BORR Team

BORR Southern Section Response to Public Submissions on Preliminary Documentation (EPBC Ref: 2019/8543)

BORR-02-RP-EN-0025

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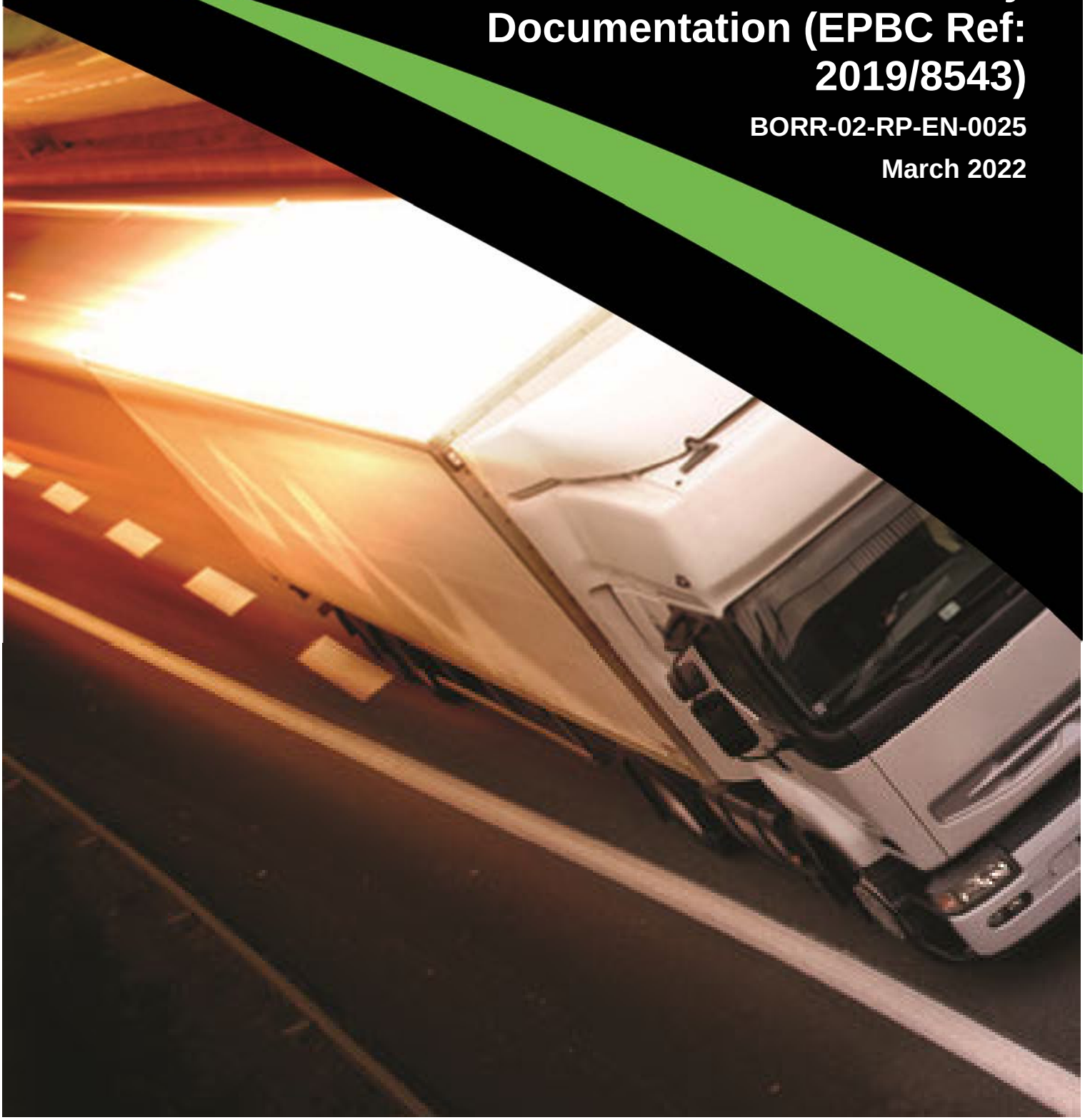

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APPENDICES

Document *Control*

Revision	Date	Description	Prepared	Reviewed	Approved
A	2/2/2021	Draft for Main Roads Review	BORR IPT	FH	FH
O	12/02/2021	Final for Issue	BORR IPT	FH	FH
1	18/02/2021	Final for Issue	BORR IPT	FH	FH
2	26/10/2021	Final for issue	BORR IPT	Main Roads	FH
3	16/03/2022	Final for issue	BORR IPT	Main Roads	FH

ACRONYMS

AH Act	*Aboriginal Heritage Act 1972*
AHIS	Aboriginal Heritage Inquiry System
AMP	Action Management Plan
ARI	Additional Referral Information
ASS	Acid Sulfate Soils
Biota	Biota Environmental Sciences
BORR IPT	Bunbury Outer Ring Road Integrated Project Team
BORR	Bunbury Outer Ring Road
BSM	Black-striped Minnow
BTP	Brush-tailed Phascogale
CBP	Common Brushtail Possum
CCT	Correlated Colour Temperature
CCW	Conservation Category Wetland
CCWA	Conservation Council of WA
CEMP	Construction Environmental Management Plan
CO	Carbon monoxide
CRG	Community Reference Group
dB	Decibels
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height
DEC	Department of Environment and Conservation
DEWHA	Department of the Environment, Water, Heritage and the Arts
DO	Dissolved Oxygen
DoEE	Department of Environment and Energy
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPAS	Environmental Protection Authority Services
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FOG	Friends of Gelorup
FCT	Floristic Community Type

GBRS	Greater Bunbury Region Scheme
GIS	Geographic Information System
ha	Hectares
IBSA	Index of Biodiversity Surveys for Assessments
IUCN	International Union for Conservation of Nature
k	Kelvin
km	Kilometres
LGA	Local Government Area
LVIA	Landscape Visual Impact Assessment
m	Metres
mAHD	Metres Australian Height Datum
mm	Millimetres
MCA	Multi-Criteria Analysis
ML	Megalitres
ML/pa	Megalitres per annum
MNES	Matters of National Environmental Significance
MRWA	Main Roads Western Australia
MS	Ministerial Statement
MUW	Multiple Use Wetlands
NO_2	Nitrogen dioxide
NSHA	Noongar Standard Heritage Agreement
PASS	Potential Acid Sulfate Soils
PD	Preliminary Documentation
PEC	Priority Ecological Community
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	Particulate matter less than or equal to 10 microns in diameter
PSP	Principle Shared Path
PTA	Public Transport Authority
REW	Resource Enhancement Wetlands
RiWI Act	*Rights in Water and Irrigation Act 1914*
SCP	Swan Coastal Plain
SSASR	Southern Section Alignment Report
SWEC	South-West Environment Centre
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
UDLF	Urban Landscape Design Framework
UFI	Unique Feature Identifier
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound

VIA	Visual Impact Assessment
VT	Vegetation Type
WA	Western Australia
WAPC	Western Australian Planning Commission
WRM	Wetland Research and Management
WRP	Western Ringtail Possum
WSWA	Wildflower Society of Western Australia

1. INTRODUCTION

1.1. Background

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Southern section of the Bunbury Outer Ring Road (BORR) project (BORR IPT 2019a). 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 will also provide an effective bypass of Bunbury for inter-regional traffic. BORR forms a major component of the planned regional road network for the Greater Bunbury area.

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
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

The majority of the BORR Central Section (four kilometres (km)) was completed in May 2013, along with a three km extension of Willinge Drive southwards to South Western Highway.

This document refers to BORR Southern Section (the Proposal). Although the majority of the Central Section has been built, improved connection to the Central Section is still required.

1.2. Assessment of Referral Information and response to submissions

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

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).

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 (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.

A total of 82 public submissions were received by Main Roads and conveyed to DAWE, with an additional submission provided through DAWE. The key issues raised are:

- Unacceptable impacts to MNES including threatened fauna (particularly western ringtail possum and black cockatoos) and threatened ecological communities (Banksia and Tuart woodlands)
- Inadequate assessment of alternative alignments
- Offsets identified are inadequate
- Unacceptable impacts to natural hydrology
- Unacceptable economic and social impacts
- Inadequate consultation with aboriginal people on sites of cultural significance.

A Summary of Public Submissions is provided in Section 3.

1.3. Purpose of this Document

The purpose of this document is to provide responses to issues in submissions received during the public comment period. This document also provides Main Roads with an opportunity to:

- Present additional information from investigations undertaken since the Southern Section Additional Information for Preliminary Documentation was submitted
- Highlight aspects of the Proposal that have been modified in response to submissions received
- Address any errors and/or omissions identified in the Southern Section Additional Information for Preliminary Documentation
- Amend environmental commitments and/or include additional environmental commitments in response to submissions received.

1.4. Response Method and Structure of this Document

This Response to Submissions document has several components. Each component and its purpose is described below:

1. Introduction – this introduction is intended to provide the context of the Response to Submissions document.
2. Description of the Proposal – the Proposal has not changed since the issue of the Southern Section Additional Information for Preliminary Documentation, but a brief description has been provided for context.
3. Summary of Public Submissions – A listing of the 82 submissions received, appropriately noting confidential submissions, and a summary of the key topics identified in the comments derived from the submissions.
4. Responses to Public Submissions –The public submissions have been collated with respect to matters of National environmental significance and other relevant matters:
    a) Alternatives and Consultation
    b) Threatened ecological communities and flora

c) Threatened Fauna

d) Management, Monitoring and Offsets

e) Other Matters

f) Economics and Social Impacts.

5. References – The final section of the document includes full references for citations included in this document.
6. Appendices – Documents appended to inform the Responses to Public Submissions.
   a) Appendix A – Supplemental Reports.

2. DESCRIPTION OF THE PROPOSAL

2.1. Background

Subsequent to the referral of the BORR Southern Section to DAWE in September 2019, the Proposal Area was modified as a result of refinement of the alignment. This refinement was in part the result of modifications to the road design, and in part the outcome of targeted efforts to avoid, wherever possible, the direct loss of TECs and PECs and fauna habitats. The changes were summarised and presented in Table 1-4 of the Southern Section Additional Information document submitted to DAWE in October 2020. The Southern Section Additional Information for Preliminary Documentation document discussed the changes to the Proposal and detailed the change in potential impact with particular attention to the potential impact to threatened species and communities as detailed in DAWE's request for additional information. As detailed in the Southern Section Additional Information document, the changes to the Proposal resulted in a reduction in the overall area (from 300 ha to 200 ha) and potential impact of the Proposal on the environment, in particular on habitat for threatened species, TECs and PECs.

Further refinement of the BORR Southern Section was undertaken subsequent to the commitments presented in the Southern Section Information Document submitted in October 2020. The additional refinement was undertaken to further improve both social connectivity for Gelorup residents and improve fauna connectivity between established fauna habitat patches along the BORR corridor. Further offsets have also been proposed in addition to those presented in the October 2020 response.

2.2. Description of Proposal

The Proposal is located approximately 200 km south of Perth and at its closest point, approximately six km south-east of Bunbury. It occurs within the Shire of Capel, including the localities of Gelorup, North Boyanup and Stratham. A small section of the Proposal occurs in the City of the Bunbury.

The Proposal includes the construction and operation of 10.5 km of freeway standard, dual carriageway southwest of South Western Highway (south of Bunbury Airport) to Bussell Highway and a 3 km regional distributor from Bussell Highway at Centenary Road southeast to a grade separated interchange at the western end of Lilydale Road. The Proposal includes associated bridges, interchanges, local road modifications and other infrastructure including, but not limited to, drainage basins, drains, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs.

The development envelope for the Proposal referred by Main Roads is up to 200 ha and referred to as the Proposal Area (BORR IPT 2020, Appendix A in the Southern Section Additional Information Preliminary Documentation).

No changes have been made to the Proposal since the submission of the Southern Section Additional Information document and its release for a four week public comment on 20 November 2020.

The key proposal characteristics of the Proposal are presented in Table 1.

Table 1. Key Proposal characteristics

ELEMENT	PROPOSED EXTENT
Physical elements	
Overall Proposal footprint (including all physical elements below)	Clearing or disturbance of up to 200 ha comprising approximately: • 71.5 ha native vegetation • 124 ha cleared and highly modified area (agricultural land and existing built infrastructure).
Road construction and associated infrastructure	Road construction and associated infrastructure for the Proposal includes the following components: • Approximately 10.5 km of new rural freeway standard, dual carriageway • Grade separation of Yalinda Drive across the highway • A grade separated interchange at Bussell Highway • Approximately 3 km of regional distributor (Centenary Road at Bussell Highway to Lilydale Road) • A grade separated interchange at the western end of Lilydale Road • Local road modifications • Utility modifications • A Principal Shared Path (PSP) for the full length of the Proposal including grade separated crossings of local roads and Bussell Highway • Other road infrastructure and furniture including, but not limited to culverts, lighting, noise barriers, fencing, landscaping, road safety barriers, underpasses and signs.
Operational elements	
Constructed BORR	Main Roads will operate the Proposal using standard management and maintenance practices.

2.3. Changes to the Proposal

Since the Preliminary Documentation was released for public comment, Main Roads has further reduced the amount to be cleared for the project from 76 ha to 71.5 ha. This reduction in the native vegetation clearing limit will also see the impacts on other significant values reduce. The proposed change will result in the Proposal impacting up to:

- 60.9 ha of WRP habitat (down from 65.4 ha).
- 49 to 72 WRP individual home ranges (down from 53 to 79 WRP individual home ranges).
- 60.9 ha of Black Cockatoo habitat (down from 65.4 ha).
- 1,088 Suitable DBH Trees (down from 1,098).
- 11 trees containing a suitable nest hollow for breeding of Black Cockatoos (down from 13 trees). It should be noted that there is no change to the number (two) of trees to be impacted that have some evidence of use.

- 39.2 ha of BTP foraging / breeding habitat (down from 43.7 ha).
- 23.4 ha Banksia Woodlands TEC / PEC (down from 26.6 ha).

Several changes have been made since the publication of the Preliminary Documentation to reduce the Proposal's overall impact, including:

- Design modifications and establishing Clearing Exclusion Areas to reduce clearing impacts.
- Additional fauna movement structures to improve habitat connectivity for the WRP, Brush-tail Phascogale and other fauna.
- Additional environmental offset measures to address the EPA's concerns regarding the Proposal's residual impact on the local and regional WRP population.

The proposed variations will reduce the maximum clearing limit associated with MNES. These modifications have been developed in close consultation with the EPA and the proposed amendment will ensure consistency between Commonwealth and State impact assessments processes.

The proposed variation will result in most MNES impacts being reduced, as shown in Table 2:

Table 2. How the proposed variation impacts on MNES compared with impacts of the original proposal.

MNES	ORIGINAL PROPOSAL	VARIED PROPOSAL	COMMENT
Western Ringtail Possum habitat	• 65.4 ha	• 60.9 ha	• 4.5 ha reduction
Fauna movement structures	• Fauna land bridge at Yalinda Drive bridge • 8 fauna rope bridges • 14 fauna underpasses/culverts	• Two fauna land bridges (Yalinda Drive bridge and a new land bridge east of Yalinda Drive) • 10 fauna rope bridges • 14 fauna underpasses	• Additional fauna land bridge east of Yalinda Drive • Two additional fauna rope bridge overpass structures
Brush-tail Phascogale habitat	• 26.6 ha	• 23.4 ha	• 3.2 ha reduction
Black Cockatoo foraging habitat	• 65.4 ha	• 60.9 ha	• 4.5 ha reduction
Potential Black Cockatoo breeding habitat (trees containing a suitable nest hollow for breeding)	• 13	• 11	• No change to the number (two) of trees to be impacted that have some evidence of use.
Banksia Woodland TEC	• 26.6 ha	• 23.4 ha	• 3.2 ha reduction

3. SUMMARY OF SUBMISSIONS

This section provides a listing of public submissions and notes the confidential submissions received. A total of 82 submissions, numbered in order of receipt, were received by Main Roads during the public review period, which took place between 18 November and 18 December 2020. Table 1 lists the submissions and presents the list of unique submissions and those provided by way of a pro-forma. A summary of the number of submissions in which each topic was raised is presented in Table 3.

Table 3. Public Submissions

Submission No.	Submitter	Stakeholder Group
Unique Submissions		
1	Alexis Marsden	General Public
2	Chris Elks	General Public
3	Susanne Elks	General Public
4	Confidential	General Public
14	Urban Bushland Council WA	Environmental Group
16	Sheryl Moppett	General Public
17	John Collingridge	General Public
18	Jane Putland	General Public
21	Confidential	General Public
22	Confidential	General Public
23	Confidential	General Public
25	Confidential	General Public
29	Christopher Stone	General Public
30	Confidential	General Public
32	Deborah Lim	General Public
33	Confidential	General Public
34	Wildflower Society of WA	Environmental Group
38	Shire of Capel	Government
39	Ian Spicer	General Public
40	Confidential	General Public
42	Stephanie Crowe	General Public
43	Maureen and Graham Briggs	General Public

Submission No.	Submitter	Stakeholder Group
44	Kieran Noonan	General Public
45	Neil Davies	General Public
46	Aron Abolis	General Public
47	Helen Oostryck	General Public
48	Nathan Hammer	General Public
50	Friends of the Gelorup Corridor	Community Group
53	Confidential	General Public
55	Elizabeth Golden	General Public
56	Conservation Council of WA	Environmental Group
58	Keith Wilcox	General Public
59	Daphne Wilcox	General Public
60	Jenny Dunlop	General Public
61	John Sherwood	General Public
62	Hon Diane Evers MLC	Government
66	AH Kirk	General Public
67	Tanja Kirk	General Public
68	Laurie Sorensen	General Public
70	Terri Sharp	General Public
72	Confidential	Government
73	Confidential	General Public
76	Ed and Merilyn Reid	General Public
78	Terry Stone	General Public
79	Confidential	Environmental Group
82	Birdlife Australia	Environmental Group
Pro Forma Submissions		
5	Leeann Hudson	General Public
6	Confidential	General Public
7	Confidential	General Public
8	Shanayra Benzie	General Public
9	Donald Benzie	General Public

Submission No.	Submitter	Stakeholder Group
10	Leonie Stock	General Public
11	Confidential	General Public
12	Confidential	General Public
13	Graeme Foulds	General Public
15	Dr Wilson Lim	General Public
19	David Simmonds	General Public
20	Jennifer Simmonds	General Public
24	Jonathon Spencer	General Public
26	Georgia Hudson	General Public
27	Confidential	General Public
28	Steve Moppett	General Public
31	Jenny Kikeros	General Public
35	Jill Chapple	General Public
36	Kye Twigg	General Public
37	Tracey Woodhouse	General Public
41	Phillip O'Meehan	General Public
49	Confidential	General Public
51	Daria Smith	General Public
52	John Spice	General Public
54	Stephen Adams	General Public
57	Bee Denham	General Public
63	Robert Oostryck	General Public
64	Joshua Noonan	General Public
65	Saibra Twigg	General Public
69	Shelley Blechynden	General Public
71	John and Dianne Dunn	General Public
74	Confidential	General Public
75	Confidential	General Public
77	Jennifer McDonnell	General Public
80	Confidential	General Public

Submission No.	Submitter	Stakeholder Group
81	Confidential	General Public

Table 4. Summary of Public Submissions in which topic was addressed

Topic / Matter	Number of Comments
Alternatives and Consultation	
Alternatives	73
Consultation	3
Threatened Ecological Communities and Flora	
TECs - General	4
Banksia Woodlands TEC	65
Tuart Woodlands TEC	63
Flora	5
Threatened Fauna	
Western Ringtail Possum	64
Black Cockatoos	67
Black Stripe Minnow	62
Brush-tailed Phascogale	5
Chuditch	1
Fauna Habitat - General	56
Other Matters	
Aboriginal Heritage	5
Significant Trees	13
Cumulative Impacts	13
Management, Monitoring and Offsets	
Management	3
Offsets	17
Economic and Social Matters	
Economics	6
Social Impacts	63
Air Quality	4
Climate Change	4
Contamination	3
Mineral Resources	7
Water	6
Sustainability	2

4. RESPONSES TO PUBLIC SUBMISSIONS

This section provides a summary of public submissions provided to Main Roads and DAWE regarding the information provided in the Southern Section Additional Information for Preliminary Documentation. Main Roads has provided a response to each issue raised during the public comment period. The public review period for the Proposal commenced 18 November 2020 for a period of four weeks ending 18 December 2020. Submissions received by Main Roads after this date have been included in this response document. A total of 83 submissions were received.

The principle issues raised in the submissions and advice received included environmental and social issues as well as issues focused on questions of fact and technical aspects of the Proposal.

The key issues raised in the submissions were:

- Alternative alignments not considered adequately, Multi-Criteria Assessment not valid
- Unacceptable impacts to conservation significant fauna species (particularly western ringtail possum black cockatoos and black stripe minnow)
- Unacceptable impacts to Tuart Woodlands and Banksia Woodlands TEC/PEC and significant trees
- Unacceptable social impacts – noise, visual amenity, community connectivity
- Inadequate mitigation and management measures proposed
- Offset information provided is inadequate.

The Pro Forma submission represented either the entirety of (37 submissions) or a portion of (11 submissions) 48 of the 83 submissions. The Pro-Forma submission comments are captured in the following responses provided in this Section:

- Alternatives
- 24. Banksia Woodlands TEC
- 36. Tuart Woodlands TEC
- 51. Western Ringtail Possum (WRP)
- 70. Black Cockatoos
- 83. Black Stripe Minnow (BSM)
- 91. Street lighting impacts on fauna
- 111. Social Impacts.

4.1. Alternatives and Consultation

4.1.1. Alternatives

Response No.	Submission and/or issue	Relevant Submissions
1	A number of submitters noted the Alternative Alignment had less impact on Matters of National Environmental Significance when compared to the Proposed Project. Commenters cited the Interim Report of the EPBC Independent Review statement: "The Review has noted proposals where proponents have placed linear infrastructure through habitat, rather than considering all opportunities to site it through adjacent already disturbed or cleared lands (pp. 87 Interim Report of the Independent Review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act))."	1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 49, 50, 51, 52, 53, 54, 55, 57, 58, 59, 60, 61, 63, 64, 65, 66, 67, 69, 70, 71, 72, 74, 75, 76, 77, 78, 79, 80, 81, 82

Alternate alignment selection

The Alignment Selection Study was undertaken to develop and ultimately compare two alignments to determine if there is a more suitable alignment to the BORR Southern Alignment as defined in the Greater Bunbury Region Scheme (GBRS). The BORR Southern Section (GBRS) alignment has been in place for over 40 years. In 2000, the alignment was confirmed in the GBRS when the Scheme was issued for public comment. The Scheme came into effect in 2007 and remains the current planning document for the Greater Bunbury Area.

In May 2018, the Commonwealth Government elevated the conservation status of the Western Ringtail Possum (WRP) from 'vulnerable' to 'critically endangered' under the EPBC Act. This elevated status was initially considered to potentially be a fatal flaw to the BORR Southern Section (GBRS) alignment, triggering a review of alternative alignments.

The Alignment Selection Study developed an Alternative Alignment for comparison purposes. The Environmental Impact Assessments (EIAs) found that both alignments, the BORR Southern Section (GBRS) alignmentand Alternative Alignment impacted Matters of National Environmental Significance (MNES). While the potential impact of the BORR Southern Section (GBRS) alignmentwas reported to be higher for WRP and potential Black Cockatoo (BC) foraging habitat BORR Southern Section (GBRS) alignment, the impact on the endangered Black Stripe Minnow (BSM) was higher for the Alternative Alignment.

The alignment selection process undertaken by Main Roads, confirmed that the BORR Southern Section (GBRS) alignmentremained a feasible option to progress to concept design and approvals. Following this determination, Main Roads undertook a range of strategies to both directly avoid and mitigate the expected environmental impacts. These strategies included reducing the footprint of the Development Envelope (DE), establishing structures to maintain connectivity between patches of vegetation and clearing protocols and procedures.

As a result of these strategies, Main Roads reduced the potential impact to WRP and Black Cockatoo habitat by 14.6 Ha. Mitigation strategies included connectivity between habitat patches, managed clearing processes and establishing supplementary dreys and watering points.

Independent review

The 2020 Independent Review of the EPBC Act by Professor Graeme Samuel AC advised that proponents had not considered all opportunities to site linear infrastructure in already disturbed lands or cleared lands before referring a proposal for assessment, and that offsets policies were used as a tool to enable a decision to site this infrastructure in areas impacting habitat and other MNES.

Main Roads did consider an alternative alignment through land that was cleared. This land however, is long-established and profitable agricultural land that supports a range of farming systems. While the alignment selection process included considerations of the impact of the construction and operation of BORR on MNES, the process, also accounted for environmental, socio-economic, planning and engineering impacts.

In summary, Main Roads considered an alternative alignment on cleared land before confirming the longstanding BORR Southern Section planned in the GBRS remained a feasible alignment to progress to concept design and environmental approvals. Both alignments impact MNES. Main Roads has applied the mitigation hierarchy to the BORR Southern Section alignment prior to offsets being considered.

Response No.	Submission and/or issue	Relevant Submissions
2	The Alignment Selection Report and EIAs supporting the alternatives rely on a significant number of unpublished reports that the public do not have access to and cannot comment on. The Southern Section Alignment report of September 2019 has not upheld the high-level review required and much of the data collected was based on historical surveys and desk top studies. Some of these data are over 25 years old.	16, 17, 30, 32, 38, 50, 58, 59, 61, 72, 78, 79

Unpublished reports

The alignment selection process commissioned a number studies to report on the potential environmental impact the Alternative Alignment may have on a range of environmental and social values. While the reports remain unpublished, findings from these studies were provided in the EIA chapter of the Alignment Selection Report. The Alignment Selection Report was published on the Main Roads website and presented at a number of stakeholder meetings, including the BORR South Community Reference Group (CRG), where attendees had the opportunity to comment on the data used to inform the alignment selection study.

Historical data

The Alignment Selection report drew from both historical and contemporary data. A number of studies were commissioned in both the alignments in order that a like for like comparison could be undertaken.

These studies were:

- BORR Southern Section Alternative Alignment Vegetation and Flora Study, (GHD 2019a)
- BORR Southern Section Alternative Alignment Vegetation and Flora Study, (GHD 2019b)
- BORR South GBRS Alignment Targeted Fauna Assessment (Biota 2019a)
- BORR South GBRS Alignment Targeted Fauna Assessment (Biota 2019b)
- BORR Southern Section Alternative Alignment Targeted Fauna Assessment (Biota 2019)
- BORR Southern Section Alternative Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey, (WRM 2018)
- European Heritage Assessment – Southern Alternative Investigation Corridor, D.G. Burnside and Associates 2019.

Historical data provide important and necessary context from which environmental values and trends are described and compared to data recorded from the contemporary field investigations.

The above reports remain unpublished.

Response No.	Submission and/or issue	Relevant Submissions
3	Main Roads has failed to ensure that the proposal design avoids serious or irreversible damage to the environment. Alternatives to the proposed action were not sufficiently comprehensive or objective and that its conclusions were unreasonable and not consistent with the Precautionary Principle of avoiding in the first instance. Main Roads has failed to follow the mitigation hierarchy of avoid, minimise, mitigate/manage, rehabilitate and offset.	16, 17, 22, 38, 50, 58, 59, 61, 72, 76

The Alignment Selection Study was undertaken to develop and ultimately compare two alignments to determine if there is a more suitable alignment to the BORR Southern Alignment published in the GBRS. The assessment primarily comprised the comparison of key factors (environmental, socio-economic and engineering) between the alignments and so determine which alignment would be progressed for environmental approval.

The alternative alignments considered the potential impact of BORR on cleared agricultural land. The studies found that both alignments, BORR Southern Section (GBRS) and the Alternative Alignment, impacted environmental, socio-economic and engineering factors and therefore the BORR Southern Section (GBRS) alignment remained a feasible option to progress to concept design and environmental approvals.

Main Roads has applied the mitigation hierarchy in the preparation of the State and Commonwealth environmental approvals for the BORR Southern Section proposal, referred to both the EPA and DAWE for assessment.

Response No.	Submission and/or issue	Relevant Submissions
4	To satisfy the requirements of Federal environmental legislation, as part of the referral process, Main Roads WA was required to demonstrate that they have comprehensively investigated alternatives routes for the BORR Southern Section with less environmental impact on Matters of National Environmental Significance (MNES).	30, 38, 50, 61, 72, 78

Main Roads commissioned the following studies to thoroughly understand and transparently compare the two alignments:

- BORR Southern Section Alternative Alignment Vegetation and Flora Study, (GHD 2019a)
- BORR Southern Section Alternative Alignment Vegetation and Flora Study, (GHD 2019b)
- BORR Southern Section GBRS Alignment Targeted Fauna Assessment (Biota 2019a)
- BORR Southern Section GBRS Alignment Targeted Fauna Assessment (Biota 2019b)
- BORR Southern Alternative Alignment Targeted Fauna Assessment (Biota 2019)
- BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey, (WRM 2018)
- European Heritage Assessment, D.G. Burnside and Associates 2019.

The majority of studies were completed in the Alternative Alignment as the BORR Southern Section (GBRS) alignment has been extensively and recently surveyed, therefore comparative data were required from the Alternative Alignment in order than an equitable comparison between the alignments was completed.

The EIA concluded that MNES were impacted in both alignments, WRP and BC in the BORR Southern Section and WRP, BC and BSM in the Alternative Alignment. As a result of this finding, along with the Multi-Criteria Assessment (MCA) results of the socio-economic and engineering factors, the BORR Southern Section (GBRS) alignment was progressed for State and Commonwealth environmental approval.

Response No.	Submission and/or issue	Relevant Submissions
5	The MCA and reasons for selection of the proposed alignment over the alternative one is too general and too subjective for adequate comment by the public and response by the federal government. They are too general because MRWA has not provided MCA criteria and weightings, and too general because insufficient objective data is provided. The MCA did not include any environmental criteria – only social, engineering and economic. Thus, the entire MCA is flawed	34, 43, 44, 50, 60, 61, 79

Justification of the MCA process

The Alignment Selection Study was undertaken to develop and ultimately compare two Alignments to determine if there was an alternate alignment to the BORR Southern Section Alignment published in the GBRS. While the MCA was an integral process in the determination of the feasibility of the BORR Southern Alignment as the primary road alignment for the Bunbury Outer Ring Road in the GBRS, it

was one of three components of the process. The three components applied in the determination of the alignment is shown in the following conceptual drawing. The figure shows that in addition to the MCA, environmental impact assessments and the Regional WRP Survey were also undertaken. The results from each process were considered in the alignment selection process. Each stage of the process is reported in full in the Alignment Selection Report, (BORR IPT 2019). Environmental values were not considered in the MCA, this was done by way of the EIA. The EIAs are published on Main Roads website and reported in the Alignment Selection Report. Further to the EIAs, Main Roads commissioned a Regional WRP Survey to describe and quantify the broader context of the WRP population.

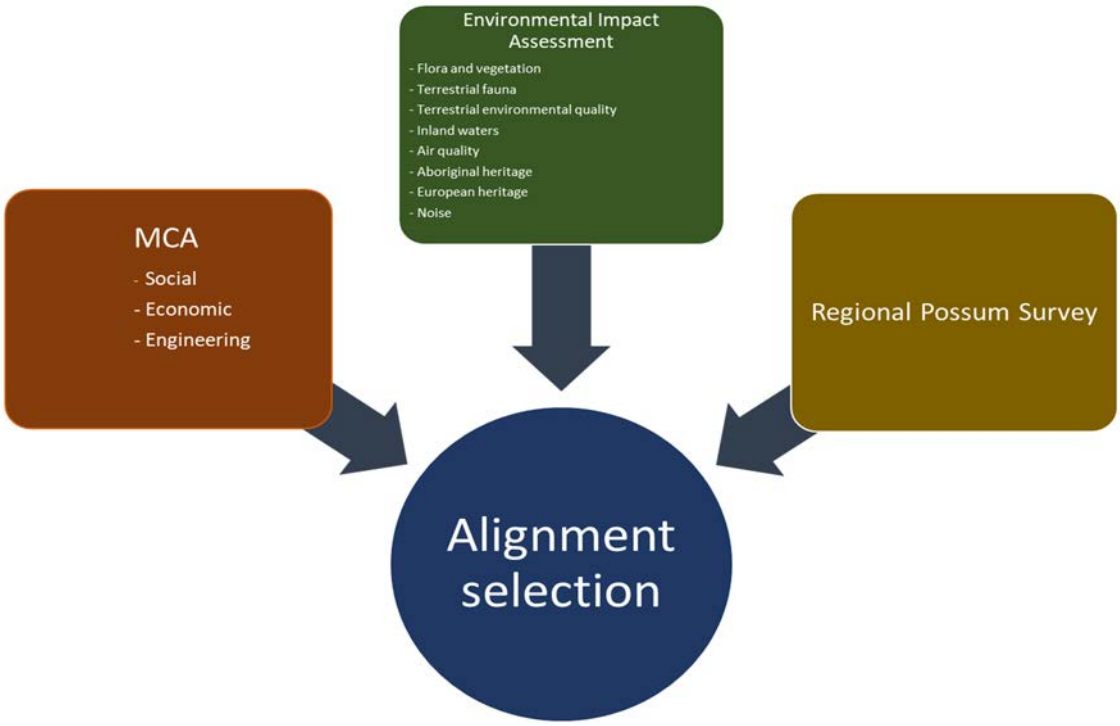

Figure 1. Processes involved in Alignment selection

The alignment selection process was undertaken in five stages. These stages are shown in the following figure.

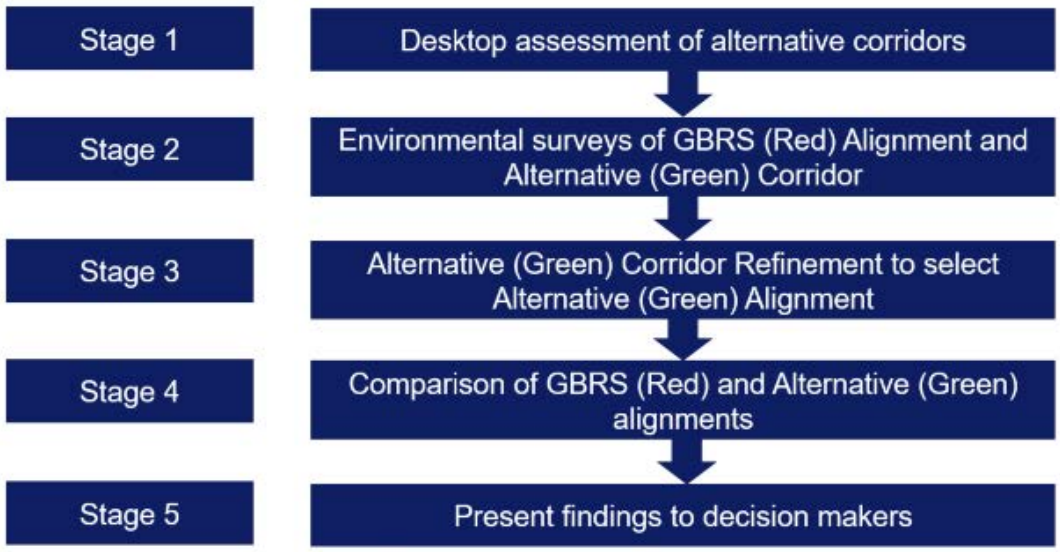

Figure 2. Alignment selection process

The work undertaken as part of each stage is briefly described below:

- Stage 1. This involved the preparation of constraints mapping and a review of the previous routes identified through earlier studies. The purpose of this was to identify a corridor for investigation. The resultant corridor is referred to as the Alternative Corridor and is approximately 750 m wide to facilitate development of a potential alignment
- Stage 2. Undertake environmental field surveys in both the BORR Southern Section (GBRS) alignment and the Alternative Corridor to identify environmental constraints. These along with desktop assessments were used in Stage 3. These studies are listed above. In addition to the targeted environmental studies, the Regional WRP Survey was also undertaken
- Stage 3. Within the Alternative Corridor, identify feasible alignments approximately 100 m wide and undertake an MCA to determine a potential Alternative Alignment for comparison with the BORR Southern Section (GBRS) alignment. This MCA only assessed Social, Engineering and Economic constraints. Data reported from the environmental surveys were used in tandem with the results of the MCA to determine the Alternative Alignment to be progressed to Stage 4
- Stage 4. The existing BORR Southern Section (GBRS) alignment and the Alternative Alignment were evaluated using a second MCA and EIA process
- Stage 5. (Refer Section 14): Present the findings to Main Roads and document recommendations.

Multi Criteria Assessment Process

The alignment selection process involved two separate MCA processes. The first MCA compared the socio-economic and engineering impacts of four potential alignments identified with the Alternative (Green) Corridor (Stage 3). This MCA identified the preferred Alternative Alignment to proceed for assessment as a possible alternative alignment to the BORR Southern Section (GBRS) alignment.

A second MCA was undertaken to assess the planning criteria and other matters between the BORR Southern Section (GBRS) alignment and the Alternative Alignment.

The criteria assessed were:

- Social
  - Severance
  - Landuse
  - Land acquisition
  - Noise impacts
  - Visual impacts
- Engineering
  - Hydrology
  - Ground conditions
  - Rivers, streams
  - Road safety
  - Constructability
- Economic
  - Construction cost
  - Operation costs
  - Network performance
  - Travel time savings
  - Strategic agricultural resources
  - Basic raw materials and mining tenements

The summary table provided below presents the findings of the second MCA.

Table 5. Results of the MCA comparing the BORR Southern Section (GBRS) Alignment and the Alternative Alignment

Criteria	Sub-Criteria	GBRS (Red) Alignment	Alternative (Green) Alignment
Social	Severance	1	3
	Land Use	1	3
	Land Acquisition	1	3
	Noise Impacts	3	1
	Visual Impacts	3	1
Engineering	Hydrology	1	3
	Ground Conditions	1	3
	Rivers, Streams	1	2
	Road Safety	1	1
	Constructability	3	1
Economic	Construction Cost	2	3
	Operation Costs	2	2
	Network Performance	1	2
	Travel time Savings	1	1
	Strategic Agricultural Resources	1	3
	Basic Raw Materials & Mining Tenements	1	3
Total Scores		**24/48**	**35/48**

Environmental Impact Assessment

The environmental values comparing the BORR Southern Section (GBRS) alignment and Alternative Alignment were not assessed as part of the MCA process. This assessment approach was undertaken by way of a detailed EIA prepared for the BORR Southern Section and Alternative Alignment. The environmental and cultural factors studied for the EIAs were:

- Flora and vegetation
- Terrestrial fauna
- Terrestrial environmental quality
- Inland waters
- Air quality
- Aboriginal heritage
- European heritage.

The key results for the above environmental factors are provided in the following table. The results show that the amenity values for both alignments are anticipated to have a relatively similar level of impact. The results also show that while the BORR Southern Section (GBRS) alignment is likely to have a greater impact on Terrestrial flora and vegetation and WRP and BC habitat, there is a predicted impact on the same values in the Alternative alignment. The impact on BSM and wetlands in the Alternative Alignment, is predicted to be higher than the potential impact estimated in the BORR Southern Section (GBRS) alignment.

The EIAs provide the technical detail of the environmental values predicted to be impacted in both alignments, including potential impacts on the WRP and are published on the Main Roads website.

Table 6. Broad comparisons of the key environmental values considered in the alignment selection process

Criteria	Sub-criteria	BORR Southern Section (GBRS) Alignment	Alternative Alignment
Flora and Vegetation	Total Native vegetation	3	2
	Total TEC/PEC	3	2
Fauna	Black Cockatoos Potential breeding trees Foraging habitat	2	2
	WRP Habitat Est density	3	2
	Black Stripe Minnows	2	3
Wetland and Waterways	Geomorphic wetlands	2	3
	Waterways	2	3
	Riparian vegetation	2	2
Heritage	Aboriginal Heritage	1	1
	European Heritage	1	1

TOTAL		21/30	21/30

Detailed discussion on the potential impacts in the EIAs are provided in Appendix G of the Alignment Selection Report.

Regional WRP Survey

The Regional WRP Survey was the third tranche of information used to inform the alignment selection process. This work was undertaken to gain further insight into the status of the WRP population, particularly in the south west region. The results of the work became the basis of discussion as to the vulnerability of this species in the region, particularly its vulnerability with the planned BORR Southern Section alignment.

The survey area covered five areas in the south west and south coast regions, including the South Swan coastal plain and Cape to Cape region. Regional Surveys were based on the survey of 114,243 ha using 1,249 transects equating to a total effort of 1,287.2 km of transect. Across these transects 2,939 detections of 3,677 individual WRP were made. Survey effort was divided amongst the three WRP key management zones: SCP, Southern Forest and South Coast. The field survey results recorded a population of 5 704 WRP in the South Swan coastal plain and 2 262 WRP in the Cape to Capes region. The survey extent was limited to public land and did not include the occurrence of WRP individuals on private property and peri-urban areas.

The results of the Regional WRP Survey found that the WRP population estimate is far greater than was predicted in 2015, with an estimated population in excess of 20 000 individual WRP in the surveyed areas, the Swan Coastal Plain, Southern Forest and South Coast region of Western Australia (Biota 2020c).

Summary

The approach to the alignment selection was not solely based on the MCA process, but included EIAs completed for both alignments, both of which were based on current data and finally the WRP Regional Survey. This tripartite approach provided a robust and thorough assessment of the two alignments.

Response No.	Submission and/or issue	Relevant Submissions
6	The Southern Section Alignment selection report uses data from historical surveys and assessments (including the ERM 1997 and the HGM 1995 reports and desktop analysis). Reports used in the alignment selection are outdated and not reflective of the current conservation status of MNES.	16, 17, 58, 59, 61, 66, 72

Main Roads commissioned a number of studies to inform the EIAs. These studies were:

- BORR Southern Section Alternative Alignment Vegetation and Flora Study, (GHD 2019a)
- BORR Southern Section Alternative Alignment Vegetation and Flora Study, (GHD 2019b)
- BORR Southern Section GBRS Alignment Targeted Fauna Assessment (Biota 2019a)
- BORR Southern Section GBRS Alignment Targeted Fauna Assessment (Biota 2019b)
- BORR Southern Alternative Alignment, Targeted Fauna Assessment (Biota 2019)

- BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey, (WRM 2018)
- European Heritage Assessment, D.G. Burnside and Associates 2019.

In addition to the data reported in these studies, desktop data, including the ERM 1997 and HGM 1995 reports were reported. Desktop data provide important historical context used to interpret the findings from the more recently completed surveys.

Response No.	Submission and/or issue	Relevant Submissions
7	The proposed BORR Southern section does not provide sufficient capacity for future rail options within the corridor. Main Roads did not consider rail as a feasible alternative, both for freight and passenger service, to the BORR Southern Section Proposal.	14, 32, 44, 61, 62

Future rail was considered during the planning and development phases of the BORR Proposal. During consultation the Public Transport Authority (PTA) advised that rail planning surrounding Bunbury is in its early stages with no current plan for rail south of Bunbury.

In 2020, the WA Government announced its intention to fund a feasibility study to determine potential alignments for the Perth to Bunbury fast train.

Provision for a potential fast rail corridor has been in the BORR concept design at the northern interchange of Forrest Highway (BORR Northern and Central Sections) where the rail corridor deviates to follow Forrest Highway to Bunbury. There is no provision for a rail corridor within the Gelorup Corridor. There are a number of potential rail corridors (separate to the BORR corridor) that could be considered in the future should rail south of Bunbury ever be considered.

Response No.	Submission and/or issue	Relevant Submissions
8	The green corridor is not valuable farmland and should be considered as less of a constraint and should have been given less weight in the Alternatives Analysis. The 2017 GBRS Priority Agricultural Land Policy does not classify land within the Green route as in the “Priority Agricultural Land Policy” area (DPLH, 2017). The Southern Section Alignment selection report concluded that the green corridor has significantly higher impact on wetlands. The majority of these wetlands, however, are classified as multiple use. According to Geomorphic mapping and thus are erroneously weighted in the Alternatives Analysis. These deficiencies suggest the Green corridor should be the Preferred Alternative.	32, 48, 50, 61, 72, 76, 79

The submission advises that the Greater Bunbury Region Scheme Priority Agricultural Land Policy 2017 classifies the area as Spearwood and Bassendean soil systems and the Shire of Capel Strategy 1999 advises this soil system has moderate capability for grazing with farmland ‘requiring extra nutrients and …supplementary feed’. Irrespective of the soil composition, the land is managed as productive agricultural land and is accordingly considered to have value as productive agricultural land.

Wetlands

The EIAs for the BORR Southern Section and Alternative Alignment do not compare the geomorphic classifications of the wetlands as they occur in the two alignments, rather, the importance of their hydrologic function in sustaining the endangered BSM population has been weighted.

Response No.	Submission and/or issue	Relevant Submissions
9	The decision to keep the current alignment from South Western Highway to Hasties Rd was based on desk top survey only. The accuracy of data supporting the decision is called into question.	16, 17, 38, 58, 59, 50, 61

Desktop survey is a valid screening tool for the definition of Alternative Routes and is based on recent independent data on MNES available from DBCA and the Commonwealth. A desktop survey was used to measure the BORR Southern Section (GBRS) alignment against potential alternatives.

The alignment from South Western Highway to Hasties Road is predicated on the connection to the existing BORR Central Section at South Western Highway and is thus a fixed constraint on alternatives. This fixed initiation point constrained options for the alignment and no alternative was defined that minimised impacts on native vegetation, geomorphic wetlands, or WRP without increasing social and economic impacts.

Response No.	Submission and/or issue	Relevant Submissions
10	No economic Cost-Benefit Analysis detailing the volume and value of the basalt to be saved versus the cost of widening the Bussell Highway and improving the intersections was made.	38, 44, 61, 72

The future extraction possibilities of basalt in this area has been a consideration of the Proposal throughout its development. Main Roads met with the Department of Mines, Industry Regulation and Safety (DMIRS) and the two quarry operators in Gelorup and these discussions have guided development of the Proposal and aimed to minimise any potential impacts to the basalt resource, whilst maintaining good accessibility to the BORR from quarry operations.

The regional importance of the resource was acknowledged with the basalt area boundary included as a factor in the MCA used to determine the BORR Southern Section. Further details can be found in the Southern Alignment Selection Report.

In terms of long-term impacts on strategic basalt resource availability, the Gelorup basalt is not the only source of rock aggregate in the region. The Greater Bunbury Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy identifies another location for rock aggregate in Roelands. Main Roads is aware of another basalt resource area within the Shire of Capel, south of the Capel townsite.

Response No.	Submission and/or issue	Relevant Submissions
11	Social Impacts related to noise, amenity, and community severance are unacceptable. The green corridor has lower social impacts.	2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 34, 35, 36, 37, 41, 43, 45, 46, 47, 49, 50, 51, 52, 54, 55, 57, 60, 61, 63, 64, 65, 66, 67, 69, 70, 71, 74, 75, 77, 78, 79

The MCA in the Alignment Selection report acknowledges the amenity impact in the BORR Southern Section is higher than in the Alternative Alignment as shown in the following Table.

Table 7. Socio-economic and engineering MCA comparing the two Alignments

Criteria	Sub-Criteria	GBRS (Red) Alignment	Alternative (Green) Alignment
Social	Severance	1	3
	Land Use	1	3
	Land Acquisition	1	3
	Noise Impacts	3	1
	Visual Impacts	3	1
Engineering	Hydrology	1	3
	Ground Conditions	1	3
	Rivers, Streams	1	2
	Road Safety	1	1
	Constructability	3	1
Economic	Construction Cost	2	3
	Operation Costs	2	2
	Network Performance	1	2
	Travel time Savings	1	1
	Strategic Agricultural Resources	1	3
	Basic Raw Materials & Mining Tenements	1	3
Total Scores		24/48	35/48

Main Roads commissioned noise impact and visual impact amenity studies for the BORR Southern Section to quantify and describe these impacts within the BORR Southern Section.

The noise impact assessment study identified the properties potentially impacted as a result of the construction and operation of the BORR. Main Roads is required, under SPP 5.4 to mitigate noise impacts to these properties, principally using architectural solutions.

The Visual Impact Amenity study confirmed that the findings and recommendations of the Urban Design Landscape Framework (UDLF) will mitigate the visual amenity impact of the BORR Southern Section at key locations.

Maintaining connectivity within the Gelorup community is included in the concept design for the BORR Southern Section, notably the Yalinda Bridge.

Response No.	Submission and/or issue	Relevant Submissions
12	Submitters questioned aspects of the planning framework for the Proposal. The GBRS Alignment was determined based on 'long-term land use planning for the area'. Main Roads acknowledges that the current proposal cannot be fully located within land currently reserved under the GBRS for Primary Regional Roads or Other Regional Roads'. This calls into question the planning framework and suitability of the GBRS to define the current Proposal. Submitters expressed concern the GBRS planning has resulted in a process skewed towards the Proposal. Planning is inconsistent with BORR Northern Section which was re-aligned to avoid the future planned community of Wanju. GBRS and Road reserve are outdated and do not provide a sustainable long-term corridor for the region. Submission also noted that statements from government in selecting the preferred alternative and the current acquisition of property in the corridor reflect a decision to proceed irrespective of environmental approvals.	2, 32, 45, 61, 72, 79

As described in Response to submission #5, the Alignment Selection Study was undertaken to develop and ultimately compare two alignments to determine if there is a more suitable alignment to the BORR Southern Section published in the GBRS. A process similar to that was undertaken for the realignment of the BORR North Section. The MCA was an integral process in the determination of the feasibility of the BORR Southern Section (GBRS) as the primary road alignment for the Bunbury Outer Ring Road in the GBRS and revisited the social, economic, and engineering aspects of the Proposal.

The MCA found no compelling reason to change the BORR Southern Section alignment, which has been included in the GBRS and the preceding Bunbury Wellington Region Plan for many years.

The combined assessment inclusive of the MCA, EIAs, and the Regional WRP Survey, resulted in the conclusion that the BORR Southern Section (GBRS) alignment remained feasible and therefore should be referred to the EPA and the then Department of Environment and Energy (DotEE) for environmental assessment under the EP Act and EPBC Act respectively.

Response No.	Submission and/or issue	Relevant Submissions
13	With respect to other alternatives not considered by Main Roads, submissions noted the connection to BORR planned for Centenary Ave could be upgraded from a two-lane highway to a four-lane highway. Other submissions noted upgrades on the existing Bussell Highway with upgrade infrastructure at congestion points or through the implementation of Smart Freeway technology used on Kwinana Freeway would be preferred to the Proposal.	4, 14, 32, 44

One of the key objectives of the BORR proposal is to separate local traffic from regional traffic, including heavy vehicles. By addressing this objective, the BORR proposal will accommodate future long-term traffic demands for many decades to come (2050+) and forms part of the ultimate Primary Regional Road network.

Any upgrade of Bussell Highway through Gelorup and Dalyellup would require significant land acquisition and environmental impacts along the existing corridor to facilitate the infrastructure associated with a free flowing control of access highway. This would likely include interchanges at Bussell Highway/Centenary Road and four or five other locations along the section of Bussell Highway to Lakes Road. The environmental, social and economic impacts of creating this level of infrastructure through this area is untenable. Smart Freeways technology only works where there is an existing freeflow highway that needs to facilitate additional through movement traffic. This would not reduce the requirement to have significant impacts as described above.

No.	Submission and/or issue	Relevant Submissions
14	On the Multi-Criteria Assessment (MCA) BORR Southern Alignment – GBRS (Red) Alignment VS Alternative (Green) Alignment in the 'Volume to Capacity Ratio' the Green route is assigned a higher score because of 'an additional 12% residual capacity …. viewed as an over investment in infrastructure'. The number of interchanges rated the same at the time, between the two routes (both 1) however, the 'Red' route has more conflict points on Service Roads and now has substantially more redesigned grade separated interchanges and bridges therefore this should be re assessed on the revised proposal.	38, 61

The volume of service roads required in the Alternative Alignment was significant and would need to be constructed in this option. The number of conflict points associated with the service roads on both options was very similar and not considered a major differentiator.

The number of interchanges and bridges in the assessment of both routes is the same.

BORR Southern Section

- Yalinda Bridge
- BORR / Bussell Interchange
- Bussell / Boyanup West Road interchange.

Alternative Alignment:

- BORR over Jilley Road
- BORR / Boyanup West Road interchange
- BORR / Bussell Interchange.

4.1.2. Consultation

No.	Submission and/or issue	Relevant Submissions
15	The State and Federal Submission periods intersected despite our request that this not happen. Reading, absorbing and analysing over 2, 000 pages of unfamiliar text and write a meaningful, well informed submissions in a period of almost 9 weeks is unrealistic. Federal and state documents could not be cross referenced.	50

The concern regarding the overlap of the public comment period is noted. Importantly, the data and interpretation of the data are consistent between the State and Commonwealth referral documents.

Given all the Commonwealth matters were also factors within the State process, it was considered appropriate to coordinate the public submission period to provide stakeholders the best chance possible of providing a submission within either process, noting the bilateral process has one submission period for both state and commonwealth matters.

No.	Submission and/or issue	Relevant Submissions
16	Additional information was requested about the "details of any public and/or Indigenous stakeholder consultation activities, including the outcomes of those consultations". However, the information provided (see Appendix O9), while somewhat useful, is not adequate. There is no way of telling whether the various forms of "consultation" used were of a high quality. We cannot tell whether they were deliberative, or whether they were truly representative of the full range of community members and stakeholders concerned about the southern section of the BORR. There is no evaluation of how the participants of consultation events rated them—whether the participants believed that the processes they were involved in were influential, whether their voices were actually heard, whether the right people were involved, and whether they had adequate information and time to consider it. Without this information, it is impossible to evaluate the usefulness of the outcomes. This is a common failing of "consultation" in Australian planning (and elsewhere) that undermines the legitimacy of "consultation" processes. Ideally, such feedback would be required from participants, and an independent evaluation of the quality and efficacy of "consultation" processes should be undertaken. This should be required by environmental assessment agencies, including DAWE.	62

Indigenous engagement

Extensive Aboriginal heritage surveys for the BORR Southern Section alignment have been commissioned by or on behalf of Main Roads over a twenty-five year period, including in 1995 (Hammond & O'Reilly, 1995), 2002 and 2009 (Brad Goode & Associates, 2010), and 2012 (Brad Goode & Associates, 2012). Subsequent to referral of the Proposal, additional archaeological surveys were conducted in October / November 2019 (Brad Goode & Associates, 2020) and ethnographic surveys were conducted in November 2019 and January 2020 (Ethnosciences, 2020). Each survey was undertaken in accordance with the reporting requirements under the *Aboriginal Heritage Act 1972* (AH Act) and involved people who were nominated to speak for country. On this basis, the nature of the engagement and consultation with aboriginal groups was both appropriate and adequate.

Participants to the 2019 and 2020 Aboriginal Heritage surveys were selected by the Gnaala Karla Boojarah (GKB) working party through the South West Aboriginal Land and Sea Council. This process is in line with the Noongar Standard Heritage Agreement (NSHA) between Main Roads and GKB.

Community consultation

Main Roads initiated a BORR CRG for the Project. To achieve fair and equitable representation on the CRG, nominations for membership were invited from residents, local businesses and community groups via print advertising in the local media, the project website and an e-mail broadcast to project subscribers.

All applications were considered and all those who nominated were accepted. There were approximately 30 members in the BORR Southern Section CRG.

The CRG membership represented:

- Local residents
- Directly affected landowners
- Representatives from the Friends of Gelorup Corridor
- A representative from the South West Environment Centre
- The South West Orchid Propagation and Restoration Incorporation

Observers from the Gelorup community were invited to attend CRG meetings.

The inaugural meetings were held in July 2018 and the Terms of Reference were presented for comment and group endorsement. As part of the Terms of Reference, members were permitted to nominate a proxy representative for meetings where they were unable to attend. Observers were also accepted to attend CRG meetings.

The meetings were independently facilitated. Senior members of the BORR Project Team attended each session, held locally, to provide technical advice and updates on progress and respond to questions or concerns raised by members. Wherever possible, an agenda and background materials were provided to CRG members five working days before the meeting and summary notes issued ten working days following the session.

Presentations delivered by the BORR Team were provided electronically to CRG members and made available to the general public via Main Roads' project website post session.

Initially, the CRG was expected to meet on six occasions scheduled to coincide with program milestones. However, in response to early requests from the CRG members, the meeting frequency was increased to monthly to provide more time to discuss the range of issues.

In March 2019, the BORR Southern Section CRG went into recess pending a decision on the corridor selection and reconvened in June 2019. The BORR Southern Section CRG held its final meeting in December 2019. A total of 11 meetings were held with the BORR Southern Section CRG.

Main Roads made a number of adjustments to the BORR Southern Section as a result of the advice provided by the community. Most notably was the decision to re-locate the connection from Gelorup to Bussell Highway from Hasties Road to Centenary Road, and to re-align the BORR to avoid impacting the giant Tuart tree.

All CRG presentations were published on Main Roads website and minutes distributed to each CRG member.

No.	Submission and/or issue	Relevant submission
17	The proponents held a series of Community Reference Groups (CRGs) which were restricted in numbers. This presented limited opportunity. Information was not forthcoming from these meetings. It was believed that due process was occurring however, there was also apparently, a lack of effective communication, leading to community frustration.	43

Main Roads initiated a BORR CRG for the Project. To achieve fair and equitable representation on the CRG, nominations for membership were invited from residents, local businesses and community groups via print advertising in the local media, the project website and an e-mail broadcast to project subscribers.

All applications were considered and all those who nominated were accepted. There were approximately 30 members in the BORR Southern Section CRG.

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In March 2019 the BORR Southern Section CRG went into recess pending a decision on the corridor selection and reconvened in June 2019. The Southern CRG held its final meeting in December 2019. A total of 11 meetings were held with the BORR Southern Section CRG.

All CRG presentations are available on Main Roads website for all members of the public to access.

In addition to the CRG meetings, a series of community Drop-in sessions were held to raise community awareness and provide an opportunity for the community to meet senior members of the project team. Two sessions were held in Gelorup, 31 October 2018 and 22 August, 2019. A total of 286 people attended these two sessions.

No.	Submission and/or issue	Relevant Submissions
18	May I initially state my concern about the requirement to lodge this submission to the proponent as opposed to a Federal government department or agency. I trust my submission will reach the appropriate Federal body in its totality for the consideration of that body. Having to lodge this submission with the proponent makes a mockery of the option of lodging a confidential submission. The submission period closing just before Christmas requiring the community to make the time to lodge a submission during what is already a very busy time, adds insult to injury in the way this project has been handled by MRWA.	72

The concerns raised by the Confidential party number 72 are noted.

The EPBC environmental assessment process requires the proponent (Main Roads), rather than the DAWE, to seek public comment on an action being assessed under the Act. All submissions received by Main Roads have been provided to DAWE. Submissions received directly by DAWE have also been addressed in this document.

4.2. Threatened ecological communities and flora

4.2.1. TECs - General

No.	Submission and/or issue	Relevant Submissions
19	Clay Pans TEC No Clay Pans TEC recorded in the proposal area, so no direct impact considered. Report states no indirect impact as nearest is at a “notable separation distance” of 650m. This is close, what is the justification for ruling out any indirect impacts? The proponent has dismissed the need to consider this TEC further without any real justification why.	18, 43

As stated in Section 2.4.3 of the Preliminary Documentation, environmental surveys conducted for the Proposal did not identify the Clay Pans TEC within or adjacent to the Proposal Area (BORR IPT, 2020i).

Accordingly, the Proposal will not result in any direct impact to Clay Pans TEC vegetation. As noted, the nearest record for the Clay Pans TEC is located approximately 650 m north-east of the Proposal and is outside of the range of any anticipated indirect impacts (Figure 8, Appendix A of the Preliminary Documentation). Detailed targeted survey and inclusion in the assessment clearly document full consideration of Clay Pans TEC in the Preliminary Documentation.

As is stated in the conservation advice, Claypan TEC is reliant on rainfall, "The Clay Pans of the Swan Coastal Plain ecological community occurs in Western Australia where clay soils form an impermeable layer close to the landscape surface, and wetlands form that rely solely on rainfall to fill and then dry to impervious pans in summer." (p1, Approved Conservation Advice for Clay Pans of the Swan Coastal Plain).

The Proposal is not expected to result in indirect impacts to the Clay Pans TEC from changes in hydrology or any other indirect impacts and would have no direct impact on the community. An indirect impact is not expect as:

- The Proposal will not impact on rainfall levels or alter surface water hydrology in the vicinity of the Claypan TEC occurrence.
- Potential impacts on surface water hydrology will be minimised during the detailed design phase and implementation of the CEMP.
- Further, DBCA has advised that it is unlikely that the hydrology of the Clay Pan TEC occurrence will be impacted by this Proposal.

Regardless, this site has been included in the vegetation monitoring program as part of the conservative approach adopted for the Proposal. The site is anticipated to also inform Vegetation Monitoring of Clay Pans TEC already in progress for the BORR North and Central Sections Project. Monitoring of vegetation within Claypan TEC occurrences in the BORR Northern and Central section commenced in spring 2019 and is conducted bi-annually, in August and October. To date, vegetation monitoring has occurred in spring 2019, August 2020 and spring 2020. Monitoring comprises of transects and photopoints. The following parameters are assessed:

- Species diversity and cover
- Plant deaths
- Level of plant stress
- Ground characteristics (% bare ground, leaf litter, etc)
- Site conditions
- Evidence of erosion
- Vegetation community structure.

In addition to vegetation monitoring, drainage monitoring is also conducted quarterly at Claypan TEC occurrences to assess for changes in hydrology. Evidence of the following impacts are assessed:

- Flooding and / or inundation
- Erosion
- Drying of Claypan TEC vegetation.

Monitoring of groundwater and surface water is required and managed under the Vegetation Monitoring Program and will be included in the CEMP.

No.	Submission and/or issue	Relevant Submissions
20	MRWA presents no transparent, quantitative, scientific, ecologically defensible evidence, assessment or decision making to determine that the impact on both the TECs/PECs and the Priority species is not significant (p82, p84, BORR Team 2020a). This, considering that Threatened, particularly Critically Endangered, species and ecological communities, are so designated because they are so rare or infrequent or limited in extent or occurrence that they are likely to become extinct, is totally unacceptable, and this project should not be approved.	34

Results of targeted surveys for conservation significant flora and TECs/PECs undertaken for the Proposal have been included in the updated 2020 flora and vegetation survey report, which was appended to the Preliminary Documentation. Additional targeted surveys where relevant (e.g. for Clay Pans TEC) were also appended. Surveys undertaken for Banksia and Tuart Woodlands TEC/PEC have identified all occurrences of these communities and are considered sufficiently comprehensive to inform the assessment of the Proposal.

Surveys conducted for the Proposal were undertaken consistent with EPA policy and *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b), as well as the relevant Commonwealth Conservation Advice (TSSC, 2016; 2019). These guidance documents detail the methodologies and/or rigour to be used for field survey and data analysis. Further, assessment of impacts to TEC/PEC vegetation was undertaken according to the Commonwealth government's Significant Impact Guidelines 1.1 (DoE, 2013), which prescribes the required approach. Thus surveys, analyses and assessments conducted in accordance with these documents are considered to be transparent, quantitative, scientific, ecologically defensible.

Priority flora is not listed under the EPBC Act and therefore not assessed against DoE (2013), but rather was assessed under the relevant EPA process.

No.	Submission and/or issue	Relevant Submissions
21	MRWA states that 24.9 ha of the Banksia Woodlands of the Swan Coastal Plain TEC / PEC will be cleared, equating to 0.007% of the current extent remaining in the Swan Coastal Plain (p84 and p97, BORR Team 2020). MRWA indicates this area equates to <0.01% in the local regional context (p84, BORR Team 2020a). MRWA states that 4.4 ha of the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC / PEC which will be cleared, equating to up to 0.03 % of the current extent remaining in the Swan Coastal Plain, or up to 0.04% in the local regional area (p85 and p97, BORR Team 2020). MRWA states that the 4.5 ha of the Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa* woodlands PEC which will be cleared equates to approximately 0.03% of the current extent remaining in the Swan Coastal Plain (p86, BORR Team 2020).	34, 38

	Although MRWA's discussion of the regional context of clearing of the TECs does suggest that the proposed clearing is not significant, this is based solely on size of the extents, and does not consider condition, fragmentation, local extent of remnants and threats. These other factors need to be considered when determining whether the clearing is environmentally significant.	

In the Preliminary Documentation, Table 3-2 (for Banksia Woodlands TEC / PEC) and Table 3-6 (for Tuart Woodlands TEC / PEC) address the impact from fragmentation in regard to the threshold in the relevant conservation advice for each patch of TEC directly impacted by the Proposal. The assessment of each patch was conducted with respect to the extent of the impact, and condition of the vegetation to be cleared and retained in accordance with the conservation advice for Banksia Woodlands TEC / PEC (TSSC, 2016) and Tuart Woodlands TEC / PEC (TSSC, 2019). All occurrences of Banksia Woodlands TEC / PEC and Tuart Woodlands TEC / PEC remaining after Proposal implementation will still meet the criteria for the TEC. The viability of these occurrences is considered unlikely to change as a result of the Proposal.

The total amount of Commonwealth listed Tuart TEC that will be directly and indirectly impacted is 4.4 ha and 3.65 ha respectively. The 4.4 ha and 4.5 ha occurrences that contain Tuarts overlap.

The impact to the local extent of TEC remnants has been addressed through the information presented in Tables 3-2 and 3-6 (proportion of each occurrence directly impacted).

Regional impacts of the proposed action on TECs were assessed against the best available regional SWA02 IBRA subregion extent remaining data, as provided in the relevant conservation advice. Main Roads acknowledges that the conservation advice may not accurately reflect the amount of TECs remaining, however these documents provide the best available data and have been used in this context.

Fragmentation of TEC occurrences will occur as a result of the Proposal however not to the extent that the occurrences do not meet the criteria for inclusion in the TEC. At Centenary Road, the Proposal will divide the existing single Tuart Woodlands TEC occurrence into two occurrences, one to the north of Centenary Road and one to the south. The same separation of the existing Banksia Woodland TEC occurrence into a northern and southern occurrence will also occur in Gelorup.

Adjacent and near to Centenary Road, Tuart Woodlands TEC is situated within an agricultural landscape and as such is already subjected to edge effects, as is indicated by the 'Good-Degraded' vegetation condition. In the adjacent Kalgulup Regional Park (KRP) to the north of Centenary Road, Tuart vegetation is more intact and in better condition. As the Proposal is impacting only on the edge of this large occurrence, which is already currently impacted by edge effects, no further degradation of condition is expected to occur as a result of fragmentation.

Along the Gelorup Corridor, the adjacent Banksia Woodlands TEC occurs across privately owned small (approximately 2 ha) land holdings in a rural residential setting. Each landholder individually manages their property, and may or may not be aware of the presence of the TEC, and may or may not manage the vegetation for the conservation of the TEC. Each Lot has a firebreak, and the area is traversed by many local roads. As such, edge effects are already present throughout and the TEC condition is variable throughout. Similarly, the TEC occurrences at Marchetti Road, Jilley Road and adjacent to Centenary Road adjoin cleared agricultural land, and are therefore already subjected to edge effects, noting that the Marchetti and Jilley Road occurrences are in Excellent and Very Good-Excellent condition, respectively.

Main Roads has not claimed that indirect impacts to adjacent TEC occurrences will not occur. As is stated in Sections 3.1.1 and 3.1.2, "Indirect impacts to (Banksia and) Tuart Woodlands TEC potentially

resulting from Proposal implementation are expected to be restricted to the introduction and / or spread of weeds and Phytophthora dieback and damage through the accidental generation of a bushfire during construction."

In response to the risk of these indirect impacts, Main Roads has implemented a Vegetation Monitoring Program (PD Appendix J) and proposed a series of management actions (PD Table 4-3) to ensure vegetation condition does not decline as a result of Proposal-related impacts. These management actions are detailed within Main Roads Standard Scope of Work and Technical Criteria and will be included in the CEMP and are expected to sufficiently manage any indirect impacts.

No.	Submission and/or issue	Relevant Submissions
22	"With regard to stormwater in particular, WQPN41 also states that 'potentially contaminated stormwater, typically from paved areas where chemical residues or animal wastes may be present, should not discharge directly into surface water bodies, except during major storm events.' There are guidelines for this in the Stormwater management manual for Western Australia (reference 7d). This same plan reiterates 'that extreme care is needed where soils are disturbed or exposed on potential or confirmed 'contaminated sites.' (Department of Environment and Swan River Trust, 2005). It is not just the immediate TEC to be considered, it is that the threatened ecological community extends beyond the immediate location and from the 'Guidance note – Modification of a Threatened Ecological Community.' it should be noted that 'Whether there are any occurrences of threatened ecological communities adjacent to, nearby, downgradient, or downstream from the immediate location that may potentially be impacted should also be considered.' (page 6 or 15) (Department of Biodiversity, Conservation and Attraction, 2016) "	43

The Proposal may cause minor temporary (dewatering activities) change to groundwater levels associated with the Banksia Woodlands TEC and Tuart Woodlands TEC adjacent to the Proposal Area in the short term. Changes to surface water hydrology as a consequence of construction of the Proposal are considered unlikely.

A Drainage Strategy has been developed for the project with in-principle support from DWER (BORR IPT, 2019g). One of the main objectives of the strategy is "maintenance of existing water cycle balance within the project area whilst also improving the surface and groundwater quality". Drainage design will be undertaken at the detailed design stage to allow for pre-development flows to be maintained within the Proposal Area.

A drainage monitoring plan for TEC / PEC vegetation adjacent to the Proposal will be conducted in conjunction with the Vegetation Monitoring Program (Appendix J). Monitoring for changes to hydrology and drainage will be undertaken through a combination of visual assessments and assessment of data collected from monitoring wells. Analysis of data collected will aim to determine the impact, if any, of Proposal implementation in regards to groundwater levels and quality, and any resulting effect on TEC and PEC vegetation.

Potential impacts on inland waters will be minimised during the detailed design phase, and implementation of the *Conservation Significant Fauna AMP* (BORR IPT, 2020d) (Appendix M) and CEMP:

- Transverse drainage design will be developed at the detailed design stage to achieve the objective of maintaining the existing water cycle balance of the Proposal Area (i.e. minimising drainage shadow effects on surrounding wetlands, waterways, vegetation and agricultural properties) and prevention of adverse impacts to the existing built environment.
- In particular, detailed drainage design will consider requirements for fauna movement including fish passage (Black-stripe Minnow) under the constructed road (culverts or other) where appropriate.
- The risk of erosion and sedimentation during construction will be managed under a CEMP, and will include (but is not limited to) the following site-specific erosion and sediment controls:
  - Ensure there is no direct run-off to the adjacent watercourses and wetlands.
  - Install temporary erosion and sediment control measures and during bridge construction.
  - Design watercourse crossings to include erosion control and scour protection measures.
  - Prepare the Landscape Management Plan so that roadsides and medians will be vegetated and capable of acting as a biological filter for run-off.
- The risk of contamination from poor hydrocarbon and chemical management during construction will be managed under a CEMP which includes management measures outlined in Section 4.4, as well as the following:
  - Ensure there is a Spill Response Procedure for hazardous material spill events to ensure any spill is contained effectively and cleaned up appropriately.
  - Hydrocarbon storage and re-fuelling will not be permitted within 200 m of a natural watercourse or Conservation / Resource Enhancement wetland.
  - Storage of hydrocarbons on site will be within suitably designed containers within a bunded area.
- Implement an ASS Management Plan throughout construction of the Proposal. Compliance with the ASS Management Plan is required in the event of dewatering. Compliance will ensure correct dewatering methods, effluent management, effluent treatment, effluent disposal and monitoring requirements. The ASS Management Plan will be prepared in accordance with the *Overarching ASS Management and Dewatering Plan* prepared by BORR IPT (2020g).
- Minimise the risk of exposing existing contamination as described in
- The risk of erosion, sedimentation and spills of hazardous chemicals during operation of the Proposal will be managed through drainage design:
  - Erosion control will be applied at drainage discharge points.
  - Detention / infiltration basins where there is potential for discharge of hazardous spills into the major waterways.
- Monitoring of groundwater and surface water will be required and managed under both a CEMP, *Conservation Significant Fauna AMP* (Appendix M) and Vegetation Monitoring Program (Appendix J) and will include the following:
  - Baseline water monitoring event prior to commencing construction, which will be used to ascertain water quality performance criteria.

- Evidence of erosion on embankments to be monitored opportunistically and weekly during construction.
- Run-off from construction areas into wetlands and watercourses to be monitored opportunistically and weekly during construction.
- Daily surface water monitoring during construction over rivers.
- If dewatering is required:
    - Fortnightly groundwater and surface water monitoring by an Environmental Scientist.
    - Daily monitoring and reporting of dewater effluent, undertaken by the Contractor, with reference to specific trigger criteria (as outlined in the CEMP).
    - Twice per week groundwater monitoring undertaken by the Contractor.
- Monitoring as per individual ground and / or surface water abstraction and dewatering licence conditions (if required).
- Post-construction monitoring of surface and groundwater required.

No.	Submission and/or issue	Relevant Submissions
23	"There are specific conditions surrounding management of threatened ecological communities and the need for careful assessment before a proposal is implemented. From the 'Guidance note – Modification of an occurrence of a threatened ecological community', regarding authorisation, 4. Is the proposed action likely to modify an occurrence of a threatened ecological community?' (Dept of Biodiversity, Conservation and Attractions, 2016) The reportable decline rate is set at 20% and this would seem excessively high. What evidence is there to suggest that a TEC / PEC will recover from a 20% decline? (page 14). Will management measures be sufficient to address this issue and for how far post construction, will these measures be taken? "	43

The comment is in reference to Page 14 (Section 3.2 Reportable decline) of the *Vegetation Monitoring Plan* (Appendix J of the Preliminary Documentation). A change in the order of 20% is considered a reasonable maximum threshold at which to set the implementation of contingency actions. Management actions will also be implemented as required prior to any decline reaching this point. Thus, and noting Main Roads' extensive experience with successfully minimizing its indirect impacts for its large road projects, it is considered highly unlikely that any monitored parameters in monitored vegetation will decline by 20%. Regardless, vegetation monitoring has been designed to detect changes in monitoring parameters of less than 20%. Should changes be detected, causes will be investigated, and appropriate management actions will be implemented as necessary.

4.2.2. Banksia Woodlands TEC

No.	Submission and/or issue	Relevant Submissions
24	This proposal is going to clear up to 24.9 hectares (ha) of Banksia Woodland TEC. This is unacceptable. The proponent claims to have minimised the impact but in fact has the opportunity to potentially AVOID any impact by using the alternative route as outlined in the Southern Selection Alternative Alignment Environmental Impact Statement (June 2019). This route has the potential to clear 4.8 ha and has a much wider corridor which could allow for refinements to AVOID any impact.	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 35, 36, 37, 40, 41, 42, 44, 45, 46, 47, 49, 51, 52, 54, 55, 57, 58, 59, 60, 61, 63, 64, 65, 66, 67, 69, 70, 71, 72, 74, 75, 76, 77, 78, 79, 80, 81, 82

An Alignment Selection Study was undertaken to develop and ultimately compare two alignments to determine if there is an alternate alignment to the BORR Southern Alignment published in the GBRS. While environmental impacts were an important consideration in determining the feasibility of the alternate corridor, it was not the only factor that required consideration. As such, the report drew from a range of engineering and environmental studies as well as desktop review relevant planning policies and data that informs the planning of primary road networks.

Actions to be implemented to manage indirect impacts to remaining Banksia Woodlands TEC vegetation directly adjacent to the Proposal Area are detailed in Section 4.1.4 and Appendix J of the Preliminary Documentation. These actions are a combination of those included in the Main Roads Standard Scope of Work and Technical Criteria and those formulated in consideration of the specific TEC occurrences that will remain after Proposal implementation. It is expected that these actions will sufficiently manage any indirect impacts. As is detailed in Section 3.1.1 of the Preliminary Documentation, Proposal implementation is not expected to reduce the viability of any remaining Banksia Woodlands TEC occurrences.

Changes to the Proposal have been made since referral in September 2019 to reduce impacts to Banksia Woodlands TEC vegetation by 1.7 ha to 24.9 ha of impact. Changes to the design have included a range of refinements to minimise the impacts to the environment such as reducing median widths and changing the design of interchanges to reduce clearing requirements. The resulting Proposal reflects the minimum land area required for the road corridor.

No.	Submission and/or issue	Relevant Submissions
25	The corridor proposal is insufficient to protect remnant vegetation with an appropriate buffer zone (at least 20–50 m around patches of the ecological community) and prevent disruption during the construction process. Banksia Woodland Conservation Advice states that buffers of at least 20m-50m from the edge of patches of the ecological community and avoid activities that could cause significant hydrological change or eutrophication. Wider buffers may be required where there is larger scale landscape change, for example hydrological modifications. Given that the Southern BORR would qualify as a large landscape change, we believe	16, 17, 22, 38, 50, 58, 59, 61, 72, 79

	Main Roads WA has insufficient room within the development envelope to provide buffers for Banksia Woodlands adjacent to the freeway.	

Clearing for the Proposal has been minimised to the greatest extent possible and cannot be reduced further if the Proposal is to proceed. It was not possible to incorporate buffers into the Proposal footprint/design given that the Proposal Area is constrained within the road reserve gazetted under the Greater Bunbury Region Scheme. Main Roads has defined a potential indirect impact zone extending 20 m into adjacent TEC occurrences. This zone is in accordance with the Banksia Woodlands TEC conservation advice, which suggests buffers of between 20 m and 50 m in width. The Proposal comprises linear road infrastructure that is not erosion causing or sedimentation forming, and for which all stormwater will be contained within the footprint and access beyond the footprint will be controlled (through fencing).

The Proposal is being implemented by Main Roads, an organisation with many decades of experience in the effective monitoring and management of roadside vegetation. Through the development and implementation of industry-leading standards and practices, impacts to vegetation adjacent to construction and maintenance activities, rarely occur and if they do occur, rarely extend more than 5-10 m beyond the construction zone. The fact that much of the State's high-value remnant vegetation is contained within road reserves is testament to this.

For these reasons and based on the nature and scale of the Proposal, Main Roads considers a Banksia Woodland TEC buffer width of 20 m to be sufficient for the Proposal, and considers this to be in accordance with the conservation advice.

Main Roads will implement the Vegetation Monitoring Program, vegetation management actions as detailed in PD Table 4-3 and in the CEMP to detect and mitigate any impacts that may occur within this zone.

Buffers are as defined in the Banksia Woodland TEC conservation advice (TSSC, 2016) as part of determination of TEC patches. They are not development exclusion zones but rather relate to the consideration and management of potential indirect impacts to TEC occurrences. Buffers are not part of the ecological community and are not formally protected as MNES (TSSC, 2016). Potential indirect impacts to TEC occurrences resulting from the Proposal have been minimised where possible and assessed in the Preliminary Documentation.

No.	Submission and/or issue	Relevant Submissions
26	Whilst the proposal is planned to clear up to 24.9ha of Banksia Woodland TEC, it also places up to 38.8 ha at risk due to the proximity of 20 m of the proposal.	16, 17, 38, 58, 59, 61

To identify areas of higher risk and greater potential for indirect impacts proximate to the Proposal Area, the extent of Banksia Woodlands TEC within 20 m of the Proposal Area has been calculated and is presented in Table 2- 4 of the Preliminary Documentation. Considering the nature of the project Proposal (road construction), Main Roads' extensive experience in successfully avoiding indirect impacts on adjacent vegetation and that construction will be limited to the Proposal Area, the likelihood of indirect impacts from the introduction or spread of weeds on Banksia Woodlands TEC vegetation extending further than 20 m from the Proposal Area boundary resulting from the Proposal is negligible.

Actions to be implemented to manage indirect impacts to remaining Banksia Woodlands TEC vegetation directly adjacent to the Proposal Area are detailed in Section 4.1.4 of the Preliminary Documentation. The majority of these actions are a combination of those are included in the Main Roads Standard Scope of Work and Technical Criteria and have been those formulated in consideration of the specific TEC occurrences that will remain after Proposal implementation. It is expected that they will sufficiently manage any indirect impacts. As is detailed in Section 3.1.1 of the Preliminary Documentation, Proposal implementation is not expected to reduce the viability of any remaining Banksia Woodlands TEC occurrences.

To ensure the vegetation management objectives and targets detailed in the Preliminary Documentation are being achieved and determine whether management actions need to be reviewed and revised, Main Roads is proposing a Vegetation Monitoring Program (Appendix J of the Preliminary Documentation) covering TEC / PEC occurrences adjacent to the Proposal. The monitoring program comprises:

- TEC / PEC and other vegetation monitoring plan
- Drainage monitoring plan for TEC / PEC vegetation
- Triggers, thresholds and contingency actions for management of TEC / PEC vegetation.

The vegetation monitoring program will enable the detection of any indirect impacts to adjacent TEC occurrences, such as edge effects. The proposed management actions detailed Table 4-3 of the Preliminary Documentation (PD), will effectively manage these impacts should they occur.

Banksia Woodlands TEC adjacent to the Proposal Area is in varying condition. Along the Gelorup Corridor, the TEC occurs across privately owned small (approximately 2 ha) land holdings in a rural residential setting. Each landholder individually manages their property, and may or may not be aware of the presence of the TEC, and may or may not manage the vegetation for the conservation of the TEC. Each Lot has a firebreak, and the area is traversed by many local roads. As such, edge effects are already present throughout and the TEC condition is variable throughout.

Similarly, the TEC occurrences at Marchetti Road, Jilley Road and adjacent to Centenary Road adjoin cleared agricultural land, and are therefore already subjected to edge effects, noting that the Marchetti and Jilley Road occurrences are in Excellent and Very Good-Excellent condition, respectively.

Considering the above, as well as the nature and scale of the Proposal and Main Roads experience and standard of works as detailed above, the construction and operation of BORR is unlikely to further increase the existing edge effects in the adjacent TEC vegetation.

Main Roads will implement the Vegetation Monitoring Program, vegetation management actions as detailed in PD Table 4-3 (which include control of Declared weeds and WONS), and in the CEMP to detect and mitigate any impacts to Banksia Woodland TEC vegetation that may occur within the 20 m indirect impact zone.

No.	Submission and/or issue	Relevant Submissions
27	The proposal contravenes approved conservation advice (DEE 2016) which states that priority actions are recommended for the abatement of threats and to support recovery of the ecological community. Actions inconsistent with these recommendations that are likely to significantly affect the ecological community should not be undertaken.	16, 17, 22, 38, 50, 56, 58, 59, 61, 79

The Proposal will directly impact (clear) 24.9 ha of Banksia Woodland TEC/PEC at three occurrences. As shown in Table 3-2 of the Preliminary Documentation, all three occurrences will still meet the criteria for occurrences of TECs as specified in the conservation advice (TSSC, 2016) after clearing has occurred.

Changes to the Proposal design have been made since referral in September 2019 to reduce impacts to Banksia Woodlands TEC vegetation. As discussed in Section 1.3.6 of the Preliminary Documentation, changes to the design have included a range of refinements to minimise the impacts to the environment such as reducing median widths and changing the design of interchanges to reduce clearing requirements. The resulting Proposal reflects the minimum land area required for the road corridor. Impacts to MNES and other environmental values have been reduced to the maximum extent possible and the remaining impact cannot be avoided if the Proposal is to proceed.

The Proposal will be carried out in accordance with the management actions detailed in Section 4.1.4 of the Preliminary Documentation. These include management of aspects that have the potential to cause further degradation of the retained Banksia Woodlands TEC patches. This includes *Phytophthora* Dieback, weeds, topsoil and drainage management. Monitoring will be conducted according to the Vegetation Monitoring Plan, which is included in Appendix J of the Preliminary Documentation. Triggers and thresholds against which impacts will be measured are also detailed therein, along with proposed contingency measures.

As is detailed in Section 3.1.1 of the Preliminary Documentation, Proposal implementation is not expected to reduce the viability of any remaining Banksia Woodlands TEC occurrences as defined in the Conservation Advice (TSSC, 2016). While the Banksia Woodland TEC occurrence in Gelorup will be divided into a northern and southern occurrence as a result of the Proposal, the viability of these occurrences is considered unlikely to change as a result of the Proposal.

The vegetation monitoring program will enable the detection of any indirect impacts to adjacent TEC occurrences, such as edge effects. The proposed management actions detailed in Table 4-3 of the PD will effectively manage these impacts should they occur.

Banksia Woodlands TEC adjacent to the Proposal Area is in varying condition. Along the Gelorup Corridor, the TEC occurs across privately owned small (approximately 2 ha) land holdings in a rural residential setting. Each landholder individually manages their property, and may or may not be aware of the presence of the TEC, and may or may not manage the vegetation for the conservation of the TEC. Each Lot has a firebreak, and the area is traversed by many local roads. As such, edge effects are already present throughout and the TEC condition is variable throughout.

Similarly, the TEC occurrences at Marchetti Road, Jilley Road and adjacent to Centenary Road adjoin cleared agricultural land, and are therefore already subjected to edge effects, noting that the Marchetti and Jilley Road occurrences are in Excellent and Very Good-Excellent condition, respectively.

Considering the above, as well as the nature and scale of the Proposal and Main Roads experience and standard of works as detailed above, the construction and operation of BORR is unlikely to further increase the existing edge effects in the adjacent TEC vegetation.

Main Roads will implement the Vegetation Monitoring Program, vegetation management actions as detailed in Table 4-3 of the PD (which include control of Declared weeds and WONS), and in the CEMP to detect and mitigate any impacts to Banksia Woodland TEC vegetation that may occur within the 20 m indirect impact zone.

No.	Submission and/or issue	Relevant Submissions
28	According to SSAIPD Table 3-1 p89, the vegetation condition for the southern end of Marchetti Road, (BW-S-D-3) is rated 'excellent', one of few locations to be rated this, whilst the land immediately to the south, is degraded. This location (BW-S-D-3) is classified as Banksia Woodlands (VT2) immediately abutting Environmentally Sensitive Areas. Given the degraded nature of the land immediately south of this patch, it is questionable as to why the road cannot be moved further to the south and avoid any destruction of this woodland.	38, 50

The corridor is wider at this location to allow for the Jilley Road connection to Ducane Road, allowing access to the severed lot on the northern side of the alignment. The inclusion of access to the northern side of the alignment is necessary to reduce the impact on the local community and provide bushfire egress. The alignment cannot be moved any further south at this location as the alignment needs to tie into the existing road reserve through Gelorup. Any modification at this point would result in greater impacts in other locations. Impacts on the patch are 0.5 ha and have been minimised to the maximum extent practicable, leaving > 8 ha (> 94 %) of the total patch extent remaining.

The final design will investigate options to avoid this occurrence, but the approach taken conservatively was that the Proposal would require clearing of all vegetation within the Proposal Area. Final design protocol is to avoid and minimise all occurrences of TEC / PEC and remnant native vegetation where possible. As final design has not yet been completed, Main Roads cannot commit to changes without a more detailed design review of the engineering and safety constraints of realignment.

The Alignment Selection Report, previously acknowledged by DAWE, considered viable alignment alternatives to the alignment identified in the Greater Bunbury Region Scheme (this action). The alignment selection process concluded that the proposed action currently under consideration by DAWE was the preferred alignment.

No.	Submission and/or issue	Relevant Submissions
29	Due to a re alignment of definitions between Commonwealth and State entities, vegetation mapped within the proposal area was formerly known as 'Banksia Woodland PEC'. It is predicted that 24.9ha of Banksia Woodlands TEC / PEC will be cleared. Table 4-10 (page 70) predicts a loss of 90% for BW-S-D-1, leaving only 10% approx. 2.4ha. Table 3-2 (page 89) of the preliminary documentation, states that for BW-S-D-2, only 1.7ha or 37% will be retained, after the removal of 2.9 ha of a 4.6 ha patch. This patch will be fragmented from the other two patches and will be less than half of its pre-clearing existence. In a definition taken from the Guidance note – Modification of an occurrence of a threatened ecological community, an action with regards to a major reduction in the extent of an occurrence… 'The proportion of the occurrence of the threatened ecological community to be destroyed is significant, for example more than 10 percent of the occurrence, or…' (Dept of Biodiversity,	43, 50

	Conservation and Attractions, 2016). In the case of BW-S-D-1 (90%) and BW-S-D-2(63%) to be cleared, this is clearly the case and clearly exceeds 10%.	

When considering significance related to modification of an occurrence, the guidance note defines modification through clearing of an occurrence based on three potential criteria:

- the area of the occurrence destroyed is considered to be significant compared to the size of other occurrences of the threatened ecological community, or
- the proportion of the occurrence of the threatened ecological community to be destroyed is significant, for example more than 10 percent of the occurrence, or
- the remaining area of the occurrence of the threatened ecological community will not retain the structure and composition that it had prior to the action.

When considering modification of an occurrence, the context of the occurrence relative to other local occurrences, the percentage of the occurrence cleared (with 10% as an example and not a definitive criterion), and the function of the retained occurrence all represent criteria to be considered.

In the case of BW-S-D-1, the occurrence forms part of a large expanse (> 100 ha) of Banksia Woodlands in a rural residential setting. As such, while the impact to the mapped extent is 90%, the per cent loss of full extent is closer to 20% and the patch would still retain substantial size, structure, and composition in the local context. The patch is also a larger patch relative to other patches in the local area and should be considered accordingly. For BW-S-D-2, the impact is 37%, noting that the patch is contextually small (4.6 ha) and that the functional structure and composition is retained to qualify as an occurrence of the TEC (TSSC, 2016). As such at a patch level, impacts to both patches are potentially significant.

In the overall context of impacts at the patch level, no occurrences of Banksia Woodlands TEC will be fragmented by the Proposal to the extent that they no longer represent occurrences of the TEC under the criteria specified by the TSSC (2016). Further, no occurrences of Banksia Woodlands TEC vegetation are expected to be indirectly impacted to the extent that these no longer represent their respective Floristic Community Type.

While the Banksia Woodland TEC occurrence in Gelorup will be divided into a northern and southern occurrence as a result of the Proposal, the viability of these occurrences is considered unlikely to change as a result of the Proposal.

The vegetation monitoring program will enable the detection of any indirect impacts to adjacent TEC occurrences, such as edge effects. The proposed management actions detailed in will effectively manage these impacts should they occur.

Banksia Woodlands TEC adjacent to the Proposal Area is in varying condition. Along the Gelorup Corridor, the TEC occurs across privately owned small (approximately 2 ha) land holdings in a rural residential setting. Each landholder individually manages their property, and may or may not be aware of the presence of the TEC, and may or may not manage the vegetation for the conservation of the TEC. Each Lot has a firebreak, and the area is traversed by many local roads. As such, edge effects are already present throughout and the TEC condition is variable throughout.

Similarly, the TEC occurrences at Marchetti Road, Jilley Road and adjacent to Centenary Road adjoin cleared agricultural land, and are therefore already subjected to edge effects, noting that the Marchetti and Jilley Road occurrences are in Excellent and Very Good-Excellent condition, respectively.

Considering the above, as well as the nature and scale of the Proposal and Main Roads experience and standard of works as detailed above, the construction and operation of BORR is unlikely to further increase the existing edge effects in the adjacent TEC vegetation.

Main Roads will implement the Vegetation Monitoring Program, vegetation management actions as detailed in Table 4-3 of the PD (which include control of Declared weeds and WONS), and in the CEMP to detect and mitigate any impacts to Banksia Woodlands TEC vegetation that may occur within the 20 m indirect impact zone.

At a regional level, the Banksia Woodlands TEC conservation advice (TSSC, 2016) estimates that > 335,000 ha of Banksia Woodlands TEC remains, with more than 253,000 ha remaining on the SCP. Based on this, the clearing of up to 24.9 ha (direct impact), would result in a reduction of up to 0.007 % in the reported extent of the Banksia Woodlands TEC. Accordingly, assessment against the Commonwealth significant impact criteria (DoE, 2013) for 'Critically Endangered' and 'Endangered' ecological communities indicate impacts on Banksia Woodlands TEC are not significant.

No.	Submission and/or issue	Relevant Submissions
30	The SSAIPD relating to Extent of Banksia Woodlands TEC/PEC is taken from the Conservation Advice from 2016. These figures are now over four years old and given the rate of decline in vegetation, may have changed substantially.	38

The calculations are based on the most recent available data (2016, as presented in the conservation advice), which is considered the most appropriate measure of the extent of Banksia Woodlands TEC/PEC.

No.	Submission and/or issue	Relevant Submissions
31	The proponent states that approximately 34 ha of Banksia Woodlands TEC/PEC is within the 350 ha Surveyed Area and that 34 ha are within the survey area and 24.92 is within the proposal area, earmarked for clearing. Further to this, that this potential loss of 24.92 ha, equates to 0.007% of the 'known TEC extent' (regional) when all protected reserves are considered. This equation needs further investigation as to what exactly is the local proportion. The SSAIPD highlights that there is significantly higher potential loss of Banksia Woodlands TEC/PEC associated with the BORR Southern Section than with the BORR Northern and Central sections combined.	38, 50, 56

The Proposal will directly impact (clear) 24.9 ha of Banksia Woodland TEC / PEC at three occurrences. As shown in Table 3-2 in the Preliminary Documentation, all three occurrences will still meet the criteria as specified in the conservation advice after clearing has occurred.

The calculations of regional presence of Banksia Woodland TEC / PEC are estimated based on the total known extent and the Perth SWA02 subregion (TSSC, 2016) (Table 2-4 of the Preliminary Documentation). Based on these calculations, the Proposal would result in a reduction of up to 0.007 % of the total extent (> 335,000 ha) and < 0.01 % of the regional extent (> 253,000 ha), as discussed in

Section 3.1.1 of the Preliminary Documentation. 34 ha of the TEC/PEC was recorded within the BORR Southern Section survey area (that totaled 350 ha), which provides local context for the extent of the TEC / PEC adjacent to the Proposal Area.

The submission compares local impacts for BORR Southern Section to BORR Northern and Central Sections, which is problematic in that the landscape contexts of both corridors are different.

Local scale is variable for each MNES depending on the context and surrounding landscape relevant to the Proposal. For Banksia Woodland TEC / PEC, the conservation advice (TSSC, 2016) does not define a metric for local context. While evaluation of the context of MNES requires a minimum 2 km buffer from the Proposal to evaluate context, the analysis looked at the local extent of Banksia Woodland TEC / PEC within a 5 km radius of the Proposal Area.

No.	Submission and/or issue	Relevant Submissions
32	MRWA's data and methodology is biased and not fit for purpose; MRWA must use a more detailed methodology to quantify the relative importance of the clearing of 24.9 ha of Banksia Woodlands TEC/PEC. MRWA's discussion of the regional context of clearing of the Banksia Woodland TEC (p 84, BORR Team 2020) does not consider the condition, fragmentation and threats across the full extent of the TEC/PEC's range. This is a major weakness in the presentation of data used for assessment and fails to offer an accurate representation of the condition of the TEC across the range. MRWA's simplistic approach essentially assumes that occurrences of the TEC/PEC throughout the range are in the exact same condition, are not impacted by fragmentation and that threats facing the TEC/PEC are of negligible importance. A more appropriate approach would be to include detailed discussion and evaluation of the dispersion of patches across the range and the effects of the present-day distribution of this TEC/PEC on its long-term survival. Further, MRWA's discussion of the regional context of clearing of this TEC/PEC could be considered negligent for failing to engage with the existential threat of climate change on vegetation communities across the south west of Western Australia. MRWA has largely ignored central conservation concerns relating to the condition, fragmentation and threats across the full extent of the TEC/PEC's range, in order to present its case as favourably as possible. MRWA needs to collect and provide detailed data relating to condition, fragmentation and threats across the full extent of the TEC/PEC's range. DAWE should condemn MRWA for a lack of transparency in the data and discussion provided and direct the Proponent to conduct further works across the entire range of this TEC/PEC in order to better quantify and qualify the impacts of the proposal on the long-term health and survival of this TEC/PEC.	56

Surveys conducted for the Proposal were done in accordance with the EPA Technical Guidance Banksia Woodlands TEC Conservation Advice (TSSC, 2016), the latter of which sets out the methodology for determination of TEC occurrences. An assessment of the condition, fragmentation and threats across

the full extent of the TEC / PEC's range is not a requirement under either the Technical Guidance or the conservation advice, nor is it feasible for such an assessment to be undertaken.

The conservation status of the community (i.e. its listing as a TEC) was determined based on the TSSC's cumulative assessment of these and other factors, thus these factors have been effectively considered at the community scale.

As discussed in further detail under responses to Submissions #21 and #27, Table 3-2 of the Preliminary Documentation address the impacts from fragmentation in regard to the threshold in the conservation advice for each patch of Banksia Woodlands TEC / PEC directly impacted by the Proposal. All data collected for TECs / PECs was included for Public Review in Appendix C (*Bunbury Outer Ring Road Southern Section Vegetation and Flora Study*) of the Preliminary Documentation.

The impact assessment undertaken for the Banksia Woodlands TEC / PEC addressed the current status (extent remaining, according to the most recent data available) as well as both direct and indirect threats (including fragmentation) in accordance with the EPBC Act Significant Impact Guidelines 1.1. The impact assessment undertaken for the Proposal is considered adequate.

No.	Submission and/or issue	Relevant Submissions
33	MRWA must undertake further work to provide transparent baseline data on the broader significance of the Banksia Woodlands within and beyond the Proposal Area to facilitate a proper technical assessment of the indirect impacts of the proposal on adjacent vegetation and habitat. The Proponent has outlined the full extent of the survey efforts used to inform the assessment of impacts in Section 5.3.1 of the Flora and Vegetation Study. From the information provided, it appears that only one targeted survey for this TEC/PEC has been conducted, although no useful description of this survey is made available throughout the AIPD or appendices.	56

An excerpt from Table 2-3 of the Preliminary Documentation and description of the previous and additional studies vegetation and flora surveys conducted for the Proposal is provided below.

This work includes targeted vegetation community surveys of the Proposal Area in the spring season of 2014, 2018, and 2019 that informed the mapping of TECs within the Proposal Area. While only one round of targeted surveys has occurred since the listing of the Tuart Woodlands TEC in 2019, sufficient survey effort of Tuart communities prior to the listing in 2014 and 2018 has suitably informed the further targeted mapping that occurred in 2019.

Results of targeted TEC / PEC surveys undertaken for the proposal have been included in the updated 2020 flora and vegetation survey report, which was appended to the Preliminary Documentation. Additional targeted surveys where relevant (e.g. for Clay pans TEC) were also appended. Surveys undertaken for Banksia Woodlands TEC / PEC and Tuart Woodlands TEC / PEC have identified all occurrences of these communities and are considered sufficiently comprehensive.

Additionally, as part of the Proposal Vegetation Monitoring Program, in order to enable the future determination and assessment of potential indirect impacts resulting from the Proposal, baseline vegetation condition information has been and continues to be collected at all TEC / PEC occurrences adjoining the Proposal Area boundary.

Appropriate management of surface water hydrology will also be included in the CEMP. The Proposal is located 650 m away from the Clay Pan TEC. The Proposal will not impact on rainfall levels or alter surface water hydrology in the vicinity of the Claypan TEC occurrence.

Transverse drainage design will be developed at the detailed design stage to achieve the objective of maintaining the existing water cycle balance of the Proposal Area. Appropriate management of surface water hydrology will also be included in the CEMP.

Monitoring of vegetation within Claypan TEC occurrences in the BORR Northern and Central section commenced in spring 2019 and is conducted bi-annually, in August and October. To date, vegetation monitoring has occurred in spring 2019, August 2020 and spring 2020. Monitoring comprises of transects and photopoints. The following parameters are assessed:

- Species diversity and cover
- Plant deaths
- Level of plant stress
- Ground characteristics (% bare ground, leaf litter, etc)
- Site conditions
- Evidence of erosion
- Vegetation community structure.

In addition to the above, drainage monitoring is conducted quarterly at Claypan TEC occurrences to assess for changes in hydrology. Evidence of the following impacts are assessed:

- Flooding and / or inundation
- Erosion
- Drying effects.

Monitoring of groundwater and surface water is required and managed under the Vegetation Monitoring Program and will be included in the CEMP.

Indirect impact to Banksia and Tuart Woodlands TEC / PEC from changes in hydrology is not expected. Altering existing flow paths has the potential to negatively impact the hydrological regime (most notably drying) of TEC / PEC occurrences. Through implementation of the Drainage Strategy developed for the Proposal (BORR IPT, 2019g), and the management actions listed in Table 4.3, existing drainage patterns to adjacent TEC / PEC vegetation will be maintained. Impacts from changes to flow paths are therefore not expected to result from the Proposal.

Table 2-3. Studies and surveys relevant to the Proposal (*Excerpted from the preliminary documentation*)

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODOLOGY
Surveys undertaken for the Proposal prior to referral		
Vegetation and Flora		
Bennett Environmental Consulting Pty Ltd (2003)	Vegetation and flora assessment of selected areas along the Bunbury Outer Ring Road and Port Access Road	Vegetation and flora assessment

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODOLOGY
Bennett Environmental Consulting Pty Ltd (2008)	Assessment of significant flora along the proposed Bunbury Ring Road	Targeted significant flora assessment
Report for Bunbury Outer Ring Road (Stage 1) and Port Access Road (Stage 2) – Flora and Vegetation Spring Survey (GHD, 2009)	Flora and vegetation survey within the Bunbury Outer Ring Road (Stage 1) and Port Access Road (Stage 2) survey areas	Vegetation and flora assessment
Lot 1 Ducane Road Environmental Values Assessment (GHD, 2014)	Flora and vegetation assessment of Lot 1 Ducane Road conducted on 13 June 2013. The area assessed vegetation types and floristic diversity for Lot 1 Ducane Road, which is partly located within the Proposal Area.	The assessment described the vegetation types present and their conditions and also searched for conservation significant flora
BORR South Flora Survey (GHD, 2015b)	Survey for BORR South Proposal Area. This occurs immediately south of the current Surveyed Area and is used to provide context. Two quadrats are within the current Surveyed Area.	Survey completed on 21 – 23 September 2011 and 16 – 18 June 2014. Level 2 flora and vegetation survey including quadrat sampling, targeted searches and vegetation type / condition mapping.
Waterloo Urban and Industrial Expansion Flora and Fauna Survey (GHD, 2015c)	Approximately 2,700 ha between Collie River and approximately Boyanup Picton Road. The study boundaries overlap the current Surveyed Area	Two season flora survey in accordance with EPA guidelines at the time of survey (EPA, 2004b). Late winter (13 – 14 August 2014) and mid-spring (30 – 31 October 2014). Vegetation type and condition mapping based on quadrats and opportunistic records. Searches for conservation significant flora.
Reassessment of Floristic Communities (Biota, 2016)	Targeted areas within BORR South alignment. Two quadrats are within the current Surveyed Area.	Additional quadrats and re-analysis of the FCTs presented in GHD (2015b). Surveys carried out in September 2016.
Report of a Targeted Rare Flora Survey for *Diuris drummondii* along four sections of the Bunbury Outer Ring Road proposed alignment (Ecoedge, 2017)	Targeted assessment on 19 and 30 November 2016 of portions of the BORR South proposed alignment that provide suitable habitat for *Diuris drummondii*. A total of 18.6 ha was searched, however no *D. drummondii* plants were found.	The survey was completed in accordance with the Commonwealth's Draft Survey Guidelines for Australia's Threatened Orchids (Commonwealth of Australia, 2013). A known population of the species nearby was used as a reference to determine when flowering had commenced and optimal timing for the survey.

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODOLOGY
Banksia TEC Assessment for BORR South (Biota, Bunbury Outer Ring Road Southern Section - Banksia Woodlands TEC Assessment., 2018c) – included in (BORR IPT, 2020i))	24 target areas within BORR South area and surrounds. This report also provides context for the Banksia TEC assessment. Three target sites are located south-west of the current Surveyed Area. The closest target site is approximately 3 km south-west of the current Surveyed Area.	Walking transects and quadrats within the target sites conducted in November 2017
A Flora and Vegetation survey on Lot 104 **Willinge Drive Davenport (Ecoedge, 2018)**	Survey of the 83.3 ha within Lot 104 (North east of the Preston River). The study boundary intersects the Proposal Area.	Survey carried out on 30 October and 2 and 3 November 2017. Vegetation type and condition mapping and species lists presented.
Assessment for the presence of *Phytophthora cinnamomi* - Bunbury Outer Ring Road, Stage 2 (Glevan Consulting, 2011)	BORR Southern Section alignment	Visual diagnosis of disease within areas of assessable remnant vegetation
BORR Northern and Central Sections Vegetation and Flora Study (BORR IPT, 2020c)	Detailed flora and vegetation assessment of 1,128 ha, including the Proposal Area. This occurs immediately north of the Proposal Area and is used to provide context.	Detailed vegetation and flora survey was undertaken from 20 August 2018 to 19 December 2018. Targeted surveys were undertaken from 19 to 30 August 2019. The survey included late winter, early spring, mid-spring, late spring and summer survey periods.
Bunbury Outer Ring Road South Alternate Section Vegetation and Flora Study (BORR IPT, 2019a)	Detailed flora and vegetation assessment	Detailed flora and vegetation survey and targeted survey. The surveys were undertaken from 22-25 October 2018 and on 18 November 2018. Surveys included quadrat sampling to determine vegetation types and presence of Threatened and Priority Ecological Communities, as well as targeted surveys for conservation listed flora and weeds.
Further surveys undertaken for Proposal following referral to provide supplementary information		
Vegetation and Flora		
Bunbury Outer Ring Road Southern Section Vegetation and Flora Study (BORR IPT, 2020i)	Detailed flora and vegetation assessment	Detailed flora and vegetation survey and targeted survey. The surveys included August (late winter/ early spring) and September 2018 (spring). A targeted orchid survey of selected sites was completed in August and

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODOLOGY
		September 2019. A targeted *D. drummondii* (Tall Donkey Orchid) survey was also completed in 19 November and 30 November 2016 and 30 November 2019. In addition a targeted survey for TECs/PECs, including Tuart TEC, and confirmation of vegetation types in previously unsurveyed gaps in the survey area was also undertaken in September 2019.
A Review of the Regional Conservation Status of a Clay-based Wetland Community (Claypans) (Ecoedge, 2019a)	Region defined as on the SCP within Harvey, Bunbury, Capel, Dardanup and Busselton local government areas	Desktop review and targeted field assessments for Claypan TECs conducted in 26 July – 1 August 2019 to provide additional information requested in Section 40(2)(a) Notice.
Memorandum of a Targeted Rare Flora Survey for *Diuris drummondii* within and adjacent to the Bunbury Outer Ring Road South referral area (Ecoedge, 2019b)	Targeted Rare Flora Survey for *D. drummondii* within and adjacent to the Bunbury Outer Ring Road South referral area	Survey conducted in accordance with the Commonwealth's Draft Survey Guidelines for Australia's Threatened Orchids (Commonwealth of Australia, 2013)
Review of Potential Claypan Occurrences in the BORR Southern Section – included in (BORR IPT, 2020i)	Within the locality of the BORR Southern Section alignment	Survey carried out on 1 August 2019. Condition, hydrology and species diversity were assessed to confirm whether the vegetation met the floristic and condition thresholds of the Claypan TEC. Results are documented in an updated revision of the Flora and Vegetation Study for the Proposal to informed the avoidance, management, mitigation and monitoring actions to provide additional information requested in Section 40(2)(a) Notice.
***Phytophthora* Dieback Survey Bunbury Outer Ring Road South (Great Southern Bio Logic Pty Ltd, 2020)**	*Phytophthora* dieback survey of the Bunbury Outer Ring Road southern section alignment	Survey undertaken in accordance with DBCA guidelines

No.	Submission and/or issue	Relevant Submissions
34	In relation to Patch 1, the Proponent has selected a survey site which strictly overlaps with the vegetation to be cleared (Appendix J, Figure 11, Page 4 of	56

	4). It is clear from the map provided that the densely populated areas of the TEC/PEC which are immediately adjacent to the development envelope (particularly the western, southern and northernmost parts of the Patch) would suffer serious reductions in their ecological integrity and biological diversity due to broadscale clearing through this section of the development. These impacts range from direct to indirect, which are key considerations for DAWE's assessment. The deep excavation and uprooting of vegetation will have a severe direct impact on the adjacent vegetation by permanently altering the substrate on which this TEC/PEC occurs. CCWA notes that the Proponent has failed to characterise or even acknowledge this impact appropriately in the AIPD, and therefore has not proposed any relevant or practical mitigation approaches to ameliorate this impact.	

The Preliminary Documentation identifies "Patch 1" as BW-S-D-1 and recognises the occurrence forms part of a large expanse (> 100 ha) of Banksia Woodlands in a rural residential setting consisting of Reserve 23000 and areas to the north and south of Patch 1. The Preliminary Documentation identifies the associated indirect impact Site BTW-S-I-4 (within Reserve 23000 to the west of Patch 1) is more than 100 ha, of which less than 3.4 % is within 20 m of the Proposal. Site BTW-S-I-4 will be monitored for potential indirect impacts as part of the Vegetation Monitoring Program (Appendix J of the Preliminary Documentation).

As is stated in Section 3.1.1 of the Preliminary Documentation, the Proposal may cause minor temporary (dewatering activities) change to groundwater levels associated with the Banksia Woodlands TEC adjacent to the Proposal Area in the short term. Changes to surface water hydrology as a consequence of construction of the Proposal are considered unlikely.

A Drainage Strategy has been developed for the project with in-principle support from DWER (BORR IPT, 2019g). One of the main objectives of the strategy is "maintenance of existing water cycle balance within the project area whilst also improving the surface and groundwater quality". Drainage design will be undertaken at the detailed design stage to allow for pre-development flows to be maintained within the Proposal Area.

A drainage monitoring plan for TEC / PEC vegetation adjacent to the Proposal will be conducted in conjunction with the Vegetation Monitoring Program (Appendix J of the Preliminary Documentation). Monitoring for changes to hydrology and drainage will be undertaken through a combination of visual assessments and assessment of data collected from monitoring wells. Analysis of data collected will aim to determine the impact, if any, of Proposal implementation in regards to groundwater levels and quality, and any resulting effect on TEC and PEC vegetation. Management actions necessary to mitigate any resulting impact will be implemented in accordance with the Vegetation Monitoring Program.

No.	Submission and/or issue	Relevant Submissions
35	MRWA has not proposed a commensurate level of mitigation; MRWA's proposed mitigation approaches are not sufficiently enforceable; MRWA needs to provide an additional enforceable range of mitigation and monitoring strategies capable of countering the significant impact of the proposal and the repercussions of the environmental damage caused over long term (100-year timescale).	56

	The mitigation approaches that the Proponent has proposed are largely insignificant, and their scope has been poorly defined. All the Proponent's mitigation approaches are proposed to occur within a very limited timescale (during the construction phase of the project) and are not commensurate with the longer timescale over which the significant risks to the adjacent vegetation in this TEC/PEC are likely to occur. For example, the Proponent's Construction Environmental Management Plan (CEMP) and the Hygiene Management Plan (HMP) relate only to minimising risks during the period of the construction phase and will presumably cease to have any effect after the construction phase. Similarly, there are no measurable outcomes provided relating to the development of a Landscape Management Plan (LMP) or proposed methods to ensure its effectiveness to curtail the effects of run-off over the long term, for example, in the event of flooding. The Proponent has cited "mitigation of indirect impacts to vegetation" as one of its standalone mitigation measures, however, there has been no information provided whatsoever to describe this measure or how it could be useful.	

Potential direct Proposal impacts have been minimised through design, and will be further minimised where possible during the detailed design phase. Main Roads has proposed environmental offsets for unavoidable direct impacts to MNES. Potential indirect impacts have been considered and assessed within the Preliminary Documentation. The associated proposed mitigation measures have been developed commensurate with the potential risks and consequences of these potential impacts, and are considered adequate.

The proposed Vegetation Monitoring Program has been designed to ensure early detection of any indirect impact, including any impact from flooding, thus enabling the timely implementation of management and contingency actions. The Vegetation Monitoring Program specifies the continuation of monitoring activities for a minimum of two years beyond the construction phase, and longer if required. Triggers, thresholds and contingency actions that will be implemented should monitoring indicate a decline in monitored parameters are detailed in the Vegetation Monitoring Program (Appendix J of the Preliminary Documentation).

Management actions relating to the mitigation of indirect impacts to TEC/PEC vegetation are detailed in Table 4-3 of the PD.

4.2.3. Tuart Woodlands TEC

No.	Submission and/or issue	Relevant Submissions
36	This proposal will clear up to 4.9 hectares of Tuart Woodlands TEC. This is unacceptable. The proponent claims to have minimised the impact but in fact has an alternative route which would have the capacity to avoid ANY clearing (Southern Selection Alternative Alignment Environmental Impact Assessment June 2019). The stated impact in this document would be 0.4 ha and given the wide	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 34, 35, 36, 37, 40, 41, 42, 44, 45, 46, 47, 49, 51, 52, 54, 55, 57, 58, 59, 60, 61, 63, 64, 65, 66, 67, 69, 70, 71, 72, 74, 75, 77, 78, 80, 81, 82

	corridor available, it is likely this could be AVOIDED completely.	

An Alignment Selection Study was undertaken to develop and ultimately compare two Alignments to determine if there is an alternate Alignment to the BORR Southern Alignment published in the GBRS. While environmental impacts were an important consideration in determining the feasibility of the alternate corridor, it was not the only factor that required consideration. As such, the Report drew from a range of engineering and environmental studies as well as desktop review relevant planning policies and data that informs the planning of primary road networks.

Changes to the Proposal have been made since referral in September 2019 to reduce impacts to Tuart Woodlands TEC vegetation. The direct impact to Tuart Woodlands TEC will be 4.4 ha. Changes to the design have included a range of refinements to minimise the impacts to all MNES, such as reducing median widths and changing the design of interchanges to reduce clearing requirements. The resulting Proposal reflects the minimum land area required for the road corridor. To counterbalance remaining potentially significant residual impacts, offsets are proposed for Tuart Woodlands TEC.

Following referral of the Proposal to the Commonwealth, Main Roads undertook a comprehensive review of the design and revised the infrastructure components and the Proposal Area with the objective to reduce the potential impacts to key environmental values, including:

- Conservation significant fauna taxa, specifically WRP, BSM and BTP.
- TECs and PECs, specifically Banksia Woodlands TEC / PEC, Tuart Woodlands TEC / PEC and Tuart-Peppermint Woodland PEC.

From Centenary Road to Lilydale Road these refinements included:

- Main alignment amended to further avoid areas of vegetation and fauna habitat
- Reduced median width to minimise impacts on vegetation
- Batter slopes steepened to minimise width of clearing
- Access track off Centenary Road designed in a cleared area
- Jules Road connection redesigned to reduce clearing impacts.

These changes represent the full extent of possible design alterations at the time of completion. Additional avoidance is not possible. Main Roads has assumed the full extent of impacts based on the concept design as it currently stands.

No.	Submission and/or issue	Relevant Submissions
37	MRWA must undertake a full investigation of alternative design concepts to avoid any clearing of this critically endangered TEC/PEC. Threatened, particularly Critically Endangered, species and ecological communities, are so designated because they are so rare or infrequent or limited in extent or occurrence that they are likely to become extinct. Any impact which causes considerable losses within a local area is totally unacceptable as it is likely to make the threat of extinction even more severe. This area contains large numbers of trees significant for their habitat, cultural and aesthetic value. CCWA emphatically urges MRWA to undertake a full investigation to ensure all possible alternative design concepts, which avoid	50

	clearing of this critically endangered TEC/PEC, are genuinely considered and pursued.	

As required under the EPBC Act and by the WA EPA (precautionary principle approach) Main Roads has sought to avoid, minimise, reduce, rehabilitate and offset environmental impacts to Tuart Woodlands TEC/PEC. The extent of clearing associated with the Proposal has been refined to avoid Tuart Woodlands TEC/PEC along with other TECs, PECs, and habitat supporting conservation significant species. Further effort to refine the Proposal to avoid Tuart Woodlands TEC/PEC will continue to be undertaken where possible through detailed design.

No.	Submission and/or issue	Relevant Submissions
38	The proposal contravenes approved conservation advice (TSSC 2019) which states that priority actions are recommended for the abatement of threats and to support recovery of the ecological community. Actions inconsistent with these recommendations that are likely to significantly affect the ecological community should not be undertaken.	14, 16, 17, 22, 32, 38, 50, 56, 58, 59, 61, 72, 79

Up to 4.4 ha of vegetation representing Tuart Woodlands TEC will be cleared as a result of Proposal implementation, as is detailed in Table 2-5 of the Preliminary Documentation. This loss will be permanent and offsets for impacts to Tuart Woodlands TEC have been proposed. Tuart Woodlands TEC is contained within one occurrence in the Proposal Area, comprising vegetation ranging in condition from Excellent-Very Good to Completely Degraded. The clearing of up to 4.4 ha associated with the Proposal would result in a reduction of up to 0.03 % of the reported extent of the Tuart Woodlands TEC. At a local scale, this would represent a reduction of 0.26 % of the Tuart Woodlands TEC. This represents the maximum possible direct impact associated with the Proposal.

Changes to the Proposal design have been made since referral in September 2019 to reduce impacts by 0.5 ha to Tuart Woodlands TEC vegetation. As discussed in Section 1.3.6 of the Preliminary Documentation, changes to the design have included a range of refinements to minimise the impacts to the environment such as reducing median widths and changing the design of interchanges to reduce clearing requirements. The resulting Proposal reflects the minimum land area required for the road corridor. Impacts to MNES and other environmental values have been reduced to the maximum extent possible and the remaining impact cannot be avoided if the Proposal is to proceed.

The Proposal will be carried out in accordance with the management actions detailed in Section 4.1.4 of the Preliminary Documentation. These include management of aspects that have the potential to cause further degradation of the retained Tuart Woodlands TEC patches within 20 m of the Proposal. This includes *Phytophthora* Dieback, weeds, topsoil and drainage management. Monitoring will be conducted according to the Vegetation Monitoring Plan, which is included in Appendix J. Triggers and thresholds against which impacts will be measured are also detailed therein, along with proposed contingency measures.

As is detailed in Section 3.1.1 of the Preliminary Documentation, Proposal implementation is not expected to reduce the viability of any remaining Tuart Woodlands TEC occurrences as defined in the Conservation Advice (2019).

No.	Submission and/or issue	Relevant Submissions
39	Among the threats to Tuart Woodland TECs and Banksia Woodland TECs, from the proposed alignment, is in the Kalgulup Regional Park (KRP), on both sides of Bussell Highway near the centenary Road intersection. KRP is a unique and priceless 7km bush corridor from the Preston River to the Ocean. The two areas planned for destruction are not in the Southern BORR itself, but for the Centenary Road link. The intervention is not in the Gelorup Corridor, but further north on the proposed Centenary Road link off the Southern BORR. I have been actively involved in the process of protection Kalgulup Regional Park (KRP) for over 25 years, and was involved in successful campaigns to save large blocks of Tuart and Banksia woodland from bulldozing for housing purposes. The community put in huge efforts and persuaded the WA government that the woodlands should be protected, and they were included in the KRP. I was therefore highly concerned and dismayed to see that MRWA proposes to destroy some areas of KRP for the BORR Southern Section (See BORR Team UERS Document, 2020, Figs 5 p1, 7 p1 and p2, 10 p1, 11 p.1, 12 p1 and 2, 16 p1, 19 p1). In particular, MRWA plans to destroy areas of Tuart Woodland TEC/PEC and Tuart Peppermint Woodland PEC near the Bussell Highway and Centenary Rd intersection. The intended destruction area on the east of Bussell Highway is in the College Grove bushland, and the intended destruction area west of Bussell Highway intrudes into the narrowest strip of KRP, which is very vulnerable because of its current 100 metre width.	61

Potential impacts at the interchange of Centenary Road with Bussell Highway would be up to 0.25 ha as shown in Figure 3 below. The portion of the Tuart Woodlands TEC patch TW-S-D-2 that occurs within Kalgulup Regional Park and the Proposal Area is 0.09 ha, also shown in Figure 3, would be cleared as part of the Proposal. While the August 2020 Kalgulup Regional Park draft management plan shows the boundaries of the Park indented at the interchange to provide capacity for the interchange improvements, the plan and Park boundaries are not yet final. Regardless, direct impacts of BORR on the Park would be minimal in nature based on the draft Park planning documents. Revision of the BORR infrastructure during detailed design will be undertaken to further minimise impacts to the maximum extent practicable.

Figure 3. Intersect between Kalgulup Regional Park and the BORR Southern Section Proposal

No.	Submission and/or issue	Relevant Submissions
40	Under 'Abundance' the proponent refers to Banksia Woodlands TEC as of 2015 and is estimated to be up to 17,000 ha. Is this a mistake?	43

Yes, the statement should refer to Tuart Woodlands TEC. This editorial error has been corrected. The reference and stated numbers are correct for Tuart Woodlands TEC.

No.	Submission and/or issue	Relevant Submissions
41	This proposal will clear 4.9 ha of Tuart Woodlands TEC but of significant concern is the proximity of the remnant patches to the proposal. (P38-	16, 17, 18, 22, 32, 38, 43, 50, 58, 59, 61, 72, 79

	40). After clearing the proponent states that up to 14.6% of the remnant patch will be within 20 m of the Proposal boundary. This is not in line with the Conservation advice which states "The recommended minimum buffer zone is 30 m from the outer edge of the patch (the patch boundary being defined as 30 m past the canopy of established Tuart trees, so the minimum buffer is 60 m past the canopy). This distance accounts for likely influences upon the root zone. A larger buffer zone should be applied, where practical, to protect patches that are of very high conservation value or if patches are located below drainage lines or a source of nutrient enrichment or groundwater drawdown, as Tuart trees are considered likely to be vulnerable to rapid change in groundwater conditions. (Page 26 "Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (s266B) Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community)	

Buffers as defined in the conservation advice (2019) are not development exclusion zones but rather relate to the consideration and management of potential indirect impacts Buffers are not part of the ecological community and are not formally protected as MNES (2019).

Main Roads has defined a potential indirect impact zone extending 20 m into adjacent Tuart TEC occurrences. This zone is measured from the edge of the patch, not the edge of the outermost canopy. Thus, Main Roads proposes a 50 m 'buffer', not a 20 m buffer.

The Proposal comprises linear road infrastructure that is not erosion causing or sedimentation forming, and for which all stormwater will be contained within the footprint and access beyond the footprint will be controlled (through fencing).

The Proposal is being implemented by Main Roads, an organisation with many decades of experience in the effective monitoring and management of roadside vegetation. Through the development and implementation of industry-leading standards and practices, impacts to vegetation adjacent to construction and maintenance activities, rarely occur and if they do occur, rarely extend more than 5-10 m beyond the construction zone. The fact that much of the State's high-value remnant vegetation is contained within road reserves is testament to this. In regard to the Proposal, should indirect impacts occur, due to their nature, these are most likely to occur within the first 5-10 m of the potential indirect impact zone, i.e., they will not occur at 30 m but not at 5-10 m. Further, should any such impacts occur within the 20 m indirect impact zone, management actions will be implemented within this zone and beyond as required.

For these reasons and based on the nature and scale of the Proposal, Main Roads considers a potential indirect impact zone width of 20 m to be sufficient for the Proposal.

Indirect impact to Tuart Woodlands TEC / PEC from changes in hydrology is not expected, and accordingly, has not been listed above. Altering existing flow paths has the potential to negatively impact the hydrological regime (most notably drying) of TEC / PEC occurrences. Through implementation of the Drainage Strategy developed for the Proposal (BORR IPT, 2019g), and the management actions listed in Table 4.3, existing drainage patterns to adjacent TEC / PEC vegetation will be maintained. Impacts from changes to flow paths are therefore not expected to result from the Proposal.

Main Roads will implement the Vegetation Monitoring Program to detect and mitigate any impacts that may occur within this zone. Should any such impacts be detected, vegetation management actions as detailed in PD Table 4-3 and in the CEMP will be implemented within and beyond this zone, as required.

Figure 7 of the PD has been revised to show all Tuart TEC patches and all Tuart TEC potential indirect impact zones. The boundaries of the wider patch have not been mapped in detail as this was not required to determine the presence of the TEC, however is considered to extend more than 25 ha outside of the Proposal Area. The full extent of these patches will be mapped in the first round of potential impact monitoring.

No.	Submission and/or issue	Relevant Submissions
42	Table 4-6 (page 62) (BORR Team, 2020) identifies Tuart Woodlands TEC / PEC (incorporating FCT25) as Critically Endangered under the EPBC Act and Priority 3 under the DBCA, with a total area within the proposal area (ha) of 4.40. Yet Table 4-7 (page 67) (BORR Team, 2020) states that Tuart Woodlands TEC/PEC were 'not confirmed' in the original proposal (Sept 2019). The reduction on impact to Tuart Woodlands on the Gelorup Corridor down from the initial 28 ha is not fully explained on the footnote of page 67 (BORR Team, 2020) in the latest referral, and this needs further investigation	23, 25, 83, 43

The 28.6 ha potential impact stated in the original referral document was a highly conservative estimate based on inclusion of was all vegetation potentially containing Tuart. It was clearly stated in the referral that the extent of Tuart Woodlands was estimated and would be confirmed through additional survey following the referral. The additional survey informed the status of vegetation within these areas and confirmed that less Tuart Woodlands TEC/PEC was present within the Proposal Area than was conservatively assumed to be present at the time of referral. Additionally, the Proposal Area was reduced through design refinement from 300 ha to 200 ha to avoid overall impacts to MNES, which included a reduction of impacts on Tuart Woodlands TEC/PEC by minimising the clearing footprint in the vicinity of Centenary Road and the proposed works.

No.	Submission and/or issue	Relevant Submissions
43	The total amount of Tuart Woodlands TEC mapped within the surveyed area is 7.3 ha of which 4.4 ha will be cleared, leaving 3.65ha within 20 m of the proposal area boundary. The proponent refers to a site identified a TW-S-D-1 on (Figure 6) however there appears to be four sites TW-S-D-2 on (Figure6). TW-S-D-2 is identified in Table 3-6 (Page 94) EPBC showing patch to be cleared is 4.4 ha but that the patch extends beyond the proposal area therefore no significant impact is expected. How much of the extended patch is in secure tenure? However, the 3.65 ha is below the 5ha threshold meaning, 'specific criteria need to be met to be considered the TEC' hardly 'not significant'.	43

TW-S-D-1 referenced in the Preliminary Documentation is the TW-S-D-2 site shown on Figure 6. The site is now consistently referred to as TW-S-D-2 in text and figures. The site is referred to as a single site given the continuity of the TEC occurrence beyond the Proposal Boundary.

As described in Table 2-5 of the Preliminary Documentation, TW-S-D-2 extends beyond the Surveyed Area (and Proposal Area) to a total extent of > 25 ha. 2.55 ha of that extent is located within 30 m of the Proposal Area boundary. The patch still meets the TEC threshold criteria when a 30 m potential indirect impact buffer is applied.

As is noted in the Preliminary Documentation, the three largest patches of the Tuart Woodlands TEC are also found in the southern part of the range with the Proposal and are all substantially in conservation tenure (TSSC, 2019).

No.	Submission and/or issue	Relevant Submissions
44	The Proponent has chosen to only survey 7.4 ha out of the total 32.2 ha of this TEC/PEC in Patch 1. This minor area selected for survey is located adjacent to the outer perimeter of this TEC/PEC and is thus more susceptible to threatening processes and likely to be in poorer condition than the remainder of Patch 1. By only surveying a small portion of this TEC/PEC, the Proponent has concealed information that is crucial to the DAWE's assessment of impacts to this TEC/PEC. Furthermore, it does not provide a sufficient knowledge base for the DAWE to adjudicate the Proponent's claims that no indirect impacts through fragmentation are expected. CCWA submits that the Proponent should be required to survey the entire 32.2 ha area of Patch 1. Under the Conservation Advice for this TEC/PEC, this patch clearly meets with TTSC's criteria for being part of a nationally protected ecological community, which includes patches of any condition greater than 5 ha (TSSC, 2019 p20).	56

Main Roads surveyed all portions of Patch 1 falling within the Proposal Area, and this was sufficient to determine the TEC status of this vegetation within the Proposal Area.

Main Roads agrees that Patch 1 is an occurrence of the Tuart Woodlands TEC. Patch 1 is labelled as an occurrence of the TEC in Proposal documentation, an impact assessment appropriate to the TEC status was conducted, and offsets relevant to the significant residual impact have been proposed.

Main Roads has fully disclosed all required information relating to this TEC occurrence to DAWE.

Tuart Woodlands TEC surveys conducted for the Proposal were undertaken in accordance with the Conservation Advice (TSSC, 2019[1]), with the resulting patch assessment information presented in Appendix C of the Preliminary Documentation. As required under this Advice, the extent of the Patch was determined through groundtruthing. A detailed floristic survey of Patch extents outside of the survey is not required for determination of an occurrence of the TEC under the Conservation Advice.

[1] TSSC. (2019). *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*. Canberra: Threatened Species Scientific Committee via the Department of the Environment and Energy.

Information recorded during field surveys regarding the extent of Patch 1 and the local context of the Tuart Woodlands TEC for the Proposal is considered sufficient for the impact assessment. Additional information would not materially change the impact assessment outcome or the Proposal, as the vegetation is already recognised as TEC, and the footprint has already been minimised as much as is possible to retain Tuart Woodlands TEC vegetation where possible.

That the condition of Tuart TEC Patch 1 within the Proposal Area, and thus requiring detailed survey, was more degraded compared with that in the remainder of the occurrence is outside of Main Roads control. Regardless, the vegetation was determined to be an occurrence of the TEC and has been assessed as such.

No.	Submission and/or issue	Relevant Submissions
45	MRWA's data and methodology is biased and not fit for purpose; MRWA must use a more detailed methodology to quantify the relative importance of the clearing of a significant patch of this TEC/PEC. Throughout the AIPD, MRWA has relied solely on the comparison of directly cleared area of TEC/PEC with the current extent remaining, without using any important determinants such as condition, fragmentation and threats across the full extent of the TEC/PEC's range. Quantifiable, transparent data on the condition, fragmentation and threats across the full extent of the TEC/PEC's range is absolutely critical context for DAWE's assessment. MRWA's revised methodology must, at a minimum, provide detailed discussion and modelling of the condition, fragmentation and scale of threats known for this TEC/PEC. MRWA must provide baseline information to allow comparison between affected area of TEC/PEC and average and median patch sizes across the range (as well as comparing potentially fragmented areas from loss of ecological linkages within the Proposal Area) to determine the relative significance of impacts. Submissions also noted that current remaining extents of the TEC were based on 2015 mapping and may be out of date.	16, 17, 18, 56, 58, 59

Surveys conducted for the Proposal were done in accordance with the EPA Technical Guidance, and with the Tuart Woodlands TEC Conservation Advice, which sets out the methodology for determination of TEC occurrences. An assessment of the condition, fragmentation and threats across the full extent of the TEC/PEC's range is not a requirement under the Technical Guidance, nor is it feasible for such an assessment to be undertaken.

The conservation status of the community (i.e. its listing as a TEC) was determined based on the TSSC's cumulative assessment of these and other factors, thus these factors have been effectively considered at the community scale.

The impact assessment undertaken for the Tuart Woodlands TEC addressed the current status of the population (TSSC, 2019) as well as both direct and indirect threats (including fragmentation) in accordance with the EPBC Act Significant Impact Guidelines 1.1.

The impact assessment undertaken for the Proposal is considered adequate.

No.	Submission and/or issue	Relevant Submissions
46	In the Technical Guidance, the EPA advises that "surveys should be conducted during the season that is most suitable for detection and identification of the range of flora likely to occur in the survey area" (Section 6.4, EPA Technical Guidance, 2016). The EPA also provides recommended survey timing for vegetation surveys. For vegetation in the South-West, the primary survey is recommended to be undertaken in Spring (September to November) and a supplementary survey after Autumn rains. Supplementary surveys are commonly used to supplement the data collected in the primary surveys and provide more robust data to account for events and seasonal fluctuations. The Proponent claims to have undertaken a Targeted Survey for occurrences of TEC/PEC's, including the Tuart TEC conducted in September 2019 after the Proponent's alignment change and EPBC "critically endangered" listing made previous surveys redundant (Page 1, Appendix J, Flora and Vegetation Survey). The Proponent does not refer to any supplementary surveys that it has used to supplement the data collected in the primary survey. CCWA submits that without providing any evidence of an adequate supplementary survey, the Proponent cannot be said to have completed the survey to a standard consistent with the EPA's guidance on survey timing.	56

Previous surveys were not 'made redundant' by changes to the Proposal alignment or the listing of the Tuart Woodlands TEC, but rather required some additional areas to be surveyed, and some areas to be re-surveyed. Numerous surveys were undertaken for the Proposal, with these covering various portions of the Proposal Area as relevant, being at different scales as relevant, as well as being undertaken over several years and at different times of the year.

The vegetation and flora survey (BORR IPT, 2020i) was undertaken over a 2-year period, from August to November 2018 and from August to November 2019. Approximately 560 person-hours were spent on the vegetation and flora survey over the two years. The survey effort was sufficient to determine conservation significant values and enable assessment of potential impacts resulting from Proposal implementation.

The dominant season for Proposal flora and vegetation surveys was spring, which is the critical flowering season for most species in the South West Botanical Zone. Where additional survey was required outside of spring to identify other species determined or considered likely to occur, such as early-flowering orchid species, these surveys were undertaken in suitable habitat. These additional surveys are supplementary surveys, the results of which have been incorporated into the Proposal flora and vegetation survey report (Appendix C of the Additional Information document).

All surveys were undertaken in accordance with the EPA Technical Guidance and relevant Commonwealth guidance or Conservation Advice.

4.2.4. Flora

No.	Submission and/or issue	Relevant Submissions
47	There is a potentially significant impact on & endangered and vulnerable flora taxa. Given that these species are difficult to find and identify (described as	43, 50

	"cryptic" by Main Roads), it is possible that the populations of these rare fauna species are higher than stated. Commenters requested more extensive studies were required for the following rare flora: • King Spider-orchid (*Caledonia huegelii*) (Endangered) • Tall Donkey Orchid (*Diuris drummondii*) (Vulnerable) • Dwarf Bee-orchid (*Diuris micrantha*) (Vulnerable) • Glossy-leafed Hammer Orchid (*Drakaea elastica*) (Endangered) • Dwarf Hammer-orchid (*Drakaea micrantha*) (Vulnerable) • Keighery's Eleocharis (*Eleocharis keigheryi*) (Vulnerable) A low number of specimens identified, within an area that they are known to grow previously, and is suitable habitat, affirms their low population and the need for protection of suitable habitat.	

Flora and vegetation surveys conducted for the Proposal were comprehensive and conducted over numerous phases and years. For the threatened orchid species having a potential to occur within the Proposal Area, targeted survey areas were defined within suitable vegetation types for each species as is outlined in Section 2.6 of the Preliminary Documentation. The field survey was undertaken in accordance with the Commonwealth of Australia's Draft Orchid Survey Guidelines (2013) and the methodology was developed in consultation with Mr. Andrew Webb (DBCA Flora Officer) prior to commencing the field work.

While it is acknowledged that individuals of some species may not have been observed during these field surveys, it is considered highly unlikely that any populations of these occur within the surveyed areas and remained undetected given the targeted nature of surveys.

No.	Submission and/or issue	Relevant Submissions
48	We believe that the measures implemented from the Approval Decision for the Perth Bunbury (EPBC 2005/2193) to implement an investigation into the biology of the Glossy-leaved Hammer-orchid be conducted in consultation with the Western Australian Botanic Gardens and Parks Authority, with specific reference to the proposal area.	43

Despite significant survey effort during the optimum flowering period, no *D. elastica* individuals were observed within the Proposal Area or surrounds (BORR IPT, 2020i). It is therefore considered unlikely that the species occurs in the Proposal Area or wider Surveyed Area. Accordingly, the Proposal is not expected to impact any individuals of the species.

The field survey was undertaken in accordance with the Commonwealth of Australia's *Draft Orchid Survey Guidelines* (2013) and the methodology was developed in consultation with Mr Andrew Webb (DBCA Flora Officer) prior to commencing the field work.

Approximately 12.1 ha of potentially suitable habitat for *D. elastica* was identified within the Proposal Area. This area was determined based on the area of VT1, VT2, VT3 and VT4 (Jarrah / Banksia) present

within the Proposal Area, excluding vegetation that classed as Degraded and Completely Degraded condition. In total, 100 person hours were spent surveying for the species.

Main Roads is not proposing any additional work with respect to the Glossy-leaved Hammer-orchid at this time.

No.	Submission and/or issue	Relevant Submissions
49	Subsequent to the initial proposal in 2019, more targeted desktop searches and field surveys were completed with regard to plant taxa previously not covered. Further desktop studies revealed more information on the occurrence or likely occurrence of conservation significant flora taxa within a 5 km buffer however the proponent states that no EPBC Act or BC ac list flora was recorded from the field survey.	43

Targeted desktop searches subsequent to the referral of the Proposal to the Commonwealth were done to inform further targeted survey work undertaken during spring 2019. Any new flora taxa identified would have been targeted in survey work (i.e. searches to confirm the distribution and extent of the population(s) would have been conducted). Despite significant targeted survey effort, no EPBC Act or BC Act listed flora was recorded.

Flora and vegetation surveys conducted for the Proposal were comprehensive and conducted over numerous phases and years. While it is acknowledged that individuals of some species may not have been observed during these field surveys, it is considered highly unlikely that any populations of these occur within the surveyed areas and remained undetected.

No.	Submission and/or issue	Relevant Submissions
50	Of the impacted Priority species, 104 individuals of *Caladenia speciosa* are proposed to be cleared within the BORR Southern Section (p68, BORR Team 2020). MRWA claims that because the recorded regional population of Caladenia speciosa is >3,900 individuals, and the clearing of 104 individuals only represents < 3 % of the total population which will not affect the representation, diversity, viability or ecological function of the species, clearing is therefore 'not considered significant' (p82, BORR Team 2020). WSWA submits that the clearing of 104 individuals of *Caladenia speciosa* is significant, and the project should not be approved. In addition, the existing vegetation in parts of the Proposal contains high biodiversity within excess of 255 species, though not all species present have been documented in the flora and vegetation surveys undertaken for the project. For example, the uncommon Curled-tongue Shell Orchid, *Pterostylis rogersii*, while not a Threatened or Priority species, was found in the project area by the WSWA in July 2020, but had not been documented in MRWA's flora survey.	34, 43, 56, 79

Caladenia speciosa is a Priority 4 listed flora, indicating its status is of concern but that it is still relatively common. The loss of 3% of the known regional population is not considered significant.

Substantial habitat for this species remains within the vicinity of the Proposal Area and it is considered likely that more individuals would be identified adjacent to the Proposal if further survey was undertaken.

While survey efforts did record flora species observed, survey effort was targeted on conservation significant flora taxa. It is not unreasonable that the Wildflower Society might note other flora species in other survey efforts.

4.3. Threatened Fauna

4.3.1. Western Ringtail Possum

No.	Submission and/or issue	Relevant Submissions
51	The proponent plans to clear up to 65.4 ha of suitable breeding and foraging habitat for the Western Ringtail Possum (WRP). This is unacceptable. The proponent claims to have done all it can to minimise the impact but the environmental assessment of an alternative route showed a significant potential for reduction in impact from 65.4ha to 38 ha. (Southern Section Alternative Alignment Environmental Impact Statement). This alternate route had a significantly wider corridor and so potentially the impact could be reduced further with appropriate design modifications.	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 24, 26, 27, 28, 30, 31, 34, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 47, 49, 51, 52, 54, 55, 56, 57, 60, 61, 63, 64, 65, 66, 67, 69, 70, 71, 74, 75, 77, 78, 80, 81

The Alignment Selection process, described in Response to Submission #5 concluded that MNES, including WRP, were impacted in both the BORR Southern Section (GBRS) and the Alternative Alignment. The EIAs for each alignment concluded that MNES were impacted in both alignments, WRP and BC in the BORR Southern Section and WRP, BC and BSM in the Alternative Alignment. As a result of this finding, along with the Multi-Criteria Assessment (MCA) results of the socio-economic and engineering factors, the BORR Southern Section (GBRS) alignment was progressed for state and commonwealth environmental approval. While environmental impacts were an important consideration in determining the feasibility of the alternate corridor, it was not the only factor that required assessment. The assessment drew from a range of engineering and environmental studies as well as desktop review relevant planning policies and data that informed the planning of primary road networks.

Changes to the Proposal design have been made since referral in September 2019 to reduce impacts to WRP habitat and home ranges, including consultation with technical experts Ms. Barbara Jones[2] (Independent Consultant) and Mr Roy Teale (of Biota Environmental Sciences Pty Ltd). As discussed in Section 1.3.6 of the Preliminary Documentation, changes to the design have included a range of refinements to minimise the impacts to the environment such as reducing median widths and changing the design of interchanges to reduce clearing requirements that have avoided approximately 18 % (14.6 ha) of expected habitat loss through detailed design.

[2] Barbara Jones has been studying the WRP population for more than 30 years and is recognised by the Commonwealth as one of the pre-eminent experts regarding WRP populations and ecology (TSSC, 2018a). (TSSC, 2018a).

The resulting Proposal reflects the minimum land area required for the road corridor. Impacts to MNES and other environmental values have been reduced to the maximum extent possible and the remaining impact cannot be avoided if the Proposal is to proceed.

The proposed mitigation and management measures detailed in the Preliminary Documentation, in the Conservation Significant Fauna AMP (BORR IPT, 2020g) (Appendix M) and also in the management matrix presented in Appendix K, are anticipated to preclude the need for active translocation by the construction contractor. While the proposed management actions have been proposed to avoid and minimise potential impacts, the potential remain for residually significant impacts on WRP and offsets for WRP have accordingly been proposed as described in Section 5 of the Preliminary Documentation.

Since submission of the PD, Main Roads has made additional modifications to the Proposal within the Gelorup section to address concerns raised by the WA EPA and DBCA. These modifications include:

- Additional Protected Areas. Three properties acquired at Yalinda Drive will be retained the disturbed areas and revegetated to provide retained WRP habitat adjacent to crossing structures.
- Additional Fauna Connectivity:
  - Vegetated Strip on Yalinda Drive Bridge protected from bridge traffic
  - Fauna Land Bridge east of Yalinda Drive
  - Two additional rope bridges west of Yalinda Drive

These structures are now shown in Figure 12 (Fauna Crossing Provisions and Exclusion Fencing Concept Plan) of the PD.

No.	Submission and/or issue	Relevant Submissions
52	Rather than putting measures in place to protect this Critically Endangered animal, the proponent attempts to state that measures such as replanting saplings and bridges will be sufficient to offset the loss of up to 65.4 hectares of habitat. This offset will not replace the habitat, and there will be a net loss of critical habitat. MRWA must ensure that the action is not inconsistent with the 10-year goal of the Recovery Plan for the WRP; that is "slow the decline in population size, extent and area of occupancy through managing major threatening processes affecting the subpopulations and their habitats and allowing the persistence of the species in each of the identified key management zones: Swan Coastal Plain, southern forests and south coast." In the event MRWA takes the position that any potential mortalities in the Swan Coastal Plain are offset by other available habitat, MRWA must quantify the uncertainty of their claim The proposed BORR Southern Section should not be approved where approval would destroy any of the Western Ringtail Possum habitat. This means all clearing would be unacceptable. The proposed clearing is contrary to the Recovery Plan for the Western Ringtail Possum, and the federal Minister for the Environment cannot approve a project which is contrary to a Recovery Plan.	14, 23, 25, 38, 56, 61, 79

	If this proposal was to proceed the current Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan adopted in 2017 would have to be considered a failure due to all of the "Criteria for Failure" being met.	

Within the Commonwealth Assessment for the BORR Southern Section Proposal, consistency with recovery plans for WRP and Black Cockatoo species are addressed in Table 10-2 of *Southern Section Additional Information for Preliminary Documentation – EPBC Ref: 2019/8543* (BORR IPT, 2020a). While both tables summarise salient points with respect to Plan consistency, the primary analysis of potential impacts on protected matter is assessed in Section 3 (Assessment of Impacts) of the Preliminary Documentation consistent with the Department of Environment (DoE) *Matters of National Environmental Significance: Significant Impact Guidelines 1.1*. Where Residual impacts have been identified, Main Roads has proposed offsets as described in Section 5 of the Preliminary Documentation.

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. The region's critically important habitat values are principally associated with retained WRP habitat to the west and north of the Proposal Area, and will not be impacted by the Proposal.

WRP records accumulated 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) (Conservation Significant Fauna AMP, Attachment A, Figures 1 and 2). Other 2013-21 records from the wider Bunbury area confirm that the Bunbury WRP population was not restricted to the native woodland habitat but also used moderately modified domestic habitat (e.g. within the Gelorup subdivision, as shown in Figure 1), and even heavily modified 'urban' habitat (Bunbury suburbs, Attachment A, Figure 1). These features indicate that this population was not in an overall, or significant, decline trend for the decades 2005-15 or 2010-2020. The 2018-21 survey results imply that the Bunbury WRP population remained resilient for the decades 2001-2021.

High quality WRP habitat on the SCP is especially important for the regional WRP population because it produces the majority of the population's youngsters (Shedley and Williams, 2014). This type of habitat can be vitally important, particularly for the future conservation outcomes of the species (Shedley and Williams, 2014).

In the Bunbury area, high quality habitat with higher WRP densities is associated with the substantial north-south woodland habitat strip to the west of Bussell Highway. This coastal strip vegetation, which extends for some 13 km south of Dalyellup without a substantial break before it terminates at the Capel River flats, includes areas of high quality tuart and peppermint woodlands, with some areas of tall peppermint. Part of this habitat strip carried 4 WRP/ha when surveyed in 2019 (Biota in prep.) (Attachment A, Figures 1 and 2). The northern end of this coastal strip (almost) connects, via Dalyellup's internal habitat corridors, across another 7 km of lower density (<2 WRP/ha) habitat remnants that extend via the Kalgulup Regional Park (through Manea Park) to more or less link to the riparian habitat along the Preston River (Ms. Barb Jones, Pers. Comm.) (Conservation Significant Fauna AMP, Attachment A, Figures 1 and 2). By linking the Preston riparian corridor back to the higher quality coastal habitat strip, these remnants provide unique and regionally critical population connectivity values (such as genetic exchange and population recovery potential) that extend for about 20 km of connected remnant woodlands between Minninup (at the northern end of the Tuart Forest National Park) and the Preston River corridor.

Together, these important north-south and east-west Bunbury woodland habitat strips provide high quality conservation values of significance to the species, and to the regional population of the Southern Swan Coastal Plain. They also support the existing local populations that make up the Bunbury subpopulation. Their collective conservation values are so substantial that they match key indicators common to most definitions of critical habitat, noting that there is no single or formal definition.

The above-mentioned north-south and east-west habitat strips are supported by extensive modified (subdivided and settled) habitat with retained mixed woodland canopy in the Gelorup subdivision. Compared to the higher quality tuart and/or peppermint woodland habitat further west, WRP density in the mixed Gelorup woodland is much lower at around 1 WRP/ha. This description is reflected in mapping by the Department of the Environment, Water, Heritage and the Arts (2009) which identifies the WRP habitat traversed by the BORR Southern Section as Supporting Habitat, and the north-south corridor west of Bussell Highway as Core Habitat for the species.

BORR Southern Section impacts are concentrated in <61 ha of this low density, modified mixed woodland habitat of which, according to the field data, only 45 ha was regularly used by one or more WRP on most nights (Clearing Category 1, as defined in the Conservation Significant Fauna AMP; Attachment A, Figure 3). The habitat fragments that make up the remaining 16 ha of the Proposal Area habitat (Clearing Categories 2 and 3; Attachment A, Figure 3) had more nights without WRP detections than nights with one or more detections. Patches of habitat that are often without WRP on repeat count sequences 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.

The removal of 45 ha of suitable and occupied (0.91 WRP/ha, as was recorded for the Proposal Area) habitat that would result from construction of the Proposal represents a minor and insubstantial impact for the extensive local WRP population using the Gelorup subdivision habitat.

The proposed clearing of WRP habitat is consistent with the WRP Recovery Plan as the proposed habitat impacts are not expected to result in localised extinction or contraction of WRP in the Swan Coastal Plain Management zone.

Through further development of the project in consultation with the WA EPA Main Roads has reduced the WRP habitat clearing impact by 2.9 ha.

Comments regarding environmental offsets are noted.

Since submission, Main Roads has made modifications to the Proposal within the Gelorup section to address concerns raised by the WA EPA and DBCA. These modifications include:

- Additional Protected Areas. Three properties acquired at Yalinda Drive will be retained and disturbed areas revegetated to provide retained WRP habitat adjacent to crossing structures.
- Additional Fauna Connectivity:
  - Vegetated Strip on Yalinda Drive Bridge protected from bridge traffic
  - Fauna Land Bridge east of Yalinda Drive
  - Two additional rope bridges west of Yalinda Drive

These structures are now shown in Figure 12 (Fauna Crossing Provisions and Exclusion Fencing Concept Plan) of the PD.

Table 10-2. Relevant Recovery Plans, Threat Abatement Plans and Conservation Advice for Matters of National Signficance (MNES) (*Reprinted from EPBC Ref: 2019/8543 documentation*)

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
Western Ringtail Possum	**DPaW** (2017)**, 'Western Ringtail Possum (*Pseudocheirus occidentalis*) Recovery Plan. Wildlife Management Program No. 58'**		
	1	Habitat loss and fragmentation	The Proposal may exacerbate this threat. Clearing of up to an estimated 65.4 ha of potential habitat and impact to the home ranges (to varying degrees) of up to 53 to 79 individuals estimated to utilise this habitat (up to 0.57 % to 0.85 % of the estimated regional population) could result in a minor residual impact associated with the Proposal.
	2	Timber harvesting	The Proposal is not expected to exacerbate this threat. Timber harvesting will not be undertaken other than to recover the timber within the clearing area.
	3	Fire	The Proposal is not expected to exacerbate this threat. There is considered to be a low risk of accidental fire as a result of construction activities. Clearing activities are a potential risk of fire generation. To minimise the risk of fire, clearing activities will not be undertaken when the Fire Danger Rating is severe or higher. The CEMP will include an emergency management plan.
	4	Competition for tree hollows	The Proposal may exacerbate this threat due to clearing of suitable WRP habitat thereby potentially increasing competition for tree hollows within habitat immediately surrounding the Proposal Area. Monitoring of WRP abundance in habitat immediately adjacent to the Proposal Area will be conducted with data compared against that of reference areas to determine any such impacts.
	5	Habitat tree decline	The Proposal is not expected to exacerbate this threat. Dieback mapping will be updated as part of project planning especially in regards to ascertaining areas that can be effectively protected from dieback infestation. A Hygiene Management Plan will be implemented for construction of the Proposal as per the CEMP to minimise risk of the impact of disease.
	6	Unregulated relocation of orphaned, injured and	The Proposal will not exacerbate this threat. A Conservation Significant Fauna EMP has been prepared for the Proposal.

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
		rehabilitated Western Ringtail Possums	An appropriately qualified fauna handler will be on site during clearing of Western Ringtail Possum habitat.
	7	Disease	The Proposal is not expected to exacerbate this threat. Dieback mapping will be updated as part of project planning especially in regards to identifying areas that can be effectively protected from dieback infestation. A Hygiene Management Plan will be implemented for construction of the Proposal as per the CEMP to minimise risk of impact of the disease.
	8	Gaps in knowledge	The Proposal will not exacerbate this threat, but rather has minimised this threat. Numerous studies and investigations have been conducted for the Proposal for the purpose of addressing knowledge gaps and more will be undertaken as part of detailed design.
	Threatened Species Scientific Committee (TSSC) (2018a)**, 'Conservation Advice *Pseudocheirus occidentalis* Western Ringtail Possum'**		
	1	Groundwater depletion and altered hydrology	The Proposal is not expected to exacerbate this threat. A Drainage Strategy has been developed with the main objectives of maintaining the water cycle balance within the Proposal Area whilst also improving surface and groundwater quality. Drainage design will be undertaken during detailed design to ensure pre-development flows are maintained within the Proposal Area.
	2	Land clearing and habitat fragmentation caused by urbanisation	The Proposal may exacerbate this threat. Clearing of up to an estimated 65.4 ha potential habitat for an estimated 53 to 79 WRP individuals (up to 0.57 % to 0.85 % of the estimated regional population) could result in a minor residual impact associated with the Proposal.
	3	Fire	The Proposal is not expected to exacerbate this threat. There is considered to be a low risk of accidental fire as a result of construction activities. Clearing activities are a potential risk for fire generation. To minimise the risk of fire, clearing activities will not be undertaken when the Fire Danger Rating is severe or higher. The CEMP will include an emergency management plan.
	4	Tree decline and insect outbreaks	The Proposal is not expected to exacerbate this threat. Dieback mapping will be updated as part of project planning especially in regards to identifying areas that can be effectively protected from dieback infestation.

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
			A Hygiene Management Plan will be implemented for construction of the Proposal to minimise risk of impact of the disease.
	5	Competition for tree hollows	The Proposal may exacerbate this threat due to clearing of suitable WRP habitat thereby potentially increasing competition for tree hollows within habitat immediately surrounding the Proposal Area. Monitoring of WRP abundance in habitat immediately adjacent to the Proposal Area will be conducted with data compared against that of reference areas to determine any such impacts.
	6	Logging	The Proposal will not exacerbate this threat. Timber harvesting will not be undertaken other than to recover timber within clearing area.
	7	Myrtle rust	The Proposal is not expected to exacerbate this threat. A Hygiene Management Plan will be implemented for construction of the Proposal to minimise risk of the impact of disease.
	8	Injury and mortality due to vehicle strike	The Proposal may exacerbate this threat; mitigation options will be considered as part of detailed design.
	9	Unregulated relocation of orphaned, injured and rehabilitated Western Ringtail Possums	The Proposal will not exacerbate this threat. Fauna relocation will be considered for conservation significant terrestrial fauna species, including trapping of WRPs. A Fauna Management Plan will be developed. An appropriately qualified fauna handler will be on site during clearing of WRP habitat.

No.	Submission and/or issue	Relevant Submissions
53	Whilst MRWA states there will be no translocation, it is recognised in Table 2.9 that efforts to move possums ahead of clearing and out of their habitat may be unsuccessful. The WRP Recovery Plan records that translocations have been attempted at Gelorup that is now included in the proposed clearing. 'Very few translocations have been successful.' (WRP Recovery Plan p28) In 2000 the Dalyellup Estate joint venture began clearing predominantly Tuart Woodland and some Banksia Woodland of which both ecological communities are now listed as MNES and threatened. In total nearly 270 hectares were clear felled (confirmed in Parliamentary Hansard) and mostly burned. Between 2000 and 2004 the state environment department in conjunction with Dalyellup Pty Ltd Joint venture undertook a translocation program and removed more than 50 individual Western Ringtail Possums. The WRP were placed with trackers at three locations and studied by PHD students and the state department as part of a research program. This translocation program was a failure as more than 95pc of the WRP perished. Whilst MRWA states there will be no translocation, it is recognised in Table 2.9 that efforts to move possums ahead of clearing and out of their habitat may be unsuccessful. The means by which the approved Zoologist can "move" the possum to a safer area are not described and should be outlined in detail. MRWA should therefore also be requested to apply for a licence under DPAW Regulation 15 Fauna relocation licence.	14, 16, 17, 22, 38, 42, 50, 58, 59, 61, 79

WRP self-relocation

As is stated in the response to Comment No. 52, for 16 ha of the 60.9 ha proposed to be cleared for the Proposal, the habitat was used mostly by WRP moving into and out of the surveyed habitat. Therefore, clearing the habitat fragments in this 16 ha would present only minor population disturbance. For the remaining 45 ha clearing with settled residents, the bimonthly count sequence suggests that an upper limit of 40 settled home ranges would have lost a few, many or most trees if clearing was conducted during the period when WRP counts were low in 2020 or 2021.

The bimonthly count sequence 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. 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. Around 25% of the displaced animals are likely to be living out their last year, as is described in the response to Comment No. 58. The animals in the 30 settled home ranges that retain 25-75% of their former habitat (refer to the response to Comment No. 58) will be able to relocate to familiar trees within their retained home ranges and remain, or join the transient population if they decide that the reduced home range is too small.

As part of the WRP self-relocation process, Main Roads will install artificial dreys (2/ha) into adjacent habitat areas while the rural residential development abutting the Gelorup section also provides substantial alternative options to hollows and dreys.

WRP territoriality

The assumption that all natural WRP populations, including low density ones, must be highly territorial is problematic and in this example is incorrect. Field data for the subject WRP population, in low density habitat, contradicts this assumption, as is shown by the following data recorded during the 2020 radio collaring study (Biota, in prep):

- One field example confirmed three overlapping home ranges
- One field example displayed adjacent home ranges separated by a narrow corridor rarely used by either
- Isolated records indicated that adjacent females may rarely visit, or transit through, an adjacent home range used by a mature female 'next door'.

The bimonthly monitoring count sequence revealed that the population had both a settled resident component (mature and dominant), and a substantial presence of transient animals that were sometimes moving in and out of the survey areas that had settled home ranges. These transient counts indicated that there was no shortage of suitable WRP habitat outside of the alignment. The survey data also imply that temporary transient animals were often tolerated moving around settled resident WRP. Transients would include sub-adults or young adults of both sexes as well as wandering males, and would include animals displaced by low season clearing. It is reasonable to conclude that most WRP have gone through an earlier life stage when they were a part of the local transient population.

The behaviour of this species (*P. occidentalis*) must include a wide range of flexibilities (depending on variable environmental conditions) that have kept the species functioning in diverse and changing habitats during the last few decades. An extensive recent survey (Biota in prep.) confirmed that broad scale habitat values at sampled sites across the species' distribution ranged from 0.25 hectares per possum in the best of the surveyed habitat to as low as 10-100 hectares for just one WRP. Resilient populations seem to need habitat values that can support WRP on about one suitable hectare per resident breeder. The species' highest observed densities (see Shedley and Williams 2014) indicate the south west's best forage supply could support 10 WRP on one hectare of prime Peppermint forage.

Refer also to the response to Comment No. 58 for more information regarding the likely outcome for WRPs in the Gelorup corridor that are displaced by clearing.

WRP/Brushtail possum (*Trichosurus vulpecula*) interaction/competition

With regard to competition from Brushtail possums (*Trichosurus vulpecula*) in the Bunbury mixed woodlands, Brushtail possum density was also low (Table 8, Biota in prep) when compared to reported densities for other south-western sites (Molloy and Davis, 2016). Brushtail possums have home ranges that are larger, or much larger, than WRP home ranges which means that the Proposal's linear clearing area is too narrow to entirely include even a single Brushtail possum home range. Thus although some Brushtail possums will be deprived of access to the cleared area within the Proposal Area, the density of Brushtails in the receiving habitat on either side of the proposed alignment will not increase as a result of clearing conducted for the Proposal. Therefore, for the Proposal, Brushtail possum-WRP interactions will also remain within this population's 'normal operating range'.

The results of a 2018-19 distance sampling survey recorded the densities of WRP and Brushtail possums in seven larger woodland blocks within 6 km of the Proposal Area (Table 8). At the time of

this survey, the ratio of WRP to Brushtail possums in these remnants was 3:1. Six of the sites (DSB1-6) sampled Gelorup mixed woodland habitat, and their average WRP density was 0.88/ha. DSB7 was the only site that sampled tuart peppermint habitat to the west of Bussell Highway, and it had a much higher WRP density than DSB1-6.

Table 8. Possum number estimates for seven woodland remnants near the BORR Southern Section Proposal Area (Biota in prep.).

Site	Area of habitat	Estimated WRP population	Estimated Brushtail population	Density WRP/ha	Density Brushtail/ha
DSB1	88	141	45	1.6	0.52
DSB2	155	191	95	1.23	0.61
DSB3	40	14	21	0.34	0.51
DSB4	146	151	56	1.03	1.38
DSB5	194	126	16	0.65	0.08
DSB6	188	80	146	0.42	0.77
DSB7	265	1053	193	3.98	0.72
Totals	1076	1755	571		
Averages				1.63	0.53

No.	Submission and/or issue	Relevant Submissions
54	What scientific study or previous experience has informed the design of the 1.8m high WRP exclusion fence? Do Main Roads know if it will be effective? It is known for example that Brush-tailed possums frequently scale wildlife enclosure fencing such as at Barna-mia in the Dryandra woodlands. Other submissions noted that fencing can impact genetic flow across a population (Hawyard & Kerley 2008).	16, 17, 18, 22, 43, 50, 56, 58, 59, 61, 79

The 1.8m high chain mesh fence will be used to define the road reserve (cadastral) boundary through the rural sections of the project. These fences are not designed to exclude WRP.

Noise and screen walls through the Gelorup section will be located between the road reserve boundary and the road driving surface. These walls will be solid flat structures to exclude climbing by WRP (and other arboreal animals) and vary in height from 2.5 – up to 5.0 m in height. The height of these walls will be dictated by the ultimate noise management plan which is yet to be finalised.

WRP exclusion fencing will be used at specific locations where high density WRP populations have been identified and in the vicinity of movement structures. The 1.5m fence design as shown in the FMP will be adopted to exclude WRP moving on to or crossing the nearby road. This fence is designed with a smooth 600mm high section directly above the ground and a 300mm buried mesh skirt surface to avoid climbing / digging under by WRP.

No.	Submission and/or issue	Relevant Submissions
55	As Main Roads will be shepherding WRP into surrounding agricultural land and at the southern end into residential properties, what measures will they have in place to reduce risks from dog attack, vehicle strike on local roads and predation in general, both during the daytime clearing operations when possums will be forced onto the ground and subsequently? As the surveys completed have not included the residential properties aligning the southern end, on what basis do Main Roads assume the displaced possums can be viably supported in this reduced environment. The proponent states 'WRP are mobile fauna taxa and will be encouraged and enabled to move of their own accord into adjacent areas …' (page 119 (BORR Team, 2020)) however, the disruption to their home range has the potential to cause long term impacts as this species which is strongly territorial and easily stressed. Moving from their home range and trying to navigate a 'discontinuous vegetation canopy cover' appears to increase vulnerability to other threats including predation or eviction by other territorial possums. Translocation also appears to be not viable, showing a survival rate as very low. The proponent advocates the use of 'shepherding' as a means of preservation of the WRP and 'anticipate that WRP's will readily relocate' however this does not take into account, the territorial nature of the WRP.	18, 43, 50, 61, 79

Shepherding of WRP

As is shown in Figure 3 of the updated Conservation Significant Fauna AMP (2021), the proposed clearing methodology will direct any displaced WRP into trees in the retained adjacent habitat, not into cleared agricultural land.

WRP territoriality

Refer to response to Comment No. 53 information on WRP territoriality at both the species and local Proposal Area scale.

Fragmentation of the regional population

Based on our field data, in the vicinity of the Proposal, WRP have been moving between the low density habitats of the Gelorup mixed woodland and that in Reserve 23000 (immediately west of and adjacent to Bussell Highway) via the Bussell Highway median strip, much of which retains woodland habitat. This median strip has been used by wandering WRP, some observed during the period 2018-2021 (Biota field observations), but roadkills have remained relatively uncommon on this section of road over the last 20 years or so (Barb Jones, pers. observation). This indicates that an important east-west migration or dispersal option has remained available for animals moving between the two habitat areas. Bussell Highway's retained median woodland also provides north-south transit options for wandering WRPs. The Proposal will have only a minor impact on WRP values associated with the median woodland habitat.

In regard to concerns around the Proposal creating a potential genetic barrier to the regional population, Mills and Allendorf (1996) suggest that one migrant animal per generation into a sub-population is the

minimum necessary to maintain genetic diversity. To put the Proposal habitat clearing in context, the Gelorup corridor is 2,500 m in length and transects a large native canopy patch that is part of the larger Gelorup WRP habitat. As shown at Figures 1 and 2 WRP have been recorded as occurring widely surrounding the Proposal Area providing a potential pathway for genetic flow into the areas. Further, as stated above, to the west of this habitat, WRP have been using the Bussell Highway median as a road crossing refuge, indicating that the majority of this area's main dispersal or genetic flow options (east-west and north-south) remain largely undisturbed by the Proposal.

In addition to the above, within the Gelorup corridor, Main Roads has committed to installing thirteen fauna crossing structures of five different designs, as discussed in the response to Comment No. 56. Of these, one design for a rope connection which hangs below the shelter provided by an overhead carriageway was used across the Collie River at Treendale, and has a local track record of repeated WRP crossings within 2-3 years of installation. 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*.

Based on the above, any genetic Gelorup disjunction effects resulting from construction of the Proposal would be minor but not locally or regionally significant, and not perpetual or severe. Only a small part of the larger Gelorup population would be 'effectively' prevented from using either a northern or southern dispersal option, and then probably for less than 5-10 years (1-2 WRP generations, while plantings around the fauna crossing structures acquire their first 4-8 growth seasons).

Competition for resources

The bimonthly count sequence (August 2019-August 2021) confirmed that WRP numbers were seasonal, increasing from an August low to seasonal peak around October-December (which reflects the year's main recruiting effort). From January on, WRP numbers declined, which means that the low impact seasonal clearing window for the Proposal habitat extended from March to August. It is during this period that clearing is proposed to be undertaken for the Proposal.

The large areas of undisturbed natural woodland habitat near the Proposal Area at Lot 2 Boyanup Picton Road and Reserve 23000, which together total 234 ha, were distance sampled in August 2018 and have been sampled on a bimonthly schedule (along with the Proposal Area habitat) since October 2019. In both monitored seasons the April counts were 33% lower than they had been on the most recent peak (in December 2019 or October 2020). By the August counts, numbers were 41-42% lower than they had been on the peak. This means that between 30-40% of the population has died or vacated the habitat each year, and also that, during the seasonal low, the habitat values that represent a critical limit during the seasonal recruiting peak are becoming available for transient animals, potentially including individuals displaced by a small enough clearing event.

The extent of the receiving habitat determines whether a proposed low season clearing event is small enough to result in impacts that do not significantly exceed normal tolerance levels for a natural pre-existing population (i.e. the seasonal peaks). For the Proposal, most displaced WRP will be associated with the Gelorup corridor. Field evidence suggests that overall, about 26% of the Gelorup habitat mosaic was suited for use by transient WRPS and 74% was best suited to use by settled residents. This ratio suggests that in low (1 WRP/ha) density Bunbury mixed woodland habitat, some 20-30% of WRP habitat remains available for transients, including WRP displaced by a small enough low season clearing event.

The Gelorup corridor receiving (i.e. retained adjacent) habitat is extensive, and has an abundance of connected WRP habitat that is immediately outside of the clearing area. Its suitability for transients and settled residents was confirmed in data collected during both the count sequence and tracking study. In most cases, shepherded or displaced WRP would be initially relocating to trees that are part of the retained

connected Gelorup habitat that are less than 50 m from the edge of the clearing area, and generally less than 100-150 m from the closest part of their former home range.

Overall, 80% of the settled residents that would have been impacted by clearing in a 2020 low season clearing event would have been retaining >29% of their former home range immediately after clearing. Field evidence (Biota in prep.) suggests that Gelorup WRP individuals that have untenable home range retention as a result of Proposal clearing would transition from this population's residential component to its transient component. Most displaced animals would have been part of the transient group before they became settled residents.

Competition from Brushtail possums (*Trichosurus vulpecula*)

Refer to the response to Comment No. 53 for information relating to the potential for competition from Brushtail possums in the context of the Gelorup corridor clearing.

Predation

As stated above, the Gelorup WRP population is low density (1 WRP/ha), and the majority of WRP likely to be impacted by Proposal clearing will have portions of their home range retained to which they can relocate after clearing. In addition to this, there is a substantial extent of habitat available for transient/displaced WRPs. In light of this, predation by foxes or domestic dogs is less likely to be problematic for animals displaced by the Proposal clearing than for animals displaced by a clearing event proposed for a footprint that would displace higher densities (>3-4 WRP/ha).

The bimonthly count sequence 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 in spite of predation threats from domestic dogs, cats or foxes. The range of management options that Main Roads has committed to will aim to keep dispersing WRPs off the ground and in trees with which they are familiar.

Refer also to the response to Comment No. 58 for more information regarding the likely outcome for WRPs in the Gelorup corridor that are displaced by clearing.

No.	Submission and/or issue	Relevant Submissions
56	The proponent states that they will knowingly fragment two areas of habitat with increased risk of injury or death from road traffic, and loss of habitat. The planned mitigation devices of possum bridges and underpasses are insufficient as Main Roads own documentation states they are aware of the failure of rope bridges in the Central BORR. (p128 Southern Section Additional information EPBC ref 2019/8543). The plans to incorporate underpasses is also surprising given the statement on p55 (Southern Section Additional information EPBC ref 2019/8543) that the use of underpasses in the Busselton Bypass has been shown to be unsuccessful. Possum bridges can work if they are constructed in the optimum places such as Caves Road in Margaret River. This bridge extends over a single lane road from ecological linkage to ecological linkage. This is not the case across a four lane freeway where the ecological linkage is destroyed to make way for the SBORR. This bridge will extend from a small remnant area close to housing into cleared, degraded farmland.	16, 17, 18, 22, 23, 25, 32, 34, 38, 43, 58, 59, 61

	There is anecdotal evidence of fox predation at the point of exits from underpasses on MRWA freeway projects. MRWA freely states that most of these structures aimed at facilitating connectivity are experimental (p 55 Southern Section Additional information EPBC ref 2019/8543). It would be better to have a green corridor, such as MRWA have built across the NorthLink/Tonkin Highway near Muchea. Fauna bridges can be engineered to be very wide with plenty of cover and they resemble real native vegetation. The key issue again is the end of the corridor – there needs to be suitable habitat on both sides of the corridor and protection from predators.	

The design of the proposed bridges for the BORR Southern section are different to the existing BORR Central rope bridge structure (Shown in Figure 12 of the Preliminary Documentation). The planned BORR rope bridge structures will also be constructed to include refuges for fauna to encourage use. WRP movement is not deterred by artificial light in the urban and peri-urban environment (i.e. Bunbury, Busselton). The alternative option of rope bridge underpasses is intended to improve possum usage.

The WRP habitat traversed by BORR is not isolated from other WRP habitat to the north and south with habitat connections at the local and regional level.

As noted above, in order to further mitigate impacts of the project Main Roads will construct an additional fauna bridge and two additional rope bridge structures in the Gelorup section of the Proposal. Main Roads is proposing a number of WRP movement structures to provide options for WRP movement across BORR. The Project provides the first opportunity to install and monitor a variety of WRP movement structure designs in the south west.

Monitoring the use of the structures is included in the Fauna AMP (6.3.1).

The proposed refuges will mimic artificial hollows rather than tree canopy. Any structure built over the road needs to comply with strict design requirements to ensure road user safety. Where alterations and changes of the movement structures are identified as possible these will be implemented to improve uptake by local fauna.

Main Roads acknowledges that the long crossing structure constructed across the BORR Central section has not been effective in facilitating WRP movements. It is expected that this is in part due to the length of the structure and the lack of cover/shelter for animals as they use the structure. Therefore the purpose of these artificial refuge structures is to encourage animal use of crossing structures by providing infrequent shelter over the length of the structure.

No.	Submission and/or issue	Relevant Submissions
57	Main Roads have not fully assessed the area of Western Ringtail Habitat in the proposal area, with 33 % not assessed.	16, 17, 22, 23, 25, 43, 50, 58, 59, 61, 72

The studies undertaken for the BORR Southern Section mapped an additional 33% of WRP habitat, compared to the Shedley and Williams (2014) study.

Due to the regional scale at which the Shedley and Williams (2014) mapping was conducted there are differences between Shedley and Williams mapping of habitat and the field survey of the Proposal Area. Surveys for the Proposal identified an additional 21.6 ha of smaller suitable habitat patches than

were identified by Shedley and Williams (2014), accounting for the 33% "not assessed". Shedley and Williams (2014) is high level landscape analysis focused on larger patches of habitat and thus doesn't account for smaller patches of habitat assessed in recent detailed survey for the Proposal. Regardless, Shedley and Williams (2014) provides a valuable rigorous approximation of general quality of WRP habitat within the Proposal Area and the context of habitat quality in the greater region. The more specific survey by Biota (2020) of suitable habitat within the Survey Area (inclusive of the Proposal Footprint and additional areas) provides a more rigorous and accurate reflection of habitat within the Proposal and immediate vicinity of the Proposal Area.

Accordingly, the more specific habitat survey information is used to calculate impacts. Whereas Shedley and Williams (2014) recent landscape level analysis is used as a suitable proxy for remaining landscape level habitat within the local area and immediate region of the Proposal.

No.	Submission and/or issue	Relevant Submissions
58	The proponent documents that this proposal is likely to impact the home ranges of 53-79 individuals. The disruption to home range has the potential to cause long term impacts as this species is uniquely territorial and have an increased vulnerability to other threats when moved from their habitat. The notion that all they are doing is disturbing the home ranges of 53-79 WRP's is deliberately misleading. WRP living in the corridor will be forced into surrounding residential properties and open agricultural land. This will expose WRP's to increased risks including spending more time on the ground and increased exposure to dogs on residential properties. Possums in urban areas are regularly killed by dogs and young possums killed by cats. The risk of being hit by cars on local roads will increase.	16, 17, 18, 22, 34, 43, 56, 58, 59, 61, 72

The proposed clearing of 60.9 ha required for the Proposal is not likely to displace the precautionary estimate of 79 individual WRPs. The reasons for this are detailed below.

A bimonthly WRP count of the WRP habitat within the potential clearing footprint commenced in August 2019. At that point, this area totalled 80 ha. By August 2021, this habitat had been surveyed for WRP twelve times, and the extent of WRP habitat within the proposed clearing footprint had been reduced from 80 ha to 60.9 ha as a result of changes to the Proposal. The almost 25% reduction in WRP habitat to be cleared will proportionally reduce WRP impacts.

The bimonthly count sequence revealed that only 45 ha of habitat in the current (revised) clearing footprint (of 60.9 ha) was regularly used by more than one WRP on most nights (Clearing Category 1; Attachment A Figure 3). The habitat fragments that make up the remaining 16 ha of the Proposal Area habitat had more nights without WRP detections than nights with one or few (Clearing Categories 2 and 3; Attachment A Figure 3). Patches of habitat that are often without WRP on repeat count sequences 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 permanent resident WRP but adequate for wandering or dispersing WRP to feed and rest in for a few nights or weeks before moving to other areas.

The bimonthly count sequence confirmed that WRP numbers were increasing from an August low to a seasonal peak around November-December. From January on, WRP numbers declined, indicating that the seasonal window resulting in the lowest impact for the Proposal Area habitat extends from March

to August. As is stated in the Conservation Significant Fauna AMP, Proposal clearing will be restricted to the February to August seasonal low.

The bimonthly count sequence revealed that two contrasting groups of possums were being detected in the narrow habitat fragments associated with the clearing footprint. These were transient WRPs, which were sometimes present in the surveyed habitat patch, and local resident animals that were usually present within the footprint. These transient counts indicated that there was no shortage of accessible habitat outside of the alignment. The data also imply that temporary transients were often tolerated moving around settled residents. Transients would include sub-adults or young adults of both sexes, as well as wandering males, and could include animals displaced by low season clearing.

The lifespan of mature WRP is determined and ultimately limited by how their grinding teeth wear down with each year of use. Few individuals would still have another year of viable grinding capacity at the end of their third year of wear (Volck, 2015[3]). This suggests that, in wild populations with a natural diet, most individuals would be unlikely to be able to live past their fourth year. Therefore, on average, the oldest portion of the population would account for approximately 25% of the previous season's adults, implying a 1 in 4 adult vacancy rate that the population needs to resettle before the next recruiting season.

The bimonthly count sequence now spans two seasonal lows, those in 2020 and 2021, providing a sound indication of WRP within the clearing area if the proposed clearing had been applied in either year's low season. Our estimates suggest that the Proposal clearing impacts during these seasonal population lows could have disturbed up to 65 (mature or near mature) individuals, at least 25 of which were often or usually outside of the alignment. In 16 ha of the 60.9 ha required to be cleared, the habitat was used mostly by WRP moving into and out of the surveyed habitat. Therefore clearing the habitat fragments in this 16 ha would present only minor population disturbance. For the remaining 45 ha with settled resident animals, the bimonthly count sequence suggest an upper limit of 40 settled WRP home ranges would have lost a few, many or most trees if low season clearing had been conducted in 2020.

The radio collaring study (Biota, in prep) prepared for Main Roads (Ethics AEC No. 19-6-26, DBCA Licence No. TFA 2019-0188) determined that, of 10 WRP collared in the Gelorup corridor during 2020, five would have retained 29-35% of their home range outside of the Proposal corridor, and three would retain 58-74% outside the corridor. Only two of the ten home ranges would not retain more than 12% outside of the clearing area, and only one of the ten studied home ranges was entirely within the clearing footprint. Overall, 30% of the 2020 settled home ranges would be reduced by less than half. Such reduced home ranges may not be viable in subsequent seasons but are likely to provide ideal post-clearing refuge conditions that can support residents and transients immediately after clearing, and potentially for weeks or months. To provide additional resources for WRP with a reduced home range, artificial shelters, with water, will be added to the nearby receiving habitat at least six weeks prior to clearing. These will be removed after the winter rain has started in the following year.

These field results imply that for a probable upper limit of 40 settled WRP home ranges, up to 10 WRP would be likely to have retained no part of their former home range. For these 'immediately displaced' animals, clearing means they must immediately move on to nearby trees and would join the transient part of the population. Most of these animals would have been transients before they became residents. Around 30% of the displaced animals are likely to be living out their last year, as is described above. The animals in the 30 settled home ranges that retain 29-74 % of their former

[3] Volck, G. (2015) *Development of age determination techniques for the western ringtail possum (*Pseudocheirus occidentalis*) using tooth wear and tooth cementum evaluation*. SCIE4501-04 Research Dissertation, Faculty of Science School of Animal Biology. University of Western Australia.

habitat will be able to relocate to familiar trees within their retained home ranges and remain there, or join the transient population if they decide that the reduced home range is too small.

The field results indicate that a precautionary presumption that up to 79 WRP could be needing to re-establish new home ranges outside the clearing footprint is an overestimate of the probable displacement had low season clearing been done in 2020 or 2021.

Refer also to the response to Comment No. 55, which provides a comprehensive overview of the results of Main Roads bimonthly WRP count sequences (conducted between August 2019 and August 2021), and how this data has enabled sound estimation of the Proposal's clearing impact on WRPs, and also informed the proposed WRP mitigation and management responses.

Monitoring

A displacement monitoring study will be undertaken that aims to catch and radio collar up to 50 mature WRP prior to clearing. It will seek to apply collars to 25 animals within the Gelorup corridor, and 25 collars on animals in the receiving habitat closest to the collared animals in the Gelorup corridor. DBCA input identified the BORR Southern Section project as being well suited to enabling the first detailed study to be undertaken on the outcomes of shepherding as a WRP management tool. This is significant because shepherding has now been selectively used for appropriate WRP habitat clearing events for about 20 years (Barb Jones, pers. observation).

Information from the tracked individuals will be collected before, during and after clearing. A mark and recapture element accommodates any uncollared or sub-mature WRP in the study area. Genetic samples will be collected from all the individuals to determine the relatedness of the WRP in the study. The appropriate WA animal ethics approval for the study has already been obtained.

For habitat to be cleared, the bimonthly monitoring count sequence will continue until clearing is undertaken. The monitoring count sequence for Lot 2 Boyanup Picton Road and Reserve 23000 will also continue, to inform about the seasonal patterns that prevail for the undisturbed larger population before, during and after the period when the displacement study is undertaken. Understanding whether the larger population was increasing or declining (climate impacts) during, after or before the clearing impact will be critical to understanding the results of the displacement monitoring study.

A fauna spotter will be present during clearing operations at all times to minimise the potential injury of fauna, including one fauna spotter per machine during clearing operations in lower quality WRP habitat (Clearing Categories 2 and 3) and two fauna spotters per machine conducting clearing during work in Category 1 areas known to support WRP.

Conservation significant fauna injured by construction activity will trigger corrective and contingency actions in consultation with DBCA and DAWE as per the Fauna AMP (Appendix G of the Preliminary Documentation).

No.	Submission and/or issue	Relevant Submissions
59	From the Approval Decision – Perth – Bunbury (EPBC 2005/2193) a condition was that 'a study be implemented, in consultation with the Western Australian Department of the Environment and Conservation, to investigate the mortality of the Western Ringtail Possum at sites where highway impact on habitat connectivity south of Perth'. Was such a study conducted and what was the result? Such a study is relevant to this proposal. (EPBC, 2006)	43

Main Roads implemented a study with the University of Western Australia to investigate road-kill hotspots of WRP in south west WA. The research study "Why wouldn't the Ringtail possum cross the road?" - Rural land uses and medium forest affect the number of ringtail possum (*Pseudocheirus occidentalis*) road-kills was released in 2008.

The results of the study are not particularly relevant to the BORR Proposal as the study was focused on existing main roads, whereas specific WRP management measures will be incorporated into the construction and operation of BORR.

No.	Submission and/or issue	Relevant Submissions
60	How will Main Roads manage interspecies competition, specifically with the larger, more aggressive Brush tailed possums who compete for the same resources and are resident in the habitat before the WRP are located there. No survey of Brush Tailed possums in these adjacent areas have been mentioned.	50

In the context of the Proposal Area, Common Brushtail Possum (CBP) numbers are lower than those of the WRP by approximately one-third, as observed in Biota's bimonthly surveys over the course of 2020 (as shown in Table below). While CBPs could present competition for WRP and are known to do so in areas where CBP numbers are higher than WRP, in the context of the Proposal Aarea, the risk of interspecies competition for WRP is low given the comparative dominance of WRP in the Proposal Area and adjacent habitats.

Table 9. Common Brushtail Possum and Western Ringtail Possum in the Proposal Area during 2020.

Survey Timing (2020)	Common Brushtail Possum *Trichosurus vulpecula*	Western Ringtail Possum *Pseudocheirus occidentalis*	Ratio WRP:CBP
Feb	30	88	2.9:1
Apr	31	94	3.0:1
Jun	29	103	3.6:1
Aug	36	105	2.9:1
Oct	43	115	2.7:1
Dec	33	117	3.5:1
	202	622	3.1:1

Competition from Brushtail possums

With regard to competition from Brushtail possums (*Trichosurus vulpecula*), in the Bunbury mixed woodlands, Brushtail possum density was low (Biota, in prep) when compared to reported densities for other south western field sites (Molloy and Davis, 2016[4]). Negative outcomes from direct

[4] Molloy S. W. and Davis, R. A. (2016) A Resilience to agricultural habitat fragmentation in an arboreal marsupial. *Australian Mammalogy*. October 2016

competition between the two species is less when the relative population densities are low as in the case of the Proposal Area.

Brushtail possums have home ranges that are larger, or much larger (Molloy and Davis, 2016[5]), than WRP home ranges which means that the Proposal's linear clearing area is too narrow to contain viable Brushtail possum home ranges. Thus, although some Brushtail possums will lose access to part of their range within the Proposal Area, the density of Brushtails in the nearby receiving habitat will not increase as a result of Proposal clearing. Therefore, for the Proposal, Brushtail possum-WRP interactions will also remain within this population's normal 'operating range'.

Brushtail possums may compete with WRP for tree hollows and browse where their ranges overlap (Shedley and Williams, ibid). Brushtail possums require a more varied diet and this may lead to habitat partitioning between the species where the landscape supports a variety of vegetation types (Clarke, 2011[6]).

Shepherding of 79 WRP to Reserve 23000

As is described in the response to Comment No. 58, the proposed clearing of 60.9 ha required for the Proposal is very unlikely to displace the precautionary estimate of 79 individual WRPs. Field data indicates that Proposal clearing would impact a probable upper limit of 40 settled WRP home ranges.

During clearing works, WRP will be shepherded to trees in the closest habitat adjacent to the clearing area over the length of the Gelorup section of BORR.

It is considered unlikely that many disturbed WRP will re-locate to Reserve 23000, noting R23000 is located at the south western end of the 10.5 km proposal area and is located on the opposite side of Bussell Highway (dual carriageway). For further context regarding Reserve 23000, also refer to the responses provided for Comment No. 52 and Comment No. 55.

WRP density calculations

The figure of 0.34 WRP/ha is very clearly presented as a 'Proposal Area' density and, considering it is presented immediately after the sentence confirming the WRP density within mapped Proposal Area, WRP habitat is in no way construed to imply a lower density of WRP than is present. The figure of 0.34 WRP/ha is correct in what it represents, as is the figure of 0.91 individuals per hectare of surveyed habitat. The figure of 0.34 WRP/ha is not 'used' anywhere in the impact assessment. Main Roads agrees that, when contrasted with the WRP habitat density figure, the Proposal Area density figure illustrates the extent of the Proposal Area that is cleared and therefore not supporting of WRP, which is the great majority of the Proposal Area.

No.	Submission and/or issue	Relevant Submissions
61	The "bumping of trees with machinery", bumping a tree without pushing it over (even with a loader) is unlikely to move the WRP inside, and if that does not work, the tree will still be felled with the WRP still inside the tree.	50

[5] Molloy S. W. and Davis, R. A. (2016) A Resilience to agricultural habitat fragmentation in an arboreal marsupial. *Australian Mammalogy*. October 2016

[6] Clarke JR (2011) Translocation outcomes for the Western Ringtail Possum (*Pseudocheirus occidentalis*) in the presence of the Common Brushtail Possum (*Trichosurus vulpecula*): health, survivorship and Habitat use. PhD Thesis, Murdoch University, Perth Western Australia.

Management measures do not preferentially fell a tree with a threatened animal present. The "gentle bumping" and "soft felling" of trees with respect to WRP is part of a larger process within which other actions to minimise the presence of WRP at the time clearing commences are anticipated to be the primary mechanism for relocation of WRP and is a standard clearing technique approved previously by both DBCA and DWER. All protocols being undertaken are consistent with the DBCA management procedure *Procedures to Minimise the Risk to Western Ringtail Possums During Vegetation Clearing and Building Demolition* (DPaW, 2015) included in Appendix A of this document.

WRP habitat clearing protocols have been developed based on WRP site surveys and observations, and the potential for WRP use. Habitat clearing categories within the Proposal Area have been developed in consultation with Ms Barbara Jones, based on her WRP knowledge and the results of recent targeted WRP surveys within the Proposal Area completed to date.

Clearing within WRP habitat areas will be conducted during the period of February to August based on designated clearing categories clearing from the Proposal corridor towards adjacent habitat to support passive relocation. Clearing of Category 1 areas (known to support regular populations of WRP) would occur in winter months when densities area generally lower and would support the shepherding of WRP from the Proposal Area to adjoining habitats without the competition pressures from recently weaned young present in the spring months. Prior to and during construction the following actions would include:

- All WRP and BTP habitat that is to be retained within the development envelope will be surveyed and delineated with temporary fencing prior to site works to ensure it is conserved
- Pre-clearing fauna searches shall be conducted immediately prior to and during clearing operations and will include hollows, dreys, ground debris, dense ground-level vegetation, fallen timber and logs
- Vacant tree hollows suitable for WPR or BTP will be removed or blocked prior to clearing if feasible and where accessible
- Vacant dreys will be removed prior to clearing if feasible and where accessible
- Spotlighting of potential WRP and BTP habitat will be undertaken by a suitably experienced person for two nights immediately prior to clearing
- If WRP or BTP are observed during clearing operations, the tree containing the animal shall be left for up to 48 hours to allow for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied after 48 hours, the animal will be coerced / moved to a safe area outside of the clearing footprint by the appointed zoologist / environmental scientist / fauna spotter
- Trees, as noted above, that are observed to support WRP and / or BTP after 48 hours will be 'bumped gently' with a machine prior to felling. The operator and spotter will wait and observe the tree for a short time. If the animal remains in the tree it shall be pushed over slowly onto vegetation within the clearing area that is yet to be cleared. The 'soft felling' of habitat trees will provide a 'cushion' for the vegetation being felled, minimising the risk of injury to the animal and allowing any WRP and BTP present with the opportunity to safely vacate
- Felled trees with hollows, will be checked immediately for fauna after felling and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate
- Habitat clearing is to be staged, commencing from existing edge lines / roads and progressing towards habitat that will be retained to direct WRP and BTP towards these areas

- Vacant dreys within felled trees will be destroyed immediately to prevent animals re-entering them
- A post-clearing survey shall be undertaken immediately following each day's clearing operations and the following morning to identify the presence of any injured animals
- Cleared vegetation will be chipped immediately or transported at least 100 m from WRP and BTP habitat before further processing
- Movement / disturbance of clearing stockpiles will be confined to the period one hour after sunrise to one hour prior to sunset
- All buildings requiring demolition for the Proposal will be inspected for WRP and BTP for two days prior to demolition works
- An experienced zoologist / environmental scientist / fauna-spotter will be on-site at all times during the demolition of buildings suspected or observed to house WRP or BTP
- Machinery operators will maintain radio communication with their spotter.

Direct actions within habitat or vegetation with WRP or other threatened fauna individuals present inclusive of "gentle bumping" and "soft felling" of trees are a last resort action after other means of allowing for passive relocation have failed. The combination of the preclusion of refuge site use prior to clearing (where possible), pre-clearance surveys, staged clearing and implementation of sensitive clearing protocols will substantially reduce the likelihood of any WRP remaining within trees to be felled. To ensure the best outcome in regard to animal welfare, Main Roads intends to avoid handling any fauna during Proposal construction. The Proposal to gently bump any trees still housing WRP after 48 hrs is considered adequate and the best option to allow animals to self-relocate.

No.	Submission and/or issue	Relevant Submissions
62	The method described in the AMP for clearing (p.25, BORR IPT, 2020d), if followed, will likely results in the contravention of the Occupational Health and Safety Act 1984 (WA). It has some major occupational health and safety risks. A basic workplace risk assessment would show a significant risk being to the pedestrian (zoologist/fauna spotter) moving in the vicinity of large mobile plant while it is moving – even with radio communication. Vision is limited in these vehicles, and at most workplaces, the area where loaders operate are pedestrian free zones, and visibly signed as such. The only way to safely work is for the fauna spotter to keep a significant distance away from the loader while it is moving. Falling trees and debris will also constitute a major risk to anyone on the ground, which means that fauna spotters will be unable observe closely to see fleeing or injured animals during clearing operations, rendering the entire process unworkable. Procedures for leaving trees for 48 hours if an animal is spotted would result in major delays for clearing.	50, 61

The on-ground monitoring of fauna during clearing operations in a safe manner is common practice on Main Roads projects where fauna are expected to be encountered. Main Roads has full confidence from experience that fauna spotters can be safely managed during clearing operations without impeding safety or fauna management requirements.

No.	Submission and/or issue	Relevant Submissions
63	The Proponent has failed to provide sufficient discussion and analysis of the susceptibility of the WRP to climate change. Western ringtail possums are known to be susceptible to heat stress and can easily overheat at temperatures of 35ºC and above (Yin 2006). Due to their small size, WRP are thought to live close to the ecological and physiological limits of viability (DPW, 2014). The interaction of climate change and habitat quality is not sufficiently addressed by the Proponent in the AIPD, which forms a major gap in the Proponent's assessment of the impacts of the proposal, particularly over longer timescales	50, 56, 79

No significant impacts associated with the proposal would exacerbate the impact of climate change on the local populations of WRP (See Section 3.2.2 of the Preliminary Documentation). Considerations relative to climate change and a drying climate are important considerations for long term projects. However, the primary direct and indirect impacts of the proposal will occur during construction and thus are managed over a shorter time frame of 3-5 years. Accordingly, impacts associated with construction will be managed during the construction period and are not anticipated to be materially impacted by the long term effects of climate change.

The potential for seasonal impacts on WRP due to increased heat stress risk would be managed through clearing management protocols in Category 1 clearing category areas that provide key known WRP habitat. Management measures will include installation of temporary supplemental watering points and clearing towards adjacent habitat to promote passive relocation of WRP into adjacent habitats.

No.	Submission and/or issue	Relevant Submissions
64	MRWA's classification of habitat in the Proposal Area is inconsistent with EPBC Act policy statement 3.10; MRWA must revise to 'Area 1 – Core Habitat' to ensure consistency. The Targeted Fauna surveys show a high portion of the individuals observed within the Proposal area were mothers and their young (Table 4-2, Page 35 TFS). This is consistent with other localised observations of the species utilizing habitat in the area for breeding (Stone pers comm) and research on typical gestation periods for the species (Jones, 1994). Under the EPBC Act Policy Statement 3.10 for this species, existing habitat used for breeding purposes is considered 'Area 1 - Core Habitat'. DPW's Recovery Plan for the WRP notes that reproductive output is apparently related to habitat quality (preferring higher foliage nitrogen content in good condition Peppermint woodlands). Habitat quality may also influence sex ratios with a male bias likely to occur in marginal habitat (Jones et al 1994b). DPW notes that the mature peppermint woodland habitat within the Project area is considered critical to the survival of the species given the optimal densities that they can support (DPW, 2014, page 8). Contrastingly, Biota makes the claim that "none of the Proposal Area was defined as very high suitability". This claim	56

	intends to distract from the critical importance of the habitat in the Proposal Area.	

The submitter misconstrues the framing of habitat units in Policy Statement 3.10. The Proposal Area is not within the Area defined as "Core Habitat in Policy Statement 3.10, as is shown below. The Figure clearly shows that "Core Habitat, as defined by the Commonwealth, in the vicinity of the Proposal lies to the west of Bussell Highway. The Proposal Area lies fully within "Supporting Habitat" areas, which as is clearly noted Policy Statement 3.10, can include "*opportunities for foraging, breeding and dispersal*".

The comments by Biota are based on site specific WRP surveys that they have conducted since 2019.

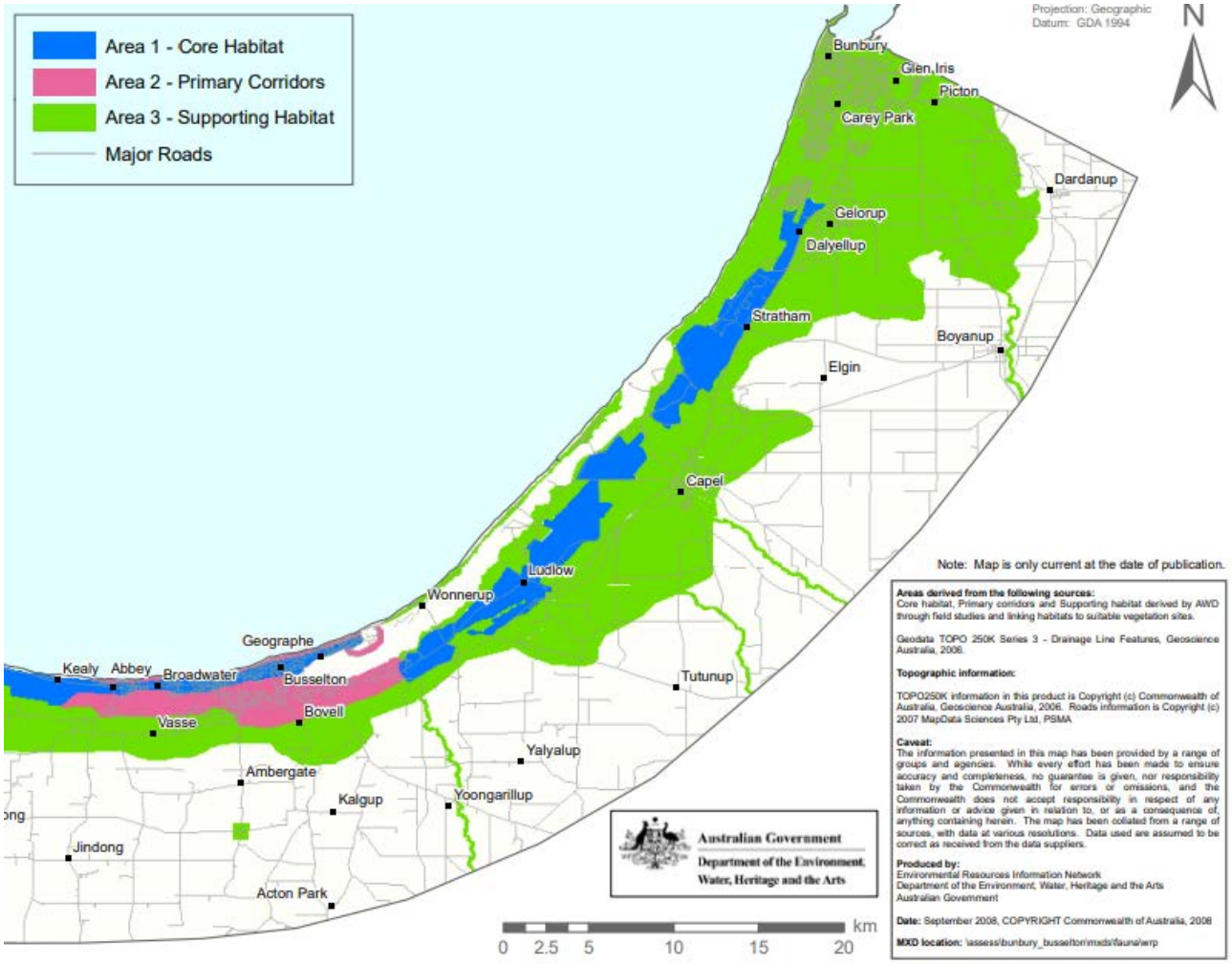

Figure 4. WRP habitat units in EPBC Act Policy Statement 3.10

No.	Submission and/or issue	Relevant Submissions
65	Table 3-2 summarises the impacts on the WRP and in 4/9 of the categories the impact is deemed to be potentially significant. This is an unacceptable result and the use of wording such as "potentially significant" is subjective with inadequate scientific data to support the conclusion.	16, 17, 22, 58, 59, 61, 79

The assessment of impacts is based on extensive survey effort the best available information for the species. With any assessment, uncertainties remain, and the Precautionary Principle may be applied in instances where impacts are anticipated to be significant. As defined under the EPBC Act (Section 391):

> *The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.*

Main Roads has in this instance highlighted a situation where all available data indicates impacts are less than significant, but the risk of uncertainty could result in the potential for significant impacts. In accordance with the explicit definition above Main Roads has identified where avoidance, management, or other measures can address that risk of uncertainty. Where management measures are anticipated to be sufficient to manage impacts, but uncertainties remain, potentially significant is wholly appropriate to ensure potential risk is identified and managed accordingly.

By identifying areas where potential residual significance remains, appropriate management and monitoring measures can be identified and implemented to minimise identified risk. As an example, identifying 'fragment an existing population into two or more populations' as potentially significant identifies the risks associated with impacts on connectivity of the WRP population. This in turn informs the design and construction of underpasses / rope bridges (engineered movement structures) to maintain connection between the habitat areas where residual significance potentially exists.

Refer to the responses to Comment No. 55 and Comment No. 58 with respect to additional data supporting the assessment of potential impacts on WRP.

No.	Submission and/or issue	Relevant Submissions
66	The proponent suggests that the impacts on the WRP are "considered unlikely to be significant" (Table 4.59 Updated environmental Referral Supporting Documentation and additional information) but then offers offsets to manage the residual impact. The offset properties however are not yet in possession of MRWA or DAWE and have not been fully assessed for suitability of possum habitat. Planting seedlings and revegetation measures cannot compensate for loss of foraging habitat.	22

Environmental offsets to address residual environmental impacts are a common requirement under State and Commonwealth environmental approvals processes.

The status of the proposed offsets is described in detail under Public Submission No.96. Main Roads will continue to assess viable offset options that meet the requirements of the proposal should any property identified to date be found to not have the desired values or not be able to be ultimately acquired. Environmental survey reports of proposed offset sites will be provided as part of Main Roads response.

No.	Submission and/or issue	Relevant Submissions
67	Biota (2019a) identified approximately 38 ha of breeding and foraging habitat for WRPs within the Surveyed Area including Jarrah/Marri Woodland and scattered trees over introduced grasses. WRPs were recorded wherever woodland fragments (particularly mixed woodland) occurred. Biota (2019a) undertook their investigations by using possum density, and assessed the importance of WRP habitat, within the targeted fauna Biota Study Area, by direct comparison with habitat in four contextual sites (within an 18 km radius of Bunbury town centre). Possum density was calculated based on the results of strip and distance sampling (Biota, 2019a). Based on the occurrence density, approximately 56 individuals are estimated to occur within the Surveyed Area (~38 ha). The un-surveyed area (~100 ha) is estimated to have up to 33 ha of potential WRP habitat. Based on a total potential habitat area of approximately 71 ha (8 ha within Surveyed Area and 33 ha within un-surveyed area) and the occurrence density, a conservative estimate of the abundance of WRPs within the Project Area is around 100 individuals. Biota (2019c) completed additional surveys to provide a regional context for the potential impacts from the Southern BORR proposal on WRPs. Preliminary results from the additional surveys estimate the WRP population for the Southern Swan Coastal Plain at 5,373 individuals. This estimate does not include suitable habitats in the semi urban and urban environment that are known to be inhabited by WRPs and is therefore considered to be a conservative estimate (i.e. lower than in reality). Based on the conservative estimate of WRPs within the Project Area (approximately 100 individuals), the Project Area represents up to 2.0 % of the regional population.	79

For WRP, field density is the most available and quantifiable 'proxy' for the carrying capacity of any woodland hectare (Shedley & Williams, 2014). However, some caution is required when using field results for this purpose, since WRP numbers, or density, rarely remain stable, especially in the modern climate. If sequential monitoring counts are applied to a subject site over more than 12 months, they can identify the two most important site population features, these being the annual minimum count of numbers, and the annual peak count, when most of each season's young are included in the count. If these two counts are known for a proposed habitat area clearing event, informed, quantitative and site relevant judgements regarding the probable impact outcomes for the area's habitat are possible. Management approaches that keep overall population numbers close to or within the monitored population's normal operational range (peak to trough) can impose 'within tolerance' disturbances and also identify clearing proposals that need to be modified. For this Proposal, no clearing will be undertaken during the months when WRP counts are peaking when most females have smaller youngsters. In regard to the use of WRP density as a proxy for mitigation measures, WRP field density information informs the WRP Clearing Categories (as defined in the Conservation Significant Fauna AMP, Appendix M) and what constitutes low/high risk clearing areas based on comparable baseline data.

Refer also to the response to Comment No. 55, which provides a comprehensive overview of the results of Main Roads bimonthly WRP count sequences (conducted between August 2019 and August

2021), and how this data has enabled sound estimation of the Proposal's clearing impact on WRPs, and also informed the proposed WRP mitigation and management responses.

No.	Submission and/or issue	Relevant Submissions
68	Possums located within urban areas should not be considered to be a viable part of the population. An urban environment is obviously not the natural habitat for the Western Ringtail Possum and although it can survive, its susceptibility to predator attack, disease and a reliance on food sources not found in their natural environment increases significantly. They can also become a pest to householders and if the community begins to dislike the WRP, it once again goes against the goals of the Recovery Plan.	79

We would note within Submission 79, it is also noted "Furthermore, the 2019 southern SCP estimate does not include suitable habitat in the semi-urban and urban environment, which are known to be utilised by WRPs. As such, the 2019 estimate is conservative (i.e. expected to be lower than in reality)."

While no part of the assessment relies on the presence of habitat in the semi-urban and urban environment, the reality exists that these habitats do likely represent part of the home ranges of WRP in the Proposal Area, especially in the Gelorup section where WRP home ranges occur in a very narrow corridor of remnant native vegetation between semi-urban residences that retain native vegetation. Accordingly, suitable habitat in the semi-urban and urban environment is considered relevant and appropriate in the context of WRPs in and adjacent to the Proposal Area.

No.	Submission and/or issue	Relevant Submissions
69	The report presents percentages of less than 1% based on an unpublished study, funded by Main Roads, to playdown and obscure the impact to the critically endangered WRP. The prospect of regional studies bolstering the overall population is a shallow argument as the species is still in decline due to increasing and cumulative impacts of threatening processes. Some submissions tied the increase in WRP population in the regional survey to an increase in survey effort, and not indicative of long term WRP numbers as quantitate survey methods have been overlooked. Biota's broad-brush population estimate (well above 20,000) is rough, simplistic and unreliable. Numerous surveys have confirmed that western ringtail possums are not evenly distributed across the habitats sampled (e.g. Jones et al. 1994b, Jones and Hillcox 1995, Jones et al. 2004, Wayne 2005, Wayne et al. 2006, Jones and Francesconi 2007). Biota has failed to adequately disclose the limitations and variability in their survey methods in providing a total sum estimate (Biota 2020, page 72). Biota has also failed to provide appropriate comparison to other relevant surveys and methodologies. Most of the populations within the Busselton area that	16, 17, 18, 43, 56, 58, 59, 79

	have had sufficient monitoring to detect a decline over the last 5-12 years have shown declines of 20-80 per cent (Woinarski et al. 2014). CCWA advises MRWA to seek independent population estimates as the weight of recent research indicates that MRWA has underestimated the population density in the Proposal Area and adjacent area which infects MRWA's conclusions about the level of impact the proposal will cause to WRP.	

The population estimate derived from Biota's Regional Surveys (Biota, 2020d) is based on the survey of 114,243 ha using 1,249 transects equating to a total effort of 1,287.2 km of transect. Across these transects 2,939 detections of 3,677 individual WRP were made. Survey effort was divided amongst the three WRP key management zones: SCP, Southern Forest and South Coast.

Of the three key management zones, the surveyed area of the SCP management zone yielded the greatest estimated abundance of WRP at 9,270 individuals, the Southern Forest management zone yielded an estimate of 7,500 individuals and the South Coast management zone yielded an estimate of 3,340, WRP. These three regional population estimates indicate a combined number in excess of 20,000 individual WRP in the surveyed area, far exceeding that for the entire State as documented in the IUCN assessment (estimated at 3,400 mature individuals).

The methods and results of the Regional Surveys provide a useful framework for two major applications; to determine the potential impact of development projects upon local WRP populations, and to understand the wider trends in population abundance and distribution (i.e. conservation status) of WRP with these data providing a robust 2019 baseline.

By successfully applying a unified survey method (line transect distance sampling) across a variety of geographic settings and vegetation types in each of the primary WRP Management Zones, the Regional Surveys also address the key Threatening Process identified in the WRP Recovery Plan (DPaW, 2017) "Gaps In Knowledge". Similarly addressed are several of the WRP Recovery Plan Objectives. The Regional Surveys therefore are a significant contribution to the ongoing conservation efforts for the WRP.

The final report for the WRP Regional Survey (Biota, 2020b) is appended to the response to submissions in Appendix A. The rationale for selecting distance sampling as the methodology for the survey is discussed in detail in Section 2.3.3 of that report. The findings of the Regional Survey have been provided to the WRP Recovery Team, DBCA, DWER, DAWE and EPA. WA Regulator and Recovery Team feedback received to date on the Regional Survey does not align with CCWA's position.

4.3.2. Black Cockatoos

No.	Submission and/or issue	Relevant Submissions
70	*Calyptorhynchus latirostris* (Carnaby's Cockatoo or Black Cockatoo) (Endangered); *Calyptorhynchus baudinii* (Baudin's Cockatoo) (Endangered); *Calyptorhynchus banksii naso* (Forest Redtailed Black Cockatoo) (Vulnerable) The proponent intends to clear up to 64.5 ha of foraging habitat, and destroy up to 1109 large trees (diameter at Breast Height >500 mm). This is unacceptable.	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 35, 36, 37, 40, 41, 43, 44, 45, 46, 47, 49, 51, 52, 54, 55, 57, 58, 59, 60, 63, 64, 65, 66, 67, 69, 70, 71, 74, 75, 77, 78, 80, 81, 82

	The proponent claims to have done everything to minimise the impact but has an alternative route with less impact that has been surveyed. This alternative route would potentially remove 48 ha of foraging habitat and 588 large trees but has a larger corridor and so these impacts have the potential to be reduced with further study and design improvements. (Southern Selection Alternative Alignment Environmental Impact Assessment June 2019).	

The Alignment Selection process, described in Response to Submission #5 concluded that Black Cockatoo habitat was equally impacted under both the BORR Southern Section (GBRS) and the Alternative Alignment.

A high level of mitigation and management has been applied to the Proposal, with Main Roads making substantial changes to the Proposal design in order to mitigate potential impacts on terrestrial fauna including Black Cockatoos. The changes made have resulted in the reduction of 14.6 ha in the area of Black Cockatoo habitat impacted, and five trees with potentially suitable nest hollows no longer being impacted. Connectivity of habitat will be maintained and enhanced through revegetation of additional areas within the Proposal Area.

As described in section 1.3.6 of the Preliminary Documentation, changes to the Proposal design have been made since referral in September 2019 to reduce impacts to Black Cockatoos. Main Roads has recently made additional changes to the Proposal Area which has reduced impacts on Black Cockatoo foraging habitat by 4.5 ha including 10 Suitable DBH Trees (>500DBH) of which two contain a potentially suitable nest hollow for breeding of Black Cockatoos.

Main Roads has committed to revisiting impact areas in detailed design, but additional avoidance may not be possible. Changes to the design have included a range of refinements to minimise the impacts to the environment such as reducing median widths and changing the design of interchanges to reduce clearing requirements. The resulting Proposal reflects the minimum land area required for the road corridor. Impacts to MNES and other environmental values have been reduced to the maximum extent possible and the remaining impact cannot be avoided if the Proposal is to proceed.

The key management actions that Main Roads will implement to manage the potential impacts of the Proposal to Black Cockatoo individuals and habitat are identified in Table 4 6 of the Preliminary Documentation. A complete list of management actions is outlined within the Black Cockatoo Action Management Plan (AMP) (BORR IPT, 2020e) (Appendix L) and in the management matrices presented in Appendix K.

No.	Submission and/or issue	Relevant Submissions
71	Main Roads' plan 'to block suitable nest hollows within the area of the Proposal prior to the Black Cockatoo breeding season' assumes that black cockatoos can find other hollows. Black cockatoos may be returning to a suitable hollow that they know has been successful in the past or to one in which that bird was raised. There is competition for any hollow (ducks, other parrots, feral bees) so every hollow over the area of occupancy is significant.	14, 16, 17, 18, 58, 59

Based on discussions to date with DBCA on the Proposal, nesting hollows on the Swan Coastal Plain are not believed to be a constraint for Black Cockatoo breeding. Main Roads will continue to consult with DBCA and is open to the use of artificial hollows should it be determined that the loss of breeding habitat is likely to have a significant residual impact on the breeding of Black Cockatoos in the area.

No.	Submission and/or issue	Relevant Submissions
72	The Referral Guidelines state of foraging habitat that 'large areas of foraging habitat are required to support black cockatoo populations.' (p 13 ibid) Over 2 million hectares of Carnaby's Cockatoo habitat has already been cleared since European settlement (DEC unpublished data 2010, Carnaby's Cockatoo Recovery Plan). The Recovery Plan also advises that EPA Guidance Statement No 33 states 'that the EPA is unlikely to recommend the approval of projects that have significant adverse impact on the species.' (p 22). BORR Team's Table E-1 is headed 'Environmental management measures'. Here we read phrases 'where possible' and 'to the extent practicable', and 'the tree [with a hollow] may be pushed over slowly to minimise risk of injury to any undetected animal (if present)'. (pp 3, 4 Black Cockatoo Action Management Plan (AMP)). 'The key environmental management and monitoring actions for the Proposal' cannot be seen as adequate reassurance when the fact remains that black cockatoo habitat and foraging trees and shrubs will be cleared under this proposal. Such clearing will have a direct and indirect impact that cannot be managed and mitigated. Should the proposal proceed, monitoring would be recording the further decline of populations of Carnaby's Cockatoo. The 'Performance Targets' 'Post construction', state that 'Rehabilitation provides suitable foraging habitat within 10 years of completion.' Black cockatoos cannot wait ten years. Black cockatoos must have enough suitable food to enable them to be healthy enough to breed. 'For black cockatoos, it is more appropriate [than referring to 'populations' and 'important populations'] to consider significance in terms of impacts on habitat rather than a resident population. (p4 Referral guidelines for three threatened black cockatoo species: Department of SEWPAC)	14, 23, 25, 56, 61, 79

Main Roads recognises the lag between rehabilitation offsets tree planting and the impacts of the Proposal with respect to Black Cockatoo foraging and breeding hollows. Based on discussions to date with DBCA on the Proposal, nesting hollows on the Swan Coastal Plain are not believed to be a constraint for Black Cockatoo breeding. Therefore artificial nest hollows are not being proposed at this time.

Main Roads is confident that the proposed offsets will address the residual impact regarding DBH Trees. Offset site 1 has been identified to provide a total of 1,243 trees (Biota, 2019) that have a DBH suitable to develop nest hollows for black cockatoos. Based on ground survey, the site assessment for Option 1 determined that 154 potential nest hollows were present in 133 trees located on the offset site.

Main Roads has recently made additional changes to the Proposal Area which has reduced impacts on Black Cockatoo foraging habitat by 4.5 ha including 10 Suitable DBH Trees (>500DBH) of which two contain a potentially suitable nest hollow for breeding of Black Cockatoos.

No.	Submission and/or issue	Relevant Submissions
73	According to the WESTERN AUSTRALIAN WILDLIFE MANAGEMENT PROGRAM NO. 52: "Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan: "This Recovery Plan will be deemed completely successful if, within a ten year period, depend on: The extent of nesting habitat (trees with nesting hollows), feeding habitat (as defined by vegetation complexes or suitable revegetation), and night roosting habitat (as identified through community survey) are maintained throughout the species' range. " The long-term survival of a robust population of all three black cockatoos depends on the availability of suitable woodland breeding habitat and tree hollows, and foraging habitat capable of providing enough food to sustain the population. A widespread decline in the health of canopy species and the ecosystems they support would have consequences for Carnaby's Cockatoos in terms of available nesting, food and roosting sites. Further loss associated with the Proposal is contrary to the Approved Recovery Plans.	14, 22, 32, 38, 50, 56, 61, 79

Within the Commonwealth Assessment for the BORR Southern Section Proposal, consistency with recovery plans for Black Cockatoo species are addressed in Table 10-2 of *Southern Section Additional Information for Preliminary Documentation – EPBC Ref: 2019/8543* (BORR IPT, 2020a).

Table 10-3. Relevant Recovery Plans, Threat Abatement Plans and Conservation Advice for Matters of National Signficance (MNES) (*Reprinted from EPBC Ref: 2019/8543 documentation*)

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
Black Cockatoos	**WA Department of Parks and Wildlife (DPaW)** (2013)**, 'Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan'**		
	1	Loss of breeding habitat	The Proposal may exacerbate this threat, however the Proposal is designed to maximise use of existing disturbed areas to minimise the loss of breeding habitat. Up to an estimated 60.9 ha of native vegetation will be removed for the Proposal which has been assessed as potential Black Cockatoo breeding habitat. A total of up to 1,088 Black Cockatoo Suitable DBH Trees will be removed for the Proposal including 11 trees with a potentially suitable nest hollow(s). No known nesting trees are present within the Proposal Area. In relation to breeding within the Proposal Area, taking into account the lack of evidence of confirmed use of any Proposal Area hollows by Black Cockatoos, the accessibility of the area for community observations, the number of surveys undertaken over several breeding seasons, and the fact that the species is iconic and easily identified, Main Roads considers that Black Cockatoo breeding is not occurring within the Proposal Area.
	2	Loss of non-breeding, foraging and night roosting habitat	The Proposal may exacerbate this threat; however the Proposal is designed to maximise the use of existing disturbed areas to minimise the loss of habitat. No night roosting habitat was recorded within the Proposal Area during field surveys, therefore no impact to this habitat is expected to result.
	3	Tree health	The Proposal is not expected to exacerbate this threat. Dieback mapping will be updated as part of project planning especially in regards to ascertaining areas that can be effectively protected from dieback infestation. A Hygiene Management Plan will be implemented for construction of the Proposal as per the CEMP to minimise risk of the impact of disease.
	4	Illegal shooting	The Proposal will not exacerbate this threat. No firearms will be permitted on site as per the CEMP.
	5	Illegal taking	The Proposal will not exacerbate this threat.

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
			Only qualified fauna handlers will relocate fauna as per the *Conservation Significant Fauna AMP* (BORR IPT, 2020a).
	6	Collisions with motor vehicles	The Proposal may exacerbate this threat; mitigation options will be considered as part of detailed design. The risk of vehicle strike is recognised and addressed through management measures outlined in the Black Cockatoo AMP, including the exclusion of revegetation for foraging habitat within a 10 m buffer from nearest traffic lane.
	Department of the Environment, Water, Heritage and the Arts (DEWHA) (2009a)**, 'Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo)'**		
	1	Illegal shooting	The Proposal will not exacerbate this threat. No firearms will be permitted on site as per the Construction Environmental Management Plan (CEMP).
	2	Habitat loss	The Proposal may exacerbate this threat, however the Proposal is designed to maximise the use of existing disturbed areas to minimise the loss of habitat. Up to an estimated 60.9 ha of native vegetation that has been assessed as potential Black Cockatoo (breeding and foraging) habitat will be removed for the Proposal. No night roosting habitat was recorded within the Proposal Area during field surveys, therefore no impact to this habitat is expected to result.
	3	Nest hollow shortage	The Proposal may exacerbate this threat however, the Proposal is designed to maximise use of existing disturbed areas to minimise the loss of breeding habitat. An estimated maximum of approximately 60.9 ha of native vegetation that has been assessed as potential Black Cockatoo breeding habitat will be removed for the Proposal. A total of up to 1,088 Black Cockatoo Suitable DBH Trees will be removed for the Proposal including 11 trees with a potentially suitable nest hollow(s). No known nesting trees are present within the Proposal Area. In relation to breeding within the Proposal Area, taking into account the lack of evidence of confirmed use of any Proposal Area hollows by Black Cockatoos, the accessibility of the area for community observations, the number of surveys undertaken over several breeding seasons, and the fact that the species is iconic and easily identified, Main Roads considers that Black Cockatoo breeding is not occurring within the Proposal Area.

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
	4	Competition from other species	The Proposal is unlikely to exacerbate this threat. Various other bird species (e.g. other Black Cockatoo species, Galahs and Wood Ducks) and other fauna (WRP and South-western Brush-tailed Phascogales) that may compete for hollows with the Black Cockatoos are known to occur within the Proposal Area.
	5	Injury or death from *Apis mellifera* (European Honeybees)	The Proposal is unlikely to exacerbate this threat. The Proposal will result in the clearing of 11 Trees with a potentially Suitable Nest Hollow for Black Cockatoos. A general reduction in the amount of tree hollows may increase competition between fauna using the hollows and the European Honeybee. There are no plans to control European Honeybee populations.
	Department of Environment and Conservation (DEC) (2008)**, 'Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus Baudinii* and Forest Red-Tailed Black Cockatoo *Calyptorhynchus Banksii Naso*) Recovery Plan'**		
	1	Killing by illegal shooting	The Proposal will not exacerbate this threat. No firearms will be permitted on site as per the CEMP.
	2	Feral honeybees	The Proposal is unlikely to exacerbate this threat. The Proposal will result in clearing 11 Trees a potentially suitable nest hollow(s) for Black Cockatoos. A general reduction in the amount of tree hollows may increase competition between fauna using the hollows and feral honeybees. There are no plans to control feral honeybee populations.
	3	Habitat loss	The Proposal may exacerbate this threat, however the Proposal is designed to maximise the use of existing disturbed areas to minimise the loss of habitat. Up to an estimated 60.9 ha of native vegetation that has been assessed as potential Black Cockatoo (breeding and foraging) habitat will be removed for the Proposal.
	4	Nest hollow shortage	The Proposal may exacerbate this threat however, the Proposal is designed to maximise use of existing disturbed areas to minimise the loss of breeding habitat Up to an estimated 60.9 ha of native vegetation that has been assessed as potential Black Cockatoo (breeding and foraging) habitat will be removed for the Proposal.

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
			In relation to breeding within the Proposal Area, taking into account the lack of evidence of confirmed use of any Proposal Area hollows by Black Cockatoos, the accessibility of the area for community observations, the number of surveys undertaken over several breeding seasons, and the fact that the species is iconic and easily identified, Main Roads considers that Black Cockatoo breeding is not occurring within the Proposal Area. A total of up to 1,088 Black Cockatoo Suitable DBH Trees will be removed for the Proposal including 11 trees with a potentially suitable nest hollow(s). No known nesting trees are present within the Proposal Area.
	5	Nest hollow competition	The Proposal is unlikely to exacerbate this threat. The Proposal will result in clearing of up to 11 Trees a potentially suitable nest hollow(s) for Black Cockatoo. A general reduction in the amount of tree hollows may increase competition between fauna and other species using hollows.
	TSSC (2018b)**, 'Conservation Advice *Calyptorhynchus baudinii* Baudin's Cockatoo'**		
	1	Destruction of nesting and foraging trees from fire events	The Proposal is not expected to exacerbate this threat. The threat of bushfires will be managed as per the CEMP.
	2	Loss of hollows from European honey bees (*Apis mellifera*)	The Proposal is unlikely to exacerbate this threat. The Proposal will result in clearing of up to 11 Trees a potentially suitable nest hollow(s) for Black Cockatoo. A general reduction in the amount of tree hollows may increase competition between fauna using the hollows and the European Honeybee. There are no plans to control European Honeybee populations.
	3	Nest hollow shortage due to competition with native bird species	The Proposal may exacerbate this threat, however the Proposal is designed to maximise use of existing disturbed areas to minimise the loss of breeding habitat. Various other bird species (e.g. other Black Cockatoo species, Galahs and Wood Ducks) and other fauna (WRP and South-western Brush-tailed Phascogales) that may compete for hollows with Baudin's Cockatoo are known to occur within the Proposal Area; the general reduction in available hollows may increase competition between bird species.
	4	Illegal shooting	The Proposal will not exacerbate this threat. No firearms will be permitted on site as per the CEMP.
	5	Phytopathogens (Dieback)	The Proposal is not expected to exacerbate this threat. Dieback mapping will be updated as part of detailed project planning especially in regards to ascertaining areas that can be effectively protected from dieback infestation.

EPBC ACT LISTED	PLAN/ CONSERVATION ADVICE AND THREATS		RESPONSE
			A Hygiene Management Plan will be implemented for construction of the Proposal as per the CEMP to minimise risk of the impact of disease.

No.	Submission and/or issue	Relevant Submissions
74	Abundance figures for Red-tailed Black Cockatoo are from 2009 and out of date. Carnaby's numbers are from 2013 and also out of date.	16, 17, 58, 59, 61

All calculations are based on the most recent available data, which is deemed appropriate for use in the assessment. With respect to Red-tailed Black Cockatoo (DEWHA, 2009a) and Carnaby's (DPaW, 2013), these are the most current population abundance estimates and appropriate for assessment.

No.	Submission and/or issue	Relevant Submissions
75	A 12km radius around the proposed site has been considered but no justification for selecting 12km. % impact less than 1 is produced by using vegetation in a 12km radius but do not say why 12km radius is selected. The report states there are no confirmed roosting sites within 12km of the proposal area, this is not correct, from Birdlife Australia's Great Cocky Count there are 16 recorded roost sites within 12km of the proposal, (Peck A, pers. comm., 2020, Nov 27), see roost site data supplied. This raises the question what other key information has been missed and suggests that the habitat to be removed will have a significant impact on local BC populations, particularly for breeding. It may suggest that Main Roads do not have a good understanding of the BC populations in the area.	16, 17, 18, 22, 58, 59, 61, 72, 83

Assessment of the location and extent of any roosting and breeding habitat within the development envelope and within a 12 km radius of the proposed action area was included specifically in the request to the proponent for the Preliminary Documentation to be provided. This is noted in Appendix B of the Preliminary Documentation (*Additional Information Request*).

Data found within the Great Cocky Count roosting datasets (GoWA, 2019) includes data for occurrences of Black Cockatoo roosting within 12 km of the Proposal, including three buffers that intersect the Proposal Areas. Figure 9 of the Preliminary Documentation has been updated to show all potential roosting sites and is replicated below. The potential for impacts on Black Cockatoo roosting within the Proposal Area were already recognised to potentially exist in the Preliminary Documentation. No roosting sites are known to occur within the Proposal Area based on MRWA site assessments and the impact is not anticipated to be significant.

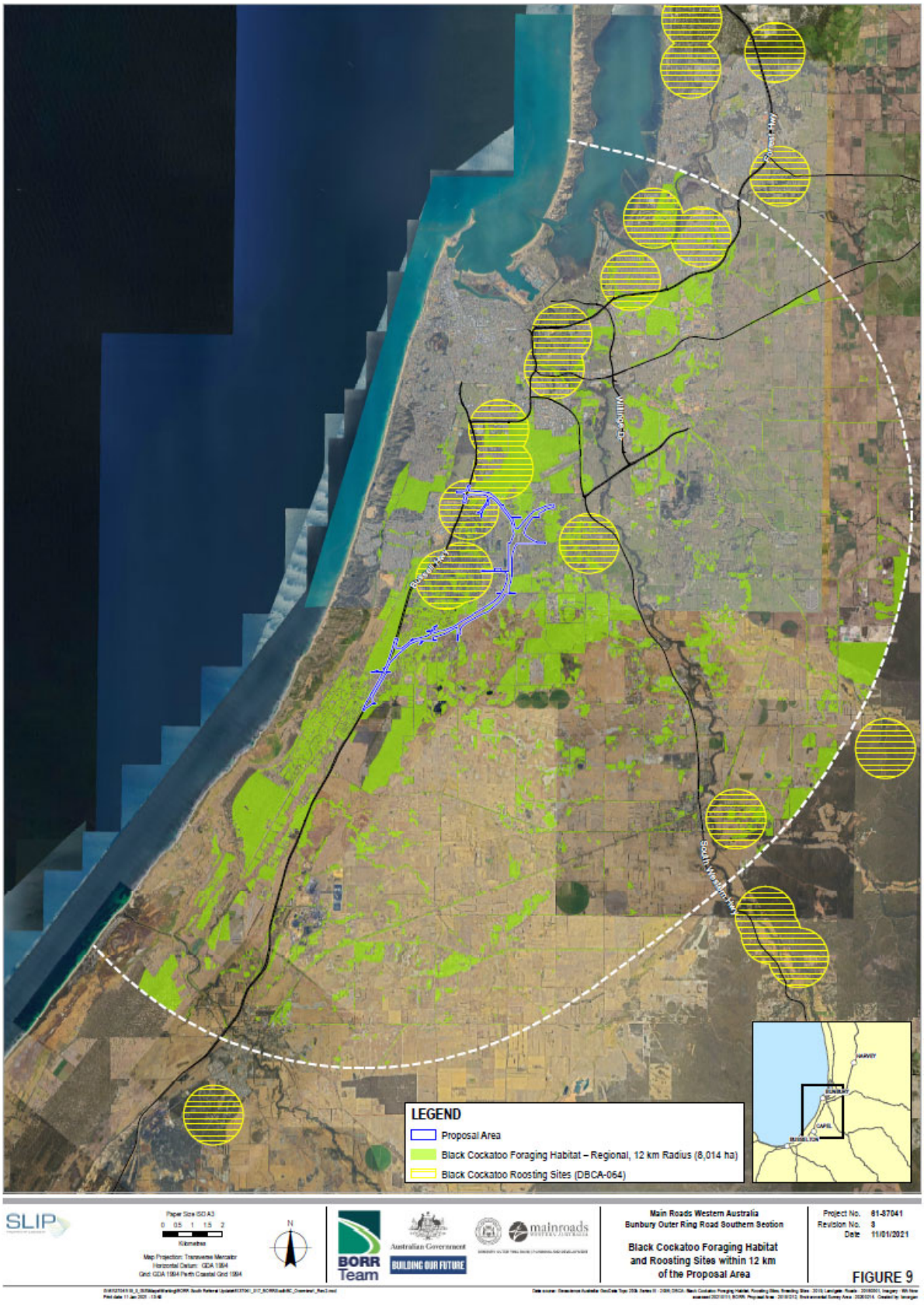

Figure 9. Black Cockatoo Foraging Habitat and Roosting sites within 12km of the Proposal Area (*excerpted from Preliminary Documentation*)

No.	Submission and/or issue	Relevant Submissions
76	"Vehicle strike has been recognised as being an important threatening factor for black cockatoos and is likely to increase in significance as the number of vehicles on roads in Western Australia grows (Le Souëf 2012)." Page 19 Report talks up the risks of vehicle strike as they believe their lack of planting within 10m of the road will mitigate this risk. Elsewhere the reason for no reveg. in this area is given as road safety and minimising future maintenance (section 1.3.4).	16, 17, 18, 23, 25, 38, 50, 56, 58, 59, 61

In relation to vehicle use of the Proposal following construction, the risk of mortality of Black Cockatoos from vehicle strike has been minimised as far as practicable. Mortality or injury by vehicle strike has been recognised as a general threat from interaction with humans, and vehicle strike is a specific threat to Carnaby's Cockatoo (DSEWPC, 2012b). Vehicle strike has been recorded as accounting for up to 10 % of mortality or injury to Black Cockatoos (Saunders *et al.* 2011b cited in DBCA (2013), however this is considered to be conservative as there are likely to be a large proportion of vehicle strikes not reported (DBCA, 2013), and in addition, the number of vehicle strikes is expected to increase as the number of vehicles on roads increase (DBCA, 2013).

Revegetation works within the Proposal Area will ensure that vegetation suitable for Black Cockatoo foraging is not established within 10 m of the road formation; such that Black Cockatoos are less likely to be present near the road formation when compared to other existing roads (for example, Bussell Highway where the foraging vegetation occurs adjacent to the road formation). The parallel use of the 10 m buffer for road safety and minimising future maintenance does not negate the value of the buffer in minimising vehicle strike risks. The measure is of such value that it was included as a condition of approval for the BORR Northern and Central Sections Project by the WA EPA (MS 1155, Condition 6-2(4)).

Further, the risk of pooled water on the road surface which may attract Black Cockatoos for drinking has been minimised through the Proposal design which incorporates road drainage to direct water run-off away from the road formation. Commonwealth guidance recommends road designs which limit the concentration of Black Cockatoos on roadsides (DSEWPC, 2012b). While management will minimise impacts, the risk of vehicle strike cannot be eliminated completely as foraging habitat and water sources for Black Cockatoos occur adjacent to the Proposal Area.

No.	Submission and/or issue	Relevant Submissions
77	MRWA will remove 1,096 trees with a Diameter Breast Height >500mm and up to 13 trees considered to have Potentially Suitable Hollows. MRWA must undertake new detailed surveys for Black Cockatoos as MRWA's own survey efforts to date are likely to have underestimated the importance of Proposal Area habitat for Black Cockatoos. A citizen science survey was conducted in 2020, which sought to quantify the environmental values of the project area with particular reference to Black Cockatoo habitat. The survey team discovered 487 mature trees with potentially suitable nest hollows for Black Cockatoos (Gelorup Citizen	16, 17, 18, 22, 34, 38, 56, 58, 59, 61, 72

	Science Team, 2020). Submissions note that the findings of the citizen science survey indicate that further work is required by the Proponent to determine the correct number of active and potential nesting sites for Black Cockatoos before DAWE is sufficiently informed to assess whether the impacts of the proposal are acceptable.	

Based on the limited information provided, a preliminary review of the information available indicates that data collected by Main Roads for the Proposal is complete and suitable for assessment. It is understood that the community survey covered the Gelorup section of the BORR Southern Section alignment (approximately 2.5 km in length), which contains the majority of the Black Cockatoo habitat.

More than 1000 trees that had a suitable DBH were recorded within the corridor, while the community survey recorded less than 500 trees with a suitable DBH.

The assessment of Black Cockatoo habitat was undertaken in accordance with the relevant State and Commonwealth guidelines. The survey undertaken by FoG used a different classification criteria. As such, a direct comparison is not possible.

The community survey used different criteria for the full survey which resulted in the identification of 2,350 “significant trees”, with “significant trees” being described as:

- Tuart (*Eucalyptus gomphocephala*): circumference >940 millimeters (mm)
- Jarrah (*Eucalyptus marginata*): circumference >500 mm
- Marri: *Corymbia calophylla*: circumference >500 mm
- Peppermint: *Agonis flexuosa*: circumference>500 mm
- Common (Candlestick) Banksia: *Banksia attenuata*: circumference >300 mm
- Snottygobble: *Persoonia longifolia*: circumference >140 mm
- Woody Pear (*Xylomelum occidentale*): circumference >300 mm
- Moodja: (Christmas Tree, *Nuytsia floribunda*): circumference >400 mm
- Culturally significant trees: trees with scars, twists, leans.

Notably, the criteria for culturally significant trees is subjective and no accounting for trees that met this classification or the DBH of those trees is provided. Regardless, given that several species were counted below a DBH of 500 mm, notably including Woody Pear and Candlestick Banksia at ≥ 300 mm DBH (312 and 693 individuals respectively), the variance in numbers is reasonable and reflects the differing criteria.

For “habitat trees”, the Proposal’s assessment focused on trees with at ≥ 500 mm DBH, trees potentially suitable to support hollows and Black cockatoo breeding, which were subsequently assessed by drone to verify the suitability of the hollows. For the community tree survey, trees were classified as “habitat trees” if they met any of the following criteria:

- Diameter >500 mm at breast height (DBH)
- Hollow diameter >300 mm
- Likely spouts visible from ground level
- Visible evidence of nests or dreys

- Significant evidence of cockatoo foraging nearby.

Again, the more expansive set of criteria inclusive of WRP habitat and subjective criteria, suggests the two surveys are not likely to be significantly different if compared in detail on an equivalent basis. As such, differences between the two surveys are logical and reflective of the different methodologies used. None of the differences between the two surveys suggest any lack of efficacy or rigour in either survey and do not change the outcomes of the assessment.

No.	Submission and/or issue	Relevant Submissions
78	The proponent recognises the concern that breeding hollows typically only occur in large mature trees of >200 years of age. (p46 -47 Table 2.7) The proposal to destroy 1109 large suitable nesting trees will ultimately reduce the number of nesting hollows available as current nesting trees mature and die. These large trees are natures "reserve" for the next generation of hollows and cannot be replaced.	16, 17, 18, 22, 50, 58, 59, 61, 79

Main Roads recognises the lag between offset tree planting and the impacts of the Proposal with respect to Black Cockatoo breeding hollows. Based on discussions to date with DBCA on the Proposal, nesting hollows on the Swan Coastal Plain are not believed to be a constraint for Black Cockatoo breeding. Main Roads will continue to consult with DBCA and is open to the use of artificial hollows should it be determined that the loss of breeding habitat is likely to have a significant residual impact on the breeding of Black Cockatoos in the area.

No.	Submission and/or issue	Relevant Submissions
79	MRWA was specifically asked to provide a threatened fauna EMP but has only provided this for the Western Ringtail Possum, and there is no EMP provided for the Black Cockatoo species.	23, 25, 72

The Black Cockatoo AMP has been submitted to the Commonwealth for assessment under EPBC Ref: 2019/8543 and is available on Main Roads Website at https://www.mainroads.wa.gov.au/globalassets/projects-initiatives/projects/regional/bunbury-outer-ring-road/environment-and-community/appendix-l-black-cockatoo-action-management-plan.pdf

The AMP was available throughout the EPBC Public Review process (14 November 2020- 18 December 2020), which ran in part concurrently to the EPA Review process (19 October 2020- 14 December 2020)

No.	Submission and/or issue	Relevant Submissions
80	Of the 13 potential nest sites, only 5 were able to be assessed using drone technology. Two of these trees showed positive signs of nesting and yet the proponent states (page 47) that no known nesting hollows … will be impacted by the Proposal. The Proponent has not made sufficient survey effort to affirmatively identify breeding habitat sites. All trees need to be assessed, with specific attention to the breeding period (Nov-Feb) and any trees with evidence of active breeding should be retained.	43, 50, 56, 61, 79

A total of 1,088 trees with a suitable DBH to develop nest hollows (i.e. ≥ 500 mm DBH) for black cockatoos have been recorded within the BORR Southern Section Proposal Area. Of these, 115 were the subject of a separate hollow-suitability assessment. Of the 115 trees subject to the hollow-suitability assessment:

- **76** were determined to be not suitable
- **26** were determined to be Unlikely suitable[7]
- **Three (3)** were determined to be potentially suitable
- **Two (2)** were determined to be potentially suitable and had potential BC nesting evidence
- **Eight (8)** were ground assessed only and conservatively assumed to be potentially suitable

In total 11 trees were determined to be potentially suitable within the Proposal Area, including 8 which could not be accessed by drone for assessment.

Main Roads assumes the potential that breeding does occur and may occur during construction. Management measures are proposed accordingly, and the impact is considered to not be significant. The statement “no known nesting hollows” does not infer that no potential black cockatoo nesting sites would be impacted. The removal of 11 large trees containing hollow(s) potentially suitable for Black Cockatoo nesting is not anticipated to be significant. Based on discussions to date with DBCA on the Proposal, nesting hollows on the Swan Coastal Plain are not believed to be a constraint for Black Cockatoo breeding.

No.	Submission and/or issue	Relevant Submissions
81	The Biota (2020b) survey relied on by the Proponent, failed to allocate sufficient survey effort to affirmatively identify critical habitat for this species, including nesting hollows. The treatment of this survey in Section 4.4.5.1 fails to engage with the DPW’s criteria for habitat critical to survival and does not describe the habitat in adequate, definitive terms. CCWA notes that the Proponent must undertake further surveys to make quantifications and qualifications that actually inform DAWE in the framework provided by the DPW, otherwise it is likely that DAWE is not sufficiently equipped to	56

[7] Consistent with Draft Commonwealth Guidance, “Unlikely Suitable” trees have hollows with an entrance greater than 12cm, but other required criteria of “Potentially suitable” (i.e. width and depth to support nesting chamber, suitable angle of entrance/egress) were absent (DoEE, 2017).

	determine the extent to which the 65.4 ha of habitat to be cleared is habitat critical to the survival of the species.	

DPaW (2013) summarises habitat critical to survival for Carnaby's Cockatoos as:

- *The eucalypt woodlands that provide nest hollows used for breeding, together with nearby vegetation that provides feeding, roosting and watering habitat that supports successful breeding;*
- *Woodland sites known to have supported breeding in the past and which could be used in the future, provided adequate nearby food and/or water resources are available or are re-established;*
- *In the non-breeding season the vegetation that provides food resources as well as the sites for nearby watering and night roosting that enable the cockatoos to effectively utilise the available food resources.*

The Bunbury Outer Ring Road Southern Section Targeted Fauna Assessment (Appendix E, (Biota, 2020b) characterises all of these critical habitat components in appropriate detail to inform the assessment of impacts in the Preliminary Documentation, defining suitable foraging and breeding habitat associated with appropriate vegetation communities mapped within the Proposal Area (Appendix E, Table 5.1), mapping potential breeding hollows with a drone level survey of potentially suitable hollows (Appendix E, Section 4.4.2.1), and an assessment of potential roosting habitat within 12 km of the Proposal (Table 2-7, Section 2.5.1 and Figure 9 of the Preliminary Documentation).

The extensive work undertaken has informed Main Roads implementation of the mitigation hierarchy to avoid and minimise potential impacts associated with the Proposal and should allow the EPA to be able to adequately assess the Proposal's impact on Black Cockatoo.

No.	Submission and/or issue	Relevant Submissions
82	MRWA needs to improve the analysis of cumulative impacts of the Proposal on Black Cockatoos. MRWA has determined cumulative impacts at a miniscule scale and has failed to consider important implications of the project for the survival of the species. Approximately 87% (525,732 ha) of potential Carnaby's cockatoo habitat has been cleared in the wheatbelt since European settlement (DPW, 2016). Hollow bearing trees suitable for nesting are now largely restricted to remnant patches of woodland and individual trees within cleared sites (Saunders et al 1998) such as the vegetation proposed to be destroyed by the Proponent. Black Cockatoos must compete with other species such as introduced corellas and galahs, which further restricts their distribution and may lead to breeding failures (Sanders, 1982). Additionally, a widespread decline in the health of canopy species and the ecosystems relied on by this species (due to introduced pathogens, particularly dieback) has significantly reduced the availability of critical habitat across the species distribution. The Proponent's failure to properly disclose this context for assessment of impacts should not inhibit DAWE's consideration of the implications and scale of cumulative impacts, and significance of the risk to Black Cockatoos from considerable loss of habitat.	56

The assessment of impacts for the BORR Southern Section is considered cumulatively with regard to the potential impacts of the BORR Northern and Central Section, the only other identified reasonably foreseeable action within the Proposal Area. An assessment of direct and potential indirect impacts, as well as cumulative impacts for both Proposals, is presented in the Preliminary Documentation under the "Assessment of Impacts" Section of each relevant Environmental Factor.

Respective to the ongoing development of land within the Bunbury region, approval and assessment is encompassed under the GBRS and subsequent amendments which previously considered the cumulative context of BORR within the landscape. The GBRS provides the legal basis for land use planning within the Greater Bunbury area. The GBRS defines the future use of land and requires local government to provide detailed plans consistent with the GBRS local planning schemes. The GBRS has been in operation since November 2007 (WAPC, 2017) and encompasses the planning approval for the BORR alignment.

4.3.3. Black Stripe Minnow

No.	Submission and/or issue	Relevant Submissions
83	This proposal will clear 5.5 ha of habitat and has the potential to significantly impact the hydrology of local waterways including the conservation category wetland of 5 Mile Brook. Studies identified one individual in the proposal area in site South 8. The proponent claims to have done all that was possible to minimise the impact however the alternative alignment outlined in the Southern Section Alternative Alignment Environmental report (BORR IPT, June 2019) would result in the clearing of only 0.3 ha habitat. BSM were found to be connected to the project area, but not within this proposal footprint.	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 35, 36, 37, 41, 44, 45, 46, 47, 49, 51, 52, 54, 55, 57, 58, 59, 60, 63, 64, 65, 66, 67, 69, 70, 71, 74, 75, 77, 78, 80, 81, 82

The potential clearing of 5.5 ha of BSM habitat and 9.4 ha of riparian vegetation represents a maximum and conservative estimate of potential impacts. While the local extent of BSM habitat is annually variable and dependent on precipitation, using the same criteria for calculating impacts results in an estimate of 1,185 ha of BSM habitat within 5 km of the Proposal Area. Depending on the average annual rainfall, the actual extent of BSM in any given year may be variable from this calculation.

While up to 5.5 ha of BSM Habitat may be cleared within the Proposal at Five Mile Brook and south of Manea Park, this would assume full loss of habitat within the Proposal boundary. The construction of a bridge at Five Mile Brook means this maximum impact is highly unlikely to be realised. It is also important to note that Five Mile Brook within the Proposal boundary appears to have been artificially constructed and moved from its original flow path at some point in the past, likely contributing to the classification as a Multiple Use Wetland as opposed to a Conservation Category Wetland.

The management focus of the Proposal minimises both direct and indirect impacts within the Proposal Area. Substantial changes to the Proposal design have been made subsequent to referral of the Proposal in September 2019 to reduce impacts to BSM habitat by 40% to the current impact of 5.5 ha. Key design requirements minimise indirect impacts on hydrology that supports suitable habitat on

either side of the Proposal Area at Five Mile Brook and south of Manea Park. As part of the design, hydrologic modelling of surface water was conducted (BORR IPT, 2019b) to ensure the design of the bridge at Five Mile Brook and culverts south of Manea Park minimise impacts on and maintain surface hydrology.

No.	Submission and/or issue	Relevant Submissions
84	"The objective to 'maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected' will be difficult if not impossible, to implement as the Project area encompasses Geomorphic mapped (Dept of Biodiversity Conservation and Attractions, 2020), Five Mile Brook which is listed as Conservation Category, plus several Resource Enhancement (RE) and Multiple Use (MU) areas.	16, 17, 50, 58, 59, 61

As noted under response to submission #83, hydrologic modelling of surface water was conducted (BORR IPT, 2019b) to ensure the design of Five Mile Brook crossings and culverts south of Manea Park minimise impacts on and maintain surface hydrology. A Drainage Management Strategy was prepared to inform the concept design phase particularly for the dimension and locations of culverts to maintain surface water flow.

Monitoring for impacts to BSM will be conducted at a reference site (Manea Park) and potential impact site (Five Mile Brook at the southern extent of the Proposal Area). The reference site will be established for the purposes of providing comparative species and population trend data. Monitoring will comprise sampling and visual assessment and will include photo monitoring. Monitoring will be conducted by a suitably experienced zoologist / environmental scientist.

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

Main Roads has also completed a 12 month groundwater (GW) and surface water (SW) monitoring programme. This dataset provides the baseline data from which potential impacts on hydrological regimes and the quality of groundwater may be monitored. Main Roads will continue to monitor GW and SW levels and analytes on a quarterly basis at sensitive locations.

No.	Submission and/or issue	Relevant Submissions
85	Of concern is the proposed loss of 9.4 ha of riparian vegetation (associated with watercourses or wetlands) and 0.16 Conservation Category wetland will also be cleared. The significance of riparian vegetation is acknowledged in many sources but not in this Proposal. One from the Dept of Water and Environmental Regulations states that 'Aquatic and riparian vegetation is important for the health of waterways, contributing to the balance of oxygen, nutrients and sediment, and providing habitat and food for fauna.' (Dept of Water and Environmental Regulation, 2020). "	14, 16, 17, 18, 22, 58, 59, 61

	Five Mile Brook is listed as conservation category wetland up to the point of intersection with the Southern BORR along Yalinda Drive. The suggestion that the conservation category of a continuously flowing creek changes, and stops being Conservation Category Wetland is spurious. We contend that Five Mile Creek is one continuous waterway, and that Five Mile Creek in its entirety should be re-classified and recognised as a Conservation Category Wetlands, and the impact formally reassessed.	

Five Mile Brook

The riparian vegetation in Five Mile Brook is representative of the Southern River Complex – Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species with fringing woodland of Eucalyptus rudis (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.

The Flora and Vegetation survey (BORR IPT, 2019c) mapped the vegetation as VT8 - Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over grassland of **Ehrharta longiflora* and **Avena species* over sedgeland of *Lepidosperma longitudinale* over herbland of **Rumex* species.

The total area of this vegetation type within the Proposal Area is 0.6 ha of which 0.5 ha was reported in Degraded condition and 0.1 ha Degraded to Completely degraded condition.

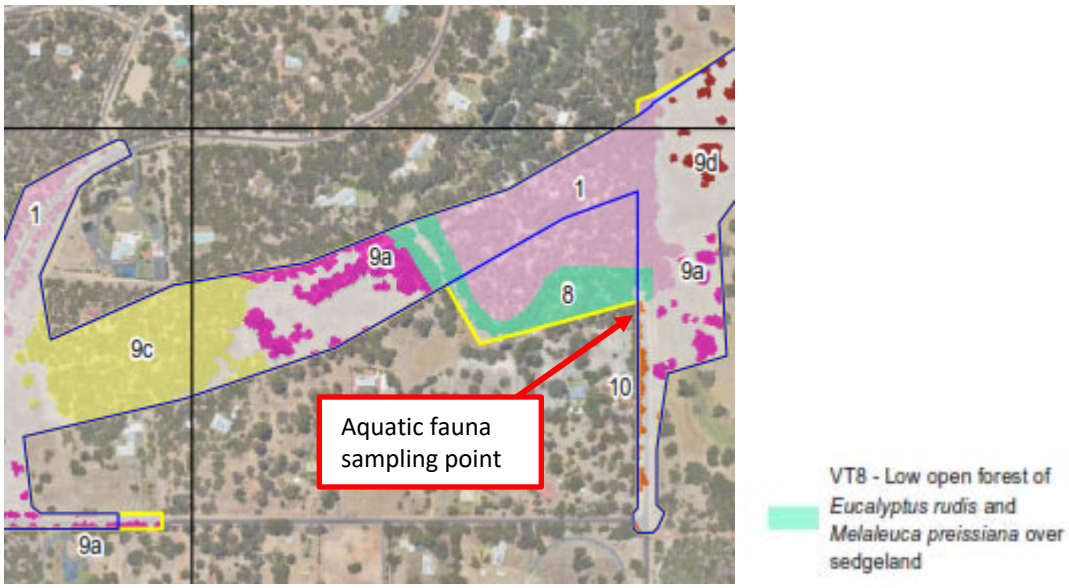

Figure 5. Vegetation type VT8 mapped in Five Mile Brook

The aquatic fauna survey undertaken in the BORR southern section reported finding one Black Stripe Minnow in Five Mile Brook (WRM, 2020b). The sampling point is shown in Figure 7 of this document. The Report described the site as having little intact riparian vegetation. While the riparian vegetation has been reported as being in Degraded condition, the hydrologic connectivity is an important environmental value that should be maintained to sustain a functional habitat for the BSM.

Figure 6. South 8 site at time of survey.

The change in the designation along Five Mile Brook is based on observable conditions. The section of Five Mile Brook within the Proposal boundary appears to have been artificially constructed and moved from its original flow path at some point in the past, likely contributing to its classification as a multiple use wetland as opposed to a Conservation Category Wetland. Further upstream the brook transitions into areas of paddock with significantly less riparian cover.

Regardless, many of the multiple use wetlands in the Five Mile Brook catchment do support BSM and the hydrologic connection of the Five Mile Brook system to multiple use wetlands intersecting the Alternative Alignment were determined to support numerous BSM. Targeted Conservation Significant Aquatic Fauna Surveys of the Alternative Alignment in October 2018 found 113 BSM in four wetlands all intersecting the Alternative Alignment footprint.

Key design requirements minimise indirect impacts on hydrology that supports suitable habitat on either side of the Proposal Area at Five Mile Brook. As part of the design, hydrologic modelling of surface water was conducted (BORR IPT, 2019b) to ensure the design of the clear span bridge at Five Mile Brook avoids impacts on surface hydrology and potential BSM habitat.

The BORR Southern section includes construction of a bridge over Five Mile Brook. While riparian vegetation may be impacted during construction, the banks of Five Mile Brook will be revegetated post construction to maintain the stability of its banks. The bridge has been designed to not impact the flow of Five Mile Brook and therefore will not impact the habitat of the BSM.

Conservation Category Wetland (CCW)

The 0.16 ha of CCW is shown on Figure 24 of the Assessment of Preliminary Document and shown below in detail and with photos of the area in question. The impact area is located along the edge of the CCW where it adjoins the existing Bussell Highway. The extent of construction works in this location is a tie-in to an existing driveway. The total area of the CCW as mapped by the Geomorphic Wetland database is approximately 59.5 Ha of which 0.16 ha or 0.003 % will be cleared. The Flora and Vegetation survey maps the vegetation at this site as VT10 – Parkland cleared with scattered natives/planted species and is 'Highly Modified and Cleared' Condition.

The 0.16 ha of CCW potentially impacted by the construction of BORR is shown on Figure 24, as inset here.

Figure 7. Location of 0.16 Ha CCW in BORR Southern Section Proposal Area.

Figure 8. General context Photo of 0.16 Ha CCW in BORR Southern Section Proposal Area.

The impact area is located along the edge of the mapped CCW where it adjoins the existing Bussell Highway and the extent of construction works is a tie-in to an existing driveway.

The potential impact to the CCW is not considered significant for the following reasons.

- The total area of the CCW as mapped by the Geomorphic Wetland database is approximately 59.5 Ha of which 0.16 ha or 0.003 % will be cleared.
- The Flora and Vegetation survey maps the vegetation at this site as VT10 – Parkland cleared with scattered natives/planted species and is 'Highly Modified and Cleared' Condition.
- The clearing area is directly adjacent to an existing highway and driveway and potentially already impacted from edge effects and other disturbances.

No.	Submission and/or issue	Relevant Submissions
86	Climate change is briefly mentioned with respect to habitat loss for the Black-Stripe Minnow as a result of climate change, but fails to rate any significant mention in the rest of the document. This is unacceptable and further studies and modelling should be provided to allow accurate assessment of the impact of this proposal on climate change.	43

Where the potential impacts of a drying climate may exacerbate or inform impacts, they have been considered when relevant and practicable. For example, hydrologic connectivity has emerged as an important environmental factor for BORR Southern Section particularly to sustain the habitat for the BSM and riparian values of Five Mile Brook. As part of the design, hydrologic modelling of surface water was conducted (BORR IPT, 2019b) to ensure the design of the clear span bridge at Five Mile

Brook avoids impacts on surface hydrology and potential BSM habitat. A Drainage Management Strategy was prepared to inform the concept design phase particularly for the dimension and locations of culverts to maintain surface water flow.

No.	Submission and/or issue	Relevant Submissions
87	For the Black Stripe Minnow (BSM) it is noted that on page 139 of the 2020 proposal, no post construction monitoring is proposed. It is also proposed to install silt curtains / fences in watercourse / wetlands to maintain water quality but how effective is this in dealing with ASS? The Conservation Category wetland known as Five Mile Brook has a 'high to moderate risk for Acid Sulphate Soils' As identified by BORR IPT (2019d; 2020g), and in accordance with Main Roads' standard operational controls, the risk of ASS will be managed in accordance with the ASS Management Plan addressing spoil treatment, groundwater dewatering and water monitoring / management, such that the risk of disturbance of ASS by the Proposal is not expected to result in a significant impact to BSM habitat. The proponent also states on page 133 under 'Monitoring' for the BSM that 'Visual inspection for presence of BSM' will be conducted annually, however, given the elusive nature and aestivation habit of this aquatic fauna, plus the fact that it lives in tannin rich water, how effective is visual monitoring?	43

Monitoring associated with BSM is focused on indirect impacts on habitat quality (focused on water quality parameters including total nitrate, total phosphorous, temperature, pH, oxidation-reduction potential, conductivity and turbidity) and hydrologic function. Main Roads is also proposing additional surveys in areas of retained habitat and will compare the survey results with data collected from reference sites.

Monitoring for impacts to BSM will be conducted at a reference site (Manea Park) and potential impact site (Five Mile Brook at the southern extent of the Proposal Area). The reference site will be established for the purposes of providing comparative species and population trend data. Monitoring will comprise sampling and visual assessment and will include photo monitoring. Monitoring will be conducted by a suitably experienced zoologist / environmental scientist.

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

Visual inspection for presence of BSM has identified the presence of the species in prior survey efforts and is only one data point in the overall monitoring program. Visual presence is an informative initial data point in the survey process. Visual inspection is considered the preferred method of monitoring during construction. Given water depths, clarity, and work being undertaken by qualified aquatic ecologists, this is anticipated to be best method to identify presence without having to employ more invasive and potentially harmful trapping methods.

Where required due to depths and/or visibility, fish sampling methods included beach seine netting, dip netting, baited box traps, and fyke netting may be employed as appropriate with aquatic fauna returned live to the environment in line with standard procedures.

An Acid Sulphate Soil Management plan has been prepared and will be refined during detailed design. This plan includes treatment of Potential Acid Sulphate Soil material and disposal of Actual Acid Sulphate Soil where required at appropriately classified landfill facilities. Management of Acid Sulphate Soils in the immediate vicinity of Five Mile Brook will be conducted in line with the management plan and water quality monitoring in BSM habitat is anticipate to be sufficient to manage potential indirect impacts, not that not direct impacts to Five Mile Brook would occur.

No.	Submission and/or issue	Relevant Submissions
88	The proponent states that a single BSM was recorded within the Proposal area, (page 61) (2020) and that during August 2019 a total of five were recorded in one site South 8, and four in another site South 11, which reflect the variance in recording. However, the footnote on page 62, (2020) states that 113 individuals were recorded in wetlands in the Gelorup area in 2018. This would indicate a substantial decline in numbers.	43

Potential habitat for BSM is dependent on hydrology and annual precipitation and is consequently variable. Accordingly, monitoring of the population across seasons may not be reflective of actual population dynamics over time within the context of two monitoring periods. Main Roads is continuing to monitor BSM habitat prior to approval and would continue to monitor BSM into the construction period to manage potential impacts on BSM within the context of the hydrology and available habitat during the period of construction.

No.	Submission and/or issue	Relevant Submissions
89	The recent find of Black Stripe Minnow in the Bunbury area is important. It should have prompted MRWA to conduct further studies. The Department should require further studies to be conducted in order to be adequately informed when making a determination on the project. In the absence of detailed information about this recent find and the potential loss of habitat and potential associated changes to hydrology, MRWA cannot offset the loss of this habitat in a meaningful way due to the lack of relevant information. Surveys by MRWA were performed on desktop studies and out of season surveys and therefore cannot be classed as an accurate assessment of the waterway.	32, 61

The presence of BSM in the Bunbury area prompted Main Roads to conduct further studies which continue to involve monitoring undertaken in the winter of 2020. Recognising that the 2018 survey was likely too late in the season to observe BSM Main Roads engaged WRM consultants for two years of targeted aquatic fauna sampling within and adjacent to the BORR Southern Section Proposal Area.

This resulted in surveys being conducted in November 2018, August 2019 and May, August and October 2020, to fully characterise aquatic fauna potentially present within the Proposal Area. These surveys highlighted the likelihood that BSM was present in the Proposal Area and Main Roads has pursued avoidance and management accordingly assuming the potential for impacts to BSM.

4.3.4. Brush-tailed Phascogale

No.	Submission and/or issue	Relevant Submissions
90	The Proposal will result in the clearing of up to 43.7ha of Brush-tailed Phascogale habitat, representing approximately 0.9% of the Brush-tailed Phascogale habitat within a 5 km radius(p123, BORR Team 2020). These data indicate that there is likely to be significant impact on Brush-tailed Phascogale, but MRWA has again asserted with no evidence of transparent, quantitative, scientific, ecologically defensible assessment and decision making to determine that the impact on the Brush-tailed Phascogale is not significant (p127, BORR Team 2020a).	32, 34, 38, 50

BTP are not MNES and were assessed solely under the WA State assessment by the EPA.

As detailed in Table 4-39 of the WA EPA Updated Referral Document (reprinted on the following page for reference), BTP habitat is closely associated with Marri / Eucalyptus woodland. While the regional extent of BTP habitat has not been modelled, the local extent of BTP habitat within a 5 km radius of the Proposal has been estimated at 4,705 ha by intersecting the DPIRD remnant vegetation extent dataset with the habitat type dataset resulting from the field assessment.

The Proposal will require the clearing of up to 43.7 ha of BTP habitat, representing approximately 0.9 % of the modelled local (5km) extent of BTP habitat 4,705 ha based on calculation of known BTP habitat associations with remnant vegetation data. This quantitative modelled correlation based on known habitat associations represent a commonly used and appropriate method for determining potential impacts at a regional scale. The loss of less than 1% of the calculated extent of remnant vegetation supporting BTP (A priority species, but not considered to be under imminent threat) indicates that impacts are not significant.

Table 4-39 Conservation significant fauna species which likely or possibly occur within the Proposal Area (*Reprinted from WA EPA Updated Referral Document*)

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DBCA PRIORITY LIST	LISTING UNDER EPBC ACT	LIKELIHOOD OF OCCURRENCE ASSESSMENT	FAUNA HABITAT TYPE		
					MARRI / EUCALYPTUS WOODLAND	MARRI / EUCALYPTUS IN PADDOCKS AND RESERVES	DAMPLAND WITH MELALEUCA SHRUBLAND AND / OR WOODLAND
Mammals							
Pseudocheirus occidentalis	Western Ringtail Possum	S1	CR	Recorded	Breeding, Foraging	Breeding, Foraging	-
Isoodon fusciventer	Quenda, Southern Brown Bandicoot	P4		Recorded	Breeding, Foraging	Breeding, Foraging	Breeding, Foraging
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale, Wambenger	S6		Likely to occur	Breeding, Foraging	-	-
Dasyurus geoffroii	Chuditch, Western Quoll	S3	VU	Possible	Foraging	Foraging	-
Falsistrellus mackenziei	Western False Pipistrelle, Western Falsistrelle	P4		Possible	Breeding, Foraging	Foraging	-
Notamacropus irma	Western Brush Wallaby	P4		Possible	Foraging	Foraging	-
Reptiles							
Ctenotus ora	Coastal Plains Skink	P3		Possible	Breeding, Foraging	Breeding, Foraging	-
Birds							
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S3	VU	Recorded	Breeding, Foraging	Breeding, Foraging	-
Calyptorhynchus baudinii	Baudin's Cockatoo	S2	EN	Recorded	Breeding, Foraging	Breeding, Foraging	-
Calyptorhynchus latirostris	Carnaby's Cockatoo	S2	EN	Recorded	Breeding, Foraging	Breeding, Foraging	-
Falco peregrinus	Peregrine Falcon	S7		Likely to Occur	Foraging	Foraging	-
Oxyura australia	Blue-billed Duck	P4		Possible	-	-	Foraging

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DBCA PRIORITY LIST	LISTING UNDER EPBC ACT	LIKELIHOOD OF OCCURRENCE ASSESSMENT	FAUNA HABITAT TYPE		
					MARRI / EUCALYPTUS WOODLAND	MARRI / EUCALYPTUS IN PADDOCKS AND RESERVES	DAMPLAND WITH MELALEUCA SHRUBLAND AND / OR WOODLAND
Fish							
Galaxiella nigrostriata	Black-stripe Minnow	EN	EN	Recorded	-	-	Habitat

4.3.5. Fauna Habitat – General

No.	Submission and/or issue	Relevant Submissions
91	Street lighting impacts residents and fauna. Efforts have been made to reduce street lighting at interchanges with LED's proposed. However, studies have shown that LED's have increased ecological impacts on nocturnal fauna and humans due to the blue light they contain. Blue light is believed to affect wildlife and human physiological functions for example the production of melatonin which can affect sleep patterns and interfere with seasonal reproduction prompts (National Light Guidelines). It can potentially also damage photoreceptors in the eyes of nocturnal fauna, which are adapted for low levels of light (National Light Guidelines).	5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 19, 20, 24, 26, 27, 28, 30, 31, 35, 36, 37, 41, 45, 46, 47, 49, 51, 52, 54, 55, 57, 60, 63, 64, 65, 66, 67, 69, 70, 71, 74, 75, 77, 78

Studies have shown that the blue light in LEDs can potentially impact fauna. Early adoption of lighting technology tended to opt for light with a high Correlated Colour Temperature (CCT) in the order of 5000 Kelvin (k) to 6000k in the blue spectrum. Main Roads limits the CCT in the Perth Metropolitan area to 4000k and in specific circumstances this has been reduced further to 3000k or less (Kwinana Freeway at the Swan River is 3000k). Main Roads is working with its suppliers to continually improve the output and efficiencies of LED luminaires and to reduce potential indirect impacts associated with street lighting.

Main Roads will use a white/yellow light LED luminaire with a CCT of equal to or less than 3000k and select a luminaire that minimises the levels of lower wavelength light. A luminaire of this frequency is unlikely to impact wildlife, whilst still providing energy efficiency benefits.

No.	Submission and/or issue	Relevant Submissions
92	"Ecological Linkages This plan intersects with two significant Ecological Linkages of the SW (SWREL) - the Maidens Preston River Linkage at the northern end of the proposal and more significantly, the Dalyellup Gelorup Crooked Brook Linkage at the southern end of the proposal (SSAIPD) The enormous impact on the southern SWREL can be seen on Figure 13 page 3 where significant remnant good quality vegetation within the SWREL will be impacted by the Bussell Highway interchange. According to the SWERL documents (p 5 Appendix 4 Greater Bunbury Region Ecological Linkages Plan): 'g) Naturally vegetated areas (in particular the larger relatively intact remnants) in the area of the linkages will be priorities for retention and protection, being expected to meet the criteria for regional significance against at least two criteria, that is 'Representation of ecological communities' and 'Maintaining of ecological processes or natural systems'.'	16, 17, 22, 32, 38, 43, 44, 50, 58, 59, 61, 66, 79

	Previous proposals for development have been rejected by the WA EPA due to the potential impact on the Dalyellup-Gelorup-Crooked Brook Linkage and the topography of the dune system in the region (Environmental Protection Authority Bulletin 1194 August 2005). This proposal with its intention to significantly impact two SWREL and two of the natural hills of the Spearwood Dune system and associated significant loss of natural vegetation needs to be rejected based on this precedent. "	

The Proposal crosses Dalyellup/Gelorup/Crooked Brook South West Regional Ecological Linkage at one location at the southern end of the Proposal Area where the BORR Southern Section alignments is proposed to traverse the Gelorup section into the merger with Bussell Highway. The linkage was developed as part of planning associated with the GBRS, which also included the provision for and location of the future BORR road corridor. To the west of Bussell Highway sits Reserve 23000 and to the east is the partially cleared peri-urban area of Gelorup.

The impact was assessed by the WA EPA as part of the State assessment process in regard to its local context at the point of intersect and connectivity for conservation significant fauna (Figure 13 of the EPA Updated Referral Document). Proposed management measures include the installation of an fauna movement structure at Bussell Highway, two box culvert underpasses within the Gelorup section, and rope bridges at the proposed Yalinda Drive interchange to maintain connectivity for conservation significant fauna, including WRP, through the area.

While residual impacts have not been determined to be significant, the proposed Offset 1 comprises 152 ha of vegetated land in Lots 153, 267 and 268 Ducane Road, Gelorup. These properties occur 2 km east of the BORR Southern Section alignment and form a component of the 'Dalyellup/Gelorup/Crooked Brook Ecological Linkage'.

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 considered. 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).

As noted under Response #51, a 5m wide land bridge is now proposed to the east of Yalinda Road, with a 5m wide vegetated strip added to the Yalinda Road Bridge, and an additional two rope bridges to the west of Yalinda Road. Main Roads has added these structures to the proposed project in the Gelorup section to reduce uncertainty with proposed structures in consultation with the WA EPA.

The addition of the land bridges and rope structures provides further basis for the conclusion that Main Roads is providing significant connectivity such that any risk associated with the efficacy of these structures is minimised.

No.	Submission and/or issue	Relevant Submissions
93	The installation of walls and fencing will provide further obstacle to connectivity and create fragmentation of habitat, leading to population isolation, reduction and genetic decline. These walls and fencing will also provide obstacles to other wildlife and in particular kangaroos in the area. Large kangaroos have been known to damage fencing and potentially injure themselves in the process. The Proposal (BORR Team, 2020) briefly acknowledges the existence of but not the importance of, linkages of 'vegetation along road reserves, Five Mile Brook and Gynudup Brook provide local ecological linkages that are intersected by the Proposal Area. These linkages are likely to be used by conservation significant fauna (e.g., WRP) as well as other mammals, birds, reptiles and amphibians.' (BORR Team, 2020) (page 132).	43

The Proposal crosses Dalyellup/Gelorup/Crooked Brook South West Regional Ecological Linkage at one location at the southern end of the Proposal Area where the BORR Southern Section alignments is proposed to traverse the Gelorup section into the merger with Bussell Highway. The linkage was developed as part of planning associated with the GBRS, which also included the provision for and location of the future BORR road corridor. To the west of Bussell Highway sits Reserve 23000 and to the east is partially cleared peri-urban context of the Gelorup community. In addition, Main Roads does recognise the smaller crossing and habitat connection points throughout the Proposal Area, especially along creek and drainage lines

Proposed management measures include the installation of fauna movement structures at Bussell Highway, two box culvert underpasses within the Gelorup Road Reserve, and rope bridges at the proposed Yalinda Drive interchange to maintain connectivity for fauna, including WRP, through the area of the Regional Ecological Linkage. Additional crossing structures include the clear span bridge at Five Mile Brook where it is crossed by the main alignment.

See discussion above under Response #92 and Response #51 regarding additional crossing structures proposed by Main Roads to increase certainty that the Proposal will manage potential impacts associated with fauna connectivity.

No.	Submission and/or issue	Relevant submission
94	High density perspex to be used for noise walls over 2.5-3.8 metres. Are there any studies regarding possible impacts these perspex panels may have on fauna or birds who may fly into them e.g. Black-Cockatoos?	16, 17, 18, 43, 58, 59

The use of high density perspex panels as the upper extent of noise walls is generally only used when shadow effect will occur on adjacent houses. The use of clear perspex panels will be further refined during the detailed design process and minimised as far as practical.

Main Roads has used high density perspex panels in many parts of its road network and isn't aware of situations where Black Cockatoos have collided with it.

Collison with windows or other clear panels in urban environments and/or infrastructure is not listed as a key threat for Black Cockatoos and is not considered a risk under the Proposal. While bird strike with windows or clear panels are known to occur, occurrences are rare and there are no known attractant effects associated with clear panels. Conversely, airflow patterns over clear panels often provide a clear indication that a structure is present even when visibility of the structure is compromised. Accordingly, the risk of impacts occurring is low and anticipated to be effectively managed through the design process.

As presented in Section 3.2.1 of the Preliminary Documentation, revegetation works within the Proposal Area will ensure that vegetation suitable for Black Cockatoo foraging is not established within 10 m of the road formation; such that Black Cockatoos are less likely to be present near the road formation when compared to other existing roads (for example, Bussell Highway where the foraging vegetation occurs adjacent to the road formation). The risk of pooled water on the road surface which may attract Black Cockatoos for drinking has been minimised through the Proposal design which incorporates road drainage to direct water run-off away from the road formation.

4.4. Management, Monitoring and Offsets

4.4.1. Management and Monitoring

This section covers comments on management that did not directly fall within the specific context of a single MNES, but were considered relevant within the context of MNES.

No.	Submission and/or issue	Relevant Submissions
95	Two submissions recommend the following in order to minimise the impact of the BORR Project on Five Mile Brook: 1. Through the preparation and implementation of a Foreshore Management Plan to manage any potential impacts which may occur through the construction process; and 2. Prepare and implement a Drainage, Nutrient and Water Management Plan for the BORR Project to minimise the impact of off-road drainage into the adjacent wetlands.	38, 61

A Drainage Strategy has been developed for the project with in-principle support from DWER (BORR IPT, 2019g). One of the main objectives of the strategy is “maintenance of existing water cycle balance within the project area whilst also improving the surface and groundwater quality”. Drainage design will be undertaken at the detailed design stage to allow for pre-development flows to be maintained within the Proposal Area.

A drainage monitoring plan for TEC / PEC vegetation adjacent to the Proposal will be conducted in conjunction with the Vegetation Monitoring Program (Appendix J of the Preliminary Documentation). Monitoring for changes to hydrology and drainage will be undertaken through a combination of visual assessments and assessment of data collected from monitoring wells. Analysis of data collected will aim to determine the impact, if any, of Proposal implementation in regards to groundwater levels and quality, and any resulting effect on TEC and PEC vegetation.

With respect to Five Mile Brook, monitoring associated with BSM is focused on indirect impacts on habitat quality (focused on water quality parameters including total nitrate, total phosphorous, temperature, pH, oxidation-reduction potential, conductivity and turbidity) and hydrologic function.

Main Roads is also proposing additional surveys in areas of retained habitat and will compare the survey results with data collected from reference sites. A Foreshore Management Plan is not proposed or considered necessary at this time.

Prior to ground disturbing works occurring, a CEMP must be prepared. The CEMP will include mitigation actions to:

- Clarify hydrocarbon and chemical management through the CEMP will include details on the handling and storage of hydrocarbons, chemicals and hazardous materials and include the following site specific erosion and sediment controls
- Ensure there is a Spill Response Procedure for hazardous material spills events to ensure any spill is contained effectively and cleaned up appropriately
- Ensure hydrocarbon storage and re-fuelling will not be permitted within 200 m of a natural watercourse or Conservation /Resource Enhancement wetland
- Ensure the storage of hydrocarbons on site will be within suitably designed containers within a bunded area
- The CEMP will also provide mechanisms to mitigate the risk of erosion and sedimentation during construction with the following site-specific controls
- Ensure there is no direct run-off to the adjacent watercourses and wetlands
- Install temporary erosion and sediment control measures during bridge construction
- Design watercourse crossings to include erosion control and scour protection measures
- Prepare the Landscape Management Plan so that roadside and medians will be vegetated and capable of acting as a biological filter for runoff.

The CEMP will address all aspects that would otherwise be covered within a Foreshore Management Plan and Drainage, Nutrient and Water Management Plan.

No.	Submission and/or issue	Relevant Submissions
96	The maps provided in Appendix G, BORR Southern Section 2020 Additional Information do not fully address one of the criteria for Environmental Management Plans as they do not identify the fauna values of the remnant vegetation outside of the proposal area.	43

It is assumed the submission is referring to the inclusion of the *Conservation Significant Fauna AMP* (BORR IPT, 2020e) as Appendix G in the State EPA Updated Referral Document but is applicable to the AMP submitted as Appendix M in the Preliminary Documentation.

Action Management Plan (AMP) has been prepared to support the documentation prepared to address both DAWE and State EPA requests for further information. The AMP structure and content has been prepared to align to Commonwealth standards (DotE 2014). The content has been extended to incorporate the additional criteria as outlined by DoEE (2019). While the document is intended to cover element necessary for the State EPA, it is not presented in the format of the State EPA Environmental Management Plan template.

Regardless, the AMP does include discussion of adjacent habitat in Section 1.5 of the AMP and mapping for fauna values / species presence with respect to WRP, BSM, and BTP in Appendix A of the AMP in the Preliminary Documentation.

No.	Submission and/or issue	Relevant Submissions
97	Whilst including reference to ANZECC guidelines Vol1, regarding toxicants, (Table 3.4.1) and Tables 3.3.6-3.3.7 do not appear to be included in the document Appendix G, Fauna AMP, (BORR Team, 2020) therefore it is difficult to comment on trigger / early warning indicators or to understand if the corrective / contingency action is appropriate or adequate.	43

It is assumed the submission is referring to the *Conservation Significant Fauna AMP* (BORR IPT, 2020e) as Appendix G in the State EPA Updated Referral Document but is applicable to the AMP submitted as Appendix M in the Preliminary Documentation.

The Australian and New Zealand Environment and Conservation Council (ANZECC) 2000 water quality guidelines are publicly available national standards online at https://www.waterquality.gov.au/anz-guidelines/resources/previous-guidelines/anzecc-armcanz-2000. Given the size and length of the tables referenced, they are not included in the Preliminary Documentation. Given that the guidelines are national guidelines for fresh & marine water quality, Main Roads considers the guidelines appropriate.

4.4.1. Offsets

In addition to the impact reduction measures detailed in Section 2.3, at the request of the EPA, Main Roads has also significantly increased the scale and nature of its offset strategy. The additional offsets were developed to:

- Further reduce habitat fragmentation.
- Be in reasonable proximity to the Proposal.
- Contribute to the WRP recovery plan.
- Provide a long term environmental benefit.

The key additions to the Offset Strategy include:

- Increasing the revegetation within Ludlow State Forest from 95 ha to 185 ha.
- Contributing $200,000 to the Western Australia Department of Biodiversity and Conservation and Attractions (DBCA) for additional fox control through a ground-based baiting program within Ludlow State Forest.
- Establishing a one hectare Peppermint tree orchard (monoculture) on DBCA managed land within the City of Busselton to provide foraging foliage for WRP wildlife carers.

No.	Submission and/or issue	Relevant Submissions
98	Despite MRWA asserting throughout the Referral documents that the environmental impacts from clearing native vegetation to make way for the Southern BORR are 'minor' and 'not significant', MRWA has undertaken to provide offsets for residual environmental impacts (p179, BORR 2020a) and does acknowledge in the Offset proposal documents that there are significant residual impacts (p34, BORR Team	4, 14, 16, 17, 22, 32, 34, 42, 43, 38, 50, 58, 59, 61, 62, 72, 76

	2020b). These statements are contradictory, and an acknowledgement by MRWA that the project has unacceptable residual impacts." Submissions challenged the conclusion that offsetting and mitigation will 'counter the reduction of habitat supporting conservation significant fauna.' (p iv Referral). This is incorrect as there will be a substantial net loss of habitat and a significant loss of fauna, including multiple endangered species including those species of National Environmental Significance. Submissions also asserted that the mitigation hierarchy has not been followed.	

The BORR Southern Section Proposal has been developed to avoid and minimise environmental impacts. Offsets are not a default negotiation position but in this case are required as potential residual impacts remain. The assessment of impacts is based on extensive survey effort the best available information for the species. With any assessment, uncertainties remain, and the Precautionary Principle may be applied in instances where impacts are anticipated to be significant. As defined under the EPBC Act (Section 391):

> *The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.*

Main Roads has in this instance highlighted a situation where all available data indicates impacts are less than significant, but the risk of uncertainty could result in the potential for significant impacts. In accordance with the explicit definition above Main Roads has identified where avoidance, management, or other measures can address that risk of uncertainty. Where management measures are anticipated to be sufficient to manage impacts, but uncertainties remain, potentially significant is wholly appropriate to ensure potential risk is identified and managed accordingly.

Main Roads, through the alignment selection process, environmental assessment of the preferred and alternative alignment, and design refinement that has been completed during the planning phase continuing through to final design have contributed to efforts to avoid impacts to date and that will continue through to the construction of the Proposal. The first effort in all Main Roads Proposals is to avoid impacts in the first instance. Avoidance is based on continuing survey and characterisation of the environment to ensure the highest value habitats and vegetation communities are protected and avoided.

At the same time, the feasibility and functional requirements of the Proposal will result in some impacts on the environment. Main Roads has made every effort to derive a feasible Proposal that utilises previously cleared land for the Proposal.

No.	Submission and/or issue	Relevant Submissions
99	A number of submission expressed concern regarding as yet unsurveyed offset properties and unsecured land purchases Property number 1 is held by MRWA but the presence of Banksia Woodland TEC has not yet been established. Property number 2 and 3 are both in private land holdings and DBCA and MRWA are still in negotiations to	16, 17, 22, 50, 58, 59, 61

	purchase. Neither property is confirmed to contain Banksia Woodland TEC. The 5th property is owned by MRWA but is 30 km away from the proposal. The presence of Tuart TEC on this property has not yet been assessed. Property Number 4 is for revegetation for habitat for WRP and Black Cockatoo which cannot compensate for the loss of mature good quality habitat WRP Offset 4 (State Forest No. 2 Revegetation) lists an 80 ha property as an offset some 35-40 km to the south and the existing quality of WRP habitat values at that location, is stated as 'likely to have low value' and the time until ecological benefit, is listed as 10 years. This cannot be considered as a viable offset given the distance and time to become effective.	

As noted in the in the introduction to Section 4.4.2 (Offsets) Main Roads has significantly increased the scale and nature of its offset strategy. The updated PD includes this revised strategy as an appendix.

Copies of the site environmental assessment reports relevant to the environmental offset sites are also appended to this response.

A summary of each offset contained within the revised Offset Strategy is provided in Table 10 and shown in Appendix N of the PD.

Table 10. Overview of revised proposed offset package

NO.	OFFSET TYPE	OFFSET SUMMARY	PROPERTY LOCATION	CHANGE
1	Land Acquisition	140.0 ha of native vegetation. 22.5 ha of the 162.7 ha property is set aside as under an existing Conservation Covenant. The areas below are those environmental values external to the covenanted area. • 124.1 ha of Banksia Woodlands TEC / PEC (confirmed) • 126.0 ha of WRP habitat (confirmed) • 126.0 ha of BTP habitat (confirmed) • 124.1 ha of Black Cockatoo habitat (confirmed)	Lots 153, 267 and 268 Ducane Road, Gelorup	No change
2	Land Acquisition	38.9 ha property providing: • 38.5 ha of WRP habitat (confirmed) • 38.5 ha of BTP habitat (confirmed) • 37.7 ha of Black Cockatoo habitat (confirmed)	Lot 1 Ducane Rd, Gelorup	Increase in offset area for Black Cockatoo habitat from 36.6 ha to 37.7 ha

NO.	OFFSET TYPE	OFFSET SUMMARY	PROPERTY LOCATION	CHANGE
3	Land Acquisition	16 ha property providing: • 8.5 ha of Banksia Woodlands TEC / PEC (confirmed) • 14.2 ha of WRP habitat (confirmed) • 14.2 ha of BTP habitat (confirmed) • 9.7 ha of Black Cockatoo habitat (confirmed)	Lot 156 Marchetti Rd, Gelorup	No change
4	On-ground management	35 ha of revegetation to provide habitat for WRP, BTP and Black Cockatoo	Lot 104 (north) Willinge Drive Davenport	No change
5	On-ground management	185 ha of revegetation to provide habitat for WRP, BTP and Black Cockatoo	Ludlow State Forest (LSF) (also referred to as State Forest No. 2)/ /Tuart Forest National Park (TFNP)	Increase to the area proposed for revegetation from 95 ha to 185 ha an increase of 90 ha.
6	On-ground management	Establishment of 1 ha Peppermint orchard	Lot 12 on Plan 414806	Additional offset
7	Financial contribution	$200,000 contribution to DBCA to enhance on-ground feral animal baiting to manage predation of WRP	Within DBCA managed lands.	Additional offset
8	Land acquisition and management	40 ha property providing 20 ha of Tuart Woodlands TEC / PEC (confirmed)	Lot 27 Tredrea Rd, Myalup	No change

The creation of 220 ha of additional WRP habitat (185 ha within Tuart Forest National Park and 35 ha within Lot 104 Willinge Drive Davenport) within secure tenure, the contribution of $200,000 to the predator (fox) control program, together with the acquisition and protection of 179 ha of existing critical WRP habitat in secure tenure, and the establishment of a 1 ha Peppermint orchard will provide a significant and lasting benefit to the regional WRP population and will adequately offset the impact of clearing up to 61 ha of WRP habitat.

No.	Submission and/or issue	Relevant Submissions
100	The offset strategy is clearly flawed and incomplete. MRWA proposes to place some of the offsets into the GBRS as Regional Open space, but this proposal is now impacting Regional Open space in the northern section, where it intersects with the Kalgulup Regional Park. (Figure 2). Presumably in the future, these potential offsets may be destroyed if another transport	16, 17, 22, 50, 58, 59, 61,

	corridor is required, as this proposal clearly shows that Regional Open Space is not protected under the GBRS.	

Main Roads follows EPA, DBCA, and Commonwealth policy with regard to offsets. Offsets are required to be maintained in perpetuity. Records are maintained of required management actions for maintaining offset properties.

As noted in response to Submission #39, potential impacts on the proposed Kalgulup Regional Park at the interchange of Centenary Road with Bussell Highway would be up to 0.25 ha as shown in the figure below. While the August 2020 Kalgulup Regional Park draft management plan shows the boundaries of the park indented at the interchange to provide capacity for the interchange improvements, the plan and park boundaries are not yet final. Regardless, direct impacts of BORR on the Park would be minimal in nature based on the draft Park planning documents. Revision of the BORR infrastructure during detailed design will be undertaken to further minimise impacts to the maximum extent practicable.

No.	Submission and/or issue	Relevant Submissions
101	Despite MRWA asserting throughout the Referral documents that the environmental impacts from clearing native vegetation to make way for the Southern BORR are 'minor' and 'not significant', MRWA has undertaken to provide offsets for residual environmental impacts (p179, BORR 2020a) and does acknowledge in the Offset proposal documents that there are significant residual impacts (p34, BORR Team 2020b). These statements are contradictory, and an acknowledgement by MRWA that the project has unacceptable residual impacts."	22, 34, 50, 61,

The BORR Southern Section Proposal has been developed to avoid and minimise environmental impacts. Offsets are not a default negotiation position but in this case are required as potential residual impacts remain.

The assessment of impacts is based on extensive survey effort and the best available information for each MNES. With any assessment, uncertainties remain, and the Precautionary Principle may be applied in instances where impacts are anticipated to be significant. As per the WA offset guidelines, although the impact is not considered significant, the potential for significant residual impacts still exists and an offset is required to manage those potential risks.

4.5. Other Matters

4.5.1. Aboriginal Heritage

No.	Submission and/or issue	Relevant submissions
102	A number of submitters have concerns around significant sites and trees to indigenous people. This includes: • Five Mile Brook	4, 34, 38, 79.

	• Tuart woodlands and forests • 30 scar trees • 17 spiral trees • 4 directional trees • 1 resource hollow tree. Due to this it is submitted that 'There are further outstanding natural features and/or any other important or unique values relevant to the Proposal' and therefore the proposal should be rejected.	

Extensive Aboriginal heritage surveys for the BORR Southern Section alignment have been commissioned by or on behalf of Main Roads over a twenty-five year period, including in 1995 (Hammond & O'Reilly, 1995), 2002 and 2009 (Brad Goode & Associates, 2010), and 2012 (Brad Goode & Associates, 2012). Subsequent to referral of the Proposal, additional archaeological surveys were conducted in October / November 2019 (Brad Goode & Associates, 2020) and ethnographic surveys were conducted in November 2019 and January 2020 (Ethnosciences, 2020). Each survey was undertaken in accordance with the reporting requirements under the AH Act 1972 and involved people who were eligible to speak for country.

Participants to the surveys were selected by the Gnaala Karla Boojarah (GKB) working party through the South West Aboriginal Land and Sea Council. This process is in line with the Noongar Standard Heritage Agreement between Main Roads and GKB.

In 2019, Main Roads commissioned another archaeological survey of the alignment and corresponding ethnographic site identification survey. These surveys were undertaken in accordance with the Noongar Standard Heritage Agreement (NSHA) where all registered sites and potential sites, were assessed. The ethnographic survey reported involved two investigations, November 2019 and January 2020. These surveys considered the recent reporting of DPLH ID 37869 and DPLH 37870, the potential scarred or modified tree BR1 as reported in the Archaeological Report (BORR IPT, 2019b) and the structural design of the bridges crossing the Ferguson and Preston Rivers and Five Mile Brook.

The GKB consultants confirmed there are no cultural heritage sites of significance in the BORR Southern Section alignment. The consultants confirmed that the bridges would not impact flow of the respective rivers and waterway, notably Five Mile Brook.

No.	Submission and/or issue	Relevant submissions
103	Concerns around Aboriginal groups not having been consulted properly during development of the project.	4, 38

Participants to the 2019 and 2020 Aboriginal Heritage surveys were selected by the Gnaala Karla Boojarah (GKB) working party through the South West Aboriginal Land and Sea Council. This process is in line with the Noongar Standard Heritage Agreement between Main Roads and GKB.

During the ethnographic consultation held with the GKB consultants in October 2020, an elder advised the meeting that the approach to aboriginal heritage undertaken by those parties responsible for the lodgement of the Sites (discussed further in Response #105 below) was neither acceptable nor appropriate and that as a result of these Sites being lodged, considerable disharmony had occurred within the

aboriginal community. He also advised that only those of 'traditional origin' should speak on heritage matters, i.e. they belong to the country and that neither party responsible for lodgement of the Sites could make this claim. Furthermore, the elders advised the meeting that Main Roads had conducted the investigations with integrity and transparency, given that appropriately qualified people had conducted the archaeologic and ethnographic studies and the correct processes had been applied in determining the GKB consultants who could speak for country.

The GKB Consultants advised the meeting that there are no heritage impediments to the construction of the BORR and that the BORR should proceed.

As a result of the findings of the investigation, it was determined that an assessment of direct and indirect impacts of the two Sites was not required.

Further consultation was undertaken with Traditional Owners following the registering of a few two lodged Aboriginal Sites ID 38551 Five Canoes and ID 38552 Ancient Moojar Grove Burial Ground. This included work included an additional ethnographic study and archaeological assessment. The meeting with the Traditional owners was held in October 2020.

Following the archaeological examination of the two Sites and the meeting held with the GKB Consultants nominated to speak for the area, the additional study and heritage consultation concluded that neither Site has potential historical, anthropological, archaeological or enthographical interest.

No.	Submission and/or issue	Relevant submission
104	The Tuart Woodlands and Forests have considerable cultural heritage value for the Noongar people who are the traditional owners of the southwest of Western Australia. The traditional owners have a rich legacy of highly organised, sustainable land management on the Swan Coastal Plain. This is another area that BORR IPT did not sufficiently highlight in their referral documentation.	79

Archaeological, ethnographic and anthropological studies have been undertaken in the BORR Southern Section corridor since 1995, with the most recent undertaken in 2019 and 2020 (Appendix E of the Updated Referral Document). Each study has investigated the sites of potential cultural heritage significance in consultation with the Traditional Owners who speak for the country.

All Sites registered or identified as potential Sites of cultural significance have been recorded and assessed. The Tuart Woodlands within the corridor are not registered nor recognised as a Site of significance from a cultural heritage perspective and hence were not assessed in the Heritage Reports.

At a meeting held in October 2020 with the GKB consultants, one representative spoke eloquently and firmly with the following advice:

'that the approach to aboriginal heritage undertaken by those parties responsible for the lodgement of the Sites was neither acceptable nor appropriate and that as a result of these Sites being lodged, considerable disharmony had occurred within the aboriginal community. He also advised that only those of 'traditional origin' should speak on heritage matters, i.e. they belong to the country and that neither party responsible for lodgement of the Sites could make this claim.'

The GKB Consultants advised the meeting that there are no heritage impediments to the construction of the BORR and that the BORR should proceed.

No.	Submission and/or issue	Relevant Submission
105	The submitter raises that 2 sites have yet to be assessed under the *Aboriginal Heritage Act 1972*(ID 18884 and 38552). Any assessments or additional evidence required regarding these should be provided before any decision is made on the Proposal.	62

An additional ethnographic study and archaeological assessment was undertaken to examine the cultural significance of the two lodged Aboriginal Sites ID 38551 Five Canoes and ID 38552 Ancient Moojar Grove Burial Ground. The meeting was held in October 2020.

Following the archaeological examination of the two Sites and the meeting held with the GKB Consultants nominated to speak for the area, the additional study and heritage consultation concluded that neither Site has potential historical, anthropological, archaeological or enthographical interest.

The GKB Consultants were insulted that aboriginal heritage was being used a means to stop the construction and operation of the BORR in its entirety including the BORR Southern Section and as such agreed that neither registered site would be inspected.

The GKB Consultants have advised Main Roads every time they have been consulted over the 25 year period that there are no heritage impediments to the construction of the BORR and that the BORR should proceed.

Place ID 18884 (artefact scatter) is located within the slopes of a dam, approximately 30 m SW of the junction of Hasties and Allenville roads. The place is described as a low density, highly disturbed artefact scatter. Seventeen artefacts were observed and recorded within a 30 m x 35 m area during the 2019 survey. These artefacts included three flakes (27 %), six flaked pieces (55 %) and two chips (18 %) all manufactured on quartz or crystal quartz. Boundaries for place ID 18884 partially extend into the Proposal Area (Brad Goode & Associates, 2020). According to the AHIS database (accessed 11 March 2022), the site status is 'Stored data / not a site'.

4.5.2. Significant Trees

No.	Submission and/or issue	Relevant Submissions
106	Heritage listings The Giant Tuart was listed and is mentioned in the documentation as being a feature of the landscape that should be preserved. The proponent declines to mention in section 3.4 of their submission the fact that 7 trees have now been registered with the Australian National Champion Tree Register in close proximity to the proposal, including 4 that are likely to be lost in the construction period. These four trees are two Christmas trees, one Woody Pear and one Holly Leaf Banksia. The local community have strong connections to these trees and they should be preserved at all costs. The other 3 trees are the Giant Tuart and 2 massive Paperbark trees, and although these are not in the direct path of the road, they become part of an extraordinary area of Biodiversity and ancient trees that should be preserved for future generations.	4, 16, 17, 18, 22, 32, 34, 38, 43, 44, 50, 61, 72

It is noted that the National Register of Big Trees is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, it was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Of the six trees recently registered with the National Register of Big Trees, four trees occur outside the clearing footprint and therefore will not be impacted by BORR. Main Roads has made every effort, to avoid impacting the two registered Trees within the Development Envelope including re-aligning the original alignment to avoid impacting the Giant Tuart (Grey Giant) which has required compulsory property acquisition.

As a result of this effort, only one of the trees registered with the National Tree Register will be directly impacted (as detailed in the figures on the following page).

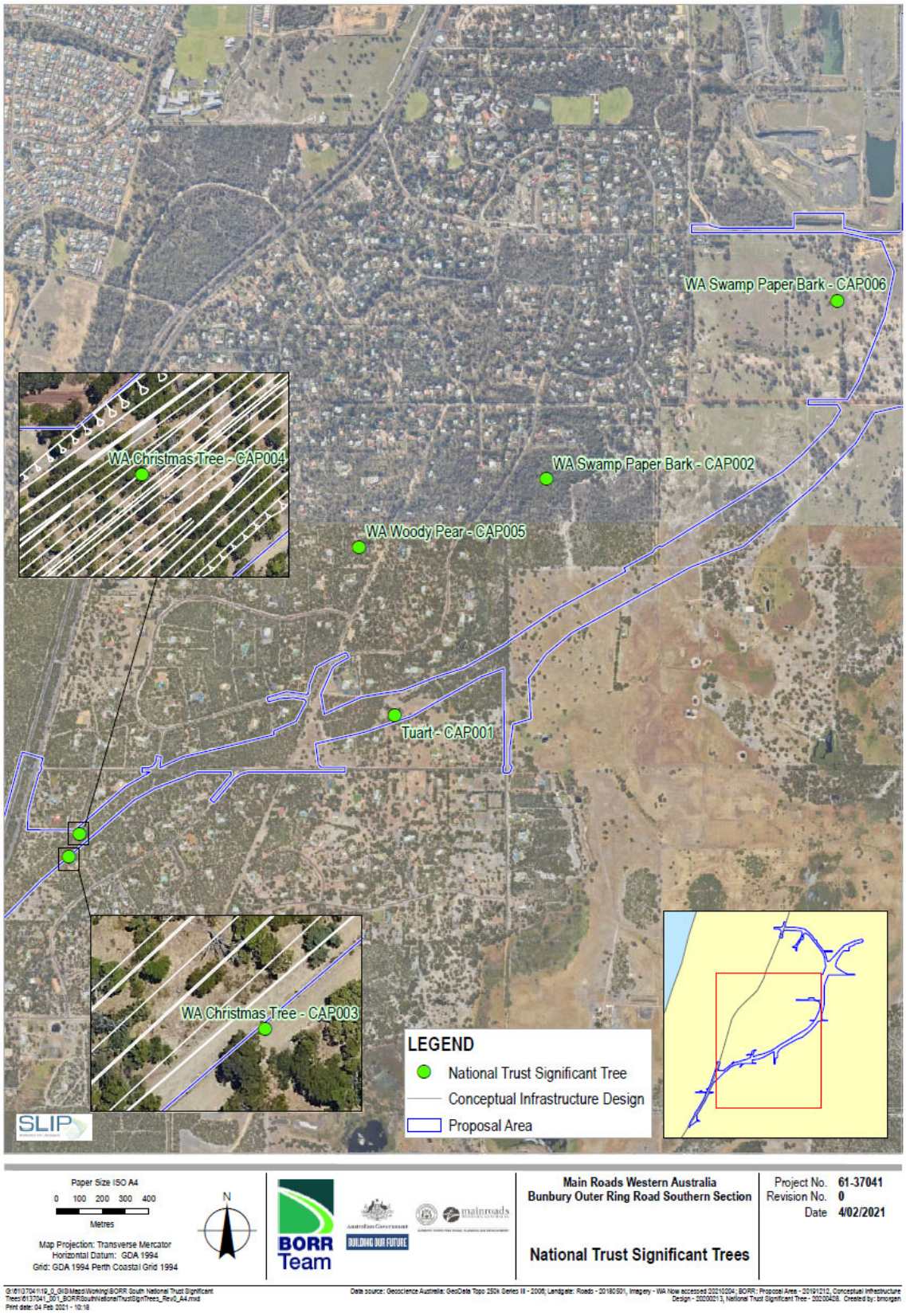

Figure 9. Location of National Trust Significant Trees

4.5.3. Cumulative Impacts

No.	Submission and/or issue	Relevant Submissions
107	The cumulative impacts of the total BORR project are significant and should be balanced in the context of all land clearing activities in the south west that have been approved. Maintaining vegetation at >30% of pre-European settlement encourages the retention of maximum biodiversity and this proposal should be viewed in the wider context of historical land clearing in the Capel LGA and the total amount of clearing approved for the south west land division in this year. Assessment should be at the broadest scope possible, for all stages and components of the action, and considering all related activities and related infrastructure such as roads, stopping bays and powerlines. It should also cover the combined impacts and in this case, cumulative impacts of this proposal to include the Northern and already constructed Central section of the BORR.	38, 42, 48, 50, 61, 79

The assessment of impacts for the BORR Southern Section is considered cumulatively with regard to the potential impacts of the BORR Northern and Central Section, the only other identified reasonably foreseeable action within the Proposal Area.

Respective to the ongoing development of land within the Bunbury region, approval and assessment is encompassed under the GBRS and subsequent amendments which previously considered the cumulative context of BORR within the landscape. The GBRS provides the legal basis for land use planning within the Greater Bunbury area. The GBRS defines the future use of land and requires local government to provide detailed plans consistent with the GBRS local planning schemes. The GBRS has been in operation since November 2007 (WAPC, 2017) and encompasses the planning approval for the BORR alignment.

No.	Submission and/or issue	Relevant Submissions
108	The impacts associated with sourcing raw materials are not considered part of the proposal – we would contend that in fact they add to cumulative impacts in the area and from the project. For example, the Binningup limestone quarry proposal is likely to negatively impact the Leschenault Estuary via the Parkfield Drain. Material sourcing strategy should consider sustainable procurement sources and practices. We reference the conditions placed upon the Forrest Highway which stated that the person taking the action must minimise impacts on relevant MNES by NOT SOURCING fill from a site that a) results in clearance of native vegetation or b) is within 500 metres of a major tributary of the Peel Harvey Estuary or c) is within 500 m of a wetland of the Peel Yalgorup System or is managed by a third party and is contrary to items 3 (a) ,3 (b) ,3 (c) or 3 (d).	16, 17, 18, 34, 42, 58, 59, 66, 67, 79

	We would request similar conditions be placed upon the sourcing of materials for this project and the impact on all local waterways and native vegetation.	

Sourcing material required for the construction of BORR Southern Section is not included in the Project description and therefore was not assessed as part of the BORR Southern Section environmental approval assessment process. The environmental impacts presented in the referral documents for BORR Southern Section reflect the potential direct and indirect impacts the Proposal may have on the relevant environmental factors as a result of the construction and operation of the Project.

Commercial suppliers proposing to provide base raw materials (i.e sand) for this Proposal, must apply for an Extractive Industry Licence under the *Planning and Development Act 2005* to their local government authority for assessment and approval. All extractive industry proposals are subject to the provisions of the EP Act for clearing applications (s51A) and the AH Act. DWER is responsible for the assessment of any clearing of native vegetation Local Government Authorities are responsible for the assessment of the potential cumulative impact an extraction industry may have.

4.6. Economics and Social Impacts

4.6.1. Economics

No.	Submission and/or issue	Relevant submission
109	MRWA has repeatedly refused requests to provide a cost benefit analysis of the proposed and alternative alignments. The proposal contains no economic analysis, making it impossible for the public to adequately assess the proposal in this "Public Comment Period". The lack of even superficial costings impedes public comment, invalidates the choice of alignment, and isn't transparent about what each alignment involves. The Business Case Study for the Southern BORR should be released for public comment. This would allow for appropriate cost benefit analysis of items such as the Yalinda bridge, the bridge over 5 Mile Brook, sound walls, land acquisitions and the interchanges. It is not acceptable that a proposed road alignment costing nearly one billion dollars is released for public comment without costings for either it or the alternative alignment. If the proposed route is not rejected, then I request that MRWA publish comprehensive costings of the two alignments, including for a rail reserve within each, and the loss of income from covering up valuable basalt reserves, so that the public can adequately comment on the two optional routes, and the EPA and DEWA can thoroughly undertake their Reviews.	61

A summary of the cost benefit analysis undertaken for the BORR project is available on Infrastructure Australia's website at:

Bunbury Outer Ring Road | Infrastructure Australia

The Alignment Selection report provides a high comparison of the economic and engineering costs associated with BORR Southern Section and Alternative Alignments. This summary can be found in Appendix F in the Alignment Selection Report, see Main Roads website with relevant information provided in the tables below.

There is no provision for rail within the BORR corridor. The BORR Southern Section corridor is constrained and there are other viable rail corridors available south of Bunbury.

No.	Submission and/or issue	Relevant submission
110	The BORR will provide economic benefits to Greater Bunbury and the South west. The concern of stakeholders within Bunbury CBD have not been addressed by the proponent. This document provides evidence to suggest that currently up to 40 % of traffic would stop in Bunbury for at least 1 hour and the loss of this traffic will have a dramatic effect on local tourist attractions such as the Dolphin Discovery Centre and the Bunbury Farmers Market, as well as businesses in the CBD. The project provides short-term economic gains at the expense of both short-term and long-term significant detrimental environmental and social outcomes	16, 17, 18, 58, 59

The South West has a diverse range of industries with an annual economic output of $34.762 billion (as at 2017/18) (South West Economy Profile | Gross Regional Product, Industries | REMPLAN). The Gross Regional Product (net measure of wealth generated by the region) grew 25.6% between 2009 and 2019 (Diverse & Growing Industry - South West Development Commission (swdc.wa.gov.au), and in 2020 was estimated at $16.024 billion. $8.092 billion of this was contributed by the local authorities traversed by BORR, including $4.731 billion contributed by Bunbury (South West Economy Profile | Gross Regional Product, Industries | REMPLAN).

Bunbury is the largest regional city outside the Perth/Peel regions and functions as the commercial and administrative hub of the broader South West region and some parts of the western Wheatbelt region. Continued population growth in Bunbury and the broader South West region is likely to generate opportunities for further commercial and retail development. This, however, is tempered by the increasing popularity of on-line shopping that is becoming more prevalent (State of WA, 2020).

The estimated construction cost of BORR is greater than $600 M which will be expended over several years. A spending target of $300 m has been set aside for local businesses, including over $20m with Aboriginal businesses. KPMG (Bunbury Outer Ring Road | Main Roads Western Australia) estimated that local industry sectors expected to directly benefit from the project include:

- Construction services - $50m output
- Professional, scientific and technical services - $58m output
- Wholesale and retail trade - $30m output
- Transport, machinery and equipment services - $7m output
- Other business sectors - $10m output

Bypasses Effects

Main Roads conducted Traffic Origin and Destination (OD) Surveys in 2018 and 2019 on both a long weekend and a normal weekend to monitor traffic at locations north and south of Bunbury. The OD Survey provided a snapshot of traffic movements including those vehicles recorded bypassing Bunbury. The survey results indicated that:

- Around 60% of traffic did not stop in Bunbury;
- Some 30% of traffic stopped in Bunbury for less than one hour (the majority of which stop for up to 20 minutes); and
- Approximately 10% of traffic stopped in Bunbury for longer than one hour.

The results of the OD Survey indicated that Bunbury, including the CBD, is already impacted by the bypass effect (via Forrest Highway, Robertson Drive and Bussell Highway) given that some 60% of through traffic do not stop.

The 30% of vehicles that stop along the route, or in Bunbury for up to one hour may choose BORR over the current route which may impact businesses along the current route depending on location and customer base.

During the recent planning for BORR Main Roads facilitated the establishment of an Economic Advisory Group (EAG) with local business and industry stakeholders in order to prepare them for the potential economic benefits and impacts of the Proposal, and to encourage their early implementation of actions that would help to maintain customer visitation. The EAG was chaired by the SW Development Commission with membership including City of Bunbury, Bunbury Geographe Economic Alliance and Bunbury Geographe Chamber of Commerce and Industry.

The NSW Roads and Traffic Authority commissioned an evaluation of the economic impact of highway bypasses on three towns where the Hume Highway was re-aligned (Parolin, 2012) in the 1990s. The study also included a literature review of the economic impact of town bypasses in Australia and overseas. The outcomes of the study indicated the following:

To a large extent the findings of the study mirror those identified in the review of literature – that in the long-term, highway bypasses do not have adverse economic impacts on towns that are bypassed and that in most cases bypasses have resulted in economic development benefits for towns which have been bypassed;

Other factors may have more of an impact on the economy of a town than the introduction of a highway bypass (e.g. state of the national and regional economy, rural population decline, restructuring of industry and services and the number and scale of chain retail stores.); and

In consideration of the above, it is reasonable to assume that any negative economic impacts resulting from a BORR 'bypass effect' are likely to be short to medium term but not long term. It is more likely that businesses that specifically service passing trade would experience impacts but any such effect may in fact result in overall benefits to local Bunbury businesses and the community.

Furthermore, Bunbury has a diverse range of businesses, industry and commerce and serves as the regional South West hub for a number of services and facilities. With an existing urban population of around 80,000 people it is anticipated the overall bypass impacts to Bunbury and its surrounding suburbs are manageable and will result in an overall benefit to industry, business and the community.

4.6.2. Social Impacts

No.	Submission and/or issue	Relevant submission
111	This report clearly shows the impact to local landowners of construction of a four lane freeway through a rural residential area. Up to 65 landowners are likely to be affected by excess noise and 16 of those will exceed the outside noise level targets AFTER mitigation measures. (p154). In contrast the alternative will potentially impact only 10 residences BEFORE mitigation. 13 properties out of 17 predicted to exceed road upgrade allowable noise levels of 60Laeq, day, with worst property noise level of 66. New road allowable level is lower at 55 with 39 of 48 properties predicted to experience noise levels over the allowable, worst property will have level of 70.	1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 35, 36, 37, 40, 41, 42, 45, 46, 47, 49, 51, 52, 53, 54, 55, 57, 58, 59, 60, 63, 64, 65, 66, 67, 69, 70, 71, 72, 74, 75, 77, 78, 80, 81, 82

It is noted that potential noise impacts on adjacent residences is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, noise related impacts on adjacent dwellings were not addressed within the Southern Section Additional Information for Preliminary Documentation.

As discussed within the impact assessment documentation that Main Roads prepared for the WA EP Act related impact assessment documentation, the Proposal meets the requirements of State Planning Policy 5.4 where noise exceedances result in impacts on residential and social receptors.

For a new road project, State Planning Policy 5.4 allows a noise level of 55 dB LAeq(Day) and 50 dB LAeq(Night) from the road and this will be the basis for the noise mitigation design.

Main Roads has committed to construction additional screen walls to further improve noise and visual amenity along the Gelorup corridor. Existing noise walls will be extended along the road verge as screen walls. This will be in areas where gaps existed due to predicted levels being below mitigation trigger levels, except where the road is in a large cutting and therefore sunk well below existing ground levels. Continuation of screen walls between the noise walls will also reduce visual impacts by providing additional screening of road traffic.

In areas where it is not feasible to extend the noise wall to manage noise at more remote sensitive receptors, architectural treatments will be offered to impacted residences. The road surface will also be improved between Jilley Road and Bussell Highway to reduce the outdoor noise environment and minimise noise impacts at residual receptors.

Noise walls will also be designed with visual amenity in mind and the context of the local environment.

Visual impacts of BORR Southern Section will be further improved through:

- The sinking of the road through Gelorup near Yalinda Drive up to 1.5 metres over a length of 800 metres. This sinking will reduce the height of Yalinda Drive overpass and approaches. Retaining walls will be used to ensure additional clearing to accommodate the sinking is not required.
- establishing screening walls along Yalinda Drive between Eucalypt Drive and Woods Road.

No.	Submission and/or issue	Relevant submission
112	Regardless of how long plans for the BORR have been in place, there now exists a thriving connected community of families who have chosen to live in Gelorup for its semi-rural residential lifestyle. The social impacts of the project on the Gelorup community are significant. As too for the Stratham community. The proposed southern section of the BORR through Gelorup will completely and irrevocably change the semi-rural residential lifestyle and serenity that first attracted its residents to Gelorup. 19 residences have been identified as being directly impacted by excessive noise and a similar number of residences have been resumed, impacting heavily on this small community, even though the project is yet to obtain environmental approval. The BORR will also dissect a part of the Gelorup community from the Greater Bunbury area.	4, 72

Social connectivity within the Gelorup was originally provided by way of a dual use path at the Yalinda Bridge and a Principal Shared Path (PSP) on the northern side of BORR South.

To further improve the Gelorup community's social connectivity and amenity, Main Roads has amended the Proposal to:

- install a new pedestrian underpass at Woods Road to connect to local roads and walk trails.
- establish walking trails, primarily utilising previously cleared areas, that connect underpasses, bridges, local roads, remnant bush areas, including along firebreaks on BORR boundaries, and to the large tuart tree, where a viewing area will be established.
- establish a walking trail under the Five Mile Brook Bridge to connect the northern and southern sections of Gelorup.

These additional structures are presented in Figure 27 of the PD. Main Roads invited the general public to comment on the changes to social connectivity via a survey available the Main Roads website. The survey was open for two weeks and closed 22 October 2021.

The BORR Local Access Strategy was finalised during development of the Proposal and informed through extensive consultation with the local community. This included a local access strategy workshop held in Gelorup in July 2019, to gather community feedback regarding the potential changes required to local access arrangements around the Gelorup and Stratham area as part of the Proposal.

Further information on how the southern section access strategy was developed and influenced through community feedback can be found on the Main Roads website:

https://www.mainroads.wa.gov.au/globalassets/projects-initiatives/projects/regional/bunbury-outer-ring-road/borr-south-local-access-strategy-november-2019-1.pdf

Amenity through Gelorup will be further considered during the detailed design stage. Visual amenity is also a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Proposal.

In regard to noise, Main Roads is required to meet the requirements of State Planning Policy 5.4 where noise exceedances result in impacts on residential and social receptors.

Main Roads has committed to construction additional screen walls to further improve noise and visual amenity along the Gelorup corridor. Existing noise walls will be extended along the road verge as screen walls. This will be in areas where gaps existed due to predicted levels being below mitigation trigger levels, except where the road is in a large cutting and therefore sunk well below existing ground levels. Continuation of screen walls between the noise walls will also reduce visual impacts by providing additional screening of road traffic.

Noise walls will also be designed with visual amenity in mind and the context of the local environment.

No.	Submission and/or issue	Relevant submission
113	The proponent does not provide any information to support the key benefits statements. Dot Point 1- The road is NOT a bypass around Bunbury as it runs through the middle of a rural residential community only 7km south of the CBD Dot Point 2 - providing a direct link to the port of Bunbury This statement fails to acknowledge that Willinge Drive is single lane road and therefore the access to the Port will still be limited by this road. The current proposal does not provide a direct link given that trucks from Bussell Highway will still have to negotiate the Woods road interchange, the Willinge interchange and then the single lane Willinge Drive. The single lane at Willinge Drive will serve to increase driver frustration and travel times and should be a priority ahead of construction of the southern BORR. This freeway does not fit the brief of providing a safe and separate direct access for freight and trucks to the port. The road to the port, Willinge Drive is a single lane. This freeway does not provide future expansion of the South West. When the Lithium mine opens in Greenbushes, even more trucks will be using the dangerous South West Highway to the port, a single lane road that provides a link to the port for grain and mining trucks	16, 17, 22, 32, 58, 59

The completed BORR will provide a high standard route for access to the Bunbury Port and facilitate proposed development within Greater Bunbury. It will cater for a projected long-term doubling of the existing population to approximately 200,000 people within Greater Bunbury. The BORR forms a major component of the planned regional road network for Greater Bunbury, providing an effective route for inter-regional traffic as well as a safe and efficient road network for traffic travelling into and around Bunbury.

The existing road network within Greater Bunbury accommodates a range of vehicle movements, including freight, commercial and light vehicles, as well as regional and local traffic. This combination can at peak times impact on road safety and amenity within Bunbury. The new road will encourage separation of heavy and light vehicles, providing a safer, more efficient overall environment with improved travel times.

Land for the southern section of BORR through Gelorup has been identified for many decades (at least since the early 1980's), has been included in numerous planning documents and strategies and has been reserved within the Greater Bunbury Region Scheme for many years. Identification of the southern section of BORR pre-dates the rural-residential development of Gelorup which now surrounds this corridor.

Since 2016, planning for the BORR alignment has been coordinated with updated long-term land use planning in collaboration with the Department of Planning, Lands and Heritage. As a result, the BORR alignment is located to follow the perimeter of the long-term proposed urban footprint within Greater Bunbury. The only exceptions to this are several low density rural-residential areas on the outer fringe of the urban footprint including Gelorup.

The BORR has been planned to ultimately provide a controlled access and grade separated highway improving heavy vehicle efficiency as well as providing safety benefits by removing potential conflicts at intersections and minimising interactions with local traffic.

The BORR provides a direct link to the Bunbury Port via Willinge Drive. The ultimate planning for Willinge Drive and South Western Highway includes provision for a four lane dual carriageway. Major upgrades to these roads are not part of the current BORR project and will be implemented once traffic and safety requirements warrant this further work.

No.	Submission and/or issue	Relevant submission
114	A date of 2041 is used for noise level determinations but not clear why when road is designed for 50 years.	16, 17, 58, 59

The application of State Planning Policy (SPP) 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment is undertaken. As such, future impacts are calculated to 2041 for the Proposal.

No.	Submission and/or issue	Relevant submission
115	Main Roads propose to discuss mitigation treatments on a one to one basis with landowners. This may not be appropriate as Main Roads will have all the power and landowners may be disadvantaged. The suggestion that consideration be given "to architectural treatments to mitigate noise impacts…discussed on a one-to-one basis with impacted landowners" should be more strongly worded to ensure that landowners are fairly treated. Furthermore, the discussions should be conducted in such a way that landowners feel empowered to decide on the architectural treatments that suit them best and have the information they need to do so.	16, 17, 58, 59, 62

Main Roads is required under SPP 5.4 to provide mitigation to properties where noise levels exceed those listed in the SPP.

The noise modelling report finds that 18 properties exceed the reportable limit after mitigation measures have been applied. Main Roads will continue to work with the property owners to ensure a fair and reasonable outcome is obtained.

Main Roads has committed to construction additional screen walls to further improve noise and visual amenity along the Gelorup corridor. Existing noise walls will be extended along the road verge as screen walls. This will be in areas where gaps existed due to predicted levels being below mitigation trigger levels,

except where the road is in a large cutting and therefore sunk well below existing ground levels. Continuation of screen walls between the noise walls will also reduce visual impacts by providing additional screening of road traffic.

No.	Submission and/or issue	Relevant submission
116	One of the mitigation measures proposed to improve visual amenity is planting vegetation in the median strip and drainage swales, yet in section 1.3.4 they state there will be no planting in these areas to reduce future maintenance and improve safety. On some parts of the proposed route through the BORR Southern Section, all of them in the Gelorup Corridor, there is no room for a normal width grass-shrub median strip (a Commonwealth requirement). This proposes two lanes each way of traffic, travelling at 110kph, with only concrete barriers or painted lines between the middle two lanes. This is not an old road needing remediation it is a proposed new road, costing nearly a billion dollars, and yet does not have the basic safety measure of a normal width grass-shrub median strip. The lack of such a median strip on the proposed BORR through the Gelorup Corridor is in stark contrast with the rest of the BORR, which has normal grass-shrub median strips. For example, Forrest Highway to the north, and Bussell Highway to the south, both have normal width grass-shrub median strips. These three nearby examples demonstrate the significant inadequacy of the proposed alignment through Gelorup. Normal width median strips reduce traffic accidents, and therefore the proposed Southern BORR, which is for a major new, expensive freeway, must not be approved if it if it does not include such strips on its entire length. The proposed freeway through the Gelorup Corridor is highly likely to cause preventable deaths because of poor planning, including lower standards, especially in this 7 km stretch. Main Roads WA's own research, plus other independent studies, clearly demonstrate the safety outcomes of normal width median strips, yet MRWA has not provided this research for the EPA Review. Nor has it explained why it has chosen to contravene safety guidelines in its proposal for Southern BORR, by omitting normal grass-shrub median strips. The public deserves to be provided with this research and a detailed explanation as to why MRWA proposes to build a very costly freeway in contravention of safest and best practice.	16, 17, 18, 32, 43, 51, 58, 59, 61

The median width along some part of the BORR has been reduced to minimise the Proposal's footprint. This has been done in environmentally sensitive areas to avoid impacts. In particular, reducing the median width will reduce impacts to Tuart Woodlands TEC vegetation. The resulting Proposal reflects the minimum land area required for the road corridor.

The road design and modification of the median width has been undertaken in accordance with national road design standards.

Visual impacts of BORR Southern Section will be improved through:

- The sinking of the road through Gelorup near Yalinda Drive up to 1.5 metres over a length of 800 metres. This sinking will reduce the height of Yalinda Drive overpass and approaches. Retaining walls will be used to ensure additional clearing to accommodate the sinking is not required.
- establishing screening walls along Yalinda Drive between Eucalypt Drive and Woods Road.

No.	Submission and/or issue	Relevant submission
117	19 properties have been shown to have excess outside noise levels following all available noise wall and road treatment mitigation measures. These individual houses are proposed to have architectural upgrades offered (Table 5-2 Appendix S) but it is not stated how this will improve OUTSIDE noise levels. All residents should be able to have access to the outdoors of their property and enjoy its amenity. The construction of noise walls will significantly impact the visual amenity of the property (as discussed in Appendix T) and the excess noise as detailed in Appendix S will adversely impact their outside amenity. There will be significant increase in noise throughout the community. The level at most times (excluding mowing and dogs barking) is about 40 – 50 decibels. People in the North Link were quoting 90 decibels and above and they were 800 metres away. No number of architectural upgrades will mitigate outside noise.	16, 17, 22, 32, 38, 58, 59, 72

Noise

Main Roads will meet the requirements of State Planning Policy 5.4 where noise exceedances result in impacts on residential and social receptors.

For a new road project, State Planning Policy 5.4 allows a noise level of 55 dB LAeq(Day) and 50 dB LAeq(Night) from the road and this will be the basis for the noise mitigation design.

In areas where it is not feasible to extend the noise wall to manage noise at more remote sensitive receptors architectural treatments will be offered to impacted residences. The road surface will also be improved between Jilley Road and Bussell Highway to reduce the outdoor noise environment and minimise noise impacts at residual receptors.

Noise walls will also be designed with visual amenity in mind and the context of the local environment.

Main Roads has committed to construction additional screen walls to further improve noise and visual amenity along the Gelorup corridor. Existing noise walls will be extended along the road verge as screen walls. This will be in areas where gaps existed due to predicted levels being below mitigation trigger levels, except where the road is in a large cutting and therefore sunk well below existing ground levels. Continuation of screen walls between the noise walls will also reduce visual impacts by providing additional screening of road traffic.

Visual Amenity

Visual amenity is a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Proposal.

Noise walls will be designed with visual amenity in mind and the context of the local environment.

Visual amenity for surrounding residences may be partially mitigated with sensitive landscape and urban design in relation to planting, wall placement and batter slopes and concludes that due to the extent of proposed screening vegetation, as planting matures over time, many built form elements associated with the Proposal would likely be visually mitigated.

No.	Submission and/or issue	Relevant submission
118	An initial flaw in the design of this study was to set the point of visual impact at 800 m from the road. (P I Executive summary Appx T) Due to the narrow footprint of the Gelorup Corridor, many properties will lie within this 800 m and some will be as close as 200 m (primarily along Yalinda Drive). Setting the distance at 800 m is not an accurate representation of the visual impact on those properties within that envelope.	16, 17, 22, 32, 38, 58, 59, 72

It is noted that potential visual impacts on adjacent residences is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, visual related impacts on adjacent dwellings were not addressed within the Southern Section Additional Information for Preliminary Documentation.

The study area for a Visual Impact Assessment (VIA) is generally confined to the likely extent of visibility of Proposal within its surrounding context. In the case of BORR South, an indicative impact area of 800 m either side of the centre line was established. This study area provides for all potential visual impacts within the 800 m study area. Within the study area, key viewpoints were identified, photographed and the potential impact of BORR Southern Section for each viewpoint assessed. This assessment included properties on Yalinda Drive (viewpoints 9, 10 and 11) and properties either side of the road reserve. Some properties assessed were within 25 m of the Proposal.

No.	Submission and/or issue	Relevant submission
119	Another concern was to identify the landscape as “urban” when the setting is clearly rural. (p 10 Table 5, section 2.6.2.1).	16, 17, 22, 38, 58, 59, 72

The Landscape Visual Impact Assessment (LVIA) identifies five landscape units within the study area. These landscape units are:

- Landscape Character Unit 1: Forest
- Landscape Character Unit 2: Peri-Urban
- Landscape Character Unit 3: Rural
- Landscape Character Unit 4: Quarry
- Landscape Character Units 5: Highway.

Landscape units 2 and 3 reflect the environment within which the majority of Gelorup residents live.

Of note, the description of Landscape Unit 2 is LCU2 landscape values include remnant vegetation of high ecological value (which may include Endangered Banksia Woodland), and habitat for the critically endangered Western Ring Tail Possum. The Five Mile Brook environment has ecological and habitat value, as well as functioning as an important pedestrian connection for the local community. A Significant Tuart tree is also present within LCU2 to the west of Five Mile Brook. The residential development type within the bushland setting is also relatively unique in its broad-scale retention of large amounts of native vegetation within private land. LCU2 therefore has **High** landscape character value.

And Landscape Unit 3 as Landscape values associated with LCU3 include remnant vegetation on private land, which may include endangered Banksia Woodland. Local policy objectives also aim to preserve the character of rural area, including the environmental qualities of the landscape, vegetation and watercourses. LCU3 therefore has a **High** landscape character value.

No.	Submission and/or issue	Relevant submission
120	The assessment did not include consideration of impacts due to lighting or night time conditions (p12 section 2.8).	16, 17, 22, 38, 50, 58, 59, 72

It is noted that potential lighting impacts on adjacent residences is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, lighting related impacts on adjacent dwellings were not addressed within the Southern Section Additional Information for Preliminary Documentation.

Strategies will be developed to comply with the Australian and New Zealand Standard (AS / NZS 1158) Lighting of public roads (Standards Australia , 2005). This will include consideration of light backspill and treatments such as backshades and reducing light pole height where possible to minimise impact on adjacent properties.

To minimise energy use, Main Roads has committed that all lighting will be LED lighting and the extent of lighting will be minimised where possible. Lighting will only be provided at intersections and interchanges, where lighting is required for safety. The main alignment and ramps will not be lit.

The impact of lighting is addressed in the UDLF document where sensitive lighting is recommended for BORR South.

The LVIA Report also recommends the impact of street lighting should be mitigated during detailed design particularly within Landscape Units 3 and 4.

No.	Submission and/or issue	Relevant submission
121	Comment is made that according to State Legislation and Policy, it is important to “ensure that new development is consistent and sensitive to the character and quality of the landscape”. (P13 section 3.1.1.1). They also note that the Greater Bunbury Strategy relevant objectives include “ensure that development occurs in a way that safeguards and enhances the existing environmental, biodiversity and scenic assets”, and “to protect and enhance waterways, heritage areas, remnant vegetation” (P14 3.1.2.2).	16, 17, 22, 32, 38, 50, 58, 59, 61, 72

	Shire of Capel planning scheme no 7 is also referenced and states that in the areas of “special Rural” – “to make provision for retention of the rural landscape and amenity “ (p 15 3.1.3.2) The objectives of Visual management are to have “the road alignment and associated built forms sited within the natural topographic context” (p31 Section 5.1.1 appendix T) and section 5.1.2 outlines the protection of landscape character, with key protection issues being retention of dense native vegetation, retention of low lying and dunal topography and that no built form should be visible above the tree line or interrupting more open views. Section 6.2 (p35 Appendix T) clearly shows over multiple areas how this road will not confirm with the above stated objectives. The elevated interchanges at Centenary Lilydale Rds, the bridge at 5 Mile Brook, the bridge at Yalinda Drive and the Bussell Highway interchange will cause significant interruption to the visual and landscape amenity and are out of keeping with the natural low lying landscape.	

It is noted that landscape design and visual impacts are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, neither were addressed within the Southern Section Additional Information for Preliminary Documentation.

Landscape description

The LVIA identifies five landscape units within the study area. These landscape units are:

- Landscape Character Unit 1: Forest
- Landscape Character Unit 2: Peri-Urban
- Landscape Character Unit 3: Rural
- Landscape Character Unit 4: Quarry
- Landscape Character Units 5: Highway

Landscape units 2 and 3 reflect the environment within which the majority of Gelorup residents live. These units are described as follows.

Of note, the description of Landscape Unit 2 is LCU2 landscape values include remnant vegetation of high ecological value (which may include Endangered Banksia Woodland), and habitat for the critically endangered Western Ring Tail Possum. The Five Mile Brook environment has ecological and habitat value, as well as functioning as an important pedestrian connection for the local community. A Significant Tuart tree is also present within LCU2 to the west of Five Mile Brook. The residential development type within the bushland setting is also relatively unique in its broad-scale retention of large amounts of native vegetation within private land. LCU2 therefore has **High** landscape character value.

And Landscape unit 3 as Landscape values associated with LCU3 include remnant vegetation on private land, which may include endangered Banksia Woodland. Local policy objectives also aim to preserve the character of rural area, including the environmental qualities of the landscape, vegetation and watercourses. LCU3 therefore has a **High** landscape character value.

Lighting and night conditions

The LVIA only considers the visual impact of the built form of BORR Southern Section in the landscape. The impact of lighting is addressed in the UDLF document where sensitive lighting is recommended for BORR South.

The LVIA Report does however recommend the impact of street lighting should be mitigated during detailed design particularly within Landscape Units 3 and 4.

Policy documents

The LVIA reviewed several policy documents to describe the visual values and land planning objectives of the study area. The purpose of the review was not to determine if BORR Southern Section was in conflict with these documents but were used to inform the impact assessment and identify mitigation measures that are in keeping with policy intent.

Yalinda Bridge

The LVIA identified that the low lying landform of the study area had a low capacity to accommodate the visual impact as a result of the construction of the Yalinda Bridge.

The LVIA recommended that during detailed design, a combination of low retaining walls and integrated batters in locations where large cut batters, are considered in order to reduce the Proposal footprint and allow for the retention of native vegetation along the Proposal corridor on either side of the Yalinda Road bridge.

This visual impact assessment provides important information that is progressed through to detailed design and the UDLF, particularly the mitigation measures proposed in Section 8.1.1 of the LVIA that *'proposed planting appears to be in keeping with the existing landscape characteristic, however further recommendations provided later in the report provide guidance on placement for better integration.'*

Clearing of native vegetation

The LVIA is aligned with advice in the ARI that construction of BORR Southern Section will require clearing of native vegetation. The Preliminary Documentation details the vegetation type, condition and area impacted. The LVIA advises that the Proposal includes cut and fill batters and grade-separated interchanges within low-lying and dunal areas as being uncharacteristic within the existing landscape context. The Assessment goes on to advise that this could be partially mitigated with sensitive landscape and urban design in relation to planting, wall placement and batter slopes and concludes that due to the extent of proposed screening vegetation, as planting matures over time, many built form elements associated with the Proposal would likely be visually mitigated.

Landscape impact

The LVIA confirms that in certain locations, particularly Landscape Units 3 and 4, Gelorup that the construction of BORR Southern Section has the potential to have a High to Moderate impact to visual amenity. The mitigation measures both in the LVIA and ULDF will mitigate these impacts to a large extent.

No.	Submission and/or issue	Relevant submission
122	Again in section 8, the report is damning in its conclusions about the impact of this road:	16, 17, 22, 38, 50, 58, 59, 72

	Section 8.1.1 “proposed grade separated interchanges would be in conflict with the natural landform, imposing cut and fill batters, retaining walls and new elevated structures Section 8.1.2 “ due to the nature of the proposal It would not be possible to retain much of the existing valued vegetation” and “the proposal includes cut and fill batters and grade separated interchanges within low lying and dunal areas which would be uncharacteristic withing the existing landscape context” (p 66 Appendix T).	

It is noted that landscape design and visual impacts are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, neither were addressed within the Southern Section Additional Information for Preliminary Documentation.

In regard to Section 8.1.1., the visual impact assessment advises that the proposed grade-separated interchanges would be in conflict with the natural landform as would imposing cut and fill batters, retaining walls and new elevated structures to areas surrounding the interchange for Landscape Unit 3. This visual impact assessment provides important information that is progressed through to detailed design and the UDLF, particularly the mitigation measures proposed in Section 8.1.1 of the LVIA that *‘proposed planting appears to be in keeping with the existing landscape characteristic, however further recommendations provided later in the report provide guidance on placement for better integration.’*

Regarding Section 8.1.2, the LVIA is aligned with advice in the ARI that construction of BORR Southern Section will require clearing of native vegetation. The Preliminary Documentation (Section 6.4.2.4) details the vegetation type, condition and area impacted. The LVIA advises that the Proposal includes cut and fill batters and grade-separated interchanges within low-lying and dunal areas as being uncharacteristic within the existing landscape context. The Assessment goes on to advise that this could be partially mitigated with sensitive landscape and urban design in relation to planting, wall placement and batter slopes and concludes that due to the extent of proposed screening vegetation, as planting matures over time, many built form elements associated with the Proposal would likely be visually mitigated.

No.	Submission and/or issue	Relevant submission
123	Schoolchildren on the east side of Bussell Hwy will be unable to safely access north bound school bus services. Residents on the west side of Bussell Hwy wishing to travel south will have to exit left onto Bussell Hwy, negotiate the roundabout at the Woods Rd interchange and then travel south. Residents of northern Stratham wishing to visit South Gelorup will have to turn right at Jaymon Rd across the merging traffic travelling at 110 km /hr both north and south bound to enter the Calinup Rd slip Rd and then head north once more into Gelorup. Main Roads has no plans to upgrade the intersection at Jaymon Rd which will become the main entry and exit point for North Stratham with the road closure of Lakes Rd. This is a major safety concern.	16, 17, 22, 38, 50, 58, 59, 61, 72

It is noted that road user safety is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, it was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The Jaymon Road intersection will remain as a full movement intersection as part of the project, with minor improvements to right turn out of Jaymon Rd.

The Jaymon Road intersection will be monitored, like all road intersections in the state, for road user safety.

No.	Submission and/or issue	Relevant submission
124	Residents of northern Gelorup were not consulted about the changes in design to incorporate upgrades to Jules Rd and Centenary Rd. The road is planned to pass through a local playground and public open space where community members can exercise their dogs. Residents of Sleaford Park Drive are likely to experience a significant increase in traffic as people use this road as a "rat run" rather than continuing on to the BORR interchange and Centenary Rd roundabout. The design changes will significantly reduce these residents' amenity.	16, 17, 22, 38, 50, 58, 59, 61, 72

The BORR Local Access Strategy was finalised during development of the Proposal and informed by consultation with the local community. This included a local access strategy workshop held in Gelorup in July 2019, to gather community feedback regarding the potential changes required to local access arrangements around the Gelorup and Stratham area as part of the Proposal.

The extension of Jules Road was included in the project to provide a safer access to Bussell Highway via Centenary Road. Jules Road would be used by local traffic only and does not provide a convenient route for through traffic.

In response to concerns raised by local residents the Shire of Capel requested inclusion of a roundabout at Jules Road Sleaford Road intersection. The roundabout will further discourage the use of the route by through traffic and will aim to calm traffic. As a result, there is a minor land requirement on Reserve 45214, which is public open space. The playground on the reserve is not impacted by the works.

No.	Submission and/or issue	Relevant submission
125	For the people directly affected by the road as it splits the community of Gelorup in two, the impacts of loss of neighbours with land resumptions, the loss of a valued local community resource in the destruction of the Gelorup corridor, the loss of visual amenity as a four lane freeway with soundwalls is built through a rural landscape and the impact of sound and light on remaining properties are all significant and have not been adequately addressed during the planning and design phase of this freeway.	16, 17, 22, 32, 38, 43, 58, 59, 61, 76

It is noted that landscape design, noise and visual impacts and connectivity are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, these matters were not addressed within the Southern Section Additional Information for Preliminary Documentation.

Land Requirement

The alignment for the BORR Southern Section in Gelorup was originally planned and established in a statutory Town Planning Scheme in the early 1980's when land, which it passed through, was zoned rural. Subsequent to this planning, the development of the adjacent land has recognised the alignment of the BORR and its objectives by restricting subdivision to low density Special Rural land uses.

The land acquired for the project is largely consistent with the land requirement that has been shown in GBRS for many years. The decision to realign BORR to avoid impacting the Giant Tuart, as requested by the Gelorup community, required land acquisition outside the GBRS. As a result six landowners were offered the option for the whole of their property to be acquired to accommodate the realignment. Alternatively, they were offered the choice for only a partial acquisition to be undertaken to allow them to remain on their property.

The majority of the land acquisition impacts rural properties and does not result in the loss residences. As noted above, the land identified in various planning documents for a number of decades and is has been reserved in the GBRS since its gazettal.

Loss of Community

During the development phase of the project a Local Access Strategy was prepared which considered the need for changes and additions to the local road network to ensure that connectivity was maintained for the local community following construction of BORR. The scope of the project includes the construction of a bridge at Yalinda Drive which maintain connectivity and accessibility between the areas of Gelorup north and south of BORR.

During this process, input was sought from a range of stakeholders and based on the feedback received, a number of changes were made to the Local Access Strategy. These changes ensured that a high standard of access and egress was available for the local community.

Further information on how the Local Access Strategy was developed and influenced through community feedback can be found on the Main Roads website:

https://www.mainroads.wa.gov.au/globalassets/projects-initiatives/projects/regional/bunbury outer-ring-road/borr-south-local-access-strategy-november-2019-1. pdf

Loss of Visual Amenity

A Landscape Visual Impact Assessment (LVIA) has been prepared providing an assessment of the potential impact the Proposal will have at key viewpoints surrounding the BORR Southern Section corridor. This recognised a number of landscape character units and strategies were proposed to mitigate the visual impact of the project.

Further work will be undertaken through the detailed design phase of the project to ensure that the visual impacts of the project are minimised to the extent possible. This work will be incorporated into the Urban and Landscape design for the project.

Main Roads has undertaken early screen planting in a number of sections of the project to minimise visual impacts for adjacent residents on rural properties. Further work is in progress to extend these treatments to semi-rural properties adjacent to the BORR alignment in Gelorup.

Sound and Light

Main Roads will meet the requirements of State Planning Policy 5.4 where noise exceedances result in impacts on residential and social receptors.

For a new road project, State Planning Policy 5.4 allows a noise level of 55 dB LAeq(Day) and 50 dB LAeq(Night) from the road and this will be the basis for the noise mitigation design.

In areas where it is not feasible to provide noise walls to manage noise at isolated sensitive receptors, architectural treatments will be offered to impacted residences. Stone Mastic Asphalt (SMA) surfacing is proposed between Jilley Road and Bussell Highway to minimise noise impacts. SMA is a quieter surface treatment than the 14mm Sprayed Seal planned for most of the BORR alignment.

Noise walls will be designed with visual amenity in mind and the community will be consulted in regard to aesthetic design of the walls.

Lighting will only be provided at intersections and interchanges, where lighting is required for safety. The main alignment and ramps will not be lit. To minimise potential light pollution, Main Roads has committed that all lighting will be LED lighting with the colour temperature selected to minimise blue light pollution. Light backspill will be addressed using treatments such as backshades.

The Standard of lighting on local roads will be selected to minimise impact on adjacent properties whilst still maintaining a safe road environment.

No.	Submission and/or issue	Relevant submission
126	During the CRG meetings, MRWA consistently referred to a report that was to look at the social impact but this report, the KPMG report, was completed BEFORE the road selection was finalised and was highly flawed in methodology and conclusions (KPMG Socioeconomic Impact Assessment September 2019). It was meant to be performed using the methodology of the NSW Roads and Maritime document (p32 Table 3-3 SEIA report) which was provided by the BORR Team's Project Director to the CRG members. After reviewing that document, it is clear that KPMG's SEIA Report should have been a comprehensive and quantitative assessment of the social and economic impacts caused by the BORR Project, and not just a qualitative (i.e. superficial) assessment that relied primarily on minimal interviews by KPMG's Project Manager with just a few CRG representatives, community members and local government stakeholders. In fact for the largest infrastructure project ever proposed in the south west, the KPMG report interviewed just eight people (Appendix B p46). Interestingly this report is not referenced once in the Social or Amenity impacts section of the documentation and further appropriate Social impact studies must be concluded. The Socio-Impact Assessment (KPMG, 2019) was completed before the final road selection was finalized, and so could not possibly have assessed the impact correctly. I believe that many aspects of this Review process have been illegitimate, poorly coordinated, and that consultation with the community has not been satisfactory. Residents who would be impacted by the proposal have been denied important information, and the public has not been provided appropriate data to enable rigorous analysis and comment. The widespread social impacts of this process have been distressing.	16, 17, 22, 38, 50, 58, 59, 61

It is noted that landscape design, noise and visual impacts and connectivity are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, these matters were not addressed within the Southern Section Additional Information for Preliminary Documentation.

Maintaining connectivity for local communities is a major priority for BORR. The Yalinda Drive Bridge is proposed to maintain connectivity and accessibility between the areas of Gelorup north and south of BORR. The Centenary Road upgrade maintains connectivity along Lilydale Road and potential secondary access for the residents along Jules Road. Connectivity will be maintained for Stratham to Bussell Hwy at Jaymon Road and Lakes Road.

The BORR Local Access Strategy was finalised during development of the Proposal and informed through extensive consultation with the local community. This included a local access strategy workshop held in Gelorup in July 2019, to gather community feedback regarding the potential changes required to local access arrangements around the Gelorup and Stratham area as part of the Proposal.

Further information on how the southern section access strategy was developed and influenced through community feedback can be found on the Main Roads website: https://www.mainroads.wa.gov.au/globalassets/projects-initiatives/projects/regional/bunbury outer-ring-road/borr-south-local-access-strategy-november-2019-1. pdf

Amenity through Gelorup will be further considered during the detailed design stage. Visual amenity is also a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Proposal.

Main Roads commissioned KPMG to conduct an independent Socio-Economic Impact Assessment, and not a socio-connectivity assessment. Therefore, the consultation undertaken by KPMG while preparing the Socio-Economic Assessment was not focused on the impacts of individual local road amendments as the assessment was intended to provide a holistic view of the Proposal's long term effects to the Greater Bunbury region. KPMG conducted targeted stakeholder consultation with local government authorities, regional economic development bodies, industry associations, local businesses, social infrastructure providers, as well as community members.

No.	Submission and/or issue	Relevant submission
127	Documents obtained from Main Roads also suggest that oversize vehicles will not be able to utilise this southern section due to the configuration of the Bussell Hwy Interchange (PEG meeting Minutes 6/8/2019, obtained via FOI from MRWA). The maximum clearance will be 5.9m. These vehicles will still travel north on Bussell Hwy to the proposed Centenary Rd Interchange, increasing congestion in the Gelorup Dalyellup region.	22

It is noted that oversize vehicle utilisation is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The decision to reduce the clearance at this interchange and at the Yalinda Drive bridge from 7.0 m to 5.9 m was made in an effort to avoid impacts on the surrounding flora and fauna. If the structural clearance is reduced, then the overall footprint of the project is reduced.

Vehicles with loads greater than 5.9 m in height will have to use Bussell Highway and Centenary Road. This will apply only to vehicles which are permitted under the Main Roads control of Heavy Vehicles.

This applies to less than 1% of the traffic volume on this road network and is likely to occur no more than once per week.

No.	Submission and/or issue	Relevant submission
128	Comment is made also that fencing and noise walls will have heights of up to 5 m and therefore have long term negative impacts on visual amenity for nearby residents. Construction of noise walls will significantly impact the visual amenity of the properties and the community's largely visual aspect of an untouched native bushland. In addition, residents will have sound walls blocking vision of the semi-rural landscape.	22, 38, 72

It is noted that visual impacts are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Visual amenity is a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Proposal.

The LVIA provides an assessment of the potential impact BORR Southern Section will have at key viewpoints within the Corridor. As part of this study, the LVIA assessed the UDLF prepared for BORR Southern Section to confirm the landscape character units and that the strategies proposed in the UDLF mitigate the visual impact of the built form.

The visual amenity of BORR Southern Section is presented in three parts:

- Landscape Character Units as described in the UDLF
- 17 Viewpoint locations
- Four photomontages.

Each of the above provide the visual context that is impacted by BORR South. The four photomontages were selected as representative viewpoints. The potential visual amenity impact of the noise wall is shown in viewpoint 12 as representative of the potential impact on amenity. Existing photomontages 11 and 12 are representative of other requested viewpoints, potential amenity impacts, and mitigation treatments.

Noise walls will also be designed with visual amenity in mind and the context of the local environment.

No.	Submission and/or issue	Relevant submission
129	MRWA undertook to build the Forrest Hwy and was approved to build under the EPBC Act 1999 on 7 December 2006. (Approval Decision EPBC 2005/2193). As part of the conditions of approval, MRWA was asked to undertake audited compliance and that this audited compliance documentation was to be publicly available until 2026. There is no	22

	documentation available on the EPBC website compliance data and none on the MRWA Website. It has been requested directly from MRWA but to date has not been forthcoming. The Interim Report of the Independent Review of the EPBC Act released this year raised questions over accountability of organisations once approvals have been obtained. I would state that MRWA has been shown to not comply with the conditions of approval on a previous large piece of infrastructure and should not be given approval for any further projects until their compliance is in place.	

Main Roads conducted independent audits of compliance with the approval conditions for the New Perth Bunbury Highway (EPBC 2005/2193) in 2008, 2010 and 2013. These reports were made publicly available on the Southern Gateway Alliance and/or Main Roads websites until October 2014, which was five years after construction was completed. Main Roads formally advised DAWE (then Department of Sustainability, Environment, Water, Population and Communities) of the public availability of the audit reports on Main Roads website until October 2014.

No.	Submission and/or issue	Relevant submission
130	The very fact MRWA moved the road to avoid the Giant Tuart tree closer to Yalinda Drive has meant that many more people will be severely affected by this freeway, both from a noise and visual perspective.	32

It is noted that potential impacts on adjacent property owners is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The listing of the Giant Tuart tree on the National Tree Register by Gelorup residents and the value this tree has to the community as advised at CRGs led to a decision that the road be re-aligned to avoid the Giant Tuart tree. The construction of the original alignment would have resulted in the tree being removed. The decision to avoid clearing the Giant Tuart Tree is a direct response to the concerns raised by Gelorup residents to Main Roads. The unfortunate consequence of the alignment avoiding the tree was that several adjacent properties would now be directly impacted.

No.	Submission and/or issue	Relevant submission
131	The proposal to place lighting on the interchange roundabout at Woods Road will not only have a severe impact on the residents but also the nocturnal animals such as the WRTP. It has been suggested that lights with shades over the back of the lighting unit will minimise this issue but the fact still remains, the light will shine across the road and into the bush beyond. If the lighting is turn off during the early hours of the morning this will increase the risk of crashes along the road.	32, 50

	This raised urban style roundabout is both a waste of tax payers' money and an environmental disaster. For residents along Woods Road and near the Bussell Highway/BORR interchange, visual impact from lighting has the potential to be a major issue, given that the area will be continuously lit.	

It is noted that lighting impacts on adjacent properties are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Strategies will be developed to comply with the Australian and New Zealand Standard (AS / NZS 1158) Lighting of public roads (Standards Australia , 2005). This will include consideration of light backspill and treatments such as backshades and reducing light pole height where possible to minimise impact on adjacent properties.

Main Roads is proposing that all lighting will be LED lighting and the extent of lighting will be minimised where possible. Lighting will only be provided at intersections and interchanges, where lighting is required for safety. The main alignment and ramps will not be lit.

Main Roads will use a white/yellow light LED luminaire with a CCT of equal to or less than 3000 k and select a luminaire that minimises the levels of lower wavelength light. A luminaire of this frequency is unlikely to impact wildlife, whilst still providing energy efficiency benefits. If a satisfactory LED luminaire is not available, the option of the less energy efficient High Pressure Sodium (HPS) luminaire remains available.

Main Roads will use a white/yellow light LED luminaire with a CCT of equal to or less than 3000 k and select a luminaire that minimises the levels of lower wavelength light. A luminaire of this frequency is unlikely to impact wildlife, whilst still providing energy efficiency benefits.

No.	Submission and/or issue	Relevant submission
132	Jaymon Road and Lakes Road intersections Residents in North Stratham and will be directly affected by increased traffic numbers and/or the potential risk for escaping fire in the event that this should occur. The intersection north and south of Jayman Road is extremely dangerous as traffic needs to enter or exist onto Bussell Highway in a 110kph zone and there is a high probability that future accidents will occur particularly when the closure of Lakes Road limits traffic to the north only. The closure of Lakes Road and use of Jayman Road will also impinge on the quality of local roads. eg Minninup Road as Lakes Road and Quambi Drive traffic will have to utilise Jayman Road to get to their properties hence putting pressure on Minninup Road which is already a difficult local road to drive on. It is understood Main Roads has no plans to upgrade the intersection at Jaymon Rd which will become the main entry and exit point for North Stratham with the road closure of Lakes Rd. This is a major safety concern.	40, 46, 50, 61

	Further consideration and implementation measures will be required to ensure a better intersection is provided at both Lakes Road and Jayman Road to minimise local traffic congestion, improve safety of intersections and manage potential fire routes in the event of a fire	

Lakes Road is proposed to remain open and become a left in left out intersection onto Bussell Highway as part of the project. From an access and egress perspective during emergency events, there is no significant impact for Stratham residents. There will still be two entry and exit points from Stratham.

The road network in Stratham is not affected by the BORR project, and no additional traffic introduced to the local area. The banning of the right turn from Lakes Road will cause minor redistribution of traffic within the local area.

The additional volume of traffic turning south from Jaymon Road, is not expected to be significant, and the intersection is adequate for this additional use. The local roads within Stratham are adequate for the expected traffic volumes.

Future improvements to the network will be undertaken over time as needs arise and funding becomes available.

No.	Submission and/or issue	Relevant submission
133	The noise assessment levels seem conservative for the noise level that is anticipated during construction i.e., the use of excavators, front end loader, tip trucks, screen, reversing alarms and road trucks. There is now a parking bay located along the BORR Southern Section, which will involve traffic de accelerating and re accelerating, creating higher levels of noise but there is no mention of trucks being prohibited from using air brakes.	43

It is noted that noise impacts on adjacent property owners were not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation. Construction related noise impacts will be managed in accordance with the WA *Environmental Protection (Noise) Regulations 1997*.

No.	Submission and/or issue	Relevant submission
134	The report also discusses a lack of access to potentially affected private properties (p.12). We have spoken to residents that will be affected in a major way, and they have told us that Main Roads WA has not contacted them to ask permission to come on their land for an assessment. Most would certainly have been agreeable if they had known the reasoning.	50

It is noted that access to adjacent properties are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Landowner approvals for site surveys was a pre-requisite of environmental surveys being undertaken. Main Roads was circumspect in seeking access to private properties during the project planning phase.

Main Roads will continue to engage with all relevant stakeholders who may be impacted by the proposal in an effort to ensure all access related impacts are management properly.

No.	Submission and/or issue	Relevant submission
135	It is mentioned that there will be a shared path along the freeway, but presumably no access for local residents given that the sound walls must be continuous along the residential areas. During the CRG meetings, Main Roads WA did not discuss these social issues, but consistently referred to a report that was to look at these various social impacts. When the Report was released in January 2020, the community had some serious misgivings.	50

It is noted that access to infrastructure is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Maintaining connectivity for local communities is a major priority for BORR. The community connectivity structures currently planned for BORR for the Gelorup community includes Improvements to, and where required additional works, to establish walk track loop(s) around BORR. North south connection of the walk track loop will be by way of a pedestrian underpass at Banksia Road, a dual use path at Yalinda Drive and an improved pedestrian underpass at Five Mile Brook. Figure 10 illustrates the location of these social connectivity structures. Figures 11 and 12 present the design for the north/south connection at Five Mile Brook.

The Yalinda Drive Bridge is proposed to maintain connectivity and accessibility between the areas of Gelorup north and south of BORR. The Centenary Road upgrade maintains connectivity along Lilydale Road and potential secondary access for the residents along Jules Road. Connectivity will be maintained for Stratham to Bussell Hwy at Jaymon Road and Lakes Road. The BORR Local Access Strategy was finalised during development of the Proposal and informed through extensive consultation with the local community. This included a local access strategy workshop held in Gelorup in July 2019, to gather community feedback regarding the potential changes required to local access arrangements around the Gelorup and Stratham area as part of the Proposal.
Further information on how the southern section access strategy was developed and influenced through community feedback can be found on the Main Roads website:
https://www.mainroads.wa.gov.au/globalassets/projects- initiatives/projects/regional/bunbury outerring- road/borr-south-local-access-strategy-november-2019- 1. pdf

Amenity through Gelorup will be further considered during the detailed design stage. Visual amenity is also a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Proposal. Main Roads commissioned KPMG to conduct an independent Socio-Economic Impact Assessment, and not a socio-connectivity assessment. Therefore, the consultation undertaken by KPMG while preparing the Socio-Economic Assessment was not focused on the impacts of individual local road amendments as the assessment was intended to provide a holistic view of the Proposal's long term effects to the Greater Bunbury region. KPMG conducted targeted stakeholder consultation with local government authorities, regional economic development bodies, industry associations, local businesses, social infrastructure providers, as well as community members

The detailed design phase will make provision for local residents to access the PSP. Typically, these points are provided at interchange locations, bridge and to adjacent local roads. This will include overlapping locations of noise walls where required to provide local access to the PSP.

The current concept design shows a number of local access points for the Gelorup community to the PSP. These locations will be refined during the detailed design. Further consultation will be conducted with the community through the detailed designed phase.

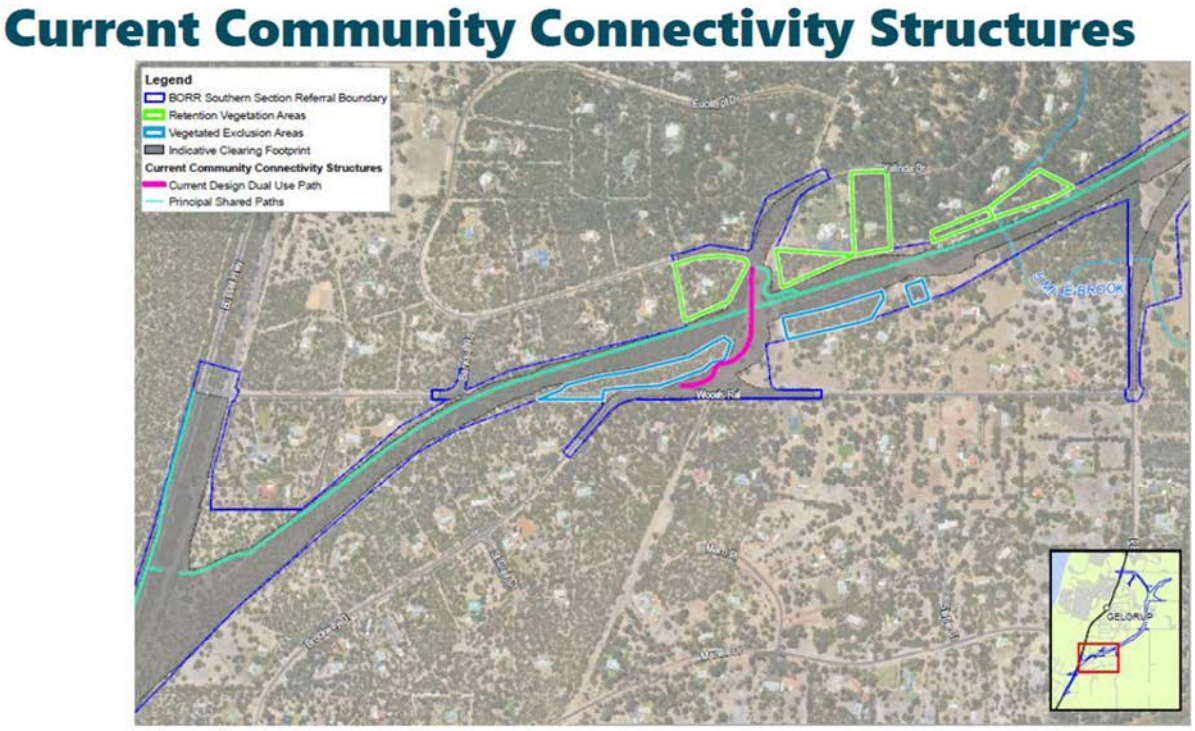

Figure 10 Current (initially proposed) community connectivity structures

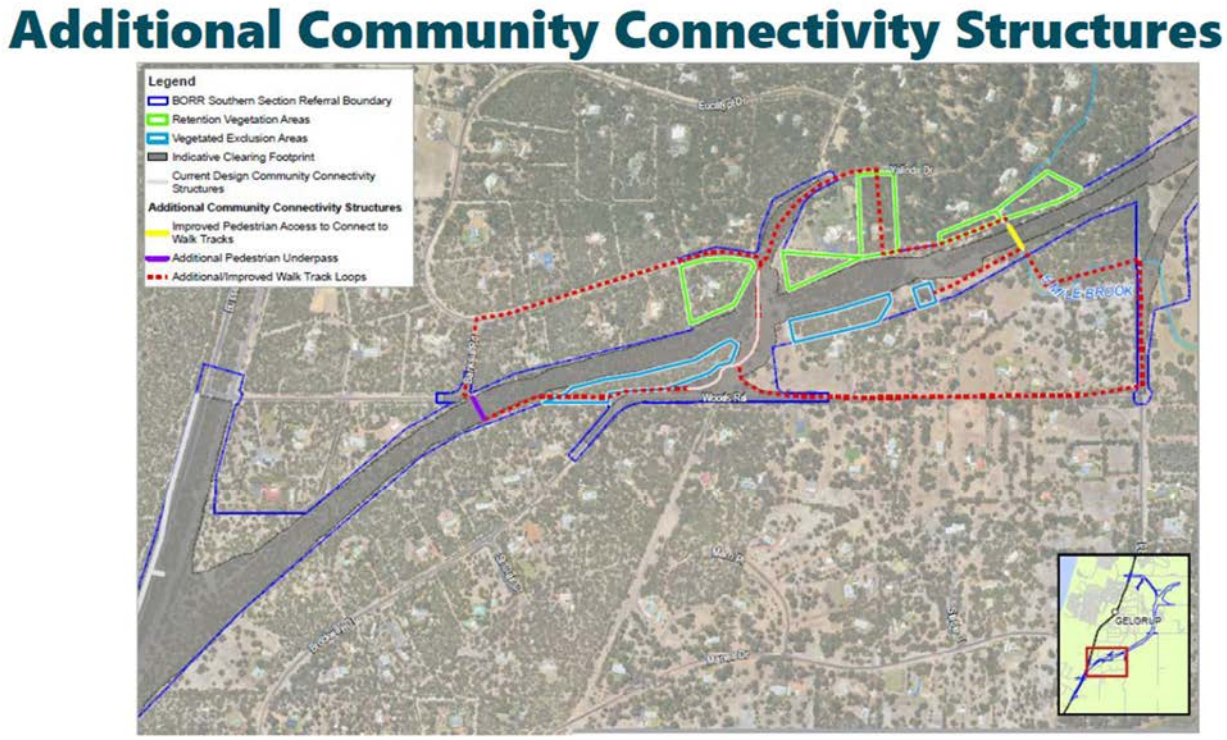

Figure 11 Additional community connectivity structures

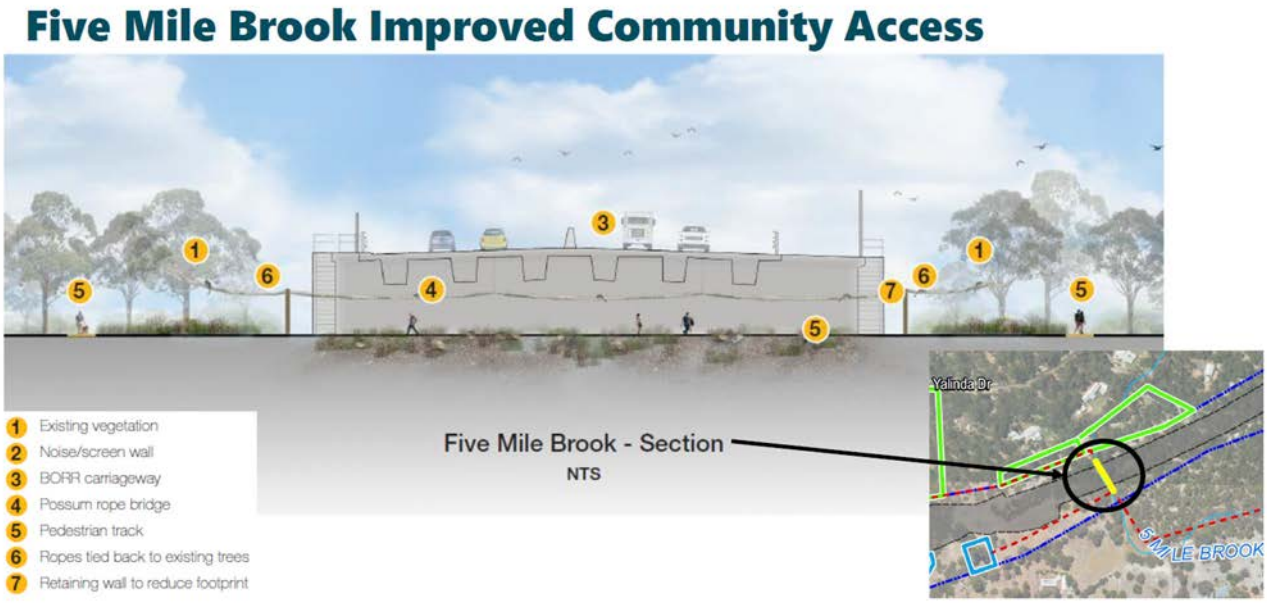

Figure 12 Five Mile Brook improved community access

No.	Submission and/or issue	Relevant submission
136	The local community, especially residents, also lose the environment to which they are deeply attached. In the Gelorup case, about 18 families have already been removed forever from their homes and properties through government compulsory acquisition – something MRWA said for decades would never	32, 61, 73

	happen. It claimed the corridor was fully fit for purpose, but after continual expansion of its plans, this year (2020) started the acquisitions. Another 12 families are expected to suffer under compulsory takeovers. No amount of offsets will compensate any of the Gelorup corridor families for the loss of their neighbourhood and environment. The few replies that were received from Minister Saffioti's office stated that: "The Gelorup Corridor is sufficient to accommodate the BORR" and on several occasions state that "no land acquisitions will be required". This has not been the case. Ms Saffioti, who had advised that no land acquisitions would happen, then made the decision to take the route through the centre of the Gelorup Community as it was "cost effective". This decision was made in May 2019 when some of the environmental data was flawed and yet to be corrected. A total of 9 whole properties and 13 partial properties have been acquired. The total cost of land acquisitions is expected to cost up to 26 million dollars.	

It is noted that government acquisition of freehold land is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The land acquired for the project is largely consistent with the land requirement that has been shown in GBRS for many years. The decision to realign BORR to avoid impacting the Giant Tuart, as requested by the Gelorup community, required land acquisition outside the GBRS. As a result, six landowners were offered the option for the whole of their property to be acquired to accommodate the realignment. Alternatively, they were offered the choice for only a partial acquisition to be undertaken to allow them to remain on their property.

The majority of the land acquisition impacts rural properties and does not result in the loss residences. As noted above, the land identified in various planning documents for a number of decades and has been reserved in the GBRS since its gazettal.

No.	Submission and/or issue	Relevant submission
137	This proposal also highlights poor coordination of planning processes by the WA government, because the KLP draft Management Plan was released for public comment by the WA Department of Biodiversity, Conservation and Attractions (DBCA) in September 2020, but did not mention MRWA's proposal to damage areas of Tuart Woodland TEC/PEC and Tuart Peppermint Woodland PEC near and in the narrowest part of the park. During a special workshop organised by DBCA to assist submission writers, no mention was made of this proposed destruction of protected species. This prevented public comment on MRWA's proposed damage, from people interested in the KLP.	61

It is noted that potential impacts on regional parks is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Potential impacts on the proposed Kalgulup Regional Park at the interchange of Centenary Road with Bussell Highway would be up to 0.25 ha. While the August 2020 Kalgulup Regional Park draft management plan shows the boundaries of the park indented at the interchange to provide capacity for the interchange improvements, the plan and park boundaries are not yet final. Regardless, direct impacts of BORR on the Park would be minimal in nature based on the draft Park planning documents. Revision of the BORR infrastructure during detailed design will be undertaken to further minimise impacts to the maximum extent practicable.

No.	Submission and/or issue	Relevant submission
138	Another social impact is that of fire risks caused during construction of the BORR Southern Section, and into the long term future after construction is completed. No fire risk management plan has been conducted, and therefore no consideration of impacts of bushfires on flora, fauna, humans or property. This is not acceptable. No real consideration has been given to the increased risk of fires being started during construction or operation of the freeway and the potential impact on adjacent remaining bushland. Main Roads has provided evidence of 1 meeting with local fire brigades and DFES, where details of emergency vehicle access on and off the BORR were considered along with discussion of fire fighting equipment for the local fire brigades in the form of water stands. (5 August 2019, Minutes provided by BORR team via email). This meeting was prior to finalisation of the Southern Local Access Strategy and prior to finalisation of design elements south of Jilley Rd which incorporate possum fencing and sound walls along the length of the freeway. No discussion was held about how these design elements would impact users of the road, in the event of a major incident, or local residents, in the event of a major bushfire event. Main Roads has not provided any form of Bushfire Management plan in their proposal to build this freeway through an extreme fire risk zone, and this is a major deficit in their documentation. A thorough fire risk management plan needs to investigate whether the proposed alignment is likely to increase fire risks to Gelorup and/or Stratham woodland and bushland, with resulting harm to humans, flora, fauna and property. Results of such a plan must be recorded as criteria in a published MCA in deciding the final alignment.	61, 72, 73

It is noted that fire management risk is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Main Roads consulted with the Department of Fire and Emergency Services (DFES) during project development and will continue to liaise with the DFES through detailed design to mitigate any additional risks identified. DFES advised that the connectivity afforded by the local road connections planned for the project will allow adequate provision to meet response times.

This consultation informed the commitment to provide a borehole and tank, and equipment on the eastern side of BORR for the exclusive use of the Local Fire Fighting Services. There is also a commitment to provide a bore water tank and equipment at Yalinda Drive, south of BORR. Improved local access roads will also provide a benefit, by connecting Jilley Road, Ducane Road and Lillydale Road East of BORR as part of the project.

The local access strategy was developed to address the impacts on the local road network. This strategy has ensured that any impacts to local roads are mitigated by construction of additional local access. For example, the impact of closing Woods Road will be mitigated by the construction of Yalinda Drive Bridge. This strategy also ensures that two possible paths of egress are available from all properties.

During the delivery phase of the project, the Alliance will be responsible for communicating changes to the road network to emergency services authorities and the local community to enable necessary adjustments to bushfire and evacuation plans.

No.	Submission and/or issue	Relevant submission
139	The referral document states the referral requires local government approval, the previous LG council were in favour of the currently proposed route endorsing it numerous times through the acceptance of the Town Planning Scheme, the new current Council is not endorsing the GBRS route and have instead voted in favour of an alternate route. Currently the local town planning scheme 7 has no planning restrictions on the alternate route.	79

It is noted that the administration and implementation of local government processes is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Main Roads will comply with all local and State government planning processes.

4.6.3. Air Quality, Greenhouse Gas Emissions, and Climate Change

No.	Submission and/or issue	Relevant Submissions
140	Air Quality: Air quality will be compromised by dust generated during construction and operation of the Project. This is a major concern for local occupants especially as on page 158 (BORR 2020) the proponent acknowledges 'Motor vehicles dominate the emissions of carbon monoxide (CO), volatile organic carbon (VOC) or (Volatile Organic Compounds) and nitrous oxides (NOx) (SKM, 2003)' and this adverse effect will be increased through this proposal. The proponent dismisses this concern, stating that the BORR alignment is situated on rural land, which is not the case. Dwellings and public recreational areas will now be subjected to increased construction vehicle emission and dust. Further potential impacts from the operation of this	38, 43, 61

	proposal could affect the long-term health of vegetation and vegetation communities (smothering) in areas directly adjacent to the road. It is also concerning that there are no mitigation measures proposed to counteract Greenhouse Gas Emissions, which will be increased due to larger volumes of traffic, heavy machinery use, higher demand for electricity generation and the loss of vegetation. "	

It is noted that nuisance dust nor minor greenhouse gas (GHG) emissions are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, these matters were not addressed within the Southern Section Additional Information for Preliminary Documentation.

Nuisance Dust

Some visible dust emissions will be likely occur during construction. Dust emission are expected to be minor and will be managed through appropriate mitigation measures. Construction management measures to address dust lift will be addressed in a Construction Environmental Management Plan to be implemented during the project construction phase. The CEMP will include mitigation measures including:

- Implementation of dust suppression measures, such as surface watering and spreading of hydromulch
- Daily monitoring of meteorological conditions to identify and prepare or modify operations which increase the risk of windblown dust
- Restriction of earthmoving if high winds are generating unmanageable dust levels
- Progressive clearing to minimise the extent of soil exposed
- Restriction on vehicle speeds to minimise the generation of dust
- Establishment of a complaints register
- Maintenance of vehicles in accordance with manufacturer's specifications to minimise exhaust emissions
- Low emissions producing equipment will be selected (if possible).

An Air Quality Assessment (BORR IPT, 2020g) was completed for the Proposal and modelled potential changes in air quality as a result of the traffic predicted to travel on BORR South. The assessment criteria were:

- National Environment Protection Measure
- World Health Organisation.

The air quality assessment noted potential increases in CO, NO_2, PM10, PM2.5 and Volatile Organic Compounds (VOCs). Air quality modelling was undertaken for two scenarios, 2019 and 2041. The modelling results indicated that maximum predicted concentrations for all pollutants were below the relevant assessment criteria.

Greenhouse Gas

Modelling undertaken for the BORR Southern Section estimate the Scope 1 emission of 42 251 t CO2-e over the three year period of construction or 14 083 t CO2-e. per annum, well below the 100 000 t CO2-e. criteria. Assessment of this Project for potential environmental harm by the WA EPA would only be required had the predicted results exceed the 100 000 t CO2-e. criteria. These results advise

that GHG emissions during construction do not conflict with the limit set by the EPA and therefore no residual impacts are expected as a result of this Project.

Implementation of the Proposal is predicted to result in a minor increase in operational emissions over a 'Do Nothing' scenario.

The results of the GHG assessment for construction and operation of the Proposal indicate that the Proposal is unlikely to produce significant GHG emissions.

No.	Submission and/or issue	Relevant Submissions
141	Procurement of appropriate materials for construction is a significant area where carbon footprint and greenhouse gas production could be reduced but is dismissed as 'the impacts associated with sourcing materials are not considered part of the Proposal'. The project will not comply with the EPA objective "to reduce net greenhouse gas emission in order to minimise the risk of environmental harm associate with climate change" (p.xiii, BORR IP, 2020).	38, 50

Sources of material required for the construction of BORR Southern Section have not been determined, and as such is not assessed as part of the BORR Southern Section environmental approval assessment process.

The environmental impacts presented in the referral documents for BORR Southern Section reflect the potential direct and indirect impacts the Proposal may have on the relevant environmental factors as a result of the construction and operation of the Project.

Proponents proposing to provide base raw materials (i.e. sand) for this Proposal, must apply for an Extractive Industry Licence under the *Planning and Development Act 2005* to their local government authority for assessment and approval. All extractive industry proposals are subject to the provisions of the EP Act for clearing applications (s51A) and the AH Act.

No.	Submission and/or issue	Relevant Submissions
142	Submitter raises concerns over rising sea levels and associated risks due to climate change and the need to protect coastal settlements.	32, 44, 50, 61

It is noted that the climate change preparedness is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

In accordance with the Main Roads Guideline on Climate Change, the impacts of climate change have been considered as part of the planning for the BORR project. The Guideline specifically requires that the impacts of a 300 mm sea level rise (450 mm for structures) is considered as part of planning, design and construction for all rehabilitation and expansion projects near coastal areas.

The infrastructure for the BORR South is generally above 10 mAHD and is considered to be sufficiently high that a sea level rise of 300 mm will not impact the highway or associated drainage.

No.	Submission and/or issue	Relevant submission
143	The submitter raises that further studies to determine extent climate change plays a role in impacts to the proposal area so a complete and accurate assessment of the impact of this proposal is completed.	50, 61

It is noted that the climate change preparedness is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Where the potential impacts of a drying climate may exacerbate or inform impacts, they have been considered when relevant and practicable.

Monitoring plans particularly for Threatened Ecological Communities and Conservation Significant species describe the triggers that require mitigation. For example, hydrologic connectivity has emerged as an important environmental factor for BORR Southern Section particularly to sustain the habitat for the Black Stripe minnow and riparian values of Five Mile Brook. While not explicitly referring to climate change, these monitoring plans account for a drying climate.

The EPA's objective for the factor GHG is to reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change. Given the above assessment, no residual impacts are expected for this aspect and the Proposal meets the EPA objective for GHG.

No.	Submission and/or issue	Relevant submission
144	MRWA documents in the review contain no significant plan or accounting for managing the proposed project in a time of climate change. Also, there is barely any mention of impacts of climate change associated with the proposal.	61

It is noted that the climate change preparedness is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The impacts of climate change have been considered as part of the planning for the BORR South project. In line with Main Roads Guidelines the impacts of a 300 mm sea level rise (450 mm for structures) have been considered. BORR South is generally above 10 mAHD and is considered to be sufficiently high that a sea level rise of 300 mm will not impact the highway or associated drainage.

Where the potential impacts of a drying climate may exacerbate or inform impacts, they have been considered when relevant and practicable.

Monitoring plans particularly for Threatened Ecological Communities and Conservation Significant species describe the triggers that require mitigation. For example, hydrologic connectivity has emerged as an important environmental factor for BORR Southern Section particularly to sustain the

habitat for the Black Stripe minnow and riparian values of Five Mile Brook. While not explicitly referring to climate change, these monitoring plans account for a drying climate.

No.	Submission and/or issue	Relevant submission
145	Table ES-1(p XIII) shows just how little thought has been given to complying with EPA objectives. By claiming that the Guidance is that Greenhouse Gas emissions will be assessed where they exceed 100000 tonnes of scope 1 emissions each year, they claim that the proposal does not need any mitigation. However they clearly note that the greenhouse gas emissions both during construction, maintenance and operation of the freeway will be increased – in direct conflict with the stated EPA objective of reduction in emissions.	61

It is noted that the minor GHG emissions are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

In April 2020, the EPA released the Environmental Factor Guidelines for Greenhouse Gas Emissions. Under the Guidance, GHG emission from a proposal will be assessed where they exceed 100 000 tonnes of Scope 1 emission each year measure in $CO_{2\text{-}e}$. GHG modelling undertaken for the BORR Southern Section estimate the Scope 1 emission of 42 251 t $CO_{2\text{-}e}$ over the three year period or 14 083 t $CO_{2\text{-}e}$. per annum, well below the 100 000 t $CO_{2\text{-}e}$. criteria. Assessment of this Project for potential environmental harm would only be required had the predicted results exceed the 100 000 t $CO_{2\text{-}e}$. criteria. These results advise that GHG emissions during construction do not conflict with the limit set by the EPA and therefore no residual impacts are expected as a result of this Project.

4.6.4. Contamination

No.	Submission and/or issue	Relevant submission
146	21% of the proposal area was not assessed for acid sulphate soils [ASS]- why not? Test pits indicate that acidity is likely to be mobilised easily and leached during excavation and dewatering exercises due to the presence of sulfidic soils. What extra measures will be employed to manage this? Refer to Section 2.2.5	18

An Acid Sulphate Soil Management plan (Appendix U) has been prepared and will be refined during detailed design. This plan includes treatment of Potential Acid Sulphate Soil material and disposal of Actual Acid Sulphate Soil where required at appropriately classified landfill facilities.

No.	Submission and/or issue	Relevant submission
147	With specific reference to chemical spills, pesticide use, construction pollution and all associated contamination risks, have these management plans been developed by Main Roads WA, and if so, are they available for the community's review? The contamination of ground water is covered by legislation and the protection of water resources with which Main Roads WA must comply. To date, Main Roads WA has not made public its strategies to be employed to achieve compliance.	18, 38, 61

Main Roads has prepared a Drainage Strategy (BORR IPT, 2019g) for the BORR Southern Section prepared in consultation with a project Drainage Reference Group.

To inform the selection of appropriate treatments for the runoff off the highway, the main constituents in highway runoff were identified and are presented below:

- Sediment
- Oil and Grease/hydrocarbons
- Heavy metals
- Inorganics
- Nutrients.

Heavy metals present in highway runoff are largely insoluble and adhere to sediments. Therefore, the removal of sediment from the highway runoff is also effective at removing heavy metals from the runoff.

Nutrients (TN and TP) in highway runoff are largely from atmospheric deposition. There is also some loading resulting from spillage from stock haulage, spillage of fertiliser from trucks and fertiliser application along the highway, however, the contribution of nutrients to the catchment from the highway is minor compared to adjacent land uses.

Construction Environmental Management Plans (CEMP) will be prepared by the contractor prior to ground disturbing works. The CEMP will include details on the handling and storage of hydrocarbons, chemicals and hazardous materials during construction activities. Any incidences will require that a report for the regulator is prepared.

Main Roads has completed a 12 month groundwater (GW) and surface water (SW) monitoring programme. This dataset provides the baseline data from which potential contamination may be monitored. Main Roads will continue to monitor GW and SW levels and analytes on a quarterly basis at sensitive locations.

The dates of the 12 month monitoring program are provided in Table 11.

Table 11. Surface water and groundwater monitoring dates for BORR

Monitoring Event	Survey dates
1	19 to 22 August 2019
2	16 to 19 September 2019
3	21 to 28 October 2019
4	18 to 21 November 2019
5	16 to 19 December 2019
6	20 to 23 January 2020
7	17 to 20 February 2020
8	16 to 19 March 2020
9	20 to 23 April 2020
10	18 to 21 May 2020
11	15 to 18 June 2020
12	20 to 27 July 2020
13	19 to 21 October 2020
14	18 to 20 January 2020

No.	Submission and/or issue	Relevant submission
148	The disturbance of sulphates is a further concern and one that almost certainly will not be controlled during the construction phase. To date, the community has seen no design drawings indicating the height of the road above ground water resources and there is also the potential for excavations that will not comply with the *Country Areas Water Supply Act 1947* or the Bunbury Water Reserve Catchment Protection Strategy. Main Roads WA is required to demonstrate that it can comply with the conditions of the *Country Areas Water Supply Act 1947* Section 12, whereby the Bunbury Water Reserve is a Proclaimed Protection Area. With reference to the Department of Water Quality Protection Note, Roads near Sensitive Water Resources, Main Roads WA must demonstrate the 'scientific investigation and contaminant modelling' carried out to ensure that the catchment is not compromised as stated in Note 10, during construction and operation.	38, 61

***Country Areas Water Supply Act 1947* Bunbury Water Reserve Catchment Protection Strategy**

The detailed design phase for BORR commenced in October 2020. It will be during this phase that design drawings showing elevations will be prepared. This phase of work will also entail detailed geotechnical investigations that will include assessment of potential acid sulphate soils. The BORR will not impact water sources supplying public water drinking supplies.

Water Quality Protection Note 10

Main Roads has completed a 12-month Groundwater and surface monitoring program across the entire length of the BORR (North, Central and South). The analytical suites are provided in the following table.

Table 12. Suite of analytes tested throughout the 12 month GW and SW monitoring program

LABORATORY ANALYTICAL SUITES	
Groundwater analytical suites	
Field parameters	pH, EC, DO (mg/L, % sat), redox, temperature (°C), TDS*
Inorganics	pH, EC (laboratory by titration), TDS (laboratory by gravimetric)**
Acidity and alkalinity	Alkalinity (carbonate as $CaCO_3$), alkalinity (bicarbonate as $CaCO_3$), alkalinity (hydroxide as $CaCO_3$), alkalinity (total as $CaCO_3$), acidity (as $CaCO_3$)
Major ions	Calcium, magnesium, potassium, sodium, chloride, sulfate, cations total, anions total, ionic balance, sulfide
Nutrients	Ammonium (as N), ammonia (as N), nitrogen (total oxidised) (as N), nitrogen (total), reactive phosphorus (as P), Kjeldahl nitrogen total, phosphorus (total).
Metals	Aluminium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, zinc
BTEXN	Benzene, toluene, ethylbenzene, xylene, naphthalene (sum of total)
TRH	Total recoverable hydrocarbons
Surface water analytical suites	
Field parameters	pH, EC, DO (mg/L, % sat), redox, temperature (°C), TDS*, turbidity (NTU)
Inorganics	pH, EC (laboratory by titration), TDS (laboratory by gravimetric)**
Acidity and alkalinity	Alkalinity (carbonate as $CaCO_3$), alkalinity (bicarbonate as $CaCO_3$), alkalinity (hydroxide as $CaCO_3$), alkalinity (total as $CaCO_3$), acidity (as $CaCO_3$)
Major ions	Calcium, magnesium, potassium, sodium, chloride, sulfate, cations total, anions total, ionic balance, sulfide
Nutrients	Ammonium (as N), ammonia (as N), nitrogen (total oxidised) (as N), nitrogen (total), reactive phosphorus (as P), Kjeldahl nitrogen total, phosphorus (total)
Metals	Aluminium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, zinc

LABORATORY ANALYTICAL SUITES	
BTEXN	Benzene, toluene, ethylbenzene, xylene, naphthalene (sum of total)
TRH	Total recoverable hydrocarbons
Pesticides and herbicides	OP pesticides, glyphosate

This monitoring program will continue on a quarterly basis at strategic locations.

No.	Submission and/or issue	Relevant submission
149	Submitters are concerned with groundwater monitoring documented to have 25% variance from baseline as a trigger threshold. It is suggested that this monitoring threshold is too high and must be reviewed.	38

Main Roads has completed a 12 month GW and SW monitoring programme across the length of BORR. These data provide the baseline information necessary to monitor for a change in trends in GW levels. A change in the order of 25% is considered a reasonable maximum threshold at which to set the implementation of contingency actions. Management actions will also be implemented as required prior to any decline reaching this point. Thus, it is considered highly unlikely that any monitored parameters in monitored groundwater levels will decline by 25%.

The monitoring programme will continue on a quarterly basis at sites where PEC and TEC vegetation is dependent on GW being maintained at current levels.

4.6.5. Mineral Resources

No.	Submission and/or issue	Relevant Submissions
150	Bunbury has been identified as a key area vulnerable to rising sea levels due to climate change. Gelorup basalt has been identified as a key resource for coastal mitigation (DPLH, 2019). The basalt in the Gelorup quarries are recognised as having strategic importance to the region. The WAPC study into the Gelorup Basalt (WAPC, 2002) state that "It is of particular importance to the State and the South West Region as it is a near-surface deposit with high and consistent quality, has good access to the Greater Bunbury and South West markets…. It is considered to be in the state's interest to maintain mining access to the resource". This local resource required less resources to extract, and less transport to bring it to the market, therefore less greenhouse gases. This quarry is the source of the blue-metal for roads, buildings and footpaths in the South West Region over the last 68 years. It has been identified in numerous government reports as a strategic resource which may be	32, 34, 38, 42, 44, 50, 61

	required for coastal mitigation work in the event of increased erosion due to rising sea levels and increased storm surges. There is an estimated 70 to 150 years of additional resource availability at the Gelorup quarry, which will provide thousands of jobs for quarry workers, truck drivers, road workers, concreters and builders who will continue to depend on this resource. Economically, the Gelorup Corridor is a short-term route that will require a replacement bypass in the near future and will sterilise basalt by sealing over the Gelorup quarry. MRWA should be required to accurately assess a. The volume of basalt to be sterilised b. The value of basalt to be sterilised c. The forecast of anticipated use in the short-term (1-10 years) medium term (10-100 years) and long term (100 years plus) d. The location, depth, quantity and quality of any alternative basalt resource e. The additional average distance to market of any alternative basalt resource f. The additional costs of developing any alternative resource, including the cost of clearing and impact on remnant bushland; establishing the quarry; cost of transport to market and so on g. The long-term intergenerational impact additional costs that will be passed on to future consumers (our descendants) as a result of wasting this resource.	

It is noted that accessing raw building materials is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The need to consider future extraction possibilities of basalt in this area has been a consideration of the Proposal throughout its development. Main Roads met with DMIRS and the two quarry operators in Gelorup and these discussions have guided the development of the Proposal and aimed to minimise any potential impacts to the basalt resource, whilst maintaining good accessibility to the BORR from quarry operations.

Furthermore, in recognition of the resource's regional importance, the basalt area boundary was a factor in the MCA used to determine the southern section alignment. Further details can be found in the Southern Alignment Selection Report, Appendix F.

In terms of long-term impacts on strategic basalt resource availability, the Gelorup basalt is not the only source of rock aggregate in the region. The Greater Bunbury Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy indicates another location for rock aggregate in Roelands. Main Roads is aware of another basalt resource area within the Shire of Capel, south of the Capel townsite.

4.6.6. Water

No.	Submission and/or issue	Relevant submission
151	Given there is no scheme water is present in either Gelorup or Stratham, submitters are concerned about the proposal's impacts to domestic water supply from contamination of rooftop rainwater and bore-water quality via heavy diesel particulates or other airborne pollutants. This risk of drinking water contamination needs to be thoroughly investigated prior to any construction of this proposal as analysis after completion with vehicular movement allowed is too late. The water contamination impacts on the Gelorup drinking water supply will be exacerbated and compounded by the additional effects of building a dual carriageway through a residential area.	32, 38, 43, 44, 61

It is noted that access to potable water is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

The quality and safety of the drinking water supply for the residents of Gelorup is a consideration that will be impacted by many factors including nearby land uses, catchment conditions, bore equipment and processes, rainwater tank and/or bore maintenance, illegal dumping, climate change and other factors.

Particulates on roofs and other catchment surfaces come from a variety of sources, with tank hygiene and maintenance one of the key factors in water quality. It is landowner's responsibility to manage tank hygiene.

National standards for air and water quality apply for land and water managed under the EP Act, but not necessarily water in rainwater tanks.

There are pollutants present from diesel and petrol powered vehicle emissions, however, the concentration levels of those elements has decreased over the last number of years with improved engine and fuel technology.

No.	Submission and/or issue	Relevant Submissions
152	Main Roads has made an application for a licence under s5C to take 333,062 kilolitres of water from the Yarragadee Aquifer for road construction and dust suppression at the Bunbury Outer Ring Road - Southern Section, under the *Rights in Water and Irrigation Act 1914*. Much of the water available in the South West region (approximately 70 per cent of the total 213 GL/yr allocation limit) is already licensed or reserved for future public water supply.	32, 38, 43, 61

	There is currently 44 GL/yr available for licensing for general use. However, this is made up of small volumes spread across the plan area, mostly in shallow superficial aquifers. Several large industrial facilities e.g. Holcim and Hanson Quarries in Gelorup are reliant on a sustained water allocation to operate their businesses, which support many families and our local economy. Many local recreation areas e.g. three golf clubs and the Bunbury turf/ trotting clubs, as well as local schools and farming communities rely on this water allocation for the long term viability of their business. Using valuable drinking water to construct a road places a significant drain on the aquifer, and as there is now the option of using reclaimed water or the use of the groundwater replenishment system now operational in Perth, Main Roads should be required to replenish the aquifer with the same amount of water as is drawn from the aquifer. Use of the Yarragadee aquifer has been opposed by residents.	

It is noted that the potential economic and social impacts associated with the over utilisation of groundwater is not considered to be an EPBC Matter of National Environmental Significance. Accordingly, this matter was not addressed within the Southern Section Additional Information for Preliminary Documentation.

Main Roads has applied to DWER for a groundwater abstraction licence for approximately 333 ML/pa from the Yarragadee aquifer. The application is for a 36-month period. The application remains under assessment under the RiWI Act and will only be progressed once specific locations are confirmed. Main Roads does not intend to locate bores close to potentially sensitive sites, for example Five Mile Brook, if there is a risk of drawdown effects on the waterway.

Main Roads is currently investigating alternate sources of water to reduce reliance on groundwater use for construction and dust suppression purposes. The use of groundwater resources is yet to be fully determined and will be avoided where other practicable alternatives are available.

DWER in its assessment of Main Roads application will consider existing groundwater users and the potential impact the application may have on current operating licences.

No.	Submission and/or issue	Relevant submission
153	Who are members of the drainage reference group? Priorities for drainage strategy seem to be road safety, protecting infrastructure from flooding rather than protecting and conserving wetland ecology. Although does talk about maintaining existing water cycle balance in the proposal area (not wider wetlands) and improving surface and groundwater quality.	18

It is noted that the membership and terms of the Drainage Reference Group are not considered to be an EPBC Matter of National Environmental Significance. Accordingly, these matters were not addressed within the Southern Section Additional Information for Preliminary Documentation.

The Drainage Reference Group (DRG) membership included:

- Local Government Authorities
- Department of Water and Environmental Regulation
- Leschenault Catchment Council
- Water Service Providers
- Department of Primary Industries and Regional Development
- Department of Planning
- Department of Biodiversity Conservation and Attractions.

The DRG considered a range of matters in the preparation of the Drainage Strategy. An important aspect of the work was to maintain, particularly in key locations, the hydrologic function of the landscape. While road safety is a key aspect in designing the drainage system, maintaining the hydrologic connections necessary to support the habitat for the BSM and Claypan TECs and Conservation Category Wetlands was also addressed.

Maintaining hydrologic function across the landscape will benefit wetlands and waterways both within and outside the Proposal Area.

4.6.7. Sustainability

No.	Submission and/or issue	Relevant Submissions
154	This proposal is not sustainable, if it has received a silver rating under the ISCA Infrastructure framework, the framework is not fit for purpose. The Infrastructure Sustainability Council of Australia (ISCA) rating that Main Roads seeks in this project is fundamentally flawed in that it does not assess whether this project should be undertaken at all, focusing instead on engineering and procurement in the construction phase.	32, 61

The ISCA framework is designed to cover the Planning, Design, Construction and Operation of a project/asset. The Silver IS Planning rating achieved by the BORR team reflects the efforts undertaken to investigate opportunities and implement sustainable practices to drive outcomes during construction and operation. The framework considers decision making, and the alignment reviews that were undertaken were done so in alignment with the IS requirements, namely that social, environmental and local economic impacts were considered alongside engineering aspects to assess the most appropriate option. Decisions made during Planning and Design can also have significant benefits extended to the operational phase, for example in the application of LED lighting, lower impact pavements and monitoring programmes.

The rating framework covers a broad range of categories that have the potential to influence sustainable outcomes, including procurement, resilience, energy, water, environmental impacts, resource efficiency and workforce sustainability across the lifecycle of the BORR, not just during the construction phase.

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Biota
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Western Ringtail Possum
Pseudocheirus occidentalis
Regional Surveys

Main Roads Western Australia

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Western Ringtail Possum Regional Survey

Contents

Figures

1.0 Summary

This report presents the findings from Distance Sampling surveys conducted to estimate the density (and population size) of Western Ringtail Possum (*Pseudocheirus occidentalis*) at over 40 sites across the species' documented geographic range. During the planning stage, the design and approach to this study were refined during presentations to, and discussions with the Western Ringtail Possum Recovery Committee and key ecologists within the Department of Biodiversity, Conservation and Attractions.

The entire study surveyed 114,243 ha using 1,249 transects equating to a total effort of 1,287.2 km of transect. Across these transects 2,939 detections of 3,677 individual WRP were made. Survey effort was divided amongst the three WRP key management zones; Swan Coastal Plain, Southern Forest and South Coast.

Within each of the management zones, sites were selected based on four key criteria: sites would ideally support, or once have supported, Western Ringtail Possums; sites represented the geographic extent of each management zone; sites were readily accessible to survey and sites needed to be sufficiently large to undertake distance sampling.

Within and between study sites the average encounter rate (number of individual WRP per kilometre of transect) was found to be variable and ranged between 0 and 15.9, and for some sections of transects even higher encounter rates were recorded. The variable encounter rates translate into variable density estimates both within and between sites, though no site yielded a higher average density than 3.98 WRP per hectare.

Of the three key management zones, the surveyed area of the Swan Coastal Plain management zone yielded the greatest estimated abundance of WRP at 9,270 individuals, the Southern Forest management zone yielded an estimate of 7,500 individuals and the South Coast management zone yielded an estimate of 3,340, WRP.

These three regional population estimates indicate a combined number in excess of 20,000 individual WRP in the surveyed area, far exceeding that for the entire State as documented in the IUCN assessment (estimated at 3,400 mature individuals) (Burbidge and Zichy-Woinarski 2017).

The methods and results of this study provide a useful framework for two major applications; to determine the potential impact of development projects upon local Western Ringtail Possum populations, and to understand the wider trends in population abundance and distribution (i.e. conservation status) of Western Ringtail Possum with these data providing a robust 2019 baseline.

By successfully applying a unified survey method (line transect distance sampling) across a variety of geographic settings and vegetation types in each of the primary WRP Management Zones, this study also addressed the key Threatening Process identified in the Western Ringtail Possum Recovery Plan (Department of Parks and Wildlife 2017) "Gaps In Knowledge". Similarly addressed were several of the Recovery Plans Objectives. This study therefore makes a significant contribution to the ongoing conservation efforts for the WRP.

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2.0 Introduction

This research was undertaken in response to a series of proposed developments by Main Roads, Western Australia, which will impact upon known populations of Western Ringtail Possum (*Pseudocheirus occidentalis*). This report presents the findings from surveys conducted to estimate the density of Western Ringtail Possum at over 40 study sites across the species' documented geographic range (as defined in Burbidge and Zichy-Woinarski (2017)). It is also aimed at fulfilling the most significant of the 10 Threatening Processes affecting the conservation status of the species as defined in The Western Ringtail Possum Recovery Plan: "Gaps in Knowledge" (Department of Parks and Wildlife 2017). Gaps in Knowledge manifests in a variety of forms, constraining a unified conservation outcome for the species (Table 2.1).

Understanding local and regional context of Western Ringtail Possum population density within project areas is critical to the assessment of impact. To date, assessments have been compromised by a lack of robust methodology and geographical context, leading to the risk that future proposals may likewise be compromised.

The dearth of robustly derived abundance estimates, or even a consistent approach to estimating abundance, is recognised as a key knowledge gap and threatening processes identified in the Western Ringtail Possum Recovery Plan (the Recovery Plan; Department of Parks and Wildlife 2017). The recent (2018) elevation of the species' conservation status to Critically Endangered (Burbidge and Zichy-Woinarski 2017) emphasises the importance of developing an accurate and robust estimate of the abundance of the species across its range and throughout the variety of habitats it occupies.

Here we advocate that a consensus should be agreed on the metric used to describe populations, namely density, and that as long as a robust and repeatable technique is employed to estimate density then the actual technique is not critical. For this study we have adopted line-transect distance sampling to estimate density and present our rationale as to why this should be the preferred technique in more detail below (Section 2.3.3)

2.1 Report Structure

The following parts of Section 2.0 summarises the most recent assessment of the conservation status of the Western Ringtail Possum (Burbidge and Zichy-Woinarski 2017; Section 2.2). Section 2.3 describes how this study aligns with the Recovery Plan (Department of Parks and Wildlife 2017). Section 2.4 provides a synopsis of distance sampling, including robustness and repeatability, and justification for its use for Western Ringtail Possum. The stakeholder engagement undertaken during the development, implementation and reporting of the study are detailed in Section 2.5.

Section 3.0 describes our interpretation of the geographic extent of the five subpopulations identified in the most recent International Union for the Conservation of Nature (IUCN) conservation assessment (Burbidge and Zichy-Woinarski 2017), and where possible associates these with the species' Management Zones as per the Recovery Plan (Department of Parks and Wildlife 2017). Within the defined geographic extent of each of the subpopulations, the candidate study sites within which distance sampling was undertaken are identified. Section 3.1 provides a description of the field survey approach and the balance of Section 3.0 outlines the analyses using both conventional distance sampling (Section 3.3.1) and density surface modelling (Section 3.3.2).

Section 4.0 presents the results of the survey. Summary statistics including the number of transects surveyed, effort (expressed as kilometres walked), number of detection events, number of individual animals sighted and encounter rates for each of the study areas are summarised in Section 4.1. These data are described in greater detail for each study site and a frequency histogram of perpendicular distances (perpendicular distance from the transect to the sighting) and a basic plot of detection events are provided in a separate Technical Supplement (Biota 2020). Plots of detection events on high-resolution aerial imagery are similarly provided in the

Technical Supplement (Biota 2020). Results of conventional distance sampling analyses including model selection for each of the study sites or for data pooled across study sites (where appropriate) are presented along with density and abundance estimates in Section 4.2. At selected study sites density surfaces are modelled and described in Section 4.3.

Section 5.0 discusses the findings of the study in respect of the provision of local and regional abundance context and revisits the identified knowledge gaps and key recovery objectives in light of the results.

2.2 Conservation Status of the Western Ringtail Possum

The most recent assessment of the conservation status of the Western Ringtail Possum took place in 2014 and was published in 2017 (Burbidge and Zichy-Woinarski 2017). This re-assessment determined that the conservation ranking should be Critically Endangered under the IUCN Red List of Threatened Species. The key elements justifying the ranking were that:

- The species has an area of occupancy of <50,000 ha (area of occurrence 40,000 ha);
- The species occurs in small, severely fragmented populations;
- There was evidence of a continuing decline (threats being a drying climate, urban development, inappropriate fire regime, predation by foxes and cats);
- The Upper Warren sub-population, which was identified as the largest prior to 2002, underwent a severe decline (>95%) between 1998 and 2009 (from >10,000 individuals to near extirpation);
- Remaining fragmented populations in coastal habitats were also rapidly declining (equating to an overall population decline of >80% in the past 10 years); and
- The above factors yielded a predicted further decline of >80% within the next 10 years.

The following 2015 estimates of population size are quoted from the IUCN Red List for five subpopulations of Western Ringtail Possum with Ms B. Jones cited as the source:

- Southern Swan: 2,000;
- Cape to Cape: 500;
- Other Forest Rivers: 300;
- Upper Warren: 100; and
- Around Albany: 500.

These subpopulation estimates yield a 2015 total population number estimate of 3,400 adult Western Ringtail Possums (Burbidge and Zichy-Woinarski 2017). At the time of the IUCN assessment, the Western Ringtail Possum was considered to occur "....*patchily in coastal areas from near Bunbury to the Leeuwin-Naturaliste National Park and near Albany (B. Jones pers. comm).*" The authors go on to say that "*Most of these fragmented habitat remnants are on private land*" (Burbidge and Zichy-Woinarski 2017).

2.3 Alignment with the Western Ringtail Possum Recovery Plan

2.3.1 Threatening Processes

The Recovery Plan (Department of Parks and Wildlife 2017) identifies 10 Threatening Processes affecting the conservation status of the species. One of these ten, "Gaps in Knowledge", manifests in a variety of forms, compromising a unified conservation outcome for the species.

Initially, Gaps in Knowledge affect the basic data collection and reporting required to accurately assess the size and abundance of local populations. Shedley and Williams (2014) clearly enunciate this problem when they state:

> *"However, knowledge of absolute abundance is limited because of a lack of comparable population estimates and variability in survey methods across the range of the western ringtail possum (Inions 1985, Jones et al. 1994b, de Tores 2000, de Tores et al . 2004). Techniques used to census western ringtail possums commonly include spotlighting, drey (a nest typically formed from a mass of twigs) searches, distance sampling and scat counts (Wayne et al. 2005a ; de Torres and Elscot 2010) . However, variations in survey methodology compromise comparable estimates of abundance between studies, areas and over time".*

The Recovery Plan (Department of Parks and Wildlife 2017) further emphasises the problem by stating:

> *"Limited short term studies and anecdotal accounts have contributed most of the knowledge on the western ringtail possum. An understanding of the ecology and conservation status has also been constrained by the difficulty in surveying (detection of) this species (Inions et al. 1989, Jones et al. 1994b, de Tores 2000)."*

The Recovery Plan (Department of Parks and Wildlife 2017) lists eight shortfalls in knowledge, which we address in Table 2.1 with proposed mitigation measures arising from this study where relevant.

2.3.2 Recovery Objectives

The Recovery Plan (Department of Parks and Wildlife 2017) outlines a series of key recovery objectives that need to be met over the ten-year period. The ones pertinent to this study, and that we feel are being met by its design, are outlined in Table 2.2, along with key anticipated deliverables. These are re-visited in the Discussion based on the results of the study.

2.3.3 Rationale for Selecting Distance Sampling

In this study we have selected distance sampling as the preferred method to estimate Western Ringtail Possum density. This approach is a thoroughly documented and published method (Buckland et al. 2001, Buckland et al. 2004, Buckland et al. 2015) for estimating animal density and thereby abundance, across a very broad range of species, including the Western Ringtail Possum (e.g. Biota 2018a, Biota 2018b, Biota 2018c, de Tores and Elscot 2010, Finlayson et al. 2010, Zimmermann 2010).

In selecting distance sampling as the approach, we have discounted other sampling approaches whilst acknowledging that each has its uses in certain situations. Arguably the most limited are unstructured spotlight surveys, drey counts or scat counts, which are not comparable across localities, surveyors or time but which remain useful for initial habitat appraisal. Similarly, non-spatial mark-recapture studies (such as non-spatial cage trapping studies) do not yield robust density estimates (Royle et al. 2013).

While strip transects of known width and length provide density estimates, and where the assumption of complete detection is made (i.e. that all the animals within the strip are detected), they are most applicable to situations where habitat comprises small or narrow remnant vegetation strips such as road reserves or riparian belts.

Spatially explicit capture recapture (Royle et al. 2013) and distance sampling both estimate the probability of detection and provide robust density estimates. However, Western Ringtail Possums are rarely trapped, hence spotlighting (distance sampling) provides a more efficient sampling method. To obtain sufficient observations we have selected line transects as opposed to point transects.

Table 2.1: Knowledge gaps for Western Ringtail Possums identified in the Department of Parks and Wildlife (2017) Recovery Plan and mitigation of these incorporated into the design of this study.

Knowledge Gaps	Mitigation
A lack of information on most populations that are small, isolated, and/or at the margins of the extant distribution, including the Waroona, Harvey, Collie, Shannon, Lower Warren and D'Entrecasteaux areas.	We selected sites at the northern (Yalgorup) and south-western (Augusta) edges of the documented distribution.
Robust survey methods appropriate for the various habitats that can provide reliable estimates of population density and/or abundance (as distinct from uncalibrated indices and indirect measures of abundance).	Distance sampling is one of two techniques that robustly estimates density (and hence abundance), by accounting for detectability and the area effectively sampled.
No strategic or co-ordinated long-term monitoring program across the species range that can quantify and track population trends over time.	Site selection was undertaken in collaboration with local experts, and survey methods are clearly described. Transect layouts are available as spatial files. These sites can be used as a foundation for future monitoring.
The causes for decline are not completely understood.	Covariates of density may help explain which land management practices or other factors best predict density, thus allowing inferences regarding factors causing decline to be made.
The relative importance and extent of threatening processes is generally not known for the species or for individual populations.	Robust density estimation at some sites provides the opportunity to test the relative impact of threatening process as inferred from covariates (see above).
Factors influencing population persistence in urban environments.	Significant sampling is done in peri-urban environments (and in large remnants). We have not designed this study to address this knowledge gap directly.
Understanding the factors that improve the success of translocations.	Collection of environmental covariates at these study sites may help explain density and could be used to help identify suitable characteristics of potential recipient sites. Two of the study sites, Yalgorup National Park and Leschanault Peninsula Conservation Park are both historical translocation sites.
Habitat restoration/creation parameters/prescriptions and effectiveness.	Collection of additional environmental variables at the study sites may be used to help explain density, which may inform habitat restoration.

Table 2.2: Recovery objectives for Department of Parks and Wildlife (2017) Western Ringtail Possums Recovery Plan and outputs from this study.

Recovery Objective	Outputs from this study
Habitat critical for survival for Western Ringtail Possums is identified and protected in each key management zone.	This study aims to sample a range of vegetation types and localities using a standardised approach and may identify areas of relatively high density, indicative of habitat critical for the survival of the species.
Threatening processes that are constraining the recovery of Western Ringtail Possums are mitigated in each key management zone.	By selecting density as the primary metric and nominating robust approaches for estimating density, this study will mitigate the Knowledge Gap Threatening Process (see Section 2.4 above).
An evidence-based approach is applied to the management and recovery of Western Ringtail Possums.	Distance sampling permits incorporation of variables that may assist in predicting density estimation, thereby providing a framework for an evidence based approach
The management of displaced, orphaned, injured and rehabilitated Western Ringtail Ppossums aids the conservation outcome for the species.	Understanding sites at which intact Western Ringtail Possum populations occur may help inform their suitability or otherwise as potential release sites.
Increased awareness of the status of Western Ringtail Possums and support behaviour change to mitigate anthropogenic threatening processes.	Collaboration with international experts on distance sampling and population modelling ensures a rigorous outcome. The subsequent peer reviewed publication of the study in a suitable journal should facilitate awareness.

Line transect surveys using distance sampling protocols are a common method used to assess terrestrial mammal populations (Buckland et al. 2001, Thomas et al. 2010). They have been recommended for use in estimating the density and abundance of Western Ringtail Possums (de Tores and Elscot 2010) and applied in several studies (e.g. Biota 2018a, Biota 2018b, Biota 2018c, de Tores and Elscot 2010, Finlayson et al. 2010, Zimmermann 2010). Studies have shown that distance sampling delivers reliable results and is efficient for sampling large areas (Hounsome et al. 2005, Newson et al. 2008, Stenkewitz et al. 2010, Gottschalk and Huettmann 2011, Warren and Baines 2011, Dick and Hines 2011), making it an appropriate choice for this study.

2.4 Synopsis of Distance Sampling

When conducting a survey, the observer may conduct a census of all individuals of the target species present at the survey site. That is, to obtain a complete census the observer must count all the individuals within a designated plot. This is commonly called a strip transect. In the example shown in Figure 1A, the plot size (A) is $2w \times 10$, and the number of individuals (N) is 20. An estimate of density easily follows:

$$\widehat{D} = N/A \qquad \text{(Eq. 1)}$$

In many circumstances censuses work well. For example, when the target species is sessile (e.g. plants, sea anemone), or if densities are high, technology can be utilised to ensure all individuals are detected (e.g. aerial photographs of seal colonies). In reality, however, it is rare that all individuals present in the survey area are actually detected. Typically, a portion of animals actually present in the survey site are missed by the observer. Without accounting for the portion of animals missed (the detectability of the target), the resulting estimate of density can be severely negatively biased.

For example, in Figure 1B, only 11 animals were actually detected (even though there were 20 present). Had N been taken to be 11, without accounting for detectability (as in Eq. 1), the resulting density estimate would have been 0.55 animals per km^2, instead of 1 animal per km^2. In order to account for detectability, Eq. 1 must be modified:

$$\widehat{D} = \frac{N/p}{A} \qquad \text{(Eq. 2)}$$

where p is the probability of detection, essentially a correction factor for the proportion of animals present in the survey area but not actually detected. Distance sampling (Buckland et al. 2001) can be used to estimate p. Here, we only consider line-transect sampling. In line-transect sampling, the perpendicular distance between the transect and each detected animal is measured (Figure 1C).

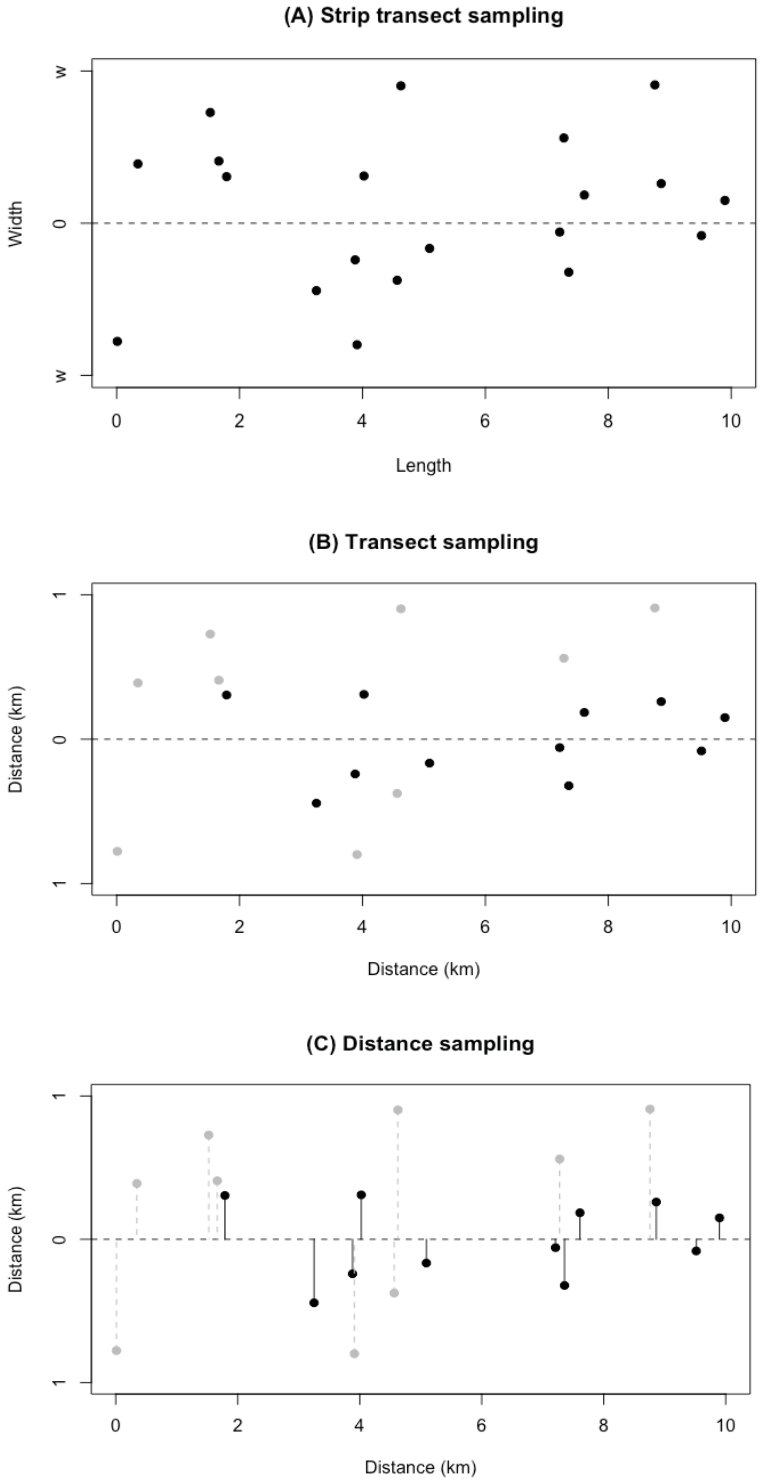

Figure 2.1. (A) a strip transect sampling example, where all animals along the transect out to distance w are detected (black dots). (B) a transect sampling example, where only a portion of animals present in the survey region are actually detected (black dots), and some animals are missed (grey dots). (C) a distance sampling example, where the perpendicular distances between the transect line (dark grey line) of all detected animals (black dots) are measured. Some animals may be present in the survey region but not detected (grey dots), and the distances these animals are from the transect line (dotted lines) are unobserved and unknown.

In distance sampling, it is assumed the distances between the line transect and all animals in the survey area is uniformly distributed. This is appropriate and valid if transects are placed at random and not perpendicular to a known density gradient like a road. It is easy to visualise how the ratio of animals detected compared to animals actually present in the survey region changes with increasing distance between the line transect and the animals (Figure 2A). This decline occurs due to detectability (i.e. it is harder to detect animals at greater distance from the line transect). Since animals that were not observed are assumed to follow a uniform distribution (Figure 2B), the probability of detection, *p*, is the ratio between the detected animals (i.e. the area under the red curve in Figure 2B), and the total number of animals present (i.e. the area under the black line in Figure 2B).

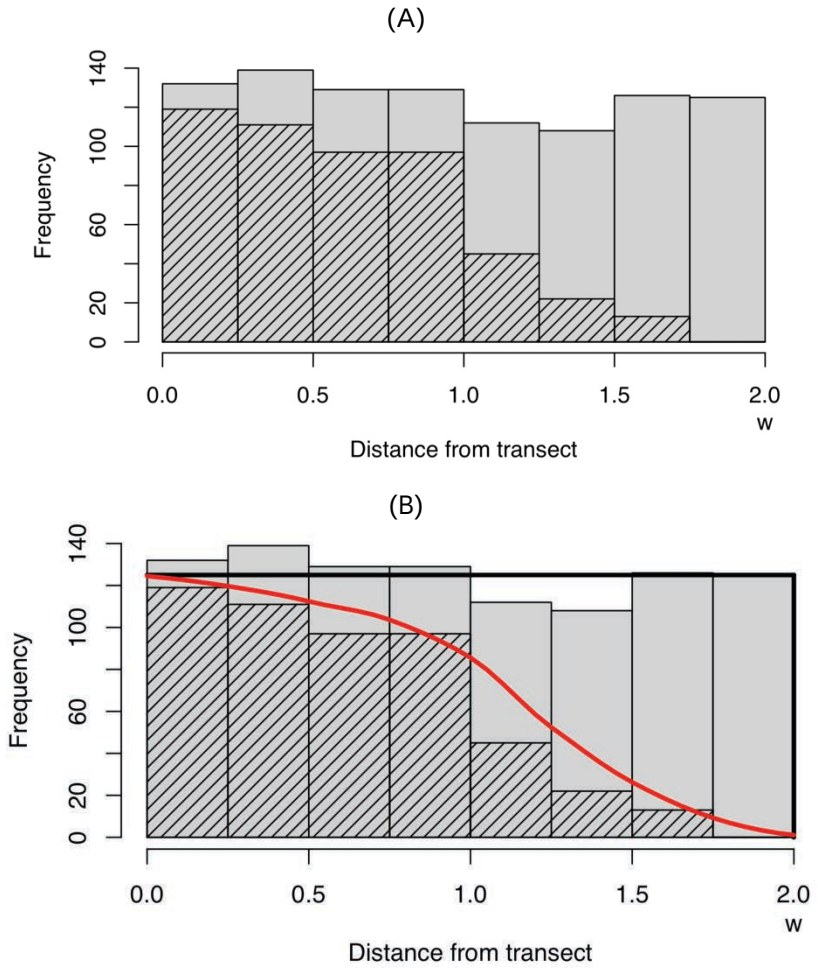

Figure 2.2. (A) In distance sampling, the distances between the line transect and detected animals are measured. These can be plotted in a histogram of frequencies (hatched bars). That is, 120 animals were observed within a distance of 0.25w from the transect. Animals that were present in the survey region but not detected are assumed to be uniformly distributed from the line transect, and are shown as grey bars. (B) A 'line of best fit' to the distance data, shown in red, whereby as distance increases from the line transect the frequency of observations decreases, whereas the underlying distribution of distances is shown as a solid black line remains constant with increasing distance (a uniform distribution).

The red curve in Fig. 2B is essentially a detection function, *g(x)*, i.e. what is the probability of detecting an animal given it is x m from the transect. To calculate the area under this red curve, we take the integral, and divide it by the area under the black rectangle, to obtain *p*:

$$\hat{p} = \frac{\int_0^w g(x)dx}{w} \qquad \text{(Eq. 3)}$$

Once we have estimated *p* using distance sampling, we also know how many animals we detected along our transect (*n*), we can calculate the total number of animals present ($\hat{N}$) and estimate D using Eq. 1.

2.5 Stakeholder Engagement

During the site selection process, Biota presented and discussed the proposed design and approach to this study with the Western Ringtail Possum Recovery Committee. Direct contact was made with a number of committee members to assist with site selection, including:

- Ms Barbara Jones (biologist).
- Sarah Comer, Regional Ecologist, Parks and Wildlife Service, South Coast Region, Department of Biodiversity, Conservation and Attractions (DBCA).
- Deon Utber, Regional Leader Conservation, Parks and Wildlife Service, South Coast Region, DBCA.
- Kim Williams, Regional Leader Nature Conservation, Southwest Region, Parks and Wildlife Service, DBCA.
- Ian Wilson, Regional Leader, Nature Conservation, Warren Region. DBCA.
- Dr Adrian Wayne, Senior Research Scientist, Science and Conservation Directorate, DBCA.
- Dr Manda Page, Principal Zoologist, Biodiversity and Conservation Science, DBCA.

3.0 Methods

3.1 Field Sampling Methods

Line transect distance sampling surveys were undertaken at each of the 43 study sites. Based on previous Western Ringtail Possum distance sampling surveys and fitted detection functions (Biota 2018a, Biota 2018b, Biota 2018c), a minimum transect spacing of 75 m was considered optimal to maximise the effective area sampled in the survey, whilst ensuring individual possums were not detected at neighbouring transects. At some survey sites a wider inter-transect spacing of 150 m was adopted to ensure adequate coverage of large sites, given available survey effort.

Experienced observers independently walked transects using a high-powered head torch (Led Lenser XEO 19R model) to detect animals. The location of each observation was recorded using a Hemisphere R330 Differential GPS or UniStrong UT10 tablet, typically providing accuracy to within 1.5 m. The following data were recorded for each observation:

- species (Western Ringtail Possum, Common Brushtail Possum, Brush-tailed Phascogale, Fox and Cat);
- observer;
- animal location (i.e. the observer standing directly underneath the animal);
- time;
- number of individual animals;
- status of individual animals (adult / independent animal, female with joey on back, female with joey at heel);
- cue: seen (eyeshine), seen (no eyeshine) or heard; and
- tree species.

3.2 Study Regions

Sampling was focussed on the Western Ringtail Possum subpopulations that were identified in the IUCN assessment (Burbidge and Zichy-Woinarski 2017), with the exception of the Inland Rivers subpopulation, which was not surveyed. These subpopulations are variously overlapped by the key management zones identified in the Western Ringtail Possum Recovery Plan (Department of Parks and Wildlife 2017). The Swan Coastal Plain management zone encompasses the Swan Coastal Plain and the Cape to Cape subpopulations, the Upper Warren subpopulation is within the Manjimup management zone, and the Around Albany subpopulation is within the South Coast management zone (Figure 3.1).

Surveyed sites on the edge of the Darling Range near Boyanup do not fall into any of the IUCN identified subpopulations, though they are within the Swan Coastal Plain management zone.

Within the geographic extent of each of the IUCN subpopulations (described in further detail below), study sites were selected based on a number of criteria:

- Given the primary purpose of providing local and regional context, sites would ideally support, or once have supported, Western Ringtail Possums.
- Study sites needed to span the geographic extent of each of the subpopulations identified within the IUCN assessment (Burbidge and Zichy-Woinarski 2017).
- Study sites were readily accessible to survey. This largely precluded freehold land and meant that the majority of surveys were conducted on Crown Land.
- Study sites needed to be sufficiently large to undertake distance sampling. This required that there be space to position sufficient transects to estimate the encounter rate variance (nominally 16 (Buckland et al. 2001)) and would yield sufficient observations (typically 60 – 80 (Buckland et al. 2001)) of Western Ringtail Possums to model density without re-sampling transects or pooling data across separate sites.

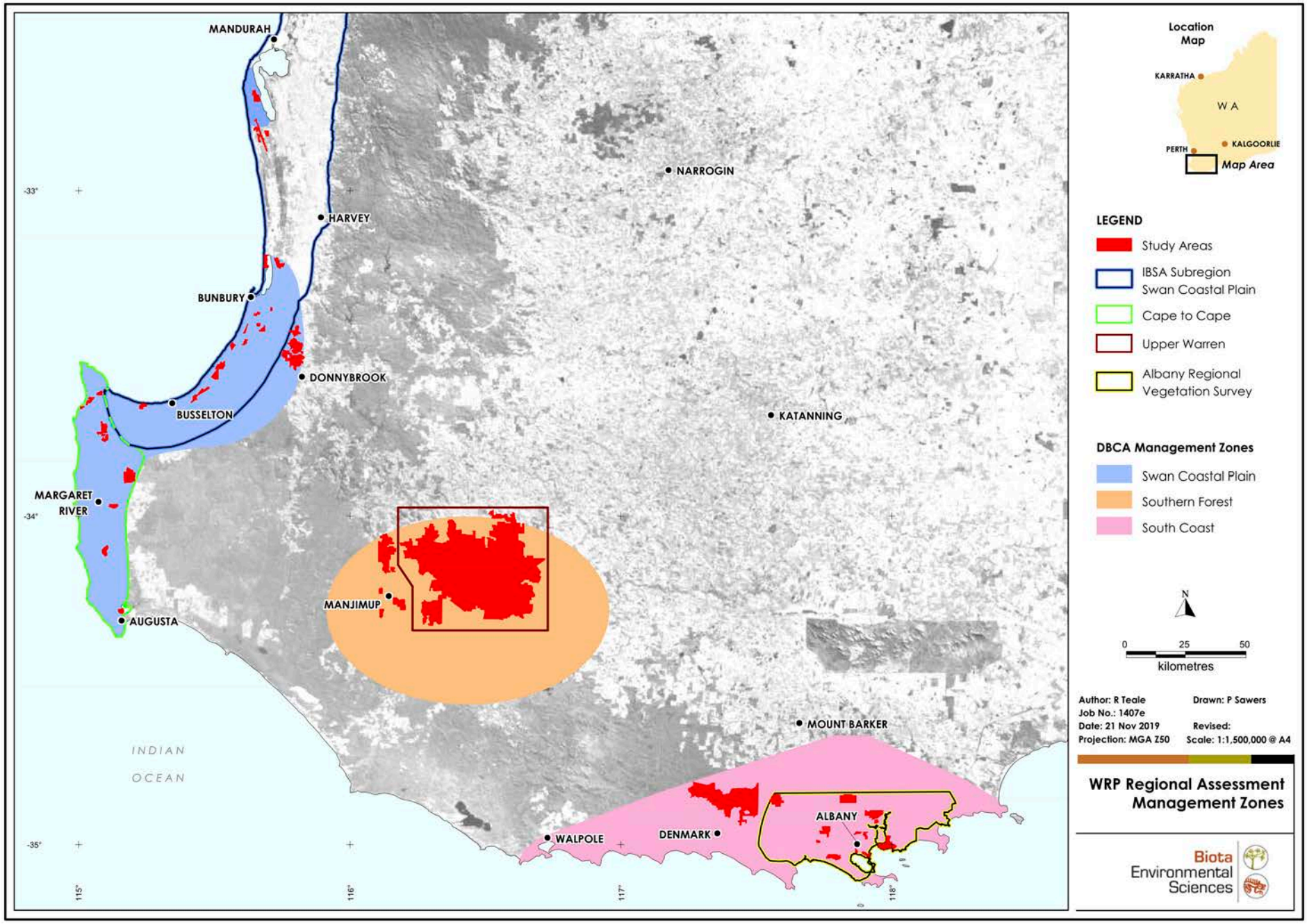

Figure 3.1: Western Ringtail Possum key management zones and IUCN sub-populations.

This study did not survey urban and peri-urban settings, riparian belts in agricultural settings, road reserves and smaller vegetation remnants (see criteria above), or the inland Rivers subpopulation (noted above). Some of these are known to support Western Ringtail Possums (Shedley and Williams 2014). Also excluded from survey were vegetation assemblages or habitats considered unlikely to support Western Ringtail Possums, and exceptionally densely vegetated habitats that prevented thorough sampling. Some coastal settings, including sections of the Leschenault Peninsula Conservation Park (Swan Coastal Plain), coastal scrub of the Leeuwin-Naturaliste National Park (Cape to Cape) and thickets of *Hakea* spp. Shrubland / Woodland complexes (Around Albany) are examples of densely vegetated habitats that were often impenetrable or nearly so. Also excluded were vegetation communities where vision to the upper canopy and mid storey was restricted, including Karri Hazel, *Trymalium odoratissimum,* understorey of mature Karri, *Eucalyptus diversicolor,* forest, and thickets of *Hakea* spp. Shrubland / Woodland (Around Albany). Most of the 'difficult to sample' vegetation types were encountered in the South Coast management zone, and the vegetation mapping of Sandiford and Barrett (2010) was used to exclude areas of unsampled vegetation from the area calculation for a given survey site.

3.2.1 Swan Coastal Plain Management Zone

3.2.1.1 Southern Swan Coastal Plain Study Sites and Survey Timing

To estimate the area of this subpopulation we have adopted the boundary of the Swan Coastal Plain (sub-bioregion SWA02) as defined by the Interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Cresswell 1995). This sub-bioregion largely coincides with that considered by Shedley and Williams (2014), who considered sites as far north as Myalup. This study includes the Western Ringtail Possum population in the Yalgorup National Park. The species is not currently known from north of the Dawesville Channel.

Total Western Ringtail Possum habitat in the Swan Coastal Plain IBRA bioregion (south of Myalup, Shedley and Williams 2014) has been estimated at 354 km^2. Biota sampled approximately 35 km^2 (10%) of this habitat using a line-transect distance sampling approach. A further 12 km^2 of habitat was surveyed in Yalgorup National Park (this area is not mapped for Western Ringtail Possum habitat). A total estimate of the potential Western Ringtail Possum habitat is derived by combining the Shedley and Williams (2014) estimate with the surveyed area of Yalgorup National Park. This yields 366 km^2, of which 12.8 % was surveyed by this study.

As part of the regional assessment, distance sampling surveys were conducted at eight study sites on the Southern Swan Coastal Plain (Figure 3.1, Table 3.1). The three Tuart Forest National Park sections are named following Keighery and Keighery (2002).

Land tenure and the area of each study site is given in Table 3.1. In the case of the Leschenault Peninsula Conservation Park, Dardanup Conservation Park and Kemerton, the study site boundaries represent a portion of a larger extent of remnant vegetation (Figure 3.1). For the Tuart Forest (excluding recently rehabilitated blocks) and Locke Nature Reserve, the study site encompasses the entirety of the remnant (Figure 3.1).

Table 3.1: Study sites at which distance sampling for Western Ringtail Possum was undertaken on the Southern Swan Coastal Plain.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Yalgorup National Park	Crown Land	June 2019	589
Yalgorup National Park - Martins Tank	Crown Land	June 2019	590
Leschenault Peninsula Conservation Park	Crown Land	January 2019	257.7
Kemerton	Freehold	January 2019	581
Tuart Forest - North (Minninup block)	Crown Land	January 2019	265
Tuart Forest - Central (North, Lime Kiln, James and Buffer blocks)	Crown Land	January 2019	1,080
Tuart Forest - South (Old 14, Hall, Webster and Bullock blocks)	Crown Land	January 2019	643
Locke Nature Reserve	Crown Land	January 2019	107.5
		Total:	4,113.2

In addition to the findings of the current survey program, density estimates of previous distance sampling surveys in the vicinity of Bunbury, carried out in the latter half of 2018 and first half of 2019 for the proposed Bunbury Outer Ring Road project, are included. These study sites are Reserve 23,000 in the Shire of Capel, Lot 2 Boyanup – Picton Road, Lot 1 Ducane Road, various lots Ducane Road (Manea Park Bunbury) and various lots near Boyanup-West Road in the vicinity of Stratham, collectively referred to as Southern Lots (Table 3.2).

Lot 2 on the Boyanup - Picton Road and the Southern Lots are freehold land, whilst Reserve 23,000 in the Shire of Capel and Manea Park are Crown Land or Unallocated Crown Land.

The study site boundaries and hence area estimates tabulated in Table 3.2 represent the entirety of the remnant in the case of Reserve 23,000 and Lot 2 Boyanup - Picton Road, and part of the remnant in the case of Manea Park, various lots Ducane Road and the Southern Lots Boyanup West Road.

Table 3.2: Additional study sites at which recent (2018 and 2019) distance sampling has been completed in the Southern Swan Coastal Plain (as part of Main Roads Western Australia project work) and for which results are included in this document.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Reserve 23,000 Shire of Capel	Crown Land	August 2018	146.1
Lot 2 Boyanup – Picton Rd	Freehold	August 2018	87.6
Lot 1 Ducane Rd	Crown Land	August 2018	40.5
Various Lots Ducane Rd	Freehold	July 2019	194
Manea Park - Bunbury	Part Crown Land and Unallocated Crown Land	October 2018	155
Southern Lots (Boyanup West Road Stratham)	Freehold	November 2018	188
		Total:	811.2

3.2.1.2 Dardanup and Crooked Brook Study Sites and Survey Timing

The Dardanup and Crooked Brook study sites fall within the Swan Coastal Plain management zone, and within with the Southern Jarrah Forest IBRA sub-bioregion (Thackway and Cresswell 1995). Within this region two study sites were surveyed, both on Crown Land. Both of the study sites were part of much larger remnants. The area calculations presented Table 3.3 (and for which abundance has been estimated) are for the area surveyed.

Table 3.3: Study sites at which distance sampling was undertaken between Dardanup and Crooked Brook.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Dardanup State Forest	Crown Land	December 2018	330.7
Crooked Brook	Crown Land	July – August 2019	3,044.0
		Total:	3,374.7

3.2.1.3 Cape to Cape Study Sites and Survey Timing

The Cape to Cape subpopulation falls within the Swan Coastal Plain management zone and for the purpose of this study coincides with the Warren and part of the Southern Jarrah Forest IBRA sub-regions (Thackway and Cresswell 1995). Within this region eight study sites were surveyed, all on Crown Land. With the exception of Big Rock Nature Reserve, Yelverton and Augusta North each of the remaining study sites were part of much larger remnants. The area calculations presented in Table 3.4 (and for which abundance has been estimated) for these study areas is constrained to the extent surveyed.

Table 3.4: Study sites at which distance sampling was undertaken in the Cape to Cape region.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Big Rock Nature Reserve	Crown Land	February 2019	72.0
Leeuwin-Naturaliste National Park (Yallingup)	Crown Land	February 2019	342.0
Leeuwin-Naturaliste National Park (Canal Rocks)	Crown Land	February 2019	17.9
Yelverton	Crown Land	February 2019	1,128
North East Margaret River State Forest	Crown Land	February 2019	2,125
Woodjtup National Park (10 Mile Brook Dam)	Crown Land	February 2019	323.9
Boranup	Crown Land	February - March 2019	222.0
Augusta North	Crown Land	March 2019	89.3
		Total:	4,320.1

3.2.2 Southern Forest Management Zone

3.2.2.1 Upper Warren Survey Timing

The Upper Warren study site coincides with the Upper Warren subpopulation of the IUCN assessment and is entirely encompassed by the Manjimup management zone.

3.2.2.2 Manjimup Study Sites and Survey Timing

The Manjimup management zone also encompassed the four smaller study sites Dingup, Faunadale, Jardee and Linfarne. Faunadale and Jardee were surveyed in their entirety, whereas only small sections of the entire extent of Dingup and Faunadale were surveyed (Figure 3.5).

Table 3.5: Study sites at which distance sampling was undertaken in the Warren management zone.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Upper Warren	Crown Land	February - March 2019	9,514.0
Dingup	Crown Land	July 2019	118.0
Faunadale	Crown Land	July 2019	84.4
Jardee	Crown Land	July 2019	118.0
Linfarne	Crown Land	July 2019	980.0
		Total:	10,814.4

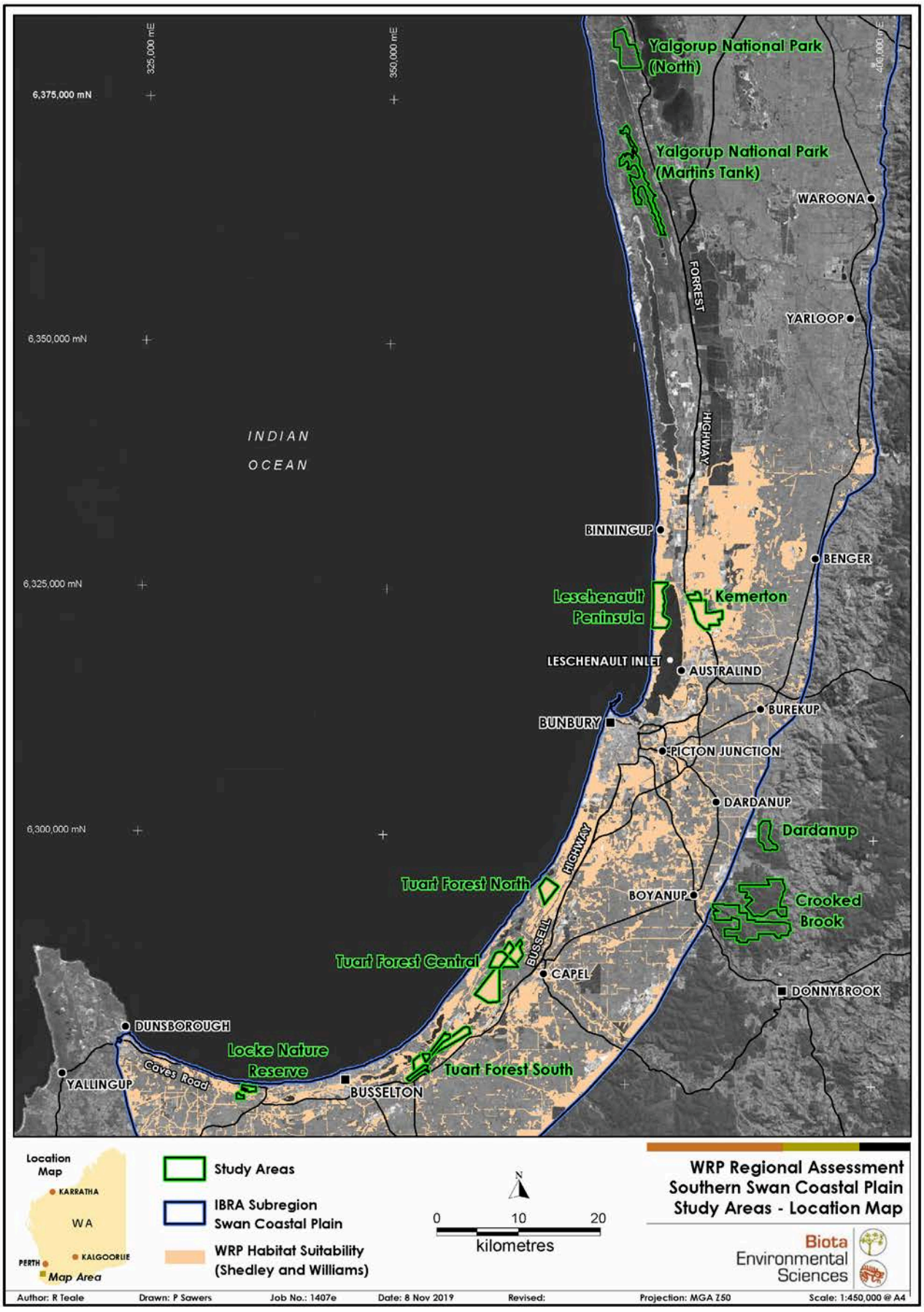

Figure 3.2: Study sites at which distance sampling surveys for the Western Ringtail Possum were undertaken for the Swan Coastal Plain and adjacent Dardanup and Crooked Brook locality.

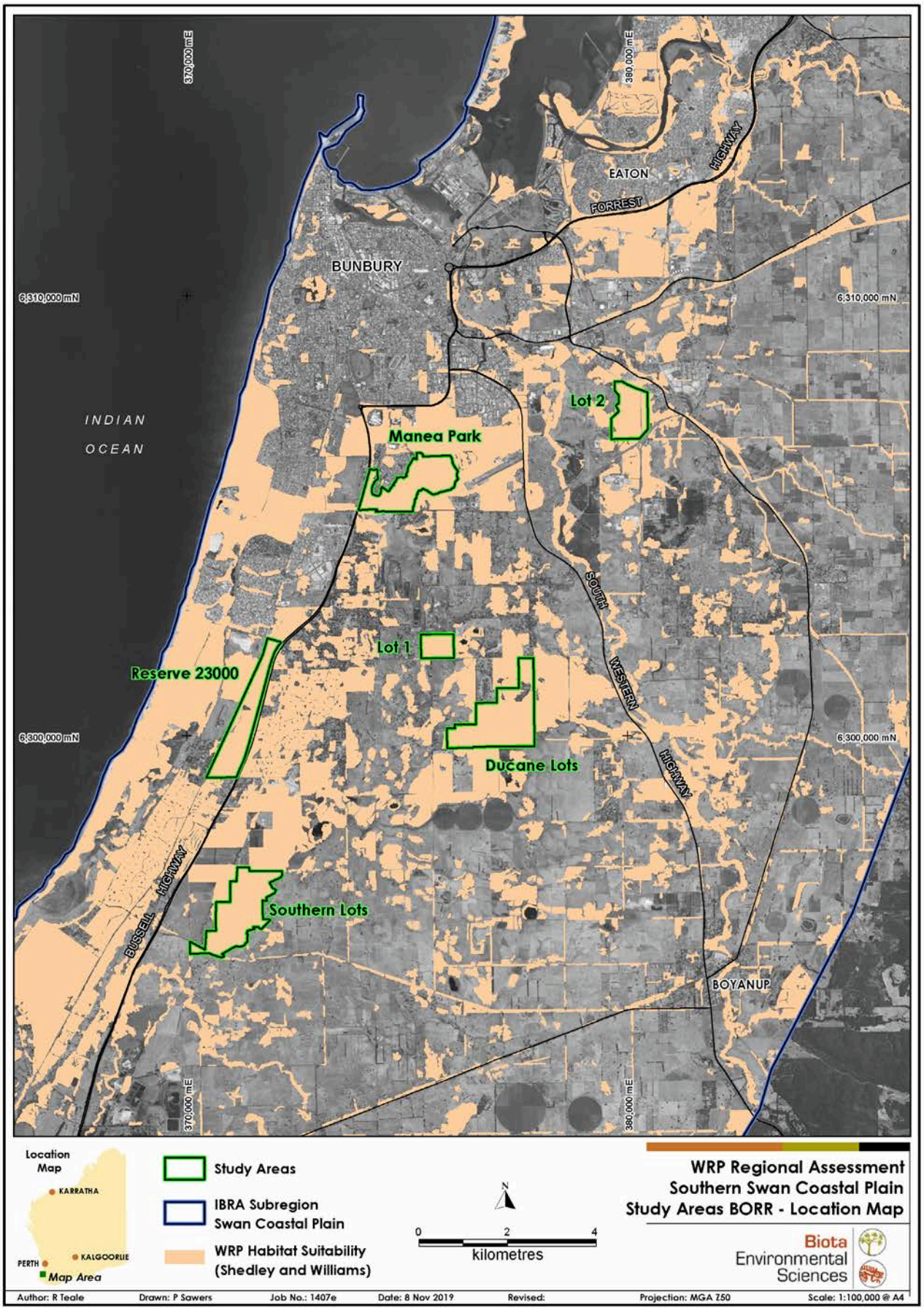

Figure 3.3: Study sites at which distance sampling surveys for the Western Ringtail Possum were undertaken for the Bunbury Outer Ring Road Project.

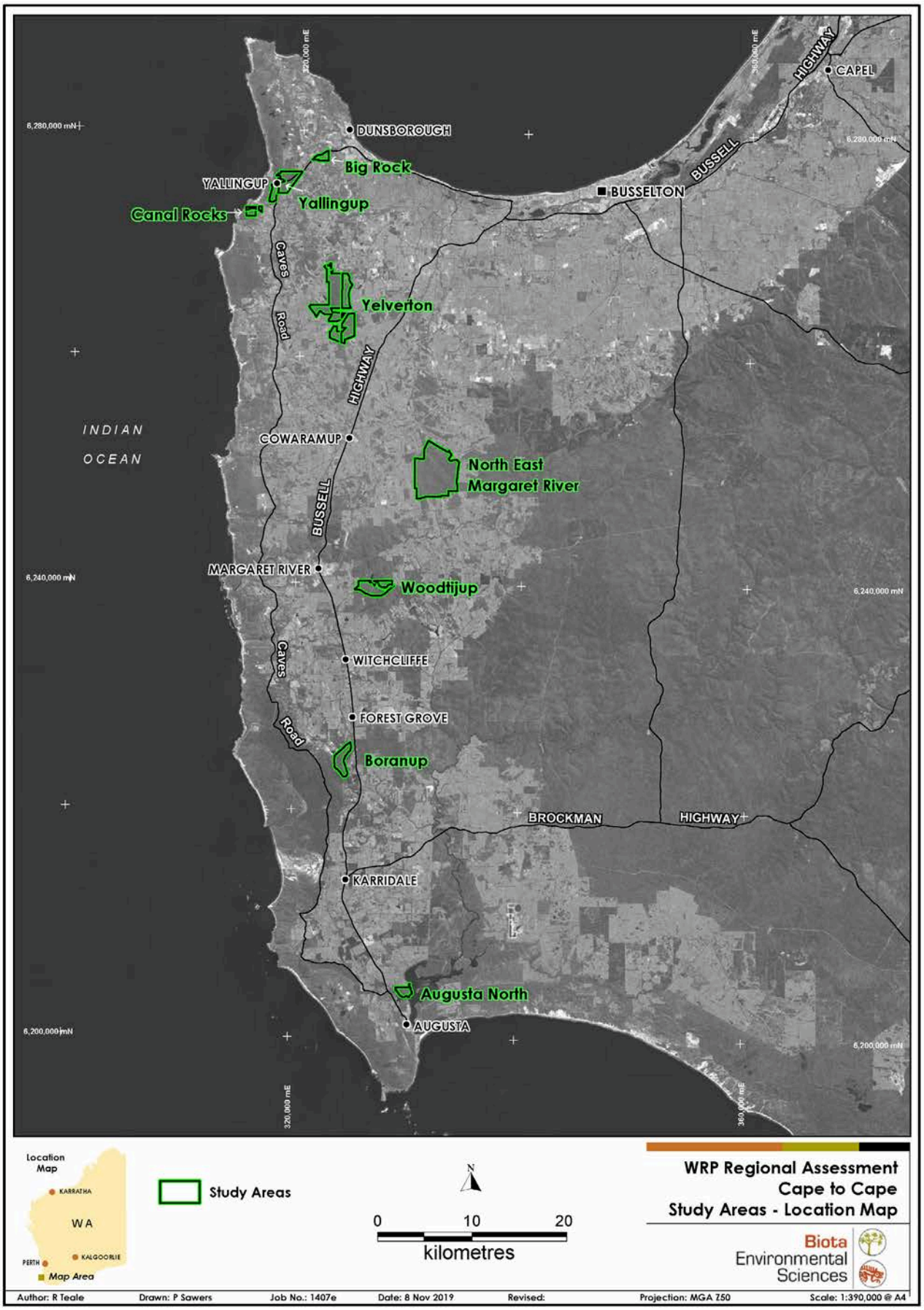

Figure 3.4: Study sites at which distance sampling surveys for the Western Ringtail Possum were undertaken for the Cape to Cape region.

3.2.3 South Coast Management Zone

3.2.3.1 Around Albany Study Sites and Survey Timing

The Around Albany sub-population is within the South Coast management zone, which extends from Mt Manypeaks in the east to Walpole in the west. We have restricted study sites to an area coincident with the Albany Regional Vegetation Survey (ARVS; Sandiford and Barrett 2010). The ARVS describes and maps vegetation types totalling 124,415 ha, surrounding the Albany town site by 30 km to the east and west and 20 km to the north. The ARVS provides a thematic layer within which potential Western Ringtail Possum habitat can be identified, and for which density estimates can be examined for different vegetation types. Nine sites were surveyed (Table 3.6), with additional transects surveyed at Mt Clarence to augment effort (see below).

Most study site boundaries included the entire vegetation remnant. For Denmark Catchment State Forest and Gull Rock National Park the study area represented a portion of a larger area of remnant vegetation (Figure 3.6). Surveys were attempted within the West Cape Howe and Torbay Campsite but were abandoned due to sampling difficulties associated with dense vegetation and poor detection probability of animals on transect.

Table 3.6: Study sites at which distance sampling for Western Ringtail Possum was undertaken in the Around Albany subpopulation.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Cuthbert	Crown Land	July 2019	106.7
Denmark Catchment State Forest	Crown Land	March 2019	1,288.0
Gull Rock National Park	Crown Land	March 2019	2,105.0
Marbelup Nature Reserve	Crown Land	June 2019	107.0
Millbrook Nature Reserve	Crown Land	March 2019	1,483
Simpson Road	Crown Land	July 2019	257.0
King River	Crown Land	June 2019	131.0
Walmsley West	Crown Land	March 2019	161.1
Walmsley East	Crown Land	March 2019	176.1
Walmsley South	Crown Land	June 2019	59.8
		Total:	5,874.7

In addition to the above study sites, data from recently completed distance sampling in the Down Road Nature Reserve (Biota 2018d), Bakers Junction Nature Reserve (Biota 2018e) and at Mt Clarence and Mt Melville (Biota 2019) are also included. During this study additional transects were completed at Mt Clarence to develop a more robust detection function for that study site.

Table 3.7: Additional study sites at which recent (2018 and 2019) distance sampling has been completed in the Around Albany area (as part of Main Roads Western Australia project work˘ or on behalf of the Shire of Albany*) and for which results are included in this document.

Study Site	Land Tenure	Time of Survey	Area of Study Site (ha)
Down Road Nature Reserve˘	Crown Land	July 2018	363.0˘
Bakers Junction Nature Reserve˘	Crown Land	July 2018	843.0
Mt Clarence*	Crown Land	April / May 2019	266.3
Mt Melville*	Crown Land	April / May 2019	97.4
		Total:	1569.7

˘ Excludes habitat that was burnt in the June 2018 fire.

3.2.3.2 Frankland Study Site and Survey Timing

The Frankland Study site, situated north of Denmark lies partly outside of the indicative boundary of the South Coast management zone and extended over a substantial area. This study surveyed part of a large forest remnant.

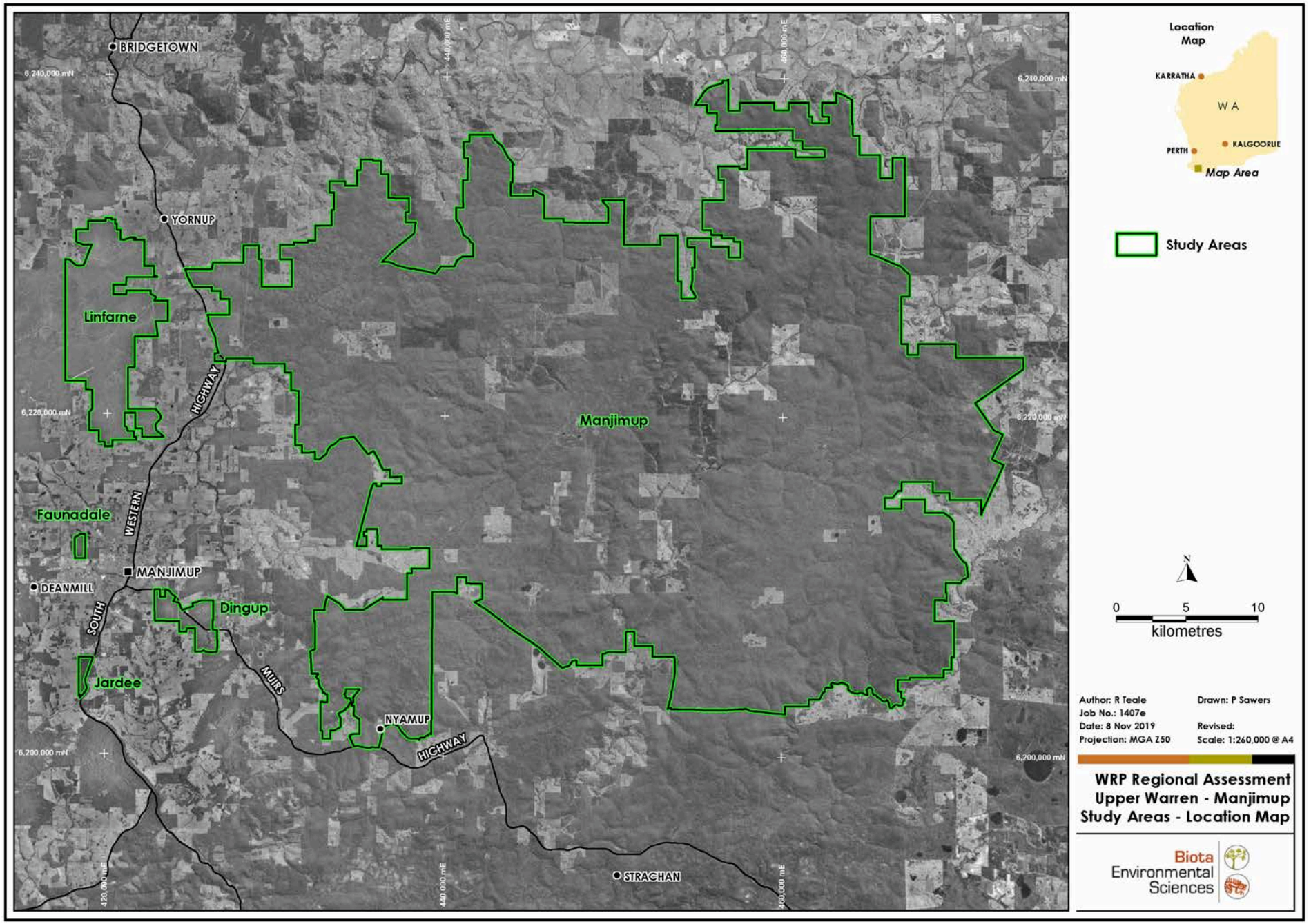

Figure 3.5: Study sites at which distance sampling surveys for the Western Ringtail Possum were undertaken for the Cape to Cape region.

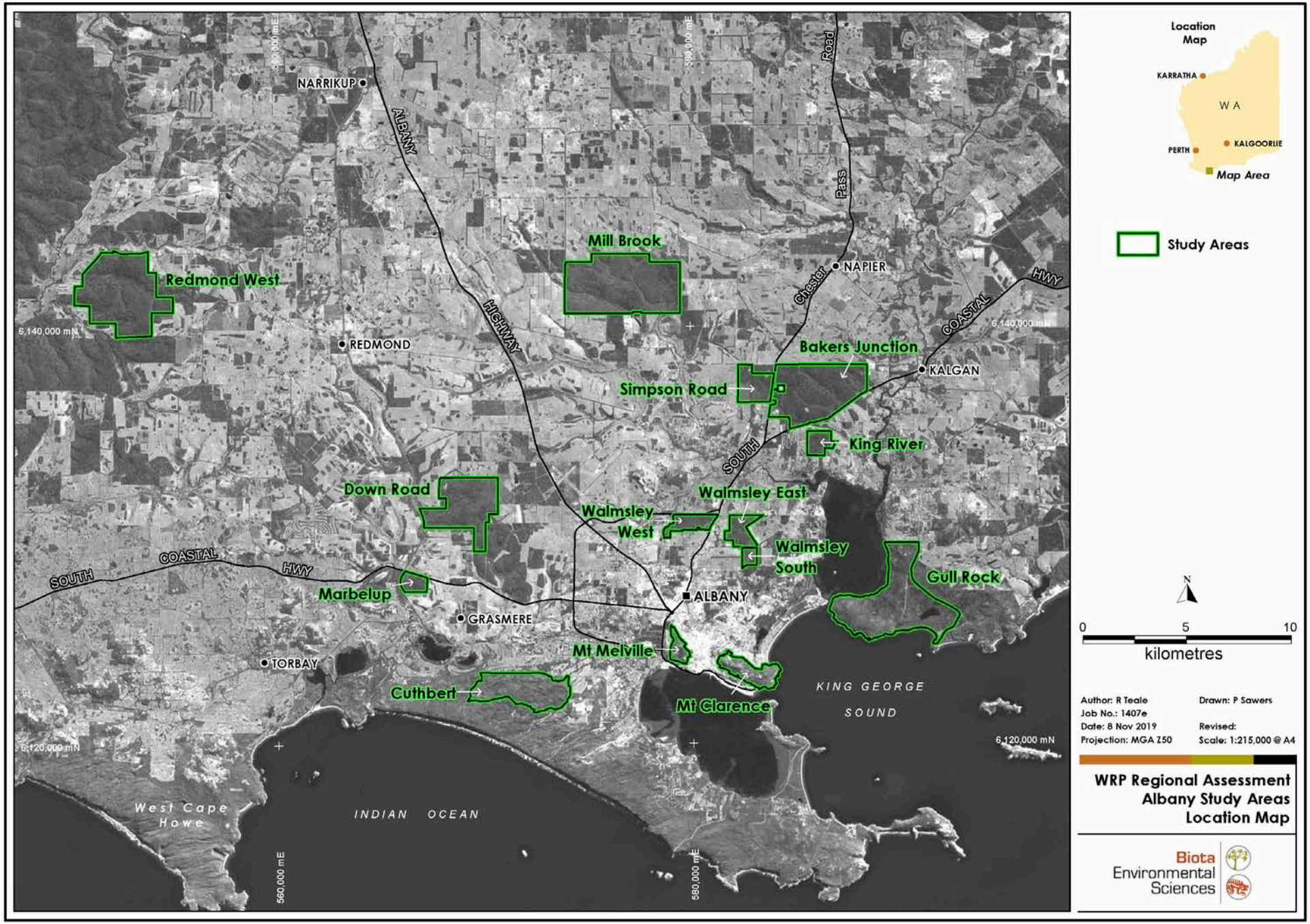

Figure 3.6: Study sites at which distance sampling surveys for the Western Ringtail Possum were undertaken for the Around Albany region.

3.3 Analyses

3.3.1 Analyses of Distance Sampling (DS) Data

Perpendicular distance data were analysed using the 'Distance' package (version 0.9.8, Miller 2017) in the R statistical software (v, 3.5.2, R Core Team 2018) to estimate the Probability Detection Fuction (i.e. the probability of detecting a possum, given it is *x* m from the transect line). Variation in the Probability Detection Function caused by observers (factor covariate: observer) and study area (factor covariate: study area) were explored. Akaike's Informative Criterion (AIC) was used to select between candidate models, such that models with a lower AIC were considered to be a *relatively* better fit to the data when compared to the candidate set of models investigated (Buckland et al. 2001). However, a given model having the lowest AIC of those models in the candidate set does not necessarily imply the model is a good fit to the data. As such, visual inspection of model fit to histograms of the observed perpendicular distances and quantile-quantile (Q-Q) plots was undertaken, and a Cramér-von Mises (CvM) test was used to formally assess goodness of fit (Buckland et al. 2004).

Within the results we provide the estimate of the encounter rate (n/L), where n was the number of observed clusters and L was the total length of the transect and the selected model was used to estimate the following parameters:

1. the average probability of detection (p);
2. a density estimate ($\widehat{D}$); and
3. an estimate of the number of animals in the specified area ($\widehat{N}$).

Two survey sites were omitted from the analysis: (1) Cuthbert (South Coast management zone), because insufficient survey effort was undertaken to effectively sample the site, and (2) Leschenault Peninsula Conservation Park (Swan Coastal Plain management zone) because of dense vegetation constraining our ability to walk transects. Summary data for these two sites, including survey effort, encounter rate and total number of observations, are still provided. In addition, during surveys at one site (Upper Warren) it became apparent to field staff the vegetation was open and consequently the detection process was different to the other surveyed sites. Consequently, this site was modelled separately.

3.3.2 Density Surface Modelling (DSM)

In Distance Sampling (Section 2.4), estimates of density in the total survey region are obtained by extrapolating the estimated density in the covered region upwards, by the ratio of the total survey area that was actually surveyed (i.e. it is assumed the estimated density of animals in the covered region applies to the uncovered region).

Alternatively, the spatial locations of detected animals (obtained via distance sampling) can be modelled according to a 2-dimensional spatial smooth, creating a density surface model (DSM) of the animals (Miller et al. 2013). To do this, the survey region is discretised. Line transects may have fallen within some grid cells in the discretised survey region (in which case, the encounter rate of animals within that grid cell is known, as is the survey effort, i.e. the transect length within each grid cell), or not (in which case there was no survey effort in the grid cell). The encounter rate of animals within each surveyed grid cell is corrected upwards based on distance sampling theory, to account for animals that were present but not detected.

Explanatory variables within each grid cell across the survey region are known (e.g. latitude and longitude). The relationship between the estimated density in each surveyed grid cell is modelled, accounting for survey effort, and extrapolated to grid cells that were not surveyed. This results in a spatial 'map' of where the animals are located within the survey region. The predicted abundance of the survey region can be obtained by summing the estimated abundance in each grid cell. This result differs slightly to that obtained via Distance Sampling, due to the reasons outlined above (the assumption that the estimated density in the covered region is applicable to the entire survey region); however, note that if survey coverage in the region is high, the estimates from DSM and DS will become approximately equal.

DSMs were fitted to all study sites, following Miller et al. (2013) using the 'dsm' package (v. 2.2.17, Miller et al. 2019) in the statistical program R (v. 3.5.2, R Core Team, 2018). Each survey region was discretised in to 75 m grid cells. The pooled detection function fitted to all Western Ringtail Possums observations across the three regions was used (excluding Upper Warren). A 2-dimensional smooth was used (in x and y), without any other covariates.

Since the detection function at Upper Warren was modelled separately to the other sites, a separate DSM for this site was developed. This was based on the detection function fitted to all detection events within Upper Warren. The DSM was developed in the same way as the other sites, however the influence of three other explanatory covariates (elevation, fire history and harvest history) on density estimates were explored.

The percentage deviance explained was calculated for each model, and spatial autocorrelation for each DSM was checked. The predicted density surface of Western Ringtail Possums for each study site was then generated.

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4.0 Results

4.1 Summary Statistics

The entire study surveyed 114,243 ha using 1,249 transects equating to a total effort of 1,287.2 km of transect. Across these transects 2,939 detections of 3,677 individual Western Ringtail Possum were made. These summary statistics are described for each subpopulation below and individual site descriptions are given in the Technical Supplement (Biota 2020).

4.1.1 Swan Coastal Plain Management Zone

4.1.1.1 Southern Swan Coastal Plain

During the current distance sampling program, a total of 224 transects were surveyed for a combined total effort of 180.07 km within the Swan Coastal Plain region. Across that effort, 940 detections of 1,267 unique Western Ringtail Possum were made at an average encounter rate of 7.04 individuals per kilometre. Combining this effort with the 75.86 km across 115 transects surveyed using distance sampling as part of the Bunbury Outer Ring Road project (excluding surveys within nominal development footprints), yields a combined distance of 255.93 km and a combined total of 1,521 unique individual Western Ringtail Possum (Table 4.1). Across those same transects, a total of 715 unique Common Brushed-tail Possums was recorded.

Western Ringtail Possum were not detected at Kemerton but were recorded from all other study sites and at a relatively wide range of average encounter rates (1.18 to 15.93 individuals per kilometre) (Table 4.1). The highest average encounter rate was from Tuart Forest North (Minninup block) study site, which yielded 15.93 individuals per kilometre (Table 4.1). Higher encounter rates were yielded from some individual forest blocks within the Tuart Forest Central study site. For example, an encounter rate of 20.93 individual Western Ringtail Possum per kilometre was recorded across transects from the Bullock, Hall and Webster blocks. Still higher encounter rates were yielded from individual transects, for example, transect M_D_14 (Tuart Forest North study site) yielded 46 individual Western Ringtail Possum along its length of 2,048.1 m, resulting in an encounter rate of 22.5 individuals per kilometre, and 19 individuals were recorded from the 511.4 m of LN_D_09 (Tuart Forest Central study site) yielding an encounter rate of 37.2 individuals per kilometre.

Generally, the encounter rates from the sites near Bunbury were lower than for sites further south on the Swan Coastal Plain. The exception to this generalisation was at the Tuart Forest Central study site where the average encounter rate of 5.92 individuals per kilometre was lower than the encounter rate of 6.17 individuals per kilometre recorded from the Lot 2 Boyanup – Picton Road study site (Table 4.1). However, there was considerable variation across the individual forest blocks: North, Lime Kiln, James and Buffer comprised the Tuart Forest Central study site, but the two southern blocks (James and Buffer) yielded a relatively low encounter rate of 4.0 individuals per kilometre that was almost half that calculated for the northern two blocks in the same study site (North and Lime Kiln) at 7.9 individuals per kilometre.

Aside from differences in real abundance, the encounter rate is clearly also a function of the probability of detection for any given distance from the surveyed transect and can vary between study sites depending on a variety of factors, the most obvious (for this survey) perhaps being the thickness of vegetation. The probability of detection assessed via statistical modelling (see Section 4.0) was found to significantly change across key management zones and therefore direct comparison of encounter rates needs bear this in mind.

Table 4.1: Key summary statistics for Western Ringtail Possum detections in Swan Coastal Plain Region study sites (raw data).

Study Site	No. of Transects	Effort (km)	Number of Detections	Number of Individuals	Detections Encounter Rate (per km)	Individuals Encounter Rate (per km)
Yalgorup National Park (North)	52	49.16	75	86	1.53 ± 0.18	1.75 ± 0.21
Yalgorup National Park (Martins Tank)	73	32.42	109	128	3.36 ± 0.51	3.95 ± 0.63
Leschenault Peninsula Conservation Park	16	6.94	7	10	1.01	1.44
Kemerton	23	20.3	0	0	0	0
Tuart Forest North	10	12.18	157	194	12.89 ± 1.48	15.93 ± 1.82
Tuart Forest Central	62	69.88	293	414	4.19 ± 0.39	5.92 ± 0.57
Tuart Forest South	67	39.9	391	534	9.79 ± 0.83	13.38 ± 1.17
Locke Nature Reserve	22	8.58	80	98	9.32 ± 1.62	11.42 ± 0.21
Reserve 23,000 Shire of Capel	40	18.2	55	74	3.02 ± 0.54	4.06 ± 0.75
Lot 2 Boyanup – Picton Rd	8	8.87	52	58	5.86 ± 0.45	6.54 ± 0.50
Lot 1 Ducane Road	10	5.08	5	6	0.98	1.18
Ducane Lots	30	22.74	45	55	1.98 ± 0.34	2.42 ± 0.42
Manea Park	28	20.36	74	103	3.63 ± 0.49	5.06 ± 0,79
Southern Lots	26	21.51	24	32	1.11 ± 0.28	1.49 ± 0.36
Grand Total	467	336.12	1367	1792	4.07	5.33

4.1.1.2 Dardanup and Crooked Brook

The survey of the Dardanup and Crooked Brook study sites traversed 127 kilometres across 127 transects and yielded 145 detections of 163 unique individuals (Table 4.2). No detections were made from Dardanup State Forest despite a search effort of 20.7 kilometres. The average encounter rate in Crooked Brook was relatively low at 0.99 ± 0.15 individuals per kilometre however, almost half of the transects (52 of 107) failed to yield any detections. On the remaining transects, some detection rates were relatively high, for example, along the 2.49 kilometres of transect CB_D_146A a total of 16 individuals were detected yielding a detection rate of 6.42 individuals per kilometre.

Table 4.2: Key summary statistics for Western Ringtail Possum detections in the Dardanup and Crooked Brook study sites (raw data).

Study Site	Number of Transects	Effort (km)	Number of Detections	Number of Individuals	Detections Encounter Rate (per km)	Individuals Encounter Rate (per km)
Dardanup State Forest	20	21.7	0	0	0	0
Crooked Brook	107	164.7	145	163	0.88 ± 0.13	0.99 ± 0.15
Grand Total	127	186.4	145	163		

4.1.1.3 Cape to Cape

Within the area coincident with the Cape to Cape subpopulation, a total of 220 transects were surveyed for a combined total effort of 158.6 km. Across that effort, 487 detections of 627 unique Western Ringtail Possum were made at an average encounter rate of 3.95 individuals per kilometre.

Western Ringtail Possum were not detected from the 14.5 km of transects within the Margaret River North East State Forest or from the 10.5 km of transects within the Wooditjup National Park (adjacent the 10 Mile Brook Dam). Western Ringtail Possum were recorded from all other surveyed sites with a general trend of decreasing encounter rates from the northern sites (Big Rock and Yallingup) to the southern sites (Boranup and Augusta North) (Table 5.2).

Table 4.3: Key summary statistics for Western Ringtail Possum detections in the Cape to Cape study sites (raw data).

Study Site	Number of Transects	Effort (km)	Number of Detections	Number of Individuals	Detections Encounter Rate (per km)	Individuals Encounter Rate (per km)
Big Rock	22	8.98	78	97	8.69 ± 0.85	10.81 ± 1.15
Yallingup	43	24.15	224	284	9.27 ± 0.85	11.56 ± 1.16
Canal Rocks	6	2.01	14	18	6.97 ± 1.85	8.97 ± 2.36
Yelverton	82	73.5	154	207	2.09 ± 0.24	2.82 ± 0.37
Margaret River NE State Forest	19	14.43	0	0	0	0
Wooditjup National Park (part)	12	10.48	0	0	0	0
Boranup	24	16.45	15	18	0.91 ± 0.34	1.09 ± 0.42
Augusta North	12	8.57	2	3	0.23 ± 0.16	0.35 ± 0.26
Grand Total	220	158.59	487	627		

4.1.2 Southern Forest

4.1.2.1 Upper Warren and Manjimup

Within the Upper Warren study area and across four additional sites in the vicinity of Manjimup (Faunadale Nature Reserve, Dingup, Jardee and Linfarne) (see Figure 3.5), a total of 151 transects were surveyed for a combined total effort of 320.4 km. Across that effort, 228 detections of 260 unique Western Ringtail Possum were made (Table 4.4).

Western Ringtail Possums were recorded from all study sites within the Manjimup region, though at variable encounter rates. The highest average encounter rate (6.16 ± 0.64 individuals per kilometre) was recorded from Faunadale Nature Reserve and was over three times as high as Jardee (1.76 ± 0.37), almost an order of magnitude higher than the Upper Warren (0.70 ± 0.14) and significantly higher than Dingup (0.23 ± 0.09) and Liinfarne (0.06 ± .04) (Table 4.4). Though the average encounter rate within the 9,514 hectares of the Upper Warren was low (in comparison to Faunadale and many other study sites throughout the species range), individual encounter rates across different transects was variable ranging between nil encounters (on 44 of the 91 transects) through to 6.55 per kilometre along the 2.9 kilometres of transect MJ_76A.

Table 4.4: Key summary statistics for Western Ringtail Possum detections in the Upper Warren, Dingup, Faunadale, Jardee and Linfarne study sites (raw data).

Study Site	Number of Transects	Effort (km)	Number of Detections	Number of Individuals	Detections Encounter Rate (per km)	Individuals Encounter Rate (per km)
Upper Warren	91	251.47	153	175	0.61 ± 0.12	0.70 ± 0.14
Dingup	8	17.32	4	5	0.23 ± 0.09	0.29 ± 0.14
Faunadale	17	10.56	58	65	5.49 ± 0.66	6.16 ± 0.64
Jardee	13	6.83	11	12	1.61 ± 0.34	1.76 ± 0.37
Linfarne	22	34.20	2	3	0.06 ± 0.04	0.09 ± 0.07
Grand Total	151	320.38	228	260		

4.1.3 South Coast

4.1.3.1 Around Albany

Within the area encompassed by our definition of the Around Albany subpopulation, a total of 272 transects were surveyed for a combined total effort of 269.9 km. Across that effort, a total of 685 detections were made yielding a total of 806 unique Western Ringtail Possums.

Western Ringtail Possums were not detected from the almost 16 kilometres of transects at the Redmond West study site but were recorded from all other study sites. The encounter rates of individual Western Ringtail Possums from those study sites where detections were made varied between 0.28 ± 0.28 individuals per kilometre (Cuthbert study site) to 13.08 ± 1.52 individuals per

kilometre (Walmsley West study site). The encounter rate at Walmsley West was amongst the highest encounter rates recorded from any of the study sites visited by the current survey.

Table 4.5: Key summary statistics for Western Ringtail Possum detections in the Around Albany study sites (raw data).

Study Site	Number of Transects	Effort (km)	Number of Detections	Number of Individuals	Detections Encounter Rate (per km)	Individuals Encounter Rate (per km)
Bakers Junction Nature Reserve	18	31.97	50	55	1.56 ± 0.37	1.72 ± 0.43
Cuthbert	5	7.13	1	2	0.14 ± 0.14	0.28 ± 0.28
Down Road Nature Reserve	29	35.84	80	86	2.23 ± 0.30	2.34 ± 0.35
Gull Rock Nature Reserve	17	25.63	5	6	0.20 ± 0.09	0.23 ± 0.11
King River	13	13.63	44	51	3.23 ± 0.56	3.74 ± 0.60
Marbelup	15	12.31	31	39	2.52 ± 0.51	3.17 ± 0.66
Millbrook Nature Reserve	39	40.10	14	19	0.35 ± 0.10	4.74 ± 0.15
Mount Clarence	35	23.84	143	165	6.00 ± 0.58	6.92 ± 0.68
Mount Melville	34	10.44	58	74	5.56 ± 1.08	7.09 ± 1.58
Redmond West	14	15.86	0	0	0	0
Simpson Road	16	22.64	27	29	1.19 ± 0.20	1.28 ± 0.21
Walmsley East	14	10.80	65	80	6.01 ± 0.93	7.41 ± 0.11
Walmsley South	9	7.64	36	42	4.71 ± 0.75	5.50 ± 0.90
Walmsley West	19	12.1	131	158	10.84 ± 0.98	13.08 ± 1.52
Grand Total	272	269.9	685	806		

4.1.3.2 Frankland

Nine transects totalling 12.89 kilometres in length were surveyed in the Frankland study site without detecting any Western Ringtail Possums. Effort was curtailed at this site and focussed in the Crooked Brook Study Site that seemed more prospective. The site is not considered in the analyses below as it was not surveyed thoroughly.

Table 4.6: Key summary statistics for Western Ringtail Possum detections in the Frankland study area (raw data).

Survey Site	Number of Transects	Effort (km)	Number of Detections	Number of Individuals	Detections Encounter Rate (per km)	Individuals Encounter Rate (per km)
Frankland	9	12.89	0	0	0	0

4.2 Distance Sampling Analyses

4.2.1 All Sites

Distance data were excluded from two sites: (1) Leschenault Peninsula Conservation Park because it was not effectively sampled during the survey due to the often-impenetrable vegetation and our inability to stay consistently on transects, and (2) Cuthbert because of insufficient survey effort.

Perpendicular distance data were pooled across the remaining 43 study sites and plotted as a histogram to determine whether evasive movement of animals was occurring prior to detection. Stepped lower initial intervals that increase away from the centreline can indicate movement away from the observers, while initially high then decreasing intervals indicate potential movement towards observers and both can lead to bias in density estimation. The resulting histogram (Figure 4.1) was not suggestive of either evasive movement or movement towards the observer.

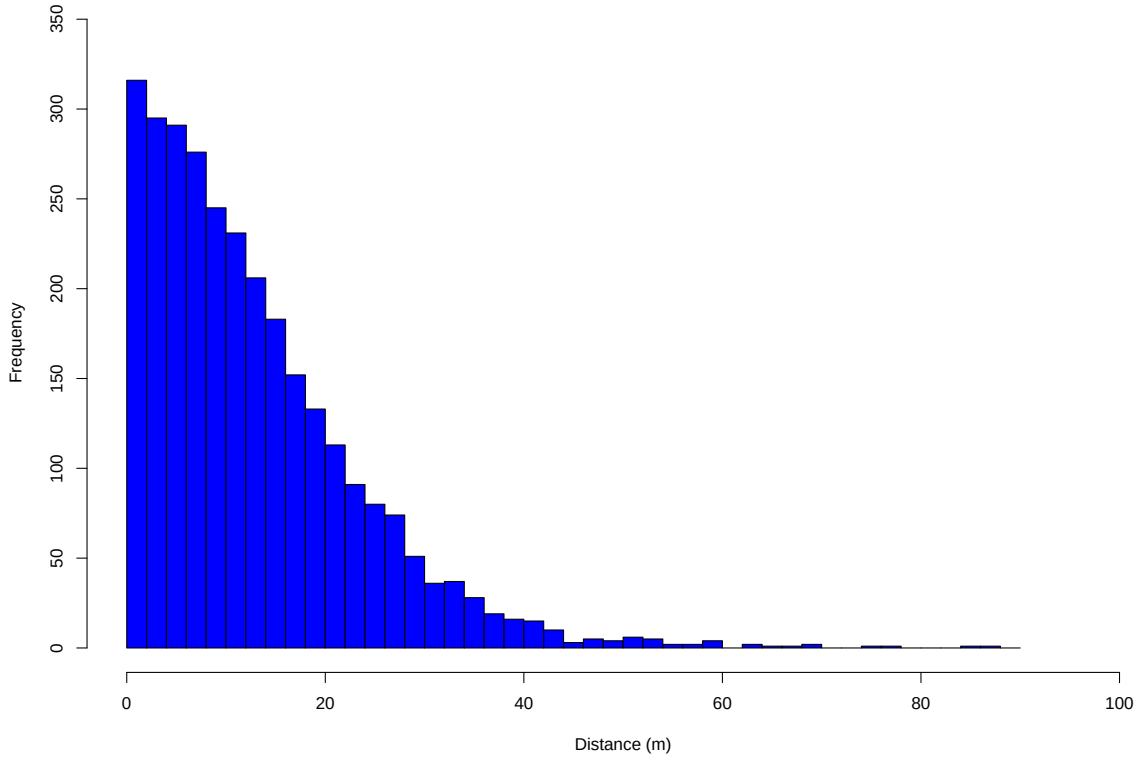


Figure 4.1: Histogram of pooled perpendicular distances to detections of Western Ringtail Possums.

For the analyses, truncation distance was set to 25 m. Six Study Sites, Augusta North, Cuthbert, Dingup, Gull Rock Nature Reserve, Linfarne and Lot 1 Ducane Rd at which six or fewer detections were made (following truncation) were excluded from the initial analyses that examined Study Site as an explanatory variable on the detection function.

The form of the detection function was first investigated (half normal versus hazard-rate versus uniform-cosine), and then the significance of explanatory variables (Study Site, IUCN sub-population and Management Zone) was explored. Study Sites were initially analysed separately (i.e. a different detection function was fitted to each study site) and then grouped, first based on which subpopulation they fell into and then secondly into their respective key management zone. Dardanup and Crooked Brook were assigned their own subpopulation (Whicher), as they were not associated with any of the subpopulations identified in the IUCN assessment. The rationale for grouping sites into IUCN subpopulations and key management zones ensured with-group sites were more similar (i.e. more geographically proximal to each other with similar environmental conditions) to between-group sites. These models were tested against the null model that assumed constant selection across all study sites (i.e. a single detection function pooled across all observations and sites).

Based on AIC model selection, the best fitting model was a half-normal detection function form, with detection varying by study site (i.e. probability of detecting Western Ringtail Possums was found to change between study sites; Table 4.7) However, examination of the resultant plot of study site specific detection functions (Figure 4.2), revealed that the probability of detection at the Upper Warren was markedly different from all other study sites, a view supported by observers in the field who noted that the habitat was much more open when compared to habitat at other study sites. Based on this finding, the Upper Warren data were considered separately and the remaining sites were re-analysed. The resultant AIC values are shown in Table 4.8. In this comparison, the probability of detection of the preferred model varied by key management zone rather than by study site.

Table 4.7. AIC scores for each model fitted to the pooled Western Ringtail Possum data excluding sites with fewer than 6 detections.

Form	Model	AIC
Half normal	Varies by study site	15906.40
Half normal	Varies by key management zone	15910.35
Half normal	Varies by subpopulation	15913.12
Observer	Varies by observer	15924.81
Half normal	Null model	15930.27

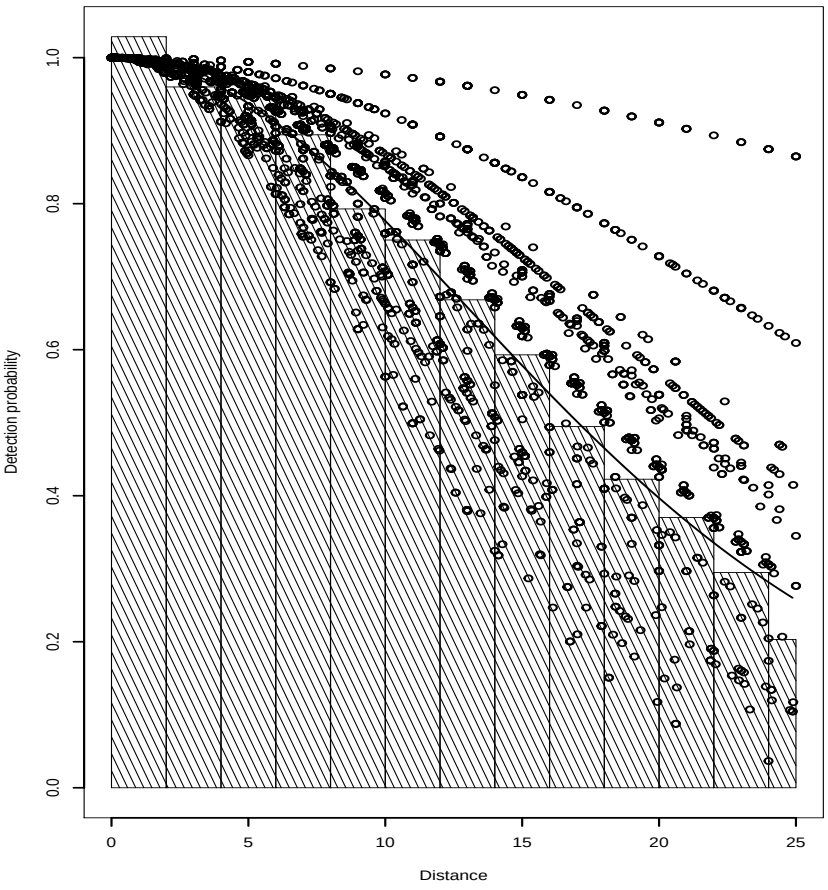


Figure 4.2. Plot of 'best-fitting' model to the pooled Western Ringtail Possum perpendicular distance data. Upper Warren detections represented by upper series of open circles.

Table 4.8. AIC scores for each model fitted to the pooled Western Ringtail Possum data excluding sites with fewer than 6 detections and the Upper Warren.

Form	Model	AIC	dAIC
Half normal	Varies by key management zone	15428.50	0
Half normal	Varies by study site	15429.36	0.86
Half normal	Varies by subpopulation	15431.27	2.77
Observer	Varies by observer	15436.72	8.22
Half normal	Null model	15442.45	13.95

Using a single detection function at the level of key management zone or subpopulation permitted data from the Augusta North, Cuthbert, Linfarne and Lot 1 Ducane Rd study sites to be included in the dataset and all the data were reanalysed and model selection repeated. Detection varying by key management zone was again found to be the preferred model (Table 4.9) and the resulting plot of the 'best model' fit is shown in Figure 4.3.

Table 4.9. AIC scores for each model fitted to the pooled Western Ringtail Possum data including all study sites except the Upper Warren.

Form	Model	AIC	dAIC
Half normal	Varies by key management zone	15544.83	0
Half normal	Varies by subpopulation	15547.62	2.79
Half normal	Null model	15558.77	13.94

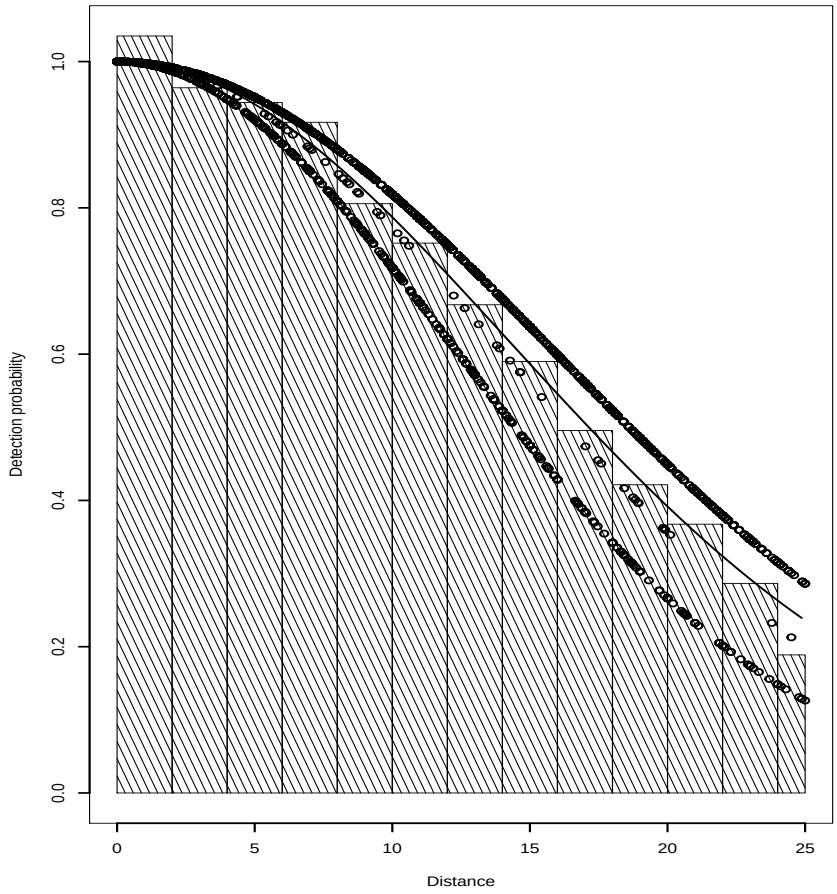


Figure 4.3. Plot of 'best-fitting' model to the pooled (excluding the Upper Warren) Western Ringtail Possum perpendicular distance data.

The Cramer-von Mises goodness of fit test indicated that the key management zone model was a good fit to the data (a test statistic of 0.07, p-value of 0.79).

Table 4.10 and Table 4.11 tabulate summary statistics following truncation at 25 m, as opposed to the data exploration presented above, which used raw data. Table 4.10 presents the summary for clusters, that is, each detection whether it was of one, two or three or more individuals, whilst Table 4.11 provides summary statistics at the level of the individuals.

The summary statistics for clusters include:

- Area (ha) representing the entire area of the surveyed polygon;

- Covered Area (ha) equivalent to total Effort multiplied by 50 m (i.e. 25 m (the truncation distance) either side of the transect) and represents the area surveyed after truncation;
- Effort (in metres) or the combined length of surveyed transects;
- n, the number of detections following truncation at 25 m;
- k, the number of surveyed transects;
- ER, the subsequent encounter rate (following truncation) given as the number of individuals per metre of transect;
- se ER the standard error of the Encounter Rate; and
- cv ER the coefficient of variation of the Encounter Rate.

The summary at the level of individuals (Table 4.11) includes the same elements as described above for clusters, but in addition provides Mean size were size is the number of individuals in each cluster and the se Mean, that is, the standard error of the mean cluster size.

The remaining two tables (Table 4.12 and Table 4.13) provide estimates of density at the level of individuals and then abundance also at the level of the individual. So for example, in Tuart Forest Central and from Table 4.12, estimated density $\hat{D}$ is 1.32 Western Ringtail Possums per hectare, Area is 1,079.0 ha, and so it follows that estimated abundance can be calculated as $\hat{N} = \hat{D} \times A \approx$ 1,420 individuals.

Table 4.10. Summary of detected clusters within the pooled study sites (except the Upper Warren) (truncation at 25 m).

Study Site	Area	Covered Area	Effort	n	k	ER	se.ER	cv.ER
Augusta North	89.3	42.9	8.57	2	12	0.23	0.16	0.70
Bakers Junction Nature Reserve	843.0	159.9	31.97	43	18	1.34	0.32	0.24
Big Rock Nature Reserve	72.0	44.9	8.98	70	22	7.80	0.98	0.13
Boranup	222.0	82.2	16.45	11	24	0.67	0.28	0.42
Crooked Brook	2,588.0	823.7	164.73	129	107	0.78	0.12	0.15
Cuthbert	106.7	35.7	7.13	1	5	0.14	0.15	1.06
Dardanup State Forest	330.7	108.7	21.75	0	20	0.00	0.00	0.00
Dingup	118.0	86.6	17.32	4	8	0.23	0.09	0.41
Down Road Nature Reserve	363.0	179.2	35.84	76	29	2.12	0.28	0.13
Faunadale	84.4	52.8	10.56	51	17	4.83	0.55	0.11
Frankland	796.1	64.5	12.90	0	9	0.00	0.00	0.00
Gull Rock National Park	360.0	128.1	25.63	5	17	0.20	0.09	0.48
Jardee	118.0	34.1	6.83	9	13	1.32	0.30	0.23
Kemerton	673.0	101.5	20.30	0	23	0.00	0.00	0.00
King River	131.0	68.1	13.63	41	13	3.01	0.55	0.18
Leeuwin-Naturaliste National Park (Canal Rocks)	17.9	10.0	2.01	14	6	6.97	1.85	0.27
Leeuwin-Naturaliste National Park (Yallingup)	342.0	120.8	24.15	210	43	8.69	0.75	0.09
Linfarne	980.0	171.0	34.20	1	22	0.03	0.03	1.02
Locke Nature Reserve	107.5	42.9	8.58	76	22	8.85	1.53	0.17
Lot 1 Ducane Road	40.5	25.4	5.08	5	10	0.98	0.43	0.43
Lot 2 Boyanup - Picton Road	87.6	44.4	8.87	44	8	4.96	0.79	0.16
Manea Park - Bunbury	155.0	101.8	20.36	61	28	3.00	0.48	0.16
Marbelup Nature Reserve	107.0	61.6	12.31	31	15	2.52	0.51	0.20
Martins Tank	590.0	178.8	35.77	100	73	2.80	0.46	0.16
Millbrook Nature Reserve	1,483.0	200.5	40.09	13	39	0.32	0.10	0.29
Mt Clarence	266.3	119.2	23.84	130	35	5.45	0.56	0.10
Mt Melville	97.4	52.2	10.44	54	34	5.17	0.96	0.19
North East Margaret River State Forest	2,125.0	72.2	14.43	0	19	0.00	0.00	0.00
Redmond West	354.0	79.3	15.86	0	14	0.00	0.00	0.00
Reserve 23,000 Shire of Capel	146.1	91.0	18.21	49	40	2.69	0.52	0.19
Simpson Road	257.0	113.2	22.64	50	16	2.21	0.37	0.17
Southern Lots (Boyanup West Road Stratham)	188.0	107.6	21.51	24	26	1.12	0.28	0.25
Tuart Forest - Central	1,079.0	349.4	69.88	228	62	3.26	0.29	0.09
Tuart Forest North	265.0	60.9	12.18	139	10	11.41	1.16	0.10
Tuart Forest South	630.0	199.5	39.90	351	67	8.80	0.77	0.09
Various Lots Ducane Road	194.0	113.7	22.74	42	30	1.85	0.33	0.18

Study Site	Area	Covered Area	Effort	n	k	ER	se.ER	cv.ER
Walmsley East	176.1	54.0	10.80	58	14	5.37	0.80	0.15
Walmsley South	59.8	38.2	7.64	35	9	4.58	0.81	0.18
Walmsley West	161.1	60.4	12.08	119	19	9.85	0.93	0.09
Woodjtup National Park (10 Mile Brook Dam)	323.9	52.4	10.48	0	12	0.00	0.00	0.00
Yalgorup National Park	589.0	245.8	49.16	66	52	1.34	0.17	0.13
Yelverton	1,128.0	367.5	73.51	132	82	1.80	0.22	0.13
Total	18,845.4	5146.6	1029.32	2474	1144	2.40	0.11	0.04

Table 4.11. Summary of detected individuals within pooled study sites except the Upper Warren (truncation at 25 m).

Study Site	Area	Covered Area	Effort	n	ER	se.ER	cv.ER	mean.size	se.mean
Augusta North	89.3	42.9	8.57	3	0.35	0.26	0.75	1.50	0.50
Bakers Junction Nature Reserve	843.0	159.9	31.97	46	1.44	0.35	0.24	1.07	0.04
Big Rock Nature Reserve	72.0	44.9	8.98	87	9.69	1.20	0.12	1.24	0.05
Boranup	222.0	82.2	16.45	13	0.79	0.35	0.45	1.18	0.12
Crooked Brook	2,588.0	823.7	164.73	146	0.89	0.14	0.16	1.13	0.03
Cuthbert	106.7	35.7	7.13	2	0.28	0.30	1.06	2.00	0.00
Dardanup State Forest	330.7	108.7	21.75	0	0.00	0.00	0	0.00	0.00
Dingup	118.0	86.6	17.32	5	0.29	0.14	0.47	1.25	0.25
Down Road Nature Reserve	363.0	179.2	35.84	81	2.26	0.33	0.15	1.07	0.03
Faunadale	84.4	52.8	10.56	58	5.49	0.55	0.10	1.14	0.05
Frankland	796.1	64.5	12.90	0	0.00	0.00	0	0.00	0.00
Gull Rock National Park	360.0	128.1	25.63	6	0.23	0.11	0.47	1.20	0.20
Jardee	118.0	34.1	6.83	10	1.47	0.34	0.23	1.11	0.11
Kemerton	673.0	101.5	20.30	0	0.00	0.00	0	0.00	0.00
King River	131.0	68.1	13.63	47	3.45	0.62	0.18	1.15	0.07
Leeuwin-Naturaliste National Park (Canal Rocks)	17.9	10.0	2.01	18	8.97	2.36	0.26	1.29	0.13
Leeuwin-Naturaliste National Park (Yallingup)	342.0	120.8	24.15	267	11.05	1.05	0.10	1.27	0.03
Linfarne	980.0	171.0	34.20	1	0.03	0.03	1.02	1.00	0.00
Locke Nature Reserve	107.5	42.9	8.60	92	10.70	1.91	0.18	1.21	0.06
Lot 1 Ducane Road	40.5	25.4	5.08	6	1.18	0.59	0.50	1.20	0.20
Lot 2 Boyanup - Picton Road	87.6	44.4	8.87	50	5.63	0.87	0.15	1.14	0.05
Manea Park - Bunbury	155.0	101.8	20.36	88	4.32	0.79	0.18	1.44	0.07
Marbelup Nature Reserve	107.0	61.6	12.31	39	3.17	0.66	0.21	1.26	0.08
Martins Tank	590.0	178.8	35.77	119	3.33	0.58	0.17	1.19	0.04
Millbrook Nature Reserve	1,483.0	200.5	40.09	17	0.42	0.13	0.32	1.31	0.17
Mt Clarence	266.3	119.2	23.84	150	6.29	0.67	0.11	1.15	0.03

Study Site	Area	Covered Area	Effort	n	ER	se.ER	cv.ER	mean.size	se.mean
Mt Melville	97.4	52.2	10.44	67	6.42	1.31	0.20	1.24	0.06
North East Margaret River State Forest	2,125.0	72.2	14.43	0	0.00	0.00	0	0.00	0.00
Redmond West	354.0	79.3	15.86	0	0.00	0.00	0	0.00	0.00
Reserve 23,000 Shire of Capel	146.1	91.0	18.21	66	3.62	0.73	0.20	1.35	0.07
Simpson Road	257.0	113.2	22.64	54	2.39	0.41	0.17	1.08	0.04
Southern Lots (Boyanup West Road Stratham)	188.0	107.6	21.51	32	1.49	0.36	0.24	1.33	0.10
Tuart Forest - Central	1,079.0	349.4	69.88	323	4.62	0.43	0.09	1.42	0.04
Tuart Forest North	265.0	60.9	12.18	170	13.96	1.42	0.10	1.22	0.04
Tuart Forest South	630.0	199.5	39.90	477	11.95	1.06	0.09	1.36	0.03
Various Lots Ducane Road	194.0	113.7	22.74	52	2.29	0.41	0.18	1.24	0.07
Walmsley East	176.1	54.0	10.80	72	6.67	1.04	0.16	1.24	0.06
Walmsley South	59.8	38.2	7.64	40	5.24	0.99	0.19	1.14	0.06
Walmsley West	161.1	60.4	12.08	142	11.75	1.37	0.12	1.19	0.04
Woodjtup National Park (10 Mile Brook Dam)	323.9	52.4	10.48	0	0.00	0.00	0	0.00	0.00
Yalgorup National Park	589.0	245.8	49.16	76	1.55	0.20	0.13	1.15	0.05
Yelverton	1,128.0	367.5	73.51	176	2.39	0.33	0.14	1.33	0.04
Total	18,845.4	5,146.6	1,029.32	3,098	3.01	0.14	0.05	1.25	0.01

Table 4.12. Summary of estimated density of Western Ringtail Possum individuals within each of the study sites (except the Upper Warren).

Study Site	Estimate	se	cv	lcl	ucl	df
Augusta North	0.10	0.08	0.75	0.02	0.44	11.02
Bakers Junction Nature Reserve	0.49	0.12	0.24	0.29	0.81	17.63
Big Rock Nature Reserve	2.76	0.35	0.13	2.13	3.58	22.40
Boranup	0.23	0.10	0.44	0.09	0.54	23.12
Crooked Brook	0.25	0.04	0.16	0.18	0.35	110.28
Cuthbert	0.10	0.10	1.06	0.01	1.05	4.01
Dardanup State Forest	0.00	0.00	0.00	0.00	0.00	0.00
Dingup	0.09	0.04	0.49	0.03	0.26	7.78
Down Road Nature Reserve	0.77	0.12	0.15	0.56	1.04	30.88
Faunadale	1.70	0.25	0.15	1.26	2.28	78.29
Frankland	0.00	0.00	0.00	0.00	0.00	0.00
Gull Rock National Park	0.08	0.04	0.47	0.03	0.21	16.16
Jardee	0.45	0.12	0.26	0.26	0.77	17.86
Kemerton	0.00	0.00	0.00	0.00	0.00	0.00
King River	1.17	0.22	0.18	0.79	1.73	12.81
Leeuwin-Naturaliste National Park (Canal Rocks)	2.55	0.68	0.26	1.31	4.97	5.07
Leeuwin-Naturaliste National Park (Yallingup)	3.15	0.31	0.10	2.59	3.83	46.81
Linfarne	0.01	0.01	1.02	0.00	0.05	21.49
Locke Nature Reserve	3.05	0.55	0.18	2.11	4.42	21.67
Lot 1 Ducane Road	0.34	0.17	0.50	0.12	0.97	9.04
Lot 2 Boyanup - Picton Road	1.60	0.25	0.16	1.12	2.31	7.30
Manea Park - Bunbury	1.23	0.23	0.19	0.85	1.79	27.81
Marbelup Nature Reserve	1.07	0.23	0.21	0.69	1.67	14.71
Martins Tank	0.95	0.17	0.18	0.67	1.34	74.43
Millbrook Nature Reserve	0.14	0.05	0.32	0.08	0.27	38.83
Mt Clarence	2.13	0.24	0.11	1.70	2.67	40.78
Mt Melville	2.17	0.45	0.21	1.44	3.29	34.74
North East Margaret River State Forest	0.00	0.00	0.00	0.00	0.00	0.00
Redmond West	0.00	0.00	0.00	0.00	0.00	0.00
Reserve 23,000 Shire of Capel	1.03	0.21	0.20	0.69	1.55	39.99
Simpson Road	0.81	0.14	0.17	0.56	1.17	16.13
Southern Lots (Boyanup West Road Stratham)	0.42	0.10	0.24	0.26	0.70	25.43
Tuart Forest - Central	1.32	0.13	0.10	1.09	1.60	68.16
Tuart Forest North	3.98	0.41	0.10	3.15	5.01	9.90
Tuart Forest South	3.40	0.31	0.09	2.84	4.08	74.81
Various Lots Ducane Road	0.65	0.12	0.18	0.45	0.94	29.93
Walmsley East	2.26	0.36	0.16	1.61	3.17	14.19
Walmsley South	1.77	0.34	0.19	1.15	2.74	8.49
Walmsley West	3.98	0.48	0.12	3.10	5.12	20.97
Woodjtup National Park (10 Mile Brook Dam)	0.00	0.00	0.00	0.00	0.00	0.00
Yalgorup National Park	0.44	0.06	0.13	0.34	0.57	54.12
Yelverton	0.68	0.09	0.14	0.52	0.90	85.48
Total	0.68	0.02	0.04	0.63	0.73	742.01

Table 4.13. Summary of estimated abundance of Western Ringtail Possum individuals within the study sites (except Upper Warren).

Study Site	Estimate	se	cv	lcl	ucl	df
Augusta North	8.90	6.71	0.75	2.03	38.96	11.02
Bakers Junction Nature Reserve	410.87	100.44	0.24	247.49	682.09	17.63
Big Rock Nature Reserve	198.75	25.02	0.13	153.27	257.71	22.40
Boranup	49.97	22.22	0.44	20.76	120.30	23.12
Crooked Brook	653.26	104.80	0.16	476.31	895.94	110.28
Cuthbert	10.14	10.70	1.06	0.92	111.83	4.01
Dardanup State Forest	0.00	0.00	0.00	0.00	0.00	0.00
Dingup	10.52	5.10	0.49	3.63	30.52	7.78
Down Road Nature Reserve	277.91	41.88	0.15	204.71	377.27	30.88
Faunadale	143.21	21.26	0.15	106.75	192.13	78.29
Frankland	0.00	0.00	0.00	0.00	0.00	0.00
Gull Rock National Park	28.55	13.56	0.47	10.99	74.20	16.16
Jardee	53.40	13.84	0.26	31.24	91.27	17.86
Kemerton	0.00	0.00	0.00	0.00	0.00	0.00
King River	153.06	28.18	0.18	103.11	227.21	12.81
Leeuwin-Naturaliste National Park (Canal Rocks)	45.71	12.08	0.26	23.50	88.90	5.07
Leeuwin-Naturaliste National Park (Yallingup)	1,076.74	105.26	0.10	884.91	1310.16	46.81
Linfarne	8.85	9.06	1.02	1.53	51.33	21.49
Locke Nature Reserve	328.15	59.04	0.18	226.56	475.29	21.67
Lot 1 Ducane Road	13.62	6.78	0.50	4.70	39.48	9.04
Lot 2 Boyanup - Picton Road	140.57	21.90	0.16	97.77	202.11	7.30
Manea Park - Bunbury	190.83	35.34	0.19	130.98	278.02	27.81
Marbelup Nature Reserve	114.84	24.12	0.21	73.70	178.96	14.71
Martins Tank	559.02	97.86	0.18	395.45	790.25	74.43
Millbrook Nature Reserve	213.03	67.52	0.32	113.93	398.35	38.83
Mt Clarence	567.68	63.41	0.11	453.34	710.86	40.78
Mt Melville	211.72	43.74	0.21	139.79	320.66	34.74
North East Margaret River State Forest	0.00	0.00	0.00	0.00	0.00	0.00
Redmond West	0.00	0.00	0.00	0.00	0.00	0.00
Reserve 23,000 Shire of Capel	150.81	30.41	0.20	100.74	225.77	39.99
Simpson Road	207.70	36.20	0.17	143.97	299.65	16.13
Southern Lots (Boyanup West Road Stratham)	79.65	19.47	0.24	48.52	130.74	25.43
Tuart Forest - Central	1,420.46	137.25	0.10	1171.90	1721.75	68.16
Tuart Forest North	1,053.39	109.66	0.10	835.57	1327.99	9.90
Tuart Forest South	2,144.84	195.39	0.09	1,789.54	2570.68	74.81
Various Lots Ducane Road	126.37	22.63	0.18	87.91	181.67	29.93
Walmsley East	397.63	63.20	0.16	283.48	557.73	14.19
Walmsley South	106.09	20.44	0.19	68.61	164.05	8.49
Walmsley West	641.52	77.87	0.12	498.86	824.97	20.97
Woodjtup National Park (10 Mile Brook Dam)	0.00	0.00	0.00	0.00	0.00	0.00
Yalgorup National Park	259.35	34.07	0.13	199.53	337.12	54.12
Yelverton	769.20	105.99	0.14	585.64	1010.30	85.48
Total	12,826.32	454.93	0.04	11,963.87	13,750.94	742.01

4.2.2 Upper Warren Only

During data collection, it became apparent to field personnel that the vegetation at Upper Warren was very open and consequently the detection process was different to the other surveyed sites. This was demonstrated above, whereby the detection function for the Upper Warren was markedly different to all other sites (Figure 4.2). Consequently, this site was modelled separately. Here, the truncation distance was set to 55 m. Based on AIC model selection, the half-normal and hazard rate were considered equivalent (i.e. the AIC of each was within 2 dAIC), and the half-normal detection function was selected (Table 4.14). Based on the Cramer-von Mises goodness of fit test, the selected model was a good fit to the data (i.e. a test statistic of 0.05, p-value of 0.9).

Table 4.14: AIC scores for each model fitted to the Upper Warren Western Ringtail Possum data.

Form	Model	AIC	dAIC
Hazard rate	Null model	944.73	0
Half normal	Null model	945.14	0.41

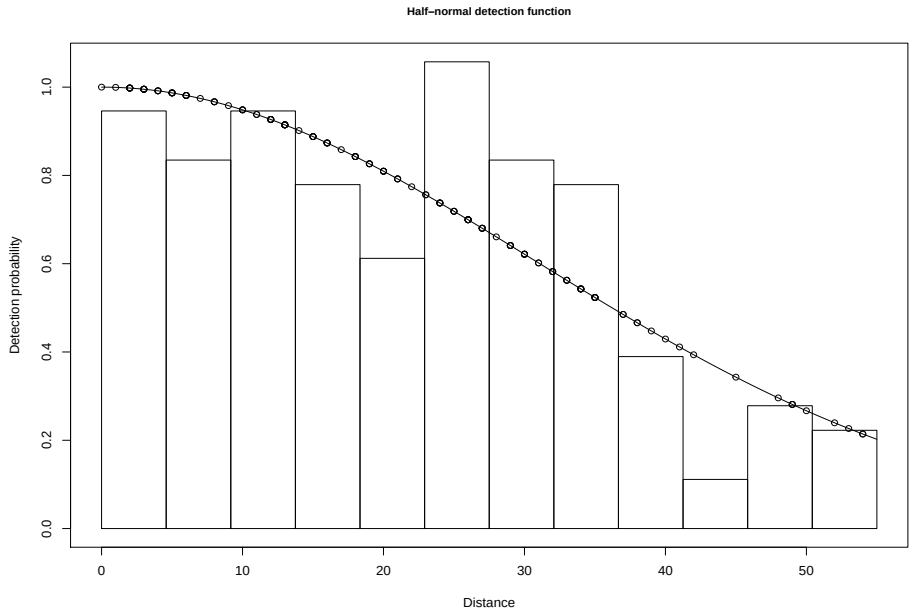


Figure 4.4. Plot of 'best-fitting' model to the Upper Warren Western Ringtail Possum perpendicular distance data.

Table 4.15 and Table 4.16 tabulate summary statistics following truncation of the Western Ringtail Possum perpendicular distance data at 55 m, as opposed to the data exploration presented above, which used raw data (Table 4.4

Table 4.15. Summary of detected clusters within the Upper Warren (truncation at 55 m).

Study Site	Area	Covered Area	Effort	n	k	ER	se.ER	cv.ER
Upper Warren	95,142.7	2,766.2	251.47	140	91	0.56	0.1	0.2024

Table 4.16. Summary of detected individuals within the Upper Warren (truncation at 55 m).

Study Site	Area	Covered Area	Effort	n	ER	se.ER	cv.ER	mean.size	se.mean
Upper Warren	95,142.7	2,766.2	251.47	159	6e-04	1e-04	0.2056	1.1357	0.029

Table 4.17. Summary of estimated density of Western Ringtail Possum individuals within the Upper Warren.

Study Site	Estimate	se	cv	lcl	ucl	df
Total	9e-06	2e-06	0.22	6e-06	1.4e-05	117.1382

A summary of estimated abundance (of individuals) is given below (i.e. in Upper Warren, $\hat{D}$ is 8. 8.853372e-06, A is 951427223, and it follows that $\hat{N} = \hat{D} \times A \approx$ 8,423 individuals) (Table 4.18).

Table 4.18. Summary of estimated abundance of Western Ringtail Possum individuals within the Upper Warren.

Region	Estimate	se	cv	lcl	ucl	df
Total	8,423.339	1,856.536	0.22	5,472.19	12,966.03	117.14

4.3 Density Surface Modelling

4.3.1 All Sites

DMSs were fitted to all sites, using only x and y coordinates in the spatial smooth. Results are presented in the Technical Supplement (Biota 2020).

4.3.2 Upper Warren Only

Three covariates were explored in the Upper Warren: fire history, elevation and harvest history (Figure 4.5 a, c and e). All covariates were representatively sampled in the survey (Figure 4.5 b, d and f). Model selection was based on deviance, so the model with the lowest deviance (the elevation model, Table 4.19) was deemed the best fitting model of those fitted. Please note, the absence of finding an effect of fire history and harvesting history on the distribution of Western Ringtail Possums in the Upper Warren does not mean there is no effect, especially given the paucity of the data (especially harvest history, Figure 4.5c and Figure 4.6c).

For each model, the deviance, percentage deviance explained, and the estimated abundance are provided in Table 4.19. Depending on the model, abundance estimates ranged between 6,389 (under a fire covariate) compared to 7,354 (under the null model), whereas under standard distance sampling, the estimated abundance was 8,423 (Table 4.18).

Spatial maps for each model are provided in Figure 4.6 in order of deviance.

Table 4.19. Model deviances.

Model	Deviance	%devExplained	Nhat	95%CI
Elevation	301.2735	59	7,292	(5,805, 9,161)
Null	303.3703	50	7,354	(6,022, 8,980)
Harvest	318.345	56	6,830	(5,615, 8,309)
Fire	318.3368	56	6,389	(5,271, 7,744)

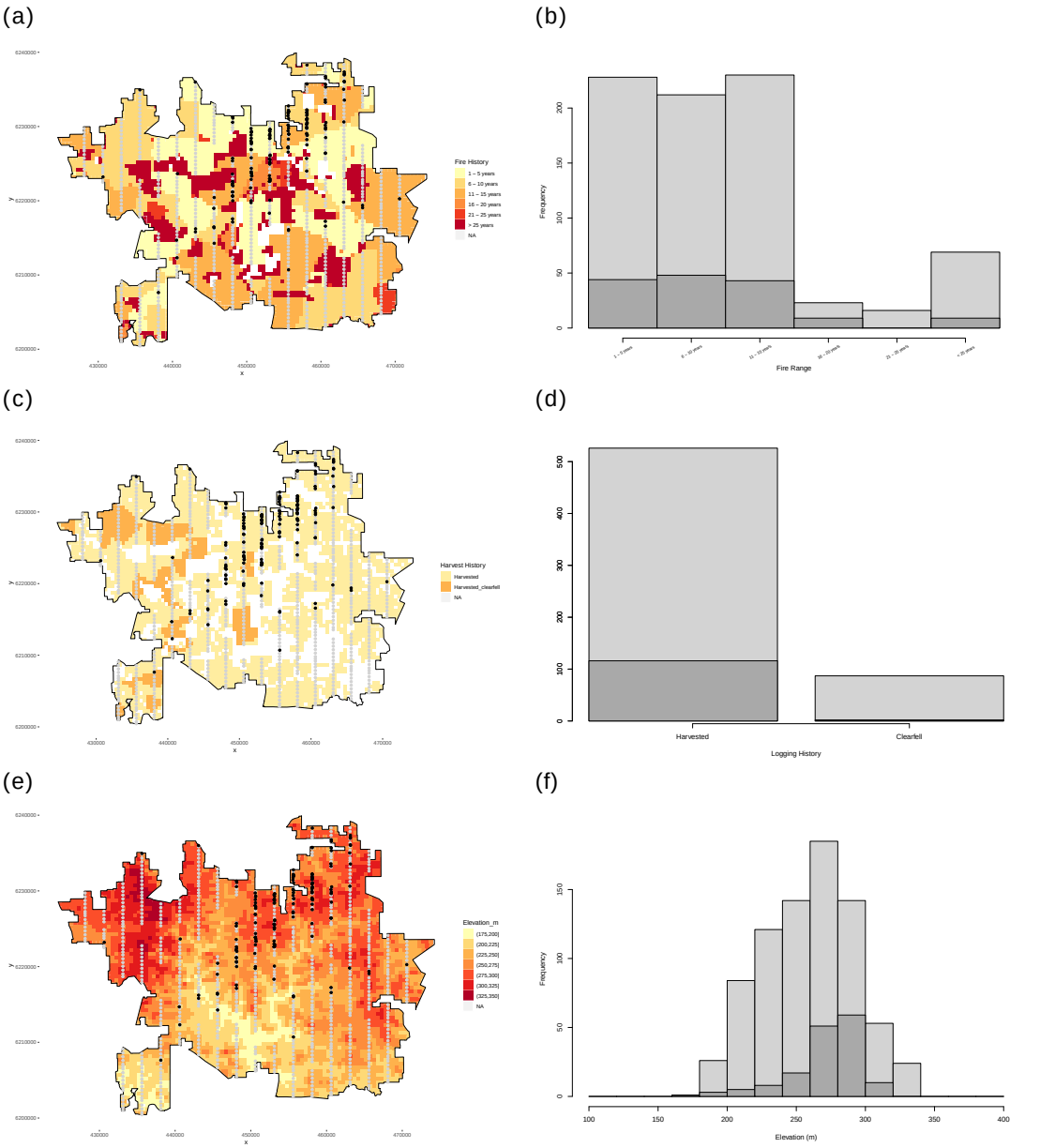
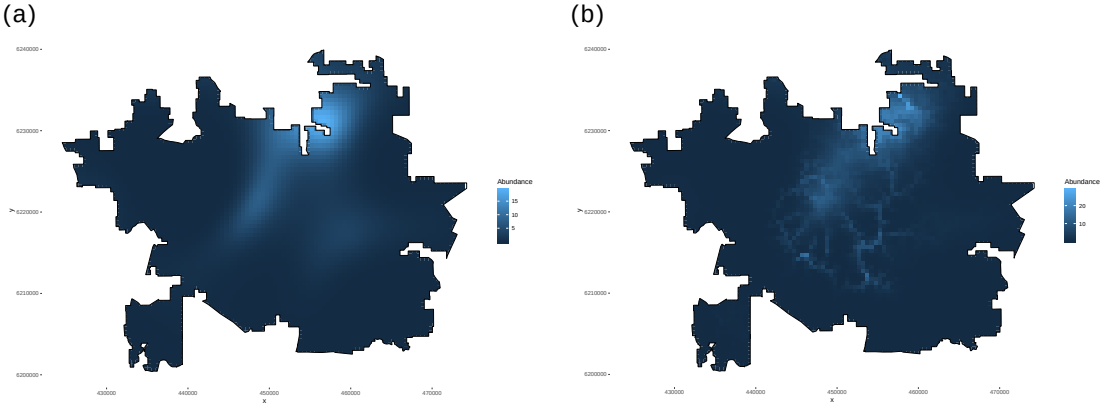


Figure 4.5 Plot of Upper Warren survey site discretised in to 75 m grid cells, with fire history (a), harvest history (c) and elevation (e) overlaid with transect locations when a possum was detected (black grid cell) or not (grey grid cell). Often, explanatory variable information was missing, especially for harvest history (c), noting high number of cells recorded as NA, and also fire history (a). Corresponding explanatory variables shown with amount available for sampling (grey bars) and that which was actually sampled (dark grey bars) (b, d and f, respectively).



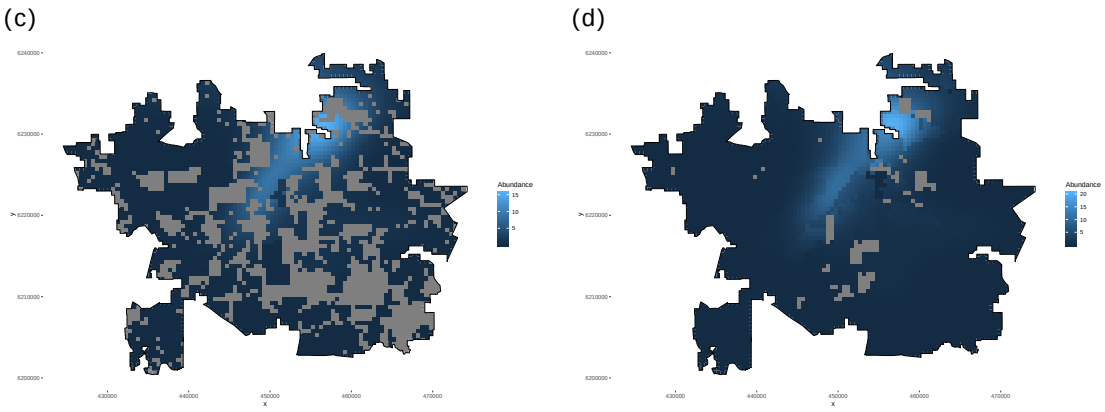


Figure 4.6. Predicted spatial density map of WRTP based on (a) the null model (i.e., a simple x and y spatial smooth), (b) elevation, (c) harvest history and (d) fire history. All models consistently predict a 'hot spot' of WRTP in the top central-NE. Harvest history (c) and fire history (d) were data depauperate, hence the high number of grid cells with no prediction (shown as grey cells). The absence of finding a significant effect of either of these two variables does not mean there is no effect, and is likely caused by a paucity of input data.

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5.0 Discussion

This study considered Western Ringtail Possum density and abundance estimates, using Distance Sampling, a proven robust and repeatable methodology (Buckland et al 2001, Buckland et al 2014, Buckland et al 2015, Miller et al 2013, Thomas et al 2010). The population estimate from this study indicated in excess of 20,000 individual Western Ringtail Possum occurred in the surveyed area across the Western Ringtail Possum Recovery Plan's three management zones (Department of Parks and Wildlife 2017) (see also Figure 3.1). This is a significant increase over the 2014 estimate of 3,400 individuals published in the most recent IUCN estimate (Burbidge and Zichy-Woinarski 2017).

The Western Ringtail Possum abundance estimates increased in each of the three management zones delineated in the Western Ringtail Possum Recovery Plan (Department of Parks and Wildlife 2017). The surveyed footprint of the Swan Coastal Plain management zone yielded the greatest estimated abundance of Western Ringtail Possum at 9,270 individuals, with the majority (around 6,500) occurring in the Swan Coastal Plain IBRA region. The well-documented stronghold for the species, the Tuart forests between Busselton and Bunbury (Shedley and Williams 2014, Jones et al. 1994; de Tores et al., 2005), yielded some of the highest estimated densities (3.40 –3.98 individuals/ha (at the study site level)) and the relatively large remnants sampled support some of the largest populations of the species.

A relatively large estimated population of Western Ringtail Possum was found to occur in the Southern Forest management zone, principally in the expansive Upper Warren study site. A combined estimate of approximately 7,500 individuals far exceeds that documented in the IUCN assessment (estimated at 100 mature individuals (Burbidge and Zichy-Woinarski 2017)).

The South Coast management zone yielded an estimate of 3,340 individuals within a 30 km around the Albany townsite. This is the least well surveyed of the three key management zones and has the potential to have a much larger population in the event that a larger area be surveyed.

The population estimate of greater than 20,000 Western Ringtail Possums from this study is likely to be an underestimate as urban and peri-urban settings were excluded from the study even though these can be strongholds for the species (Van Helden et al. 2018, references in Shedley and Williams 2014). In addition, the management zone 'Other Forest Rivers' was also not surveyed due to logistical constraints.

Clearly, natural population processes and changing environmental conditions will result in abundances fluctuations over time. Therefore, when citing the results of this study, authors should explicitly state that these estimates were derived for 2019. It is also important to note that the abundance estimates include all individuals and not just adults, as is the case for the IUCN conservation assessment. Most importantly, the abundance estimate reported here should not be referred to as the 'total population' or as the 'population size' of the Western Ringtail Possum in Western Australia, since this study surveyed only a portion (approximately 114,243 ha) of the available habitat.

The 2019 survey data and methods provide a strong population baseline and a means of directly assessing the effectiveness of management actions (such as fire management, logging, predator control, re-vegetation etc.). The 2019 survey data also permits impact assessment on population abundance as well as appraising environmental trends, such as rainfall, groundwater levels, and habitat structure and composition (e.g. dieback disease, tree senescence) on species persistence.

In addition to estimating abundance, the robust methods utilised here developed density surface models that can be used to monitor changes in local (within survey sites) possum distribution following environmental management interventions or impacts, and in responses to both seasonal and long-term environmental changes. For instance, high-resolution density surface models can be applied to test the effect of burning, re-vegetation or tree

senescence upon local Western Ringtail Possum distributions. This level of data interrogation can be applied to high-value areas where habitat for the species is subjected to planned, or unplanned, disturbance or change.

The Western Ringtail Possum Recovery Plan identifies "Gaps In Knowledge" as a primary Threatening Process. The Recovery Plan identified two main factors contributing to knowledge gaps; a lack of comparable survey methods previously used to estimate abundance (see also Shedley and Williams 2014), and general difficulties encountered when surveying and detecting the species (Department of Parks and Wildlife 2017).

This study successfully applied a unified survey method (line transect distance sampling) across a variety of geographic settings and vegetation types in each of the key management zones. Distance sampling is considered a best practice method to obtain spatially robust estimates of density, because it accounts for uncertainty in detectability. Therefore, this approach also addressed the second key gap identified by the Recovery Plan: difficulty in detecting species, clearly demonstrating that distance sampling is a feasible method for estimating density and abundance of the Western Ringtail Possum. This supports previous publications that have advocated the use of distance sampling (Finlayson et al. 2010, references in Department of Parks and Wildlife 2014), however this current study extends these earlier appraisals by applying it to 42 study sites across the geographic range of the species.

Line transect distance sampling is not suitable for every setting or proposal where abundance estimates of Western Ringtail Possums are required. Our initial site selection process excluded sites that were considered too small or poorly shaped (narrow riparian zones and road reserves) for effective line transect distance sampling. General guidance around the number of transects required to estimate the encounter rate variance and the number of detection events required to model a detection function (Buckland et al. 2001) were followed to exclude unsuitable sites. Additionally, urban settings were excluded even though these can be strongholds for the species (Van Helden et al. 2018, references in Shedley and Williams 2014). Other approaches are better suited for these settings. Some sites were excluded where site conditions precluded distance sampling or gave us considerable doubt as to whether key underlying assumptions were likely to be met. For example, vegetation of near coastal sand dunes within Leschenault Peninsula Conservation Park and some parts of the Canal Rocks study site were extremely thick and precluded walking transects. Within the Karri Forest of West Cape Howe National Park, the understorey of Karri Hazel obscured a clear view along the transect and thus reduced certainty that detections could be made directly on the transect (a critical assumption of single observer distance sampling, Buckland et al. 2001). The geographic scale and remoteness of parts of the contiguous forest of the Upper Warren study site (9,500 ha) necessitated additional planning to accommodate the range of variation in some environmental variables (including logging and fire history), and to overcome logistical constraints (including the safety of observers). Larger inter-transect spacing and careful planning and coordination with local authorities enabled this expansive study site to be surveyed.

The use of robust density estimation as the common reporting metric when describing Western Ringtail Possum populations will allow direct comparisons of density estimates from different localities and/or different times. In addition, practitioners can select from a toolbox of methods to overcome methodological limitations imposed by site conditions. Some of these approaches and the settings in which they might be appropriate are tabulated below (Table 5.1).

Table 5.1. Sampling methods available to document Western Ringtail Possum populations.

Approach	Metric	Pros	Cons	Example settings
Distance Sampling (either line- transect or point transect)	Spatially robust density estimate	• Accounts for uncertainty of detection. • Pooling robustness. • Yields density estimation. • Doesn't require trapping. • Improved accuracy of hand-help GPS units negates requirement for physically measuring perpendicular distance with either laser-range finders (problematic in dense vegetation) or tape measures.	• Impracticable when study sites are narrow strips e.g. road reserves or riparian belts, or when vegetation is difficult to traverse. • Typically requires 60 – 80 observations to model detection • Requires formal analyses. • Field techniques requires people familiar with distance sampling protocols. • Typically requires probability of detection on transect be 1 (unless compensatory approaches are used)	Larger remnants where sufficient transects can be surveyed. Repeat sampling can overcome insufficient numbers of observations to model a detection function.
Spatially Explicit Capture Recapture	Spatially robust density estimate	• Animals can be marked using a number of techniques (e.g. traditional marking methods like ear tags or PIT tags, and modern approaches utilising genetic identification from hair samples or scats) or their pelage identified from camera trapping. • Rapidly evolving field with development of statistical models that don't require uniquely marking individuals. • Collection of genetic material enhances other studies.	• Western Ringtail Possums generally considered to be trap shy. • Genetic identification (e.g., from scats) adds additional cost to the field program	The same sites at which distance sampling occurs. Where spotlighting is undesirable such as in the urban or peri-urban setting. Assumes structured surveys for scats or deployment of hair snares etc can be undertaken.
Strip Transects	Density when detection is perfect	• Suitable for small areas of habitat or where habitat is narrow such as in Riparian belts or road reserves a few tens of metres in width. • Simple statistical analyses	• Requires that the probability of detection all individuals within the strip be 1 •	Narrow Road Reserves, riparian belts. Agricultural land with scattered large paddock trees.

Approach	Metric	Pros	Cons	Example settings
Scat counts	Indice	• Rapid confirmation of species presence • Suitable for assessing habitat use especially in small patches of habitat • Suitable for occupancy modelling, if repeat visits to a site are conducted *and* scats are removed between visits.	• Requires familiarity with detecting scats and identification to the species-level • Difficult to undertake when undergrowth is very dense or considerable leaf fall makes detection of scats problematic • Estimate of scat decay and deposition rates is problematic, so translating scat-indice in to an estimate of abundance can be dubious • Cannot confirm absence	
Drey counts	Indice	• Rapid confirmation of species presence • Can be translated into a minimum estimated population size if the ratio of the number of possums per drey is known	• Cannot confirm absence	Narrow Road Reserves, riparian belts. Agricultural land with scattered large paddock trees.
Unstructured spotlight	Confirmed presence and assumed (or unconfirmed) absence	• Rapid confirmation of species presence • Suitable for occupancy modelling, if repeat visits to a site are conducted *and* survey effort is even across the survey area	• Cannot estimate abundance or density as often the surveyed area is difficult to estimate	Used as a precursor to structured surveys.

Other methods used to estimate density (cue counts (scat and drey) and simple presence estimators) are also assessed, as these are commonly used techniques. Wayne et al. (2005) suggested that scat counts might represent a suitable way to estimate abundance. However, when using scat counts to estimate abundance, both production and decay rates are required to calibrate the observed counts (Wayne et al. 2005). These rates may change in response to different environmental conditions. Arguably as possum scats are small in dimension (10 mm by 5 mm), an estimation of probability of detection would also be desirable. An advantage to the use of scat counts is they indicate habitat usage that may not be evident from single observational counts. For example, if animals forage on seasonally available Banksia flowers, then counts outside of the flowering season may not detect Western Ringtail Possum in this habitat. Thorough searching may indicate that Western Ringtail Possums have used an area, and high densities of scats may indicate a high level of use. Though this information will not in itself provide data on the size of the population in the area.

There is a perception from some stakeholders that distance sampling is a time consuming process and that structured nocturnal surveys present increased occupational health and safety risks for observers. However, during this study no injuries were sustained by any of the observers after walking in excess of 1,280 km of linear transects. In terms of rapidity of assessments an experienced and trained observer (such as used in this survey) walked an average of approximately six kilometres of linear transect per night, this allows a study site the size of Tuart Forest Central (North, Lime Kiln, James and Buffer blocks of the Tuart Forest National Park) at 1080 ha and surveyed with 62 transects at a spacing of 150 m and total effort of 70 km to be completed in approximately six nights by a team of two. Generally, this walking pace was not sustained in the Around Albany study sites where, at some sites, observers were more likely to traverse 3 kilometres of linear transect in approximately six hours. The thickness of vegetation is a consideration when estimating the required survey duration for budgeting purposes.

Some monitoring programs utilise existing track networks to conduct spotlight surveys with the rationale that cleared tracks provide a safer environment for observers during surveying. Whilst this is likely to be the case, edge-effects caused by tracks may introduce biases, and the data obtained from these areas may be likewise biased. For example, animals could be attracted to, or repelled from the track, and detection rates will be biased high and low, respectively. This practice is strongly discouraged (Buckland et al. 2010).

This study investigated two recipient translocation sites at Leschenault Peninsula Conservation Park and Yalgorup National Park. Western Ringtail Possums were released into these sites between 1991 and 2008 (Clarke 2011), and the success of these translocations has not been recently assessed. A strikingly positive result emerged from the survey effort within the Yalgorup National Park (including Martins Tank), where the translocated population within the surveyed area was estimated to be in excess of 800 individuals and is now clearly another important stronghold for the species. The 6.9 kilometres of transect within the Leschenault Conservation Park yielded seven detection events of 10 individuals, with the individuals potentially originating from the original translocated individuals or alternatively from animals that moved down the coast from Binningup.

The majority of sites investigated by this study fell within the conservation estate and are thus already afforded some level of protection. However, differences in density estimates across study sites may assist in ranking sites in significance to the species, informing the allocation of resources toward conservation operations. Similarly, within each study site, density surface models highlight hotspots that may help identify habitat critical to the persistence of the species locally. This study may provide inferences and a baseline for experimental testing. So for example, sites where no detections of Western Ringtail Possum were made may provide clues as to potential causal factors that can then be experimentally tested. For instance, the effects of fire, water table changes, forest regeneration through plantings and predator control can all be experimentally tested using these data. Additionally, this study also identified several sites at which Western Ringtail Possum were not detected and these may represent suitable repository sites where a long-term conservation gain may potentially be achieved.

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Department of Parks and Wildlife

PROCEDURES TO MINIMISE THE RISK TO WESTERN RINGTAIL POSSUMS DURING VEGETATION CLEARING AND BUILDING DEMOLITION

IMPORTANT: Contact Dept. of Parks and Wildlife Bunbury on 9725 4300 prior to clearing commencing.

These procedures are generally for development activities that occur on smaller lots (<2ha). The clearing of vegetation on larger lots should be discussed with Parks and Wildlife.

Identify trees to be retained

Clearing of native vegetation within the proposed development site should avoid any unnecessary clearing of trees. Trees retained within the development site, proposed Public Open Space and within road verges provide valuable habitat for WRP. Trees to be retained should be marked so that they are clearly recognised by clearing contractors.

Suitable expertise on-site

A suitably experienced zoologist or WRP rehabilitator ('possum spotter') should be onsite when clearing is being undertaken, that is, during the entire duration of the clearing. The 'possum spotter' is to provide advice and direction to contractors undertaking the clearing in relation to WRP matters. The contract manager or supervisor is the person responsible for all work undertaken and the safety of all personnel on site at all times.

It is suggested that the 'possum spotter' attend the site the day before clearing commences to be familiar with the location of any WRP and dreys. A person who is required to handle WRP during a clearing event that is part of development proposal should hold a Regulation 15 (fauna relocation and/or education) or a Regulation 17 (scientific/study) license, depending on circumstances.

Advice to clearing contractors

Prior to clearing, clearing contractors should be properly inducted by the 'possum spotter' about the identification and protection of trees to be retained, trees to be cleared and about the likely presence of WRP among trees and other vegetation that will be cleared. No dogs should be taken on the site.

Tree removal

The 'possum spotter' with the clearing supervisor is to inspect all trees to be removed and agree on a process and timetable for clearing. Trees that have WRP currently in them may need to be left for a subsequent day when the tree may be vacant. Where possible clearing should be undertaken in a systematic manner that minimises disruption to WRP. If there is suitable habitat adjoining the development site, a clearing pattern that encourages the movement of WRP to this habitat should be adopted.

In moderate or high-density sites, if a machine operator sees a WRP in a tree that is about to be cleared, trees should be bumped or shaken firstly. Following this the machine operator should wait and observe the tree for a short time. If present, the shaking of the tree may cause any WRP and other fauna to move and, hopefully, opportunity to safely evacuate. It would also increase the chance that the machine operator will see the animal/s prior to pushing down the tree.

In the event that a WRP is observed in a tree that is about to be cleared and there is a tree marked for retention near the tree which is to be cleared, then the tree should be gently lowered to the ground to give the animal opportunity to safely evacuate. The animal/s then need to be encouraged to move towards and occupy the trees to be retained.

If there are no trees to be retained within proximity of a tree that has a WRP and needs to be cleared, then the WRP can be removed by the 'possum spotter' using an elevated platform or by lowering the tree to the ground. The WRP is to be relocated to the nearest suitable habitat.

Dreys should be inspected prior to clearing and possibly removed. Dreys that remain in the tree during clearing have to be checked as soon as possible as baby WRP may remain in the drey.

Clearing should be undertaken on a face so as to drive WRP towards suitable habitat.

Services

The proponent will need to identify where underground services are to be installed and to ensure any detrimental impact from these services is minimised.

Understorey vegetation

There will always be a possibility that WRP, Southern Brown Bandicoots, etc, will be found in under and midstorey vegetation. Care needs to be taken when clearing this vegetation with a check to be undertaken by foot prior to machines entering the areas and clearing this vegetation.

Injured WRP

If contractors encounter injured WRP during clearing operations, then the 'possum spotter' needs to be notified immediately so that arrangements can be made for the welfare of the injured animal.

Stockpile practices

Contractors need to be made aware that displaced WRP may shelter within stockpiled vegetation. Therefore, to minimise any accidental injury or death of WRP, personnel involved in the removal or disposal of stockpiles need to be made aware of and be prepared for the potential presence of WRP. If WRP are encountered then Parks and Wildlife needs to be immediately notified. Any dreys in fallen trees are to be removed prior to stockpiling as WRP have been known to return to their dreys/trees.

The preference is that vegetation is not stockpiled but removed on the same day clearing occurs. If vegetation is to be stockpiled on-site, then it is preferable to place it in cleared areas as far as possible from retained remnant vegetation. Chipping of removed debris is to be undertaken away from retained habitat to minimise the noise impacts on WRP.

In large clearing events where chipping will be undertaken over a number of days, it is preferred that the chipper remains in one position and vegetation is brought to the chipper as opposed to the chipper moving through the site. This is to consolidate the noise impacts in one area of the development site.

Buildings

Site workers are to be advised about the potential presence of WRP in derelict buildings and to stage works to minimise potential injuries to WRP during demolition works. Prior to clearing works commencing, the roof and ceilings on derelict buildings should be removed prior to demolition to allow for dispersal of WRP. Parks and Wildlife should be immediately notified of any WRP that may be inadvertently injured during demolition works.

There is a risk to WRP if rat or mouse baiting is undertaken prior to demolition. Appropriate methods of baiting need to be engaged if rats or mice are to be controlled prior to demolition. One method is to place the poison out of WRP reach, inside poly pipe secured to a beam in the roof space. The pipe should be about 1m long and no greater than 50mm in diameter. Another method is to place a plastic ice-cream container upside down over rate poison with small arches cut into the side of the container. The arches should be a maximum height and width of about 50mm and the container secured to a rafter.

Post Clearing Reporting

The proponent is to provide **Parks and Wildlife** with a report on the impact on WRP during the habitat removal process within 28 days of completion of vegetation clearing or building demolition works.

APPENDIX 4

POST VEGETATION CLEARING AND BUILDING DEMOLITION REPORT

Was DEC notified prior to clearing occurring

- YES / NO

Date and times clearing was undertaken

- Date __/__/__ from ____ am/pm to ____ am/pm

Name of clearing contractor

- Name - _____

Name(s) of the 'possum/spotter'

- Name(s) - _____

Number of WRP observed/relocated

- ____ Observed / ____ Relocated

Location where WRP were relocated

- Location - _____

Number of dreys observed/removed

- ____ Observed / ____ Removed

Number of WRP injured/killed

- ____ Injured / ____ Killed

Name of rehabilitator/veterinarian surgery who holds the injured WRP

- Name - _____

Was the management/mitigation plan objectives met

- YES / NO

If NO, what was the reason(s)

- _____

Other comments

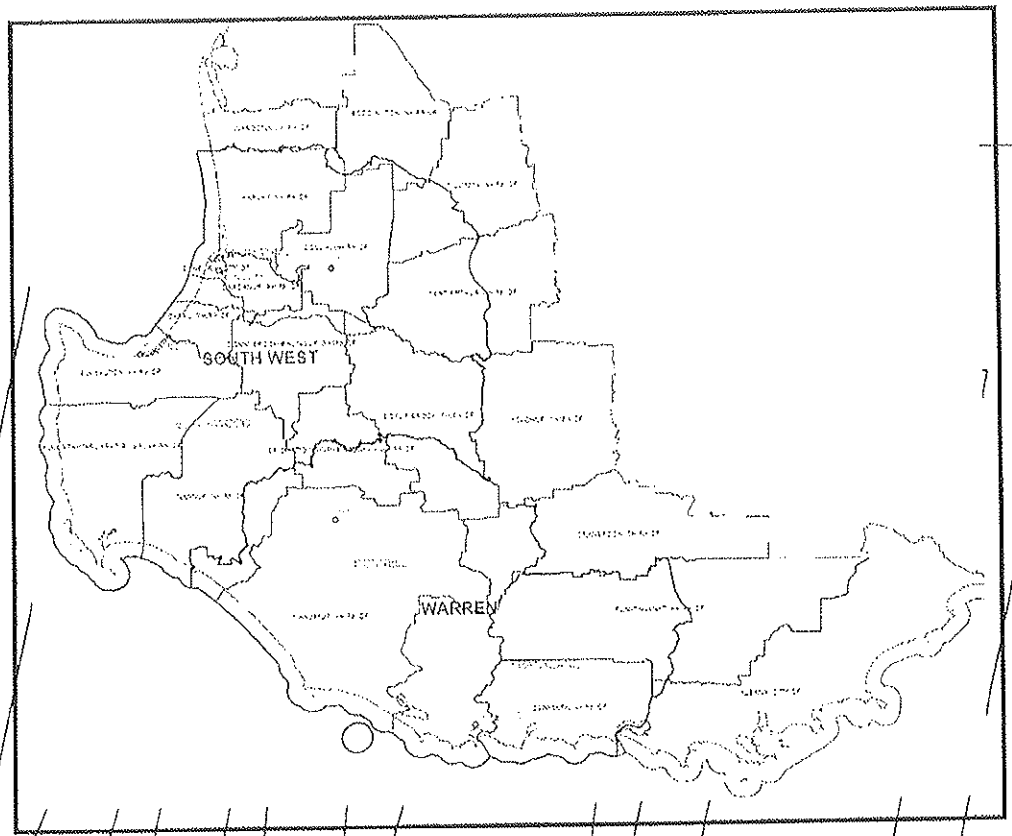
- _____

Name of person preparing the report

- Name - _____ Date - ___/___/_____

APPENDIX 5

LOCATION OF LOCAL DEC OFFICES



BLACKWOOD DISTRICT
14 Queen Street
Busselton WA 6280
9752 5555

DONNELLY DISTRICT
PO Box 20
Pemberton WA 6260
9771 7988

SOUTH COAST REGION
120 Albany Highway
Albany WA 6330
9842 4500

WELLINGTON DISTRICT
PO Box 809
Collie WA 6225
9734 1988

FRANKLAND DISTRICT
South Coast Highway
Walpole WA 6398
9840 0400

SOUTH WEST REGION
PO Box 1693
Bunbury WA 6231
9725 4300

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