8543 condition 11, this plan will be implemented for a minimum of fifteen (15) years post-construction, or otherwise:

- agreed by the CEO on advice of DBCA following review of effectiveness every five (5) years; or
- as advised otherwise by the Minister for the Environment

In accordance with condition MS 1191 condition 11-4, Main Roads shall review and revise this plan as and when directed by the CEO. The approved version of the plan will continue to be implemented until directed otherwise. Main Roads proposes to review this HFMP 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 HFMP to capture changes to the management and / or monitoring actions
- Identify any general need to update this HFMP (for example, to capture new information on WRP ecology or conservation management).

Main Roads acknowledge that a revision to this HFMP may trigger a need for additional approval by DWER and DCCEEW under the EPBC Act prior to implementing any changes to the specified management or monitoring actions.

The proposed HFMP review schedule for the Proposal is identified in Table 3-2.

Table 3-2. HFMP review schedule

Timing	Action	Schedule
Construction and Post construction	Review of HFMP management and monitoring actions Review of opportunities for an improvement in environmental performance Revise HFMP (if appropriate) and seek approval of EPA for revised HFMP	Annually (once during construction) Once every three years post construction for at least nine (9) years*.
Post construction	Peer review of EPR	Every five years post construction for 15 years
<p>* 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.</p>		

3.4 Data management

Main Roads will maintain records on the implementation of this HFMP in accordance with EPBC 2019/8543 condition 27 and Main Roads corporate standard document control procedures.

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

In accordance with MS 1191 Condition 13, a copy of all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) management plans, including this plan, and reports will be made publicly available via the Main Roads website.

4 STAKEHOLDER CONSULTATION

Main Roads consulted with stakeholders while developing this plan. This section provides a summary of consultation that occurred. The comments raised during consultations with stakeholders were considered in developing the plan. Table 4-1 presents a summary of consultation and Main Roads response.

Table 4-1. Stakeholders consulted, comments and responses

Date	Organisation	Summary of consultation	Main Roads response to comments / concerns
December 2019 – February 2020	B Jones (WRP Researcher)	Development of BORR fauna movement structure locations with Main Roads	N/A
October 2020	EPA	Proposed fauna management structures and detailed Conservation Significant Fauna Action Management Plan submitted to EPA and made available for public comment as part of project referral	N/A
November 2020	EPA Services and DBCA	Main Roads presented the proposed fauna management structures for BORR South during workshop presented to regulators	N/A
February 2021	EPA	Fauna management structures included in presentation to EPA	N/A
May 2021	EPA	Proposed additional fauna management structures included in presentation to EPA	N/A
July 2021	EPA and DBCA	Proposed additional fauna management structures included in presentation to EPA	N/A
August 2021	EPA	Meeting to discuss additional offsets	
September 2021	EPA	Proposed fauna management structures and detailed Conservation Significant Fauna Action Management Plan submitted to EPA and made available for public comment as part of Response to Public Submissions	N/A
December 2021 and	DBCA SW Region	Fauna land bridge discussed at meetings with DBCA staff	Fauna Land Bridge Concept Report

Date	Organisation	Summary of consultation	Main Roads response to comments / concerns
January 2022			prepared (incorporating DBCA input) and submitted to DBCA
June 2022	Bamford Consulting Ecologists	Peer Review. Report from the peer reviewer included as Appendix A.	Main Roads response table for the Peer Review is included in Appendix A.
June 2022	DBCA, EPA Services	Workshop to discuss and resolve DBCA comments on draft HFMP	Plan revised to incorporate DBCA and EPA Services comments

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APPENDIX A: 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) Habitat Fragmentation 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:



Full name:

Martine Scheltema, Manager Environment

Organisation:

Main Roads Western Australia (ABN 50 860 676 021)

Date

22 / 07 / 22

APPENDIX B: FIGURES

Figure 1. Development Envelope

Figure 2. WRP observations and habitat clearing categories

Figure 3. Fauna crossing provisions and exclusion fencing concept plans

Figure 4. Exclusion Fencing typical details

Figure 5. Fauna crossing typical details

Figure 6. Concept sketch of the fauna land bridge at Yalinda Drive

Figure 7. Concept sketch of the fauna land bridge 350 m east of Yalinda Drive

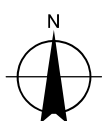
Figure 8. Receival sites adjacent to the Development Envelope

Figure 9. Reference sites

Figure 10. Radio telemetry study area



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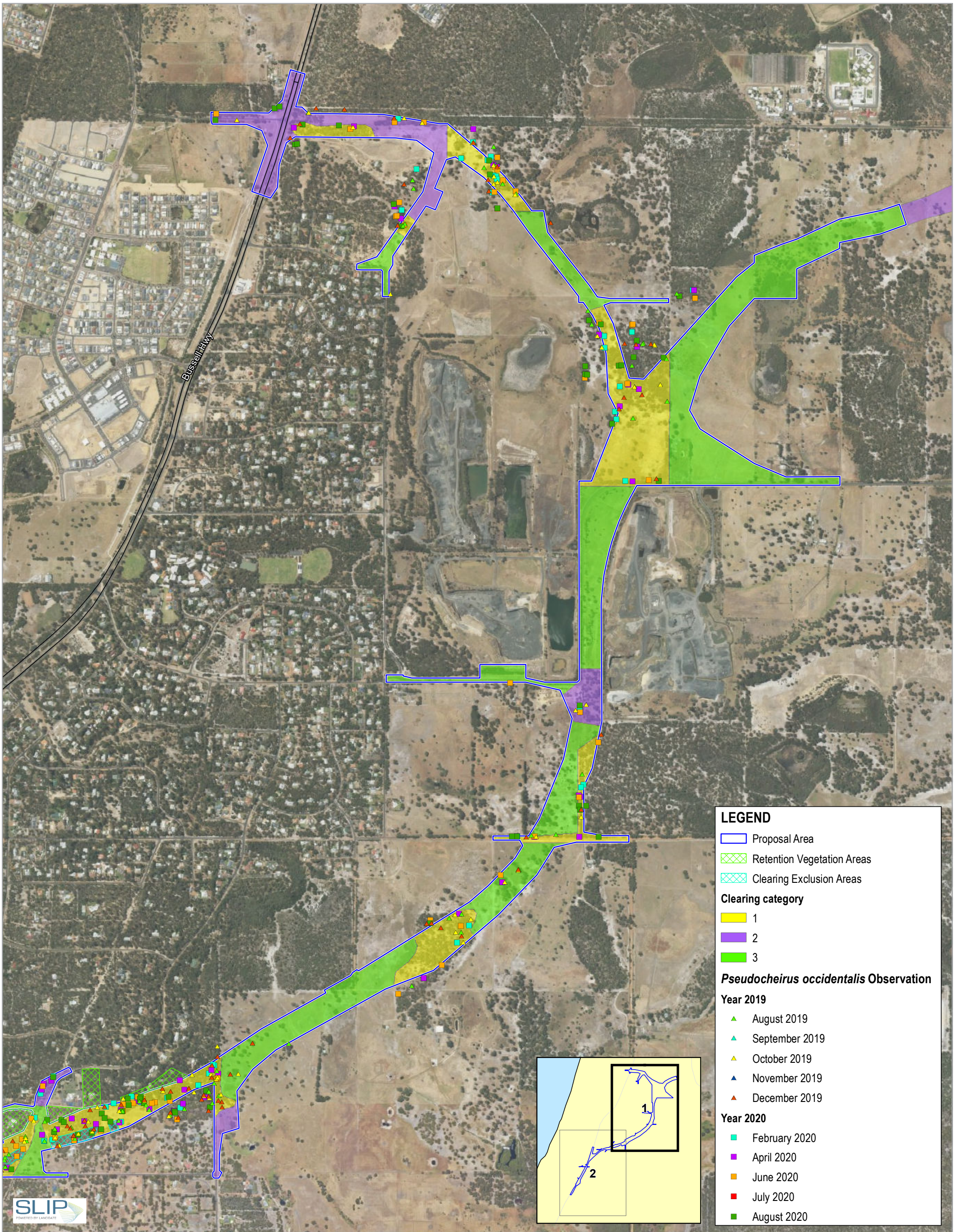


Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section
 Development Envelope

Project No. 61-37041
 Revision No. 4
 Date 19/08/2021

[Overview](#)

FIGURE 1



LEGEND

- Proposal Area
- Retention Vegetation Areas
- Clearing Exclusion Areas

Clearing category

- 1
- 2
- 3

***Pseudocheirus occidentalis* Observation**

Year 2019

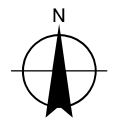
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Year 2020

- February 2020
- April 2020
- June 2020
- July 2020
- August 2020



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Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

WRP observations and
 habitat clearing categories

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

FIGURE 2

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LEGEND

- Proposal Area
- Retention Vegetation Areas
- Clearing Exclusion Areas

Clearing category

- 1
- 2
- 3

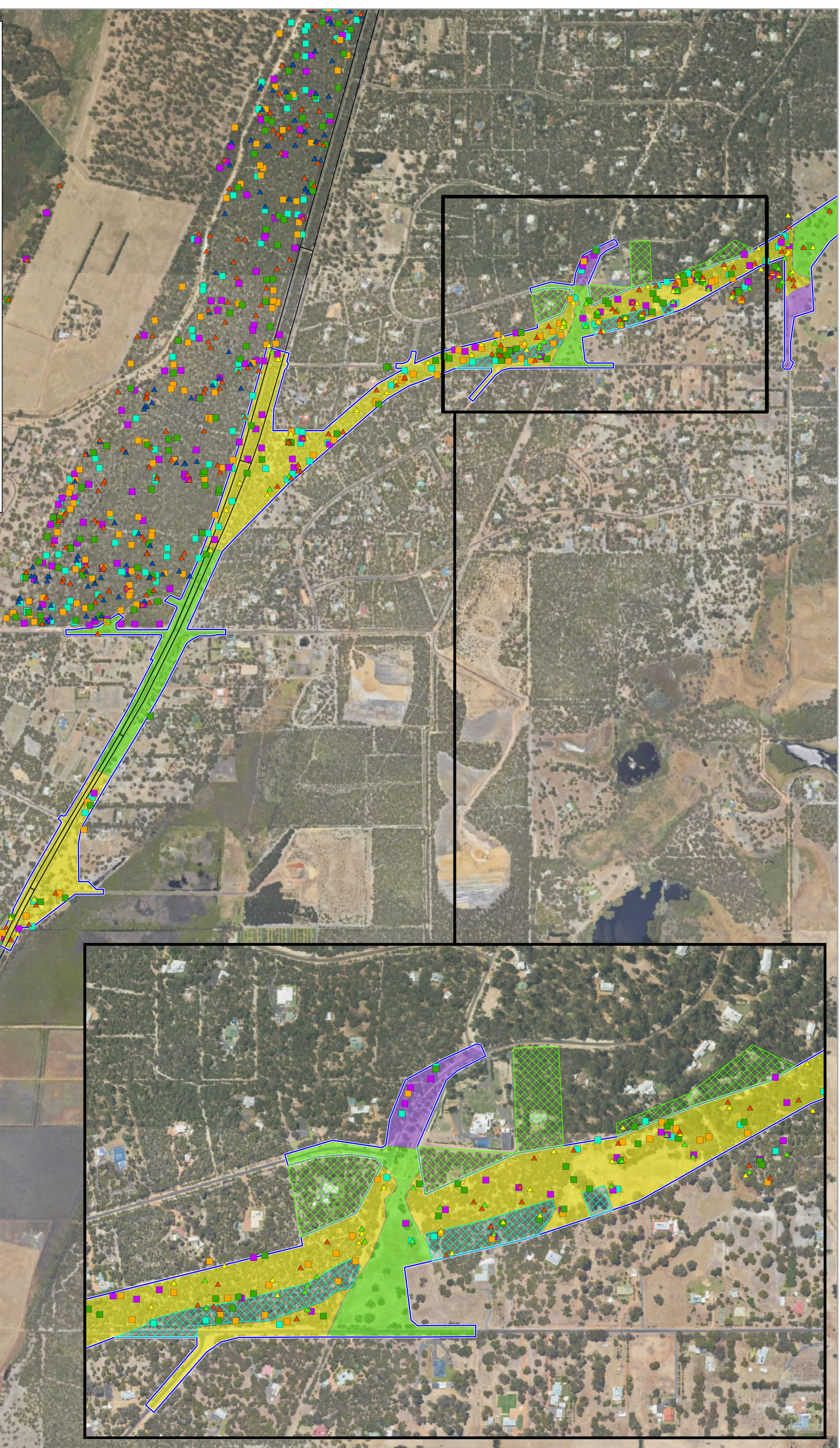
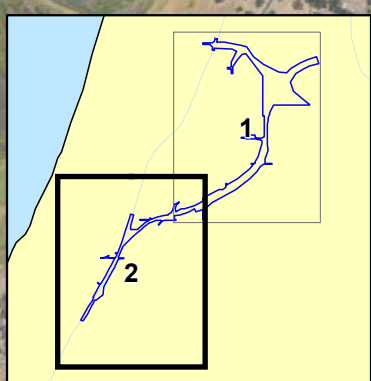
***Pseudocheirus occidentalis* Observation**

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- November 2019
- December 2019

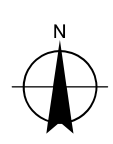
Year 2020

- February 2020
- April 2020
- June 2020
- July 2020
- August 2020



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Main Roads Western Australia
Bunbury Outer Ring Road Southern Section

WRP observations and habitat clearing categories

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

FIGURE 2

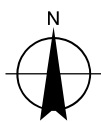
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- LEGEND**
- BORR South Design
 - BORR Southern Section Referral Boundary
 - Fauna Connectivity Structures**
 - Dual Use Culvert
 - Fauna Rope Bridge
 - Retaining Wall
 - Combined Possum and Kangaroo Exclusion Fencing
 - Kangaroo Exclusion Fencing
 - Possum Exclusion Fencing



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Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

**Fauna Crossing Provisions and
 Exclusion Fencing Plan**

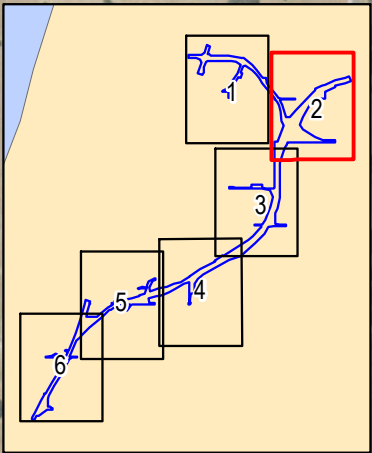
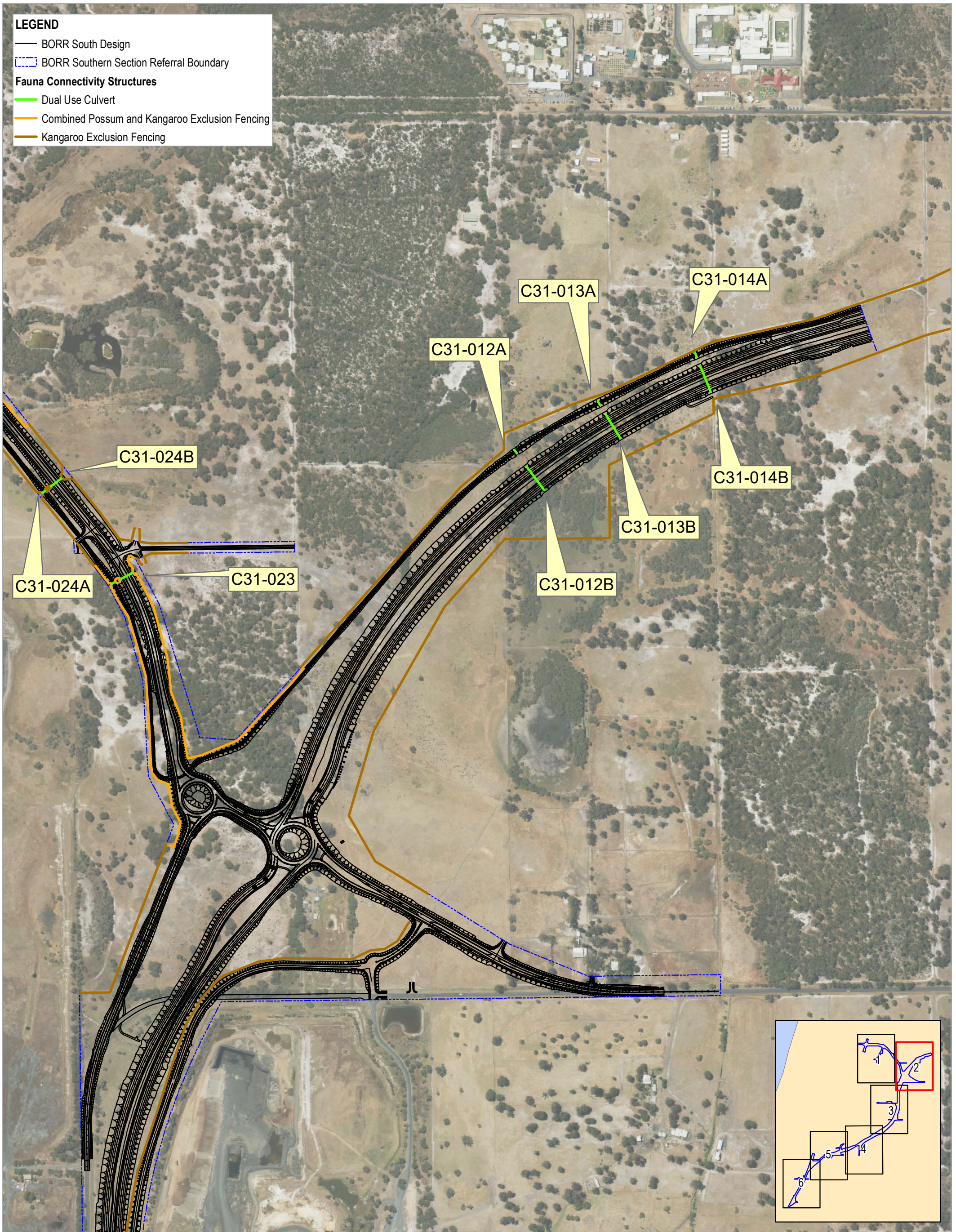
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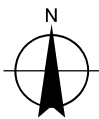
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- ▭ BORR Southern Section Referral Boundary

Fauna Connectivity Structures

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



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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

Page 2 of 6

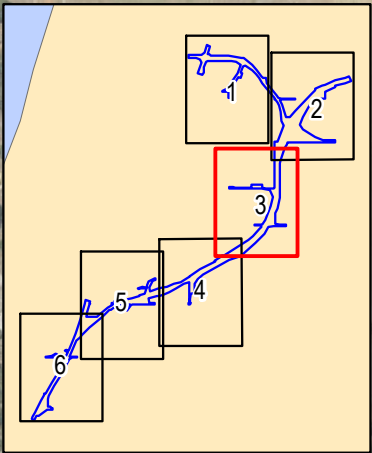
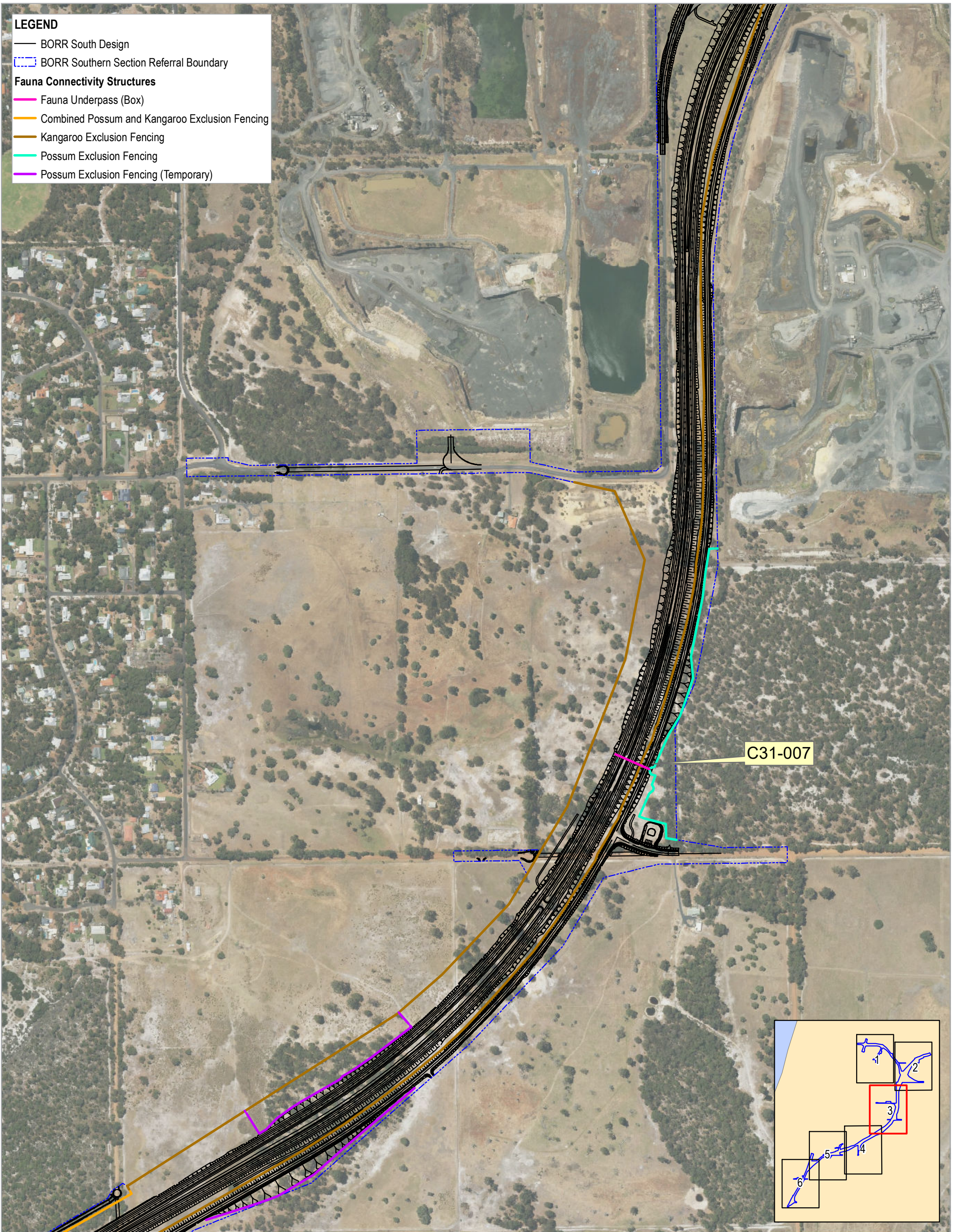
FIGURE 3

LEGEND

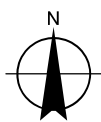
- BORR South Design
- BORR Southern Section Referral Boundary

Fauna Connectivity Structures

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



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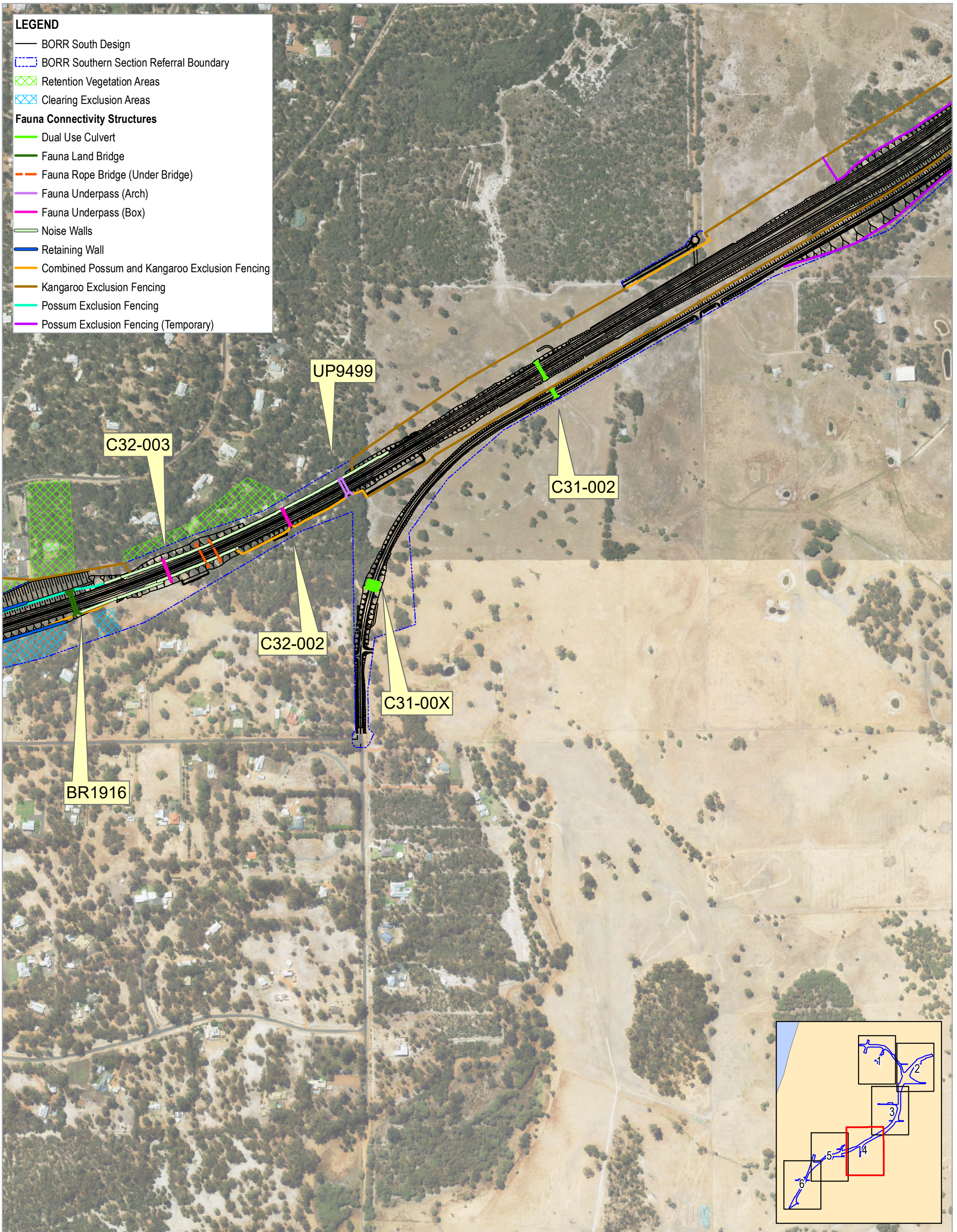


Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

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

**Fauna Crossing Provisions and
 Exclusion Fencing Plan**

FIGURE 3



- 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)

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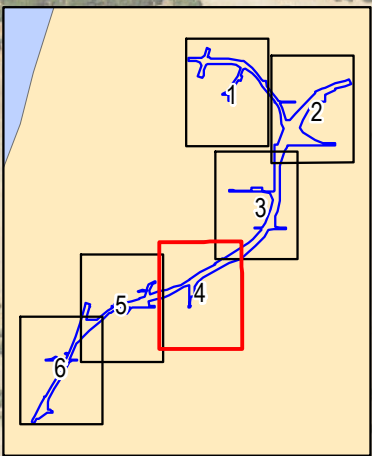
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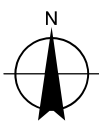
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 BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

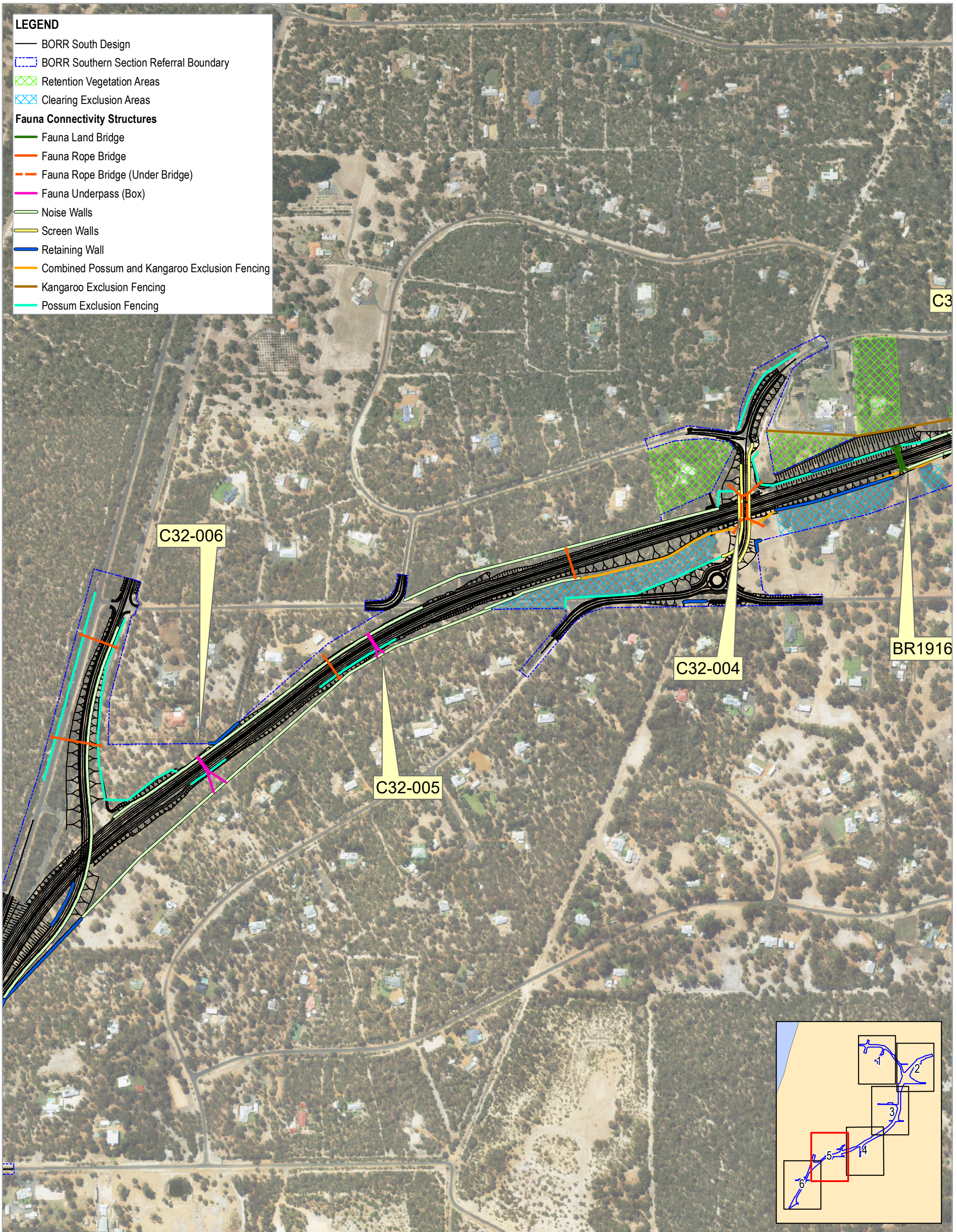
Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

Project No. 61-37041
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**Fauna Crossing Provisions and
 Exclusion Fencing Plan**

Page 4 of 6

FIGURE 3



- 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

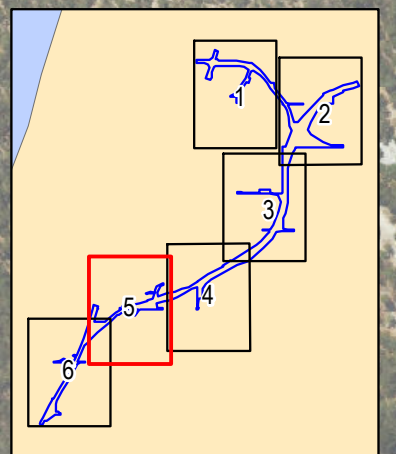
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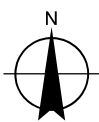
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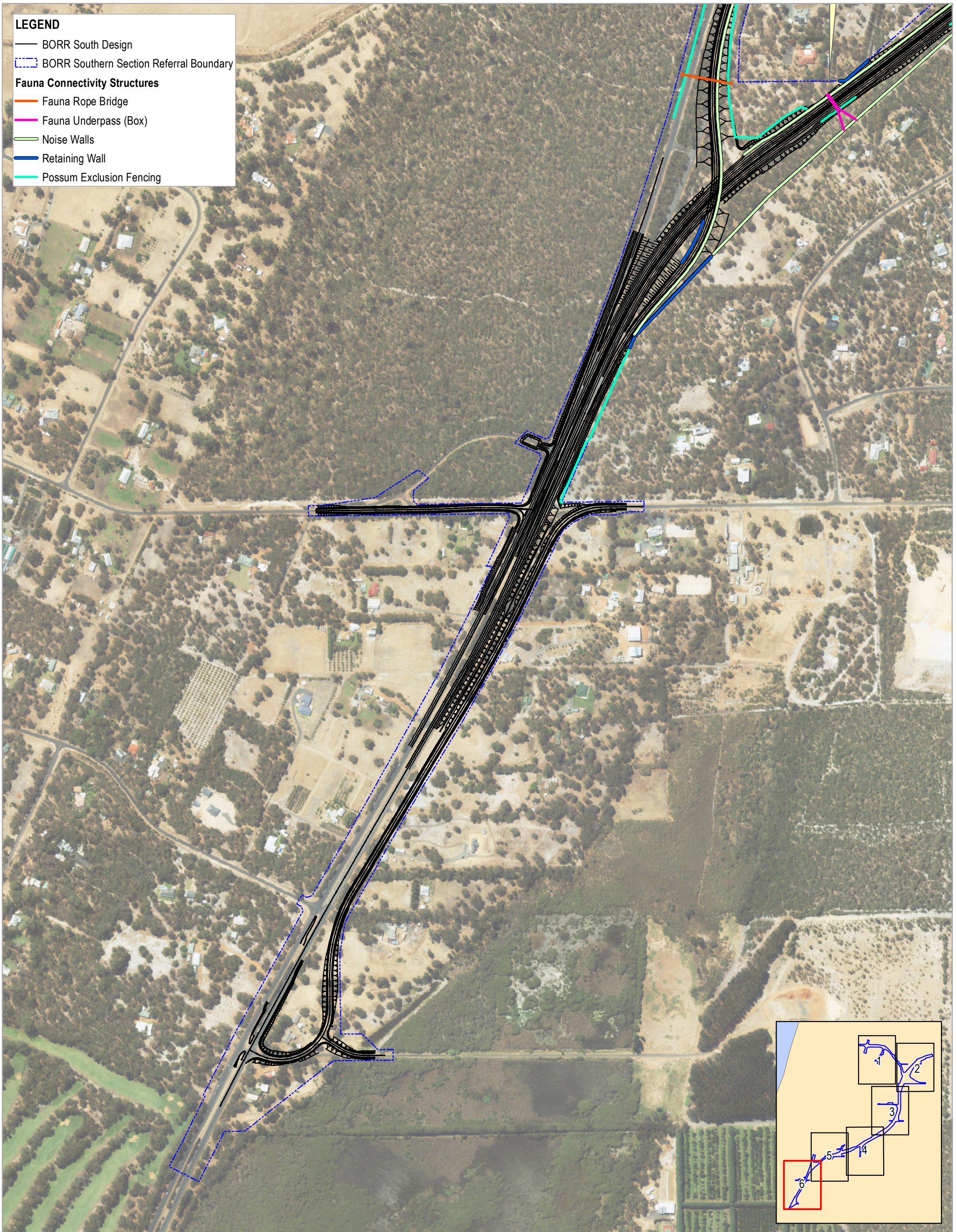


Main Roads Western Australia
 Bunbury Outer Ring Road Southern Section

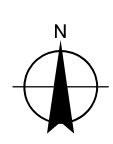
Project No. 61-37041
 Revision No. 5
 Date 30 Jun 2022

**Fauna Crossing Provisions and
 Exclusion Fencing Plan**

FIGURE 3



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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

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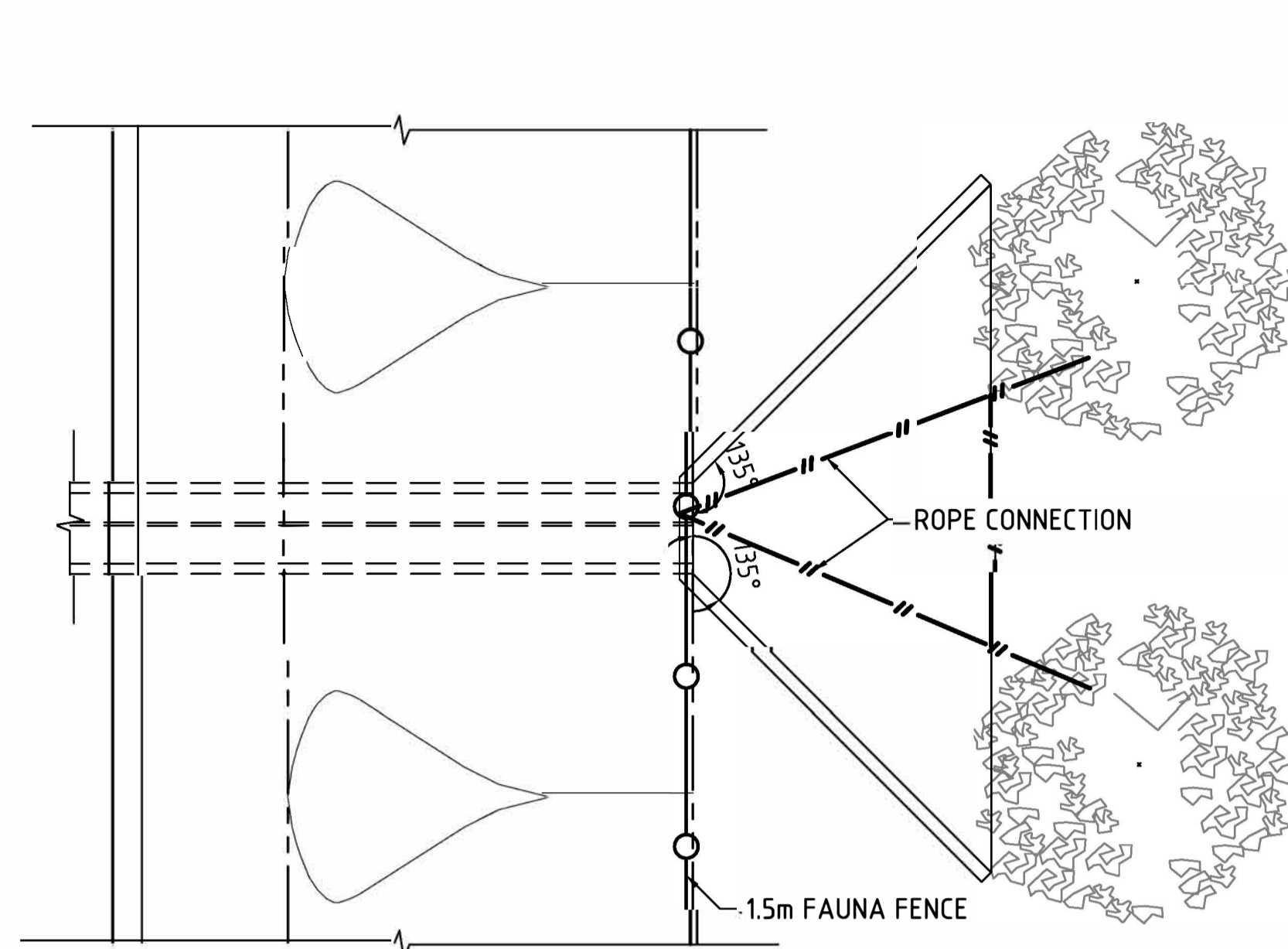
FIGURE 3

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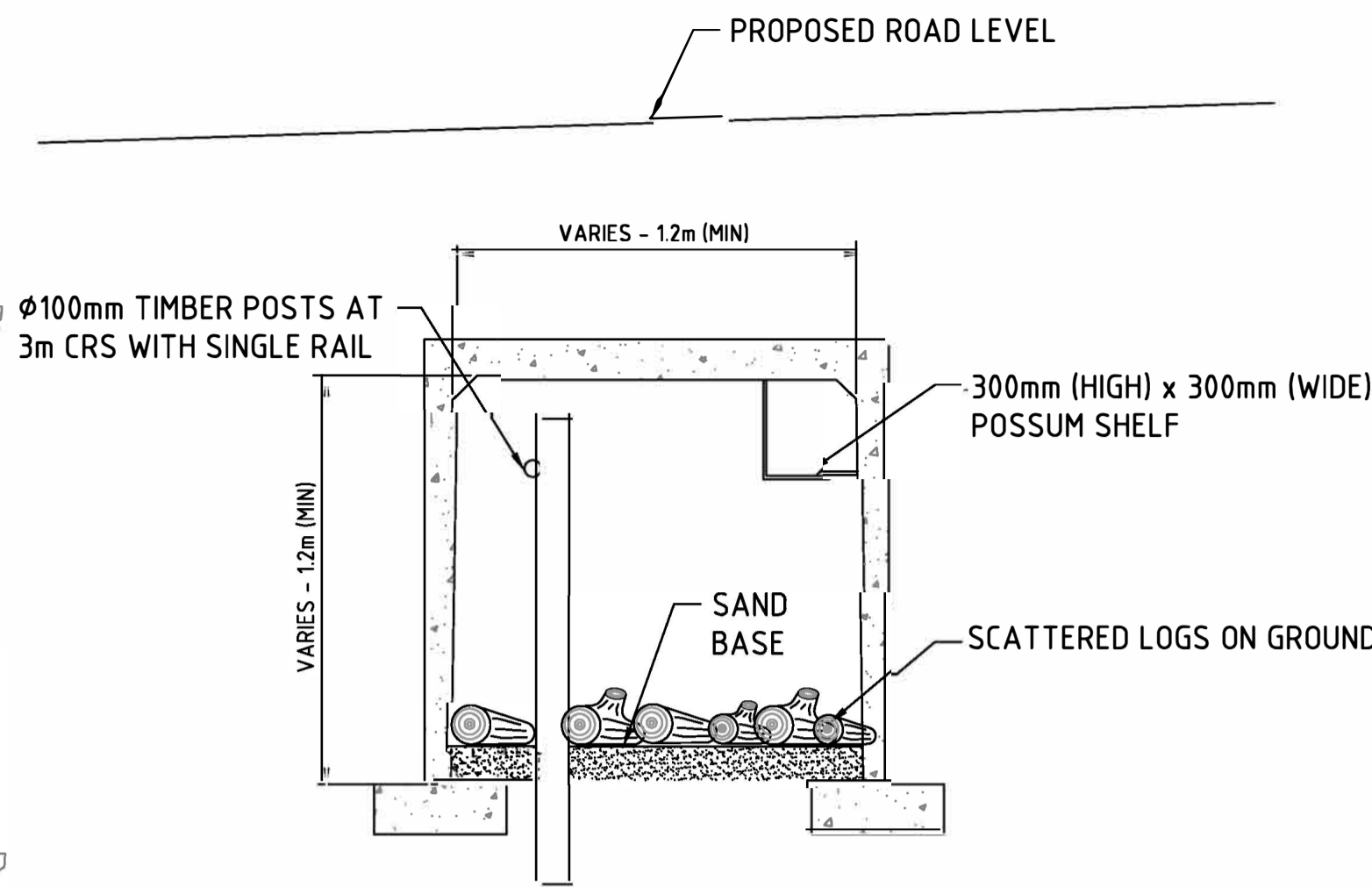
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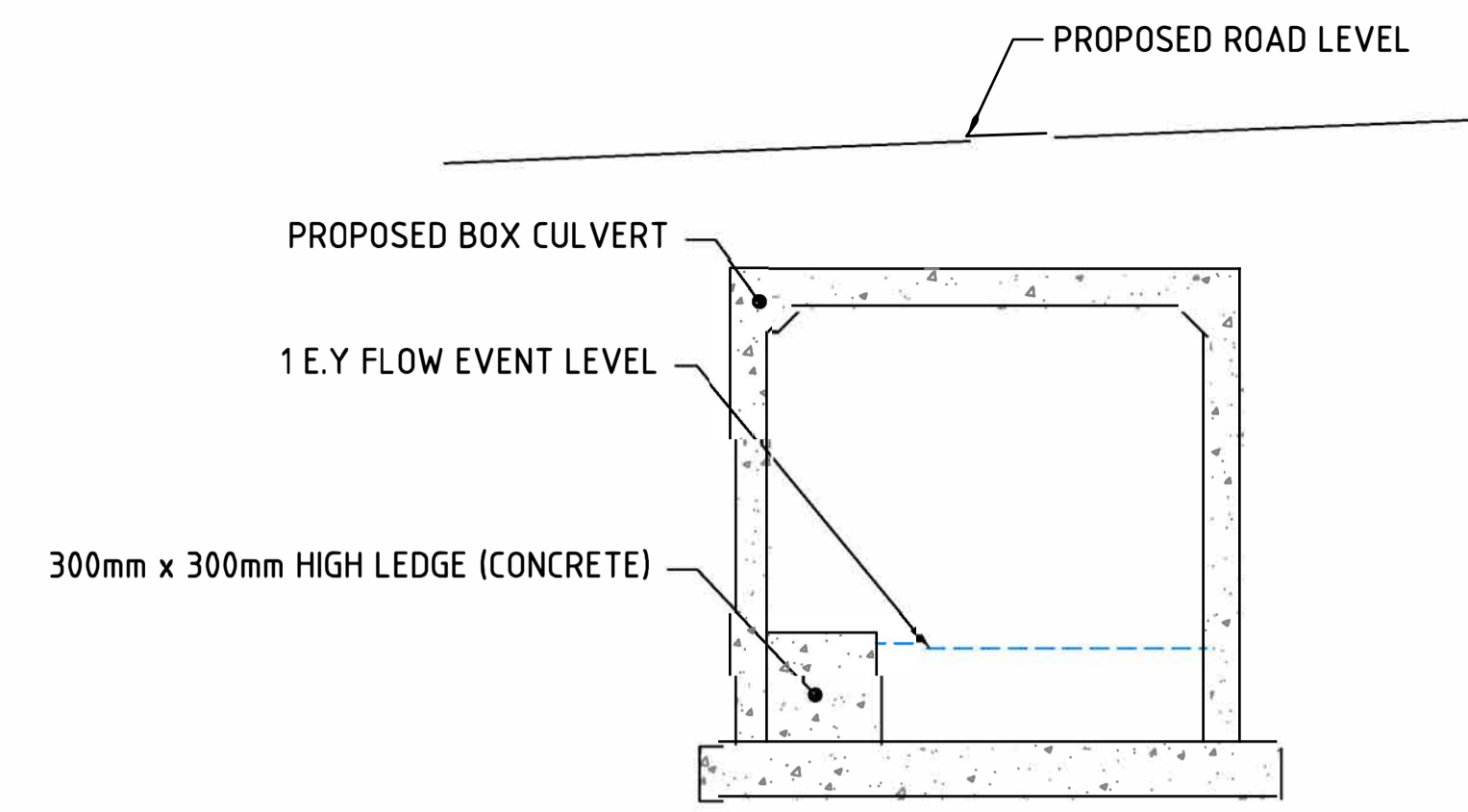
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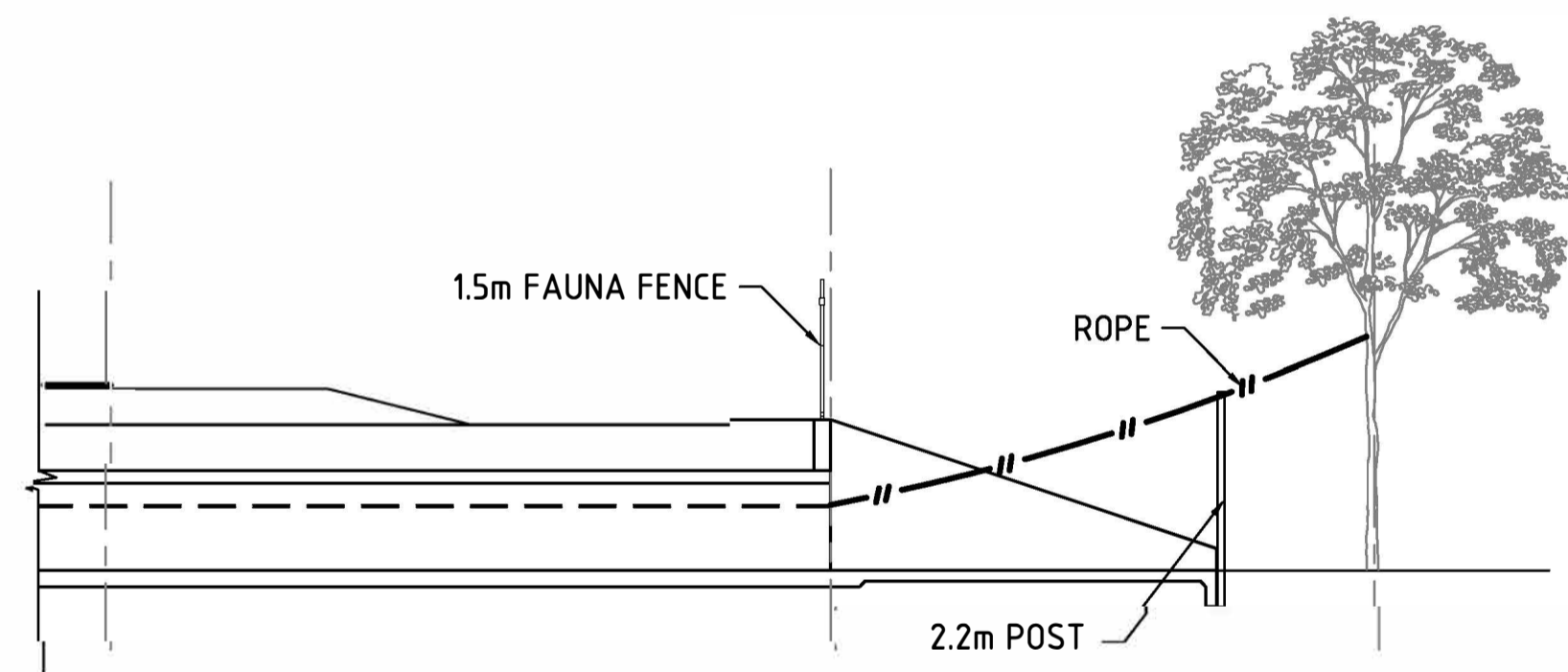
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TYPICAL FAUNA UNDERPASS
NTS



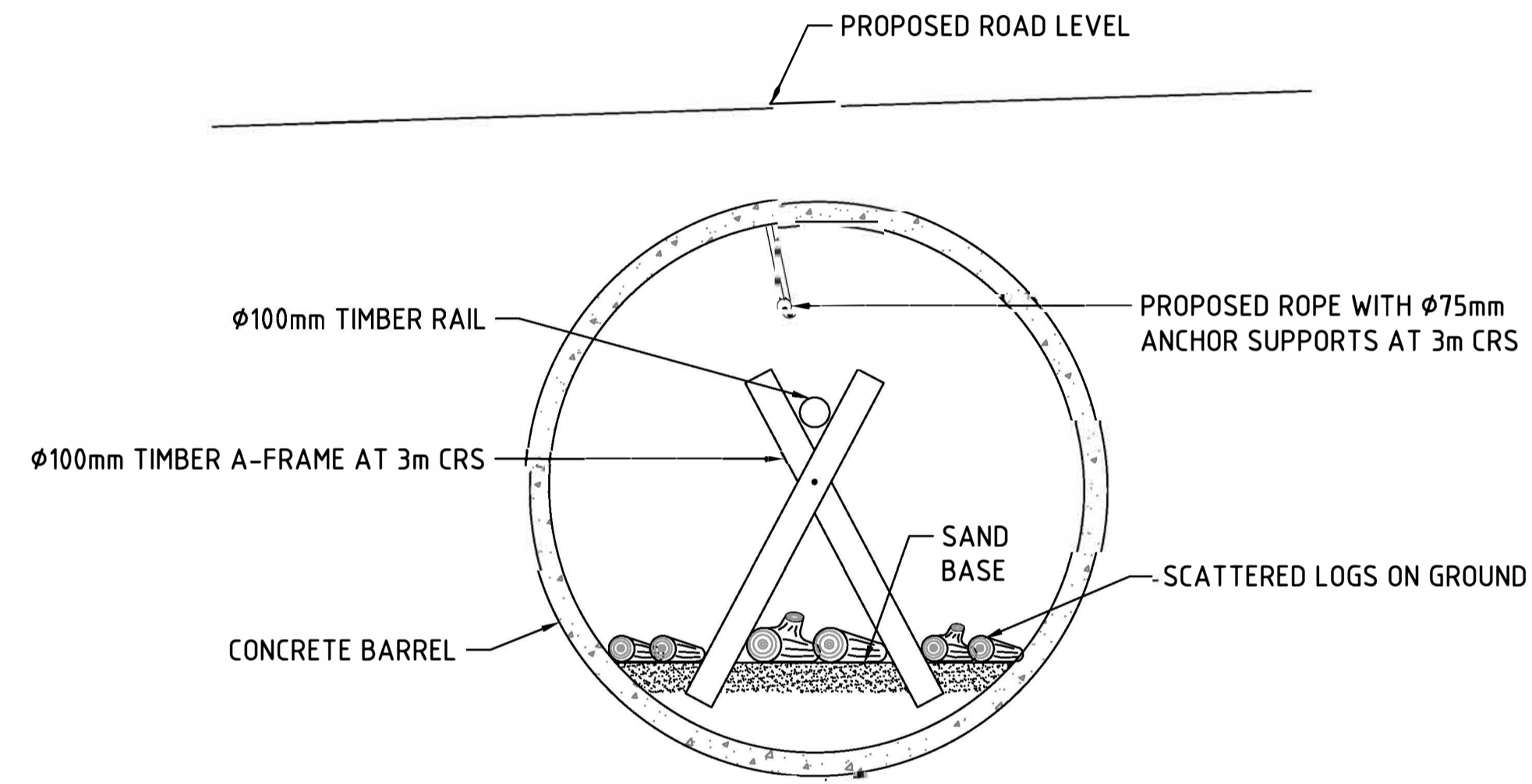
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NTS



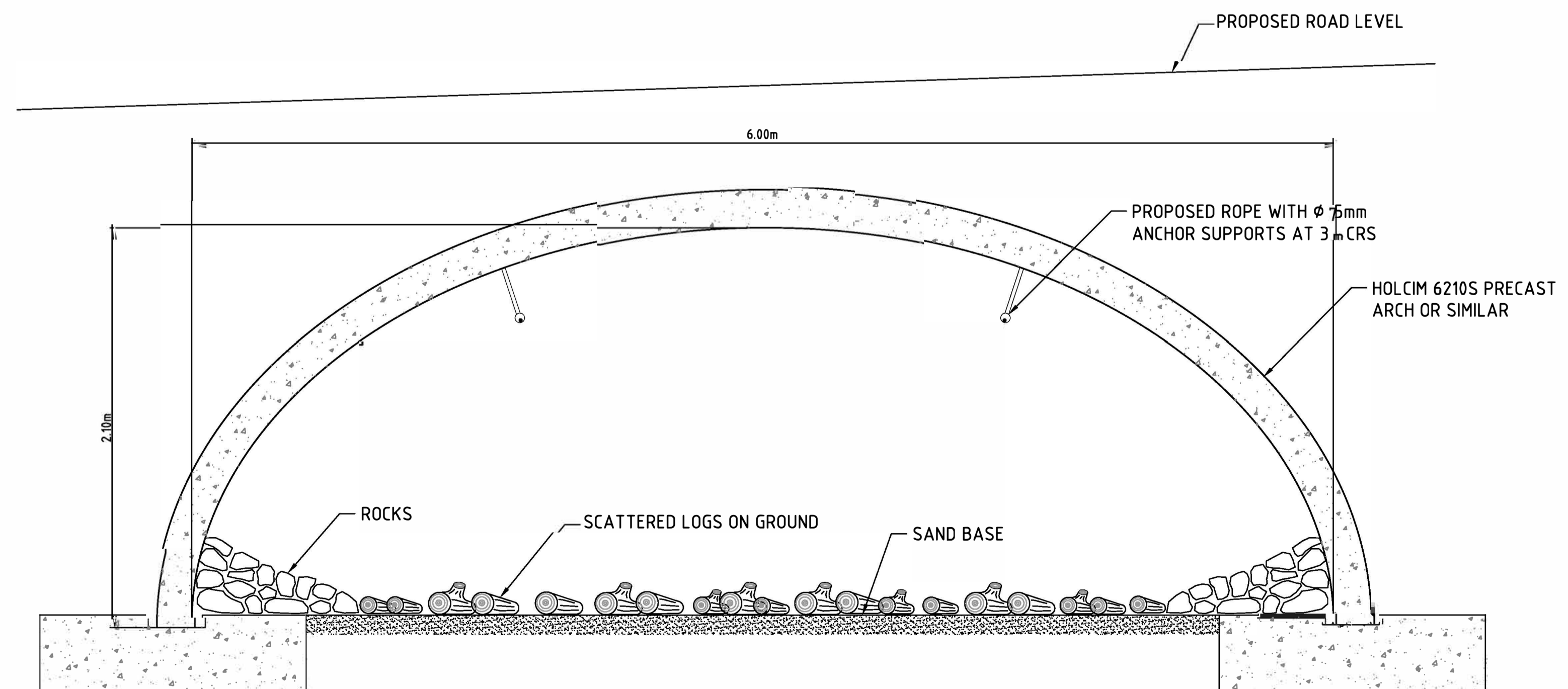
TYPICAL DUAL USE CULVERT
NTS



ELEVATION
NTS



TYPICAL FAUNA UNDERPASS - ϕ 1500 PIPE
NTS



TYPICAL FAUNA UNDERPASS - ARCH
NTS

FIGURE 4



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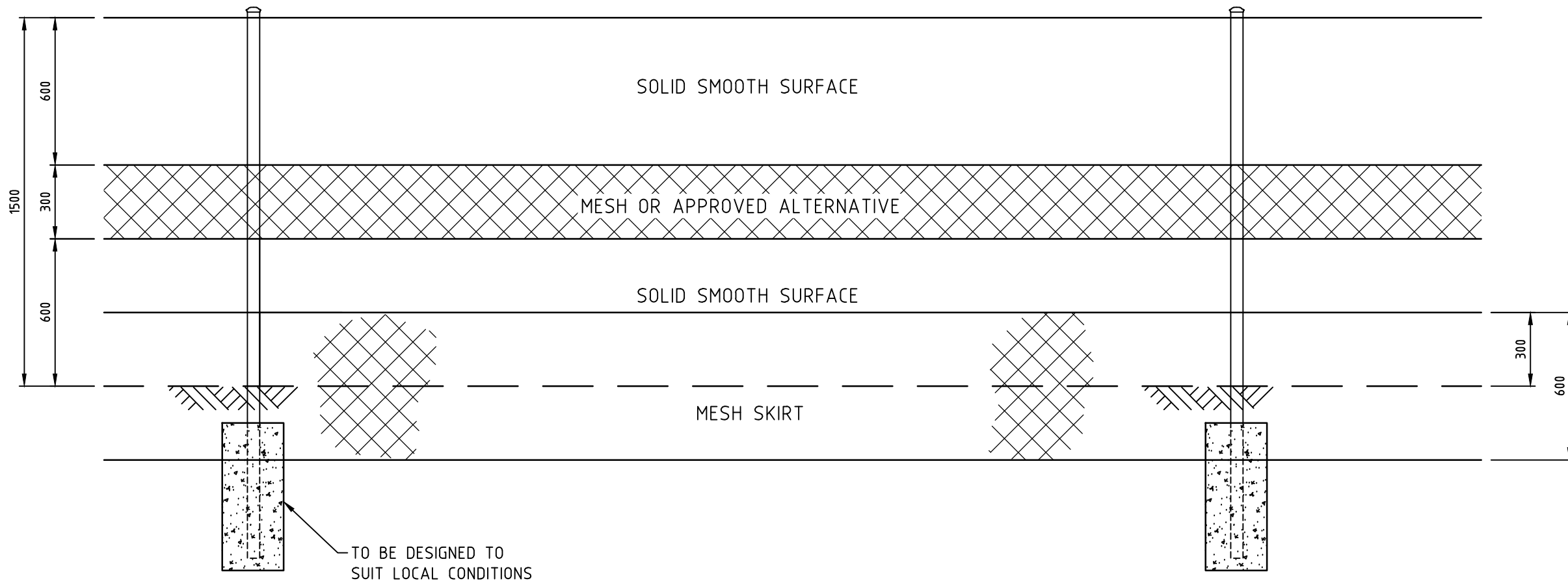
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PROJECT
BUNBURY OUTER RING ROAD (H058)

TITLE
BUNBURY OUTER RING ROAD
BORR NORTH AND SOUTH
FAUNA CROSSING TYPICAL DETAILS

SKETCH NO.	BORR-00-SK-RD-0150	REV	A
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AMENDMENTS		
No.	DATE	DESCRIPTION

- 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 5

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

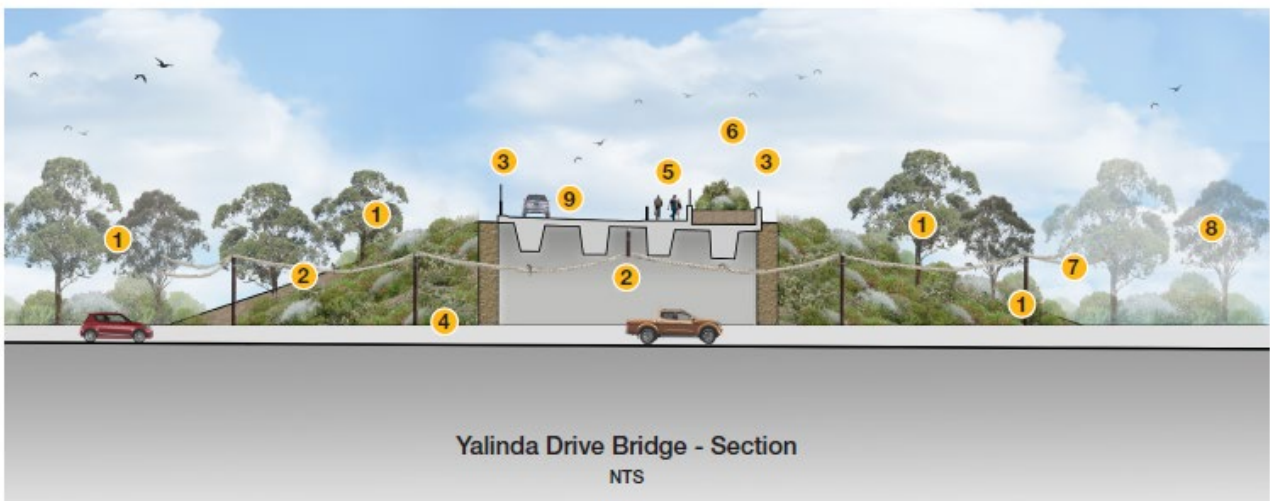
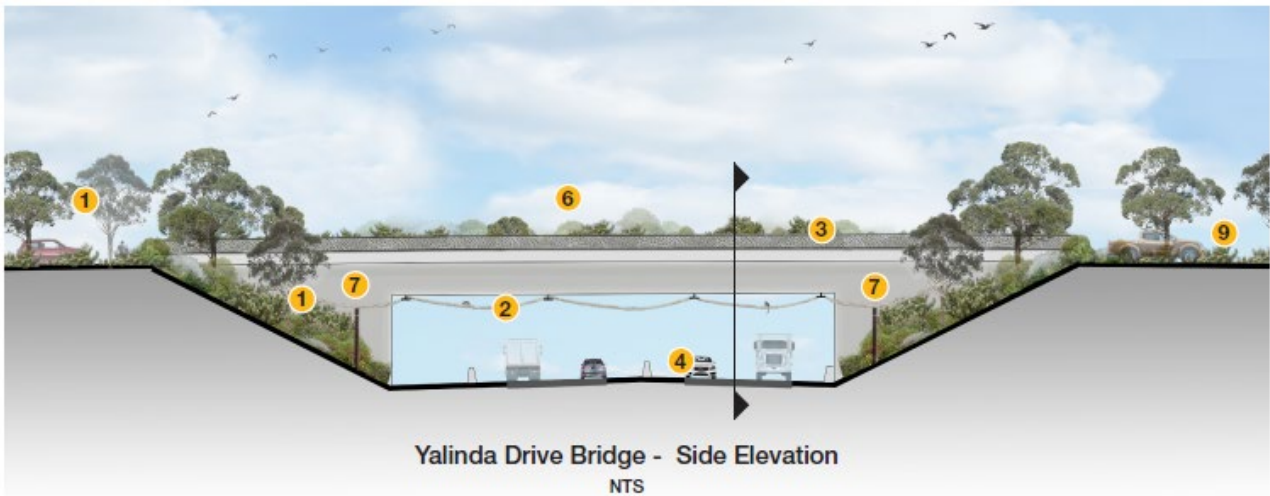
METROPOLITAN & SOUTHERN REGIONS DIRECTORATE
 SOUTH WEST REGION
 ROBERTSON DRIVE BUNBURY 6230
 Telephone(08) 9724 5600 Fax (08) 9724 5656

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**

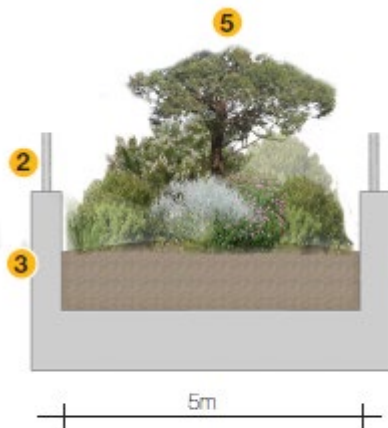
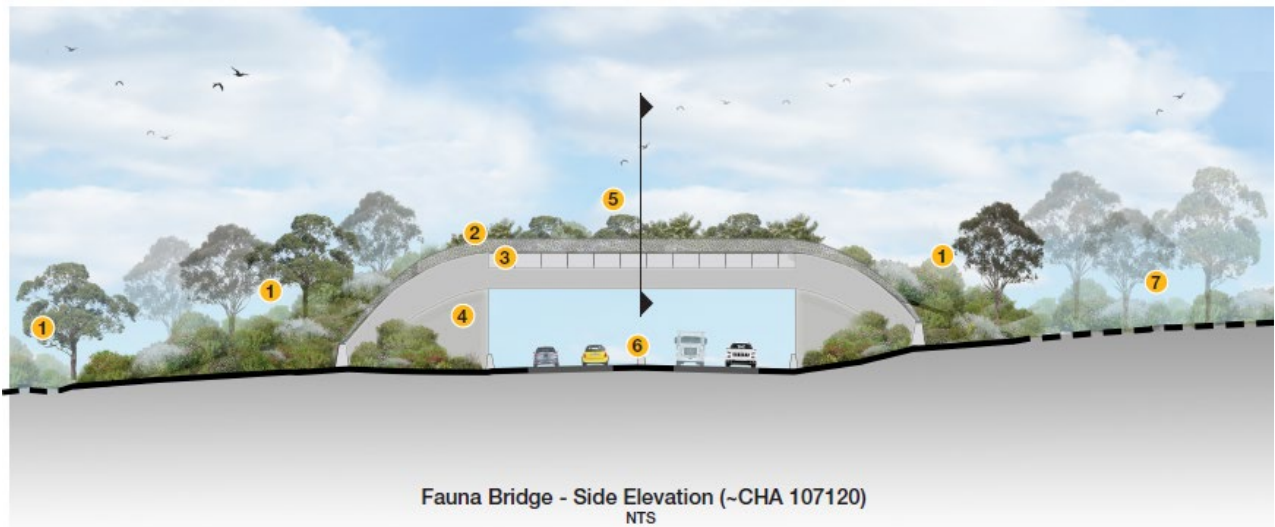
LOCAL AUTHORITY	(211, 208, 206) SHIRE OF HARVEY, DARDANUP & CAPEL
MRWA DRAWING NUMBER	202002-0251
AMENDMENT	

SCALE NOT TO SCALE
A 3



- 1 Revegetation
- 2 Possum rope bridge
- 3 Screen wall
- 4 BORR carriageway
- 5 Pedestrian and cycling path
- 6 5m wide vegetated strip (1m deep soil)
- 7 Ropes tied to trees
- 8 Vegetated exclusion area
- 9 Yalinda Drive carriageway

Figure 6 Fauna Land Bridge at the Yalinda Drive



Fauna Bridge - Section
NTS

Legend




- 1 Revegetation
- 2 Fence/Balustrade
- 3 Concrete barrier/edge
- 4 Abutment wall
- 5 Vegetated strip (1m deep soil)
- 6 BORR carriageway
- 7 Existing vegetation

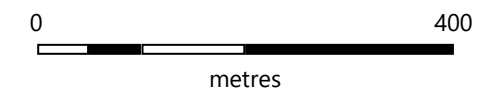
Figure 7 Fauna Land Bridge east of the Yalinda bridge

Location Map



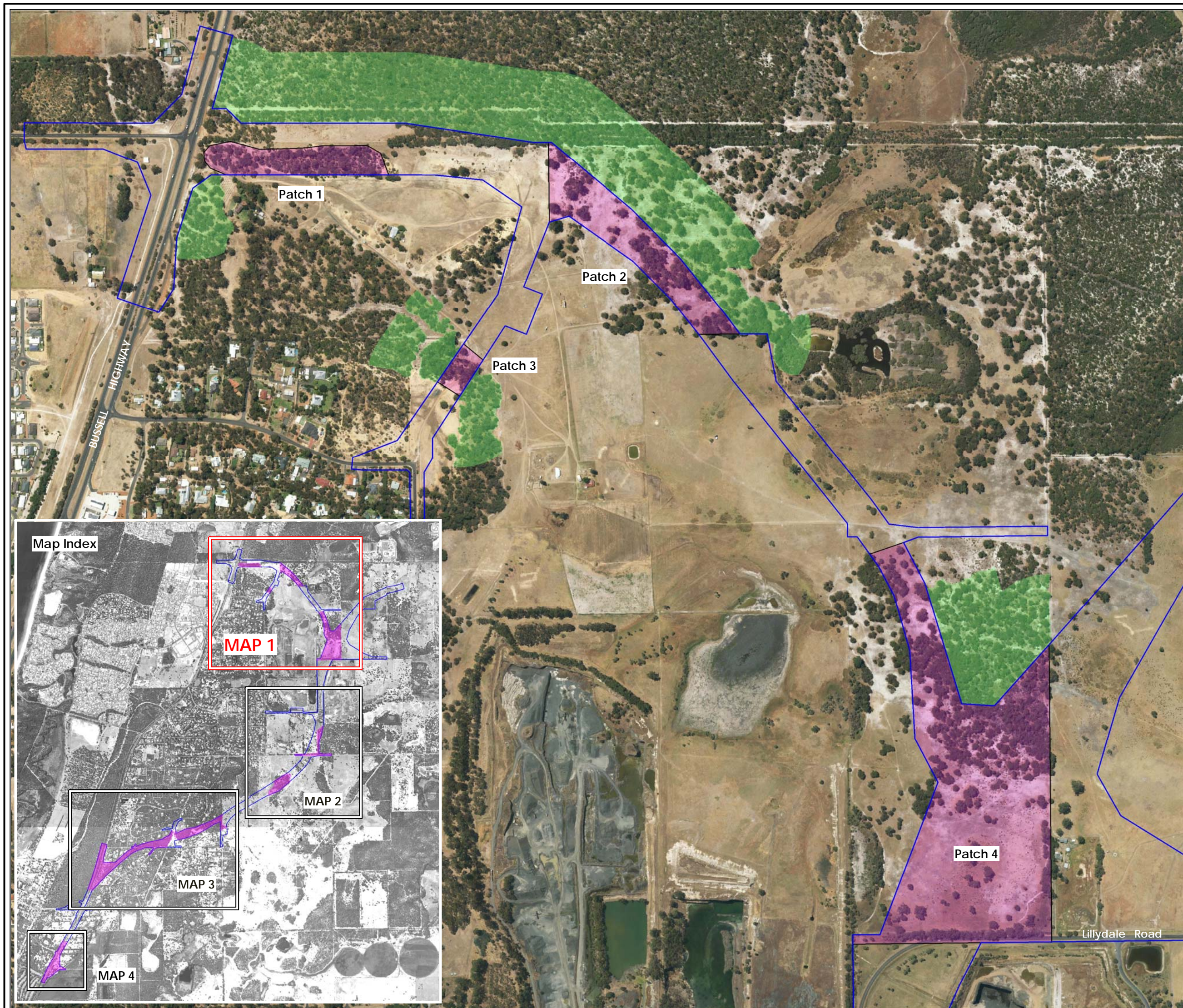
LEGEND

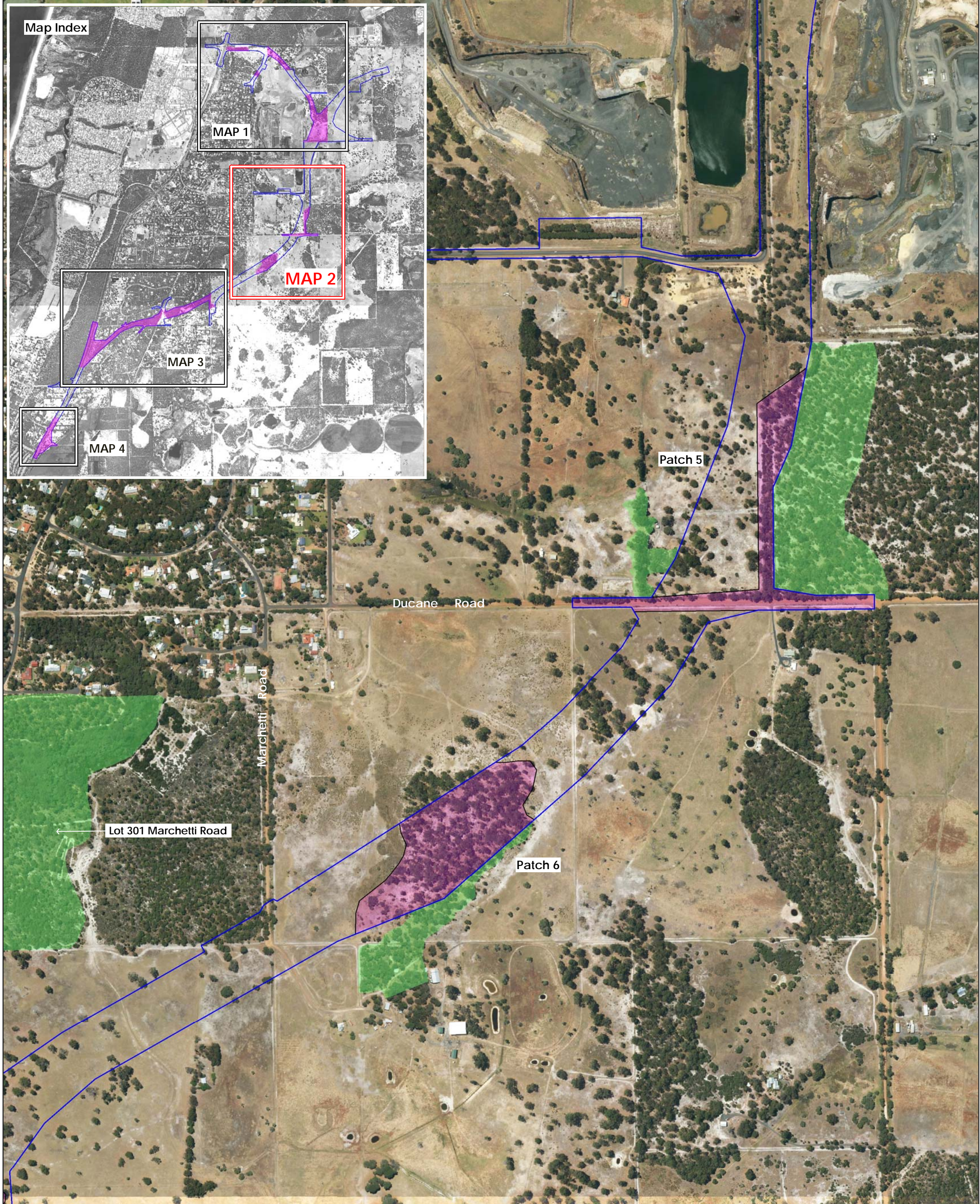
-  BORR South development envelope
-  BORR South category 1 clearing areas
-  WRP receiving sites



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 8
BORR South - Map 1
Category 1 Clearing Areas
WRP Receiving Sites





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

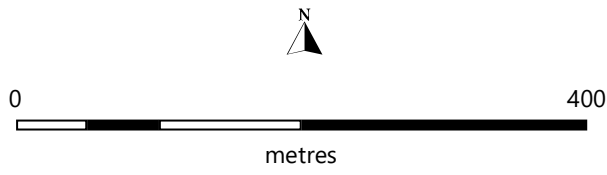
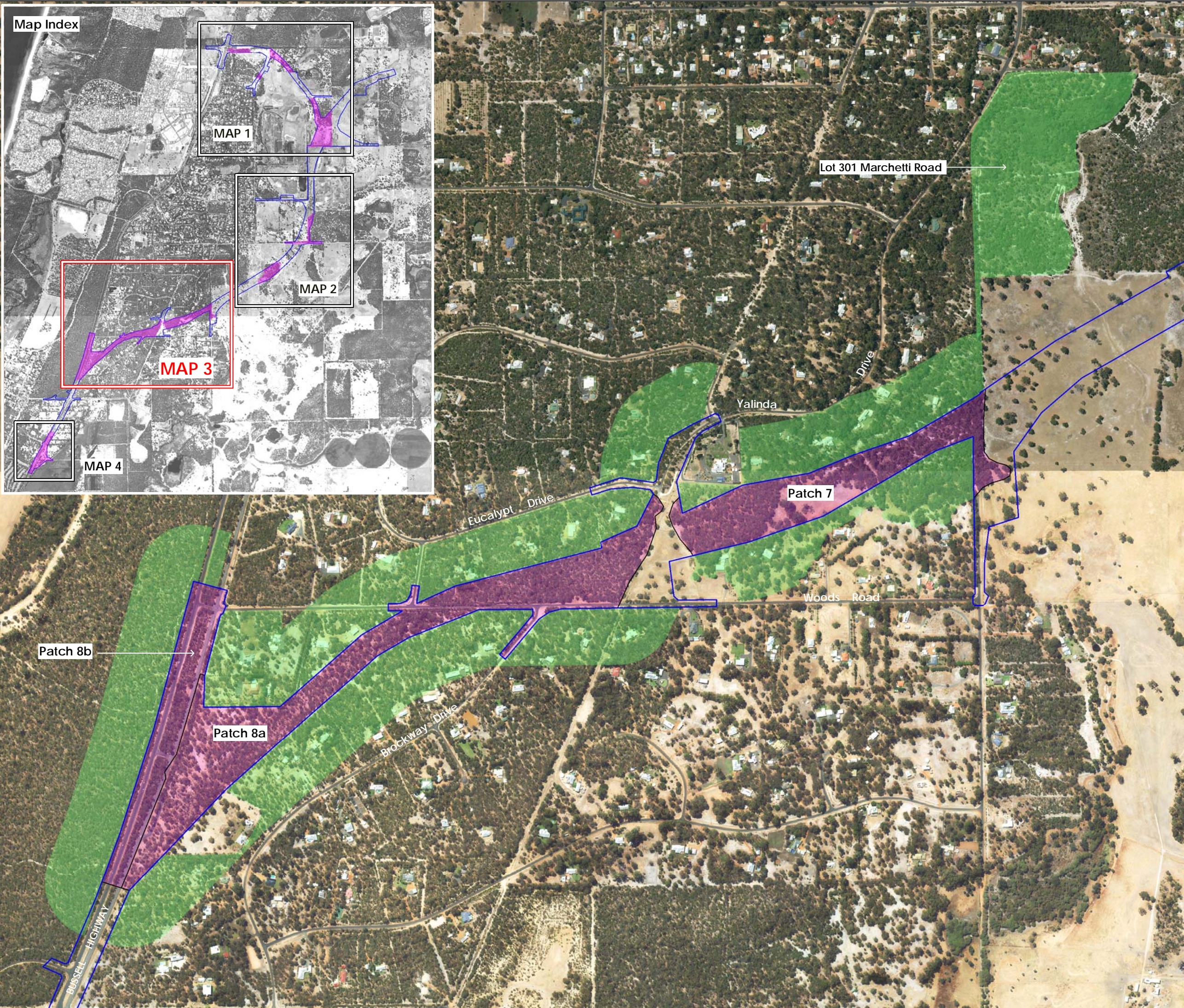
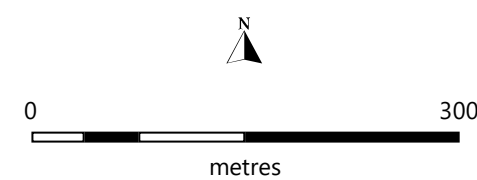


Figure 8
BORR South - Map 2
Category 1 Clearing Areas
WRP Receiving Sites



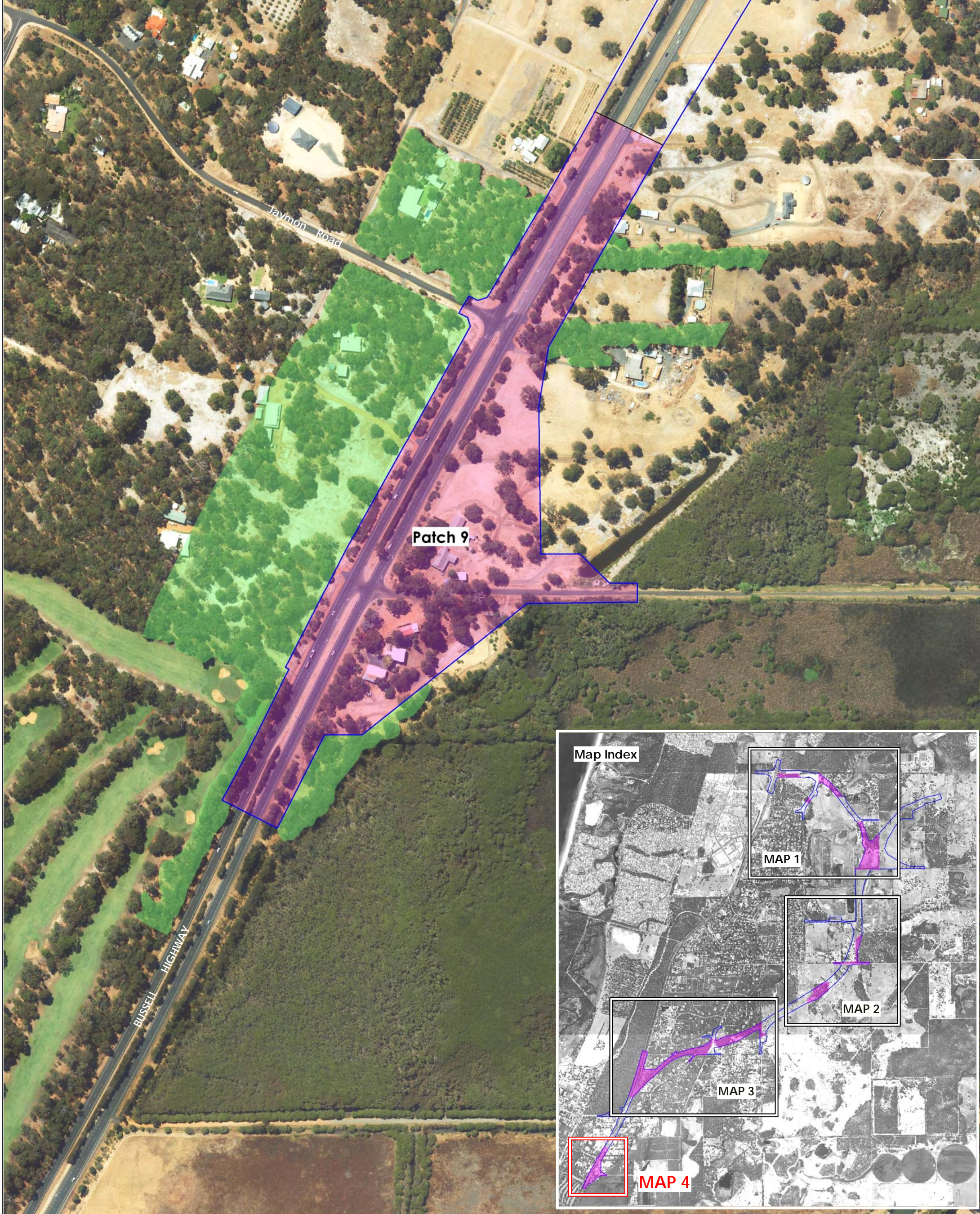


- LEGEND**
- BORR South development envelope
 - BORR South category 1 clearing areas
 - WRP receiving sites



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 8
BORR South - Map 3
Category 1 Clearing Areas
WRP Receiving Sites



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

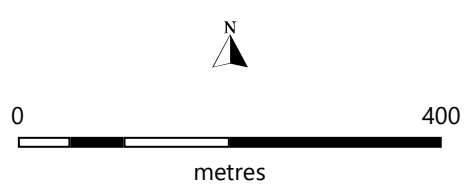
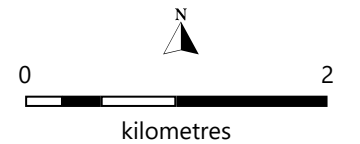
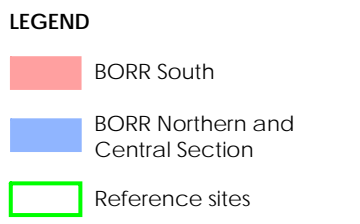
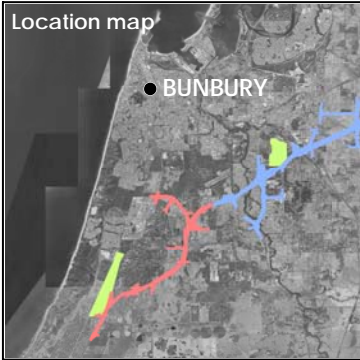
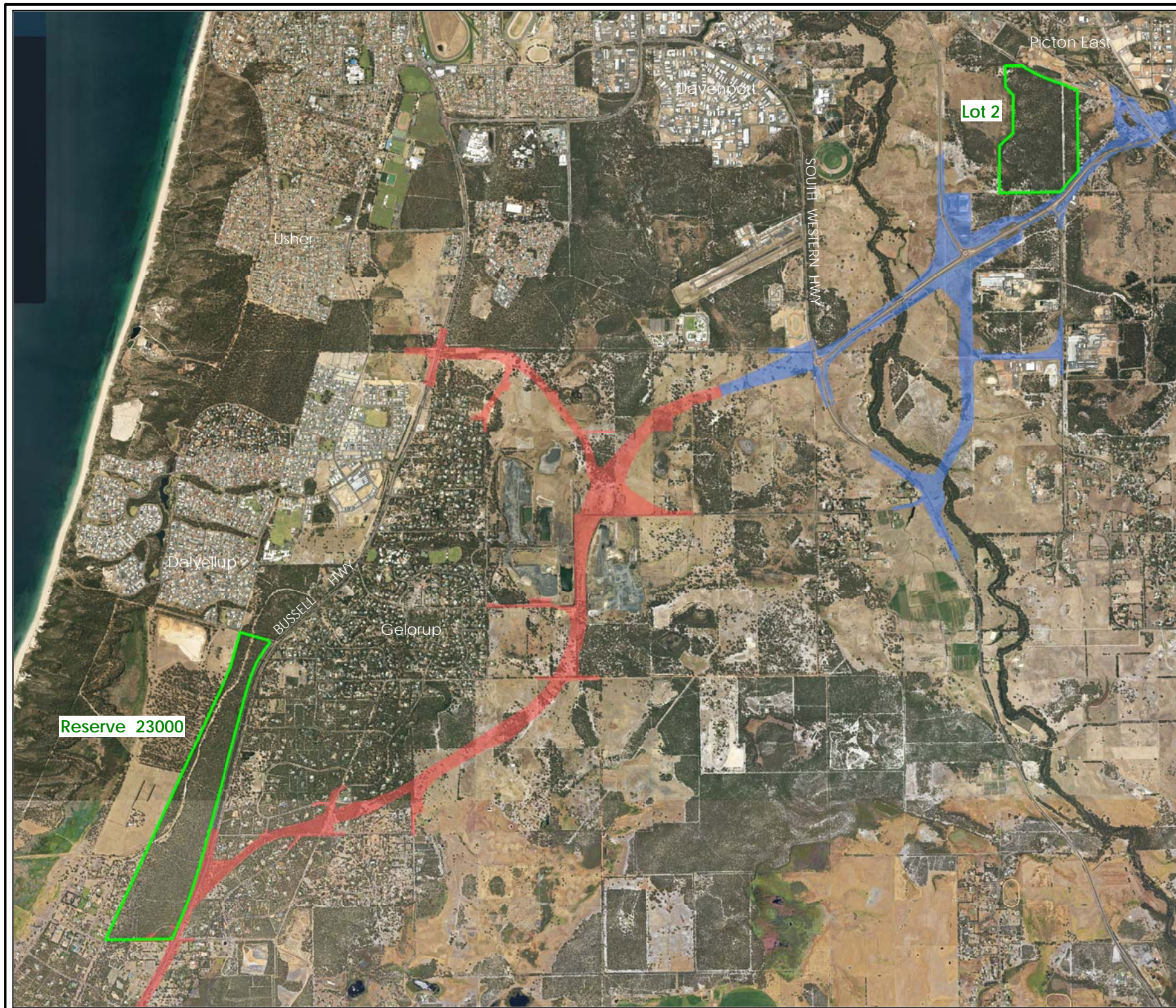


Figure 8
BORR South - Map 4
Category 1 Clearing Areas
WRP Receiving Sites





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 9
BORR WRP Reference Sites

Location Map



LEGEND

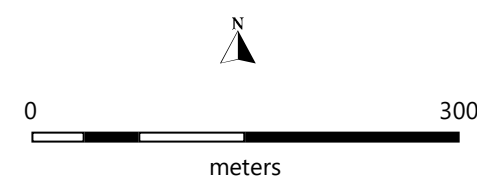
WRP Targeted for Collars

- BORR South category 1 clearing areas
- WRP receiving habitats

Development envelope

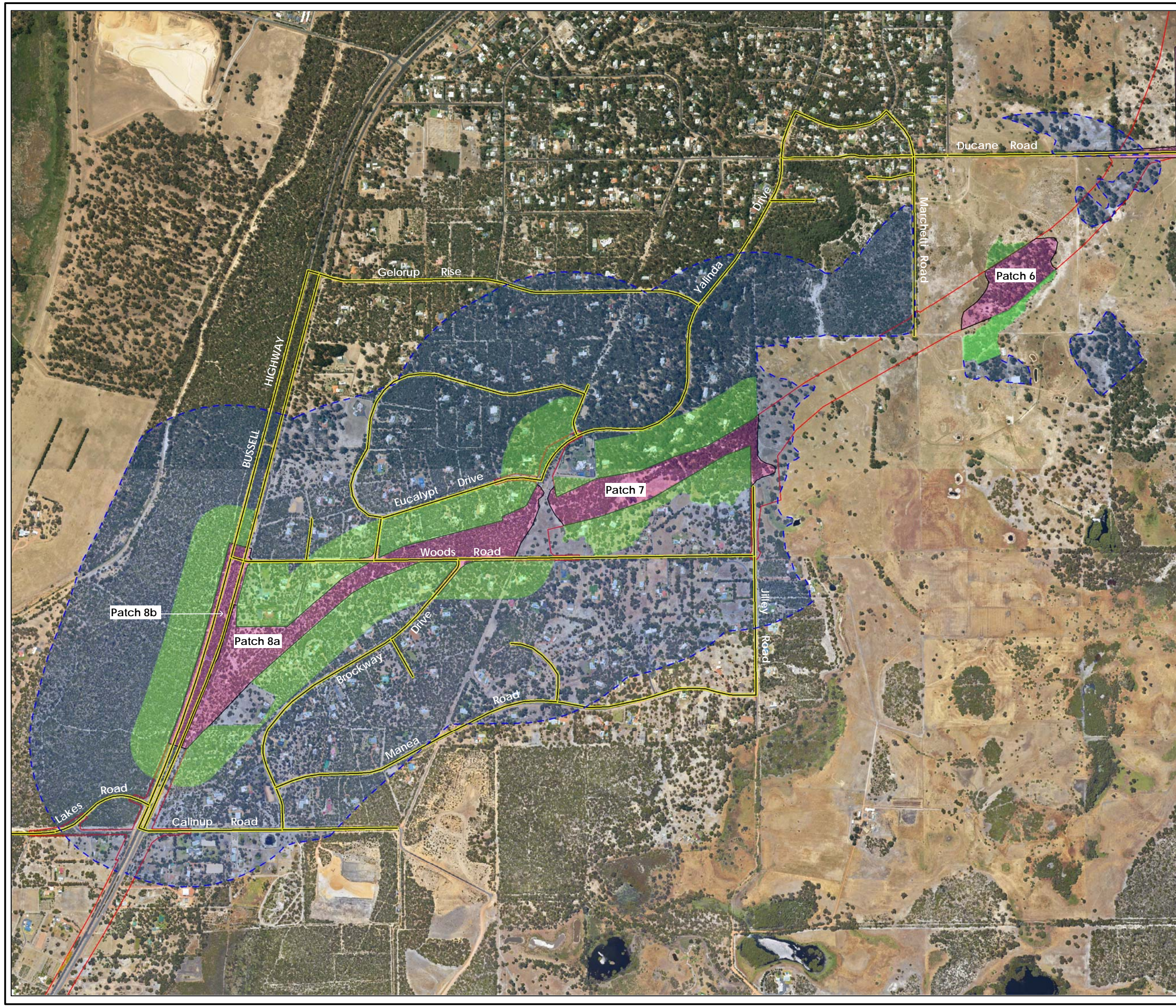
Search areas for collars

Roads that can be used to locate collars (others will be used as required)



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 10
 BORR South Gelorup WRP
 Receiving Habitat &
 Telemetry Study



APPENDIX C: REPORT OF A PEER REVIEW OF THE BORR SOUTH HABITAT FRAGMENTATION MANAGEMENT PLAN

Bunbury Outer Ring Road (BORR) southern section
Peer Review of Habitat Fragmentation Management Plan (HFMP)
Bamford Consulting Ecologists (BCE)

8th June 2022

Preamble

Bamford Consulting Ecologists (BCE) has been engaged by Main Roads to provide a peer review of the HFMP for the Bunbury Outer Ring Road Southern Section proposal (“BORR South”, or “the Proposal”), in accordance with MS 1191 Condition 6.4. The purpose of this review is to ‘report on the adequacy’ of the HFMP to meet the objectives and outcomes specified in Ministerial Conditions 6-1 and 6-2, which form part of the approval of BORR South. As defined in MS 1191 Condition 6-1, the **objectives** are:

- minimise the impacts of habitat fragmentation that are attributable to the proposal on Western Ringtail Possum; and
- minimise the impacts from predation that are exacerbated by the proposal on Western Ringtail Possum.

The **outcome** (MS 1191 Condition 6-2) is for the abundance and persistence of the Western Ringtail Possum in the receival sites returns to pre-disturbance levels within a maximum of fifteen (15) years from the commencement of construction.

The purpose of the peer review is to provide an independent expert opinion as to whether the HFMP is ‘fit for purpose’. Such a review can also provide recommendations where improvements may be needed, if necessary. A peer review such as this can be considered to have three components to ensure that the HFMP is effective:

1. Is the HFMP likely to meet the objectives and to achieve the outcome of the Ministerial conditions?
2. Does the HFMP adequately convey the rationale for and the details of the methods to be undertaken?
3. Are the methods adequate and appropriate to meet Ministerial conditions?

Is the HFMP likely to meet the objectives and outcome of the Ministerial conditions?

In considering the objectives and outcome, it is worth noting that they only address impacts other than the direct effect of habitat loss. There are separate management plans that addresses impacts during clearing and impacts from road mortality, and there are proposals for revegetation (ie habitat creation). There will be an overall loss of habitat in the project area due to development, and with the outcome that ‘the abundance and persistence of the Western Ringtail Possum...returns to pre-disturbance levels’ in the receival sites, there will be an overall decline in population size. in the project area (ie. the impact area and receival sites). ‘Receival sites’ are those areas outside of but adjacent to the impact footprint and into which Western Ringtail Possums from the footprint will be relocated. Implicit (but not stated) in the outcome is that there will be some vegetation retention in the project area, and that there is

habitat immediately outside the project area; and that these areas of habitat will continue to support a sustainable and ecologically viable population of the Western Ringtail Possum. This might have been a better over-arching outcome.

The objectives address two forms of impact: fragmentation and an increase in the risk of predation. **Fragmentation**, due to the construction of the BORR through the road reserve that is currently vegetated and supports a population of the Western Ringtail Possum, will divide that population into two smaller groups of animals. Smaller groups of animals are more vulnerable to local extinction and, in the long term, can suffer a loss in genetic richness. As the fragmentation is due to construction and operation of a major highway, an increase in potential disturbance from light, noise and vibration will also occur, although this is speculative and the HFMP does note that the species appears to habituate to such disturbance very readily elsewhere in its range. The HFMP addresses fragmentation primarily through the construction of fauna crossing structures (overpasses, underpasses and rope bridges) to ensure that the completed road does not form a barrier to movement by possums. The plan details design features of these structures and the monitoring that will be undertaken to ensure they are being used. The monitoring is very comprehensive and while the HFMP does not appear to propose specific remedial actions in the event that fauna crossing structures are not used, the use of such structures by the Western Ringtail Possum has been well-documented. The plan also details how vegetation will be monitored to ensure it is effective in providing habitat and facilitating use of crossing structures.

The HFMP provides no explanation as to how risk from predation will increase as a result of the proposal. Risks from **predation** could increase as a result of fragmented (smaller) populations (more vulnerable to predation due to smaller size), an increase in actual numbers of predators (predators such as the Feral Cat and Red Fox may increase in abundance along roads and in areas of disturbance), and to altered behaviour by possums (individuals spending more time close to or on the ground). Fauna crossing structures and habitat restoration will reduce the vulnerability of the possum population to predation, provided that approaches to crossing structures are appropriately designed. Predator control and monitoring are proposed to address the risk from increased predator numbers. There is very little detail on the intensity of predator control or monitoring, and no information on the pre-construction abundance of predators. However, assuming monitoring is adequate and there is a rapid response to a detected increase in feral predator abundance, the approach should be effective.

Detailed **monitoring** of Western Ringtail Possums is proposed (and indeed is already taking place) in receival sites. This is required to demonstrate usage of fauna crossing structures and in particular that the outcome (the abundance and persistence of the Western Ringtail Possum in the receival sites returns to pre-disturbance levels within a maximum of fifteen (15) years from the commencement of construction) is achieved. The monitoring methods are appropriate but possibly even excessive to meet the outcome; this concern is discussed below. At best, excessive monitoring is unnecessary, but at worst, excessive monitoring could compromise the outcome through monitoring interfering with and disturbing animals.

Despite some concerns with the effects of detailed monitoring, it is very likely that the HFMP will meet the objectives and outcome of the Ministerial conditions.

Does the HFMP adequately convey the rationale for and the details of the methods to be undertaken?

In parts, the HFMP lacks clarity in explaining the reasons for methods and the approach to the methods that are proposed. An over-arching comment with respect to structure and clarity is that there is no clear context provided in the HFMP. Many readers will examine only this document and therefore the HFMP would benefit from a concise summary of the proposal (the BORR) and the risk it poses to the Western Ringtail Possum. This could be part of the Executive Summary of the plan, and would include elements from other plans, such as the clearing plan.

Are the methods adequate and appropriate to meeting Ministerial conditions?

The outcome is a deceptively simple requirement that ‘the abundance and persistence of the Western Ringtail Possum in the receival sites returns to pre-disturbance levels within a maximum of fifteen (15) years from the commencement of construction’. While there is no justification given (such as from the scientific literature) to support a period of 15 years as opposed to a greater or lesser period, the outcome clearly needs to be demonstrated, and therefore the monitoring would be expected to focus on this outcome. The simplest way to monitor the abundance and persistence of Western Ringtail Possums in an area would be through a structured spotlighting program, perhaps supplemented with systematic counts of scats and even use of cameras (such as on crossing structures). While this is proposed, in addition the monitoring includes capture and marking (including radio-tracking) potentially the entire population in the project area, including those animals that will be relocated. This will provide detailed information on the movement and fate of individual animals, and while it is unclear how this is required to ensure that the outcome has been met, it is stipulated in the Ministerial Condition. There is a level of interference in capturing, marking and tracking of marked animals, and while these are standard techniques, this may add to the stress particularly for animals that are relocated. Condition 5-2 3(e) states that monitoring should include but not be limited to radio telemetry with robust sample sizes. The condition would therefore appear to allow for some flexibility, such as potentially having some of the relocated animals that are not marked or tracked, and even varying the intensity of monitoring, as actions such as regular spot-lighting constitute an additional form of disturbance. Monitoring of unmarked animals outside the Gelorup corridor would also provide a form of control, but these animals would not have been subject to relocation.

The genetic study is further interference with the animals and while presumably intended to investigate long-term impacts of fragmentation should this occur, the whole intent of the management is that such fragmentation will not occur, and it is unlikely that any genetic impacts of fragmentation would be detected within the time frame of the study.

The detailed investigations are research that is only weakly linked to achieving the required outcome. However, the information gained may be useful in the broader conservation of the species.

Conclusion

The purpose of this peer review is to provide an expert opinion on whether or not the HFMP will achieve conditions 6-1 and 6-2 of MC 1191. These conditions are:

- MS 1191 Condition 6-1 objectives of:
 - minimise the impacts of habitat fragmentation that are attributable to the proposal on western ringtail possum; and
 - minimise the impacts from predation that are exacerbated by the proposal on western ringtail possum.
- MS 1191 Condition 6-2 outcome of the “abundance and persistence of the western ringtail possum in the receival sites returns to pre-disturbance levels within a maximum of fifteen (15) years from the commencement of construction.

The peer review has been approached by asking if: the HFMP is likely to meet the objectives and to achieve the outcome of the conditions; the HFMP adequately conveys the rationale for and the details of the methods and; the methods are adequate and appropriate to meet the conditions.

The actions proposed under the HFMP, in particular the installation of crossing structures, are highly likely to meet Condition 6-1. The species readily uses crossing structures, and the designs are based on structures successfully used elsewhere. Likewise, the management actions proposed can be expected to meet the outcome of condition 6-2. We would like it noted, however, that we consider there to be a slight risk to achieving this outcome due to the invasive and intensive monitoring proposed.

APPENDIX D: ANNUAL COMMONWEALTH COMPLIANCE REPORT TEMPLATE



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WESTERN AUSTRALIA

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Western Australia.*

EPBC 2019/8543 Annual Compliance Report

Bunbury Outer Ring Road
Southern Section
Month/Year

Contents

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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:

Attachment 6:

Attachment 7: