BORR Team

Bunbury Outer Ring Road
Southern Section
Alignment Selection Report

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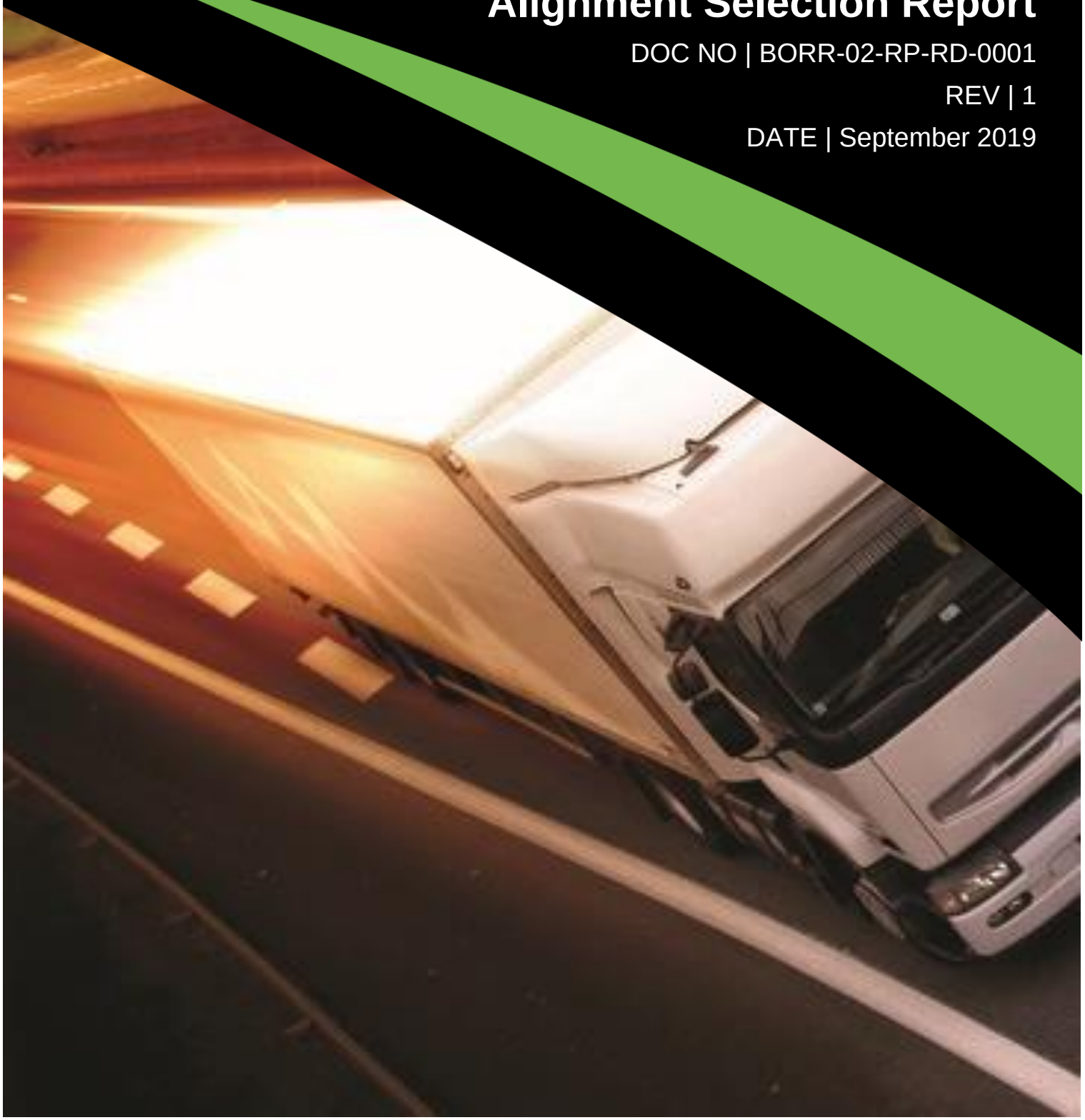

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A	June 2019	Draft for Internal review	BORR Team	CG	PM
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1 EXECUTIVE SUMMARY

The Commissioner of Main Roads Western Australia (Main Roads WA) is planning for the construction of the Bunbury Outer Ring Road (BORR) project. The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed BORR will provide a high standard route for access to the Bunbury Port 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 (South), an existing 4 km section which was completed in May 2013, along with a 3 km extension of Willinge Drive southwards to South Western Highway
- 'BORR Southern Section' – South Western Highway (South), near Bunbury Airport, to Bussell Highway.

Development of the BORR is being conducted through the BORR Integrated Project Team (IPT) which is composed of Main Roads WA, GHD and BG&E. This document refers to the BORR Southern Section only.

In response to changes to the EPBC Act's protection status of the Western Ringtail Possum in May 2018, from 'Vulnerable' to 'Critically Endangered', Main Roads WA commissioned an Environmental Options Assessment of five options for BORR Southern Section (BORR IPT, 2018).

The Environmental Options Assessment confirmed that significant environmental factors for BORR Southern Section alignments included the clearing of native vegetation and the consequent removal of fauna habitat.

A high level review was undertaken on the South Western Highway (South) to Hasties Road portion, since this contains limited areas of vegetation and is therefore unlikely to significantly impact the Western Ringtail Possum. The purpose being to validate that the GBRS (Red) Alignment over this portion is still appropriate taking account of resources, farming and the environment.

In addition to the above, through the consultation process, alternative routes proposed by the various stakeholders were also reviewed.

Therefore, the purpose of this study is:

- To review the South Western Highway (South) to Hasties Road portion of the BORR Southern Section to ensure the current planning is appropriate.
- To undertake an Alignment Selection Study including the GBRS (Red) Alignment between Hasties Road and Bussell Highway in light of the changed environmental conditions and make a recommendation for a suitable road reserve for this portion of the BORR Southern Section. Primary purpose of the study being to identify whether a suitable alternative alignment exists from Hasties Road to the ultimate connection with Bussell Highway, that has lower environmental impacts compared to the GBRS (Red) Alignment.
- To review of various proposals provided by stakeholders.
- To document Main Roads WA recommendation in respect to the BORR Southern Section corridor.

The study area, shown in Figure 1, is divided into two portions for assessment as follows:

- South Western Highway (South) to Hasties Road
- Hasties Road to Bussell Highway

This report documents the findings and recommendations for the alignment selection for the BORR Southern Section. The following are the primary findings of the report:

- For the South Western Highway (South) to Hasties Road portion of the BORR Southern Section, the GBRS (Red) Alignment is still considered appropriate, cognisant of the constraints and impacts associated with resources in this area.
- A historical alternative to use Centenary Road as an alignment for the BORR Southern Section was not supported as it would not realise the BORR project objectives.
- For the Hasties Road to Bussell Highway portion of the BORR Southern Section, an MCA process evaluated four alignments within the Alternative (Green) Corridor to identify a potential Alternative (Green) Alignment.
- Two alignments were then selected for comparison, the GBRS (Red) Alignment and the Alternative (Green) Alignment.
- Detailed environmental site surveys were completed in both the GBRS (Red) Alignment and Alternative (Green) Alignment and an Environmental Impact Assessments prepared for each.
- It was confirmed that both alignment options have environmental impacts, although of a different scale and nature. The GBRS (Red) Alignment has a higher impact upon the Western Ringtail Possum and native vegetation, whereas the Alternative (Green) Alignment has a significantly higher impact upon wetlands and endangered aquatic fauna.
- Through a second MCA process, the two alignments were evaluated using social, engineering and economic criteria. On the basis of this assessment the GBRS (Red) Alignment is recommended.
- Suggested stakeholder options that utilised existing road reserves, were considered to provide no additional benefit over the Alternative (Green) Alignment being investigated.
- Regional surveys for Western Ringtail Possum (WRP) were commissioned by Main Roads WA to more accurately estimate the population size and better determine the potential impact of the

BORR project. These surveys were undertaken in early 2019 at a number of sites within the range of the species. The survey sites did not include urban, peri-urban and agricultural areas where the species is known to occur. The survey methodology was agreed with the Department of Biodiversity, Conservation and Attractions and the Western Ringtail Possum Recovery Team. Main Roads WA has since initiated additional surveys.

- In their decision to increase the conservation status of WRP to critically endangered in May 2018, the Commonwealth Department of the Environment and Energy used a total 2015 population estimate of 3,400. The 2015 population estimate included 2,000 WRP present on the Swan Coastal Plain. The regional survey conducted in early 2019 estimated that the total population of the species within the survey was more than 17,000 with approximately 5,700 WRP located on the Swan Coastal Plain.
- The findings of the Western Ringtail Possum Regional surveys to date confirm that the population is significantly higher than previously estimated. This is an important factor when considering the potential impact of BORR.

The following are the key recommendations of this alignment selection study:

- Main Roads WA recommends to proceed with the GBRS (Red) Alignment from South Western Highway (South) to Hasties Road. There was found to be no overall advantage to amending the alignment.
- Main Roads WA recommends to proceed with the GBRS (Red) Alignment for the BORR Southern Section from Hasties Road to Bussell Highway, which was subsequently endorsed by Government. Alternative alignments will no longer be considered.

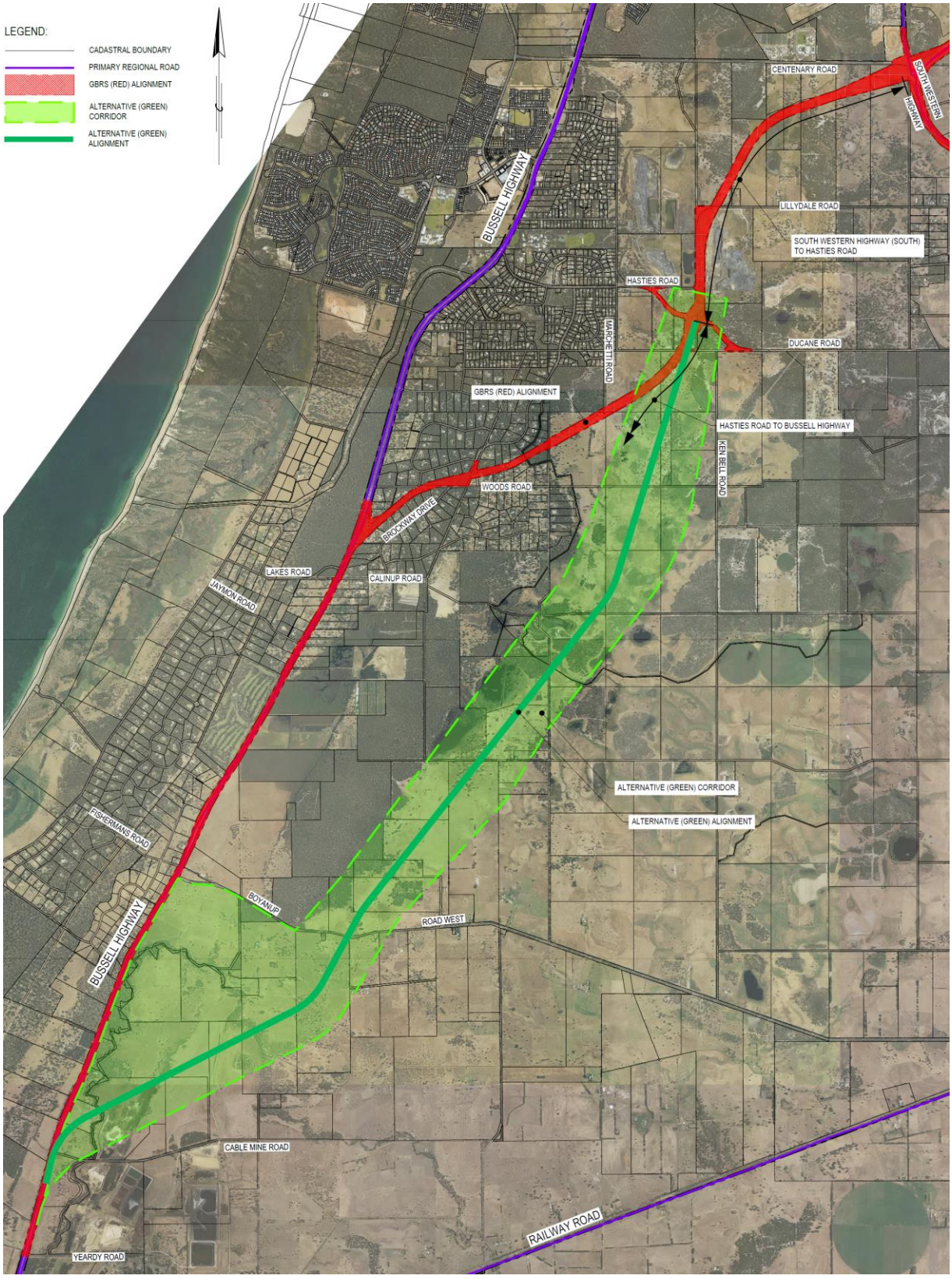

Figure 1: BORR Southern Section

2 INTRODUCTION

2.1 Purpose of Study

The Commissioner of Main Roads Western Australia (Main Roads WA) is planning for the construction of the Bunbury Outer Ring Road (BORR) project. The BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed BORR will provide a high standard route for access to the Bunbury Port 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.

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

Development of the BORR is being conducted through the BORR Integrated Project Team (IPT) which is composed of Main Roads WA, GHD and, BG&E. This document refers to the BORR Southern Section only.

In response to changes to the EPBC Act's protection status of the Western Ringtail Possum in May 2018, from 'Vulnerable' to 'Critically Endangered', Main Roads commissioned an Environmental Options Assessment of five options for BORR Southern Section (BORR IPT, 2018).

The Environmental Options Assessment confirmed that significant environmental factors for BORR Southern Section alignments included the clearing of native vegetation and the consequent removal of fauna habitat.

A high level review was undertaken on the South Western Highway (South) to Hasties Road portion, since this contains limited areas of vegetation and is therefore unlikely to significantly impact the Western Ringtail Possum. The purpose being to validate that the GBRS (Red) Alignment over this portion is still appropriate taking account of resources, farming and the environment.

In addition to the above, through the consultation process, alternative routes proposed by the various stakeholders were also reviewed.

Therefore, the purpose of this study is:

- To review the South Western Highway (South) to Hasties Road portion of the BORR Southern Section to ensure the current planning is appropriate.
- To undertake an Alignment Selection Study of the GBRS (Red) Alignment between Hasties Road and Bussell Highway in light of the changed environmental context and make a recommendation for a suitable road reserve for this portion of the BORR Southern Section. The primary purpose of the study being to identify whether a suitable alternative alignment exists from Hasties Road to the ultimate connection with Bussell Highway that has lower environmental impacts compared to the GBRS (Red) Alignment.

- To review of proposals provided by various stakeholders.
- To document Main Roads WA recommendation in respect to the BORR Southern Section alignment.

2.2 Glossary of Terms

The following is a glossary of the defined terms used:

Alignment Definition: This term refers to undertaking detailed planning work to inform the preparation of an ultimate planning design concept and required road reservation to inform a Bunbury Region Scheme Amendment.

Alignment Selection: This term refers to undertaking a planning assessment with the purpose of determining an appropriate alignment for undertaking detailed planning work as part of the alignment definition process.

Alternative (Green) Corridor: This is the corridor identified to enable investigation of an alternative alignment for the BORR Southern Section which is located to the east and south of the GBRS (Red) Alignment. The corridor extended from Hasties Road through to the Cable Mine Road / Bussell Highway intersection and is approximately 750 m wide.

Alternative (Green) Alignment: This refers to a nominal 100 m wide alignment within the Alternative (Green) Corridor, determined through a multi criteria assessment of constraints for a number of alternative alignments within the Alternative (Green) Corridor. This nominal 100 m wide alignment is identified for the purposes of comparison with the GBRS (Red) Alignment.

BORR: Bunbury Outer Ring Road.

GBRS: Greater Bunbury Regional Scheme.

GBRS (Red) Alignment: This refers to the BORR alignment from South Western Highway (South) to Bussell Highway through Gelorup and is the land set aside for the BORR in the GBRS zoned as "Primary Regional Road".

Hasties Road to Bussell Highway: This refers to the portion of the BORR Southern Section, from Hasties Road to the Yeardy Road / Bussell Highway intersection via either the GBRS (Red) Alignment or the Alternative (Green) Alignment.

IPT: Integrated Project Team which is composed of Main Roads WA, GHD and BG&E.

MCA: Multi Criteria Assessment.

Study Area: The area covered by the BORR Southern Section, which extends from South Western Highway (South) to the Yeardy Road / Bussell Highway intersection. It includes areas to the east and west of the alignments being investigated. As shown in Figure 2.

SWH (South): The part of South Western Highway leading in a southerly direction out of Bunbury. (Compared with **SWH (North):** The part of South Western Highway leading in a northerly direction out of Bunbury.)

SWH (South) to Hasties Road: This refers to the portion of the BORR Southern Section that extends from the interface with the BORR Central Section at South Western Highway (South), near Bunbury Airport, to Hasties Road east of Gelorup.

Main Roads WA: Main Roads Western Australia.

WRP: Western Ringtail Possum.

2.3 Planning Objectives

The planning objectives of the BORR project are to:

- Reduce local congestion through increasing efficiency for freight and regional traffic.
- Improve long term access for the Bunbury Port.
- Support socio-economic growth and facilitate integrated development in Greater Bunbury and the South West Region.
- Enhance amenity on local roads by reducing freight and regional traffic.
- Minimise impacts on affected communities and stakeholders.
- Create a safer road system for our community.
- Respect and enhance our environment and heritage.

These objectives are the overarching principles used in the evaluation process when comparing the GBRS (Red) Alignment with the other alignments considered as part of the review for the BORR Southern Section.

2.4 Report Structure

This report covers the BORR Southern Section alignment selection review. As the review has been undertaken in response to the change in the conservation status of the Western Ringtail Possum and this primarily affected the Hasties Road to Bussell Highway portion of the BORR Southern Section, much of the report deals with this investigation. For completeness and because of the close proximity, a high level review of the portion from SWH (South) to Hasties Road was included to confirm its planning was still appropriate.

This report has been structured into the following key sections:

- **Executive Summary** (Refer to Section 1): Provides a summary of the background, findings and recommendations.
- **Introduction** (Refer to Section 2): This section, defines the purpose, objectives and glossary of terms.
- **Planning Context** (Refer to Section 3): This section describes the former planning and covers a literary review of previous reports associated with the Study Area. The existing status of the study area is also described in terms of network, public transport, rail and Bunbury Port.
- **Traffic and Safety Assessment** (Refer to Section 4): This section provides an overview of the existing crash data and traffic in relation to the study area.
- **Planning Review Process** (Refer to Section 5): This section sets out the processes adopted for the investigation and alignment review of the BORR Southern Section.
- **South Western Highway (South) to Hasties Road Review** (Refer to Section 6)**:** This section reviews the proposed GBRS (Red) Alignment against potential other alignments for the northern portion of the BORR Southern Section, primarily taking account of resources with further consideration of farming and the environment. It also considers the use of Centenary Road as an alignment for the BORR between South Western Highway (South) and Bussell Highway.

- **Hasties Road to Bussell Highway Review** (Refer to Section 7): This section covers the constraints for the Hasties Road to Bussell Highway portion of the BORR Southern Section and the selection of the Alternative (Green) Corridor (approximately 750 m wide) for investigation.
- **Hasties Road to Bussell Highway - Alternative (Green) Corridor Refinement** (Refer Section 8): This section covers the alignments considered within the Alternative (Green) Corridor for investigation and determines a potential Alternative (Green) Alignment for comparison against the GBRS (Red) Alignment.
- **Hasties Road to Bussell Highway - Social, Engineering and Economic Assessment** (Refer Section 9): This section reviews the social, engineering and economic impacts of the GBRS (Red) Alignment and Alternative (Green) Alignment from Hasties Road to Bussell Highway.
- **Hasties Road to Bussell Highway – Environmental Assessment** (Refer Section 10): This section presents the findings of the environmental impact assessments undertaken for the GBRS (Red) Alignment and potential Alternative (Green) Alignment approximately 100 m wide.
- **Community and Stakeholder Engagement** (Refer Section 11): This section documents the community and stakeholder engagement that has been undertaken in relation to the BORR Southern Section. The section highlights key themes raised by stakeholders.
- **Stakeholder Options** (Refer Section 12): This section documents the review of suggested options raised as part of the consultation process by stakeholders to investigate the use of existing road reserves.
- **Western Ringtail Possum Regional Surveys** (Refer Section 13): This section documents the findings of the Western Ringtail Possum surveys undertaken by Main Roads WA to better understand the population numbers.
- **Alignment Selection Recommendation** (Refer Section 14): This section outlines the considerations and Main Roads WA recommendation regarding the Hasties Road to Bussell Highway portion of the BORR Southern Section.
- **Conclusion** (Refer Section 15): Documents the findings and recommendations of the study.

2.5 Study Area

The BORR Southern Section Study Area includes the area southwest of the BORR Central Section extending from the intersection with South Western Highway (South), near Bunbury Airport, to the Yeardy Road / Bussell Highway intersection. It includes areas to the east and west of the alignments being investigated.

The study area is shown in Figure 2.

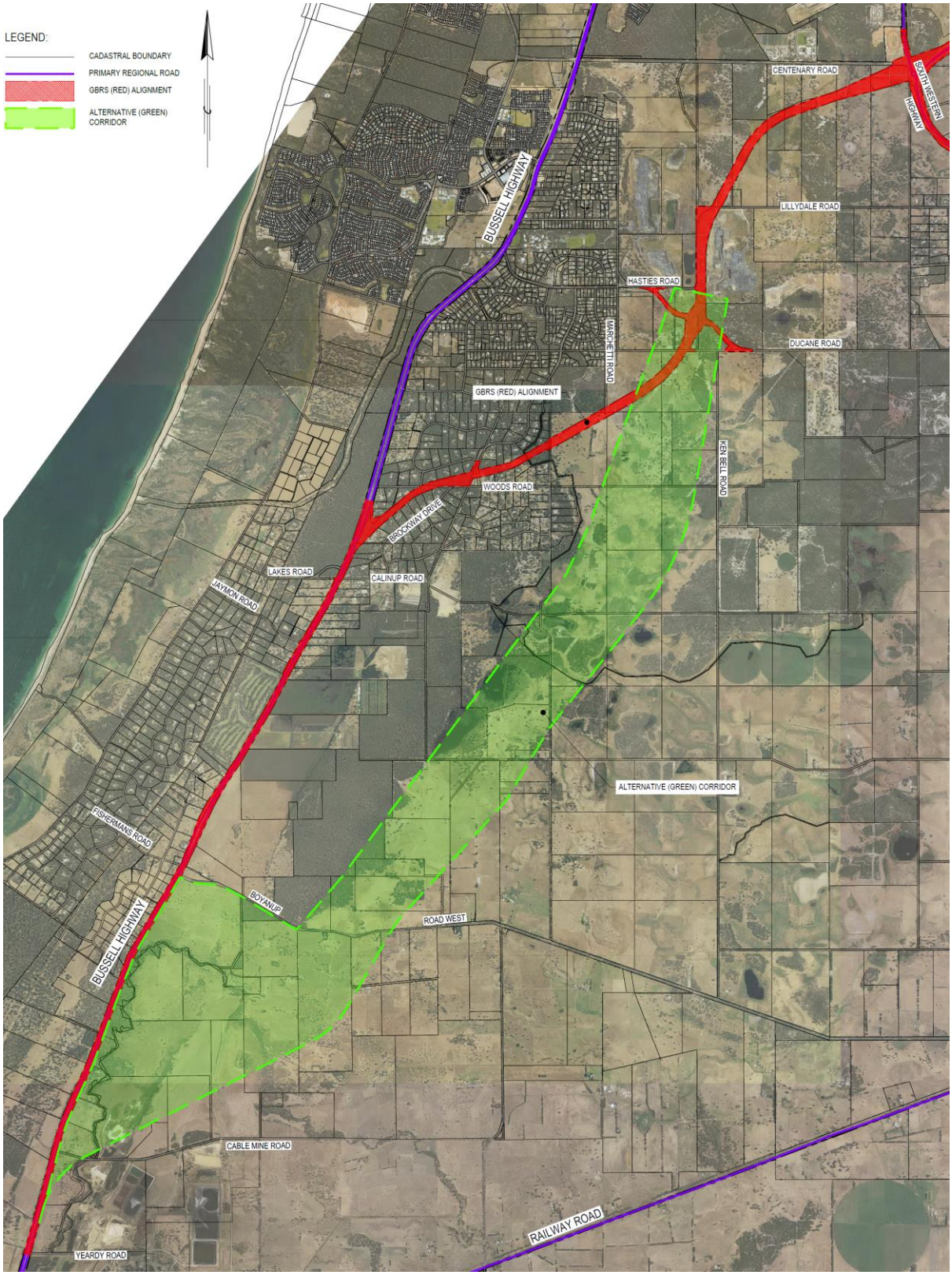


Figure 2: BORR Southern Section Study Area

3 PLANNING CONTEXT

3.1 Background

The BORR concept was originally developed by Main Roads WA in the early 1970's in consultation with other State Government departments and local authorities and formed part of the Bunbury Region Plan (State Planning Commission 1987).

The Bunbury-Wellington Region Plan, released for public comment in 1993 and published in 1995, further supported the need for the road as well as the Gelorup southern alignment.

The Greater Bunbury Region Scheme (GBRS), issued for public comment in 2000, confirmed the southern alignment of the BORR. The Scheme came into effect in 2007 and remains the current planning document for the Greater Bunbury area.

As part of the above planning process, Main Roads WA has undertaken a number of planning studies to improve traffic flow, efficiency and safety performance on the major networks around Greater Bunbury. These have been focussed on providing an ultimate corridor to provide for a heavy vehicle and regional traffic bypass of Bunbury, with a high standard link to the port.

The studies, design investigation and preliminary design mostly occurred between 1995 and 2002 as part of ongoing development of the Bunbury Outer Ring Road. The studies involved public consultation and investigation of alternative alignments for the BORR Southern Section and informed the setting of the GBRS, which included land reserved as Primary Regional Road for the BORR alignment. These studies are further discussed in the literature review in Section 3.2.

As part of the planning development, the Bunbury Port Access Road Project (BPAR) was identified as a key component and was included in the BORR planning documentation. The BPAR (Willinge Drive) was completed in 2013 and included construction of the BORR Central Section. This project aimed to improve access to Bunbury Port and alleviate traffic pressures and safety concerns particularly on South Western Highway, Robertson Drive and Eelup Rotary. The partial construction of the BORR has provided some early benefits in the short term, through improved access to Bunbury Port. However, it is only part of the ultimate solution and growth across all traffic streams is expected to continue, necessitating the completion of the BORR.

In late 2016 Main Roads WA commenced a planning review for a future South West Freeway (from Mandurah to Busselton) spanning the Forrest and Bussell Highways, with the BORR forming an integral part to this network. This study remains in progress at the time of writing this report. The Forrest and Bussell Highway network forms the primary connection of Perth with Bunbury, Busselton and the broader South West Region; including linking the Ports of Fremantle, Bunbury and the proposed Outer Harbour at Kwinana.

Compatibility of the BORR with the South West Freeway Study is a key consideration in identifying suitable ultimate connectivity surrounding the built-up areas of Bunbury. Recent proposed amendments to land use within the Greater Bunbury area, increasing pressure on parts of the existing network and a requirement to identify a cost-effective solution for the BORR proposal necessitated a review of the planning associated with the Bunbury Outer Ring Road for the northern section. This review is documented in the Main Roads WA report D18#744837 BORR North – Alignment Selection Report (September 2018, Rev 2).

As there were no material changes to the land use planning associated with the BORR Southern Section, there was no planned review of this section and the scope of work for the IPT was to prepare the alignment definition within the GBRS (Red) Alignment.

However, in May 2018 the Commonwealth elevated the conservation status of the Western Ringtail Possum from “vulnerable” to “critically endangered”. This, along with the presence of other Matters of National Environmental Significance (MNES), such as the Black Cockatoo and Black-stripe Minnow, has led to this review of the GBRS (Red) Alignment and an alternative corridor located further to the south and east.

3.2 Literature Review

A literature review of the known key documents that have been prepared by government agencies and consultants over the past 30 years in relation to the BORR project and in particular the BORR Southern Section has been undertaken. This review has primarily focused on the BORR Southern Section, in order to identify and document past decisions around community issues, route selection, environmental constraints and any other pertinent information that should be considered and / or revisited as part of the alignment selection.

The following documents have formed part of the literature review for the BORR Southern Section:

- 1987 Bunbury Region Plan Policy Statement, State Planning Commission Western Australia (1)
- 1995 Bunbury Wellington Region Plan by the Western Australian Planning Commission (2)
- 1995 Assessment by Halpern Glick Maunsell (HGM) comprised of the following three reports:
  - 1995 Bunbury Outer Ring Road Assessment and Impact Identification Report by HGM (3)
  - 1995 Bunbury Outer Ring Road Biological Survey & Environment Impact Assessment by HGM (4)
  - 1995 Bunbury Outer Ring Road Concept Report by HGM (5)
- 1996 Bunbury Outer Ring Road Planning Study – Review and Recommendation Report by MRWA (6)
- 1996 Bunbury Outer Ring Road Gelorup Section, A submission addressing Traffic Issues arising from the Bunbury Outer Ring Road Concept Report – Final Draft, November 1995, by Halpern Glick Maunsell Pty Ltd. Uloth and Associates Pty Ltd on behalf of The Friends of the Gelorup Corridor (7).
- 1996 Submission on Bunbury Outer Ring Road Concept Report. Peter D Web and Associates and The Friends of the Gelorup Corridor (8)
- 1997 Bunbury Outer Ring Road – Comparison of Route Options - Hasties Road to Bussell Highway, Gelorup by ERM Mitchell Mc Cotter (9)
- 1997 Bunbury Basalt as a Basic Raw Material – Preliminary Assessment of possible future sources and requirements by Department of Minerals and Energy / Land Access Unit (10)
- 1999 Shire of Capel Land Use Strategy by the Western Australian Planning Commission (11)
- 2002 Bunbury Outer Ring Road Concept Report by HGM (12)

The full literature review is included in Appendix A with a summary of the key findings with respect to the BORR Southern Section presented below:

- The 1987 The Bunbury Region Plan Policy Statement (1) included the Bunbury Region Plan, September 1986, which was the culmination of public comment and review based on the 1980 draft region plan which made an allowance for the BORR along the current GBRS (Red) Alignment though Gelorup.
- The 1995 Bunbury-Wellington Regional Plan (2), identified the need to complete the Southern Province Transport Strategy by the Department of Transport as this would complement the South West region Road Strategy. The importance of Bunbury as the only Port for the South West and the significance of good road and rail access from all areas. The Bunbury Outer Ring Road was recognised as a high priority including the construction of the haul road within the planned service corridor to eliminate the large numbers of heavy vehicles that would otherwise use local roads to gain access to the port or other major industrial areas. The plan, in Figure 17: Transport Strategy, shows the construction of the Outer Ring road as a single carriageway in <5 years and dual carriageway in <20 years.
- The 1995 The Ring Road Assessment and Impact Identification Report (3) noted, "*none of the previous broad scaled planning studies, which had been reviewed, indicated that the general alignment of the Bunbury Outer Ring Road was inappropriate.*" However, in the actions arising from Stage 1 of the study, it identified the need to broadly examine alternative alignments between North Boyanup Road (now South Western Highway) and Bussell Highway using Centenary Road or an alignment that passes around Gelorup to determine their viability.
- The 1995 The Biological Survey and Environmental impact assessment (4) identified the good condition remnant native vegetation in the Gelorup area road reserve as a significant natural feature. The report proposed environmental mitigation measures associated with the identified areas.
- The 1995 The BORR Concept Report (5) documented the preferred layout of the BORR and port access road and describes the process which led to the preferred layout being chosen. The report reviewed three alternative alignments around Gelorup and one that considered utilising Centenary Road to connect the BORR to Bussell Highway. In respect to the investigation of alternative alignments for Gelorup, the report concluded that, "*As all the alternative alignments will have significant impacts of one form or another and they do not provide any clear advantage over the existing corridor the relocation of the Outer Ring Road cannot be justified.*" With respect to investigation of the Centenary Road alternative this was also discarded due to complexities associated with construction, future land use planning and likely traffic impacting Bussell Highway servicing both local traffic movements in Bunbury and through traffic.
- The 1996 The Bunbury Outer Ring Road Planning Study – Review and Recommendations (6) supports the route selection proposed by the BORR Concept Report (5). The report notes that, "*The Concept Report was released for public comment in November 1995 with the submission period closing in February 1996.*" and that, "*No new issues were raised as a result of the public submissions received which would have altered the Outcome of the Consultants Study.*"
- The 1996 The Uloth and Associates (7) submission on the BORR Concept Report (5) was prepared on behalf of the Friends of the Gelorup Corridor (FOGC). The submission documents a number of community concerns on local traffic and road user impacts from changes to the Gelorup road network and impacts on quality of life from noise and pollution as a result of the preferred BORR alignment. The submission requests identification of the best alignment by

quantifying alternative alignment options benefits and dis-benefits and assessing the options in a full Multi Criteria Assessment instead of the justification provided in the HGM concept report.

- The 1996 The Webb (8) submission on the BORR Concept Report (5) was prepared on behalf of the FOGC. The submission sought MRWA to review the preferred alignment for the BORR through Gelorup to Bussell Highway and to determine an alternate alignment. The submission claimed that the BORR objective, "*to provide a high standard, free flowing route for traffic bypassing Bunbury*" (HGM 1995), would not be met by the preferred alignment because it would be located in a developed area of Bunbury and this community, Gelorup, would be severed. The second objection was on the basis that the HGM (1995) preferred alignment would become obsolete, and "*be a temporary measure that will eventually be replaced by an alternative outer route*". The report raised a number of concerns around safety, severance, conflict of land use, responses from Ministers and Governments and economic feasibility.
- The 1997 The ERM Mitchell Mc Cotter report (9), undertook a further review of alternative alignments for the Gelorup section of the BORR as a result of the Gelorup communities appeals to the local Members of Parliament. Consequently the Minister for Transport agreed to undertake a review and MRWA commissioned ERM Mitchell Mc Cotter to undertake this investigation. The report investigated similar routes to the HGM report (5) and one route proposed by the Gelorup community. The multi criteria assessment highlighted the advantage of the existing route over the other alternatives.
- The 1997 Bunbury Basalt as a Basic Raw Material (10). This report identified the importance of the basalt resources in the area.
- The 1999 Shire of Capel Land Use Strategy by the Western Australian Planning Commission (11). This document provided a clear indication to future landowners about the guidelines for land use and subdivision which apply in the Shire of Capel, including the areas of Gelorup/Dalyellup.
- The 2002 Bunbury Outer Ring Road Concept Report (12), this report documents the further development of the BORR route and interchange forms.

3.3 Regional Planning – Federal Government

Through the Department of Infrastructure and Regional Development, Infrastructure Australia, and the Transport and Infrastructure Council, the federal government aims to develop policy, plans and deliver national reforms to improve the efficiency and productivity of Australia's nationally significant infrastructure and transport systems. These bodies have released a number of documents setting priorities and identifying the strategic national land transport corridors and freight routes connecting Australia's nationally significant places. These places include the Bunbury Port, Perth, the South West of Western Australia as well as the Wheatbelt and surrounding regions. These documents help to guide and inform planning and investment decisions, particularly those that involve federal funding.

3.3.1 National Infrastructure Priorities Infrastructure for an economically, socially, and environmentally sustainable future (Infrastructure Australia, 2009)

Infrastructure Australia (13) developed 7 priorities to ensure an economic, social and environmentally sustainable future. These themes provide a framework for action to meet the gaps, deficiencies and bottlenecks in the nation's infrastructure to improve international competitiveness and boost productivity. Relevant priorities include:

- Transforming our cities
- National freight network
- Competitive international gateways

3.3.2 National Ports Strategy (Infrastructure Australia / National Transport Commission, 2011)

The National Ports Strategy (14) presents a national ports strategy for Australia, aiming to improve the efficiency of port related freight movement across infrastructure networks. The BORR Project is consistent with this and will improve access to the Port of Bunbury through appropriate long term freight corridors. The state and national strategic significance of the Bunbury Port is under further consideration as part of the Westport Taskforce deliberations (in progress at the time of writing this report).

3.3.3 National Land Freight Strategy (Standing Council on Transport and Infrastructure, 2012)

The National Land Freight Strategy (15) is a national strategy to drive efficient and sustainable freight logistics and to improve economic, social and safety outcomes for freight logistics. It identifies National Key Freight Routes associated with the BORR Project including:

- Forrest Highway
- South Western Highway (to the northeast and southeast of Bunbury)
- Coalfields Highway
- Bussell Highway

3.3.4 National Land Transport Act 2014

The National Land Transport Act (NLT Act) (16) provides funding for projects related to land transport matters, and for related purposes. The objective is to assist national and regional economic and social development by the provision of Federal funding aimed at improving the performance of land transport infrastructure. The BORR Project is consistent with the NLT Act and comprises sections of the National Land Transport Network including:

- Forrest Highway
- Willinge Drive (Port Access Road)

3.3.5 Australian Infrastructure Plan (Infrastructure Australia, 2016)

The Australian Infrastructure Plan (17) sets out 78 recommendations for infrastructure reform to drive productivity growth, maintain and enhance our standard of living, and ensure our cities remain world class. The BORR Project is consistent with the plan's regional strategy to "Maximise opportunities for growth in productive regional economies and support sustainable regional communities." Bunbury is identified as being one of the top 4 major regional centres in WA in 2031 with a projected gross regional product of $13bn. The BORR project will improve access to and around Bunbury and support economic growth through improved freight productivity and efficiency.

3.3.6 Infrastructure priority List (Infrastructure Australia, 2018)

In 2018, Infrastructure Australia confirmed the Bunbury Outer Ring Road (BORR) Project on its "*Infrastructure Priority List*" (18) addressing "*National Connectivity*". This BORR project is recognised by infrastructure Australia as a "*Nationally Significant Investment*". The project infrastructure will form part of the national freight network, improving the efficiency of movement of freight and commercial vehicles in the State's southwest. It will facilitate growth in international trade through Bunbury Port in mineral and agricultural exports.

3.4 Regional Planning – State Government

3.4.1 The Greater Bunbury Region Scheme

The Greater Bunbury Region Scheme (GBRS) has been in operation since November 2007 and provides the basis for land use planning in the Greater Bunbury region. This region stretches from Lake Preston in the north, Peppermint Grove Beach in the south, eastwards to Darling Scarp, and covers the City of Bunbury and the Shires of Harvey, Dardanup and Capel. The scheme's purpose is to ensure that there is an adequate supply of commercial, residential and industrial land as well as conserving key environmental features to provide future growth. To plan for changing needs, the Greater Bunbury Region Scheme map is amended from time to time. Figure 3 shows the current GBRS plan within the Study Area.

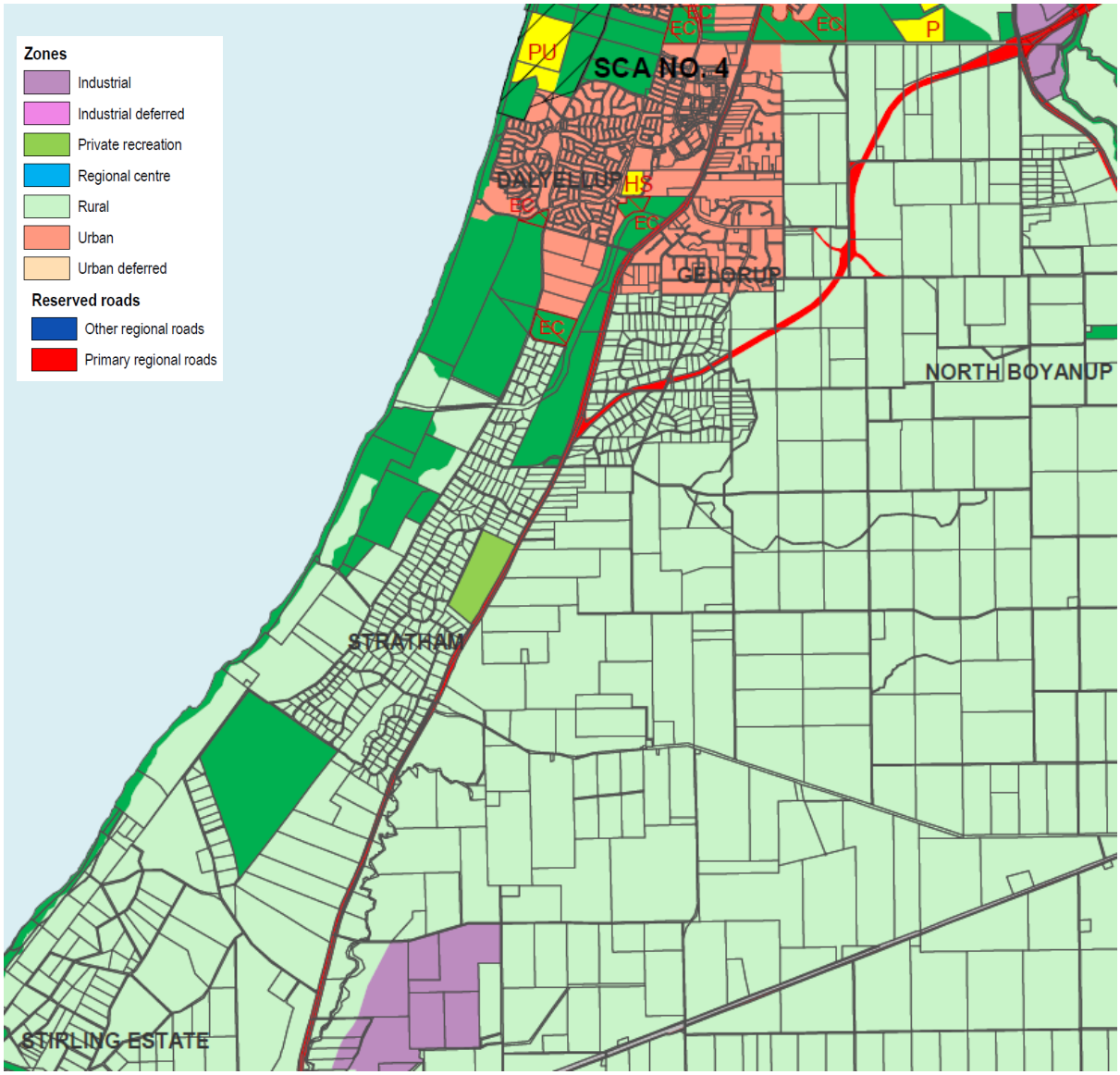


Figure 3: Greater Bunbury Regional Scheme (GBRS) 2018 amendment

3.4.2 South-West Framework (2009 by WAPC)

The South-West Framework (19) is a broad planning blueprint to guide the development of the South West region over the next 20 years. It provides a strategic view of the region's future, focusing on its major challenges and opportunities to ensure growth and development are achieved.

The framework identifies that, the South-West has the most diversified economy of all the State's nine regions, contributing to the region's strong economic growth. Key industries include:

- Agriculture and horticulture
- Timber and forest products
- Mineral extraction
- Processing and manufacturing
- Retail
- Tourism
- Construction
- Fishing and aquaculture

The vision is for a region that generates high standards of social amenity, diverse economic activities and high quality food, while preserving and enhancing the natural environment.

3.4.3 Western Australian Regional Freight Transport Network Plan (2012 Department of Transport)

The Western Australian Regional Freight Transport Network Plan (20) sets out the WA state government's commitments and priorities for upgrade and expansion of the WA regional freight transport. The Western Australian Regional Freight Transport Network Plan is a strategic guide for the sustainable use and development of land throughout the State.

This plan identifies the strategic long-term planning, policy and project priorities required to facilitate growth and ensure optimal network performance for the Western Australian regional freight network to 2031. This plan was prepared prior to the construction of BORR Central section (completed May 2013) indicating this project as 'funded'.

The plan provided a series of Project Investment Priorities which included the completion of BORR South and North sections over the period beyond 2015.

Relevant priorities from this plan are summarised in the table below:

Table 1: WA Regional Freight Plan Priorities for South West Region

Priorities	Reference
Interlinking projects to better connect South West industry to bulk ports at Bunbury and Kwinana, unlock capacity at the port of Bunbury, manage the Greater Bunbury Area's increasing freight circulation task, and upgrade east-west transport links to freight growth areas such as Collie [and the Wheatbelt].	Western Australian Regional Freight Transport Network Plan Page 12
Direction 10: Improve landside access to regional port authority ports.	Western Australian Regional Freight Transport

Priorities	Reference
Bunbury Port: Complete the Bunbury Port Access Road and Bunbury Outer Ring Road.	Network Plan page 54
Direction 11: Alleviate the impact of heavy freight movements on regional centres. Population growth across the South West region, together with strong underlying tourism activity, point to the need to complete the Bunbury Outer Ring Road. The road will be a four-lane dual carriageway with the capacity to be upgraded to freeway status in the long term. Once completed, the project will also provide an effective bypass of Bunbury for inter-regional traffic.	Western Australian Regional Freight Transport Network Plan page 55

3.4.4 The Greater Bunbury Strategy 2013, Final Report (December 2013 by WAPC)

The Greater Bunbury Strategy (21) provides guidance on land use planning and infrastructure delivery to support a population growth from 83,600 (2011 census) to over 150,000 people, adequate for the short, medium and long terms. The strategy's vision is for an *'attractive, compact and well-connected city'*.

Key infrastructure challenges identified in the strategy include:

- Protect and facilitate access to the Bunbury Port for direct access to international markets.
- Identify and facilitate appropriate opportunities for road and rail freight movement.
- Support the development of the Perth-Bunbury Fast Passenger Rail Service, with a station in the Bunbury CBD.

Figure 4 presents the "Greater Bunbury Sub-Regional Structure Plan 2013" which identifies a number of elements that are relevant to the BORR Southern Section planning including:

- Identification of an environmental area / corridor of significance between the GBRS corridor and South Western Highway.
- Identification of "Investigation Area" for urban expansion in the southeast corner of Gelorup bounded by BORR and in the rural zoned area immediately north of the existing Stratham development on the west side of the BORR / Bussell Highway tie-in location.
- GBRS (Red) Alignment passes through land zoned as rural (outside the GBRS Primary Regional Road reserve).
- Alternative (Green) Corridor passes through land zoned as rural and an environmental significant area / corridor.

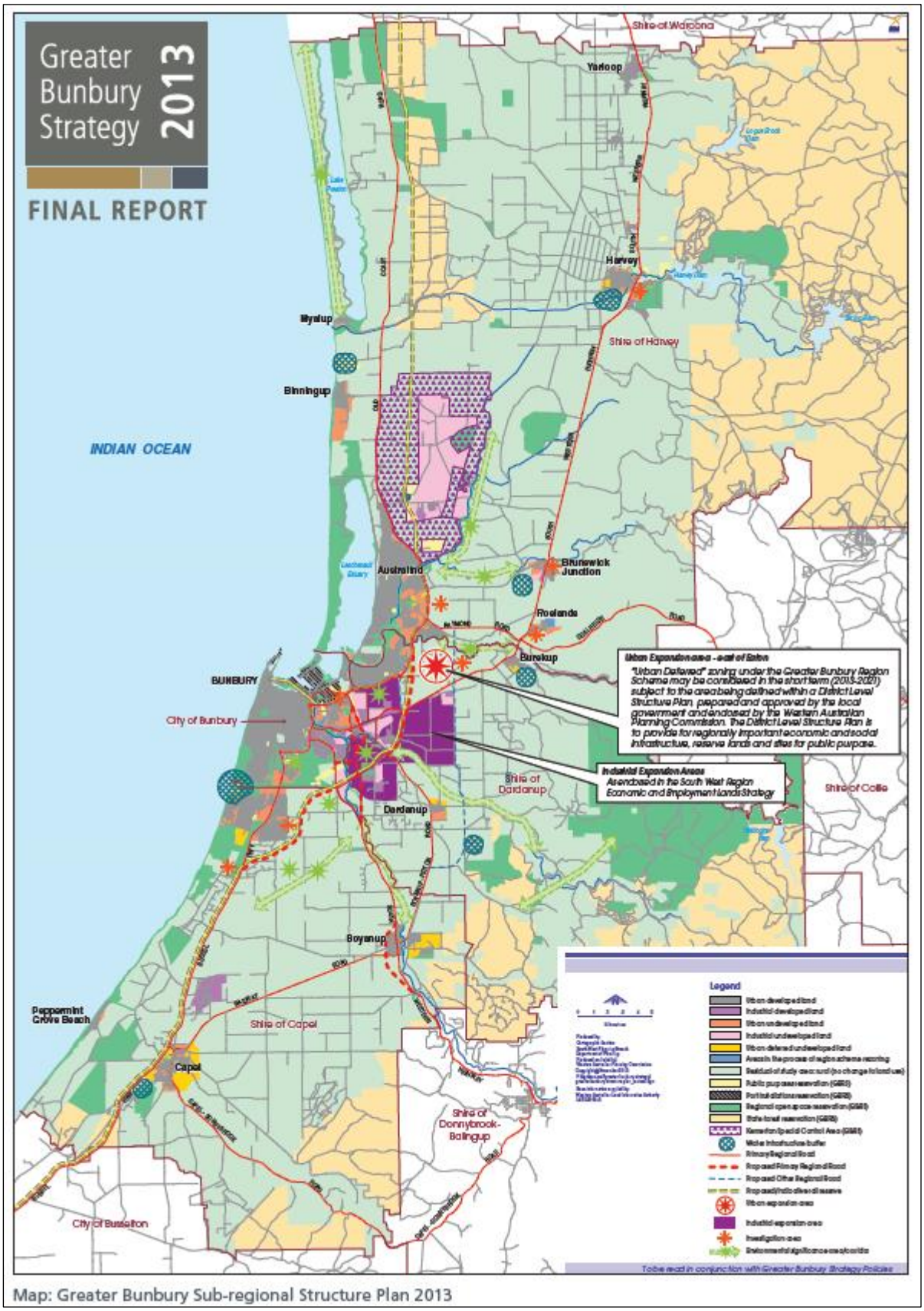


Figure 4: Greater Bunbury Strategy 2013

3.4.5 South West Region Economic and Employment Land Strategy (2014, WAPC)

This Strategy's (22) objective is to ensure optimum supply of suitable industrial land (heavy, special, general and light) that addresses the current and future needs of the South West region and supports economic growth. The strategy identifies key areas for expansion or new industrial activity and looks at existing and future infrastructure requirements to support this land development.

3.4.6 South West Regional Blueprint (2014 South West Development Commission and Regional Development Australia – South West)

The South West Development Commission (SWDC) and Regional Development Australia – South West (RDASW) have jointly developed the Blueprint to provide the best possible advice to both State and Commonwealth governments on the strategic imperatives of the region.

The strategic framework for the Blueprint includes four overarching imperatives for the South West region. These imperatives are:

- Infrastructure
- Industry and Business
- People and Place
- Community

The blueprint highlights the importance of completing the BORR to realise the full potential.

3.4.7 South West Regional Planning and Infrastructure Framework Part A: Regional Strategic Planning (2015 WAPC)

For transport and infrastructure, this Framework (23) identifies 11 infrastructure needs for the region. The following are those directly related to this study:

- A high standard of road links connecting Bunbury to the South West region as a whole.
- Improved access to the Bunbury Port through completion of the Port Access Road and the Bunbury Outer Ring Road.
- Expansion of the Bunbury Port including the diversion of the Preston River.

3.4.8 South West Regional Planning and Infrastructure Framework Part B: Regional Infrastructure Planning (2015 WAPC)

This Framework (24) aligns generally with the Regional Investment Blueprint (25) and identifies completion of the BORR as an objective of the framework.

3.4.9 Westport – What have you told us (2018 Westport Task Force)

The Westport taskforce released the "Westport – What have you told us" document in 2018 outlining feedback obtained through a public consultation process including:

"*The Westport Taskforce was established in September 2017 to develop a long-term integrated solution to meet the freight, logistics and trade needs of Perth and the surrounding regions…. The Taskforce will provide guidance to the Western Australian Government on the planning, development and growth of the Port of Fremantle at the Inner and Outer Harbours, the required rail and road networks, supporting industrial land and intermodal terminals and the potential for the Port of Bunbury to contribute to the handling of the growing trade task.*"

Inclusion of the Bunbury Port as part of these assessments confirm its strategic importance and the requirement for efficient transport links between Bunbury and Fremantle in the short to medium term

and the proposed Kwinana Outer Harbour in the long term. Additionally, access from the South West from Bussell Highway onto the BORR and to the port is also key for the resources that access the port from this part of the region.

It is understood the Taskforce will report their findings in 2019.

3.5 Existing Road Network

Figure 5 shows the existing road hierarchy in the BORR Southern Section study area. The five Primary Distributor routes (light blue) from Bunbury town centre include Forrest Highway, South Western Highway (North), Boyanup Picton Road, South Western Highway (South) and Bussell Highway. Other routes that form part of the Primary Distributor network include:

- BORR Central
- Willinge Drive (including a small section of Estuary Drive) which connects to Bunbury Port
- Railway Road
- Robertson Drive which connects to the southern end of Forrest Highway and the northern end of Bussell Highway and forms the main through route for traffic currently bypassing Bunbury

All Primary Distributor roads are also part of the State Road network under the care, control and management of Main Roads WA.

Within the extents of the Study Area the Bussell Highway, Robertson Drive, South Western Highway and Willinge Drive form part of the National Key Freight Network (Department of Infrastructure and Regional Development), recognising their importance as links contributing to local and national economic success.

The state road network presently carries a mix of freight, regional, local and tourist traffic with no separation of traffic streams. Freight movements vary widely given the broad range of industries and user groups accessing both the Bunbury Port, various industrial and commercial areas, agricultural areas and locations further afield. These movements broadly originate from the local area, greater South West Region, Wheatbelt Region as well as other parts of Western Australia. These freight routes also incorporate a number of at grade rail crossings, and intersections where speed limits have been reduced (largely for safety reasons) impacting on the overall network efficiency. A combination of these factors result in increased costs for local and global operators and industry as well as a detrimental impact on safety and amenity for the local community using these routes.

Figure 5: Existing Road Hierarchy

The speed limit in the study area varies significantly, as shown in Figure 6. Generally, the Primary Distributor roads in the project peripheries have a speed limit of 100 km/h or 110 km/h. Through the built-up areas the speed limits progressively drop to 80km/h, and two short segments of 60 km/h along Robertson Drive near the Eelup Rotary and at the roundabout with Bussell Highway. Roads through the built-up area of Bunbury with short sections of speed change generally correspond with signalised intersections and/or rail crossings. It is envisaged that with increasing urban and industrial development pressures surrounding Greater Bunbury as well as increasing freight demands, safety and efficiency pressures on the road network will continue to increase.

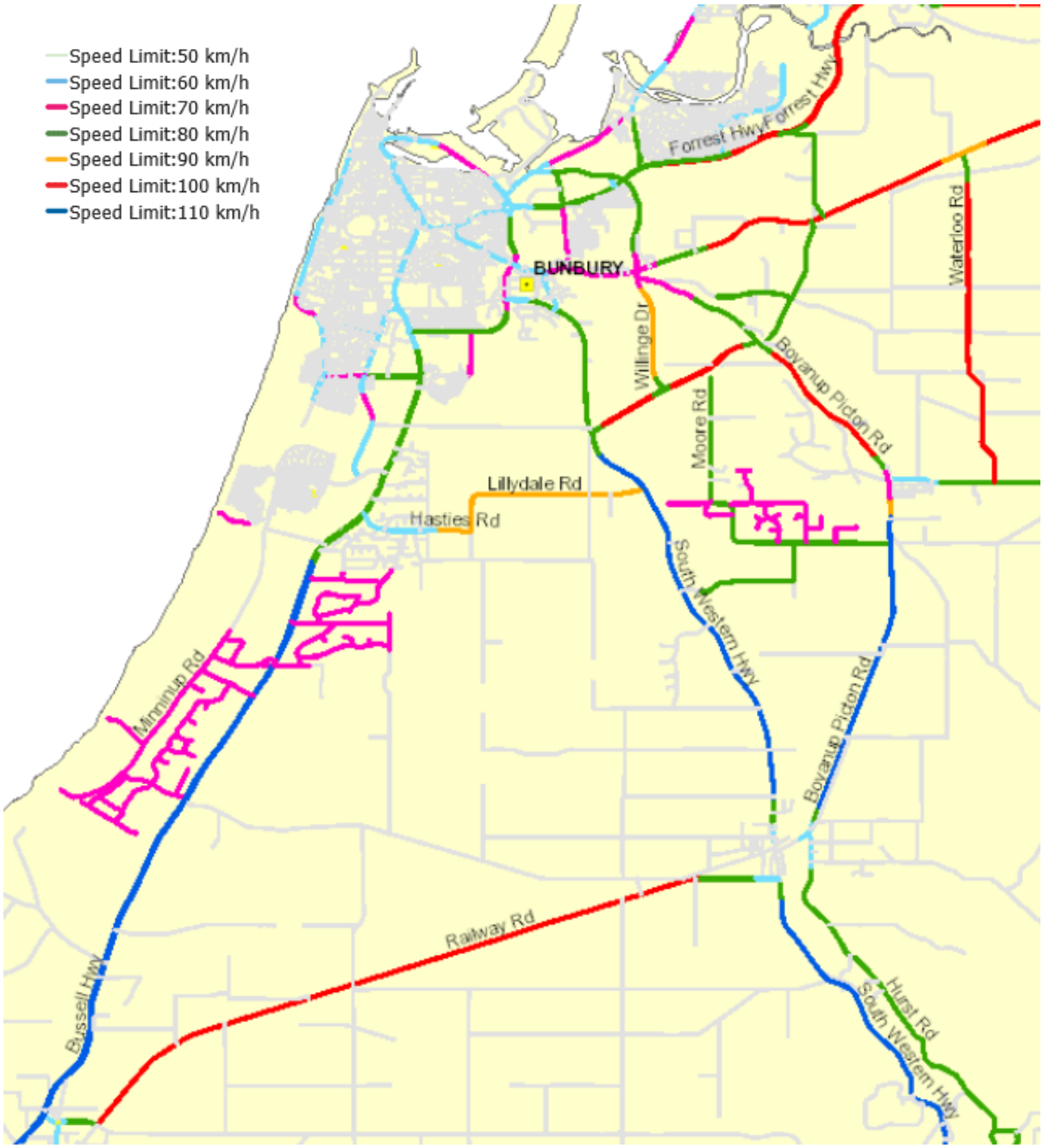


Figure 6: Existing Speed Limits

3.6 Planned Road Network

A number of the changes to the road network have been identified over the years in and around Bunbury given increases in traffic, urban and industrial development, agriculture and mining as well as a number of other aspects. Planned significant changes to the road network provided for in the GBRS include the following:

- Extension of Eaton Drive north to Treendale including a bridge over the Collie River. Complete and opened to traffic in 2018.

- BORR Central Section and first Stage of the Port Access Road. Completed and opened to traffic in 2013.
- Grade separations along Forrest Highway. Long term planning (unfunded).
- Widening and upgrades of Forrest Highway, Bussell Highway and South Western Highway. Long term planning (unfunded)
- Grade separation of the Port Access Road at the rail/South Western Highway intersection (including realignment through Picton referred to as the Ultimate Bunbury Port Access Road). Long term planning (unfunded).
- Grade separation of the South Western Highway with the rail to the Bunbury Port (including realignment through Picton referred to as the "Picton Deviation"). Long term planning (unfunded).

Other network amendments associated with the growth of the South West region are:

- Led by the Department of Planning, Lands and Heritage (DPLH), the establishment of Wanju urban and Waterloo industrial developments and the traffic generated in the medium / long term will have a significant impact on the Bunbury road network. Inter-agency coordination of the associated local network, considerations and options for the Primary Distributor network and overall land use and transport planning will continue. Short to medium term planning while these developments are established (long term planning for the ultimate land use scenario).
- Planning for a future "South West Freeway" providing an overarching strategy for future grade separation along Forrest Highway and Bussell Highway to the north and south of the BORR tie in locations. Long term planning (unfunded).

3.7 Restricted Access Vehicle (RAV) Network

Figure 7 shows the existing restricted access vehicle (RAV) network in the study area. Forrest Highway, South Western Highway (North), Willinge Drive / PAR, Raymond Road, Leschenault Drive, Moore Road and the northern section of Robertson Drive are part of the RAV 7 network, which allows for vehicles up to 36.5 m length.

Other major arterial roads in the BORR South Study area include Bussell Highway, Lillydale Road, Hasties Road and Railway Road are part of the RAV 4 network, which allows for vehicles up to 27.5 m.

Boyanup Road West, Fishermans Road and Calinup Road are part of the RAV 3 network, which allows for vehicles up to 27.5 m length but to lower weight limits associated with RAV 4 networks.

Planning for the BORR will seek to accommodate the larger combinations on the BORR to enable access to planned industrial precincts as well as Bunbury port. The planning will also consider the extension of the RAV 7 network down to Busselton, however, this is dependent on the construction of a Road Train Assembly area north of Busselton.

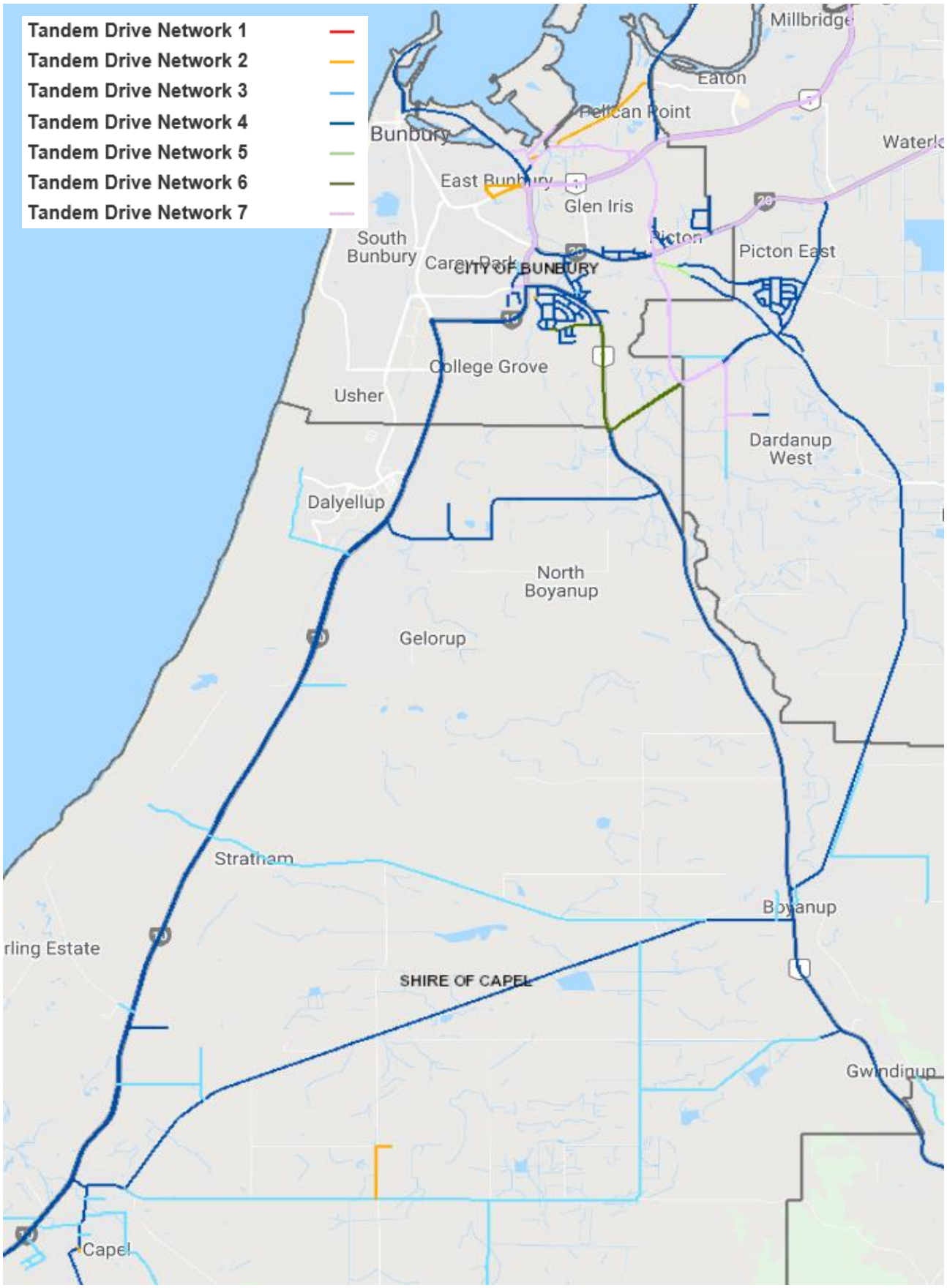


Figure 7: Existing RAV Network

3.8 Public Transport Network

3.8.1 Bunbury Bus Services

Through their TransBunbury brand, the Public Transport Authority (PTA) operates a total of 12 town bus routes between Bunbury and surrounding suburbs (such as Dalyellup, College Grove, Glen Iris, Eaton and Australind), as well as multiple school special services connecting students with local schools. Most bus routes operate during daylight hours on Monday through to Saturday, with a limited number of services operating on Thursday nights and Sundays. As of July 2018, none of the town bus services and only one school special service (Route 786) crosses the GBRS (Red) Alignment, at the southern section via Banksia Road and Woods Road in Gelorup.

Through this network there is a reasonable service provision of buses. Bus frequencies vary by time of day and route. There are multiple routes along a number of corridors helping to service similar centres which helps increase frequencies and opportunities along these routes. Bus frequencies on particular routes are generally 30 minutes to 1 hour depending on time of day. Where there are multiple routes servicing a single bus stop frequencies below 10 minutes can be expected in peak hours.

A number of school bus services use the Greater Bunbury road network with a number travelling to adjoining areas including Harvey, Brunswick Junction, Boyanup, Donnybrook (and further afield), Busselton and other locations within the South West Region. These services link communities to a broad range of schools in the Bunbury area and typically utilise various routes including the South Western Highway (north and south), Forrest Highway, Bussell Highway, various other regional and local roads as well as the Bunbury road network.

The proposed development of a high density population centre proposed through a number of Draft District Structure Plan amendments to the GBRS is seen as a means of generating concentrated long term demand from which sustainable public transport and non-motorised transport modes will develop. An increase in density of existing urban areas such as Eaton and within the City of Bunbury will also promote demand for public transport.

3.8.2 Regional Bus Services

Transwa and South West Coach Lines operate a number of intercity coach routes between Perth and various towns in the South West region via Bunbury. Each week, around 50 coach services pass through Bunbury in both directions, primarily using Forrest Highway, Old Coast Road and Bussell Highway to get to the Bunbury city centre or Bunbury Terminal on Picton Road.

3.8.3 Passenger Rail

The BORR will not impact the twice-daily Australind train service (which runs roughly parallel to the northern section of South Western Highway), as a grade-separated crossing of the railway and the South Western Highway (North) will be provided.

The PTA has commissioned a number of studies over the last ten years in relation to a future fast rail service between Perth and Bunbury (Public Transport Authority, Perth to Bunbury Fast Train Feasibility Study Final Report, GHD, November 2013 (26)). This would likely replace the existing Australind train service and run on a new track alignment roughly parallel to Forrest Highway. Although details of the alignment and timing for construction have not yet been finalised.

As the fast train infrastructure is currently unfunded and the timing may be close to the end of the planning horizon for the BORR. The following constraints and provisions for the future fast rail have been made:

- At the northern interchange of Forrest Highway and the BORR consideration and allowance for the rail to deviate to follow Forrest Highway on the west side or median.
- South of the northern interchange along the BORR alignment, no provision for any rail within the BORR road reserve has been made.
- Rail along Forrest highway reserve into Bunbury.

This approach is consistent with the Integrated Transport Strategy Framework for Greater Bunbury Sub-region report (27).

Whilst no formal planning has been undertaken for a future passenger rail service south of Bunbury, planning for the BORR should not preclude its possible provision at some point in the future. Initial consultation with the PTA suggested planning for this future rail route is not a current priority.

Future work on coordinating rail with surrounding land uses may also consider the Integrated Transport Strategy Framework for Greater Bunbury Sub-region report (27), which proposed Bus Rapid Transit (BRT) routes connecting Bunbury to the outer suburbs within the Greater Bunbury. The proposed routes have minimal interface with the Study Area.

3.9 Freight Rail

The South West region is generally dominated by road vehicular transport. The coverage of freight rail has contracted over the past 30 years and has been concentrated into high volume activities largely related to mining and/or processing. Freight rail to the south of Bunbury has remained dormant for in excess of 15 years. At the time of preparing this report, it is unclear whether this rail network will be utilised again given the potential cost of upgrade and commissioning.

The existing freight network to the north consists of a single track with connections to the north (Perth) and east to Collie departing at the Brunswick Junction town site. The rail reservation is owned by the State Government (administered through PTA) with a lease of the rail reservation by ARC Infrastructure (formerly Brookfield Rail). The single line network to the north of the Bunbury Port is operating at or near capacity and carries a significant portion of import/export commodities associated with the Bunbury Port. The single line network to the north of Bunbury is shared with the Australind passenger rail service. It is understood this single freight rail line is planned to be duplicated in the future to enable greater volumes of product to be transported to/from the Bunbury port. There are currently no timeframes available for such a rail duplication.

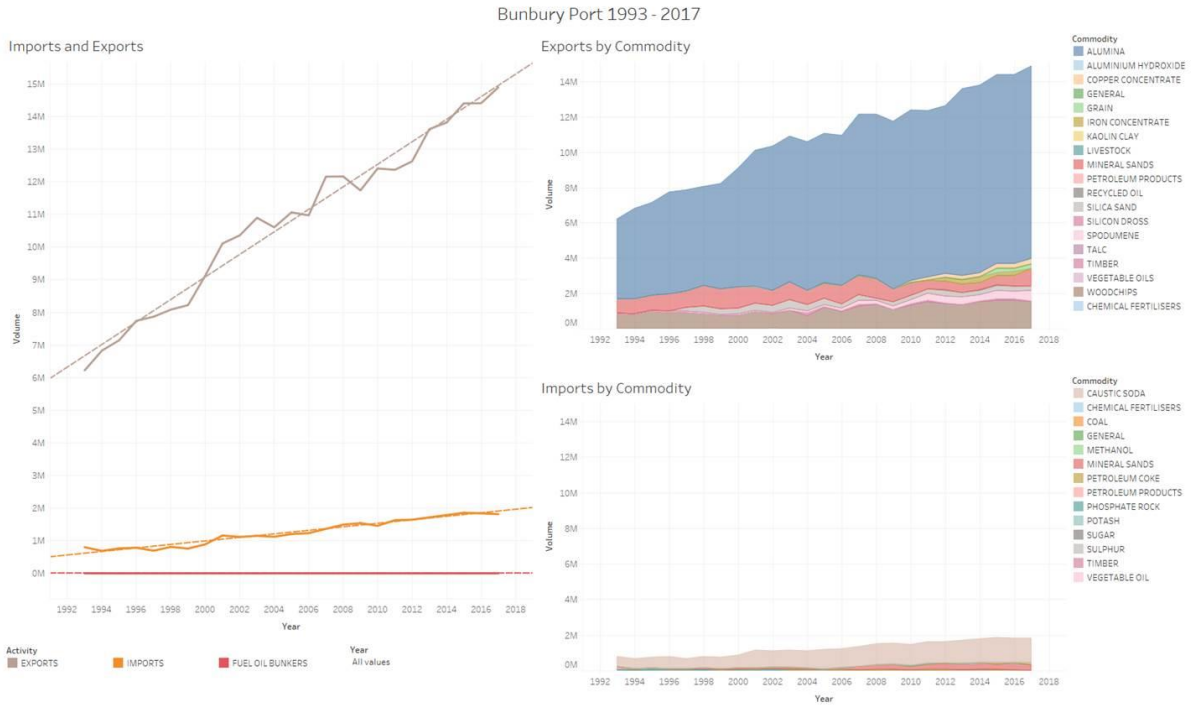
3.10 Bunbury Port

The Bunbury Port is a pivot point for world-wide distribution of products from the South West to a number of international destinations. Freight rail and road links including the Port Access Road enable the port to capitalise on cargo throughput including mining, manufacturing, agricultural and pastoral products. The major commodities that the port caters for are alumina, mineral sands, woodchips, caustic soda and silica sand. The main produces transported through the Bunbury Port are included in Figure 8 below (obtained from the Trade Statistics and Port Information, Bunbury Port Authority).

Bunbury Port is one of the world's major alumina ports exporting around 10.9 million tonnes or 12% of the world's alumina exports. There is increasing interest in lithium with the world's largest and highest grade resource mined by Talison at Greenbushes. This produce (spodumene) is exported through the Bunbury Port with further interest in this resource highlighted by Albemarle looking to establish processing facilities in the Bunbury area (Kemerton Strategic Industrial Area just north of Bunbury). Establishment of these processing facilities has the potential to significantly increase spodumene exports through the Bunbury Port. Bunge has also in recent years commenced exporting

grain through the Bunbury Port with a potential for exports to increase (season dependant). Much of this produce originates in the Wheatbelt and is transported by truck to the Port (via Coalfields Highway as well as several other east-west linkages surrounding Greater Bunbury). Growth in freight into/out of Bunbury Port is forecast to double from 2012 to 2030 (20).

Southern Ports (established in October 2014 following the merger of the Albany, Bunbury and Esperance Port Authorities) have confirmed that the port currently contains eight main berths, has five bulk mineral ship-loaders and can handle a range of bulk liquids (including fuel bunkering facilities). A number of plans have been developed for the Port to undergo expansion. However, the port expansion may be dependent on a number of key aspects including the duplication of the rail line to the north of Bunbury, realignment of the Preston River and the possible closure of Estuary Drive (which will result in significant traffic impacts to Forrest Highway). Southern Ports are in the process of reviewing and updating these port expansion plans and the associated works required to facilitate this.



Total exports breakdown (tonnes)

	2012	2013	2014	2015	2016	2017
ALUMINA	9,496,531	10,589,634	10,658,408	10,696,295	10,721,303	10,933,102
COPPER CONCENTRATE	215,846	228,362	189,236	256,430	245,755	263,225
GENERAL	33,972	20,051	27,821	26,122	27,927	29,036
GRAIN	0	0	0	244,889	154,640	273,849
IRON CONCENTRATE	193,654	254,168	318,550	182,110	248,722	0
MINERAL SANDS	486,812	461,353	423,246	515,705	592,175	960,885
PETROLEUM PRODUCTS	3,921	2,794	0	0	0	12,789
RECYCLED OIL	19,365	23,670	27,388	26,718	25,601	0
SILICA SAND	350,220	235,657	255,864	303,369	273,586	273,474
SPODUMENE	396,928	420,925	344,200	482,755	449,299	579,531
TIMBER	42,567	8,597	67,154	64,558	67,765	26,088
WOODCHIPS	1,389,988	1,370,648	1,506,607	1,606,760	1,602,058	1,543,783
Grand Total	12,629,804	13,615,859	13,818,474	14,405,711	14,408,831	14,895,762

Figure 8: Bunbury Port Exports[1]

[1] Southern Ports Albany Bunbury Esperance, Annual Reports 2016 and 2017

4 TRAFFIC AND SAFETY ASSESSMENT

4.1 Safety Assessment / Crash Report

The existing regional route through Bunbury contains the top five crash sites in the Bunbury Region. This includes the Hynes Road / Forrest Highway intersection as well as the Harewoods Rd / Bussell Highway intersection, which have had 6 and 4 killed and serious injury (**KSI**) crashes respectively between 2013 and 2017.

Table 2 displays the total count of crash statistics within the Bunbury region between 2013 and 2017.

Table 2: Crash statistics from 2013 to 2017

Severity	Count
Fatal	41
Hospital	270
Medical	517
PDO Major	2,177
PDO Minor	981
Total	3,986

Freight vehicles have been identified as having a significant influence in vehicle crashes within the Bunbury region as shown Table 3.

Table 3: High severity crash incidents along Bunbury's main freight routes

Vehicle Type	Count	%
Passenger Vehicle	70	81.4
Motorbike	19	22.1
Truck	12	14.0
Pedestrian	4	4.7
Bicycle	4	1.7
Bus	1	1.2
Total No.	86	

Based on short term traffic counts, heavy vehicle volumes typically range from 5 - 22 % of the total traffic volume, with a mean of approximately 13%, with these vehicles accounting for 14% of all fatal and hospitalised crashes that occurred along Bunbury's main freight routes within the past five years. The risk associated with freight vehicles is reinforced by crash statistics which indicate that a crash

involving a freight vehicle is approximately 1.5 times more likely to be a severe crash leading to hospitalisation or death.

Multiple vehicle crashes have the potential to be reduced with the construction of the BORR due to their correlation with road design and more broadly, road safety. Single vehicle crash incidents have a much lower association with road design as many of these incidents are caused by issues independent to the road, such as driver fatigue. Figure 9 shows that almost 85% of all crash incidents within the investigated area involve multiple vehicles and hence have a strong potential to be reduced.

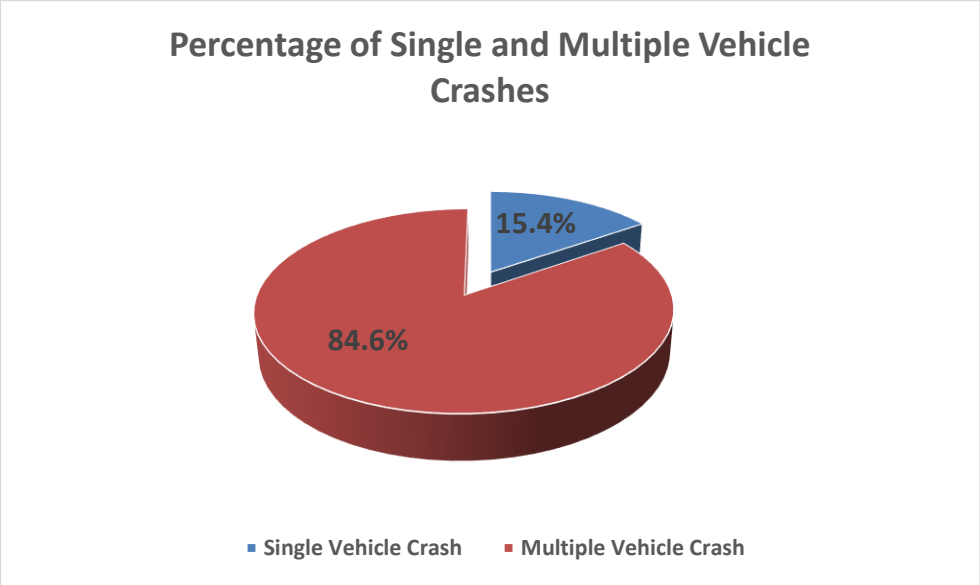


Figure 9: Percentage of Single and Multiple Vehicle crashes

Focussing on the Study Area all the intersections are within the Shire of Capel. The intersection crash ranking of the top 10 intersections by cost for the Shire of Capel on the state road network are shown in Table 4 for the 5 year period to 2017.

Table 4: Top 10 intersection crash costs

Rank	Int. ID	Street 1	Street 2	Authority	Frequency	Cost
244	75557	BUSSELL HWY	TUART DR	CAPEL	7	$2,460,970
260	11239	BUSSELL HWY	HAREWOODS RD	CAPEL	11	$2,388,660
912	116561	BUSSELL HWY	NORTON PROM	CAPEL	30	$1,059,717
991	76326	BUSSELL HWY	CAPEL DR	CAPEL	7	$970,485
1030	1327	BUSSELL HWY	HASTIE RD	CAPEL	8	$946,538
1895	66534	BOYANUP - CA	ELGIN RD	CAPEL	3	$505,287
1950	11238	BUSSELL HWY	SHEOAK ST	CAPEL	2	$485,035
2238	76896	BUSSELL HWY	SPURR ST	CAPEL	4	$411,308
2371	13698	BUSSELL HWY	LORETTA AV	CAPEL	3	$399,215
2650	11243	BUSSELL HWY	JAYMON RD	CAPEL	2	$336,858

The following intersections, all on Bussell Highway, identified in Table 4 should, with the diversion of traffic from Bussell Highway onto the BORR, experience safety benefits as a result of a reduction in mainline traffic through the intersections.

- Harewoods Road
- Norton Promenade
- Hasties Road
- Sheoak Street
- Loretta Avenue
- Jaymon Road (Closed in the Ultimate)

4.2 Current Traffic Demand (including freight)

General traffic volumes, Figure 10 and

Figure 11 on Bussell Highway and Forrest Highway respectively, grew significantly in the period leading up to 2012. However, they have in general terms not experienced the same level of significant growth since that time.

Traffic delay and restrictions in efficiency has increased through a combination of gradually expanding urban development and road network changes that generally include traffic controls at intersections that reduce travel speed. These network configuration changes can be triggered by either urban development or road network safety performance issues, resulting in a reduction in the level of service. Road users are typically experiencing increased delays in travel time through the Bunbury built up area.

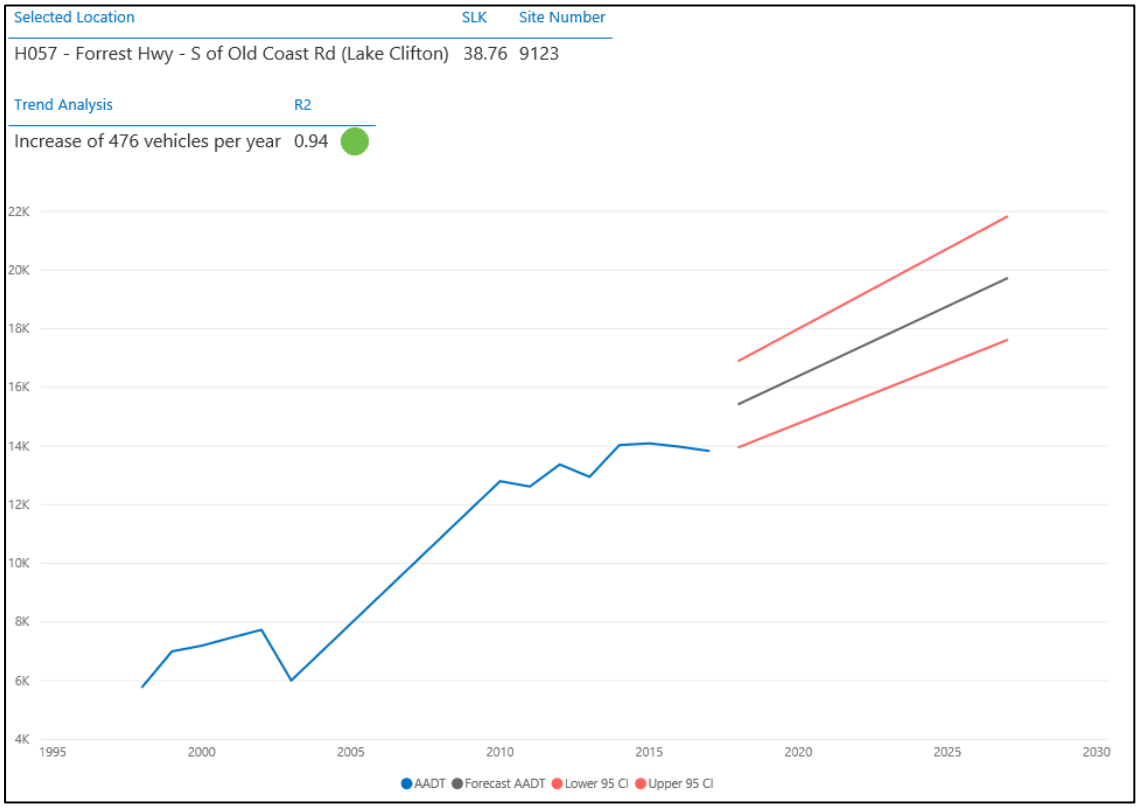


Figure 10: General regional traffic growth on Bussell Highway (North of Greater Bunbury)

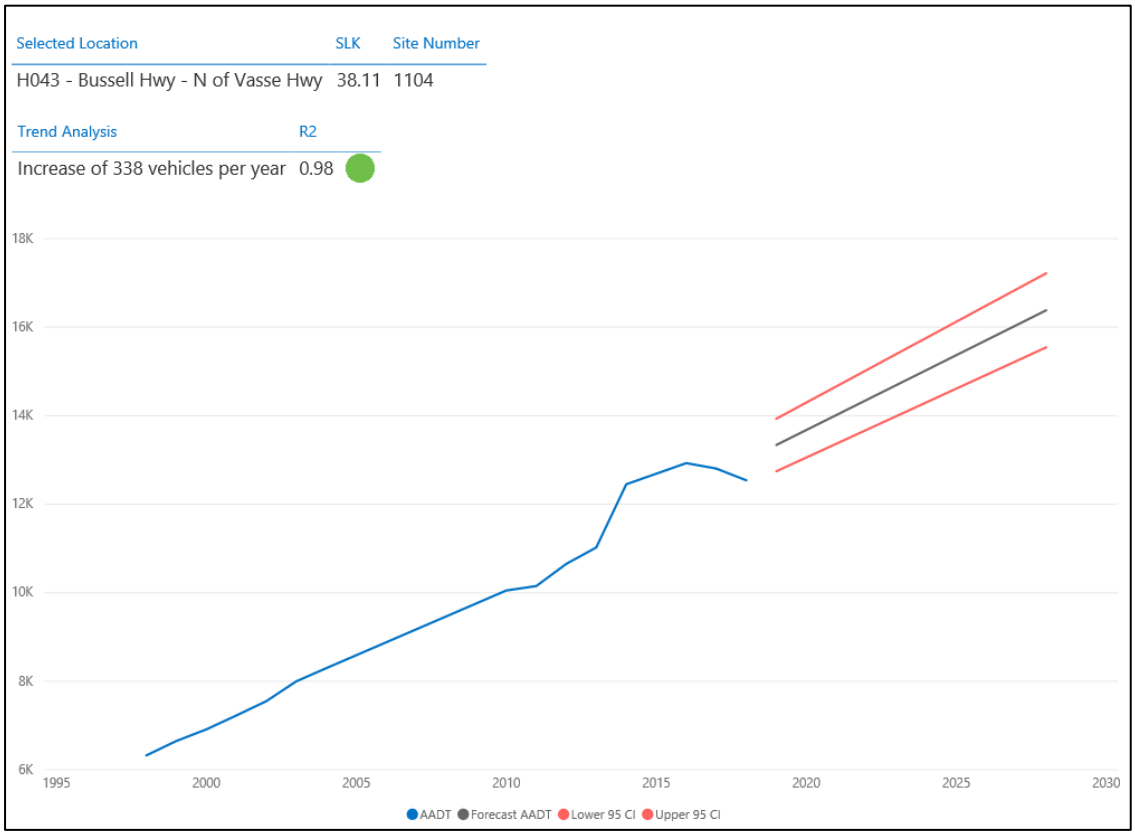


Figure 11: General regional traffic growth on Forrest Highway (South of Greater Bunbury)

Existing traffic volumes and heavy vehicle[2] composition in the project study area are shown in Figure 12 and Figure 13 respectively. The existing north-south through route along Forrest Highway, Robertson Drive and Bussell Highway currently services a demand of up to 30,000 vehicles per day (vpd) through the centre of Bunbury, with heavy vehicle composition ranging from 7 to 15%.

At the northern and southern extents of the BORR, Forrest Highway services around 20,000 vpd, and Bussell Highway services around 15,000 vpd respectively. The existing section of the BORR Central Section currently services up to 3,500 vpd, with 25% heavy vehicles equating to around 625 heavy vehicle movements each day. Willinge Drive services 2,100 vpd, with a 29% heavy vehicle composition which equates to around 600 heavy vehicle movements each day.

There are a number of alternative routes through and around Bunbury which may influence some of the traffic volume observations within Bunbury, particularly following the completion of the BORR Central Section in 2013. Discussion with Local Governments and a number of observations confirm links such as Railway Road (Capel to Boyanup), Hasties Road, Allenville Road and Lillydale Road (Bussell Highway to SWH (South)), Martin-Pelusey Road and Hynes Road (Boyanup-Picton Road to South Western Highway (North) and Forrest Highway) have been observed to carry local, heavy freight and a component of regional traffic. As a result, these parts of the network require careful consideration when assessing planning options and the subsequent detailed planning processes.

[2] The heavy vehicle composition has been counted as Class 3 through to Class 12.

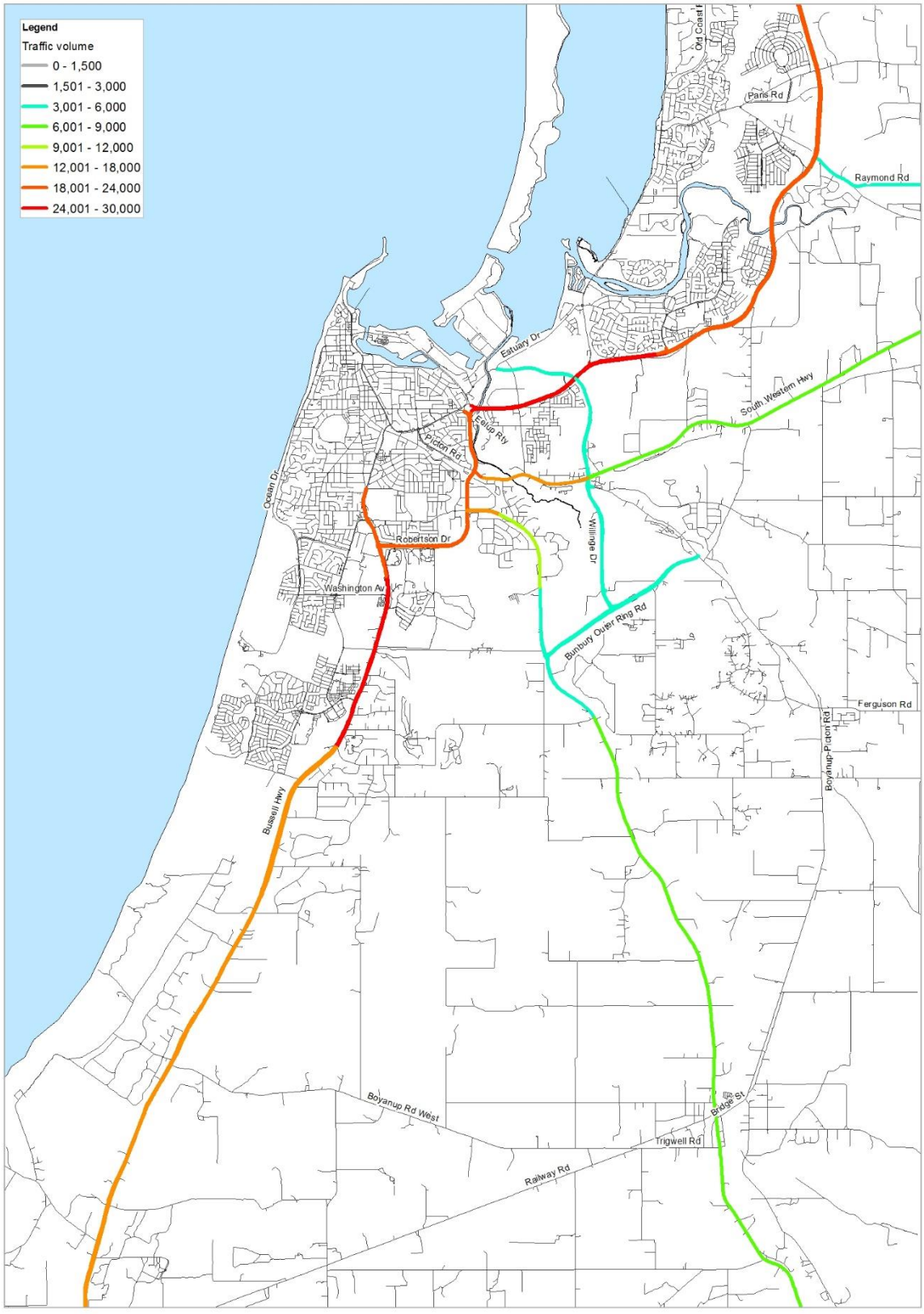


Figure 12: Existing traffic volumes along major corridors

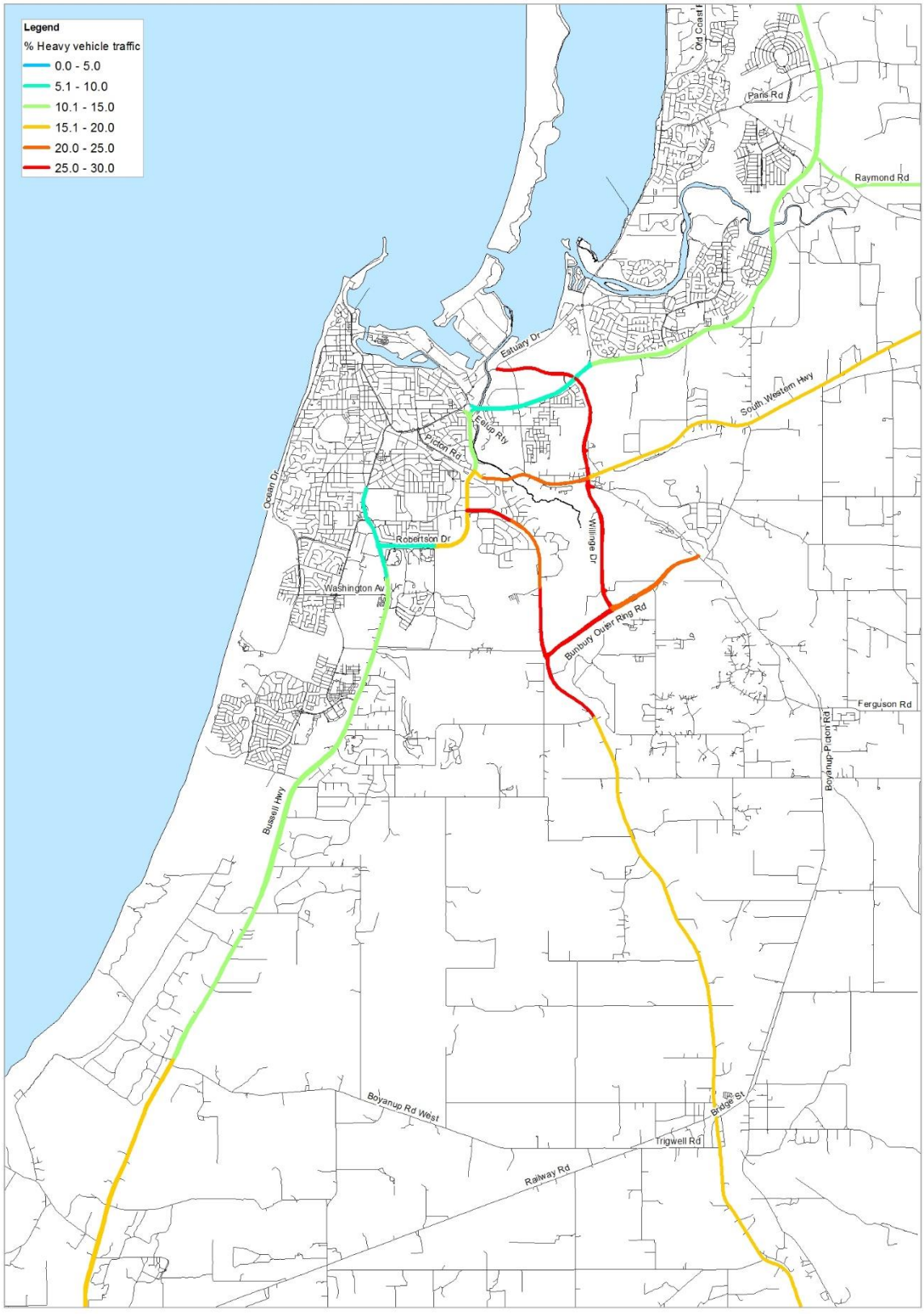


Figure 13: Existing HV% along major corridors

5 PLANNING REVIEW PROCESS

5.1 Planning Review Process

As noted in the introduction under the purpose of this study, this review has extended to cover the whole of the BORR Southern Section with the study area divided into two portions for assessment.

Separate processes were used for the different alignment reviews associated with the two portions due to differing levels of investigation and requirements.

5.1.1 South Western Highway (South) to Hasties Road

The process for the review of the SWH (South) to Hasties Road portion against the GBRS (Red) Alignment is shown in Figure 14.

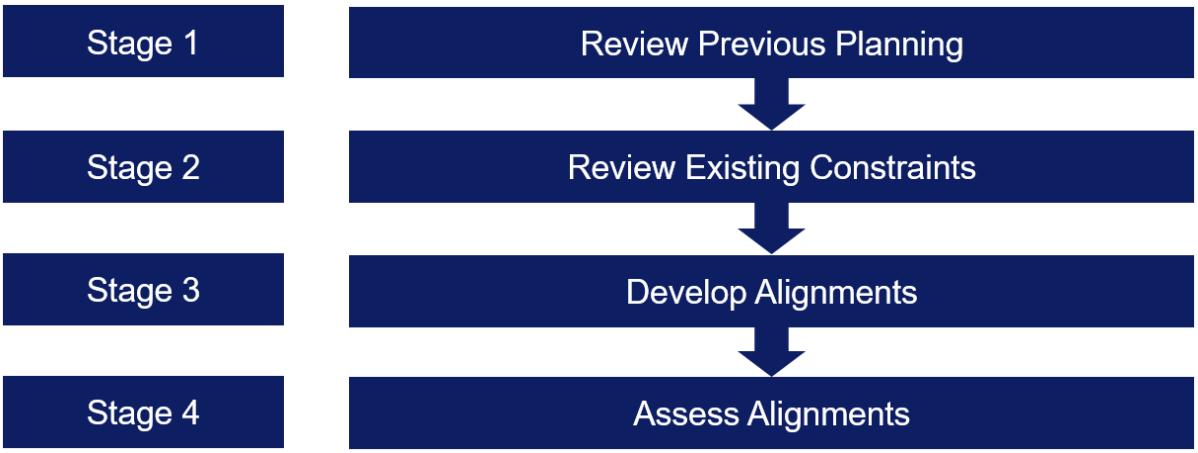


Figure 14: South Western Highway (South) to Hasties Road Review Process

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

- Stage 1 (Refer Section 6): Review previous planning documents and options considered.
- Stage 2 (Refer Section 6): Review the existing constraints and identifying potential alternative alignments to limit impacts on resources, environment, social, engineering and economic.
- Stage 3 (Refer Section 6): Develop alignments based on current constraints for the SWH (South) to Hasties Road portion to assess against the GBRS (Red) Alignment.
- Stage 4 (Refer Section 6): Assess the alternative options to understand whether there are any advantages to proceeding in a corridor other than the GBRS (Red) Alignment for this portion.

5.1.2 Hasties Road to Yeardy Road / Bussell Highway Intersection

The process adopted for the alignment selection for the Hasties Road to Bussell Highway portion of the BORR Southern Section is shown in Figure 15.

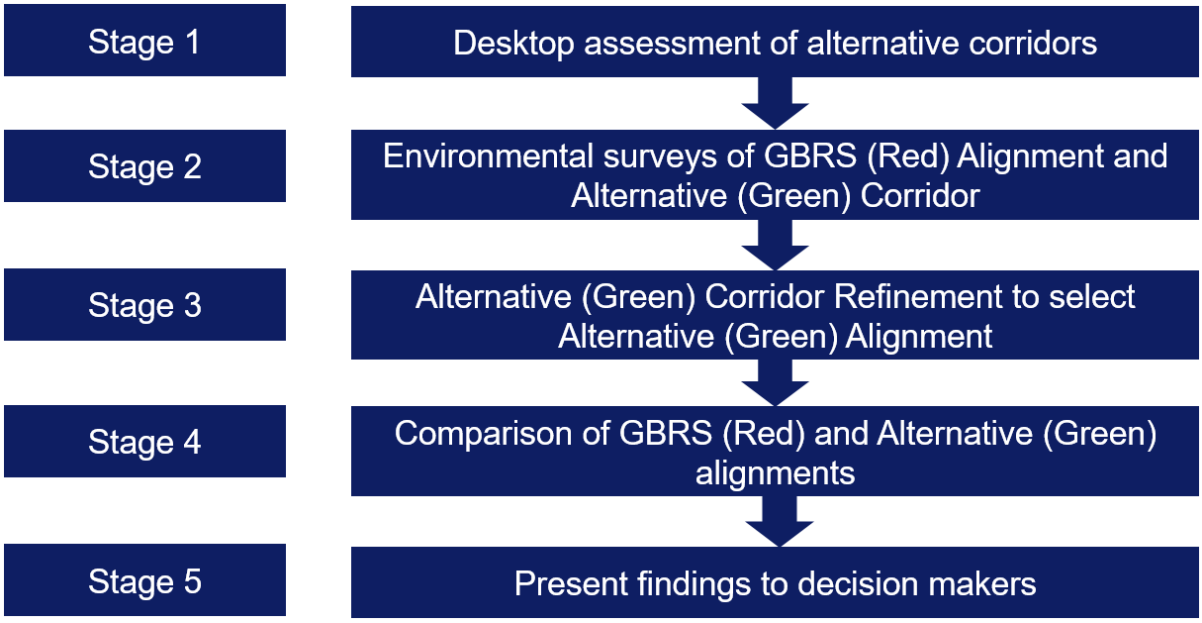


Figure 15: Planning Process Hasties Road to Bussell Highway

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

- Stage 1 (Refer Section 7): This involved the preparation of constraints mapping and 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 (Green) Corridor which is approximately 750 m wide to facilitate development of a potential alignment.
- Stage 2: Undertake environmental field surveys in both the GBRS (Red) Alignment and the Alternative (Green) Corridor to identify environmental constraints. These along with desktop assessments were used in Stage 3.
- Stage 3 (Refer Section 8): Within the Alternative (Green) Corridor, identify feasible alignments approximately 100 m wide and undertake an MCA to determine a potential Alternative (Green) Alignment for comparison with the GBRS (Red) Alignment.
- Stage 4 (Refer Sections 9 and 10): Evaluate the existing GBRS (Red) Alignment and the Alternative (Green) Alignment determined as part of Stage 3.
- Stage 5 (Refer Section 14): Present the findings to Main Roads WA and document recommendations.

5.1.3 Stakeholder Suggestions

A third review process (Refer Section 12), for consideration of suggested route options identified by stakeholders, was as follows:

- High level consideration of constraints and impacts along the suggested alignments based on environmental, social, engineering and economic factors.
- Undertake a high level assessment of the proposals as to whether they represented any further benefits over the proposed Alternative (Green) Alignment being investigated.

6 SOUTH WESTERN HIGHWAY (SOUTH) TO HASTIES ROAD REVIEW

6.1 General

This section covers the previous planning conducted and reviews the proposed GBRS (Red) Alignment against potential other alignments for the SWH (South) to Hasties Road portion of the BORR Southern Section. The review primarily takes account of resources with further consideration of farming and the environment. It also considers the use of Centenary Road as an alignment for the BORR Southern Section between SWH (South) and Bussell Highway, which was a historical option identified as part of the literature review.

6.2 Planning History

The GBRS (Red) Alignment was refined in 1995 based on the work undertaken by HGM to prepare the Bunbury Outer Ring Road Concept Report (5). The purpose of which was to develop an environmental and socially acceptable concept alignment suitable for inclusion in the town planning scheme.

This previous work (5), investigated two route options from Boyanup Road (now South Western Highway) to Hasties Road. Those options were based around minimising impacts to wetlands, community/social and resources aspects through this section. Consideration for the impacts to dairy farming, wetlands, resources and severance led to Option 2 being adopted as the preferred and incorporated into the current GBRS (Red) Alignment. These alignments are shown in Figures 3.2 and 3.3 of the Bunbury Outer Ring Road – Biological Survey and Environmental Impact Assessment report (4), with a combined extract now shown in Figure 16.

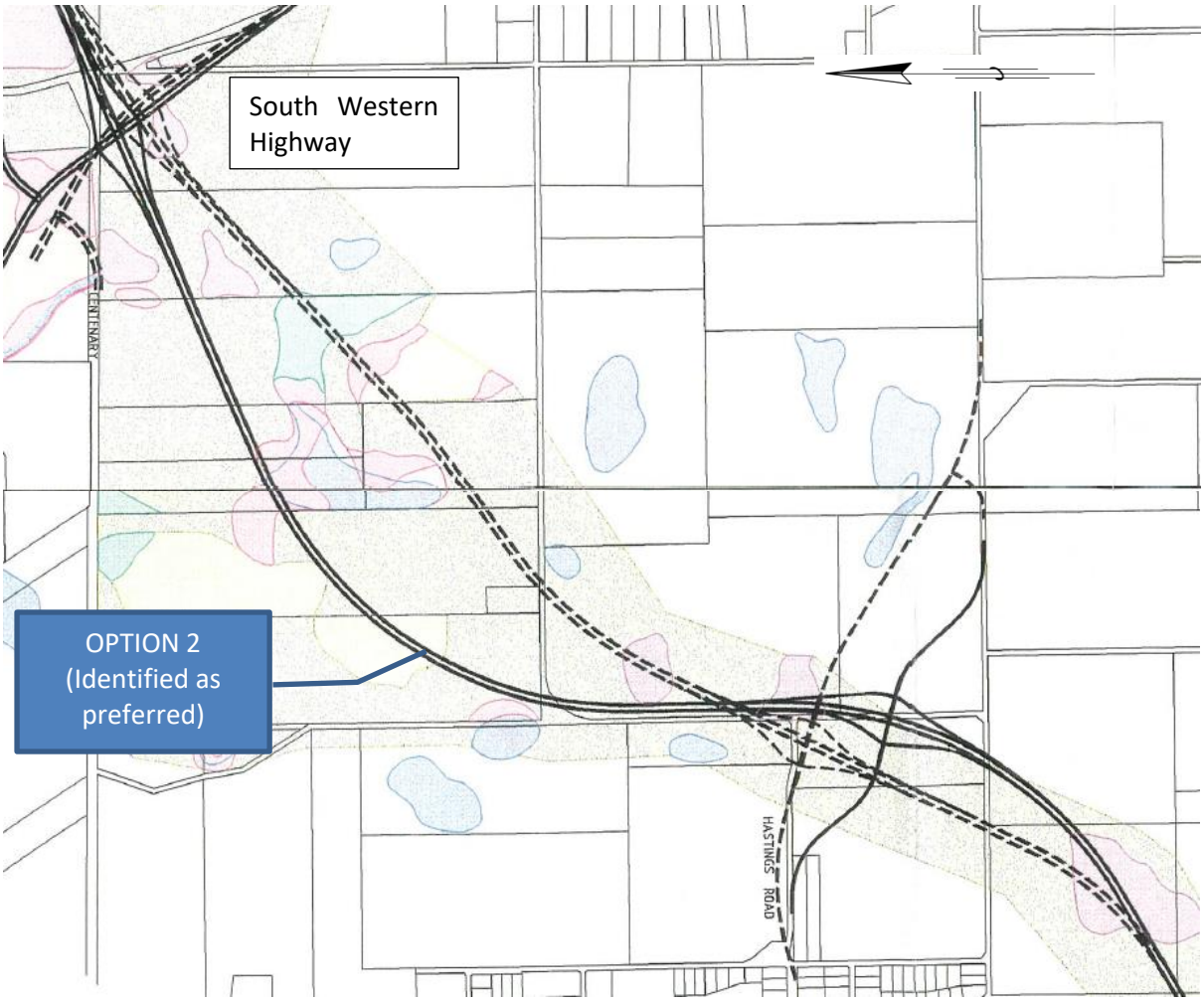


Figure 16: Combined extract of Figure 3.2 and 3.3 showing alternate alignments HGM 1995

In addition, the HGM 1995 report (5) reviewed an alignment, suggested through the public consultation process, that considered utilising Centenary Road to connect from South Western Highway to Bussell Highway. That option was reviewed in broad terms and discounted due to engineering constraints and future development plans that would impact Bussell Highway as a desirable through route.

6.3 Constraints

Alignment following Centenary Road

As noted and highlighted in the literature review of the HGM 1995 report (5), an option to align the BORR along Centenary Road was proposed as an alignment. This alternative was discounted broadly for the following reasons:

- Engineering constraints with topography at the intersection of Centenary Road with Bussell Highway make the construction of at-grade intersections difficult and grade separated interchanges would result in significant land owner impacts on both sides of Bussell Highway.

- Land use planning (Usher/Dalyellup) resulting in increased urban density, associated with requirements for direct access arrangements and local traffic movements.
- Given the adjacent development, Bussell Highway would be needed to support local traffic movements within Bunbury with limited capacity to service through traffic.
- As the development proceeded it was considered likely that speed limits on Bussell Highway would reduce making it less attractive as a through route.

South Western Highway (South) to Hasties Road

The HGM 1995 report (5) identified constraints, including existing dairy farms, a group of wetlands, a horse riding school and a proposal for a new basalt quarry. The proponents of the proposed quarry had requested that the original alignment for the BORR be realigned to the east to avoid any impact on the basalt resource. However, an eastern alignment further increased the impact of the BORR on viable dairies and wetlands and therefore, was considered unacceptable.

The major constraints identified in the HGM 1995 report (5) are still considered relevant today. Although the trend within the area appears to have moved away from dairy farming to beef cattle farming, but impacts on the farm owners are considered similar.

The extraction of resources is now underway to the east and west of Allenville Road, with strategic resources identified to the north of Lillydale Road, primarily on Lots 244 and 161.

The extents of the native vegetation are primarily located to the east of the GBRS (Red) Alignment mainly over Lots 1, 3, 4 and 8.

The following constraints mapping for the SWH (South) to Hasties Road portion of the BORR Southern Section used for the review, are included in Appendix B:

- Hydrology
- Geological conditions
- Environmentally significant areas and remnant native vegetation
- Conservation of significant fauna
- Acid sulphate soils and contaminated sites
- Agriculture and strategic minerals and basic raw materials policy

6.4 Alignment Options

Alignment following Centenary Road

In reviewing this option, the reasons associated with a BORR following a Centenary Road alignment are still relevant, particularly the need for Bussell Highway to service local traffic, and therefore this is not considered appropriate for the following reasons:

- Existing traffic on this section of Bussell Highway is in excess of 25,000 vehicles (2017/2018).
- Ultimate traffic modelling based on a Greater Bunbury at 200,000 population, with the BORR as planned, indicates this section of Bussell Highway immediately south of Centenary Road services traffic volumes in excess of 30,000 vehicles per day, decreasing to around 22,000 vehicles per day north of Hasties Road.

- If the BORR traffic were to be diverted to join Bussell Highway at Centenary Road traffic volumes are likely to exceed 60,000 vehicles per day. At these volumes Bussell Highway would possibly require upgrades to provide an additional lane in each direction and / or grade separation at this and intersections south of this location.
- Adverse impacts to local traffic due to access restrictions given the proximity of the intersecting roads and likely decrease in network performance.
- Bussell Highway access and intersection planning has been based on the GBRS (Red) Alignment. As part of the South West Freeway Study this is to be freeway standard south of the BORR Bussell interchange.

South Western Highway (South) to Hasties Road

To determine whether the GBRS (Red) Alignment is still appropriate, based upon the constraints identified as part of this study, four alternative alignments as shown in Figure 17 (yellow, cyan, blue and purple) all further east of current GBRS (Red) Alignment were developed (sketch BORR-02-SK-RD-0044 in Figure 17) for review.

No alignments to the west were considered because:

- These would impact existing mining constraints / operating quarries
- These would be closer to existing development (e.g. Gelorup)

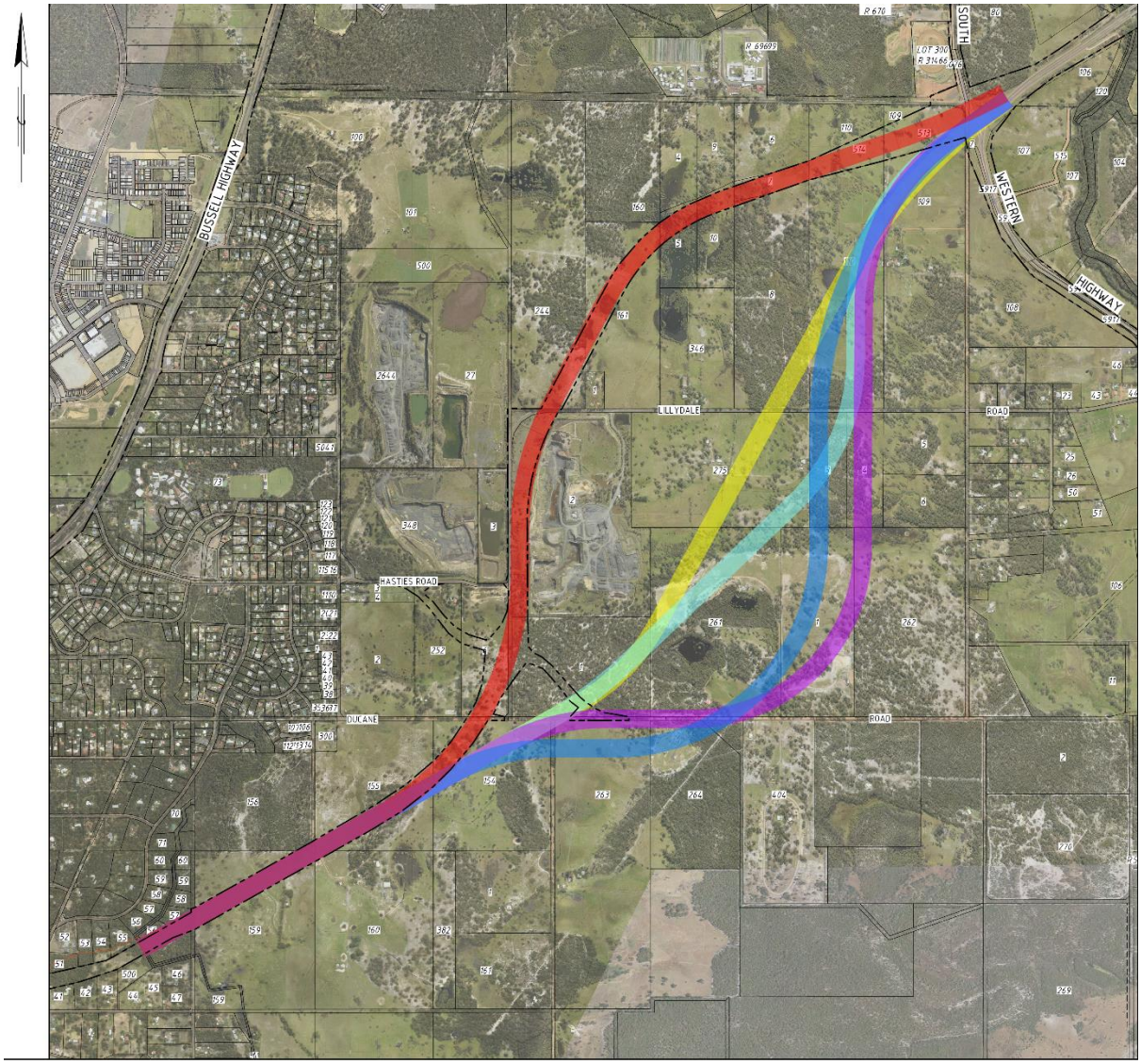


Figure 17: South Western Highway to Hasties Road alignments

The alignments broadly aimed to:

- Avoid / minimise impact to the quarry resources to the east and west of Allenville Road and to the north of Lillydale Road, which the current GBRS (Red) Alignment follows in the north / south direction.
- Avoid / minimise impact to remnant vegetation in recognition of the vegetation quality and likely habitat for Western Ringtail Possum.
- Limit impact on severance and access impacts whilst minimising the length of alternate alignments.

The assessment of these alignments was undertaken at a desk top level and the results are summarised in Table 5 with following points of note:

- **Environmental**: Although no conservation category wetlands are immediately affected by the alignments. Mitigation strategies will need to be implemented where alignments are within

proximity of resource enhancement wetlands. The yellow and cyan alignments impact Resource Enhancement Geomorphic Wetland. Strategies may include minimisation of earthworks extents and treatment of stormwater run-off from road pavement.

- **Social**: The GBRS (Red) Alignment had a low visual impact whilst the other alignments had higher visual intrusion outcomes in terms of proximity to and number of properties. The alignments all have broadly similar impacts on farming, raw material extraction (basalt and sand).
- **Engineering**: The primary distinguishing factor between the alignments from an engineering perspective was based on the ground conditions.
- **Economic:** The primary distinguishing factor between the alignments was based on the differing levels of impact on services within the area.

Table 5: SWH (South) to Hasties Road Alignment Summary

Criteria	GBRS (Red) Alignment	Yellow Alignment	Cyan Alignment	Blue Alignment	Purple Alignment
Environmental					
Social					
Engineering					
Economic					
Total					

6.5 Discussion and Recommendation

The GBRS alignment was refined in 1995 based on the work undertaken by HGM to prepare the Bunbury Outer Ring Road Concept Report (5), the purpose of which was to develop an environmental and socially acceptable concept alignment suitable for inclusion in the town planning scheme.

The purpose of this desktop review was to identify alignments, alternate to that within the GBRS (Red) Alignment, and determine whether or not the GBRS (Red) Alignment was appropriate based on the current constraints identified.

In consideration of a BORR alignment that utilises Centenary Road to connect to Bussell Highway, the previous evaluations and reasoning are still considered valid and sound. In addition, this alignment would go against a number of the project objectives (primarily the amenity on local roads through the reduction of freight and regional traffic and resulting improved safety) and is therefore not considered a viable alternative.

There have been no significant changes to the land use planning associated with the BORR Southern Section that would necessitate a review of the GBRS (Red) Alignment. For an alternate alignment that affects land not previously identified as Primary Regional Road in the GBRS to be realised it would need to offer significant environmental, social, engineering and / or economic benefits.

The major constraints identified in the 1995 assessment are still considered relevant.

The engineering and economic constraints for the alternate options are considered manageable. However, the environmental impact of the additional clearing and the social impact resulting from the

proximity to an increased number rural residences and lot severance, along with associated access issues, limit the practicality of the alternate alignments considered.

The review identified that, for the South Western Highway (South) to Hasties Road portion, there is no benefit in deviating from the GBRS (Red) Alignment. It is concluded that for this portion the GBRS (Red) Alignment is still considered appropriate and acceptable.

7 HASTIES ROAD TO BUSSELL HIGHWAY REVIEW

7.1 General

In response to changes to the EPBC Act's protection status of the Western Ringtail Possum in May 2018, from 'Vulnerable' to 'Critically Endangered', Main Roads WA commissioned an Environmental Options Assessment for an alternative route for the BORR Southern Section.

The Environmental Options Assessment (28) confirmed that significant environmental factors for BORR Southern Section alignments included the clearing of native vegetation and the consequent removal of fauna habitat.

This section covers the constraints in the Hasties Road to Bussell Highway portion of the BORR Southern Section. A review of previous alignments in relation to those constraints and on the basis of the assessments, including the BORR Southern Alignments: Environmental Options Assessment (28), identifies an Alternative (Green) Corridor (approximately 750 m wide) for investigation.

7.2 Planning History

As outlined in the literature review, this portion of the alignment has undergone a number of previous reviews. The primary review of alternative alignments was conducted by ERM Mitchell McCotter Pty in August 1997 (9). That review was undertaken in response to public comment and appeals to local Members of Parliament which led to the Minister for Transport agreeing to undertake a review of the alignment for the BORR in Gelorup.

Through consultation during the preparation of the ERM Mitchell McCotter 1997 report (9) the G1 and G2 Option alignments from the HGM 1995 report (5) were slightly modified. However, they were still closely related to the original alignments and were still referred to as the G1 and G2 Option alignments.

Figure 18 shows the three alternative alignments (reproduced from the ERM Mitchell McCotter 1997 report Figure 3.1 (9)) these are described as follows:

- Option G1: The shortest possible alternative alignment which skirted around the Gelorup Special Rural area (Blue alignment on Figure 18, full sketch SK-RD-0046 in Appendix C).
- Option G2: The route which attempted to avoid all existing development and tie back into Bussell Highway at the earliest opportunity (Cyan alignment on Figure 18, full sketch SK-RD-0046 in Appendix C)
- Gelorup Rural Alignment: This route was developed through consultation with the Friends of the Gelorup Corridor and Mr Bernie Masters, MLA. The route initially presented to the consultants was modified slightly to minimise environmental impacts and engineering structures associated with a seasonally inundated area (Brown alignment on Figure 18, full sketch SK-RD-0046 in Appendix C)

A third alignment (G3) that had formed part of the route evaluation in the HGM 1995 report (5), was excluded from the above study as it lay to the east and south of the study area. The G3 alignment from the HGM 1995 Report (Figure 7.18) (5) is reproduced and shown in purple in Figure 18, full sketch SK-RD-0046 in Appendix C.

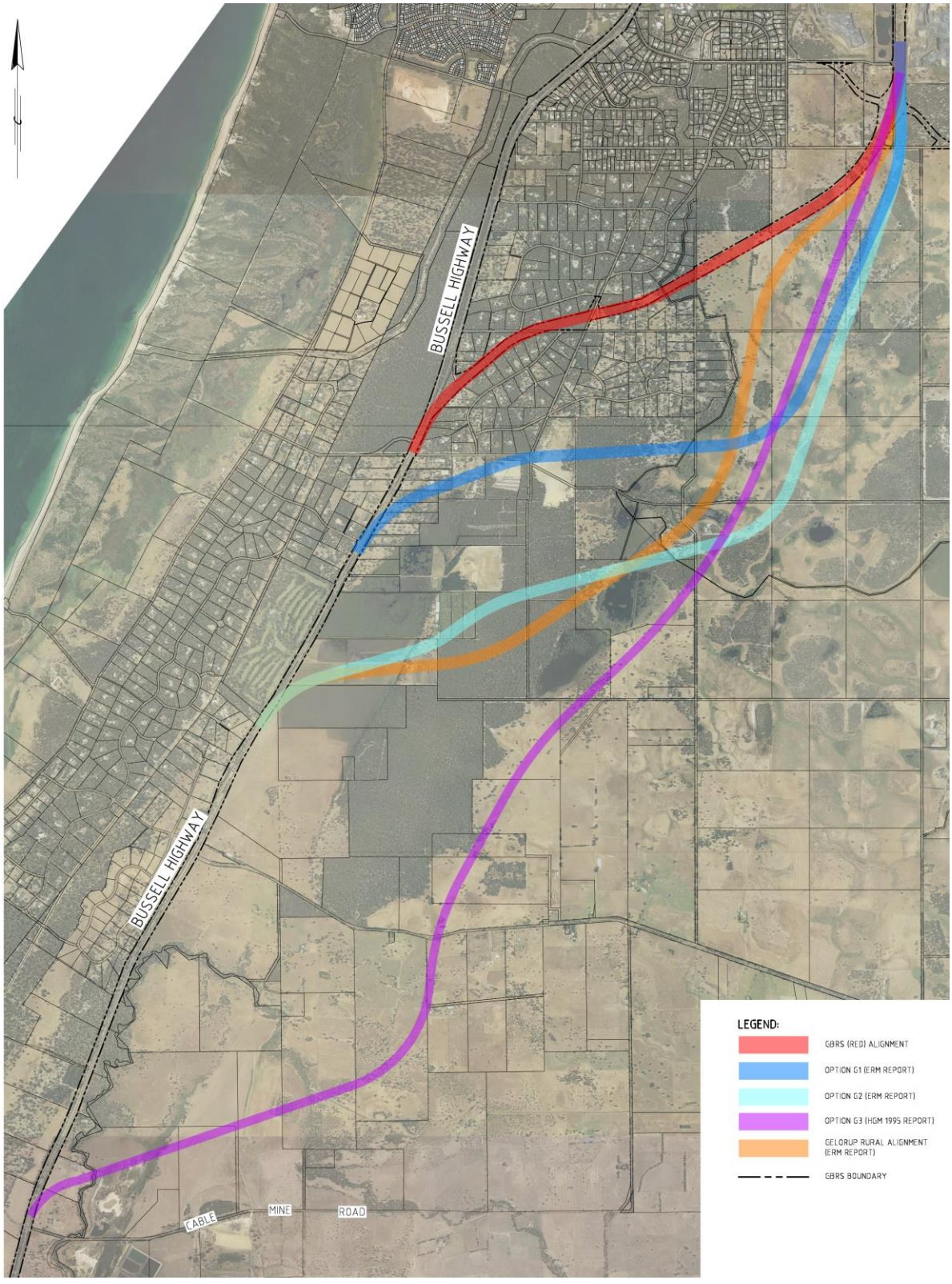


Figure 18: Previous alternative alignments BORR Southern Section[3]

[3] Reproduced from ERM Mitchell McCotter 1997 report, Figure 3.1 (9), and HGM 1995 Report, Figure 7.18 (5)

7.3 Constraints

The following constraints mapping for Hasties Road to Bussell Highway which have been used for the purposes of the current review are included in Appendix D:

- Hydrology
- Geological conditions
- Environmentally significant areas and remnant native vegetation
- Conservation of significant fauna
- Acid sulphate soils and contaminated sites
- Agriculture and strategic minerals and basic raw materials policy

This mapping displays the following alignments:

- GBRS (Red) Alignment
- G1 Alignment (as modified ERM Mitchell McCotter 1997)
- G2 Alignment (as modified ERM Mitchell McCotter 1997)
- G3 Alignment
- Gelorup Rural Alignment

The above alignments are reproduced in sketch BORR-02-SK-RD-0046 in Appendix C and shown in Figure 18.

7.3.1 Social Constraints

Property Severance

The constraints for severance are both at a property and community level. They affect the viability of farming areas at a farm level, as well as individual dwellings / properties. The need for access requirements at the local road level to address community severance and for individual dwellings are considerations when determining the corridor for investigation. In assessing severance, it is considered that community severance is addressed through an appropriate access strategy.

Alignments that are outside the existing planning area, “Primary Regional Road”, are likely to have increased severance outcomes for both individual land owners and communities’, as no prior planning to mitigate against the impact as the alignment was unknown.

Land Use

The land use in the Study Area is generally zoned as rural in the GBRS, with the exception of the areas set aside for, or forming part of, the Primary Regional Road network and the northern part of Gelorup, which are zoned as Primary Regional Road and Urban respectively.

The primary land uses in the Study Area are:

- Special rural and special residential primarily through Gelorup
- Agricultural
- Mining

Planning Status

As there have been no major land use changes surrounding the BORR Southern Section in recent decades there is no specific planning reason to review the alignment of the BORR Southern Section. Therefore, as previous planning has set aside land for the Primary Regional Road network, any alignment outside of this planning area would be undesirable.

Land requirements outside of the GBRS are undesirable as land owners could not have anticipated a change in alignment.

Land owners affected by the Primary Regional Road corridor should have been aware of the planning status.

Noise Impacts

In order to determine alignments and / or assess properties with respect to noise, dwellings within 450 m of the alignment are considered as likely to exceed the desirable noise threshold, refer State Planning Policy 5.4 (29). This distance was determined using the simplified Calculation of Road Transport Noise (CORTN) prediction equations for day time noise levels for daily traffic volumes of between 30,000 to 40,000 vehicles per day, cognisant of:

- Percentages of heavy vehicles
- Time period
- Surfacing type
- Road gradient
- Speed
- Topographic shape

Visual Impacts

Visual intrusion has been assessed by measuring the number of dwellings that are within 100 m of the corridors. MRWA's Environmental Guideline, 'Visual Screens Within The Road Reserve", states that screen walls are typically not required where the residence is located more than 100 m from the viewing source.

Impact on Commercial Properties

An overview of the number of commercial properties that may be impacted by the alignment. The assessment was based on the number of commercial enterprises crossed by the alignment.

7.3.2 Engineering Constraints

Hydrogeology

This considers the horizontal flow of ground water and the impact that road construction may have on this permeability, which will be critical in maintaining surface and groundwater regimes.

The hydrology constraints mapping is shown in Figure D1 in Appendix D.

Ground Conditions (Geology, Acid Sulphate Soils & Contaminated Sites)

This criterion considers the additional effort (time and cost) required to construct due to ground conditions, including geology, acid sulphate soils and contaminated sites.

Notes on Geology descriptions:

- **Favourable ground conditions** considered to be material, typically sand, that would require nothing more than conventional site preparation.
- **Unfavourable ground conditions** considered to be material, typically clayey sand, where ground improvements may be required.
- **Highly unfavourable conditions** are considered to be material, typically alluvial and swamp deposits, which would highly likely require ground improvement e.g. soil replacement, temporary dewatering and preloading.

The geological conditions mapping is shown in Figure D2 in Appendix D.

Note: The geology mapping shows Bussell Highway in the vicinity of the Capel Golf Course as favourable conditions. However, Main Roads South West Region has noted that approximately 2km of the southbound carriageway of this section of Bussell Highway is constructed over poor ground conditions and continues to demonstrate pavement related issues.

Rivers, Streams and Waterways

The major waterways within the study area are at Five Mile Brook and a creek down near Yeardy Road. The hydrology constraint mapping is shown in Figure D1 in Appendix D.

Network Operations

The network operations component looked at the change in tie-in location with respect to control of access requirements for Bussell Highway and the extents required to be upgraded to control of access.

Road Safety

From a road safety perspective, the assessment considers the number of interchanges and the associated number of conflict points.

Constructability

Constructability for this assessment considers safety interactions and interference with public and landowner access.

7.3.3 Environmental Considerations

General

With respect to flora, the HGM 1995 Biological Survey and Environmental Impact Assessment report notes, "*The study area falls within the South-west botanical province and is classified as belonging to the Drummond Botanical Sub-district. The flora of this region is characteristically dominated by Jarrah/Banksia low woodlands, with Melaleuca swamps on poorly drained soils, and Jarrah/Marri/Peppermint/Banksia mixed woodlands occurring on less swampy soils (Beard, 1990).*"

With respect to fauna, the HGM 1995 Biological Survey and Environmental Impact Assessment report notes: "*The study area falls within the south-west district, which contains a mixture of two biogeographic origins; partly Eyrean (central Australian) but predominantly Bassian (southern).*" and, "*In general the vertebrate fauna communities recorded from the study area were typical of the habitat types in the region. A significant portion of the fauna were wetland community species, highlighting the significance of this habitat for the fauna of the study area.*"

As the change in listing in the conservation status of the Western Ringtail Possum from "vulnerable" to "critically endangered" was the reason for undertaking this review, a critical constraint in identifying a corridor for investigation was the clearing of potential habitat of the WRP.

Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a Project. The EPA has 14 environmental factors, arranged under five themes: Sea, Land, Water, Air and People.

The environmental factors and EPA objectives are provided in Table 6 (as extracted from the Environmental Impact Assessment Reports, Refer Appendix G). The relevance of each factor to the Project is summarised and the Key Environmental Factors that require further consideration are identified.

Table 6: Identification of Key Environmental Factors

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR (YES/NO)
Sea			
Benthic communities and Habitat	To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.	No benthic communities or habitats will be impacted by this Project.	No
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	No coastal processes are expected to be impacted by this Project.	No
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	No impacts to marine environmental quality are expected to be impacted by this Project.	No
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	No impacts to marine fauna are expected.	No
Land			
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of native vegetation.	Yes
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	No significant changes to landforms are expected as much of the Project will be constructed in an existing disturbed area. Some fill of palusplain will be required to ensure the road is dry	No

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR (YES/NO)
		and allow for water passage under the road. The Project will require cut into one hill, however this is not considered to be a significant landform.	
Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	No impacts to subterranean fauna are expected from the road construction.	No
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of fauna habitat.	Yes
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	Construction is not expected to impact contaminated sites or result in increased risk of salinity. Some Acid Sulfate Soils (ASS) are expected within the Project Area.	Yes
Water			
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The Project area contains CCW, Resource Enhancement (RE) and Multiple Use (MU) Geomorphic Wetlands and Five Mile Brook. The southern half of the Project Area is also a proclaimed Surface Water Area (the Capel River System) under the RIWI Act.	Yes
Air			
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Dust will be generated during construction of the Project.	Yes
People			
Social Surroundings	To protect social surroundings from significant harm.	Aboriginal heritage aspects may be impacted during construction of the Project. Noise will be generated during construction and operation of the Project. Dust will be generated during construction of the Project.	Yes

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR (YES/NO)
		Light spill will be generated during the construction and operation of the Project. Visual amenity will be altered due to construction and operation of the Project.	
Human Health	To protect human health from significant harm.	No impacts to human health are expected.	No

7.3.4 Economic Considerations

Whole of Life Cost

This criterion considers the length of highway to be constructed for the BORR Southern Section, the structure requirements and the extents of upgrade to Bussell Highway.

Utility Impact Costs

Consideration of the likely impacts to utilities identified by those crossed or within the assessed 100 m wide alignment.

Strategic Agricultural Resources

The Department of Planning, Lands and Heritage (DPLH) have identified strategic agricultural resource policy areas for the Greater Bunbury Scheme area. This policy aims to prevent development which may adversely affect the efficient and ongoing use of the policy areas for existing and potential agricultural production.

For this assessment, an impact on this policy area is considered an economic impact to the State, due to the loss of access to a resource.

Basic Raw Materials & Mining Tenements

The DPLH Statement of Planning Policy 2.4 "*Basic Raw Materials*", sets out the matters, which are to be taken into account and given effect to, by the Commission and local governments in considering zoning, subdivision and development applications for extractive industries.

For this assessment, similar to that for strategic agricultural resources, an impact on basic raw materials is considered an economic impact to the State, due to the loss of access to a resource.

The strategic agriculture, minerals and basic raw materials policy mapping is shown in Figure D6 in Appendix D.

7.4 Alternative (Green) Corridor Identification

An initial Environmental Options Assessment (28) was undertaken reviewing the five alignments from previous studies (i.e. the GBRS, G1, G2, Gelorup Rural Alignment and G3 alignments). This review identified that a significant factor for the BORR Southern Section was the clearing of native vegetation and the consequent removal of fauna habitat.

In addition, the BORR IPT undertook a desktop assessment based environmental, social, engineering and economic considerations of the ERM Report (9) alignments, shown in Figure 18. This identified the GBRS (Red) Alignment as the preferred alignment. The primary reasons the alternate alignments were ranked lower was due to impacts on existing commercial properties, strategic and basic resources including beef and fruit farming, racehorse breeding and training, a welding/fabricating business, sand quarries and strategic titanium deposits. For the environmental evaluation, they all had similar impacts to rare flora and fauna, but with the G1, G2 and Gelorup Rural alignments having greater potential to impact geomorphic wetlands.

Table 7: ERM Alignment Review Summary

Criteria	GBRS (Red) Alignment	G1 Alignment (Blue)	G2 Alignment (Cyan)	Gelorup Rural Alignment (Orange)
Environmental				
Social				
Engineering				
Economic				
Total				

Based on the above assessment, the previous alignments considered in the ERM Report (9), as shown in Figure 18 (Alignments G1, G2 and the Gelorup Rural Alignment) were discounted as they also traversed dense remnant vegetation similar to that existing within the GBRS (Red) Alignment. Therefore, there would be limited points of difference with respect to potential Western Ringtail Possum habitat for these alternatives which was the basis for the alignment review.

The above assessments led to the identification of a corridor for investigation, notionally 750 m wide, extending to the east and south of these alignments that encompassed the previously considered G3 alternative alignment as part of the HGM 1995 (5) route evaluations. This Alternative (Green) Corridor for investigation is shown in Figure 19 and was set to allow flexibility to refine an alignment within this corridor to compare against the GBRS (Red) Alignment.

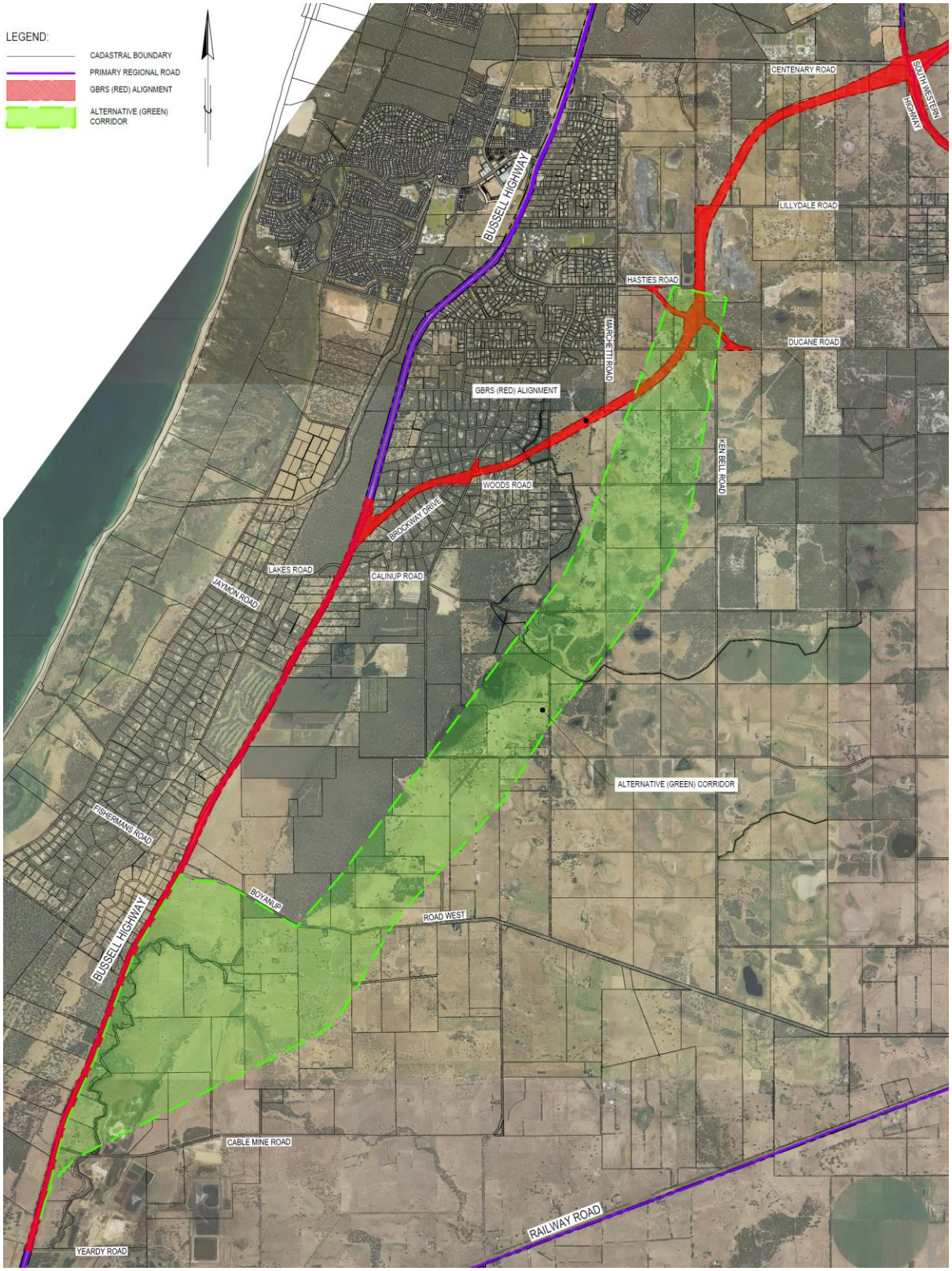


Figure 19: Alternative (Green) Corridor for Investigation

8 HASTIES ROAD TO BUSSELL HIGHWAY - ALTERNATIVE (GREEN) CORRIDOR REFINEMENT

8.1 General

This section covers the alignments considered within the Alternative (Green) Corridor for investigation and determines a potential Alternative (Green) Alignment for comparison against the GBRS (Red) Alignment.

As noted in Section 7.4, the Alternative (Green) Corridor was set at approximately 750 m wide in order to allow for flexibility in defining a nominal 100 m alignment. Environmental survey and landowner consultation was carried out within this investigation corridor to facilitate the determination of a potential alignment, notionally 100 m wide, for comparison against the GBRS (Red) Alignment.

8.2 Constraints

The key constraints identified for the Alternative (Green) Corridor are detailed as follows:

- Wetlands (conservation category and resource enhancement), rivers and watercourses
- Areas of native vegetation with threatened ecological communities and species of national significance including Black Cockatoos and Western Ringtail Possums
- Rare and priority flora
- Remnant native vegetation and sensitive environmental areas
- European heritage
- Aboriginal heritage
- Impact and land take / viability of residual property lots. Also possible access impacts
- Impact on commercial properties
- Noise and visual impacts on residential properties
- Contaminated sites and Acid Sulphate Soils (ASS) at the tie in to Bussell Highway
- Geology constraints
- Constructability issues
- Utility impacts
- Strategic agricultural resources and basic raw materials sterilisation

Guided by these defined constraints a number of 100 m wide alignments were identified within the 750 m corridor. An assessment of the impacts for these identified alignments was undertaken.

The portion from Hasties to Cable Mine Road was split into three sections to simplify the comparison of the alternative alignments being compared within the 750 m Alternative (Green) Corridor. The sections were as follows and are shown in Figure 20 along with the alignments investigated:

- Section 1 - Hasties Road to Calinup Road
- Section 2 - Calinup Road to Boyanup West Road
- Section 3 - Boyanup West Road to Bussell Highway

To develop an alternative alignment for comparison against the GBRS (Red) Alignment, the relevant constraints were revisited, these included:

- Previous work to map the constraints through this investigation corridor which included environmental and heritage areas, key infrastructure and future land use boundaries.
- Outcomes of initial consultation with stakeholders.

For Sections 1, 2 and 3 a total of three, four and five potential alignments were considered respectively.

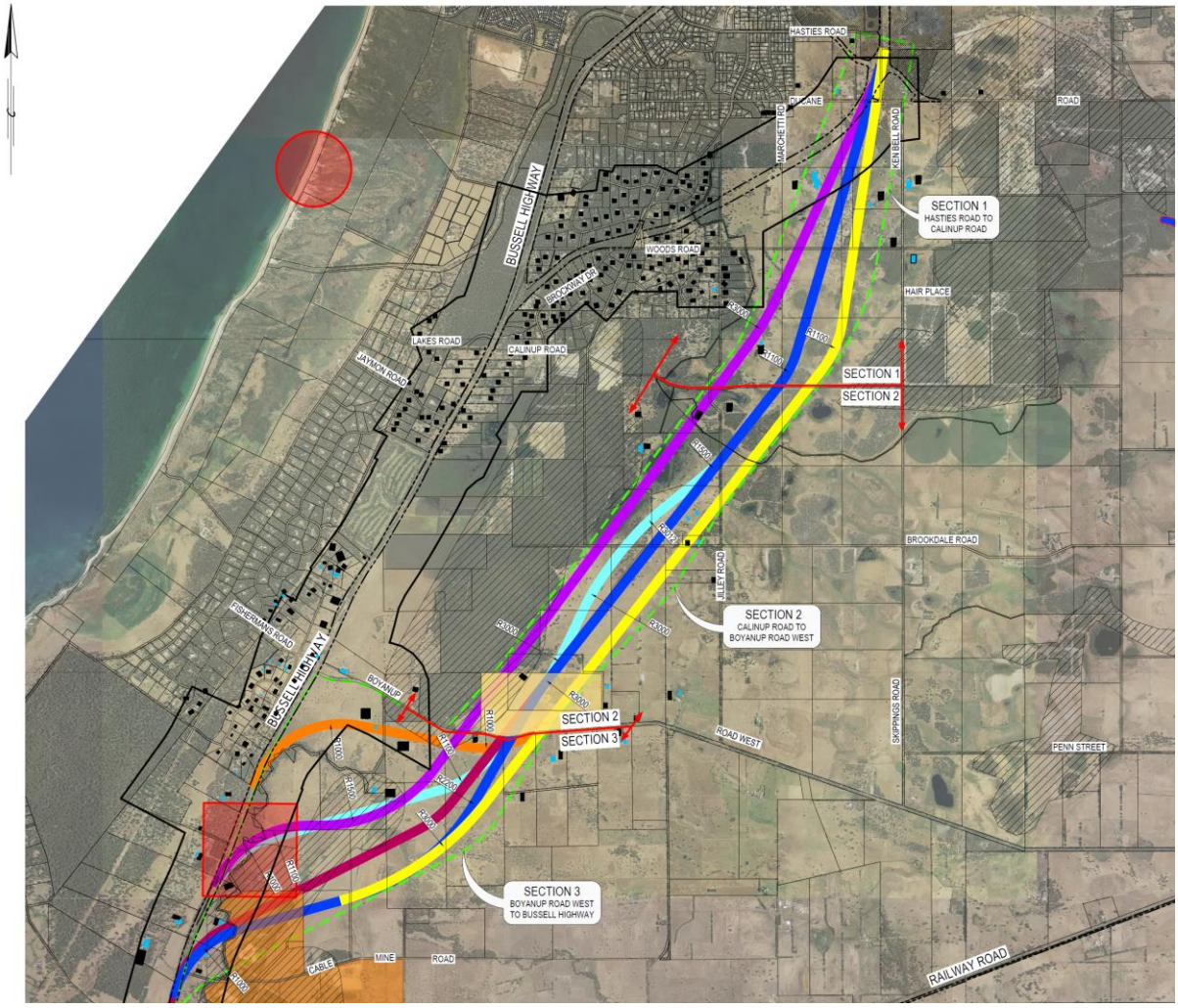


Figure 20: Alternative (Green) Corridor Refinement

8.3 Assessment Criteria

In order to identify a potential alignment, a high level Multi Criteria Assessment (MCA) was undertaken within each section using the objectives and priorities identified for the project as follows:

- **Environmental constraints**: at a desktop level considered impacts or enhancements to the vegetation, flora, fauna and wetlands. European and Aboriginal heritage sites also assessed within this category.
- **Social constraints**: considers impacts to stakeholders and the local community. This focuses on those directly impacted (i.e. land acquisition) and indirectly impacted (i.e. adjacent/in the local vicinity). It includes property severance as well as noise and visual amenity.
- **Engineering constraints**: considers impacts to the traffic flow, those within the project footprint, and in the vicinity of the project as well as potential safety issues for both the construction and operation phases. This covers both members of the workforce and the general public. Also examines exposure to acid sulphate soils (ASS) and contaminated sites, existing geology along the route and resultant road geometry.
- **Economic constraints**: considers the financial costs associated with decisions over the lifetime of the asset. This includes whole of life costs, utility impact costs and impacts on strategic agricultural resources and basic raw materials.

The assessment criteria shown as in Table 8 have been reviewed and synthesised to align with the project objectives.

Table 8: Alignment Assessment Criteria

Environment and Ecology	Community and Social	Engineering	Economic
• Wetlands (CCW and Resource Enhancement) • Remnant Native Vegetation • Rare and Priority Flora Sites • Fauna Habitat • Rare Fauna (WRP) • TECs • European Heritage • Aboriginal Heritage	• Impact on residential properties (Direct Impact and Severance) • Impact on commercial properties • Noise and visual amenity	• Acid sulphate soils and contaminated sites • Network operations • Road geometry • Geology • Constructability	• Whole of life cost • Utilities impact costs • Strategic agricultural resources and basic raw materials

The full MCA for the determination of the Alternative (Green) Alignment within the Alternative (Green) Corridor is included in Appendix E along with sketch BORR-02-SK-RD-0057, an extract of which is shown in Figure 20.

8.4 Section 1 - Hasties Road to Calinup Road

The three alignments in Section 1 were Western (Purple), Central (Blue) and Eastern (Yellow).

The Western (Purple) alignment – Impacts one resource enhancement wetland area and passes through sparse areas of native vegetation. Severs one beef farm. The alignment passes through approximately 300 m of high to moderate risk areas of acid sulphate soils (ASS).

The Central (Blue) alignment – Corridor passes through sparse areas of vegetation. Severs one beef farm. Alignment passes through approximately 100 m of high to moderate risk areas of ASS. Horizontal geometry includes one radius less than 1500 m. Impacts high voltage (HV) transmission power line and tower.

The Eastern (Yellow) alignment – Impacts two adjacent wetland areas and passes through areas of remnant vegetation. Severs one beef farm. The alignment passes through approximately 800 m of high to moderate risk of ASS. The geometry includes one radius less than 1500 m. Impacts high voltage (HV) transmission power line.

Based on the above impacts, the Western (Purple) and Central (Blue) alignments are considered to be equally preferable with the Eastern (Yellow) alignment least favourable. Although the Western (Purple) and Central (Blue) were ranked the same when all factors were considered, the Central (Blue) alignment had a better outcome for environmental and social considerations it was selected as the preferred alignment for Section 1 – Hasties Road to Calinup Road

8.5 Section 2 - Calinup Road to Boyanup West Road

The four alignments in Section 2 were Western (Purple), Central (Cyan), Central (Blue) and Eastern (Yellow).

The Western (Purple) alignment – Impacts one resource enhancement wetland area and passes through areas of dense native vegetation including potential Western Ringtail Possum (WRP) habitat. Corridor will impact European heritage site (Elgin Sports club). Severs one beef farm. Approximately two kilometres passes through high to moderate risk areas of ASS. Impacts titanium strategic mineral resource leading to land sterilisation.

The Central (Cyan) alignment – Passes through sparse areas of native vegetation. Corridor will impact two European heritage sites (Elgin Sports club and Stratham School). Impacts three businesses; one beef farm, one dairy farm and a horse breeding business. Approximately 600 m passes through high to moderate risk areas of ASS. Will impact HV transmission line at two locations. Close proximity to the titanium strategic mineral resource potentially leading to some land sterilisation.

The Central (Blue) alignment – Passes through sparse areas of native vegetation. Corridor will impact two European heritage sites (Elgin Sports club and Stratham School). Impacts three businesses; one beef farm, one dairy farm and a horse breeding business. Approximately 300 m passes through high to moderate risk areas of ASS.

The Eastern (Yellow) alignment – Impacts two resource enhancement wetland areas and passes through sparse areas of native vegetation. Corridor will impact two European heritage sites (Elgin Sports club and Stratham School). Impacts four businesses; one beef farm, one dairy farm, a seed growing business and a horse breeding business. There are two dwellings within 100 m of the corridor.

Based on the above impacts, the Central (Blue) alignment is considered to be the most favourable alternative, with the Central (Cyan) and Eastern (Yellow) considered equal second. The western (Purple) alignment considered the least favourable of the alignments.

8.6 Section 3 - Boyanup Road West to Bussell Highway

The five alignments in Section 3 were Western (Orange), Central (Purple), Central (Cyan), Central (Maroon) and Eastern (Blue / Yellow).

The Western (Orange) alignment – Severs one beef farm. Three dwellings within 100 m of the corridor. Slightly longer travel time compared to other alignments. Horizontal geometry has two radii less than 1500 m. All of the corridor passes through unfavourable but manageable ground conditions. Skew at Boyanup West Road interchange is problematic and could create secondary environmental impacts. Corridor will impact HV transmission line. 2.5 km runs through the strategic agricultural resource area.

The Central (Purple) alignment – Passes through sparse areas of native vegetation. Slight impact on boundary of one beef farm. Two dwellings within 100 m of the corridor. Approximately 500 m passes through high to moderate risk ASS. Horizontal geometry has one radius less than 1500 m. Passes through section of unfavourable ground conditions requiring significant ground improvement. Creek crossings will require some stream training to avoid skew. Corridor will impact HV transmission line. 1.5 km runs through strategic agricultural resource and 1.2 km through titanium strategic mineral resource area.

The Central (Cyan) alignment – Passes through sparse areas of native vegetation. Two dwellings within 100 m of the corridor. Approximately 600 m passes through high to moderate risk ASS. Horizontal geometry has two radii less than 1500 m. Passes through section of unfavourable ground conditions requiring significant ground improvement. Creek crossings will require some stream training to avoid skew. Corridor will impact HV transmission line. 1.5 km runs through strategic agricultural resource and 1.5 km through the titanium strategic mineral resource area.

The Central (Maroon) alignment – Impacts one conservation category wetland and passes through sparse areas of native vegetation. One dwelling within 100 m of the corridor. Approximately 1200 m passes through high to moderate risk areas of ASS. Horizontal geometry has two radii less than 1500 m. Passes through section of unfavourable ground conditions requiring significant ground improvement. Corridor will impact HV transmission line. 1.5 km runs through strategic agricultural resource and 2.5 km through the titanium strategic mineral resource area.

The Eastern (Blue) and (Yellow) alignments – Pass through sparse areas of native vegetation. One dwelling within 100 m of the corridor. Approximately 800 m pass through high to moderate risk areas of ASS. Horizontal geometry has one radius less than 1500 m. Passes through section of unfavourable ground conditions requiring significant ground improvement. Corridor will impact HV transmission line. 2 km runs through the strategic agricultural resource area and 1 km through the titanium strategic mineral resource area.

Based on the above impacts, the Western (Red), Central (Cyan), Central (Maroon) and Eastern (Blue / Yellow) alignments are considered equally favourable. Given the similarity in the Section 3 scores, a decision based on engineering judgement, was made by the IPT and Main Roads WA (South West Region) that the “Maroon” alignment was most suitable as it was considered to provide better geometry, associated travel time benefits and interfaced better with the Central (Blue) alignment from Section 2.

8.7 Alternative (Green) Alignment

Based on the review of the alignments within the Alternative (Green) Corridor as discussed above, a single Alternative (Green) Alignment notionally 100 m wide based on the Blue alignment within Sections 1 and 2 and the Maroon alignment within Section 3 is recommended for comparison against the GBRS (Red) Alignment.

The full MCA is provided in Appendix E and "traffic light" summary is shown in Table 9. The key differentiators for the combined Alternative (Green) Alignment over the others investigated being:

- Reduced fauna impact
- Reduced impact on wetlands
- Reduced impact through section two on the area of native vegetation, with threatened ecological communities and species of national significance, including Black Cockatoos and Western Ringtail Possums
- Minimised noise and visual intrusion based on total number of dwellings within 100 m of the corridor
- Less fragmentation of property and commercial businesses
- Simplified constructability of creek crossings with locations being relatively well defined.

Table 9: Alternative (Green) Alignment MCA Investigation Summary

Criteria	Hasties Road to Calinup Road			Calinup Road to Boyanup Road West				Boyanup Road West to Bussell Highway				
	Purple	Blue	Yellow	Purple	Cyan	Blue	Yellow	Orange	Purple	Cyan	Maroon	Blue
Environmental												
Social												
Engineering												
Economic												
Total												
Selected Alignment		✓				✓					✓	

Figure 21 shows the two alignments to be compared as follows:

- The GBRS (Red) Alignment
- The refined Alternative (Green) Alignment, 100 m wide, comprising of the Section 1: Blue, Section 2: Blue and Section 3: Maroon alignments.

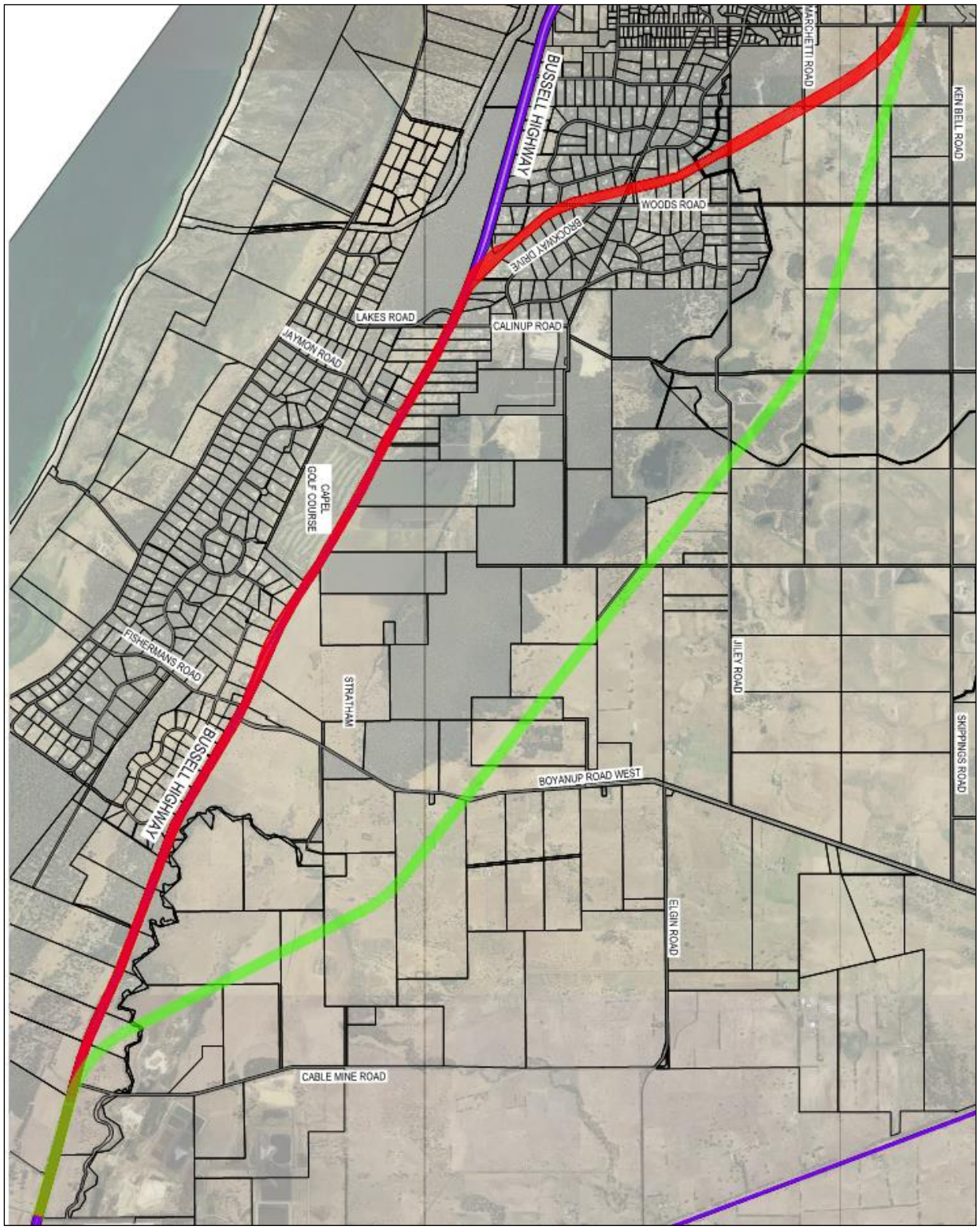


Figure 21: Alignments for further assessment

9 HASTIES ROAD TO BUSSELL HIGHWAY - SOCIAL, ENGINEERING AND ECONOMIC ASSESSMENT

9.1 General

This section reviews the social, engineering and economic impacts of the GBRS (Red) Alignment and Alternative (Green) Alignment from Hasties Road to Bussell Highway. The two alignments have been evaluated through an MCA process which is included in Appendix F.

9.2 Scope of Options

For the purposes of the comparison of the GBRS (Red) Alignment and the Alternative (Green) Alignment, the northern extent has been taken as Hasties Road (Midpoint of GBRS (Red) Alignment planned interchange) and the southern limit as Yeardy Road.

Table 10 shows a comparison of the scope of works associated with the two alignments being investigated for the purposes of the social, engineering and economic.

Table 10 : Scope of Works Comparison

BORR SOUTHERN SECTION GBRS (RED) ALIGNMNET SCOPE	BORR SOUTHERN SECTION ALTERNATIVE (GREEN) ALIGNMNET SCOPE
• Construction of a 14.1 km dual carriageway highway between Hasties Road and Yeardy Road that includes approximately 7.5 km of online widening and upgrade to existing dual carriageway of Bussell Highway. • Construction of interchanges at: ➢ Bussell Highway (in the form of a Y-interchange) ➢ Boyanup Road West/Fishermans Road (in the form of a dumbbell interchange) • Construction of a road overpass and associated road works at Yalinda Drive • Construction of 26.5 km of service/local roads including: ➢ Realignment of Calinup Road ➢ Connection of Jilley Road to Ducane Road ➢ Construction of drainage structures including basins and culverts ➢ Construction of 5.8 km of Principal Shared Path including a pedestrian bridge over Bussell Highway at Lakes Road	• Construction of a 14.0 km dual carriageway highway between Hasties Road and Yeardy Road • Construction of interchanges at: ➢ Bussell Highway (in the form of a Y-interchange) ➢ Boyanup Road West (partial dumbbell interchange with north facing ramps only) • Construction of two road underpasses to deal with access severance • Construction of 23.5 km of service/local roads including: ➢ Upgrade of Jilley Road to be all weather road ➢ Upgrade and extension of Cable Mine Road to connect to Elgin Road ➢ Construction of drainage structures including basins and culverts ➢ Construction of 14.0 km of Principal Shared Path ➢ Construction of two fauna bridges across the Highway

BORR SOUTHERN SECTION GBRS (RED) ALIGNMNET SCOPE	BORR SOUTHERN SECTION ALTERNATIVE (GREEN) ALIGNMNET SCOPE
➢ Installation of fencing and noise walls/treatments ➢ Service relocation and protection ➢ Construction of access roads to severed properties ➢ Pre-construction activities including geotechnical investigations and service utilities relocations ➢ Landscaping and rehabilitation works	➢ Installation of fencing and noise walls/treatments ➢ Service relocation and protection ➢ Construction of access roads to severed properties ➢ Pre-construction activities including geotechnical investigations and service utilities relocations ➢ Landscaping and rehabilitation works

9.3 Infrastructure Australia (IA) Objectives of National Significance

A review of the priorities and objectives identified by Infrastructure Australia (IA) as being relevant for major infrastructure of National significance and their applicability to the BORR has been undertaken. Of the relevant objectives, in considering the GBRS (Red) Alignment and the Alternative (Green) Alignment there are few points of difference between the two options. Potentially two objectives (IA aspects 1.7 and 9.4) were identified marginally in favour of the GBRS (Red) Alignment, as this makes use of more existing infrastructure and assets already acquired as part of previous planning.

9.4 Multi Criteria Analysis – Social, Engineering and Economic

An MCA was prepared to assess the GBRS (Red) Alignment and Alternative (Green) Alignment for Hasties Road to Bussell Highway. The MCA is included in Appendix F and evaluates social, engineering and economic aspects of the two alignments.

The measures included under the social considerations were as follows:

- Property Severance: The number of properties impacted by the corridor.
- Land Use: Impact on existing land use.
- Land Acquisition: Consideration of the total areas of private land required.
- Noise Impacts: Consideration for the number of dwellings within 450 m of the alignment.
- Visual Impacts: Consideration for the number of properties within 100 m of the alignment.

The measures included under the engineering considerations were as follows:

- Hydrogeology: Length of the alignment impacting the horizontal permeability of ground water and the impact the alignment may have on this.
- Ground conditions (Geology, Acid Sulphate Soils and Contaminated Sites): Area of alignment over highly unfavourable conditions and discussion on any points of difference between options.
- Rivers, Streams and Waterways: Number of water and river crossings required.
- Road Safety: The number of interchanges and the associated conflict points.

- Constructability: Review of the points of difference between the options, from a safety / traffic management, interaction with private land owners

The measures included under the economic considerations were as follows:

- Construction Costs: Estimate of the cost of each option based on the bulk earthworks being the main point of difference between the two corridor options.
- Operation Costs: Length of network added to the network.
- Network Performance: Volume to capacity ratio and indication of additional spare capacity
- Travel Time Saving: Review of the vehicle hours travelled and the vehicle kilometres travelled on the two networks.
- Strategic Agricultural Resources: Area if impacted agricultural areas.
- Basic Raw Materials and Mining Tenements: Area of strategic resources and mining tenements impacted.

9.4.1 Social Considerations

Under the social consideration the main distinguishing advantages of the GBRS (Red) Alignment over the Alternative (Green) Alignment were property severance, landuse, and land acquisition. The primary advantage associated with the GBRS (Red) Alignment, is that it is the planned corridor and therefore land use has been planned around it and, as such, the impacts under these categories is generally lower.

The primary advantages of the Alternative (Green) Alignment are associated with the noise and visual impacts. The primary difference associated with the two corridors is as a result of the GBRS (Red) Alignment traversing through the Gelorup special rural area which was developed around the planned alignment. Therefore, through that area, a greater number of properties are impacted by noise and visual amenity.

The MCA assessment included in Appendix F provides a more detailed breakdown of the assessment and based on the ranking system, for the social considerations, highlights the GBRS (Red) Alignment as the most favourable.

9.4.2 Engineering Considerations

For the engineering considerations the main advantages of the GBRS (Red) Alignment over the Alternative (Green) Alignment were hydrology, ground conditions and rivers, streams and waterways.

The majority of GBRS (Red) Alignment topography is low lying, except through the sand dune area in Gelorup. The majority of the GBRS (Red) Alignment runs through an area where the water table may be within a metre of existing ground level. However, the ground water through Gelorup, approximately 2.5 km, is relatively deep and therefore it would be expected that groundwater would not cause any issues during construction through this section. In comparison, for the majority of the Alternative (Green) Alignment, the ground water level is at or approximately 1.0 m below ground level.

The majority of the Alternative (Green) Alignment topography is low lying. On average, a road within this alignment will be on 1.5 m-2.0 m of fill to mitigate impacts from high ground water levels.

The majority, 80%, of the Alternative (Green) Alignment passes through areas of unfavourable geology conditions whilst only 20% of the GBRS (Red) Alignment will pass through unfavourable geological conditions. The majority of both alignments pass through low to moderate risk areas of acid sulphate

soils, with the Alternative (Green) Alignment passing through some small patches of moderate to high risk areas.

There are no known contaminated sites within the GBRS (Red) alignment. The Alternative (Green) Alignment has one registered contaminated land site which is currently being used as a mineral sands processing facility.

The GBRS (Red) Alignment only has 1 major water crossing (Five Mile Brook) compared to 3 (Five Mile Brook, Gynudup Brook and its tributary near the tie in with Bussell Highway near Cable Mine Road) on the Alternative (Green) Alignment .

The primary advantage of the Alternative (Green) Alignment was the constructability as the majority of the alignment would have limited interface with existing roads and thus less works in and around live traffic.

Both the alignments were deemed to have similar safety outcomes in terms of the road safety aspects. This is due to the fact that both alignments provide for grade separated interchanges based around the use of roundabouts at intersections with the minor cross roads adopting safe system principles.

The MCA assessment included in Appendix F provides a more detailed breakdown of the assessment and based on the ranking system, for the engineering considerations, highlights the existing GBRS (Red) Alignment as the most favourable.

9.4.3 Economic Considerations

For the economic considerations the main advantages of the GBRS (Red) Alignment over the Alternative (Green) Alignment were construction cost, network performance, strategic agricultural resources and basic raw materials and mining tenements. The GBRS (Red) Alignment impacts a transmission line at the proposed Yalinda Road bridge and is likely to generate an excess of cut material. The Alternative (Green) Alignment impacts a transmission line at two locations and would also require a significant net import fill.

The volume / capacity ratio was also used as a proxy for value for money, with greater reserve capacity representing reduced value for money. The residual capacities show that the Alternative (Green) Alignment provides an additional 12% residual capacity compared to the GBRS (Red) Alignment and therefore is viewed as an over investment in infrastructure.

The GBRS (Red) Alignment and the Alternative (Green) Alignment will pass through approximately 7.3 ha and 25.3 ha of the Agricultural Resource Policy area respectively.

The GBRS (Red) Alignment will pass through approximately 1.6 ha of the Strategic Titanium Area and 13.2 ha of mining tenements. The Alternative (Green) Alignment will pass through approximately 20.4 ha of the Strategic Titanium Area and 27.6 ha of mining tenements.

Both alignments were deemed to be comparable for operation cost and travel time savings.

The MCA assessment included in Appendix F provides a more detailed breakdown of the assessment and based on the ranking system, for the economic considerations, highlights existing GBRS (Red) Alignment as the most favourable.

9.4.4 Summary of Social, Engineering and Economic Assessment

The MCA was based on desktop assessment of the constraints and analysis of preliminary design information. Each of the attributes has been reviewed and where possible quantified with measurable assessments. The MCA rated each attribute with a score measuring each criteria against a score rating of 0 to 3 ranging from no impact/constraint to major impact/significant constraint.

The MCA assessment included in Appendix F provides a more detailed breakdown of the assessment. The GBRS (Red) Alignment provides a lower overall score for social, engineering and economic criteria considered. A "traffic light" summary and scores of the assessment is provided in Table 11.

Table 11: Social, Engineering and Economic MCA Summary

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**

Indirect Local Economic, Social and Environmental Impacts

Both the GBRS (Red) Alignment and the Alternative (Green) Alignment may have indirect environmental, social and local economic impacts, which are not seen within the footprint or directly adjacent to the alignment.

One of the major indirect impacts is the quantity of raw and manufactured materials used in the construction and maintenance of the new highway. These materials are finite and typically require vegetation clearing in order to access them via quarries. By minimising the use of these materials, this allows the region access to such products in the future, as land is developed. This in turn reduces the cost and greenhouse gas emissions for the supply of such material as it can be sourced as close to the site as possible.

The two alignments being assessed will have a different impact on the quantity of materials required during construction and maintenance. The Alternative (Green) Alignment will require significantly more materials during construction than the GBRS (Red) Alignment.

Both alignments will require materials and resources for maintenance. The addition of the extra road length to the total road network as a result of the Alternative (Green) Alignment will result in some increase in maintenance requirements (for the new BORR length and existing portion of Bussell Highway). Additionally, generally the materials required over a 40 year lifetime of a road are more significant in quantity and in carbon footprint during the initial construction phase than during the maintenance phase.

Some impacts to local businesses along the section of Bussell Highway between the connections to the existing GBRS (Red) Alignment and the Alternative (Green) Alignment will likely be seen. For example businesses such as roadhouses, which provide facilities such as fuel, café and ablutions. Whilst the impacts to such businesses could be managed as part of the overall potential impacts to local businesses in the Greater Bunbury Region, the bypass of this particular roadhouse may further encourage the development of new fuel station(s) along the final BORR route. It would depend on the approach taken in determining the location(s) of these new fuel station(s) as to whether the impact on the local economy and community would be positive or negative.

10 HASTIES ROAD TO BUSSELL HIGHWAY – ENVIRONMENTAL ASSESSMENT

10.1 General

This section provides a comparative summary of the environmental impact assessments undertaken for the GBRS (Red) Alignment and the Alternative (Green) Alignment. The environmental impact assessments for the two alignments are included in Appendix G.

10.2 Key Environmental Factor – Flora and Vegetation

The assessment of flora and vegetation impacts for the two alignments are summarised in Table 12.

Table 12: Flora and vegetation comparison table

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE (GREEN) ALIGNMENT
Total Area	190 ha	222 ha
FLORA AND VEGETATION		
Total Native Vegetation	Approximately 73 ha (40 ha surveyed, 33 ha unsurveyed)	Approximately 46 ha (30 ha surveyed, 17 ha unsurveyed)
Total non-native / cleared area	Approximately 120 ha	Approximately 176 ha
Total native Good or better condition	Approximately 18 ha (~9 % of the Project Area)	Approximately 6 ha (~3 % of the Project Area)
Total areas in Good – Degraded or worse condition	An estimated 172 ha (~91 % of the Project Area) (includes Cleared/parkland areas, which are classified as Completely Degraded)	An estimated 216 ha (~97 % of the Project Area) (includes Cleared/parkland areas, which are classified as Completely Degraded)
Threatened and Priority Communities	Present: 1. Banksia woodlands of the SCP TEC – approximately 21 ha 2. Banksia woodlands PEC – up to 3.5 ha 3. Tuart woodlands PEC – approximately 28 ha.	Banksia Woodlands of the SCP TEC (up to 4.5 ha) Banksia dominated woodlands of the SCP IBRA region PEC (FCT 21a) (up to 6.9 ha) The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC (FCT25) (up to 0.4 ha).
Other significant	Approximately 4 ha of riparian vegetation	Approximately 13 ha of riparian vegetation

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE (GREEN) ALIGNMENT
Conservation significant flora	One Priority Flora recorded – *Caladenia speciosa* (Priority 4), of which 71 individuals occur within the Project Area. No Threatened flora recorded during the filed investigations.	12 conservation significant flora species previously recorded or likely to occur within the Project Area, from desktop investigations. No EPBC or BC Act species recorded during field investigations. No Priority Flora recorded during field investigations.

10.3 Key Environmental Factor – Terrestrial Fauna

The assessment of terrestrial fauna impacts for the two alignments are summarised in Table 13.

Table 13: Fauna comparison table

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE (GREEN) ALIGNMENT
FAUNA		
EPBC / BC Fauna - confirmed - Black Cockatoos	Approximately 71 ha of potential Black Cockatoo habitat (38 ha surveyed and 33 ha unsurveyed). Up to 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone.	Approximately 38 ha of potential Black Cockatoo habitat (including 21 ha surveyed and 17 ha unsurveyed) Up to 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone.
- Western Ringtail Possum (Critically Endangered)	Approximately 71 ha of WRP habitat (including 37.9 ha surveyed and 32.6 ha unsurveyed) and displacement of an estimated 100 individual WRPs, representing less than 2 % of the regional population.	Approximately 38 ha of potential Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed), supporting up to 15 individual possums.
- South-western Brush-tailed Phascogale (Schedule 6)	-	Approximately 26 ha of potential Southern Brush-tailed Phascogale (including 9 ha surveyed and 17 ha unsurveyed).
Priority Fauna – confirmed - Southern Brown Bandicoot / Quenda (Priority 4)	Approximately 73 ha of potential Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 40 ha surveyed and 33 ha unsurveyed).	An estimated 46 ha of potential Southern Brown Bandicoot habitat (including 30 ha surveyed and 17 ha unsurveyed).

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE (GREEN) ALIGNMENT
FAUNA		
Threatened species likely to occur - Black-stripe Minnow (Endangered)	Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.	Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
South-western Brush-tailed Phascogale (Schedule 6)	Clearing of an estimated 63 ha of South-western Brush-tailed Phascogale habitat (including 30 ha surveyed and 33 ha unsurveyed).	-
- Peregrine Falcon (Schedule 7)	-	Approximately 46 ha of potential Peregrine Falcon habitat (including 30 ha surveyed and 17 ha unsurveyed)
Migratory birds	A small number (< 50) of migratory bird species were considered to be potentially transient visitors to the Project Area at times when wetlands are inundated and are not expected to be significantly impacted by the Project.	A small number (< 50) of migratory bird species were considered to be potentially transient visitors to the Project Area at times when wetlands are supporting water.

10.4 Key Environmental Factor – Terrestrial Environmental Quality

The assessment of impacts associated with terrestrial environmental quality for the two alignments are summarised in Table 14.

Table 14: Terrestrial environment quality comparison table

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE GREEN CORRIDOR
TERRESTRIAL ENVIRONMENT QUALITY		
Acid Sulphate Soils	The Project has low to moderate risk of ASS, with minor areas of high risk associated with watercourses and the Capel Golf Course. Although the Project will widen an existing road adjacent to the Golf Course no impacts to ASS at that location are considered likely.	There is a low to moderate risk of ASS, with minor areas of high risk associated with watercourses.
Contaminated Sites	No impact anticipated.	One site classified as contaminated with restricted use occurs within the Project Area, which is unlikely to be impacted by the Project.

10.5 Key Environmental Factor – Inland Waters

The assessment of impacts on inland waters (rivers and wetlands) for the two alignments are summarised in Table 15.

Table 15: Rivers and wetlands comparison table

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE GREEN CORRIDOR
RIVERS AND WETLANDS		
Rivers	No rivers protected under the RIWI Act will be impacted by the Project, however a number of minor waterways will be impacted, including Five Mile Brook.	No rivers protected under the RIWI Act will be impacted by the Project, however a number of minor waterways will be impacted including Gynudup Brook and Five Mile Brook.
Geomorphic wetlands	Loss of up to 33 ha of mapped Geomorphic Wetlands including approximately: Conservation: 1 ha Resource Enhancement: <1 ha Multiple use: 31 ha	Loss of approximately 75 ha of mapped Geomorphic Wetlands including: Conservation: 1 ha Resource Enhancement: <1 ha Multiple use: 73 ha

10.6 Key Environmental Factor – Air Quality

The assessment of potential air quality impacts for the two alignments are similar, with impacts generated from:

- Increased construction vehicle emissions
- Dust impacts during construction
- Reduced air quality due to bushfire
- Impacts from car emissions
- Greenhouse gas emission impacts

The assessment of impacts on air quality for the two alignments are summarised in Table 16.

Table 16: Air quality comparison table

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE GREEN CORRIDOR
AIR QUALITY		
Air quality	No significant impacts anticipated.	No significant impacts.

10.7 Key Environmental Factor – Social Surroundings

The assessment of impacts on social surroundings for the two alignments are summarised in Table 17.

Table 17: Social comparison table

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE GREEN CORRIDOR
SOCIAL		
State and Municipal heritage	No significant impacts anticipated.	Land associated with two sites on the Shire of Capel Municipal Heritage register will be impacted. • Elgin Sports Club, Boyanup West Road, Stratham • Stratham School (2nd Site), Boyanup West Road, Stratham. No structures associated with these sites will be impacted.
Aboriginal Heritage	Capel Bussell Highway (ID 5813). Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Archaeological Deposit and Camp. Paperbark Wetlands (ID 37869) is recorded as a Lodged Other Heritage Place, comprised of Modified Tree, Birth Place, Hunting Place, Water Source. The Gelorup Corridor (ID 37870) is recorded as a Lodged Other Heritage Place, comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material, Burial.	The buffered extent of 'Capel Bussell Highway' (ID 5813). Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Archaeological Deposit and Camp. The buffered extent of 'The Gelorup Corridor' (ID 37870) is recorded as an Other Heritage Place, comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material/ Burial.
Noise	Noise and vibration impacts are expected to result from the	Noise and vibration impacts are expected to result from the

ASPECT	BORR SOUTHERN SECTION GBRS (RED) ALIGNMENT	BORR SOUTHERN SECTION ALTERNATIVE GREEN CORRIDOR
	construction phase. These impacts are not considered likely to be significant. If required noise mitigation measures will be developed during the detailed design phase to be compliant with the requirements of SPP 5.4. (29)	construction phase, however the Project is in a rural location and these impacts are not considered significant. Noise mitigation measures will be developed during the detailed design phase to be compliant with the requirements of SPP 5.4. (29)
Visual	Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project. An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option.	Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project. An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option.
Amenity	Construction of the Project will potentially affect the amenity of residents through changes to the landscape. These impacts will be further investigated during visual impact assessment and mitigation measures will be identified during design phase if this alignment is selected as the preferred option.	Impacts on rural community amenity and agricultural production including loss of productive land, reducing carrying capacity and restricted access are potential consequences of the Project. The detailed design phase will consider provision of access and separation of properties and impacts will be investigated further if the alignment is selected as the preferred option.

10.8 Matters of National Environmental Significance

A search of the Protected Matters Search Tool (PMST) identified several Matters of National Environmental Significance that may be impacted by the two alignments. Table 18 provides an assessment of the Matters of National Environmental Significance (**MNES**) for the two alignments.

Table 18: Assessment against Matters of National Environmental Significance

MNES	IMPACT ASSESSMENT - GBRS (RED) ALIGNMENT	IMPACT ASSESSMENT - ALTERNATIVE GREEN CORRIDOR
Threatened Species and ecological communities	Impacts to one Threatened Ecological Community (TEC) was confirmed within the Project Area during field investigations: • Banksia Woodlands of the Swan Coastal Plain (SCP) TEC (approximately 21 ha).	Impacts to a TEC was were confirmed within the Project Area during field investigations: • Banksia Woodlands of the SCP TEC (approximately 5 ha). No EPBC Act or BC Act listed flora were recorded within the Project Area during

MNES	IMPACT ASSESSMENT - GBRS (RED) ALIGNMENT	IMPACT ASSESSMENT - ALTERNATIVE GREEN CORRIDOR
	No Threatened flora species 'known' or 'likely to occur' in the Project Area. Impacts to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and the Forest Red-Tailed Black Cockatoo (Vulnerable), including: • Removal of approximately 71 ha potential habitat (38 ha surveyed and 33 ha unsurveyed) • Removal of 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone Impacts to Western Ringtail Possums (Critically Endangered), including: • Removal of approximately 71 ha potential habitat (38 ha surveyed and 33 ha unsurveyed), providing habitat for an estimated 100 individuals, which represent less than 2 % of the regional population. Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.	the surveys conducted in October and November 2018 (BORR IPT 2019a and b). Impacts to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and the Forest Red-Tailed Black Cockatoo (Vulnerable), including: • Removal of approximately 38 ha (21 ha surveyed and 17 ha unsurveyed) potential breeding and foraging habitat • Removal of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone. Impacts to Western Ringtail Possums (Critically Endangered), including: • Removal of approximately 38 ha (21 ha surveyed and 17 ha unsurveyed) breeding and foraging habitat, providing habitat for an estimated 15 individuals, which represent up to 0.3% of the regional population. Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
Migratory Species	The PMST identified 42 migratory species including: 26 bird species (Inc. 9 wetland species) 15 marine species 1 terrestrial species.	The desktop assessment (PMST) identified 42 migratory species potentially occurring within 5 km of the Project Area, including: • 26 birds (including 9 wetlands species) • 15 marine species • 1 terrestrial species. Impacts to these species are not considered likely from the Project.

MNES	IMPACT ASSESSMENT - GBRS (RED) ALIGNMENT	IMPACT ASSESSMENT - ALTERNATIVE GREEN CORRIDOR
Commonwealth Marine Areas	The Project will not impact any Commonwealth Marine Area. The closest is Geographe Commonwealth Marine Reserve, approximately 14 km west of Project Area.	The Project will not impact any Commonwealth Marine Area. The closest is Geographe Commonwealth Marine Reserve, approximately 14 km west of Project Area.
World Heritage Properties	The Project will not impact any World Heritage Properties.	The Project will not impact any World Heritage Properties.
National Heritage Properties	The Project will not impact any National Heritage Properties.	The Project will not impact any National Heritage Properties.
Wetlands of International Importance	The Project will not impact any wetlands of international importance. The closest is the Vasse-Wonnerup System, approximately 20 km south of the Project Area.	The Project will not impact any wetlands of international importance. The closest is the Vasse-Wonnerup System, approximately 20 km south of the Project Area.

10.9 Environmental Approvals and Conclusion

Based on the assessments for the GBRS (Red) Alignment and the Alternative (Green) Alignment it is considered likely that the alignments will require the following approvals:

- Referral to the EPA under Section 38 of the EP Act
- Referral to DotEE under the EPBC Act for assessment as a Controlled Action
- Native Vegetation Clearing Permit (DWER)
- Works approval and licence to operate an asphalt plant (DWER)
- Bed and Banks Permit (DWER)
- Licence to take water for construction purposes (DWER)
- Section 18 consent to disturb Aboriginal Heritage sites (Minister for Aboriginal Heritage)
- Permission from the Shire of Capel to disturb the European heritage site.

In summary, both alignment options have environmental impacts, although of a different scale and nature. The GBRS (Red) Alignment has a higher impact upon the Western Ringtail Possum and native vegetation, whereas the Alternative (Green) Alignment has a significantly higher impact upon wetlands and endangered aquatic fauna.

11 COMMUNITY AND STAKEHOLDER ENGAGEMENT

11.1 General

The overarching objective of the engagement program was to:

- Optimise the planning concept through effective community and stakeholder engagement.

Broadly speaking, the engagement aimed to ensure:

- Stakeholders are informed about the project
- Stakeholders have the opportunity to provide input into the project
- Stakeholder input is used in the project to guide decision-making

The activities used within the engagement program focused on providing interactive stakeholder forums to facilitate and enhance communication and encourage collaboration with the various communities of interest.

The engagement program has identified a range of key issues, which can be broadly categorised into the following themes:

- Alignment selection
- Environmental impacts
- Local access/connections
- Traffic volumes/movement
- Impact on amenity/lifestyle
- Impact on agricultural land/business
- Land acquisition/compensation
- Certainty of future development
- Impact on the Bunbury economy

The BORR Team has considered the feedback from stakeholders and the community as part of the project planning, design and development. The project team has applied sustainable decision making principles and been cognisant of the benefits/impacts on the social environment and sense of community.

11.2 Consultation activities

From May 2018, the BORR Team has undertaken the following consultation activities with respect to the southern section of the project:

ENGAGEMENT ACTIVITY	DATE	PARTICIPANT AGENCIES / ENTITIES	PRIMARY OBJECTIVES OF THE ENGAGEMENT ACTIVITY
Project Briefing Presentations	May 2018 – Ongoing (At Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Shire of Busselton • Main Roads	• Project awareness – scope, impacts and benefits • Engagement opportunity to raise questions, concerns or preferences • Share feedback received from the community • Provide progress updates
Gnaala Karla Boodja WC1998/058 Native Title Claim group (GKB NTC) meeting	7 May 2018, 29 October 2018	• Brad Goode & Associates • Nine representatives from the GKB NTC group • DPLH • Main Roads	• Engagement with Traditional Owners • Project awareness – scope and potential impacts • Engagement opportunity to raise questions, concerns or preferences • Seek feedback on the proposal and identify areas of concern / for improvement
Members of Parliament briefings	May 2018 – Ongoing (At Key Milestones)	• Member for Bunbury - Don Punch • Member for Collie - Preston, Mick Murray • Member for Murray - Wellington, Robyn Clarke • Member for South West Region - Adele Farina, MLC • Nola Marino - Federal Member	• Project awareness – scope, impacts and benefits • Engagement opportunity to raise questions, concerns or preferences • Share feedback received from the community including any contentious issues • Provide progress updates as requested
Project Steering Committee	June 2018 – Ongoing (Bi-monthly)	• Chaired by Main Roads' Managing Director • Main Roads' Project Director • Department of Treasury	• Direction setting • Strategic leadership / guidance • Promote collaboration between agencies • Strategic partnerships

ENGAGEMENT ACTIVITY	DATE	PARTICIPANT AGENCIES / ENTITIES	PRIMARY OBJECTIVES OF THE ENGAGEMENT ACTIVITY
		• Department of Planning, Lands and Heritage • Department of Infrastructure, Regional Development and Cities • Others by invitation	• Decision making for key / critical issues • Ministerial liaison • Project advocacy
Project Enabling Group	June 2018 – Ongoing (Bi-monthly)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey • Shire of Dardanup • DPLH	• Liaison between agencies • Operational decision making • Inform recommendations to the Steering • Committee • Enable and facilitate progress • Technical and operational input • Promote efficient interface management • Ensure that project planning is consistent with and supports Government policy
Gelorup public meeting	June 2018	• Local residents • Directly affected landowners	• This meeting was arranged by the community and the BORR Team were invited to attend and respond to questions • Project awareness – scope, impacts and benefits • Engagement opportunity to raise questions, concerns or preferences
Community Reference Group (Southern)	July 2018; September, October, November, December; February 2019, March Ongoing	• Local residents • Directly affected landowners • Friends of Gelorup Corridor • South West Environment Centre • South West Native Orchid Propagation & Restoration Incorporation	• Provide a conduit for two-way communication and stakeholder input. • Communicate matters to, and from, their respective organisations, groups and committees. • Collaboratively inform the planning and development process for the project. • Assist in identifying and responding to project issues

ENGAGEMENT ACTIVITY	DATE	PARTICIPANT AGENCIES / ENTITIES	PRIMARY OBJECTIVES OF THE ENGAGEMENT ACTIVITY
			and opportunities identified by project stakeholders to ensure an optimal solution. • Provide issue-specific liaison in selecting / assessing options.
Landowner meetings (permission to enter for environmental investigation)	July – August 2018; Ongoing as required	• Landowners directly affected by the alternative (green) corridor under investigation	• Personalised meetings with directly affected landowners to outline the rationale for the investigation activities and seek permission to enter their private land for such purposes.
BORR Regional Local Government Advisory Group (RLGAG)	August 2018 – Ongoing (Quarterly or at Key Milestones)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey • Shire of Dardanup	• Identify and discuss local area issues for consideration during the planning and project development for BORR. • Effectively manage the interfaces between the BORR Project Team and the four affected local government authorities as partner planning agencies for adjacent or related projects and tie-ins. • Ensure that project planning reflects takes account of local government planning and policy goals. • Communicate openly and effectively to ensure accurate, timely and consistent messages and information are provided. • Respond to other matters as raised by the group members, Steering Committee members and other key stakeholders.
Freight and Road Users Group	August 2018, November 2018 – Ongoing (At Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • DFES • DPLH • Department of Transport	• Provide input on road user objectives, issues and opportunities • Promote integration and understanding between the various road users • Advise on operational requirements

ENGAGEMENT ACTIVITY	DATE	PARTICIPANT AGENCIES / ENTITIES	PRIMARY OBJECTIVES OF THE ENGAGEMENT ACTIVITY
		• Freight and Logistics Council WA • Livestock & Rural Transport Association • Public Transport Authority • RAC • WA Pilot Drivers Association	• Provide input into possible network management options • Provide input and feedback on the development of the Network Operations Plan • Provide issue-specific liaison in developing the project.
Drainage Reference Group	August 2018, December 2018 – Ongoing (At Key Milestones)	• Department of Biodiversity Conservation and Attractions (DBCA) – Parks and Wildlife Service • DWER • Water Corporation • City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • DPIRD • Harvey Water • Leschenault Catchment Council • South West Catchments Council • Main Roads	• Collaboratively inform the Drainage Strategy for Bunbury Outer Ring Road • Assist in coordinating the concerns, suggestions and advice of the various agencies and stakeholders to ensure an optimal solution • Adopt innovative outcomes extending beyond compliance to the maximum extent possible in keeping with the Bunbury Outer Ring Road objectives • Provide issue-specific liaison in developing the drainage solution • Communicate project matters to, and from, relevant drainage and stakeholder groups.
Economic Advisory Group	October 2018, December 2018 – Ongoing (At Key Milestones)	• City of Bunbury • Bunbury Geographe Economic Alliance (BGEA) • South West Development Commission (SWDC)	• Provide a conduit for two-way communication and stakeholder input. • Communicate matters to, and from, their respective organisations, groups and committees. • Collaboratively inform business case development for the project.

ENGAGEMENT ACTIVITY	DATE	PARTICIPANT AGENCIES / ENTITIES	PRIMARY OBJECTIVES OF THE ENGAGEMENT ACTIVITY
		• Regional Development Australia South West (RDASW) • Chamber of Minerals and Energy • Wespine • Bunbury Geographe Chamber of Commerce and Industry • Main Roads	• Identify potential economic risks and opportunities resulting from the project and identify measures for mitigation or realisation. • Seek to maximise opportunities for local business/workforce participation in the delivery of the project.
Project newsletter (38,000 copies)	October 2018	• Local community (distribution by letterbox drop) • General public (via website) • Local Government Areas (distribution) • MLAs (distribution)	• Public awareness of project scope, impacts and benefits • Primary source of project information (design development) • Provide contact details for public queries; website, etc
Community Information Drop In Sessions	October 2018	• Landowners (both directly affected and adjacent) • Local residents • Local businesses	• Public awareness of project scope, impacts and benefits • Primary source of project information (design development) • Provide access to project team members for personalised response to landowner queries and concerns
Landowner Briefing Session	October 2018	• Landowners directly affected by the alternative (green) corridor under investigation	• Project awareness – scope, impacts and benefits • Provide access to project team members for personalised response to landowner queries and concerns • Engagement opportunity to raise questions, concerns or preferences
Presentation to Chamber of Commerce	November 2018	• Main Roads • Chamber of Commerce	• Project awareness – scope, impacts and benefits

ENGAGEMENT ACTIVITY	DATE	PARTICIPANT AGENCIES / ENTITIES	PRIMARY OBJECTIVES OF THE ENGAGEMENT ACTIVITY
			• Promote opportunity for local industry participation
Elgin Hall public meeting	December 2018	• Landowners directly affected by the alternative (green) corridor under investigation • Local residents	• This meeting was arranged by the community and the BORR Team were invited to attend and respond to questions • Project awareness – scope, impacts and benefits • Engagement opportunity to raise questions, concerns or preferences
Department of Planning, Lands & Heritage	Ongoing	• BORR IPT Members • DPLH representatives	• Consultation regarding the alignment selection review
Western Australian Planning Commission	February 2019	• BORR IPT Members • WAPC representatives	• Presentation to WAPC • Completed detailed environmental site investigations • Identified nominal alignment within the green investigation corridor • Preparing Environmental Impact Assessments for both alignments • Documentation of other alignment issues (social, economic, planning) • Recommended alignment by Q1 2019
Shire of Capel	Ongoing	• BORR IPT Members • Shire Capel representatives	• Consultation regarding the alignment selection review
Project website	Throughout project duration	• General public	• Primary source of project information • Communication conduit
Project email and call centre	Throughout project duration	• General public	• Customer service response to public queries

11.3 Responses to Consultation

11.3.1 Department of Planning, Lands & Heritage

Advice was received from the Department of Planning, Lands and Heritage (DPLH) in relation to the BORR Southern Section Alignment Selection. The DPLH noted that:

"*The red alignment as currently reserved in the GBRS has been identified in various strategic planning documents since the mid 1980's, and was included in the Greater Bunbury Region Scheme when it was advertised in 2000. The alignment has historically been supported by the Western Australian Planning Commission (WAPC) and the WA Government, and this support was indicated by the Gazettal of the GBRS in 2008, with the alignment as currently shown on the scheme map.*

The alternative southern alignment was never formally assessed given the significant environmental issues on this alignment, however apart from any possible issues with GBRS policies (Strategic Agriculture and Strategic and Basic Raw Materials), there are no major land use planning impediments for either corridor and as such, will be guided by the outcome of the BORR team studies and recommendations."

11.3.2 Other Responses to Engagement

A summary of the key concerns raised during the stakeholder consultation is provided in Table 19[4].

Table 19: Summary of key concerns raised during consultation[1]

AGENCY	FORUM	CONCERN RAISED
CRG Members, Community members	CRG Meetings, Community Drop in Sessions,	Need for BORR and Strategic Traffic Modelling Basis
Community members, CRG members, impacted businesses	CRG Meetings, Community Drop in Sessions, Public Enquiries, Landowner Briefings	Southern Alignment Investigations
CRG members, Community members	Norther & Central and Southern CRG meetings	Western Ringtail Possum
Community members, CRG Members	Enquiries, Northern & Central and Southern CRG meetings, Drop in Sessions	Longevity of GBRS Alignment
CRG members, Community members	Northern & Central and Southern CRG meetings, Drop in Sessions	Environmental Approvals Process and Studies
CRG members, Community members	Northern & Central and Southern CRG meetings	Flora and Fauna
CRG members (local residents, road users and property owners/ farmers)	Northern & Central Community CRG Meetings (10/18, 11/18, 12/18)	Social and Economic Bypass Impacts
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	Noise Impacts

[4] Refer to Appendix G Environmental Impact Assessments, Table 2-3 for full table

AGENCY	FORUM	CONCERN RAISED
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	Future Development Noise Mitigation
CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	Noise Modelling Assumptions
Community members, CRG members	Main Roads Enquiries line, CRG Meetings, Community Drop In Sessions	Light pollution and Visual Amenity
Property owners	Main Roads Enquiries, Southern CRG (07/18, 12/18)	Air and Water Quality.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	Land Acquisition and Compensation Process
Local community and road users CRG Members	Southern CRG meetings	Local Access Changes on Journey Times
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	Property Severance
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	Property Access
Gelorup residents, local road users	Southern CRG Meeting (07/18, 9/18, 10/18, 11/18, 12/18, 2/19)	Traffic and Safety
CRG Members, Fire Emergency Service, Shire of Capel	Southern CRG meetings	Emergency Service Access and Emergency Egress
CRG members	Southern CRG meetings	Impacts to Cultural Heritage
CRG members	Southern CRG Meetings (03/19)	Impacts to Aboriginal Heritage
CRG members	Southern CRG meetings	Construction Impacts
Drainage Reference Group (DRG)	DRG meetings	Wetlands and Waterways
Land owners	Landowner meetings	Irrigation and Drainage
Drainage Reference Group (DRG) Members, Water Corporation	DRG (08/2018)	Water Quality
DRG Members, Leschenault Catchment Council Inc.	DRG (08/2018)	Water Quality

12 STAKEHOLDER OPTIONS

12.1 Introduction

Following representations made by a group of residents, two local members suggested that further alignment options utilising existing local road reserves be investigated. Three suggested options were presented for consideration.

The suggested alignments were all related to the Hasties Road to Bussell Highway portion and focussed on using the following road reserves:

- **Option 1:** Ken Bell Road, Skippings Road and Boyanup West Road to Bussell Highway
- **Option 2:** Ken Bell Road, Skippings Road and Cable Mine Road to Bussell Highway
- **Option 3:** Ken Bell Road, Skippings Road to Boyanup Road West, with an extension in a new reserve through to Railway Road to Bussell Highway

Sketches of the above proposals are included in Appendix H.

12.2 Assessment of Local Road Reserves

The local road reserves in this area are typically 20 m in width. The notional width for a freeway / expressway standard road in unconstrained locations is in the order of 100 m. In addition, the BORR is being planned as a control of access highway, therefore no direct access is permitted. As a result of utilising the existing orridors, it is likely that parallel local road roads would need to be constructed either side of BORR to maintain access to properties that currently have access to the local roads. This would require additional width in the road reserve, notionally a further 20 m to 30 m either side of the typical 100 m corridor to allow for the service roads.

The proposed road reserves also have native vegetation over significant lengths. This is either revegetated or as a result of not being previously cleared. Ken Bell and Skippings Road also pass through native vegetation and wetlands near Ducane Road, Hair Place and Lake Beridup. The Railway Road reserve is also vegetated along most of its length and includes Declared Rare Flora.

There is no existing local road reserve south of Boyanup West Road and therefore the extension of an alignment further south will need to cross agricultural / residential land to connect to Cable Mine Road and Railway Road.

Railway Road reserve has a rail reserve on the northern side of the road. The road is a key east west connector between the Boyanup and Capel townsites, maintaining this connectivity as a rail reserve and local access for this corridor would be a constraint.

12.3 Assessment of Impacts

Along all three suggested options there are a number of properties that are relatively close to the existing roads. Due to the width requirements for the BORR and the associated side road requirements for access, the properties would be significantly impacted, if not in some cases, directly.

As the majority of the suggested corridors contain native vegetation, clearing of native vegetation would not be mitigated by following these corridors. In the northern parts of the alignments there is interaction with wetlands common to all options. The use of Railway Road reserve is likely to impact on native vegetation and Declared Rare Flora.

Construction of additional local roads either side of the alignment, to maintain local access and connectivity, will be significant capital cost compared to the requirements for access roads associated with the GBRS (Red) Alignment or the Alternative (Green) Alignment.

The Railway Road reserve option would require bridging of the rail reservation twice (as a minimum) and also the provision of an associated east / west route to maintain local access and connectivity between Capel and Boyanup townsites.

The routes are also longer than the Alternative (Green) Alignment (by 3 to 8.5 km) resulting in increased capital and recurring maintenance costs. The increased lengths will also impact journey times, vehicle operating costs and network efficiency.

12.4 Conclusion

Following existing local road reserves and providing the additional width required for a rural freeway standard road is likely to result in direct impacts upon buildings, residences, local business and farming operations.

Utilising existing local road reserves would require more extensive duplication of existing infrastructure in order to maintain local traffic movements and property access. Due to the increased lengths this would result in significantly higher capital and recurrent costs.

The increased length of these suggested alignments would also result in higher journey times, thus increasing vehicle operating costs and reducing network efficiency.

As the majority of the suggested corridors contain native vegetation, clearing of native vegetation would not be mitigated by following these corridors. In the northern parts of the alignments there is interaction with wetlands which is common to all suggested options.

The alignment suggestions that follow existing local road reserves provide no additional benefit in terms of environmental, property and social impacts or better engineering outcomes than the Alternative (Green) Alignment. Therefore alignments following the existing road reserves were not considered further.

13 WESTERN RINGTAIL POSSUM REGIONAL SURVEYS

In May 2018 the conservation status of the Western Ringtail Possum (WRP) was elevated from "Vulnerable" to "Critically Endangered" by the Commonwealth Department of the Environment and Energy (DoEE) under the Environmental Protection and Biodiversity Conservation Act, 1999.

As part of the environmental assessment for the Bunbury Outer Ring Road project Main Roads WA commissioned a regional WRP survey to more accurately estimate the population size and better determine the potential impact of the BORR project. These surveys were undertaken in early 2019 at a number of sites within the range of the species. The regional survey included sites on the Southern Swan Coastal Plain as shown at Figure 22.

The regional survey methodology was agreed with the Department of Biodiversity **(DBCA)**, Conservation and Attractions and the Western Ringtail Possum Recovery Team.

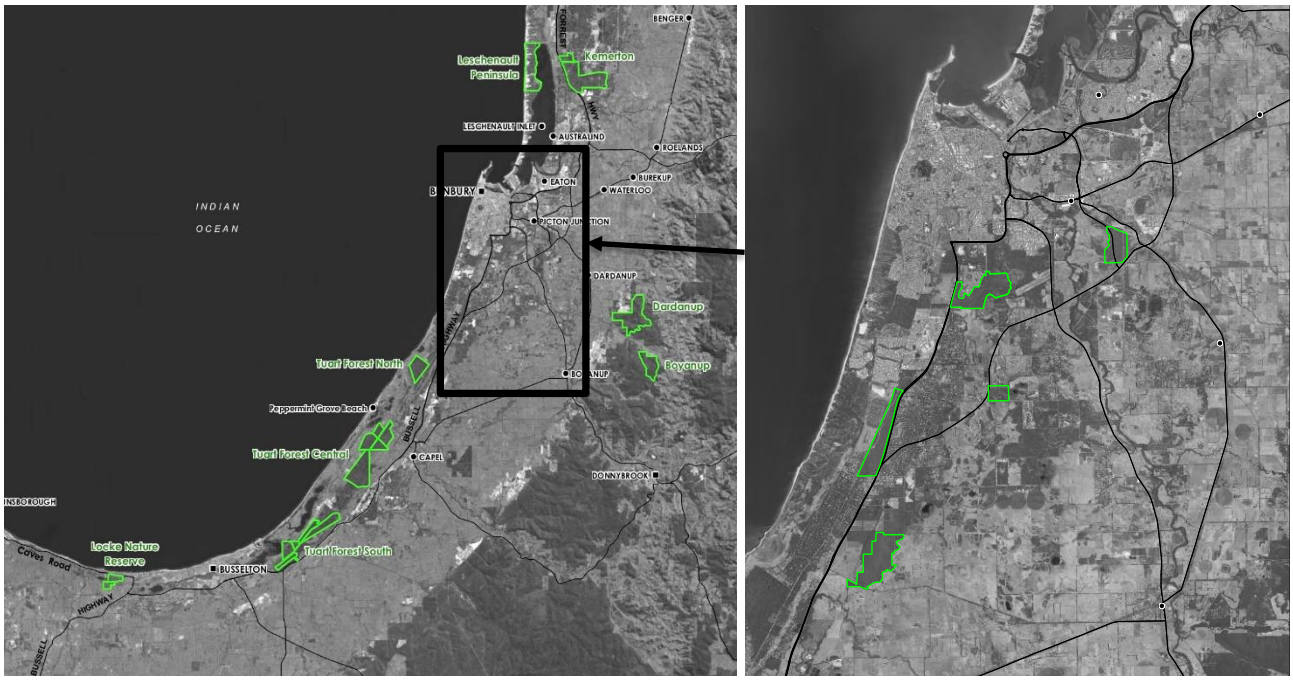


Figure 22: WRP Southern Swan Coastal PlainSurvey Sites

The DoEE considered a total 2015 WRP population estimate of 3,400 when elevating the conservation status of the species, which included 2,000 WRP on the Southern Swan Coastal Plain. The regional survey conducted in early 2019 estimated that the total population of the species within the survey sites was more than 17,000 with approximately 5,700 WRP located on the Swan Coastal Plain.

The population estimate is considered conservative as the surveys did not include all potential habitat areas including urban / peri-urban areas, and small patches of vegetation on agricultural land, all of which are known to support possums.

Main Roads has since initiated additional surveys at sites within the species range which are expected to further increase the population estimate. The findings of the WRP regional surveys will be published as a separate report.

14 ALIGNMENT SELECTION RECOMMENDATION

A range of factors have been considered in the decision making process including environment matters, social, heritage, land use planning, engineering, economic and the impact on agricultural businesses, raw materials and mining tenements.

Detailed environmental surveys have been completed in both the GBRS (Red) Alignment and Alternative (Green) Alignment and Environmental Impact Assessments prepared (Appendix G).

Uncertainty regarding the total population of the WRP was a factor in the elevation of its conservation status. Therefore, regional surveys to more accurately estimate the total population of the WRP were commissioned by Main Roads WA.

14.1 Comparisons of the GBRS (Red) Alignment and Alternative (Green) Alignment

The key comparisons of the GBRS (Red) Alignment and Alternative (Green) Alignment are summarised as follows:

- The relative impacts upon Matters of National Environmental Significance (MNES), can be summarised as follows:
  - Western Ringtail Possum (critically endangered fauna) – GBRS (Red) Alignment has a higher impact.
  - Black Cockatoo (threatened fauna) – Alternative (Green) Alignment has significantly more trees potentially used by Cockatoos for breeding. However there is less evidence of use than in the GBRS (Red) Alignment.
  - Black-stripe minnow (endangered aquatic fauna) – both the GBRS (Red) Alignment and Alternative (Green) Alignment options have potential to impact. However, the Alternative (Green) Alignment has higher impact due to the larger area of wetlands affected.
- The relative impacts upon State matters can be summarised as follows:
  - Flora and vegetation – the existing GBRS (Red) Alignment would require the clearing of a larger area of native vegetation including greater areas of threatened Ecological Communities (TECs) / Priority Ecological Communities (PECs)
  - Wetlands and Waterways – the Alternative (Green) Alignment has a significantly higher impact upon wetlands. Whilst the majority of wetlands impacted are currently classified as Multiple Use, a number of these wetlands are likely to be reclassified to Conservation Category.
- The Alternative (Green) Alignment has higher socio-economic impacts in terms of property severance, land acquisition required and impact on agricultural enterprises.
- The GBRS (Red) Alignment will result in more residences potentially impacted by noise and loss of visual amenity. However, alignment has been included in the Greater Bunbury Regional Scheme for several decades. As such, eventual noise and visual impacts were known prior to sub-division and development can be managed in line with State Planning Policy 5.4: Road and Rail transport noise and freight considerations in land use planning.
- The GBRS (Red) Alignment has fewer engineering constraints, particularly with regard to hydrogeology and ground conditions.
- The GBRS (Red) Alignment has a lower construction cost and better network performance and would require less fill material to construct. The alignment also avoids impacts upon strategic agricultural

resources, basic raw materials and mining tenements that would be impacted by the Alternative (Green) Alignment.

- The GBRS (Red) Alignment and Alternative (Green) Alignment both have comparable levels of impact upon Aboriginal Heritage that will require further investigation and management.
- The Alternative (Green) Alignment has a high impact on European Heritage. The impact area is predominantly owned and farmed by a small number of families with a connection to the land dating back to the mid -19th century.

14.2 Regional Surveys of Western Ringtail Possum

When the conservation status of the WRP was elevated, the total estimated population in 2015 was 3,400 individuals, of which approximately 2,000 estimated to be in the Swan Coastal Plain.

The regional surveys, undertaken by Main Roads WA in 2019, estimate the population to be approximately 5,700 individuals in the Swan Coastal Plain. This estimate is considered to be conservative as the surveys did not include urban / peri-urban areas (including the project area) and small patches of vegetation on agricultural land, all of which are known to contain possums.

14.3 Discussion

Both the GBRS (Red) Alignment and Alternative (Green) Alignment have environmental impacts, differing in scale and nature. The GBRS (Red) Alignment has a higher impact upon the Western Ringtail Possum and native vegetation, whereas the Alternative (Green) Alignment has a significantly higher impact upon wetlands and endangered aquatic fauna.

The increased population estimate for the WRP changes the decision making context for the Environmental Regulators, in that, with the increased numbers, the impact on the species may be deemed acceptable with appropriate management measures.

14.4 Recommendation

On this basis, Main Roads WA's recommendation is to proceed with the project development of the Hasties Road to Bussell Highway portion of the BORR Southern Section in the GBRS (Red) Alignment. Alternative alignments will no longer be considered due to:

- Land use planning in the area surrounding the BORR Southern Section has not changed.
- Alternative alignments would have increased impact upon:
  - land and strategic agricultural resources
  - Basic raw materials and mining tenements
  - European Heritage
- Increased project cost and reduced network efficiency.
- The GBRS (Red) Alignment is included in the GBRS.
- Both alignments have significant but different impacts (environmental, social, etc).
- Increased population estimate of the WRP effectively reducing the potential impact on the species.
- No compelling reason to change the alignment, which has been included in the Greater Bunbury Regional Scheme and the preceding Bunbury Wellington Region Plan for many years.

15 CONCLUSION

This report documents the findings and recommendations of the investigations into alternative options for alignments for the BORR Southern Section. The investigation into alternative alignments was triggered by the change in listing of the Western Ringtail Possum from “vulnerable” to “critically endangered” in May 2018.

The following are the primary elements of the alignment selection study:

- For the South Western Highway (South) to Hasties Road portion of the BORR Southern Section, the GBRS (Red) Alignment is still considered appropriate.
- Utilising an alignment following Centenary Road for the BORR is not appropriate. Previous constraints and arguments are still relevant (Refer to Appendix A and Section 7.15 of HGM 1995 (5)) and the alignment would not fulfil the BORR project objectives.
- For the Hasties Road to Bussell Highway portion of the BORR Southern Section, an Alternative (Green) Alignment was identified through an MCA process evaluating a number of alignments within the Alternative (Green) Corridor for investigation.
- Through an MCA process, the GBRS (Red) Alignment and Alternative (Green) Alignment were evaluated using Social, Engineering and Economic criteria. The assessment indicated that considering these criteria, the GBRS (Red) Alignment was more favourable.
- Detailed environmental site surveys were completed in both the GBRS (Red) Alignment and Alternative (Green) Alignment and an Environmental Impact Assessment prepared for each alignment, refer Appendix G.
- It was confirmed that both the GBRS (Red) Alignment and Alternative (Green) Alignment options have environmental impacts, although of a different scale and nature. The GBRS (Red) Alignment has a higher impact upon the Western Ringtail Possum and native vegetation, whereas the Alternative (Green) Alignment has a significantly higher impact upon wetlands and endangered aquatic fauna.
- Consideration of suggested alignments proposed by stakeholders that utilised existing road reserves, were considered and found to provide no additional benefit over the Alternative (Green) Alignment being evaluated against the GBRS (Red) Alignment.
- Regional surveys for Western Ringtail Possum (WRP) were commissioned by Main Roads WA to more accurately estimate the population size and better determine the potential impact of the BORR project.
- In their decision to increase the conservation status of WRP to critically endangered in May 2018, the Commonwealth Department of the Environment and Energy used a total 2015 population estimate of 3,400. The 2015 population estimate included 2,000 WRP present on the Swan Coastal Plain. The regional survey conducted in early 2019 estimated that the total population of the species within the survey sites was more than 17,000 with approximately 5,700 WRP located on the Swan Coastal Plain.
- The findings of the Western Ringtail Possum Regional surveys to date confirm that the population is significantly higher than previously estimated. This is an important factor when considering the potential impact of BORR.

The following are the key recommendations of this alignment selection study:

- Main Roads WA recommends to proceed with the GBRS (Red) Alignment from South Western Highway (South) to Hasties Road. There was found to be no overall advantage to amending the alignment.
- Main Roads WA recommends to proceed with the GBRS (Red) Alignment for the BORR Southern Section from Hasties Road to Bussell Highway, which was subsequently endorsed by Government. Alternative alignments will no longer be considered.

15.1 Further refinements and key issues to be resolved in the next stage

Based on the above and the recommendation to proceed with the GBRS (Red) Alignment the following areas of work need to be developed as part of the Alignment Definition stage.

- Environmental mitigation measures to limit the environmental impacts on the Gelorup community and the environmental values:
  - Consideration of retaining walls to limit the extent of earthwork and clearing requirements.
  - Design and provision of noise walls to limit the impact of traffic noise on impacted properties.
  - Maximise screening of the highway by retaining as much remnant vegetation as possible and through additional planting / landscaping.
  - Consider the impacts on the fauna, particularly the Western Ringtail Possum and develop strategies to avoid / minimise impacts to the species.
- To develop a local connectivity strategy that does not compromise the project objectives, minimises traffic impacts to the Gelorup community and maintains access to the existing quarries.
- Impacts on local access to be developed and resolved. Particular focus to be reviewed around Calinup Road, the connectivity between the north and south of Gelorup.
- Principal Shared Path and Shared Path arrangements to provide access consistent with the Bunbury Wellington 2050 Cycling Strategy.

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APPENDIX A LITERATURE REVIEW

Note: Numbering applied to the various documents within the appendix largely follows that used for reference purposes and recorded as such in the references section.

(1) 1987 Bunbury Region Plan Policy Statement by State Planning Commission Western Australia

The plan and Policy Statement brought together plans and studies from 1972 through to 1984. This involved investigations into comments raised on two plans for the growth of the Bunbury Region which were published in brochure form in 1981. Following the consultation period which ended in February 1982, the Bunbury and Districts Planning Committee adopted 'in principle" a compromise between the two proposals and 10 areas for further investigation. Following the completion of the investigations, Taylor and Burrell were appointed by the State Planning Commission to produce the final Region Plan. When completed, it was submitted to the State Government for adoption as a Statement of Planning Policy in 1987.

The plan characterised the development in Gelorup into three areas. Areas A and B being west of Bussell Highway were identified as future urban growth areas of Bunbury with predominant use as residential. Area C, to the east of Bussell Highway was categorised as special rural and special residential development. The plan made an allowance for the red corridor of the Bunbury Outer Ring Road alignment through Area C of Gelorup. This was presented in the Bunbury Region Plan, September 1986, which was the culmination of public comment and review based on the 1980 draft region plan.

(2) 1995 Bunbury Wellington Region Plan by WAPC

Bunbury-Wellington Region Plan 1995 identified need to complete the Southern Province transport Strategy by the Department of Transport as this would complement the South West region Road Strategy. The importance of Bunbury as the only Port for the South West and the significance of good road and rail access from all areas. The Bunbury Outer Ring Road was recognised as a high priority including the construction of the haul road within the planned service corridor to eliminate the large numbers of heavy vehicles that would otherwise use local roads to gain access to the port or other major industrial areas.

The Greater Bunbury Structure plan (Section 8), notes an emphasis on the port development and industry in the area and the need for an efficient and capable transportation system to accommodate the resulting high volume of heavy vehicles. The plan notes, "The Outer Ring road, particularly the section between North Boyanup Road and the Picton-Dardanup Road and the connection to Bussell Highway, along with the connecting road to the service corridor, are vital in that regard and a high priority".

The plan, in Figure 17: Transport Strategy, shows the construction of the Outer Ring road as a single carriageway in <5 years and dual carriageway on <20 years.

(3) 1995 Bunbury Outer Ring Road Assessment and Impact Identification Report by Halpern Glick Maunsell

The Bunbury Outer Ring Road Assessment and Impact Identification Report, issued in June 1995, identifies the constraints and opportunities within proximity of the Main Roads WA BORR concept alignment. The report identifies findings and recommendations from previous planning and technical studies.

The report notes that, "*none of the previous broad scaled planning studies, which had been reviewed, indicated that the general alignment of the Bunbury Outer Ring Road was inappropriate*." However, it did identify that the section of the alignment which was subject to the most debate was the section between South Western Highway, previously referred to as North Boyanup Road, and the tie in with Bussell Highway. In addition it notes, "*there is a strong feeling amongst some residents that the southern portion of the Gelorup special rural area will be severed from the greater Gelorup community.*"

Following review of the impacts and constraints, the report concluded that alternative alignments should be examined between South Western Highway and Gelorup and that alignment options utilising Centenary Road or an alignment that passes around Gelorup should be broadly investigated to determine their viability.

This report outlines issues relevant to the road alignment which had been identified from past planning, technical studies and from public feedback as follows:

- The Bunbury Wellington Region Plan supports the concept alignment for the Outer Ring Road prepared by Main Roads WA;
- An alternative alignment via Moore Road, South Western Highway and Ducane Road had been suggested as an option to be considered in order to avoid impacts on dairies west of South Western Highway;
- Realignment of the Outer Ring Road to the east of the proposed quarry on Lot 2 (Hanson) Allenville Road will affect dairies and wetlands;
- There are views that although the alignment of the Outer Ring Road through Gelorup was acceptable in the 1970's, it is no longer acceptable in the 1990's;
- A suggested alternative is that the ultimate alignment of the Outer Ring Road should utilise Centenary Road and the existing Bussell Highway;
- It was also suggested that the alignment of the Outer Ring Road should tie in with Bussell Highway further to the South of Gelorup; and
- A further alternative is that the alignment of the Outer Ring Road should follow the powerline easement to the east of Gelorup.

Centenary Road

This report also outlines that Centenary Road had been the subject of much debate under the topic of main side road connections. The main issues relevant to Centenary Road that have been identified in past studies and from public feedback are as follows:

- The draft Bunbury Wellington Plan originally considered Centenary Road as an interim connection of the Outer Ring Road to Bussell Highway.
- The need for future construction of Centenary Road was supported in the Industry and Transport Strategy Working Paper for the Bunbury Wellington Region Plan.
- The Greater Bunbury Structure Plan supports Centenary Road as a district distributor. However at the time it was not included as a distributor road in the Draft Bunbury Planning Strategy.
- There are engineering constraints associated with the connection of Centenary Road to Bussell Highway due to the topography at the intersection.
- There was some opinions that Centenary Road should be constructed and other opinions that it shouldn't be constructed at all.
- There was feeling amongst some members of the Gelorup community that Centenary Road and Bussell Highway should form the ultimate alignment of the Outer Ring Road.

(4) 1995 Bunbury Outer Ring Road Biological Survey & Environment Impact Assessment by Halpern Glick Maunsell

The Biological Survey and Environmental Impact assessment report issued in October of 1995, undertook an investigation to identify the environmental constraints and impacts during construction and operation of the preferred BORR route and provides recommendations on management and mitigation strategies.

The investigation incorporated a two phase biological field survey, literature review and public and authority consultation. The report identified the Gelorup road reserve corridor as likely to support rare flora, although a number of orchid species were identified, the rare Spider and Donkey Orchids were not identified in the corridor during the flora survey.

Similarly the Gelorup mixed woodlands, present within the Gelorup road corridor, is reputed to be habitats for the (at that time) endangered 'Southern Brown Bandicoot' and the schedule one 'Common Ringtail Possum' although none were spotted during fauna surveys. Despite the potential for the rare fauna and flora,

the report does not discount the preferred BORR alignment, however does recommend strategies to address and or mitigate environmental concerns during construction and operation.

(5) 1995 Bunbury Outer Ring Road Concept Report by HGM

This report documents the preferred layout of the BORR and port access road and describes the process which led to the preferred layout being chosen. The objectives of this study highlighted in the report by HGM in 1995 were to:

- Develop environmental and socially acceptable concept plans in sufficient detail for inclusion in local Town Planning Schemes;
- Define land requirements to protect future implementation of the road; and
- Develop an implementation strategy for the road (ultimate layout and first stage implementation)

In setting these objectives Main Roads recognised the significance of past planning for the road. The study was not seen as one that involved specific route selection. However, due to the significant community reaction to the planned alignment for the BORR in Gelorup, Main Roads initiated a broad investigation of the alternative alignments in this area to assess suitability of the planned alignment. This was added to the scope in August 1995.

This report summarised the previous public consultation process that had taken place from December 1994 to November 1995, including verbal and written communication, details around public information days, public displays and public meetings. The report then summarises the issues and position statements identified and described in *"Bunbury Outer Ring Road Assessment and Impact Identification Report HGM 1995b".*

Community feedback (significant outcomes that are relevant now)	
Land use and transport planning issues:	Social issues:
• Planning done in the 1970's for Gelorup is no longer applicable in the 1990's. • Alternative alignments should be considered including Moore Road, Centenary and alignments south east of Gelorup. • The outer ring road should be located to minimise the impact on a proposed quarry on Lot 2 Allenville Road.	• The peaceful lifestyle in Gelorup special rural area will be disturbed by the Outer Ring Road. • Landowners have been and still are affected by the uncertainty in the planning for the Outer Ring Road. • Properties adjacent to the road may be devalued following its construction.

Section 7.10 discusses the alignment between North Boyanup Road (now South Western Highway) and Hasties Road. Important points to note from this section are summarised as follows:

- BORR alignment was reviewed between North Boyanup Road (now South Western Highway) and Hasties Road. A number of constraints were identified, including existing dairy farms, a group of wetlands, a horse riding school and a proposal for a new basalt quarry. The proponents of the proposed quarry had requested that the original alignment for the BORR be realigned to the east of avoid any impact on the basalt resource. However, an eastern alignment further increased the impact of the Bunbury Outer Ring Road on viable dairies and wetlands and therefore was considered unacceptable.
- A more detailed review of the original alignment revealed that the impact on the dairy farm near the intersection of North Boyanup Road and Centenary Road, on the wetlands and on the horse riding school could be reduced by shifting the BORR to the northwest of the planned alignment. This change in alignment also reduced the impact on the proposed quarry but required modifications to the

location of the interchange at North Boyanup Road. This change in alignment meant different landowners were affected by BORR and additional land would be required from the approved industrial subdivision north of North Boyanup Road.

In this report, Section 7.11 discussed the history of the Hasties Road Interchange as follows:

- Original planning for Hasties included a diamond interchange at Hasties Road, with an extension of Hasties Road to the east to connect with Ducane Road. The subsequent development of a basalt quarry adjacent to the intersection at Hasties Road and Allenville Road now means that to construct the interchange in its originally planned location would require substantial filling to restore ground levels to natural surface, which isn't economically viable due to impacts on the operations of the quarry. As a result, the need for a diamond interchange was questioned, because unlike the other major side roads, Hasties does not form one of the main radial routes to Bunbury
- After discussions with Ministry of Planning and with the Shire of Capel, the need to plan for an interchange had been confirmed. A review of the ground contours showed that by moving the connection from Hasties Road to Ducane Road to the south by 300m, a much better interchange site could be obtained as it made maximum use of the low sand hills between Hasties Road and Ducane Road.
- For the short term, staggered Tee intersections were proposed at Hasties Road and at Ducane Road. Hasties Road would be realigned into its ultimate alignment.

Section 7.12 discussed Hasties Road to Bussell Highway, the main points are as follows:

- Main Roads planning in 1970's selected the alignment that passed through the rural and undeveloped land to the south of the (then) Gelorup community. Subsequent to this, an area of land adjacent to the proposed road was rezoned to "Special Rural" and gazetted in the Shire of Capel Town Planning Scheme (TPS) No.2 in February 1981. As part of this process, Main Roads WA purchased land for the future Bunbury Outer Ring Road.
- This report documented that a significant portion of this "Special Rural" community voiced concerns that construction of the Bunbury Outer Ring Road would sever their community, destroy a corridor of native vegetation, result in substantial road kills of fauna and (including rare species), remove the quiet lifestyle they had and create hazards for their existence within the area. In response to these concerns, Main Roads WA agreed to investigate the alternative road alignments through this Special Rural area.

Section 7.15 discussed Centenary Road/ Bussell Highway, the main points are as follows:

During public consultation, it was suggested that a further route be investigated, one which utilised Centenary Road and the existing Bussell Highway. This option was assessed in broad terms and was discounted due to:

- The topography (steep grades) at the intersection of Centenary Road with Bussell Highway is such that construction of at-grade intersections is extremely difficult and grade separated options result in significant impacts on landowners on both sides of Bussell Highway.
- Land adjacent to Centenary Road is proposed for intensive residential development.
- The existing eastern end of Centenary has a number of current access points which would require the provision of a service road to minimise conflicts thus increasing cost and land acquisition.
- The Usher and Dalyellup area is proposed for significant residential development, meaning that both sides of the existing Bussell Highway will support large residential populations.

- Given the proposed development the existing Bussell Highway will be needed to support local traffic movements within Bunbury rather than through traffic movements.
- As the proposed developments proceed it would be likely that speed limits would be further reduced on Bussell Highway making it a less attractive route.
- Further improvements required to Bussell Highway to cater for both the local and through traffic would affect a number of houses, businesses and a school.

Section 8 – Route Evaluation

Section 8.6 discussed Hasties Road to Bussell Highway route evaluation. Alternative alignments were investigated due to community concerns about the planned alignment for the Outer Ring Road between Hasties and Bussell Highway, particularly through the Gelorup Special Rural area.

A broad investigation was undertaken of the land to the south east of Gelorup to determine the constraints based on a review of aerial photography. The constraints that were mapped and assessed included existing houses, protected wetlands, areas of vegetation, major watercourses, intersecting roads, major services and mining tenements. There were four alignments in total that were investigated: the planned alignment (since late 1970's), G1, G2 and G3.

This report concluded that all the alternative alignments will also have significant impacts (either engineering or environmental) and do not provide any overall advantage over the existing corridor, therefore the relocation of the Bunbury Outer Ring Road was not justified. This conclusion was based on the following:

- Options G1, G2 and G3 directly impact or sever environmentally significant wetlands;
- Existing route is already defined and landowners are aware;
- Planned alignment is shorter and traverses better ground conditions and is the least expensive option;
- Options G1,G2 and G3 involve more severance of farms, creating operational difficulties;
- Option G3 duplicates a long length of existing Bussell Highway;
- Option G1 will sever small lots, destruction of existing residences and traverses an operating sand pit;
- Options G2 and G3 potentially sterilise mineral resources and could reduce the viability of the resource;
- Options G1, G2 and G3 offer no advantages for loss of flora or fauna habitat;
- Nothing was found during the detailed biological and aboriginal surveys on the planned alignment to rule out this route. Detailed studies were not undertaken on options G1, G2 and G3.

The community also expressed concern about the ultimate nature of the road being a freeway/expressway style road.

[This report summarised the ultimate layout, first stage implementation, necessary approvals and construction priorities].

(6) 1996 Bunbury Outer Ring Road Planning Study – Review and Recommendation Report by MRWA

The purpose of this report by Main Roads WA was to review the recommendation made by HGM in the 1995 Concept Report. This report noted that in response to land development pressures and uncertainties of affected landowners, a study was initiated to develop firm plans for the Outer Ring Road and to identify the land required for the road, which led to the detailed planning study undertaken by HGM in 1995.

- The HGM concept report was released for public comment in November 1995 with the submission period closing in February 1996.
- 93 public submissions were received following release of this report. 72% of the submissions were opposed to the BORR.
- Most of the opposition to the preferred alignment of the Outer Ring Road has come from the Gelorup Special Rural area. Their opposition is largely related to the perceived social and environmental impacts of the road. They argued that the past planning for the road is now invalid given the change in land use and the growth of the Gelorup community.
- The preferred alignment for the BORR in the vicinity of Gelorup was originally planned and established in a statutory Town Planning Scheme in the early 1980's when all of the 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, therefore eliminating the need for direct property access and minimising at grade intersections with side roads. Past planning therefore is relevant and must be taken into account in the determination of the alignment of the BORR.
- This report noted that Main Roads is committed to the construction of the BORR by 2005. The timing of construction was still subject to detailed planning and availability of funds, there was considerable pressure from both State and Local Government Authorities to start construction, to improve access to the Port of Bunbury and to relieve pressure on local roads which were carrying large volumes of heavy vehicles.
- This report discussed that the original intent of the 1995 HGM Concept report was not to investigate alternative routes but due to significant concerns amongst residents in Gelorup, a broad assessment was carried out of alternative route options through the Gelorup Special Rural Area.
- The aim of the assessment was to identify whether any of the alternatives provided a ***significant overall*** advantage over the planned alignment for the BORR. The report stated that the alignments south of Gelorup also have significant social or environmental impacts and provide no overall advantage.
- Main Roads WA endorsed the recommendation made by HGM in the 1995 Concept Report which was to retain the preferred alignment and concluded that the public submissions received have raised no new issues which would alter the conclusions made in the report.

Queries Detailed in Review and Recommendation Report

The most significant queries that are still relevant in today's context, are discussed in the following paragraphs.

1.0 General Issues

General query 1.1

Section 1.1 discusses a submission that was received from a member of the public as follows:

"The preferred alignment is inadequate as an outer ring road or bypass".

MRWA provided a detailed response, the most significant and relevant part of the response states that the preferred alignment for the Outer Ring Road in the vicinity of Gelorup was originally planned and established in a statutory Town Planning Scheme in the early 1980's when all of the land through which it passed was zoned rural. Subsequent to this planning, the development of the adjacent land has recognised the alignment of the Outer Ring Road and its objectives by restricting subdivision to low density Special Rural land uses, eliminating the need for direct property access and minimising at-grade intersections with side roads. The response also stated that this planning process undertaken for the Outer Ring Road in the vicinity of Gelorup is no different to the planning which is done for major arterial roads within the Perth metropolitan area. The

requirements for the road have been established in the planning process to ensure the ultimate objectives for the road are met.

General query 1.3

Section 1.3 discusses a submission from a member of the public as follows:

"Alternative routes have been given inadequate consideration. A cost-benefit study should be undertaken to properly compare the preferred route with the alternatives".

Part of Main Roads' response to this submission stated that significant past planning had been done for the Outer Ring Road in the vicinity of Gelorup prior to the commencement of this planning study and that it was therefore considered unnecessary to review the section of the road which passed through the Gelorup Special Rural area. However, in response to the concerns within the Gelorup community, it was agreed to expand the scope of the study to determine whether an alternative route existed which provided an overall advantage to that which has been originally planned. This response also stated that while examining the alternative corridors through Gelorup (G1, G2 and G3), social impacts on the original route were not given as high a priority as social impacts on the alternative routes as it was the view of Main Roads that a corridor has been established for the Outer Ring Road and special rural land around the corridor had been purchased in the intervening period in the knowledge that the proposal to build a road in that area existed.

Main Roads stated that each of the alternative corridors had pros and cons, however none provided the overall advantage to warrant a change from the route originally planned and subsequently, it was the view of Main Roads that this assessment process provided adequate consideration to the alternative routes.

General query 1.8

Section 1.8 discusses a submission that was made on behalf of the proponent of the (then) proposed quarry on Lot 2 on Allenville Road. The submission requested that the Outer Ring Road be moved to minimise the impact on the Basalt Resource. One option suggested was to relocate the Outer Ring Road to the eastern boundary of Lot 2 whilst an alternative involved the removal of Allenville Road and incorporation of the Allenville Road reserve into the Outer Ring Road reserve.

The original planning for the Outer Ring Road incorporated an alignment for the road which passed diagonally through Lot 2 Allenville Road from the north east corner to the south west corner. This alignment also had a significant impact on existing dairy farms, bisected a group of wetlands and affected a horse riding school. A realignment of the Outer Ring Road to the eastern boundary of Lot 2 was investigated by the Consultant but was found to further increase the impact of the road on dairies and wetlands and therefore was considered unacceptable.

In the process of reviewing the alignment, an alternative was prepared which reduced the impact on dairy farms, substantially avoided the wetlands and avoided the riding school. (*Note: this alternative alignment is what is currently in the GBRS*). This option also aligned the Outer Ring Road parallel with the western boundary of the proposed quarry therefore reducing the impact of the road on the quarry. Allenville Road was maintained as a service road in this proposal to provide access to an existing quarry on this road. Main Roads WA concluded that given the options investigated by the Consultant, it is considered that the preferred alignment for the Outer Ring Road does minimise the impact on the proposed quarry whilst maintaining access requirements for existing development.

3.0 Social Issues

Query 3.6

Section 3.6 provides details of a query, which suggests that the Bunbury Outer Ring Road should be realigned along Moore Road and Ducane Road to avoid loss/severance of properties. Two submissions received from farmers directly affected by the preferred alignment of the Outer Ring Road suggested that the road should be realigned down Moore Road from the Picton Boyanup Road.

4.0 Engineering Issues

Centenary Road Query

In Appendix B of that report, "*Response to issues from submission*", Item 4.8 discussed a query, "*The Bunbury Outer Ring Road should utilise the Centenary Road alignment*". The response to this query was as follows:

"*As detailed in the Concept Report, the Centenary Road alignment was not favoured for the following reasons:*

- *Steep grades and reduced safety at the intersection with the Bussell Highway due to topography.*
- *Land adjacent to Centenary Road is proposed for intensive residential development.*
- *Centenary Road currently provides access to a number of properties.*
- *The Usher/Dalyellup area is proposed for significant residential development resulting in higher population on both sides of the Bussell Highway, increased the volume of local traffic on Bussell Highway and subsequent lower speed limits.*
- *Further improvements to Bussell Highway would affect a number of houses, businesses and a school.*"

(7) 1996 Bunbury Outer Ring Road Gelorup Section – A Submission addressing Traffic Issues arising from the Bunbury Outer Ring Road Concept Report – Final Draft – Report by Uloth and Associates Pty Ltd

Prepared on behalf of "The Friends of the Gelorup Corridor" (FOGC) the purpose of the submission was to "document the traffic impact of the planned route on the Gelorup Special Rural area and investigate if a more detailed study of alternate routes should be undertaken".

The submission reviewed the HGM (1995) Concept Report in relation to the impacts on the Gelorup community, between Hasties Road to Bussell Highway and the intersection of the BORR with Bussell Highway. The submission undertook a review of the existing and future road network under the preferred BORR alignment to identify local road network impacts including severance of the community and increased travel distances for some vehicular, cycling, horse riding and pedestrian commutes.

Other concerns were raised including:

- the potential for the preferred alignment to impact on quality of living as a result of traffic noise and pollution impacts,
- the narrow 70m wide road corridor in comparison to the 100m elsewhere for BORR through Gelorup and subsequent cost impacts for amelioration measures required.

In analysis of the the HGM (1995), the submission:

- claimed that the alternate alignments provided were rejected on basis of impacts only and did not consider any of their advantages over the planned alignment
- identified that "route evaluation puts a lot of weight on a comparison of construction costs" and that cost should not be the main factor when considering options,
- recommends quantification and comparison of benefits and dis-benefits of the alternative alignment options,
- requests consideration of the Gelorup corridor within the context of long term North-South Expressway road east of Bussell Highway and subsequent interchange spacing, and
- recommends that a full Multi Criteria Assessment is undertaken into alternative routes for BORR between Hasties Rd and Bussell Highway.

(8) 1996 Submission on Bunbury Outer Ring Road Concept Report – by Peter D Webb and Associates

Also prepared on behalf of the "Friends of the Gelorup Corridor" the submission sought MRWA to review the preferred alignment for BORR through Gelorup to Bussell Highway and to determine an alternate alignment that more fully satisfied the BORR project objectives. The submission stated that the second objective of the BORR project, "to provide a high standard, free flowing route for traffic bypassing Bunbury" (HGM 1995), would not be met by the preferred alignment because "the preferred route would not function as a bypass as it is proposed to be located in a developed area of Bunbury, severing an established and growing community".

The submission states that the proposed bypass road would become obsolete, and "be a temporary measure that will eventually be replaced by an alternative outer route" and requested consideration by MRWA of an alternate, ultimate alignment on a number of scope, social and economic grounds.

Other key concerns and identified grounds for the submission included:

- safety issues due to proximity of the road through the Gelorup community and for potential impacts on pedestrians and cyclists.
- severance of the Gelorup Community
- impact to local amenity, lifestyle and land values due to noise, visual amenity and air pollution
- impacts to flora and fauna
- the spread of misinformation around the likelihood of the development of BORR in the road reservation
- inadequacy of the preferred route as a bypass and resultant land use conflicts
- inadequacy of response to community concerns from Ministers and Departments
- lack of referral to the Department of Environmental Protection
- The submission requests consideration of alternative options, undertakes their own analysis of costs considering upgrade to a future outer by-pass and requests MRWA and the State Government to review of the BORR alignment through Gelorup.

(9) 1997 Bunbury Outer Ring Road – Comparison of Route Options - Hasties Road to Bussell Highway, Gelorup by ERM Mitchell Mc Cotter

- This BORR study by ERM Mitchell McCotter was commissioned by MRWA, due to the strong community reaction to the proposed bypass alignment as contained in the 1995 Halpern Glick Maunsell Report.
- This report gave a brief discussion on the Concept Report undertaken in 1995 by HGM. During the 1995 study, pressure from the Gelorup community resulted in three additional route alignments being investigated (G1, G2 and G3). The report was released for public comment in late 1995 and recommended the existing planned alignment through the Gelorup Special Rural area.
- Residents from the Gelorup Special Rural area made numerous submissions against the proposal. The community formed the Friends of Gelorup group and appealed to local Members of Parliament for further investigations into route options in the Gelorup area. Consequently, the Minister for Transport agreed to undertake a review of the alignment for the BORR at Gelorup, which is documented in the report by ERM Mitchell McCotter.
- This report documents an MCA process wherein the proposed alignment, G1, G2 and G3 were assessed against community, environmental, social and engineering constraints

Recommendation by ERM was to keep the existing corridor due to:

- This route has fewer property and environmental impacts and scores higher in economic and engineering terms
- It does not sever or directly impact viable farms
- Does not travel within 50 metres or 1metre AHD of any natural wetland areas
- Does not affect large stands of good quality remnant vegetation
- Is the least expensive option
- Would require the least engineering considerations due to topography and groundwater levels

The report also notes, that the existing alignment (i.e. The GBRS (Red) Alignment) is the only option that avoids any impact on natural wetlands and that discussions with the Department of Environmental Protection had indicated that the route option with least impact upon wetland areas would be preferred, and was likely to be recommended during a formal environmental assessment.

It should also be noted, that the report did acknowledge that the social impacts of the existing alignment. Commenting that, "*the social impacts of the existing alignment are higher than for the alternative route options. Indeed, this study originated through the opposition of the local community to the alignment.*" The social impacts of this route are relatively high because the alignment is within a Special Rural area, with greater residential densities than any of the other routes investigated.

(10) 1997 Bunbury Basalt as a basic raw material – Preliminary Assessment of possible future sources and requirements by Department of Minerals and Energy / Land Access Unit

The purpose of this report was to document a preliminary investigation of the basalt and consideration of factors relating to it being used as a basic raw material. The report documents the current quarry operations, extent of basalt and likely life supply remaining. This report noted that the Bunbury Basalt reportedly has two uses for which no alternative source is available as follows:

- as a high-strength, very precise specification concrete aggregate because it has a high strength and no mineralogical fabric or foliation and therefore planar weaknesses and has a consisted quality;
- as a bitumen road topping gravel because it has superior wear properties, and is capable of bonding strongly to the bitumen when moist.

Other benefits of the Bunbury Basalt documented in this report includes: the horizontal nature of the flow (basalt) which facilitates mining of significant areas with very little overburden, there is almost no weathered crust on the top meaning that all exposures generate marketable rock, the columnar jointing attribute of the basalt means that it is easy to blast using minimal amount of explosives down to small enough sizes that is acceptable for earth moving equipment to handle. The Bunbury Basalt subcrop at Gelorup is considered to be one of only two locations where the rock is potentially extractable.

This report recommended that the Gelorup basalt subcrop area should be regarded as a priority resource area to be conserved to ensure that the basalt is extractable and not sterilised. The report recommended that the resource area and a buffer zone 2 km wide be identified and that no further subdivision of land be allowed within the area until cessation of basalt extraction.

The report also recommended that in order to ensure better planning is conducted, the existing mining operators should be granted a long term extraction license. This would ensure economies of scale and ensure that taxpayers do not end up paying for paying for environmental remediation.

(11) 1999 Shire of Capel Land Use Strategy by the Western Australian Planning Commission

Section 3.3.4 Gelorup and Dalyellup discusses how the Gelorup urban area was covered by the draft Greater Bunbury Structure Plan, which provided for further areas of rural residential development on the basis of infilling south of Hasties Road and between the existing development and the greater Bunbury Bypass alignment. It was noted that the density of development would be dependent on the provision of a reticulated water supply if lots as small as 4000 m² were to be considered.

The "Special Residential Area" was progressively being subdivided in accordance with the provisions of Town Planning Scheme No.3, which was a guided Subdivision Scheme. There were 450 existing 4000 m² lots and there is potential for a further 295 lots. At the time of this report being issued (1999), there were 331 houses constructed which meant that 73% of the existing lots had already been developed.

Section 4.3.1 of this report discussed that as part of the Bunbury Wellington Region Planning study a district plan was produced for the Usher, Dalyellup and Gelorup area. This plan stated that the existing Gelorup urban area would continue to function as a special residential area providing up to 750 lots of 4,000 m² in a bushland setting. The area south of Hastie Road and east of the existing Gelorup residential and special rural area identified on the District Structure Plan could be considered for rezoning to allow an appropriate style of subdivision upon preparation of a local structure plan. It was noted that particular attention would need to be given to drainage and the extent of any buffer from the basalt quarry when it moves southward to extract material closer to Hastie Road.

Under chapter 6 "Planning Units – Objectives and Policies", this section discusses the major issues associated with the BU6 Planning Unit of Gelorup and Dalyellup. One of the major issues discussed was the ongoing excavation of basalt at Gelorup and how a buffer zone of 2 km should be adopted from lots 2644, 27 and 2.

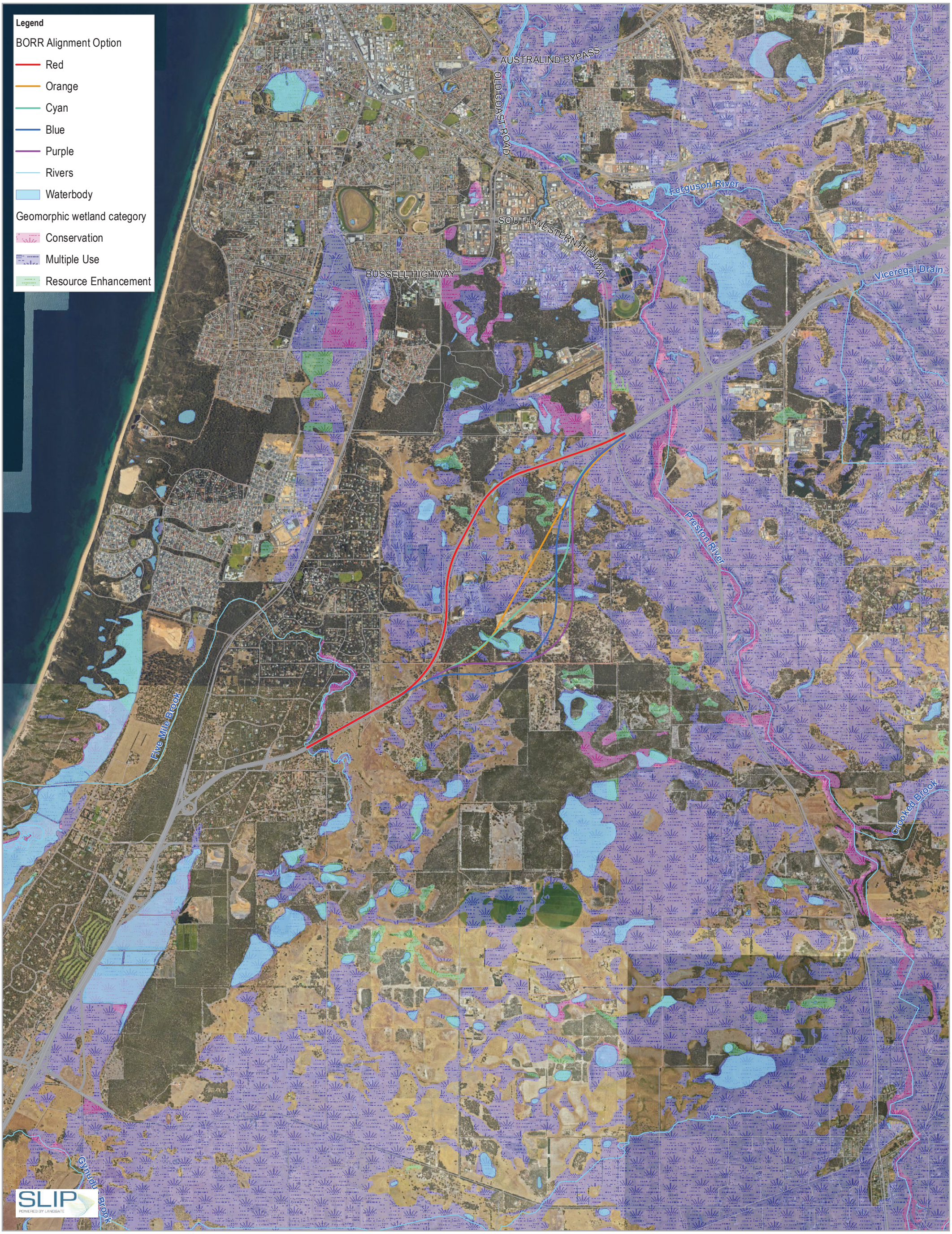
(12) 2002 Bunbury Outer Ring Road Concept Report by HGM

This report mostly built upon the work that was previously undertaken during the 1995 study by HGM. In addition to the work previously carried out, the purpose of this new study was to produce an implementation plan of three stages as follows:

- Single carriageway
- Dual carriageway
- Ultimate layout

The report also included producing concept plans for these stages and land dealings plans for the ultimate layout.

APPENDIX B CONSTRAINTS MAPPING SOUTH WESTERN HIGHWAY (SOUTH) TO HASTIES ROAD



Paper Size ISO A3

0 500 1,000

Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

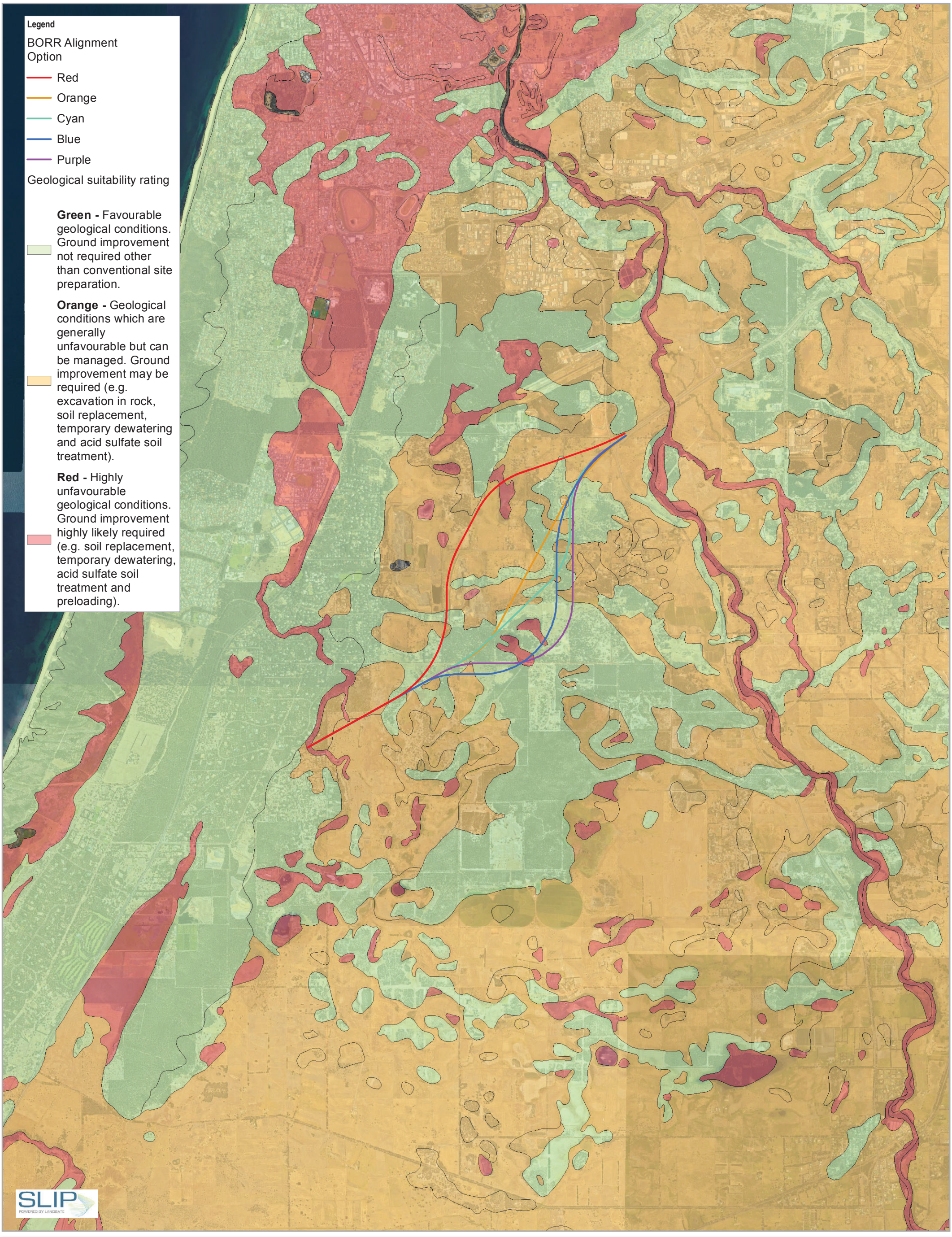
Hydrology

Project No. **61-37041**
Revision No. **0**
Date **27/05/2019**

FIGURE B-1

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_B1_Hydrology_Rev0.mxd
Print date: 02 Jul 2019 - 10:33

Data source: GHD: BORR alignment options - 201809; Landgate: Roads - 201805, Aerial photography - WA Now accessed 20190527, Watercourses, waterbodies - 20180404; DBCA: Geomorphic wetlands - 20171027. . Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Geological Conditions

Project No. **61-37041**
Revision No. **0**
Date **17/09/2018**

FIGURE B-2

Data source: BORR Team: BORR alignment options, Geological suitability - 201806; DMP: 50k surface geology - 1982; Landgate: Aerial photography (WA Now) - 20190527. . Created by: mmikkonen

Legend

- Conservation significant flora location

BORR Alignment Option

- Red
- Orange
- Cyan
- Blue
- Purple
- DBCA Nature Reserve
- Environmentally Sensitive Areas
- Threatened Ecological Community
- Priority Ecological Community
- Native vegetation extent

SOUTH BUNBURY
CAREY PARK
PICTON EAST
WITHERS
Robertson Dr
COLLEGE GROVE
DAVENPORT
Willinge Dr
USHER
Bunbury Outer Ring Rd
DARDANUP WEST
South Western Hwy
DALYELLUP
Bussell Hwy
GELORUP
NORTH BOYANUP
CROOKED BROOK
STRATHAM
Roselands Nature Reserve
BOYANUP
ELGIN
Boyanup Capel

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 0.35 0.7 1.05 1.4

Kilometres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Environmentally Significant Areas and Remnant Native Vegetation

Project No. **61-37041**
Revision No. **0**
Date **27/05/2019**

FIGURE B-3

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_B3_ESAsNativeVeg_Rev0.mxd
Print date: 02 Jul 2019 - 10:54

Data source: BORR Team: BORR alignment options - 201806, Conservation significant flora - 20190212; DBCA: TEC/PEC boundaries - 20180605, Nature Reserves - 20170730, Conservation significant flora - 20180605; DWER: ESAs - 20151012; Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190523; DPIRD: Native vegetation extent - 20171026. . Created by: mmikkonen

Legend

Taxon

- *Ardea modesta*
- *Calyptorhynchus banksii naso*
- *Calyptorhynchus baudinii*
- *Calyptorhynchus latirostris*
- *Caretta caretta*
- *Ctenotus ora*
- *Falsistrellus mackenziei*
- *Isoodon obesulus fusciventer*
- *Ixobrychus flavicollis australis*
- *Macronectes giganteus*
- *Macropus irma*
- *Merops ornatus*
- *Oxyura australis*
- *Phascogale tapoatafa wambenger*
- *Pseudocheirus occidentalis*
- *Setonix brachyurus*
- *Thalassarche carteri*

BORR Alignment Option

- Red
- Orange
- Cyan
- Blue
- Purple

SOUTH BUNBURY
SOUTH BUNBURY
SOUTH BUNBURY
PICTON EAST
SOUTH BUNBURY
CAREY PARK
Robertson Dr
PICTON EAST
WITHERS
COLLEGE GROVE
DAVENPORT
Willinge Dr
Bunbury Outer Ring Rd
USHER
DARDANUP WEST
South Western Hwy
Bussell Hwy
CROOKED BROOK
GELORUP
NORTH BOYANUP
CROOKED BROOK
BOYANUP
STRATHAM
BOYANUP
SLIP

Paper Size ISO A3

0 0.3 0.6 0.9 1.2

Kilometres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

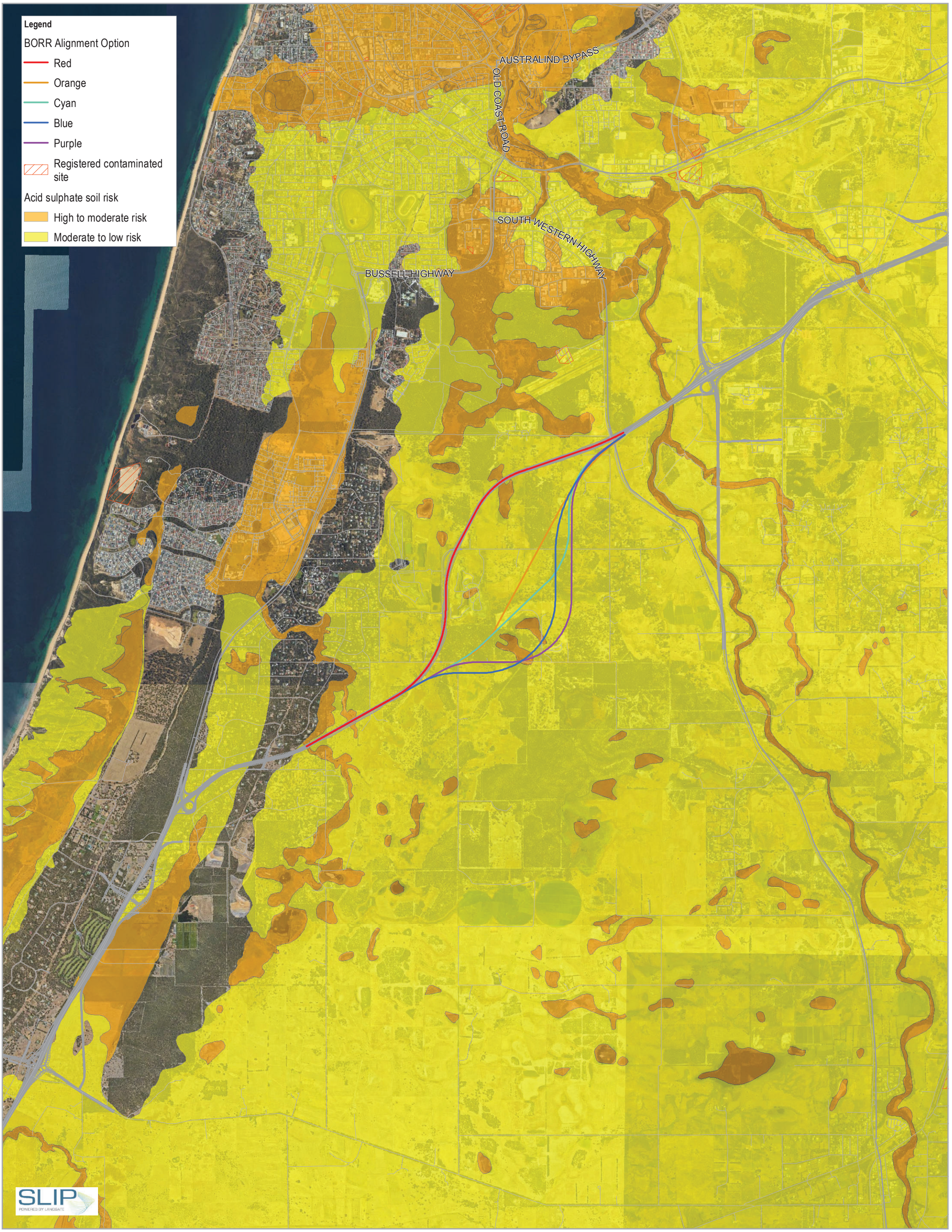
Conservation Significant Fauna

Project No. **61-37041**
Revision No. **0**
Date **27/05/2019**

FIGURE D-4

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_B4_Fauna_Rev0.mxd
Print date: 02 Jul 2019 - 10:57

Data source: BORR Team: BORR alignment options - 201806; DBCA: Conservation significant fauna - 20180605, Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190523. . Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Acid Sulphate Soils and Contaminated Sites

Project No. **61-37041**
Revision No. **0**
Date **27/05/2019**

FIGURE B-5

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_B5_ASSContam_Rev0.mxd
Print date: 02 Jul 2019 - 11:00

Data source: BORR Team: BORR alignment options - 201806; Landgate: Roads - 201805, Aerial photography - WA Now accessed 20190527, DWER: ASS mapping - 201409, Contaminated sites - 20180615. .
Created by: mmikkonen

Legend

BORR Alignment Option

- Red
- Orange
- Cyan
- Blue
- Purple
- Road

Basic Raw Material Source

- Rock aggregate
- Sand
- Strategic Mineral Source - Titanium
- Strategic Agricultural Resource Policy Area

Estuary Dr
Spencer St
Sandridge Rd
Picton Rd
Ocean Dr
Dodson Rd
Dardanup - Burekup
Boyanup-Picton Rd
Robertson Dr
Parade Rd
Washington Av
Bunbury Outer Ring Rd
Bussell Hwy
South Western Hwy
Boyanup Rd West
Capel - Boyanup
Bridge St
Railway Rd

Paper Size ISO A3

0 1 2

Kilometres

N

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

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Bunbury Outer Ring Road Alignment Options

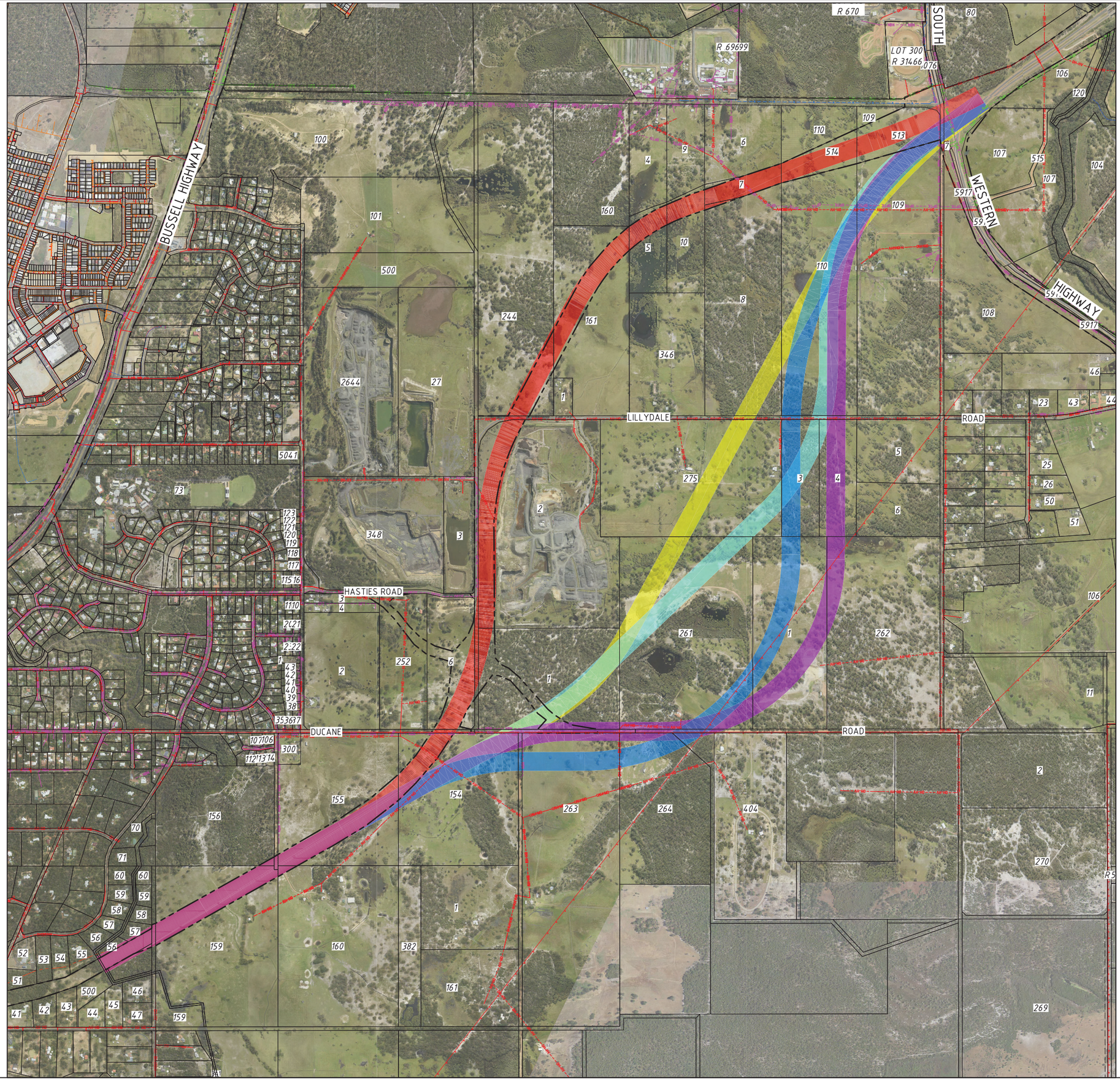
Agriculture and Strategic Minerals and Basic Raw Materials Policy

Project No. **61-37041**
Revision No. **0**
Date **27/05/2019**

FIGURE B-6

Data source: GHD: BORR alignment - 201806; Landgate: Roads - 2018, Aerial photography - WA Now accessed 20190527; GBRS: Raw material sources, Strategic mineral sources, Strategic agricultural policy boundary. . Created by: mmikkonen

APPENDIX C ALIGNMENT SKETCHES



LEGEND:

- GBRS ALIGNMENT (100m CORRIDOR)
- ALTERNATIVE ALIGNMENT 1 (100m CORRIDOR)
- ALTERNATIVE ALIGNMENT 2 (100m CORRIDOR)
- ALTERNATIVE ALIGNMENT 3 (100m CORRIDOR)
- ALTERNATIVE ALIGNMENT 4 (100m CORRIDOR)
- GBRS BOUNDARY

NOTES:

1. TO BE READ IN CONJUNCTION WITH MULTI-CRITERIA ASSESSMENT SWH TO BUSSELL VIA GELORUP CORRIDOR.

SCALES 1:10000

A1

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

DATE 28/06/2019	PREPARED ET
SCALE 1:10000m @ A1	GRID PCG 94

PROJECT: BUNBURY OUTER RING ROAD (H058)

TITLE: BORR SOUTH
ALTERNATIVE ALIGNMENT OPTIONS
SWH TO BUSSELL VIA GELORUP

SKETCH No.	REV
BORR-02-SK-RD-0044	C

BUSSELL HIGHWAY

BUSSELL HIGHWAY

CABLE MINE ROAD

LEGEND:

- GBRS (RED) ALIGNMENT
- OPTION G1 (ERM REPORT)
- OPTION G2 (ERM REPORT)
- OPTION G3 (HGM 1995 REPORT)
- GELORUP RURAL ALIGNMENT (ERM REPORT)
- GBRS BOUNDARY

1:15000 0 250m 500 750 1000 1250 1500 1750 2000

SKETCH ONLY
ULTIMATE PLANNING
UNDER DEVELOPMENT

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BORR Team

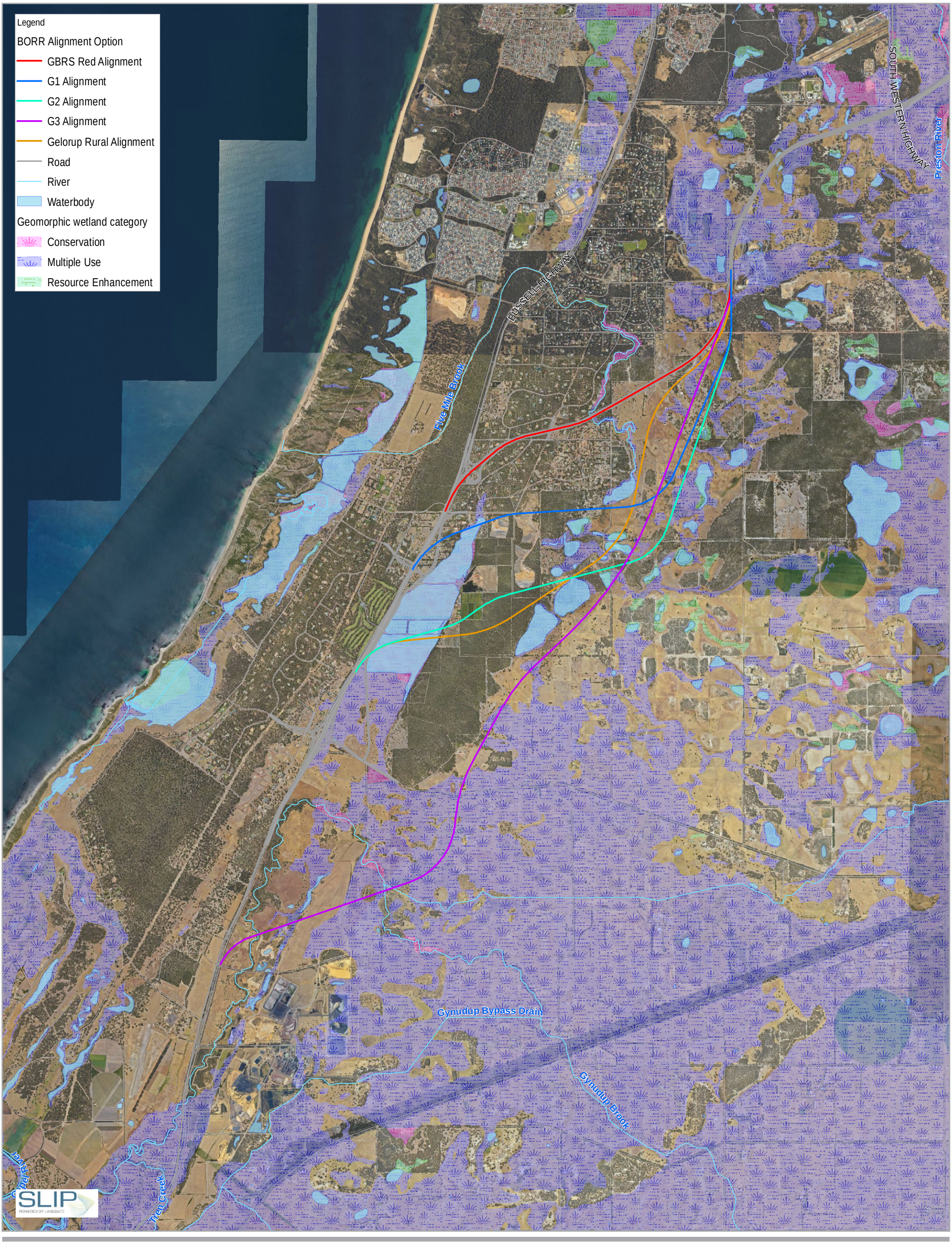
DATE	27/06/2019
SCALE	1:15000m @ A1
GRID	PCG 94
PREPARED	ET

PROJECT: BUNBURY OUTER RING ROAD (H058)

TITLE: BORR SOUTH
ALTERNATIVE ALIGNMENT OPTIONS
HASTIES RD TO BUSSELL HWY

SKETCH No. BORR-02-SK-RD-0046 REV C

APPENDIX D CONSTRAINTS MAPPING HASTIES ROAD TO BUSSELL HIGHWAY



Paper Size ISO A3

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Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Hydrology

Project No. 61-37041
Revision No. 0
Date 24/05/2019

FIGURE D-1

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_D1_Hydrology_Rev0.mxd
Print date: 02 Jul 2019 - 11:16

Data source: GHD: BORR alignment options - 201905; Landgate: Roads - 201805, Aerial photography - WA Now accessed 20190524, Watercourses, waterbodies - 20180404; DBCA: Geomorphic wetlands - 20171027. . Created by: mmikkonen

Legend

BORR Alignment Option

- GBRS Red Alignment
- G1 Alignment
- G2 Alignment
- G3 Alignment
- Gelorup Rural Alignment

Geological suitability rating

- Green - Favourable geological conditions. Ground improvement not required other than conventional site preparation.
- Orange - Geological conditions which are generally unfavourable but can be managed. Ground improvement may be required (e.g. excavation in rock, soil replacement, temporary dewatering and acid sulfate soil treatment).
- Red - Highly unfavourable geological conditions. Ground improvement highly likely required (e.g. soil replacement, temporary dewatering, acid sulfate soil treatment and preloading).

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 500 1,000

Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Geological Conditions

Project No.	61-37041
Revision No.	0
Date	24/05/2019

FIGURE D-2

Data source: BORR Team: BORR alignment options - 201905, Geological suitability - 201806; DMP: 50k surface geology - 1982; Landgate: Aerial photography (WA Now) - 20190524. . Created by: mmikkonen

Legend

- Conservation significant flora location

BORR Alignment Option

- GBRS Red Alignment
- G1 Alignment
- G2 Alignment
- G3 Alignment
- Gelorup Rural Alignment
- DBCA Nature Reserve
- Environmentally Sensitive Areas
- Threatened Ecological Community
- Priority Ecological Community
- Native vegetation extent

DALYELLUP
GELORUP
NORTH BOYANUP
Bussell Hwy
STRATHAM
Roselands Nature Reserve
Tuart Forest National Park
BOYANUP
STIRLING ESTATE
ELGIN
Boyanup Capel
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3

0 0.3 0.6 0.9 1.2

Kilometres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Environmentally Significant Areas and Remnant Native Vegetation

Project No.	61-37041
Revision No.	0
Date	27/05/2019

FIGURE D-3

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_D3_ESAsNativeVeg_Rev0.mxd
Print date: 02 Jul 2019 - 13:22

Data source: BORR Team: BORR alignment options - 201905, Conservation significant flora - 20190212; DBCA: TEC/PEC boundaries - 20180605, Nature Reserves - 20170730, Conservation significant flora - 20180605; DWER: ESAs - 20151012; Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190523; DPIRD: Native vegetation extent - 20171026. . Created by: mmikkonen

Legend

Taxon

- *Ardea modesta*
- *Bettongia penicillata ogilbyi*
- *Calyptorhynchus banksii naso*
- *Calyptorhynchus baudinii*
- *Calyptorhynchus latirostris*
- *Caretta caretta*
- *Chelonia mydas*
- *Dasyurus geoffroii*
- *Eubalaena australis*
- *Falsistrellus mackenziei*
- *Isoodon obesulus fusciventer*
- *Macropus irma*
- *Merops ornatus*
- *Phascogale tapoatafa wambenger*
- *Pseudocheirus occidentalis*
- *Setonix brachyurus*
- *Thalassarche carteri*

BORR Alignment Option

- GBRS Red Alignment
- G1 Alignment
- G2 Alignment
- G3 Alignment
- Gelorup Rural Alignment

DALYELLUP
GELORUP
NORTH BOYANUP
Bussell Hwy
STRATHAM
BOYANUP
STIRLING ESTATE
ELGIN
Boyanup Capel
CAPEL
THE PLAINS
SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 0.3 0.6 0.9 1.2

Kilometres

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

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Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

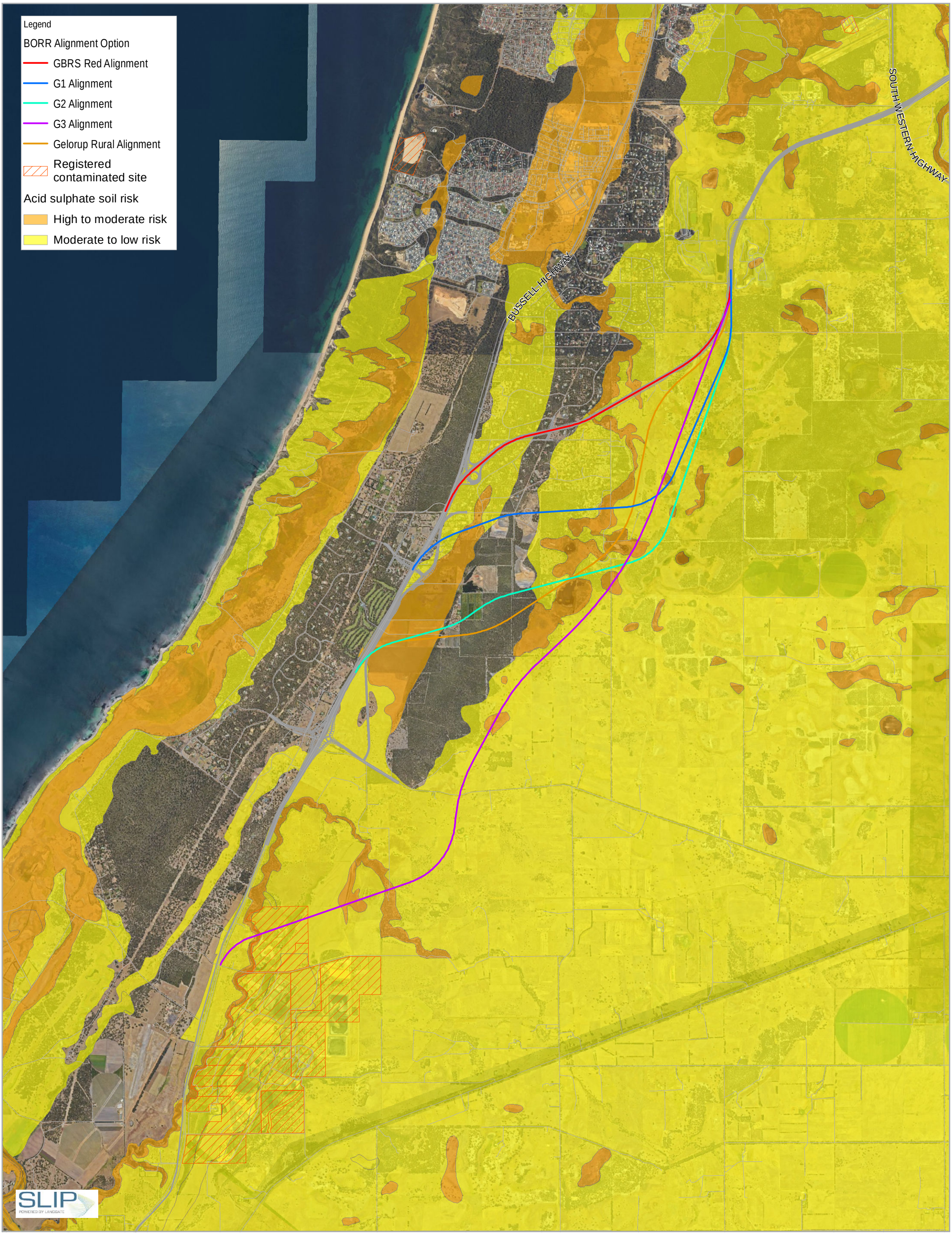
Project No. 61-37041
Revision No. 0
Date 27/05/2019

Conservation Significant Fauna

FIGURE D-4

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_D4_Fauna_Rev0.mxd
Print date: 02 Jul 2019 - 13:24

Data source: BORR Team: BORR alignment options - 201905; DBCA: Conservation significant fauna - 20180605, Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190523. . Created by: mmikkonen



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Metres

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

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mainroads WESTERN AUSTRALIA

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

Acid Sulphate Soils and Contaminated Sites

Project No. 61-37041
Revision No. 0
Date 27/05/2019

FIGURE D-5

G:\61\37041\19_0_GIS\Maps\Working\OptionsAnalysis\May2019\6137041_D5_ASSContam_Rev0.mxd
Print date: 02 Jul 2019 - 13:26

Data source: BORR Team: BORR alignment options - 201905; Landgate: Roads - 201805, Aerial photography - WA Now accessed 20190527, DWER: ASS mapping - 201409, Contaminated sites - 20180615. .
Created by: mmikkonen

Legend

BORR Alignment Option

- GBRS Red Alignment
- G1 Alignment
- G2 Alignment
- G3 Alignment
- Gelorup Rural Alignment
- Road

Basic Raw Material Source

- Rock aggregate
- Sand
- Strategic Mineral Source - Titanium
- Strategic Agricultural Resource Policy Area

Washington Av

South Western Hwy

Bussell Hwy

Boyanup Rd West

Capel - Boyanup

Railway Rd

Stratham - Gelorup

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 1 2

Kilometres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road Alignment Options

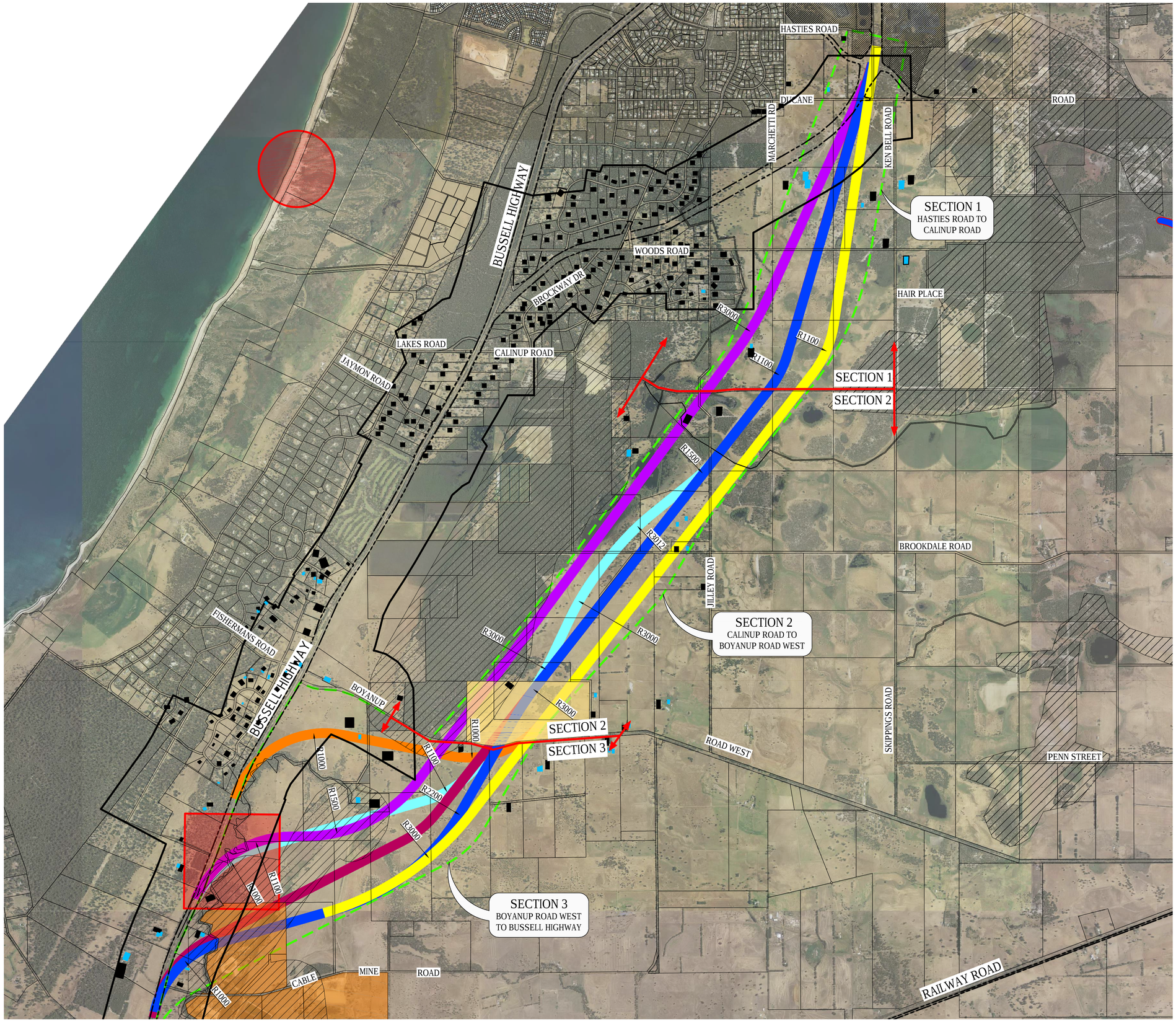
Agriculture and Strategic Minerals and Basic Raw Materials Policy

Project No. 61-37041
Revision No. 0
Date 27/05/2019

FIGURE D-6

Data source: GHD: BORR alignment - 201905; Landgate: Roads - 2018, Aerial photography - WA Now accessed 20190527; GBRS: Raw material sources, Strategic mineral sources, Strategic agricultural policy boundary. . Created by: mmikkonen

APPENDIX E MCA ALTERNATIVE (GREEN) CORRIDOR REFINEMENT



LEGEND:

- (100m CORRIDOR)
- (100m CORRIDOR)
- (100m CORRIDOR)
- (100m CORRIDOR)
- (100m CORRIDOR)
- (100m CORRIDOR)
- ALTERNATIVE SOUTHERN CORRIDOR
- STRUCTURES
- GBRS BOUNDARY
- CONSERVATION WETLANDS
- RESOURCE ENHANCEMENT WETLANDS
- POTENTIAL WETLANDS (AS DETERMINED IN DESKTOP STUDY BY NEIL)
- SIGNIFICANT ABORIGINAL HERITAGE SITE
- SIGNIFICANT EUROPEAN HERITAGE SITE
- REGIONALLY SIGNIFICANT RAW MATERIAL AND MINERALS
- CONTAMINATED SITE
- EXISTING HOUSES

SCALES 1:20000

A1

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

DATE 01/07/2019	PREPARED ET
SCALE 1:20000m @ A1	GRID PCG 94

PROJECT: BUNBURY OUTER RING ROAD (H058)

TITLE: BORR SOUTH
ALTERNATIVE GREEN CORRIDOR
REFINEMENT OPTIONS

SKETCH No. BORR-02-SK-RD-0057 REV H

29/08/2019 3:57:34 PM

Multi-Criteria Assessment - BORR Southern Alignment - Green Corridor Options Refinement

		Section 1 (Hasties Road to Calinup Road)			Section 2 (Calinup Road to Boyanup West Road)				Section 3 (Boyanup West Road to Bussell Highway)				
Criteria	**Sub-Criteria**	**Purple**	**Blue**	**Yellow**	**Purple**	**Cyan**	**Blue**	**Yellow**	**Orange**	**Purple**	**Cyan**	**Maroon**	**Blue**
Environmental Constraints - Desktop Environmental Information	**Wetlands (Conservation Category and Resource Enhancement)**	Impacts one resource enhancement wetland area	No known impacts	Impacts on two resource enhancement wetland areas	Impacts one resource enhancement wetland area	No known impacts	No known impacts	Impacts on two resource enhancement wetland areas	Impacts edge of conservation category wetland area	Impacts area between two conservation category wetland areas. Understood to be connected	Impacts area between two conservation category wetland areas. Understood to be connected	Impacts one conservation category wetland area	Impacts area between two conservation category wetland areas. Understood to be connected
		1	0	2	1	0	0	2	1	1	1	1	1
	Rare and Priority Flora	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts
		0	0	0	0	0	0	0	0	0	0	0	0
	Clearing Area (Remnant Native Vegetation)	Corridor passes through sparse areas of native vegetation	Corridor passes through sparse areas of native vegetation	Corridor passes through areas of remnant vegetation	Corridor passes through areas of dense native vegetation	Corridor passes through areas of native vegetation	Corridor passes through sparse areas of native vegetation	Corridor passes through sparse areas of native vegetation	Corridor passes through little or no areas of native vegetation	Corridor passes through sparse areas of native vegetation	Corridor passes through sparse areas of native vegetation	Corridor passes through sparse areas of native vegetation	Corridor passes through sparse areas of native vegetation
		1	1	2	2	1	1	1	0	1	1	1	1
	Fauna Habitat	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts
		0	0	0	0	0	0	0	0	0	0	0	0
	Potential Western Ringtail Possum Habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	Will impact dense vegetation that would potentially provide habitat for WRP	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat	No known impacts to WRP habitat
		0	0	0	3	0	0	0	0	0	0	0	0
	Threatened Ecological Communities (TECs)	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts
		0	0	0	0	0	0	0	0	0	0	0	0
	European Heritage	No known impacts	No known impacts	No known impacts	Corridor will impact on Elgin Sports Club (Place No.15194).	Corridor will impact on Elgin Sports Club (Place No.15194) and the Stratham School (Place No. 15156).	Corridor will impact on Elgin Sports Club (Place No.15194) and the Stratham School (Place No. 15156).	Corridor will impact on Elgin Sports Club (Place No.15194) and the Stratham School (Place No. 15156).	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts
		0	0	0	1	2	2	2	0	0	0	0	0
	Aboriginal Heritage	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts	No known impacts
		0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL Environmental Constraints	2	1	4	7	3	3	5	1	2	2	2	2

Multi-Criteria Assessment - BORR Southern Alignment - Green Corridor Options Refinement

Criteria	Sub-Criteria	Section 1 (Hasties Road to Calinup Road)			Section 2 (Calinup Road to Boyanup West Road)				Section 3 (Boyanup West Road to Bussell Highway)				
		Purple	**Blue**	**Yellow**	**Purple**	**Cyan**	**Blue**	**Yellow**	**Orange**	**Purple**	**Cyan**	**Maroon**	**Blue**
Social Constraints	**Impact on Residential Properties - Direct impact and Severance**	Does not intersect any dwellings. Corridor severs 5 lots belonging to 4 landowners.	Does not intersect any dwellings. Corridor severs 5 lots belonging to 2 landowners	Does not intersect any dwellings. Corridor severs 6 lots lots belonging to 4 landowners.	Does not intersect any dwellings. Corridor severs 11 lots belonging to 7 landowners.	Does not intersect any dwellings. Corridor severs 10 lots belonging to 6 landowners.	Does not intersect any dwellings. Corridor severs 9 lots belonging to 6 landowners	Corridor intersects 1 dwelling. Corridor severs 10 lots belonging to 7 landowners.	Does not intersect any dwellings. Corridor severs 4 lots belonging to 4 landowners.	Does not intersect any dwellings. Corridor severs 9 lots belonging to 6 landowners.	Does not intersect any dwellings. Corridor severs 7 lots belonging to 6 landowners	Does not intersect any dwellings. Corridor severs 7 lots belonging to 5 landowners	Does not intersect any dwellings. Corridor severs 8 lots belonging to 6 landowners.
		1	1	1	2	2	2	2	1	2	2	2	2
	Impact on Commercial Properties	Corridor will sever 1 beef farm.	Corridor will sever 1 beef farm.	Corridor will sever 1 beef farm.	Corridor will sever 1 beef farm.	Corridor will impact on 3 businesses.	Corridor will impact on 3 businesses.	Corridor will impact on 4 businesses.	Corridor will sever beef farm.	Corridor will slightly impact the southern corner of the beef farm.	No impact	No impact	No impact
		1	1	1	1	2	2	3	1	1	0	0	0
	Noise and Visual Amenity (within 100m)	1 dwelling within 100m of corridor	0 dwellings with 100m of corridor	1 dwelling within 100m of corridor	2 dwellings within 100m of corridor (including Rosemore European Heritage Site)	0 dwellings with 100m of corridor	0 dwellings with 100m of corridor	0 dwellings within 100m of corridor	3 dwellings within 100m of corridor (including Sunnyside European Heritage Site)	2 dwellings within 100m of corridor (including Sunnyside European Heritage Site)	2 dwellings within 100m of corridor	1 dwelling within 100m of corridor	1 dwelling within 100m of corridor
		1	0	1	1	1	1	1	2	1	1	1	1
	TOTAL Social Constraints	3	2	3	4	5	5	6	4	4	3	3	3

Multi-Criteria Assessment - BORR Southern Alignment - Green Corridor Options Refinement

Criteria	Sub-Criteria	Section 1 (Hasties Road to Calinup Road)			Section 2 (Calinup Road to Boyanup West Road)				Section 3 (Boyanup West Road to Bussell Highway)				
		Purple	**Blue**	**Yellow**	**Purple**	**Cyan**	**Blue**	**Yellow**	**Orange**	**Purple**	**Cyan**	**Maroon**	**Blue**
Engineering Constraints	**Acid Sulphate Soils (ASS) & Contaminated sites**	Approximately 300m of this corridor passes through an area of high to moderate risk of ASS. There are no known contaminated sites within this corridor.	Approximately 100m of this corridor passes through an area of high to moderate risk of ASS. There are no known contaminated sites within this corridor.	Approximatley 800m of this corridor passes through an area of high to moderate risk of ASS. There are no known contaminated sites within this corridor.	Approximatley 2km of this corridor passes through an area of high to moderate risk of ASS. There are no known contaminated sites within this corridor.	Approximatley 600m of this corridor passes through an area of high to moderate risk of ASS. There are no known contaminated sites within this corridor.	Approximately 300m of this corridor passes through an area of high to moderate risk of ASS. There are no known contaminated sites within this corridor.	No impact	No impact on any moderate to high risk ASS areas. There are no known contaminated sites within this corridor.	Approximately 500m of this corridor will pass through a moderate to high risk of ASS area. There are no known contaminated sites within this corridor.	Approximately 600m of this corridor will pass through a moderate to high risk of ASS area.	Approximately 1.2km of this corridor will pass through a moderate to high risk of ASS area. Corridor passes through approximately 1km of a contaminated site (contaminated groundwater)	Approximately 800m of this corridor will pass through a moderate to high risk of ASS area. Approximatley 1km of this corridor will pass through a contaminated site (contaminated groundwater)
		1	1	2	2	1	1	0	0	1	1	2	3
	Network Operations (Travel time from Cable Mine Rd to Boyanup West Road)	Not assessed - No significant point of difference between options			Not assessed - No significant point of difference between options				Length of alignment = 3.3km (108 seconds) Length to travel on Bussell Highway= 2.1km (68 seconds) **Total travel time= 176 seconds**	Length of alignment = 3.3 km (108 seconds) Length to travel on Bussell Highway= 1km (32 seconds) **Total travel time= 140 seconds**	Length of alignment = 3.6 km (117 seconds) Length to travel on Bussell Highway= 1km (32 seconds) **Total travel time= 149 seconds**	Length of alignment = 4.5km (147 seconds) Length to travel on Bussell Highway= 0km **Total travel time= 147 seconds**	Length of alignment = 4.8km (157 seconds) Length of travel on Bussell Highway=0km **Total travel time= 157 seconds**
									2	0	1	1	1
	Road Geometry	Radius greater than 1500 (3000)	1 radii less than 1500 (1100)	1 radii less than 1500 (1100)	Straight alignment	Radii greater than 1500 (3000)	Radius greater than 1500 (3000)	Straight alignment	2 radii less than 1500 (1000)	1 radius at 1500 1 raduis less than 1500 (1100)	2 radii less than 1500 (1000 and 1100)	2 radii less than 1500 (1000 and 1000)	1 radii less than 1500 (1000)
		0	1	1	0	0	0	0	2	1	2	2	1
	Geology	Not assessed - No significant point of difference between options			Not assessed - No significant point of difference between options				All of corridor will pass through unfavourable (but manageable) ground conditions, where ground improvement may be required eg.soil replacement.	Corridor will pass through two small patches (150-300m) of highly unfavourable ground conditions were ground improvement such as soil replacement, temporary dewatering and preloading would be required.	Corridor will pass through three small patches (150-300m) of highly unfavourable ground conditions were ground improvement such as soil replacement, temporary dewatering and preloading would be required.	Corridor will pass through four small patches (50m-300m) of highly unfavourable ground conditions were ground improvement such as soil replacement, temporary dewatering and preloading would be required.	Corridor will pass through four small patches (150-300m) of highly unfavourable ground conditions were ground improvement such as soil replacement, temporary dewatering and preloading would be required.
									1	2	2	2	2
	Constructability *(location of interchange and type of bridge crossing required)*	Not assessed - No significant point of difference between options			Not assessed - No significant point of difference between options				Corridor will most likely not cross the creek. No structure required. Likely to have difficulty with skew of interchange at Boyanup West Road (and would also impact on dense native veg area) .	This corridor will cross the creek at two locations. The most northern crossing is relatively well defined. The southern crossing is severely skewed - likely to require stream training to avoid skew.	This corridor will cross the creek at two locations. The most northern crossing is relatively well defined. The southern crossing is severely skewed - likely to require stream training to avoid skew.	TBC (most likely to be the same crossing as described in the blue alignment).	This corridor will cross the creek at two locations. Both crossings are well defined.
									3	3	2	1	1
	TOTAL Eng Constraints	1	2	3	2	1	1	0	8	7	8	8	8

Multi-Criteria Assessment - BORR Southern Alignment - Green Corridor Options Refinement

		Section 1 (Hasties Road to Calinup Road)			Section 2 (Calinup Road to Boyanup West Road)				Section 3 (Boyanup West Road to Bussell Highway)				
Criteria	**Sub-Criteria**	**Purple**	**Blue**	**Yellow**	**Purple**	**Cyan**	**Blue**	**Yellow**	**Orange**	**Purple**	**Cyan**	**Maroon**	**Blue**
Economic Assessment	**Whole of Life Costs**	Not assessed - No significant point of difference between options			Not assessed - No significant point of difference between options				Not assessed - No significant point of difference between options				
	Utilities Impact Costs	Corridor will impact an overhead HV line (for approx.120m). Corridor will impact NBN on Ducane Road (approx. 150m)	Corridor will impact an overhead HV line (for approx.200m) and a transmission line (approx.100m) and will also impact on a tower. Corridor will impact NBN on Ducane Road (approx. 100m)	Corridor will impact an overhead HV line (approx.120m) and a transmission line (approx.100m). Corridor will impact NBN on Ducane Road (approx. 150m)	Corridor will impact one HV line (approx. 150m).	Corridor will impact one transmission line (approx. 200m) at two locations.	Corridor will impact one HV line (approx. 150m).	Corridor will impact one HV line (approx. 150m).	Corridor will impact Overhead HV line at three locations (approx. 1km of relocation needed). Corridor will impact transmission line crossing (approx 100m). Similar impacts to utilities between corridors in this section at Bussell Highway: overhead HV and fibre optic.	Corridor will impact Overhead HV line at two locations (up to 300m of relocation needed). Corridor will impact transmission line for approx 1km. Similar impacts to utilities between corridors in this section at Bussell Highway: overhead HV and fibre optic	Corridor will impact Overhead HV line at two locations (up to 300m of relocation needed). Corridor will impact transmission for approx 500m. Similar impacts to utilities between corridors in this section at Bussell Highway: overhead HV and fibre optic.	Corridor will impact Overhead HV line at three locations (up to 400m of relocation needed). Corridor will impact transmission line crossing (approx 100m). Similar impacts to utilities between corridors in this section at Bussell Highway: overhead HV and fibre optic.	Corridor will impact Overhead HV line at two locations (up to 300m of relocation needed). Corridor will impact transmission line crossing (approx 100m). Similar impacts to utilities between corridors in this section at Bussell Highway: overhead HV and fibre optic.
		1	2	2	1	2	1	1	2	3	2	2	2
	Strategic Agricultural Resources & Basic Raw Materials	No impacts	No impacts	No impacts	Impact on Titanium resource (Strategic Mineral). Corridor would sterilise approximately 2km of this resource.	Corridor does not directly impact on any agriculture resource areas or basic raw material areas. Corridor comes to the outer edge of the titanium resource extent. This would potentially lead to some sterilisation / difficulty extracting due to close proximity to a highway.	No impacts	No impacts	Full length of corridor (2.5kms) will go through a Strategic Agricultural Resource Policy Area.	Approximately 1.5kms of this corridor goes through the Strategic Agricultural Resource Policy Area. Approximately 1.2kms of this corridor goes through the Titanium Strategic Mineral Resource area.	Approximately 1.5kms of this corridor goes through the Strategic Agricultural Resource Policy Area. Approximately 1.5 kms of this corridor goes through the Titanium Strategic Mineral Resource area.	Approximately 1.5kms of this corridor goes through the Strategic Agricultural Resource Policy Area. Approximately 2.5 kms of this corridor goes through the Titanium Strategic Mineral Resource area.	Approximately 2 kms of this corridor goes through the Strategic Agricultural Resource Policy Area. Approximately 1 kmsof this corridor goes through the Titanium Strategic Mineral Resource area.
		0	0	0	2	1	0	0	1	1	1	1	1
	TOTAL Economic Assessment	1	2	2	3	3	1	1	3	4	3	3	3
	TOTAL SCORES	**7**	**7**	**12**	**16**	**12**	**10**	**12**	**16**	**17**	**16**	**16**	**16**

Impact	Scoring
Major impact, major constraint very difficult to mitigate.	3
Significant impact, potential to be significant constraint, difficult to mitigate.	2
Less significant impact, potential constraint but less significant, reasonable mitigation measures	1
Minor or no impact or constraint	0

Assessment Conclusion

APPENDIX F MCA GREEN VS RED ALIGNMENT

Multi-Criteria Assessment - BORR Southern Alignment - GBRS (Red) Alignment VS Alternative (Green) Alignment

			Both corridors assessed from Ducane Road to Yeardy Road	**GBRS (Red) Alignment**	**Alternative (Green) Alignment**	
Criteria	**Sub-Criteria**	**Measure**				**Notes**
Social Constraints	**Severance**	No. of properties severed by entire corridor width		Corridor does not intersect any residential dwellings. Corridor will sever 6 lots belonging to 6 landowners. 1	Corridor does not intersect any residential dwellings. Corridor will sever 22 lots belonging to 16 landowners. 3	This considers the number of properties intersected by the corridor. (Does not include taking the corner or boundary edge of a property)
	Landuse	Impact on exsiting land use		Low impact to existing land use, which is predominantly road reserve. Red corridor has been reserved for 40 years. Land impacts publicly known. 1	High impact to existing land use, which is predominantly agricultural. Green corridor is a change to land use not previously known. 3	*Measured as "low/ med/ high" impact on existing land use*
	Land Acquisition	Total Private Land Area Required outside GBRS (ha)		This corridor will require 72 ha of private land acquisition. 1	This corridor will require 172 ha of private land acquisition. 3	Total Red Corridor Area = 189 Hectares (38% private land required) Total Green Corridor Area = 219 Hectares (79% private land required)
	Noise Impacts	No. of dwellings within 450m of corridor		232 dwellings (137 between Ducane Rd to Lakes Rd, 95 between Lakes Rd to Yeardy Rd) 3	16 dwellings 1	The number of dwellings from Ducane Road to Yeardy Road have been considered in this assessment. This assessment is based on no mitigation treatment and not considering the road profile. 16/232= 7%
	Visual Impacts	No.of dwellings within 100m of corridor		72 dwellings (43 between Ducane Rd to Lakes Rd, 29 between Lakes Rd to Yeardy Rd) 3	2 dwellings (lot 3 and 2) 1	The number of dwellings from Ducane Road to Yeardy Road have been considered in this assessment. This assessment is based on no mitigation treatment and not considering the road profile. 2/72= 3%
	TOTAL Social Constraints			9	11	
Engineering Constraints	**Hydrogeology**	Length of road impacting horizontal permeability (km)		Approximately 1.4 km (this is measured from Ducane Road down to Gelorup). **Notes** *Majority of this corridor passes through areas with a water table within 1 metre of existing ground level. However, the section through Gelorup (approximately 2.5km) has a relatively deep water table and therefore it would be expected that groundwater will not cause issues. As a result, the section through Gelorup has been excluded from the length above.* *This corridor would involve widening the existing carrigeway on both sides of Bussell Highway from Woods Road to Cable Mine Road.* *Considering that Bussell Highway is already established, it can be assumed that a certain amount of groundwater control is already in place.This length has been excluded from the length noted above.* 1	All of this corridor (13.2 km) will pass through areas with a water table to within 1 metre of existing ground level. **Notes** *It is not yet known the quantity of material that would be required for ground improvement for this corridor.* 3	This considers the horizontal flow of ground water and the impact that road construction may have on this permeability, which will be critical in maintaining surface and groundwater regimes. **Note:** This aspect is not considered/costed elsewhere in the assessment.
	Ground Conditions (Geology, Acid Sulphate Soils & Contaminated Sites).	Area (hectares) of corridor over highly unfavourable conditions and discussion on any points of difference between options		0 hectares of this corridor passes through **highly** unfavourable ground conditions as shown on the geology maps. Approximately 20% of this corridor is passing through unfavourable geological conditions and 80% passing through favourable geological conditions. Majority of the corridor passes through low to moderate risk areas of acid sulphate soils. There are no known contaminated sites within this corridor. *Note: The geology mapping shows Bussell Highway in the vicinity of the golf course as favourable conditions, however Main Roads South West Region has noted that approximately 2km of this section of Bussell Highway is constructed over poor ground conditions and continues to cause pavement issues. This may require 2km of new pavement through this area.* 1	17.2 hectares of the green corridor (8% of total corridor) is in **highly** unfavourable ground conditions. Approximately 78% of this corridor is passing through unfavourable geological conditions and 14% is passing through favourable ground conditions. Majority of the corridor passes through a low to moderate risk of acid sulphate soils and some small patches of moderate to high risk areas. This corridor will pass through approximately 1km of a contaminated site reg no.1220/590, classified as "Restricted Use". This land was classified as contaminated due to contamination in the groundwater and is currently used as a mineral sands processing facility. Depending on the extent and depth of unsuitable material encountered, this will potentially result in additional cost and time delays to the project as well as seasonal restrictions on construction periods. 3	This considers additional effort (time and cost) required to construct through these areas. **Geological conditions defined as:** Favourable ground conditions considered to be material, typically sand, that would require nothing more than conventional site preparation. Unfavourable ground conditions considered to be material, typically clayey sand, where ground improvements may be required. Highly unfavourable conditions are considered to be material, typically alluvial and swamp deposits, that would highly likely require ground improvement e.g. soil replacement, temporary dewatering and preloading.
	Rivers, Streams & Waterways	No of waterway and river crossings		1 Major Crossing Defined waterway crossing at 5 mile Brook. 1	3 Major Crossings Crossing at 5 mile Brook. This corridor will also require 2 crossings of the creek close to the tie in with Bussell Highway (both creek crossings relatively well defined). 2	**Note:** There will be various other minor crossings for each alignment.
	Road Safety	No of interchanges. No. of conflict points.		**Interchanges:** Y interchange at Bussell Highway Dumbbell interchange at Boyanup Road West **No. of Conflict points:** 10 (Main line and interchanges) 40 (Service Roads) 1	**Interchanges:** Y interchange at Bussell Highway Partial dummbell interchange with north facing ramps **No. of Conflict points on new design:** 9 (Main line and interchanges) 32 (Service Roads) **No. of Conflict points on exsiting Bussell Hwy (Lakes Rd to Yeardy Rd):** 83 existing intersection conflict points 28 existing driveways 1	For measuring conflict points, the existing conflict points that will remain on Bussell Hwy, have been added for the green corridor. Bussell Highway between the Y interchange and Yeardy Road will carry higher traffic with the GBRS option. Where local traffic once had direct access onto Bussell Hwy, they will now be redirected through local roads to an interchange location to gain access to BORR/Bussell Highway.
	Constructability	Discussion on main points of difference between options.		Approximately one third of this corridor will be in a greenfields site. The remainder will involve widening approximately 9km of Bussell Highway. From a safety and traffic management perspective, this will involve interaction with the public, landowners and maintaining access for 28 driveways. The 9km widening construction along Bussell Highway may require staging and side roads will most likely be constructed before widening can commence. 3	The entire corridor is through a greenfields site. There will be very little traffic management required with this option (only at the interface with Bussell Highway) and compairitively low involvement with the general public. It is noted that interaction with landowners / farming operations would need to be managed. 1	Issues relating to safety interactions with the public, staging requirements etc.
	TOTAL Engineering Constraints			7	10	
Economic Assessment	**Construction Costs**	Bulk earthworks and Structures ($) and discussion on impacts to major utility services (No. of crossings)		$73 M The red corridor does not impact on any major services. Approx. cut volume = 1,330,000 m³ Approx. fill volume = 820,000 m³ **Approx. excess cut = 510,000 m³** 2	$103 M The green corridor will impact the transmission line (66kv) at two locations (approximately 1km in total). Approx. cut volume = 80,000 m³ Approx. fill volume = 1,500,000 m³ **Approx. fill import = 1,420,000 m³** 3	These figures are a high level indiactive cost based on bulk earthworks volumes only. All earthworks associated with the interchanges have been included in the volumes. Indicative interchange bridge structures and underpasses have been allowed for. Major utility crossings considered to be transmission power lines and high pressure gas.
	Operation Costs	Length of freeway and access roads (km)		Length of freeway= 14.2km Length of access roads= 26.5km **Total pavement area = 630,000 m²** 2	Length of freeway= 13.2km Length of access roads= 23.5km Bussell Highway = 8.5 km (Lakes Rd to Yeardy Rd) **Total pavement area = 750,000 m²** 2	*This has been measured as the length of highway and access roads to be maintained that will be constructed by this project.* *Bussell Highway has been included for a fair comparison between the same extents in the network. For the length of Bussell Highway noted (7km), its function will change. It will experience a reduction in traffic and will mostly be used for sub regional traffic, therefore requiring less maintenance.*
	Network Performance	Volume to Capacity Ratio		Volume / Capacity = 0.5787 (based on focussed routes from the BTM) Therefore spare capacity is (1-0.5787)= 0.4213 1	Volume / Capacity = 0.4553 (based on focussed routes from the BTM) Therefore spare capacity is (1-0.4553)= 0.5447 This option provides an additional 12% residual capacity compared to the red corridor. Residual capacity is viewed as an over investment in infrastructure, therefore this option has been assigned a score of 2. 2	This criterion has been calculated using a weighted length Volume to Capacity Ratio on Bussell Highway and BORR. This has been calculated based on **focussed** routes rather than the full network, to highlight the differences in the network between Ducane Road and Yeardy Road (common tie in point of red and green).
	Travel Time Saving	Vehichle hours travelled (VHT) and vehicle kms travelled (VKT)		VHT 110,108 (hours) VKT 7,526,640 (kms) 1	VHT 109,771 (hours) VKT 7,529,438 (kms) 1	The VHT and VKT is generated from the network wide, strategic model. The green alignment provides a saving of approx. 337 hours on the overall network. The red alignment provides a saving of approx. 2,798 kms travelled on the overall network.
	Strategic Agricultural Resources	Area (ha)		Approximately 7.3 hectares will pass through the Strategic Agricultural Resource Policy Area. 1	Approximately 25.3 hectares of this corridor will pass through the Strategic Agricultural Resource Policy Area. 3	This is considered an economic impact to the State due to loss of access to a resource.
	Basic Raw Materials & Mining Tenements	Area (ha) of impact to the Strategic Titanium Area and Mining Tenements		Approximately 1.6 hectares of this corridor will pass through the Strategic Titanium Area. This corridor will impact on approximately 13.2 hectares of mining tenemens. **(Noted above approximate excess cut = 510,000 m³)** 1	Approximately 20.4 hectares of this corridor will pass through the Strategic Titanium Area. This corridor will impact on approximately 27.6 hectares of mining tenements. **(Noted above approximate fill import = 1,420,000 m³)** 3	This is considered an economic impact to the State due to loss of access to a resource. Neither alignment directly passes through the sand area in the 'Strategic Minerals and Basic Raw Materials Policy', however there is a substantial difference in fill required for the green in comparison to the red. Inevitably, both corridors will have an impact on this resource.
	TOTAL Economic Assessment			8	14	
	TOTAL COMBINED SCORE			24 / 48	35 / 48	

Impact		**Scoring**
Major impact or major constraint, very difficult to mitigate.	3	3
Significant impact or potential to be a significant constraint, difficult to mitigate.	2	2
Less significant impact or potential constraint but less significant, reasonable mitigation measures	1	1
Minor or no impact or constraint	0	0

APPENDIX G ENVIRONMENTAL IMPACT ASSESSMENTS

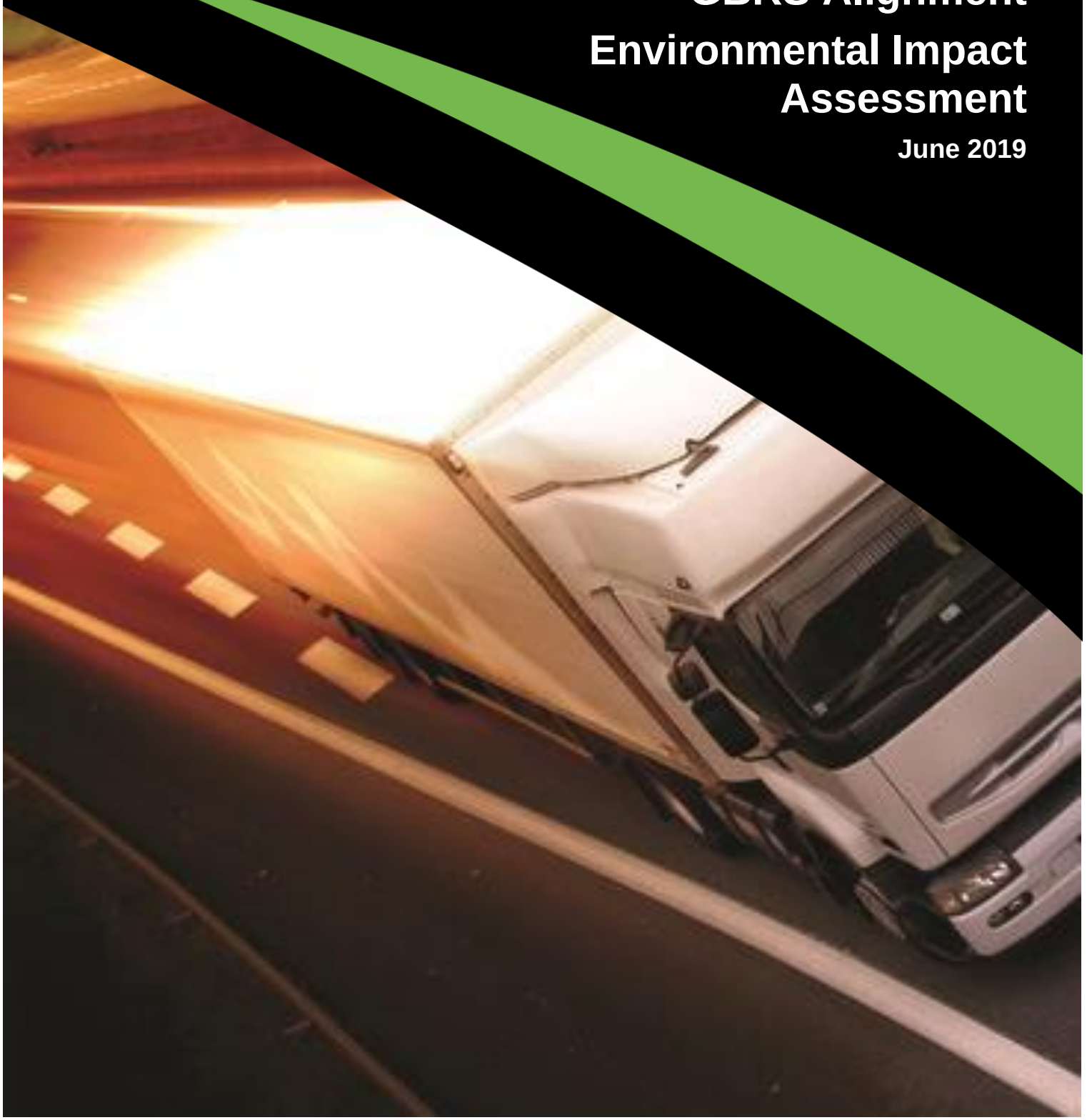
BORR Team

Bunbury Outer Ring Road Southern Section

GBRS Alignment

Environmental Impact Assessment

June 2019



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Document *Control*

Revision	Date	Description	Prepared	Reviewed	Approved
A	15/2/2019	Draft for Main Roads Review	BORR Team	FH	PM
B	10/06/2019	Draft for Main Roads Review	BORR Team	FH	FH
0	24/06/2019	Final Document	BORR Team	FH	FH
1	27/06/2019	Final Document Issued to Main Roads	BORR Team	FH	FH

1 INTRODUCTION

1.1 Background

The Commissioner of Main Roads Western Australia (Main Roads) is planning for the construction of the Bunbury Outer Ring Road (BORR) Project. BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed BORR will provide a high standard route for access to the Bunbury Port 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 land requirement for BORR is identified in the Greater Bunbury Region Scheme (GBRS).

The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway, an existing 4 km section which was completed in May 2013, along with a 3 km extension of Willinge Drive southwards to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

The alignment of BORR Northern and Central Sections is planned from Forrest Highway to South Western Highway and was referred as a single project to the Environmental Protection Authority (EPA) on 6 June 2019. BORR Southern Section will provide a highway link between South Western Highway and Bussell Highway and will link with BORR Northern and Central sections to the Port Access Road (PAR).

Main Roads referred BORR Southern Section to the EPA for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act) in November 2012. In February 2013, the EPA determined that BORR Southern Section did not require formal environmental assessment under Part IV of the EP Act and that BORR Southern Section could progress under Part V of the EP Act and other relevant legislation. Clearing of native vegetation for the Southern Section would be approved under a Purpose Clearing Permit. An application for the clearing permit was submitted in December 2015 and withdrawn prior to a decision being made in June 2017.

Main Roads also referred BORR Southern Section to the Commonwealth Minister for the Environment through the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, now Department of the Environment and Energy (DotEE)) for a decision on the requirement for formal assessment under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In March 2013, the Department of the Environment (DotE now DotEE) advised that BORR Southern Section was considered a Controlled Action and would be assessed through preliminary documentation. Main Roads has since withdrawn the referral from DotEE assessment.

In response to changes to the EPBC Act's protection status of the Western Ringtail Possum in May 2018, from 'Vulnerable' to 'Critically Endangered', Main Roads identified that the approval to construct BORR Southern Section with the GBRS Alignment may need to be reconsidered. To address this concern, Main Roads commissioned an Environmental Options Assessment of five options for an alternative route for the BORR Southern Section (BORR IPT, 2018).

The Environmental Options Assessment confirmed that significant environmental factors for BORR Southern Section alignments included the clearing of native vegetation and the consequent removal of fauna habitat (BORR IPT, 2018).

Based on outcomes of the options assessment two alignments were selected for further investigation. These were:

- BORR Southern Section GBRS Alignment
- BORR Southern Section Alternative Alignment.

A suite of field investigations was undertaken on both alignments in Q3 and Q4 of 2018.

For the purposes of comparing the environmental impact of these two alignment options, this assessment considers a dual carriageway highway from Hasties Road in Gelorup to Yeardy Road in Stratham. It should be noted that the alignments are preliminary in design and further refinement will be undertaken during the detailed design phase.

1.2 Purpose of this document

To inform the decision of the preferred Project footprint, Main Roads WA commissioned an Environmental Impact Assessment (EIA) for each of the two alignment options.

This EIA presents the environmental values and potential impact of the construction and operation of a preliminary BORR Southern Section GBRS Alignment (referred to as 'the Project' in this report). It should be noted that the alignment for the BORR Southern Section GBRS Alignment that is subject of this assessment, differs to the alignment subject of the 2012 referral. Due to the changes in the footprint and changes in status of threatened species and communities potentially impacted by the Project, this EIA supersedes the referral document and impact assessment associated with the 2012 alignment.

Main Roads used the findings in this EIA to assist in their determination of the preferred BORR Southern Section alignment. The selected alignment will be subject to environmental assessment and reporting for approvals processes under the EP and EPBC Acts. Revision of the environmental impacts (to support the referral and assessment) will be undertaken as necessary to incorporate any change in the Project footprint following the detailed design phase.

This EIA addresses the Principles and Factors of Section 4A of the EP Act and is structured around the EPA's "*Instructions on how to prepare an Environmental Review Document*" (EPA, 2018a).

1.3 Project description

The Project is located 10 km south of Bunbury in the Shire of Capel and City of Bunbury. The Project is shown in Figure 1 and comprises the following elements:

- Construction of a 14.2 km dual carriageway highway between Hasties Road and Yeardy Road
- Construction of interchanges at:
  - Bussell Highway (in the form of a Y-interchange)
  - Boyanup Road West/Fishermans Road (in the form a dumbbell interchange)
- Construction of a road overpass and associated road works at Yalinda Drive
- Upgrade of 26.5 km of service/local roads including:
  - Realignment of Calinup Road
  - Connection of Jilley Road to Ducane Road
- Construction of drainage structures including basins and culverts
- Construction of 5.8 km of Principal Shared Path including a pedestrian bridge over Bussell Highway at Lakes Road
- Installation of fencing and noise walls/treatments
- Service relocation and protection

- Construction of access roads to severed properties
- Pre-construction activities including geotechnical investigations and service utilities relocations
- Landscaping and rehabilitation works.

1.3.1 Project Area

The Project Area covers approximately 190 ha and is the boundary for this EIA (Figure 1). The majority of the Project Area is cleared land comprising of previously constructed roads and includes an approximately 80-100 m wide corridor for the dual carriageway and associated infrastructure. Pockets of native vegetation are present within the Project Area in road reserves or as isolated patches on agricultural land.

1.3.2 Surveyed and Unsurveyed areas

Access to the entire Project Area was not available when the environmental field surveys were undertaken in 2018 and the study areas differed slightly for each environmental field survey. As a result, approximately 53 % of the Project Area was not surveyed during field investigations (Figure 2).

Unsurveyed areas (identified in Sections 3.3 and 3.4) have undergone desktop investigations to inform this EIA. Additional field investigations will be completed in unsurveyed areas if this alignment is chosen for development as part of the formal environmental assessment.

The Southern section (Alternative Alignment) Study Area overlaps the Project Area by approximately 17 ha, therefore the total area surveyed within the Project Area was just under 90 ha.

Table 1-1 outlines the areas surveyed and gaps within the Project Area during the 2018 field surveys. Interpretation of aerial imagery identifies that the majority of the unsurveyed area is likely to be in Degraded or Worse condition. Two unsurveyed areas (Bourne Loop to Bussell Highway (approximately 4 ha) and Ramsey Road (<1 ha)) are likely to be in Good or Better condition.

Table 1-1 Project Area, Surveyed and Unsurveyed areas in the 2018 field surveys

	AREA
Project Area – Southern section (GBRS Alignment)	189.6 ha
Study Area – Southern section (GBRS Alignment) flora and fauna (excluding contextual sites) field surveys	Approx. 297 ha
Surveyed Area (Southern section – GBRS Alignment) intersecting the Project Area	73.0 ha
Surveyed Area (Southern section – Alternative Alignment) intersecting the Project Area	16.5 ha
Unsurveyed Area – Gap in survey effort within the Project Area)	100.1 ha

1.4 Legislative framework

A summary of the anticipated regulatory approvals required for the establishment of the Project is provided in Table 1-2.

Table 1-2 Summary of regulatory approval requirements for BORR Southern Section

PROJECT ACTIVITIES	TYPE OF APPROVAL	REGULATORY AGENCY	LEGISLATION REGULATING THE ACTIVITY
Potentially significant impacts to the environment	Division 1 of Part IV of the EP Act - referral and assessment of significant and strategic proposals Approval type to be determined if the Project is Assessed, Assessed on Referral Information or Not Assessed	Environmental Protection Authority (EPA)	EP Act
Impacts to matters of National Environmental Significance (MNES)	Referral of a Project – Approval type to be determined if the Project is deemed a Controlled Action	Department of the Environment and Energy (DotEE)	EPBC Act
Clearing of Native Vegetation	Native Vegetation Clearing Permit	Department of Water and Environment Regulation (DWER)	EP Act, Part V Div 2, EP (Clearing) Regulations 2004
Impacts to flora and fauna	Approval to take flora and fauna (if required)	Department of Biodiversity Conservation and Attractions	*Biodiversity Conservation Act 2016* (BC Act), Biodiversity Conservation Regulations 2018
Impacts to waterways	Bed and Banks Permit	DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)
Sourcing of construction water	Licence to take	DWER	RIWI Act
Impacts to Registered/Lodged Aboriginal Heritage sites	Section 18 consent	Department of Planning, Lands and Heritage	*Aboriginal Heritage Act 1972*
Impacts to Municipal heritage site	Consent from Shire	Shire of Capel	-

1.5 Limitations and assumptions

This report has been prepared by Bunbury Outer Ring Road Integrated Project Team (BORR IPT) for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between BORR IPT and Main Roads, as set out in Section 1.2 of this Report.

BORR IPT otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. BORR IPT also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by BORR IPT in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. BORR IPT has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by BORR IPT described in this report. BORR IPT disclaims liability arising from any of the assumptions being incorrect.

BORR IPT has prepared this report on the basis of information provided by Main Roads and others who provided information to BORR IPT (including Government authorities), which BORR IPT has not independently verified or checked beyond the agreed scope of work. BORR IPT does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, services and vegetation, and access. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this Report. BORR IPT does not accept responsibility arising from, or in connection with, any change to the site conditions. BORR IPT is also not responsible for updating this report if the site conditions change.

This report has assessed the environmental impact within the Project Area, as shown in Figure 1.

Approximately 53 % of the Project Area (100ha) was inaccessible during the 2018 environmental field investigations and not surveyed. Desktop assessments were undertaken to identify potential impacts of the Project in the following unsurveyed areas:

- Lakes road
- Minninup Road / Maidment Parade
- Jilley Road
- Additional sections in agricultural land near Ducane Road and Jilley Road
- Additional section north of Calinup Road between Brockway Drive and Bussell Highway
- Jaymon Road
- Eucalypt Drive
- Brockway Drive
- Ramsay Road
- Child Place
- 120 m north of the Project Area on Bussell Highway
- The southern end of the Project on Bussell Highway from Capel Golf Course to Yeardy Road, approximately 6.8 km, including intersection with Boyanup Road West and Fishermans Road
- New access road linking to Bourne Loop from Bussell Highway.

If this alignment is chosen for development, additional field surveys will be conducted for these areas as part of the formal environmental assessment process.

2 STAKEHOLDER CONSULTATION

Main Roads has been engaged in consultation with key stakeholders since the mid-1990s for the entire 'BORR Project'. Previous consultation has been undertaken by Main Roads with key stakeholders including:

- Technical Working Group: with engineering and planning representatives from Main Roads, the City of Bunbury, the Department of Planning, the Department of Environment and Conservation, the Shire of Capel and the Shire of Dardanup
- BORR Stakeholder Group: State and local government agencies that met as required and included: City of Bunbury (CEO, Mayor), Shire of Capel (CEO, Shire President), Shire of Dardanup (CEO, Shire President), Bunbury Port Authority, South West Development Commission (SWDC), Bunbury Chamber of Commerce and John Castrilli (Member for Bunbury)
- Consultation with: Department of Planning, Lands and Heritage (DPLH) (formerly Department of Planning), Public Transport Authority, Local Government, Service Authorities
- Consultation with environmental stakeholders including:
  - Commonwealth DotEE (formerly Department of Sustainability Environment, Water, Population and Communities)
  - DBCA (formerly Department of Environment and Conservation)
  - DWER (formerly Department of Water and Office of the EPA).

Stakeholder and community engagement is continuing with landowners and local residents, communities of interest, local government authorities and State Government agencies. During 2018, Main Roads consulted with key stakeholders to discuss 'BORR Project' issues and potential impacts, including environmental, heritage (Aboriginal and European), social and economic impacts.

A summary of consultation completed to date is provided in Table 2-1. Regulatory agencies consulted to date are shown in Table 2-2. A summary of the key concerns raised during stakeholder consultation is provided in Table 2-3, along with Main Roads responses.

Table 2-1 Consultation summary to date

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
Investment Logic Mapping (ILM) Workshop	4 December 2017	• Main Roads • South West Development Commission • Great Southern Ports • Qube (bulk minerals sand transporter).
Project Steering Committee	June 2018 – ongoing (bi-monthly)	• Chaired by MD Main Roads • Main Roads' Project Director • Department of Treasury • DPLH • Department of Infrastructure, Regional Development and Cities • Others by invitation.
Project Enabling Group	June 2018 – ongoing (bi-monthly)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey • Shire of Dardanup • DPLH • BORR IPT.
BORR Regional Local Government Advisory Group (RLGAG)	August 2018 – ongoing (quarterly or at Key Milestones)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey • Shire of Dardanup • BORR IPT.
Economic Advisory Group	October 2018 – ongoing (at Key Milestones)	• City of Bunbury • Bunbury Geographe Economic Alliance (BGEA) • South West Development Commission (SWDC) • Regional Development Australia South West (RDASW) • Chamber of Minerals and Energy • Wespine • Bunbury Geographe Chamber of Commerce and Industry • Main Roads • BORR IPT.
Drainage Reference Group	August 2018 – ongoing (at Key Milestones)	• DBCA – Parks and Wildlife Service • DWER • Water Corporation • City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Department of Primary Industries and Regional Development (DPIRD) • Harvey Water

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
		• Leschenault Catchment Council • South West Catchments Council • BORR Team • Main Roads.
Freight and Road Users Group	August 2018 – ongoing (at Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • DFES • DPLH • Department of Transport • Freight and Logistics Council WA • Livestock & Rural Transport Association • Public Transport Authority • RAC WA • WA Pilot Drivers Association.
Local Members meetings	Ongoing	• Member for Bunbury, Don Punch • Member for Collie - Preston, Mick Murray • Member for Murray - Wellington, Robyn Clarke • Nola Marino - Federal Member • Adele Farina, MLC.
BORR – Bunbury Freight Access Enhancement – Options workshop	25 January 2018	• Department of Transport.
Presentation to Chamber of Commerce	14 November 2018	• Main Roads • Chamber of Commerce • BORR IPT.
Shire Project Briefing Meetings	May 2018 – ongoing (at Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Main Roads • BORR IPT.
Gnaala Karla Boodja WC1998/058 Native Title Claim group (GKB NTC) meeting	7 May 2018, 29 October 2018	• Brad Goode & Associates • Nine representatives from the GKB NTC group • DPLH • Main Roads • BORR IPT.
General public and local residents drop in sessions	24, 25, 30 and 31 October 2018	• Community members.

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
Project newsletter	2018	• Local community (distribution) • General public (via website) • Local Government Areas (distribution) • MLAs (distribution).
Community Reference Group (CRG) Southern Alignment	July 2018 – ongoing (monthly)	• Community members.
Local landowners and residents	23 Oct 2019	• Landowners within BORR Southern Section GBRS Alignment • Residents (if renting within BORR Southern Section GBRS Alignment).
Local Community Group	July 2018	• Friends of Gelorup Corridor.

Table 2-2 Agency consultation

AGENCY	DATE	PURPOSE
DWER – EPA	13/03/18	Project update
	05/09/18	Project update
	13/02/19	Project update
DotEE	25/5/18	Project briefing
	26/5/18	BORR site walk through – BORR Southern Section Gelorup
	17/07/18	Meeting at Main Roads head office, Don Aitken Centre (DAC) Perth- Project update
	08/10/18	Meeting at DAC - Project update
	14/2/19	Meeting at DAC - Project update
DWER – Environmental Regulation	25/5/18	Briefing South West Regional Office
	26/5/18	BORR site walk through – BORR Southern Section Gelorup
DBCA	25/5/17	BORR Project update
	13/11/17	Site visit BORR south wetlands
	30/7/18	BORR Project Update
	24/5/18	BORR and Western Ringtail Possum issues
	14/9/18	Western Ringtail Possum issues
	28/11/18	BORR Project update

Table 2-3 Summary of key concerns raised during consultation

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
CRG Members, Community members	CRG Meetings, Community Drop in Sessions,	**Need for BORR and Strategic Traffic Modelling Basis** There have been numerous enquiries by CRG members into the basis of population statistics used to inform the traffic model. More broadly there have been questions relating to the need for BORR.	There is already significant pressure on the road network around Bunbury, and this is Projected to increase due to a number of factors including: • Population growth in Greater Bunbury • Proposed development in Wanju, Waterloo and surrounding areas • Increased freight movements, due to mining activity and associated growth in Bunbury Port activities. The existing road network in and around Bunbury supports a range of vehicle movements, including freight and light vehicles, regional and local traffic. These combinations of vehicles on local road networks impact on road safety and amenity. As a Port City, Bunbury plays an important role in the WA economy. Twelve per cent of the world exports of alumina leave from the Port of Bunbury. The current access to Bunbury Port is problematic and impacts on freight efficiency. Currently, vehicles travelling between the Bussell Highway and Forrest Highway have to navigate 13 sets of traffic lights and one rail level crossing. When complete, between 10,000 and 15,000 vehicles per day on average are expected to use the new road. These regional / port movements would otherwise mix with local traffic on local roads. Population forecasts used in strategic traffic modelling come from the land use planning by the Department of Planning, Land and Heritage and it considers the City of Bunbury, Shire of Dardanup and Shire of Harvey and is based on planned land use changes forecast for the Ultimate design life of BORR.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG members, impacted businesses	CRG Meetings, Community Drop in Sessions, Public Enquiries, Landowner Briefings	**Southern Alignment Investigations** Questions have been raised around why an alternative alignment has been investigated, what were the triggers and what investigations have been undertaken to assist in making a decision. Community members within the green alternative southern alignment voiced anxiety and mental health concerns in regards to the alignment uncertainty and potential for direct impact to their properties. Confusion between the EIA process for the southern alignment and the environmental referral process for the northern and central alignment.	Land for the southern alignment of Bunbury Outer Ring Road has been reserved within the Greater Bunbury Region Scheme for many years. It contains habitat for the Western Ringtail Possum, Black Cockatoo and Banksia Woodland Threatened Ecological Community which are Federally listed. In May 2018, the Commonwealth changed the status of the Western Ringtail Possum under the Environment Protection and Biodiversity Conservation Act from Vulnerable to Critically Endangered. This is the highest classification level possible before a species is declared extinct. When referring a Project for environmental assessment it is necessary to demonstrate that there are not feasible alternatives with lesser environmental impact. As a result of the reclassification of the Western Ringtail Possum and the presence of other Matters of National Environmental Significance (MNES) such as the Black Cockatoo, investigations into an alternative alignment located further to the east (green corridor) have been undertaken to support the environmental referral process. These investigations, including detailed site surveys, have been undertaken in addition to those in the existing GBRS alignment to support preparation of EIAs. The Project team has consulted with landowners potentially affected by this alternative alignment. Following completion of consultation and the environmental surveys, the findings will be presented to the landowners, the Community Reference Groups established for BORR Project and the wider community. Once an alignment is selected based on the results of the selection study and design progresses, then the southern alignment will be referred to the EPA and DoTEE for environmental assessment and approval.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
CRG members, Community members	Norther & Central and Southern CRG meetings	**Western Ringtail Possum** Management of impacts to Western Ringtail Possums.	The Western Ringtail Possum (WRP) is critically endangered, which means the Commonwealth Minister for the Environment is responsible for ensuring that any approved actions by The Minister will not put the species at further risk.
		What studies were undertaken and by whom?	Regional surveys of the WRP were commissioned to more accurately estimate the population size and determine the potential impact of BORR Project on the WRP population. The methodology for these surveys was agreed with the Department of Biodiversity, Conservation and Attractions and the WRP Recovery Team. WRP studies were completed by specialist zoological consultants Biota Environmental Sciences. Investigations have been undertaken in the Southern Swan Coastal Plain, Cape to Capes, Southern Forrest and Albany Areas to get a total estimate for the species.
		Will possums be relocated/translocated?	There have been examples of successful relocations in the region. If we could do it successfully that would be wonderful but we and the federal regulator must be confident that any relocation would be successful. That confidence does not exist currently. This is something we need to better understand to ensure it is successful if adopted with no perfect solution available.
		Offset areas – have they been selected, what offset ratios will be applied and is there a maintenance budget for offsets?	Offsets have not been identified yet. This comes later in the process when the nature and extent of the impacts are known. Main Roads has a bank of offsets available with further acquisitions likely to be required depending upon values impacted. There is a calculator used for determining offsets, which are generally greater in area than the impact. Budgets would depend on the offsets selected. There are previous examples where there are contributions to maintenance.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		If relocation fails what else is there? Are animals euthanised?	One of the challenges with the WRP is that there is no approved translocation program currently in operation. Other measures are available for birds, such as cockatoos. The first steps are to avoid or minimise impacts wherever possible. Native fauna are not euthanised.
		Fragmentation of possum/ fauna habitats.	Any alignment resulting in fragmentation will consider mitigation measures including bridges or underpasses.
Community members, CRG Members	Enquiries, Northern & Central and Southern CRG meetings, Drop in Sessions	**Longevity of GBRS Alignment** Queries about investigating an even more eastern alignment have been raised by numerous newly concerned communities including concerns about the redundancy of the GBRS Alignment between Hasties Road and Bussell Highway. This has been raised specifically in the context of a future north south freeway grade road.	Currently there is no planning or consideration for a further outer ring road (more eastern alignment). The capacity provided by the BORR and existing roads will service the region well into the future. BORR is being designed to cater for the long term planning needs which includes catering for the transport movements of a future population of 200,000 people living in the Greater Bunbury area. The transport movement basis is built upon the Greater Bunbury Strategy (2013) report and includes consideration of the planned expansion of residential and industrial areas at Wanju, Waterloo Industrial Park and Picton Industrial Park as well as other investigation areas for potential urban development rezoning.
CRG members, Community members	Northern & Central and Southern CRG meetings, Drop in Sessions	**Environmental Approvals Process and Studies** The community has been highly interested in the types of environmental studies being completed to support the Project.	An EIA study including multiple investigations has been undertaken for the two alternative southern alignments. We are committed to ensuring that all environmental aspects of the Project are completed with great sensitivity and in accordance with all State and Commonwealth legislative requirements. Detailed reports were completed for a portion of the Project Area including (refer to section 1.3.2 regarding Surveyed and Unsurveyed Areas): • Noise management plan • Targeted fauna (including Matters of National Environmental Significance MNES) assessment • Aquatic Fauna • Flora and Vegetation assessment

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			• Air quality impact assessment. There are three opportunities in the environmental approvals process for the public to provide feedback, they are: • At the start of the process when the level of assessment is set; • In review of the information submitted by BORR Team to the regulator/s; and • In response to the Draft Ministerial Conditions that result if approval is granted.
		The process of submitting comments on the environmental referral. Concerns around the public comment period.	This is a formal process, managed by the responsible regulatory entity (Environmental Protection Authority) and is not a process managed by Main Roads. Detailed information can be found at www.epa.wa.gov.au .
CRG members, Community members	Northern & Central and Southern CRG meetings	**Flora and Fauna** How will impacts to flora and fauna be managed?	The BORR alignment includes habitat for critically endangered species, as determined under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999*. Avoidance is the first option for impacts, but where avoidance of impacts is not practicable, minimisation of impacts is sought. In BORR Northern Alignment Selection report, the environmental criteria, alongside other criteria used in the multi criteria analysis, to assess options included: • Rare flora and native vegetation • Rare fauna, fauna habitat and TECs • Waterways or wetlands. When considering BORR interchange options and local connectivity options, assessment of the environmental criteria included: Wetlands

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			(Conservation Category Wetland (CCW) and Resource Enhancement), remnant native vegetation, rare Fauna (WRP), TECs, European Heritage and Aboriginal Heritage.
CRG members (local residents, road users and property owners/ farmers)	Northern & Central Community CRG Meetings (10/18, 11/18, 12/18)	**Social and Economic Bypass Impacts** Primacy of Bunbury and economic impacts of 'bypass'. Consideration of social and economic impacts on community business, particularly of severance on farmers. Formation of an economic advisory group was first discussed in the October North and Central CRG.	An Economic Advisory Group (EAG) was subsequently developed and is chaired by the SWDC. KPMG has been commissioned by Main Roads to undertake a Social and Economic Study for the wider BORR Project. Impacts for the local farming community will be included in this assessment. The study will be in line with NSW Road Maritime Services Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05).
		Economic impacts of BORR and impacts on businesses.	Bunbury is the gateway to the South West Region. The Region has a strong economy based on mining, manufacturing, building and construction, agriculture, viticulture, aquaculture, forestry, tourism and emerging smart and creative industries, generating $13 billion in the 2016-2017 financial year (SWDC, 2018). In addition, the Port of Bunbury is a large deep sea port which allows the berthing of commercial cargo vessels and is supporting the development of tourism by welcoming large tourist cruising passengers to our shores. The construction phase of the Project will create jobs and provide economic benefits to the region. Once constructed BORR will provide more efficient access for freight to the Bunbury Port, and enable the expansion of industrial centres, leading to more manufacturing, agricultural processing and local employment.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Noise Impacts** Community members along the alignment have raised concerns in regards to noise from vehicle traffic (particularly trucks), braking vehicles at interchanges and roundabouts and vehicles travelling over bridge joints.	The BORR Team is committed to managing the impacts of noise in line with the State Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning" with the aim to protect communities from unreasonable levels of transport noise. BORR Team has committed to undertake a noise study for the Ultimate Planning Design Concept of the Southern Section of BORR. This noise study will be informed by the development of a noise model that will help to identify locations where noise mitigation may be required to comply with State Planning Policy 5.4. The noise model will consider topography, distances between properties and the road, road design levels, gradients and surface type and consideration of future projected traffic volumes and types. Existing noise in the study area will be recorded to be used in the model development.
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Future Development Noise Mitigation** Impacts and management of noise to any future developments.	Where houses pre-date the road it is Main Roads responsibility to mitigate. Where the road pre-dates the development, it is the developer's responsibility to comply with the policy.
CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Noise Modelling Assumptions** Assumptions used in developing the noise model in regards to exclusion of mitigation measures and choice of road surface treatments.	The noise modelling process is conservative and assumes a worse-case noise scenario to ensure likely noise exceedances are identified and appropriate management implemented.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG members	Main Roads Enquiries line, CRG Meetings, Community Drop In Sessions	**Light pollution and Visual Amenity** Impact of light pollution from street lights and vehicle headlights, as well as impacts to visual amenity as the result of construction of roads, associated interchanges, bridges and overpasses.	The EIA process considers impacts to visual amenity, including lighting. This includes reporting potential visual impacts and identifying likely locations where design measures may be required to mitigate the impacts. Mitigation may include providing screening, which can take a variety of forms, including the construction of walls, earth mounds and planting of vegetation. Strategies will be developed to comply with the Australian Standard for lighting of public roads (AS/NZS 1158). 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. Visual amenity is also a key consideration of the Urban and Landscape Design Framework that has been prepared for BORR Project.
Property owners	Main Roads Enquiries, Southern CRG (07/18, 12/18)	**Air and Water Quality.** Residents of some farming and residential properties, are not connected to scheme water and rely upon rainwater tanks as their primary source of potable water. Impact of traffic pollution particulate matter on water tank water quality is a concern to the community.	There is no comparative air quality policy or legislative requirement for pollutants from traffic in comparison to SPP 5.4 that deals with noise from traffic. Air quality modelling to the relevant standards will be completed to establish baseline conditions. National standards for air and water quality apply for land and water managed under the EP Act, but not necessarily water in rainwater tanks. It is recognised that pollutants are emitted from diesel and petrol powered vehicles. The concentration levels of those chemicals have decreased with improved engine and fuel technology. Fuel used to have lead and sulphur additives but these have been removed or reduced in current vehicle fuels. Vehicle age is another factor with the average vehicle age around 10 or 11 years in Perth. As a result, the pollutants coming out of an exhaust pipe are steadily reducing over time. Pollutants in water tanks is a separate issue that is up to the land owner with various potential pollutant sources to consider.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Land Acquisition and Compensation Process** Property owners, particularly famers, are concerned about the impact of severance on their properties and businesses. Concerns include land compensation process and valuation, impacts to current and future business operations as well as social & mental health impacts that this will have on their families.	Main Roads appoints up to three independent land valuers and pays for the land owner to appoint a valuer of their choice. The valuation process includes business compensation. Main Roads can only compulsorily acquire land needed for the Project but can acquire small remnant land parcels through negotiations. We provide access to small parcels and if unviable it would be part of the compensation calculation.
		Timeline of land acquisition and ability for impact on broader Project implementation timeline.	Main Roads is planning to deliver the Project and will progress the enabling tasks including talking to the owners of property required for the Project to try and agree an early settlement as part of a voluntary acquisition process.
Local community and road users CRG Members	Southern CRG meetings	**Local Access Changes on Journey Times** Is compensation payable as a result of impacts of local road severance on journey times?	Compensation is only payable where land is required for the Project. Main Roads will endeavour to ensure connectivity remains but it will change.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Property Severance** Property owners who are likely to have access to their properties altered or their land parcels split are concerned about how they will access their properties/land and how business as usual will take place.	Main Roads will provide access to the portions of land that are severed. Any associated economic loss is included as part of the compensation payable and depends on individual circumstances. Under the Act we can't resume land that isn't required for road purposes. Main Roads often finds that if a convoluted route to provide access results, compensation will be payable. In some cases, other measures are considered to walk or even truck cattle.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Property Access** Property owners who are likely to have access to their properties altered are concerned about what form new access will take.	Any existing accesses affected by the ultimate design of the highway will require consideration of alternative routes. The planning, construction and funding of alternative routes will be undertaken by Main Roads WA as part of the Project scope. These works can include the provision of new service roads and upgrades, or realignment of existing driveways.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			Main Roads does not generally provide slip lanes for individual properties as they are usually only provided for local roads. However, in some instances where there is a need due to higher traffic volumes or presence of trucks or a road safety risk, a slip lane can be provided. This will be assessed on a case by case basis. If access is required via adjacent privately owned land – we will undertake discussions with the landowners around access routes, acquisition and compensation.
Gelorup residents, local road users	Southern CRG Meeting (07/18, 9/18, 10/18, 11/18, 12/18, 2/19)	**Traffic and Safety** BORR connection to Gelorup via Hasties Rd due to increased traffic through community and past community infrastructure, interaction with school traffic and narrow road reserve. Concern was raised at numerous CRG meetings.	Centenary Road connection concept options were subsequently developed and assessed as part of the Gelorup connectivity assessment. The Centenary Road connection is the preferred connection recommended by the BORR Team.
CRG Members, Fire Emergency Service, Shire of Capel	Southern CRG meetings	**Emergency Service Access and Emergency Egress** The effects of road severance on emergency access eg to allow firefighting and provide emergency egress to the community either side of the alignment.	BORR Team has undertaken consultation with the Shire of Capel and the Bush Fire Service to determine issues which will arise from severance to local roads and determined the requirements for the provision of additional water tanks and stand pipes. Local and access road connections are being planned where existing local and access roads will be disrupted.
CRG members	Southern CRG meetings	**Impacts to Cultural Heritage** Potential for loss of cultural heritage.	There are no European heritage sites expected to be impacted within the Project Area.
CRG members	Southern CRG Meetings (03/19)	**Impacts to Aboriginal Heritage** What was the source of data used to show aboriginal sites used to inform field investigations.	The source of mapped Aboriginal Heritage sites used to inform field investigations was publicly available data from the DPLH and a previous Aboriginal Heritage Survey which covered a portion of the Project Area (Brad Goode & Associates, 2012).

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		Concerns around the Aboriginal Heritage values and history of the assessment process and what additional studies are being completed.	Main Roads will re-consult with members of the Aboriginal community on the preferred southern alignment to update the 2012 Aboriginal Heritage Survey.
CRG members	Southern CRG meetings	**Construction Impacts** Construction impacts on access to and from properties – particularly if there is an emergency such as a fire.	Bushfire and other emergency responses will be a prime consideration to manage during and after construction. Main Roads includes requirements to maintain emergency routes during construction in contracts. The same would apply to standpipes and other fire response assets.
		Construction noise/vibration and hours of works.	Point source noises (eg horns) and noises during construction are not subject to SPP5.4. Details on the management of construction noises and vibrations will form part of the construction contract.
Drainage Reference Group (DRG)	DRG meetings	**Wetlands and Waterways** Concern in relation to two TEC (wetlands) located within the green alternative alignment. DBCA encouraged BORR Team to liaise with DBCA Wetlands unit.	BORR Team has undertaken a wetland study within a portion of the Project Area as part of a survey located predominantly to the north. BORR Team have liaised with DBCA officers where appropriate regarding TECs within the Project Area.
		Request for spill management for wetlands, outside of wetland buffers – and be based on risk based approach.	Main Roads has requirements around what is to be provided where spill control is required, but not around where spill control is required. Recommendations from DRG members were discussed.
Land owners	Landowner meetings	**Irrigation and Drainage** Concerns have been raised by landowners in relation to localised flooding impacting on access and egress to and from their properties under BORR.	BORR Team will undertake discussions with landowners to determine suitable alternate access where access will be directly impacted by BORR once a decision on the southern alignment has been made.
		Landowners have also raised concerns where investigations have been required in relation to use of heavy machinery impacting on contours/ damaging drainage of their land.	Prior to all investigations, landowners were contacted by BORR Team for approval to access their land and landowners were consulted on the proposed machinery details, size, weight etc to be used on their property. Investigations with machinery on land vulnerable to becoming waterlogged

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			during wet months was timed to occur where possible prior to the onset of the wet season.
Drainage Reference Group (DRG) Members, Water Corporation	DRG (08/2018)	**Water Quality** Need for spill management (eg oil and chemical spills). Oil spill traps were initially only considered for water draining to sensitive environmental receptors (eg wetlands). Water Corporation indicated that spill protection was required upstream of their drains.	BORR drainage strategy now includes the use of oil spill traps to Water Corporation drains.
DRG Members, Leschenault Catchment Council Inc.	DRG (08/2018)	**Water Quality** Nutrient stripping (via soil amendments using Iron Man Gypsum) in the buffer strip along the alignment.	Options were investigated, but it was identified that the major source of nutrients was farm land. Water, particularly in irrigated plots, is carefully managed on farms by paddock grading and is collected by drains and therefore is unlikely to reach the road alignment. There is limited benefit and a very high cost for undertaking soil improvement measurements within the alignment.

3 ENVIRONMENTAL PRINCIPLES AND FACTORS

3.1 Principles

Section 4A of the EP Act establishes the object and principles of the Act. In accordance with the EPA's Statement of Environmental Principles, Factors and Objectives (EPA, 2018b), this section describes how each of the five principles of the EP Act has been applied to the Project (Table 3-1).

Table 3-1 *Environmental Protection Act 1986* Principles

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
The precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decision should be guided by: • Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and • An assessment of the risk-weighted consequences of various options.	A wide range of comprehensive desktop and field studies were undertaken to assess the impact of the Project (including studies undertaken to support the previous referral of the alignment). Studies included: • Flora and vegetation • Terrestrial fauna • Inland Waters • Amenity (noise and vibration) • Heritage (Aboriginal) • Air quality. Information gathered during these studies was used to inform the EIA and has reduced the uncertainty surrounding the prediction of impacts for the assessment. Main Roads has committed that the Project's design (where possible) avoids serious or irreversible damage to the environment. Various studies have been undertaken within and adjacent to the alignment for the last two decades. Impacts have been identified and described under each key environmental factor and mitigation and management measures have been proposed to ensure they are environmentally acceptable.
The principle of intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Project will commit to maintain the health, diversity and productivity of the environment through retaining as much habitat as possible, establishing noise walls to reduce noise related impacts and maintaining access for property owners.
The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.	The Project has been subject to a number of studies to identify and reduce impacts to biological diversity and ecological integrity, including the following which cover various portions of the Project Area: • Bunbury Outer Ring Road Fauna Assessment (Biota, 2019a) • Bunbury Outer Ring Road Flora and Vegetation Assessment (BORR IPT, 2019a; BORR IPT, 2019b)

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
	• Bunbury Outer Ring Road (Southern Section GBRS Corridor) Black Cockatoo Tree Survey (Biota, 2018a) • Western Ringtail Possum Assessment (Biota, 2018b) • Bunbury Outer Ring Road Aquatic Fauna Survey (WRM, 2018a) • Bunbury Outer Ring Road Southern Section GBRS Corridor – *Banksia* Woodlands TEC Assessment (Biota, 2018c) • Report of a Targeted Rare Flora Survey for *Diuris drummondii* along four sections of the Bunbury Outer Ring Road proposed alignment (Ecoedge, 2017) • Bunbury Outer Ring Road Southern Section GBRS Corridor – Reassessment of Floristic Communities (Biota, 2016) • Bunbury Outer Ring Road - Southern Section GBRS Corridor - Fauna Study (GHD, 2015a) • Bunbury Outer Ring Road, South Western Highway to Bussell Highway Flora and Vegetation Assessment, Phase 1 and Phase 2 (GHD, 2015b) • Bunbury Outer Ring Road Southern Section GBRS Corridor Clearing Permit Supporting Document (GHD, 2015c) • Bunbury Outer Ring Road, Western Ringtail Possum Assessment (GHD, 2013) • Bunbury Outer Ring Road - Southern Section GBRS Corridor, South Western to Bussell Highways, Fauna Assessment (GHD, 2012a) • Report for the Bunbury Outer Ring Road – Southern Section GBRS Corridor (South Western Highway to Bussell Highway) Environmental Impact Assessment (GHD, 2012b). The Project will be subject to environmental assessment and approvals including referral to the EPA and DotEE.
Principles relating to the improved valuation, pricing and incentive mechanisms Environmental factors should be included in the valuation of assets and services. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or	Main Roads acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors will greatly determine the location of road corridors, with the Project having a strong focus on reducing its direct and indirect clearing footprint. Impacts on flora, vegetation and terrestrial fauna have been assessed and mitigation and management measures proposed. Main Roads accepts that the cost of the Project must include environmental impact mitigation, management and maintenance activities. These requirements will be incorporated into the overall Project costs. The Project will be subject to a sustainability rating, which will assess the environmental, social and economic impacts, including its waste stream and the resources utilised for construction. The Infrastructure Sustainability Council of Australia (ISCA) rating scheme is designed such that goals are established for a Project, then the Project is assessed against the achievement of those goals.

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
minimise costs to develop their own solutions and responses to environmental problems.	
The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	The Project will be subject to an ISCA sustainability rating, which will assess the environmental, social and economic impacts of the Project, including waste minimisation and discharges resulting from the Project. Cut and fill principles will be utilised to minimise external fill requirements. Consideration of otherwise waste materials such as crushed concrete in road construction. The design for the Project includes drainage design to minimise the discharge of contaminated water into the environment. Management strategies will be implemented to ensure that the generation of waste during the construction phase is minimised. All activities shall be carried out with the principles of cleaner production and waste minimisation.

3.2 Identification of Key Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a Project. The EPA has 14 environmental factors, arranged under five themes: Sea, Land, Water, Air and People.

The environmental factors and EPA objectives are provided in Table 3-2. The relevance of each factor to the Project is summarised and the Key Environmental Factors that require further consideration are identified.

Table 3-2 Identification of Key Environmental Factors

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR (YES/NO)
Sea			
Benthic communities and Habitat	To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.	No benthic communities or habitats will be impacted by this Project.	No
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	No coastal processes are expected to be impacted by this Project.	No
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	No impacts to marine environmental quality are expected to be impacted by this Project.	No
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	No impacts to marine fauna are expected.	No
Land			
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of native vegetation.	Yes
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	No significant changes to landforms are expected as much of the Project will be constructed in an existing disturbed area. Some fill of palusplain will be required to ensure the road is dry and allow for water passage under the road. The Project will require cut into one hill, however this is not considered to be a significant landform.	No

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR (YES/NO)
Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	No impacts to subterranean fauna are expected from the road construction.	No
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of fauna habitat.	Yes
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	Construction is not expected to impact contaminated sites or result in increased risk of salinity. Some Acid Sulfate Soils (ASS) are expected within the Project Area.	Yes
Water			
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The Project area contains CCW, Resource Enhancement (RE) and Multiple Use (MU) Geomorphic Wetlands and Five Mile Brook. The southern half of the Project Area is also a proclaimed Surface Water Area (the Capel River System) under the RIWI Act.	Yes
Air			
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected.	Dust will be generated during construction of the Project.	Yes
People			
Social Surroundings	To protect social surroundings from significant harm.	Aboriginal heritage aspects may be impacted during construction of the Project. Noise will be generated during construction and operation of the Project. Dust will be generated during construction of the Project. Light spill will be generated during the construction and operation of the Project. Visual amenity will be altered due to construction and operation of the Project.	Yes

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR (YES/NO)
Human Health	To protect human health from significant harm.	No impacts to human health are expected.	No

3.3 Key Environmental Factor – Flora and Vegetation

3.3.1 Studies undertaken

The following field investigations have been undertaken for this Factor:

- BORR Southern Section Vegetation and Flora Study (BORR IPT, 2019b), which surveyed 73 ha (~39 %) of the Project Area
- BORR Southern Section Alternative Alignment Vegetation and Flora Study (BORR IPT, 2019a), which surveyed approximately 17 ha (~8 %) of the Project Area
- BORR Southern Section GBRS Alignment– Banksia Woodlands TEC Assessment (Biota, 2018c)
- Report of a Targeted Rare Flora Survey for *Diuris drummondii* along four sections of the Bunbury Outer Ring Road proposed alignment (Ecoedge, 2017)
- BORR Southern Section GBRS Alignment – Reassessment of Floristic Communities (Biota, 2016)
- BORR, South Western Highway to Bussell Highway Flora and Vegetation Assessment, Phase 1 and Phase 2 (GHD, 2015b).

The following locations were not surveyed and have undergone desktop assessment:

- Lakes Road
- Minninup Road / Maidment Parade
- Jilley Road
- Additional sections in agricultural land near Ducane Road and Jilley Road
- Additional section north of Calinup Road between Brockway Drive and Bussell Highway
- Jaymon Road
- Eucalypt Drive
- Brockway Drive
- Ramsay Road
- Child Place
- 120 m north of the Project Area on Bussell Highway
- The southern end of the Project on Bussell Highway from Capel Golf Course to Yeardy Road, approximately 6.8 km, including intersection with Boyanup Road West and Fishermans Road
- New access road linking to Bourne Loop from Bussell Highway.

Approximately 100ha (53 %) of the Project Area has not been surveyed (Figure 2). Flora and vegetation surveys will be undertaken at these locations if BORR Southern Section GBRS Alignment is selected for development. For the purposes of this EIA, vegetation types and condition have been extrapolated for the gaps, based on:

- DPIRD Native Vegetation Extent dataset (GoWA, 2019a) – used as the initial identification of vegetated / cleared area
- The areas that were not mapped by the DPIRD Native Vegetation Extent dataset (GoWA, 2019a) were digitised based on aerial photography
- Assigning likely vegetation types / condition types based on nearby vegetation types assigned by BORR IPT (2019a and 2019b), aerial photograph and desktop information (soil type / broad vegetation mapping).

3.3.2 Receiving environment

Regional biogeography

The Project Area is located in the South West Botanical Province of WA (Beard J. , 1990) and experiences a Mediterranean climate with distinctly hot, dry summers and cool, wet winters. The Project Area is located in the Swan

Coastal Plain bioregion and Perth (SWA2) subregion as described by the Interim Biogeographic Region of Australia (IBRA) (DotEE, 2016).

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. Heath and/or Tuart woodlands occur on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvial soils. The subregion also includes a complex series of seasonal wetlands (Mitchell, Williams, & Desmond, 2002).

Broad scale (1:250,000) pre-European vegetation mapping (Beard J. S., 1979) of the area has been completed at an association level. The mapping indicates that the Project Area intersects four vegetation associations:

- Medium woodland; Tuart and Jarrah (association 6) – occurs in the northern, central and southern extents of the Study Area
- Shrublands; Teatree Thicket (association 37) – occurs in the northern extent of the Study Area
- Medium woodland; Jarrah, Marri and Wandoo (association 968) – occurs in the southern extent of the Study Area
- Mosaic: Medium forest; Jarrah-Marri / Low woodland; Banksia / Low forest; Teatree (*Melaleuca spp*.) (association 1000) – occurs in the northern extent of the Study Area (Figure 3).

Regional vegetation complex mapping, completed as an extension and consolidation of earlier mapping (Heddle, Loneragan, & Havel, 1980; Mattiske & Havel, 1998) indicates that four vegetation complexes are present within the Project Area (Webb *et al*., 2016):

- Bassendean Complex – Central and South: Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites. This area includes the transition of *Eucalyptus marginata* (Jarrah) to *Eucalyptus todtiana* (Pricklybark) in the vicinity of Perth
- Karrakatta Complex – Central and South: Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) - *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River
- Guilford Complex – A mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) - *Eucalyptus marginata* (Jarrah) and woodland of *Eucalyptus wandoo* (Wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark)
- Vasse Complex – A mixture of the closed scrub of *Melaleuca* species fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca* species and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). Will include areas dominated by *Tecticornia* and *Sarcocornia* species (Samphire) near Mandurah and south of the Capel River.

Vegetation communities

BORR IPT (2019a and 2019b) completed vegetation mapping over approximately 90 ha (47 %) within the Project Area. The sandy low dunes and plains were dominated by *Eucalyptus / Banksia* forests in particular *Eucalyptus / Agonis* and *Banksia* woodlands / forests. The creeklines, swamps and low relief / seasonally inundated areas were dominated by *Eucalyptus rudis / Melaleuca preissiana / Melaleuca rhaphiophylla* woodlands. These were generally disturbed and dominated by introduced grasses and herbs in the ground-layer. In the agricultural areas and some road reserves, native vegetation occurred as scattered remnant trees or stands over introduced grasses.

A summary of the vegetation types recorded within the Project Area during BORR IPT (2019a and 2019b) assessments is presented in Table 3-3 and mapping is provided in Figure 3. A summary of the desktop data for the unsurveyed areas and their vegetation descriptions is presented in Table 3-4. Based on DPIRD native vegetation extent mapping (GoWA, 2019a) and aerial photography, it is estimated that just under 33 ha of the 100 ha of unsurveyed area is native vegetation (approximately 33 %).

Table 3-3 Vegetation communities within the Project Area

VEGETATION DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION (KEIGHERY 1994)	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994A) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCT) AND INDICATIVE PHOTO
***Eucalyptus / Banksia* forests on sand dunes and plains**		
Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (BORR IPT (2019a) - VT01) Open forest of *Eucalyptus marginata* and *Corymbia calophylla* +/- *Agonis flexuosa* with isolated occurrences of *Eucalyptus gomphocephala* over low open forest of *Banksia attenuata* over shrubland of *Hibbertia hypericoides*, *Macrozamia riedlei* and *Xanthorrhoea brunonis* over grassland of **Ehrharta* spp., *Briza maxima* over herbland of *Dasypogon bromeliifolius*, *Lomandra* spp. and *Phlebocarya ciliata* over open sedgeland of *Lepidosperma pubisquameum*.	**19.8 ha** 3.8 ha Excellent to Very Good 2.2 ha Very Good 0.6 ha Very Good to Good 1.5 ha Good 11.0 ha Good to Degraded 0.3 ha Degraded 0.4 ha Degraded to Completely Degraded	Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25). 
Open forest of *Eucalyptus marginata*, *Corymbia calophylla, Banksia attenuata* and *Agonis flexuosa* on Bassendean dunes (BORR IPT (2019a) - VT02 and BORR IPT (2019b VT06) Open forest of *Eucalyptus marginata, Corymbia calophylla* and *Agonis flexuosa* over low forest of *Banksia attenuata* and *Banksia ilicifolia* over tall shrubland of *Kunzea glabrescens, Jacksonia furcellata* and *Xylomelum occidentale* over shrubland of *Hibbertia hypericoides*, *Acacia* spp. and *Xanthorrhoea brunonis* over grassland / sedgeland of *Tetraria octandra*, *Desmocladus fascicularis* and introduced grasses.	**3.7 ha** 0.1 ha Excellent 0.2 ha Good to Degraded 3.2 ha Degraded 0.1 ha Degraded to Completely Degraded 0.1 ha Completely Degraded	Central *Banksia attenuata – Eucalyptus marginata* woodland (FCT 21a). 

VEGETATION DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION (KEIGHERY 1994)	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994A) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCT) AND INDICATIVE PHOTO
***Corymbia calophylla* and *Eucalyptus marginata* +/- *Banksia* spp. (BORR IPT (2019a) VT03 & BORR IPT (2019b) VT07)** Scattered *Eucalyptus marginata, Corymbia calophylla* and +/- *Agonis flexuosa* over a tall open shrubland of *Banksia attenuata, Banksia ilicifolia, Xylomelum occidentale* and *Kunzea glabrescens* over grassland of introduced grasses. Occurs in paddocks and road reserves. In the road reserve along South West Highway the shrubland is largely absent and *Agonis flexuosa* is present in the tree layer.	**1.2 ha** All Degraded to Completely Degraded	Likely to be a degraded form of Central *Banksia attenuata – Eucalyptus marginata* woodland (FCT 21a) but as it only occurs in Degraded or worse condition alignment with an FCT has not been confirmed. 
Open forest of *Banksia attenuata* and *Agonis flexuosa* (BORR IPT (2019a) VT04) Open forest of *Banksia attenuata* and *Agonis flexuosa* over shrubland of *Hibbertia hypericoides*, *Macrozamia riedlei* and *Leucopogon propinquus* over open grassland of **Ehrharta* spp. and **Briza maxima* over herbland of *Dichopogon capillipes, Phlebocarya ciliata* and *Conostylis aculeata.* Scattered *Eucalyptus marginata* as an emergent. Occurs in one location on grey sands on a rounded hill slope.	**3.5 ha** 0.7 ha Very Good 2.8 ha Very Good - Good	Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25).

VEGETATION DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION (KEIGHERY 1994)	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994A) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCT) AND INDICATIVE PHOTO
		
Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland (BORR IPT (2019a) VT08 & BORR IPT (2019b) VT02) Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over grassland of **Ehrharta longiflora* and **Avena* spp. over sedgeland of *Lepidosperma longitudinale* over herbland of **Rumex* spp. In Lot 1 Ducane Road an open tall shrubland of *Kunzea glabrescens* and *Melaleuca teretifolia* over open heath of *Astartea scoparia* over a sedgeland of *Hypolaena exsulca* and *Lepidosperma longitudinale* was present. This was the only occurrence of the vegetation in Very Good condition. Occurs along drainage lines and seasonally inundated areas.	**2.2 ha** 0.9 ha Good 1.3 ha Degraded / Completely Degraded	FCT: Wet forests and woodlands (FCT 11). 

VEGETATION DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION (KEIGHERY 1994)	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994A) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCT) AND INDICATIVE PHOTO
Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* (BORR IPT (2019a) VT07 and BORR IPT (2019b) VT03) Low woodland of *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland of *Astartea scoparia* +/- *M. lateritia* over sedgeland of *Juncus pallidus, Lepidosperma longitudinale* over herbland of **Cotula coronopifolia, *Lotus subbiflorus* and *Isolepis cernua* var. *setiformis* with **Callitriche stagnalis* in open water.	**1.6 ha** All Degraded to Completely Degraded	
Scattered remnant vegetation / Highly modified vegetation types		
Scattered remnant vegetation present in agricultural areas and along road reserves: **BORR IPT (2019a)** • **VT09a** - *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* • **VT09c** – *Agonis flexuosa* stands • **VT09d** – *Eucalyptus rudis* and *Corymbia calophylla* +/- *M. rhaphiophylla.* **BORR IPT (2019b)** • **VT01a** - *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* over closed grassland of **Bromus diandrus*, **Ehrharta calycina* and **Lolium rigidum*	**5.8 ha** 9a – 1.7 ha 9c – 2.0 ha 9d – 0.5 ha 1a – 0.9 ha 1b – 0.7 ha All Degraded to Completely Degraded	N/A 

VEGETATION DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION (KEIGHERY 1994)	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994A) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCT) AND INDICATIVE PHOTO
• **VT01b –** Isolated trees of *Eucalyptus rudis* and *Corymbia calophylla* closed grassland of **Bromus diandrus*, **Ehrharta calycina* and **Lolium rigidum.*		
Parkland cleared with native / non-native trees (BORR IPT (2019a) VT10) Parkland cleared with occasional *Corymbia calophylla, Eucalyptus marginata* and *Agonis flexuosa* trees with planted tree species over an understorey of weedy herbs and grasses.	**2.0 ha** Completely Degraded	N/A 
Revegetation / Regrowth (BORR IPT (2019a) VT10b) This includes revegetation as well as areas planted with a mixture of native and non-native vegetation. There are scattered remnant trees occasionally present (including *Corymbia calophylla, Eucalyptus marginata, E. rudis*, *Agonis flexuosa* and *Casuarina obesa).* Common shrubs include *Melaleuca nesophila, M. lanceolata*, *Kunzea glabrescens* and *Acacia saligna*. The understorey was mostly dominated by introduced grasses and herbs.	**0.4 ha** All Degraded to Completely Degraded	N/A

VEGETATION DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION (KEIGHERY 1994)	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994A) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCT) AND INDICATIVE PHOTO
Cleared / Highly Disturbed Areas where clearing or other activities have fundamentally altered the composition of native vegetation and are not in a condition of self-sustaining. These areas are completely or almost completely without native species.	**49.3 ha** All Completely Degraded.	N/A 
Total Surveyed		**89.5 ha** **Native Vegetation (40.2 ha)** **Cleared (49.3 ha)**

Table 3-4 Survey gaps – Description of potential vegetation communities within the Project Area

SURVEY GAP	EXTENT WITHIN PROJECT AREA (ha)	EXTENT OF NATIVE VEGETATION (ha)	POTENTIAL DESCRIPTION OF VEGETATION COMMUNITY	POTENTIAL VEGETATION CONDITION (KEIGHERY 1994)
Lakes Road	1.0	0.2	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a).	Degraded (6) to Completely Degraded (7)
Minninup Road / Maidment Parade	3.1	0.8	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a).	Degraded (6) to Completely Degraded (7)
Jilley Road	3.8	1.4	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a). South of Manea Drive there is a dampland which is likely to be VT 7 (Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over sedgeland).	Degraded (6) to Completely Degraded (7)
Additional sections in agricultural land near Ducane Road and Jilley Road	0.4	0.1	Cleared.	Completely Degraded (7)
Additional section north of Caliinup Road and between Brockway Drive and Bussell Hwy	0.4	0.4	Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (VT 1).	Good (4) to Degraded (6)
Jaymon Road	0.8	0.3	Cleared.	Completely Degraded (7)
Eucalypt Drive	0.1	0.1	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a).	Degraded (6) to Completely Degraded (7)

SURVEY GAP	EXTENT WITHIN PROJECT AREA (ha)	EXTENT OF NATIVE VEGETATION (ha)	POTENTIAL DESCRIPTION OF VEGETATION COMMUNITY	POTENTIAL VEGETATION CONDITION (KEIGHERY 1994)
Brockway Drive	0.3	0.1	Cleared.	Completely Degraded (7)
Ramsay Road	0.8	0.8	Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (VT 1).	Good (4) or better. Aerial photography shows intact canopy cover. Condition will be dependent on the structure / weediness in the understorey.
Child Place	0.6	0.4	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a).	Degraded (6) to Completely Degraded (7)
120 m north of the Project Area on Bussell Highway	1.2	0.7	Western and median strip - Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (VT1). Likely to be Banksia Woodland TEC. Eastern side – Cleared.	Western side – Excellent (2) to Very Good (3), median strip – Good (4) Completely Degraded (7)
Bussell Highway from Capel Golf Course to Yeardy Road (6.8 km)	83.5	25.0	Appears to be mostly scattered trees with some landscape planting. Expected to be VT 9a / VT 3 and VT 10 / VT 10 b: Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a) / *Corymbia calophylla* and *Eucalyptus marginata* +/- *Banksia* spp. (VT03). Planted trees (VT10) / Revegetation/Regrowth (VT10b).	Degraded (6) to Completely Degraded (7) Aerial photograph shows that this section of Bussel Hwy look similar to the section south of Lakes Road to Capel Golf Course that was surveyed as part of BORR IPT (2019a). This area was assiged condition ratings of Degraded to Completley Degraded and it is expected that the 6.8 km section would be similar.
New access road linking Bourne Loop from Bussell Highway	4.1	2.3	Cleared through paddocks. Remnant stand of vegetatio - VT 1 (Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands).	Completley Degraded Good (4) or better – depending on weediness and structure in the understorey

SURVEY GAP	EXTENT WITHIN PROJECT AREA (ha)	EXTENT OF NATIVE VEGETATION (ha)	POTENTIAL DESCRIPTION OF VEGETATION COMMUNITY	POTENTIAL VEGETATION CONDITION (KEIGHERY 1994)
			Appears to be dampland / creekline which is likely to be VT 7 or VT 8 (Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over sedgeland [VT07], Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland [VT08]).	Degraded (6) to Completley Degraded (7)
Total Unsurveyed within the Project Area			**100.1 ha** **(Approx. 32.6 ha of vegetation and 67.5 ha cleared)**	

Vegetation condition

The vegetation condition of the Surveyed Area within the Project Area ranged from Excellent (2) to Completely Degraded (7) (BORR IPT 2019a and 2019b). The majority of this vegetation was in Degraded or worse condition (~66 ha / 74 %). Historical clearing and aggressive weed species have influenced the structure and composition of the native vegetation. There was approximately 12 ha of vegetation in Good or better condition, which is 14 % of the surveyed vegetation. The remaining vegetation was in Good – Degraded condition (~11 ha, 12 %).

From interpretation of aerial imagery, the majority of the unsurveyed area is likely to be in Degraded or worse condition. Two unsurveyed areas (Bourne Loop to Bussell Highway [~4 ha] and Ramsey Road [<1 ha]), are likely to be in Good or better condition.

A summary of the vegetation condition within the Project Area is provided in Table 3-5 and vegetation condition mapping is shown in Figure 4.

Table 3-5 Extent of vegetation condition ratings mapped within the Project Area

VEGETATION CONDITION	EXTENT IN SURVEYED AREA (ha)	POTENTIAL EXTENT IN UNSURVEYED AREA (ha)	ESTIMATED EXTENT IN PROJECT AREA (ha)
Excellent	0.1	-	0.1
Excellent - Very Good	3.8	-	3.8
Very Good	2.9	-	2.9
Very Good - Good	3.3	-	3.3
Good	2.4	5.0*	7.4
Good – Degraded	11.1	-	11.1
Degraded	8.7	95.1	103.8
Degraded - Completely Degraded	2.9	-	2.9
Completely Degraded	54.3	-	54.3
Total	**89.5**	**100.1**	**189.6**

* Good or better condition.

Dieback

The Project Area is considered to be susceptible to dieback as it has water gaining areas and lies within the 600 – 800 mm rainfall zone (CALM, 2003a), receiving a mean annual rainfall of 726.1 mm (BoM, 2019).

A dieback field assessment was conducted by Glevan Consulting in October 2011 over part of the Project Area. The survey (Glevan Conuslting, 2011) noted the following:

- The section of the Project east of Jilley Road was considered to be unmappable for dieback due to the lack of indicator species and past disturbance
- The sections west of Jilley Road were considered to be not infested with dieback
- Lot 1 Ducane Road located at the northern end of the Project Area was not infested with dieback, and hygiene measures should be implemented to access the Project Area through this property
- A Dieback Management Plan should be prepared and implemented for the construction of the Project.

The dieback mapping requires updating to confirm if there are areas that can be protected from dieback within the Project Area.

Threatened and Priority Ecological Communities

One Threatened Ecological Community (TEC) and two Priority Ecological Communities (PECs) were recorded within the Study Area (BORR IPT 2019a and 2019b):

- Banksia Woodlands of the Swan Coastal Plain (SCP) TEC
- Banksia dominated woodlands of the SCP IBRA region PEC (Floristic Community Type (FCT) 21a)
- The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC (FCT25).

The extent and condition of each of these communities within the surveyed portion of the Project Area is summarised in Table 3-6 and presented in Figure 5. The State PEC FCT21a forms part of the Federal Banksia Woodland TEC, when condition and size thresholds are met (see BORR IPT (2019b) for further information). State PEC FCT25 can also form part of the Federal Banksia Woodland TEC when the composition aligns with the TEC and condition and size thresholds are met.

Just over 16 ha of native vegetation within the surveyed portion of the Project Area was identified as the 'Banksia Woodlands of the SCP' TEC. Of this, approximately 99 % is also representative of 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC and just under 1 % is representative of the 'Banksia dominated woodlands of the SCP IBRA region' PEC.

An additional 6.5 ha of 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC and 3.5 ha of the 'Banksia dominated woodlands of the SCP IBRA region' PEC occur that are not representative of the 'Banksia Woodlands of the SCP' TEC.

The vegetation types 'Open forest of *Eucalyptus marginata*, *Corymbia calophylla*, *Banksia attenuata* and *Agonis flexuosa* on Karrakatta deep sands' (VT1) and 'Open forest of *Banksia attenuata* and *Agonis flexuosa*' (VT4) were inferred to be equivalent to FCT 25 based on geographic location, landforms and the species recorded within these vegetation types. These vegetation types contained isolated occurrences of *Eucalyptus gomphocephala*; however this is likely to be related to disturbance factors and the species is likely to have been more abundant within this area.

Mapping of the Tuart Woodlands by DBCA (CALM, 2003b) shows that *Eucalyptus gomphocephala* woodlands with 0 to 9 % canopy cover and highly disturbed visible native understorey condition have been mapped within this section of the Study Area, inferred to be equivalent to the PEC FCT 25. Mr. Andrew Webb from DBCA (pers. comm. 2011 and 2015) stated that the vegetation types with the Study Area represent FCT 25.

Based on aerial photography, Banksia TEC / Tuart PEC potentially occur within the 'Bourne Loop to Bussell Highway' and 'Ramsey Road' Unsurveyed Areas (5 ha).

Table 3-6 Threatened and Priority Ecological Communities identified within the Project Area

COMMUNITY TYPE	EPBC ACT	DBCA	EXTENT IN SURVEYED AREA (HA) AND CONDITION	POTENTIAL EXTENT IN UNSURVEYED AREA (ha)	POTENTIAL EXTENT WITHIN THE PROJECT AREA (ha)
Banksia woodlands of the SCP(TEC)	Endangered	Priority 3	**16.4** Excellent: 0.1 Excellent to Very Good: 3.8 Very Good: 2.9 Good: 1.3 Very Good to Good: 3.1 Good to Degraded: 5.2	5.0	21.4
Banksia dominated woodlands of the SCP IBRA region (PEC)	-	Priority 3	**3.5** VT2 Excellent: 0.1 Good to Degraded: 0.2 Degraded to Completely Degraded: 3.2	-	3.5
The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP (PEC)	-	Priority 3	**22.8 ha** (VT1 and VT4) Excellent to Very Good: 3.8 Very Good: 2.9 Very Good to Good: 3.3 Good: 1.5 Good to Degraded: 11.0 Degraded: 0.3	5.0	27.8

Other significant vegetation

The Project Area traverses a number of waterways including Five Mile Brook, small drainage lines and man-made drains, as well as seasonally inundated areas (wetlands). Vegetation associated with the watercourses and wetland areas includes remnant trees and shrubs (e.g. *E. rudis, Melaleuca preissiana* and *Melaleuca rhaphiophylla*) over introduced grasses and herbs, with mixed native sedges present.

There is approximately 4 ha of vegetation within the Project Area that occurs in association with a watercourse and/or wetland. This vegetation has a restricted distribution and has been impacted by extensive clearing throughout the area. Vegetation types that represent riparian/wetland vegetation included:

- Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland (BORR IPT (2019a) VT08 & BORR IPT (2019b) VT02) – just over 2 ha (0.9 ha in Good and 1.3 ha in Degraded to Completely Degraded condition)
- Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* (BORR IPT (2019a) VT7 and BORR IPT (2019b) VT03) – 1.6 ha in Degraded to Completely Degraded condition.

In addition, there is a remnant, mature Tuart tree located within the Project Area between Five Mile Brook and Woods Road, Gelorup. This tree is listed as an Australian Champion Tree (National Register of Big Trees, 2019) and was assessed by an arborist on 5 March 2019 to be:

- Large for its genus and likely well in excess of 100 years old
- Over-mature, displaying evidence of multiple large branch fractures
- Providing numerous hollows within the trunk and branch structure which could potentially be used by fauna (not Black Cockatoos as determined by the fauna assessment, see Section 3.4.2)
- Potentially going to continue to live for another 100 years, if left undisturbed.

Conservation reserves and areas

There are three conservation reserves within 5 km of the Project Area (GoWA, 2019a) (Figure 6). Two reserves are Crown Land vested to the Conservation Commission of WA and managed by DBCA. These reserves are:

- 'Roselands Nature Reserve', located adjacent to the Project Area on Boyanup West Road
- 'Un-named Nature Reserve', located adjacent to the Project Area, south of Bourne Loop and west of Bussell Highway.

The third reserve is the Tuart Forest National Park, which is located directly west of the 'Un-named Nature Reserve', approximately 350 m west of the Project Area.

Environmentally Sensitive Areas

There are numerous Environmentally Sensitive Areas (ESAs) within 5 km of the Project Area and four ESAs which intersect the Project Area (GoWA, 2019a). The Project Area intersects:

- The buffered extent of one ESA associated with Conservation Category and Resource Enhancement wetlands (UFI 1025, 1004, 1023, 1024 and 15821)
- Two ESAs that abut Bussell Highway and are associated with Conservation Category Wetlands (UFI 14478 and UFI 1019)
- The buffered extent of one ESA associated with Roselands Nature Reserve on Boyanup West Road.

The Project Area is also located adjacent to an ESA that is associated with Five Mile Brook.

Flora diversity

BORR IPT (2019b) undertook a NatureMap database search on the vegetation and flora Study Area (297 ha). The search identified 568 plant taxa, representing 92 families, and comprising 469 native and 99 introduced flora taxa (DBCA, 2007).

During the field assessment, BORR IPT (2019a) recorded 267 plant taxa (including subspecies and varieties) representing 182 genera and 62 plant families. This was recorded over 297 ha, of which 73 ha intersects the Project Area. The total flora taxa was comprised of 178 native species and 89 introduced (exotic) and planted species. Table 3-7 provides a summary of previous flora surveys and the current survey. As shown, the species diversity between the two BORR IPT surveys (2019a and b) were similar.

Whilst BORR IPT (2019b) Study Area did not cover the entire Project Area, it is considered it can be used as an indicator of flora diversity within the Project Area.

Table 3-7 Floristic diversity of the Study Area

SURVEY	TOTAL TAXA	TOTAL NATIVE : WEED	COMMENTS
BORR Southern Section Vegetation and Flora Study **(BORR IPT, 2019b)**	267	178 : 89	Survey over multiple sites and vegetation communities of 267 ha.
BORR Southern Section Alternative Alignment Vegetation and Flora Study **(BORR IPT, 2019a)**	247	171 : 76	One season survey over 1,409 ha, multiple sites assessed and differing vegetation communities.
Lot 1 Ducane Road **(GHD, 2014)**	104	81 : 23	Smaller Study Area with few vegetation types, winter survey only.
BORR, South Western Highway to Bussell Highway Flora and Vegetation Assessment, Phase 1 and Phase 2 **(GHD, 2015b)**	198	145 : 53	Similar Study Area as the current survey, September and June survey period.
BORR Southern Section GBRS Alignment – Reassessment of Floristic Communities **(Biota, 2016)**	96	62 : 34	Restricted to small Study Area with only few vegetation types.
BORR Southern Section GBRS Alignment– Banksia Woodlands TEC Assessment **(Biota, 2018c)**	112	92 : 20	Survey of potential Banksia woodland TEC only.

Conservation significant flora

No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys conducted in October and November 2018 (BORR IPT, 2019a; BORR IPT, 2019b). This supports data from flora and vegetation surveys undertaken in November 2007 (Bennett Environmental Consulting, 2008), October 2008 (GHD, 2009), November 2011 and June 2014 (GHD, 2015b), June 2013 (GHD, 2014), October 2016 (Biota, 2016), February 2017 (targeted *Diuris drummondii)* (Ecoedge, 2017) and November 2017 (Biota, 2018c).

GHD (2015b) confirmed the presence of one DBCA Priority flora species, *Caladenia speciosa* (Sandplain White Spider Orchid – Priority 4) mostly in small populations between Yalinda Drive and Bussell Highway, within the Project Area. A total of 71 individual *Caladenia speciosa* plants were recorded within the Project Area (Figure 5).

BORR IPT (2019b) completed a likelihood of occurrence assessment post-field survey for all conservation significant flora taxa identified in the desktop assessment. This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of species. The likelihood of occurrence assessment confirmed that two taxa are known to occur, one taxa is likely to occur, 27 taxa possibly occur and the remaining 15 taxa are unlikely to occur within the Study Area.

The taxa that are known and likely to occur in the Study Area are listed in Table 3-8. Species that occur more than 5 km from the Study Area and had habitat present that was heavily grazed, were considered unlikely to occur (BORR IPT, 2019b). For a conservative approach, it is considered that this likelihood of occurrence assessment also applies to the Project Area.

Table 3-8 Known and likely to occur conservation significant flora within the Study Area

TAXA	STATUS	LIKELIHOOD ASSESSMENT
Acacia semitrullata	P4	Known – recorded during the GHD (2015b) and GHD (2014) survey however has not been identified within the Project Area. This species has been recorded within 5 km of the Study Area.
Aponogeton hexatepalus	P4	Likely - species occurs within 5 km of Study Area and habitat occurs within Study Area.
Caladenia speciosa	P4	Known within the Project Area – this species was recorded during the GHD (2015b) survey. Database records show this species as recorded within the Study Area and in a 5 km buffer of the Study Area.

Introduced and invasive species

Two of the introduced taxa recorded by BORR IPT (2019a and b) within the Project Area, are listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* and one is also listed as a Weed of National Significance (WONS):

- **Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WONS
- **Zantedeschia aethiopica* (Arum lily) – Declared Pest.

Two additional Declared Pests (one of which is also a WONS) have been previously recorded within and to the north of the Project Area however were not identified in the Project Area during the 2018 field survey. These species are also considered likely to be at risk of spread within the Project Area:

- * *Lantana camara* – Declared Pest and WONS
- * *Moraea flaccida*– Declared Pest.

**Moraea flaccida* was recorded during the survey undertaken in 2016 (Biota, 2016) however it was not recorded in the current survey (BORR IPT 2019a and b). Locations of the Declared Pests are shown in Figure 3. The remaining introduced taxa are considered environmental weeds and all have been previously recorded on the Swan Coastal Plain.

Comparison with other mapped vegetation

The vegetation within the Study Area broadly aligns with the mapped Beard (1979) vegetation associations and the Webb *et al*. (2016) vegetation complexes. Based on a review of species present, where possible, vegetation types were assigned a Floristic Community Type (FCT). The FCT comparisons are provided in Table 3-3.

3.3.3 Potential impacts

The Project will potentially result in the direct loss of vegetation and flora through clearing of:

- Approximately 40 ha of mapped native vegetation (within the Surveyed Area of the Project Area), and a further 33 ha of native vegetation identified via aerial imagery (within the unsurveyed area of the Project Area). The remainder of the Project Area (~117 ha) is considered to be cleared or highly modified.
  - Within the Surveyed Area, 74 % is in Degraded or worse condition and 14 % is in Good or better condition. The remaining 12 % ranges from Good – Degraded (Figure 4)
  - Within the Unsurveyed Area, the majority of vegetation appears to be scattered trees which is likely to be assigned a Degraded condition. One remnant stand of vegetation may be in Good or better condition
- Just over 21 ha of native vegetation associated with the 'Banksia Woodlands of the Swan Coastal Plain' TEC, including approximately 16 ha of mapped native vegetation within the surveyed area and 5 ha of unsurveyed vegetation (that requires confirmation with a field survey). The majority of the surveyed

native vegetation is in Good to Degraded condition (30 %), followed by vegetation in Excellent to Very Good condition (21 %)

  - Of the approximate 16 ha mapped 'Banksia Woodlands of the Swan Coastal Plain' TEC, approximately 99 % is also representative of 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC and approximately 1 % is representative of 'Banksia dominated woodlands of the SCP IBRA region' PEC

- Approximately 4 ha of native vegetation associated with the 'Low lying *Banksia attenuata* woodlands or shrublands' PEC, the majority of which is in Degraded condition (93 %)
- A total of approximately 28 ha of native vegetation associated with 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC, approximately 50 % of this is in Good or better condition
- A total of 4 ha riparian vegetation (associated with watercourses or wetlands)
- One Priority listed species *Caladenia speciosa* (P4), of which 71 individuals are estimated to occur within the Project Area (Figure 5)
  - A conservative estimate of the known populations identified 3,906 individual plants (59 records on FloraBase)
- Potential loss of *Acacia semitrullata* (P4) and *Aponogeton hexatepalus* (P4), which are considered likely to occur but were not recorded within the Project Area
- Native vegetation associations and complexes (Beard, 1979; Webb *et al*., 2016) that have less than 30 % remaining at the local scale (Shire of Capel).

The Project also has the potential (if appropriate management and mitigation measures are not implemented) to result in the following indirect impacts to vegetation and flora:

- Fragmentation of native vegetation remnants within the local area
- Possible introduction and/or spread of Dieback and weeds (WONS and Declared Pests) to adjacent native vegetation
- Changes to vegetation structure and floristic composition in surrounding areas through altered surface water drainage patterns and flows
- Damage to surrounding vegetation through accidental generation of a bushfire.

3.3.4 Assessment of impacts

The assessment of impacts is presented (where possible) at a regional (Bioregion) and Local Government Area (LGA) scale. Information is also provided on the extent of vegetation within the broader BORR IPT (2019b) Study Area to supplement the local scale assessment.

For the purposes of this EIA, cumulative impacts have been assessed by comparing the known regional / local extents of vegetation associations / complexes and types against published information on their extent, to estimate the overall percent impact of the Project. Consideration of other future Projects have not been included at this stage.

Regional and local Significance

The pre-European vegetation mapping has been adapted and digitised (Shepherd, Beeston, & Hopkins, 2002). The extent of the vegetation associations (remaining uncleared) have been determined from the state-wide vegetation area calculations maintained by the DBCA (latest update March 2019) (GoWA, 2019b).

The DPIRD Native Vegetation Extent database (GoWA, 2019a) was used as the basis to assess direct and cumulative impacts at a local, regional and bioregional scale for this EIA. To calculate the current extent remaining, intersects between the Native Vegetation Extent, and the Pre-European Vegetation and Vegetation Complexes – SCP datasets were completed (GoWA, 2019a).

As shown in Table 3-9, the current extent of vegetation association 6 is less than 30 % of its pre-European extent at IBRA bioregion and IBRA subregion levels. Vegetation association 37 has less than 30 % remaining at the Local Government Authority (LGA) level in the Shire of Capel.

Vegetation association 968 and 1000 have less than 30 % of their pre-European extent at all levels, with the exception of association 968 at the state level. Vegetation association 968 has less than 10 % remaining at the IBRA bioregion, IBRA subregion and LGA (Shire of Capel) levels.

GoWA (2019c) has assessed the vegetation complexes mapped by Webb *et al*. (2016) against presumed pre-European extents within the SWA IBRA bioregion (Table 3-10) and LGA levels (Table 3-11). Current extents of all complexes within the Project Area are less than 30 % of their pre-European extents within the SWA IBRA bioregion and within the City of Bunbury and Shire of Capel LGAs, with the exception of the Vasse Complex at the SCP level and the Karrakatta Complex at the LGA level (GoWA, 2019c).

Table 3-9 Extent of vegetation associations mapped within the Project Area (GoWA, 2019b)

VEGETATION ASSOCIATION	SCALE	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING (%)	CURRENT EXTENT IN ALL DBCA MANAGED LAND (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Swan Coastal Plain IBRA Bioregion		1,501,221.9	579,813.5	38.6	38.5	47.6	<0.1	38.6
6	State: WA	56,343.0	13,362.3	23.7	39.8	39.8	<0.1	23.7
	IBRA Bioregion: Swan Coastal Plain	56,343.0	13,362.3	23.7	39.8	39.8	<0.1	23.7
	Sub-region: Perth	56,343.0	13,362.3	23.7	39.8	39.8	<0.1	23.7
	Shire of Capel (LGA)	5,245.3	2,301.1	43.9	16.5	39.8	1.73	43.1
37	State: WA	39,296.5	24,727.2	62.9	20.9	<0.1	<0.1	62.9
	IBRA Bioregion: Swan Coastal Plain	15,617.9	5,404.7	34.6	41.0	<0.1	<0.1	34.6
	Sub-region: Perth	14,018.5	4,784.2	34.1	44.9	<0.1	<0.1	34.1
	Shire of Capel (LGA)	1,737.0	484.6	27.9	9.9	<0.1	<0.1	27.9
968	State: WA	296,877.8	95,048.8	32.0	57.6	0.9	<0.1	32.0
	IBRA Bioregion: Swan Coastal Plain	136,188.2	9,017.3	6.6	21.6	0.9	<0.1	6.6
	Sub-region: Perth	136,188.2	9,017.3	6.6	21.6	0.9	<0.1	6.6
	Shire of Capel (LGA)	6,657.3	660.4	9.9	3.5	0.9	0.1	9.9
1000	State: WA	99,835.9	27,768.8	27.8	18.6	6.8	<0.1	27.8
	IBRA Bioregion: Swan Coastal Plain	94,175.3	24,869.2	26.4	19.2	6.8	<0.1	26.4
	Sub-region: Perth	94,175.3	24,869.2	26.4	19.2	6.8	<0.1	26.4
	Shire of Capel (LGA)	15,173.8	3,189.9	21.0	7.3	6.8	0.2	21.0

Table 3-10 Extent of vegetation complex on the Swan Coastal Plain within the Project Area (GoWA, 2019c)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING EXTENT (%)	CURRENT EXTENT REMAINING WITHIN ALL DBCA MANAGED LAND (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Bassendean Complex – Central and South	87,476.3	23,508.7	26.9	5.0	6.8	<0.1	26.9
Karrakatta Complex - Central and South	53,081.0	12,467.2	23.5	8.1	35.4	0.3	23.4
Guildford Complex	90,513.1	4,607.9	5.1	0.3	5.4	0.1	5.1
Vasse Complex	15,691.6	4,927.0	31.4	14.6	<0.1	<0.1	31.4

Table 3-11 Extent of vegetation complex within Shire of Capel within the Project Area (GoWA, 2019c)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING EXTENT (%)	PROPORTION OF THE VEGETATION COMPLEX WITHIN THE LGA (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Bassendean Complex – Central and South	4,946.6	1,162.2	23.5	5.7	6.8	0.6	23.4
Karrakatta Complex - Central and South	6,902.3	3,400.6	49.3	13.0	35.4	1.0	48.8
Guildford Complex	6,508.4	540.5	8.3	7.2	5.4	1.0	8.2
Vasse Complex	2,104.4	526.2	25.0	13.4	<0.1	<0.1	25.0

Note: red and orange indicate that less than 10 % and 30 %, respectively, of the pre-European extent remains before and after Project impacts.

Threatened and Priority Ecological Communities

Banksia Woodland TEC/ PEC

The Threatened Species Scientific Committee (TSSC) provides information on the estimated extent of Banksia Woodland TEC within the SCP Bioregion. The TSSC advises that approximately 81,800 ha (~24 %) of the TEC occurs within reserves, most of which are in the Perth subregion of the SCP Bioregion (TSSC, 2016) (Table 3-12). This document also states that there is approximately 336,490 ha of Banksia TEC remaining within the SCP (TSSC, 2016).

Table 3-12 Extent of the Banksia Woodlands ecological community estimated to be protected in reserves (TSSC, 2016)

SUBREGION	CURRENT EXTENT (ha)	EXTENT IN RESERVES (ha)	% PROTECTED
Dandaragan (SWA01)	81,067.8	24,671.2	30.4
Perth (SWA02)	253,540.6	57,054.9	23.0
Jarrah Forests (JAF01/02)	1,881.4	105.9	5.6
Total	336,489.9	81,832.2	24.3

Clearing would result in loss of just over 21 ha of Banksia TEC (Table 3-6); equivalent to a 0.006 % reduction in the Banksia Woodland TEC (Table 3-12). At the Perth subregion scale, this would represent a 0.008 % reduction. Of this, approximately 11 ha was rated as in Good or better condition. NB: Assessment of patches takes into account overall vegetation condition and therefore areas of Banksia Woodland can be included as part of a TEC patch if the condition is less than Good but the overall condition of the patch is rated Good or better.

This represents the maximum likely impact associated with the Project and includes 5 ha of potential Banksia Woodland that requires additional survey to confirm if it meets the criteria for TEC condition and patch size.

Tuart Woodland PEC

The pre-European extent of 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC is estimated to be 125,400 ha with approximately 17,060 ha (2015 indicative extent) or 14 % of the pre-European extent remaining. Of this, 5,535 ha is reserved in 20 reserves (IUCN management categories I-IV) and comprise 22 % of the remaining extent of the ecological community (DotEE, 2017a).

Approximately 28 ha of native vegetation associated with this PEC is located within the Project Area. Approximately 50 % of this is in Good or better condition. Clearing of this amount for the Project would represent a 0.2 % reduction in the remaining extent of the PEC.

This total includes 5 ha that requires additional survey to confirm if it meets the criteria for TEC condition and patch size.

Threatened Flora

No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys conducted in October and November 2018 (BORR IPT, 2019a; BORR IPT, 2019b) or previous surveys listed in Table 3.1.

The Project is not expected to result in negative impacts on any EPBC Act or BC Act listed flora.

Priority Flora

Spatial data (with sufficient information) were not available to inform a cumulative assessment for conservation significant flora at a local or regional scale. The impacts have been estimated by interrogating records on FloraBase (Western Australian Herbarium, 1998-). It is noted these records often provide the count (frequency) in descriptors such as common, abundant, frequent, occasional and scattered without providing an actual number of individuals. For the purposes of this assessment, these records have been counted as one

individual, and therefore the population estimates are underrepresented with the actual number of individuals expected to be much higher.

There were 71 individuals of *Caladenia speciosa* (P4) recorded within the Project Area (BORR IPT, 2019b). *Caladenia speciosa* is a relatively widespread species and occurs from Mundijong to Boyanup, with additional populations south towards Donnybrook and further east at Lake Muir (Brown, Dundas, Dixon, & Hopper, 2008). The potential loss of up to 71 individuals represents a <2 % reduction in the recorded occurrence of this species (compared with approximately 3906 plants from 59 records on the Western Australian Herbarium database), (Western Australian Herbarium, 1998-). It should be noted that it is likely that the population for the species is greater than the approximate 4000 plants as FloraBase and NatureMap (DBCA 2007) do not always provide details on the number of plants present.

Both priority 4 species *Acacia semitrullata* and *Aponogeton hexatepalus* considered likely to occur but not recorded within the Project Area, have relatively wide distributions. *Acacia semitrullata* has been recorded from Waroona to Manjimup and *Aponogeton hexatepalus* from Nannup to Gosnells (Western Australian Herbarium, 1998-).

Given the population estimates used are likely to be underestimates, and the species are relatively widespread, the potential impacts associated with the Project are not considered to be significant to the Priority species recorded.

3.3.5 Mitigation

The mitigation of impacts will be refined during the formal environmental assessment process and developed in consultation with Main Roads and key stakeholders if the alignment is selected as the preferred option. The following management and mitigation measures will be developed for this Project.

Impacts to flora and vegetation will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific Construction Environmental Management Plan (CEMP) that addresses issues specific to flora and vegetation including:
  - Complaints response site management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - ASS management
  - Dieback and weed management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.3.6 Predicted outcome

Based on the information available to support the EIA, the Project has the potential to result in residual impacts including:

- Clearing of approximately 73 ha of native vegetation, including:
  - Approximately 40 ha of mapped native vegetation, including 14 % Good or better condition and 61 % is in Completely Degraded condition
  - Approximately 33 ha within unsurveyed areas that appears to include native vegetation (identified from aerial imagery) the majority of which is likely to be in Degraded or worse condition

- Clearing of vegetation associations (Beard, 1979) and complexes (Webb *et al*., 2016) that are under-represented
- Permanent loss of TECS and PECs:
  - Banksia Woodlands of the Swan Coastal Plain (TEC) – an estimated 21 ha
  - Banksia dominated woodlands of the Swan Coastal Plain IBRA region (PEC) – approximately 4 ha
  - The Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain (PEC) – approximately 28 ha
- Loss of up to 4 ha riparian vegetation associated with wetlands and minor waterways / drainage lines
- Permanent loss of approximately 71 known individuals of *Caledenia speciosa* (P4). This represents an estimated 2 % of the known population.

Given the extent of impacts to conservation significant communities (TECs / PECs), loss of under-represented vegetation, riparian vegetation and priority flora species, offsetting of residual impacts may need to be investigated. Additional surveys will be required to address information gaps in unsurveyed area and confirm the likely outcome for flora and vegetation if this alignment is selected as the preferred option.

3.4 Key Environmental Factor – Terrestrial Fauna

3.4.1 Studies undertaken

The following field investigations have been undertaken for this aspect:

- BORR GBRS Alignment Targeted Fauna Assessment and BORR Southern Alternative Alignment Targeted Fauna Assessment (Biota 2019a and 2019b respectively), which covered approximately 90 ha (47 %) of the Project Area
- Bunbury Outer Ring Road Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018b)
- BORR Southern Investigation Area: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018a)
- BORR (Southern Section GBRS Corridor) Black Cockatoo Tree Survey (Biota, 2018a)
- Western Ringtail Possum Assessment (Biota, 2018b)
- Western Ringtail Possum Survey (GHD 2018)
- BORR Southern Section GBRS Alignment- Fauna Study (GHD, 2015a)
- BORR Southern Section GBRS Alignment Clearing Permit Supporting Document (GHD, 2015c)
- Lot 1 Ducane Road, Environmental Values Assessment (GHD, 2014)
- BORR Western Ringtail Possum Assessment (GHD, 2013)
- Report for the Bunbury Outer Ring Road – Southern Section GBRS Corridor (South Western Highway to Bussell Highway) Environmental Impact Assessment (GHD, 2012b)
- BORR Southern Section GBRS Alignment, South Western to Bussell Highways, Fauna Assessment (GHD, 2012a).

The following locations were not surveyed and have undergone desktop assessment:

- Lakes road
- Jilley Road
- Jaymon Road
- Minninup Road / Maidment Parade (surveyed for Western Ringtail Possums only)
- Ramsay Road
- Child Place
- 120 m north of the Project Area on Bussell Highway
- The southern end of the Project on Bussell Highway from Capel Golf Course to Yeardy Road, approximately 6.8 km, including intersection with Boyanup Road West and Fishermans Road
- New access road linking to Bourne Loop from Bussell Highway.

Gaps in the field surveys total approximately 100 ha and are shown in Figure 2. Additional fauna field surveys will be undertaken at these locations if BORR Southern Section GBRS Alignment is selected for development. For the purposes of the EIA, Biota 2019a and 2019b have been used as the primary reference to identify fauna species occurring or likely to occur within the Project Area and fauna habitats occurring within the Project Area. The Biota field surveys included reference sites outside of the Project Area and all areas surveyed are referred to as the Biota Study Area. Parts of the Biota Study Area intersect the Project Area. These are referred to as Surveyed Areas. Sections of the Project Area were not covered by the Biota Study Area and are referred to as unsurveyed areas.

3.4.2 Receiving environment

Fauna habitat

Fauna habitat within the Surveyed Areas Biota (2019a and b) were classified into three dominant fauna habitat types covering approximately 40 ha combined (Figure 7):

- Jarrah/Marri woodland: Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) dominated over storey, varying understorey of Banksia (*Banksia attenuata* and *B. grandis*) or Peppermint (*Agonis flexuosa*) dominance
- Scattered trees over introduced grasses: Overstorey consisting of a scattering of mature Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) in upland areas, and Flooded Gum (*Eucalyptus rudis*) and Tuart (*Eucalyptus gomphocephala*) in low lying areas over introduced grasses
- Damplands and Wetlands: dominated by *Melaleuca* spp. and sedges often in grazed paddocks. Vegetation comprised *Melaleuca raphiophylla* with scattered Flooded Gum (*Eucalyptus rudis*) over mixed sedge species. In some wetland areas Peppermint (*Agonis flexuosa*) often co-dominant with *Melaleuca* spp.

The remainder of the Surveyed Area (~49 ha) was classified as Cleared. The fauna habitat types are based on vegetation composition or features in the environment that fauna can utilise and includes scattered remnant paddock trees, as these are often suitable forging and / or potential breeding (e.g. hollow-bearing trees) resources.

The description and area of each habitat type within the Surveyed Area is summarised in Table 3-13. Approximately 33 ha of potential fauna habitat has been estimated in the unsurveyed area, based on interpretation of aerial imagery (Table 3-14). Therefore, the Project Area contains up to 73 ha of fauna habitat.

Table 3-13 Fauna habitat types identified within the surveyed component of the Project Area

HABITAT TYPE AND DESCRIPTION	EXTENT WITHIN THE PROJECT AREA (ha)
Damplands with Melaleuca shrubland and/or woodland 	2.3
Marri/Eucalyptus Woodland 	30.3
Marri/Eucalyptus in paddocks and road reserves 	7.6
Cleared	49.3
Total	89.5

Table 3-14 Survey gaps – description of potential fauna habitat within the Project Area

SURVEY GAP	EXTENT WITHIN PROJECT AREA (ha)	EXTENT OF NATIVE VEGETATION (ha)	POTENTIAL DESCRIPTION OF FAUNA HABITAT
Lakes Road	1.0	0.2	Marri/Eucalyptus in paddocks and road reserves.
Minninup Road / Maidment Parade	3.1	0.8	Marri/Eucalyptus in paddocks and road reserves.
Jilley Road	3.8	1.4	Marri/Eucalyptus in paddocks and road reserves. Dampland with Melaleuca shrubland and/or woodland (patch south of Manea Drive).
Additional sections in agricultural land near Ducane Road and Jilley Road	0.4	0.1	Cleared.
Additional section north of Calinup Road and between Brockway Drive and Bussell Hwy	0.4	0.4	Marri/Eucalyptus woodland.
Jaymon Road	0.8	0.3	Cleared.
Eucalypt Drive	0.1	0.1	Marri/Eucalyptus in paddocks and road reserves.
Brockway Drive	0.3	0.1	Cleared.
Ramsay Road	0.8	0.7	Marri/Eucalyptus woodland.
Child Place	0.6	0.4	Marri/Eucalyptus in paddocks and road reserves.
120 m north of the Project Area on Bussell Highway	1.2	0.7	Western and median strip - Marri/Eucalyptus woodland. Eastern side – Cleared.
Bussell Highway from Capel Golf Course to Yeardy Road (6.8 km)	83.4	25.1	Marri/Eucalyptus in paddocks and road reserves.

SURVEY GAP	EXTENT WITHIN PROJECT AREA (ha)	EXTENT OF NATIVE VEGETATION (ha)	POTENTIAL DESCRIPTION OF FAUNA HABITAT
New access road linking Bourne Loop from Bussell Highway	4.1	2.3	Cleared through paddocks. Remnant stand of vegetation – Marri/ Eucalyptus woodland. Creekline – Dampland with Melaleuca shrubland and/or woodland.
Total Unsurveyed Gaps			**100.1 ha** (including an estimated 32.6 ha of fauna habitat and 67.5 ha Cleared/ Highly Modified land)

Fauna habitat value

The fauna habitat types recorded within the Project Area have both suitable foraging and potential breeding habitat for conservation significant species such as Black Cockatoos (Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo) and Western Ringtail Possum (Biota 2019a and b).

The majority of fauna habitats mapped within the Project Area were assessed as potentially Very High Quality for Black Cockatoo species (Biota, 2019a). Only those areas comprising uniform stands of *Melaleuca* shrubs and Peppermint woodland were considered unlikely to contain foraging or breeding habitat.

WRPs were observed utilising habitats ranging from relatively isolated trees through to remnant strips (along road reserves and riparian belts) surrounding by cleared land, to larger remnants of native vegetation.

The fauna habitat within the unsurveyed area is estimated to comprise approximately 33 ha of native vegetation which may provide additional habitat for conservation significant fauna species. The fauna habitat types within the Biota Study Area and how they are used by conservation significant fauna species (possibly, likely or known to occur) are presented in Table 3-15.

Ecological linkages

The Project Area intersects one South West Regional Ecological Linkage (SWREL) axis line which connects large vegetation remnants west of Bussell Highway to large vegetation remnants in South Boyanup (approximately 7 km to the east) (Molloy, Wood, Wallrodt, & Whisson, 2009). The location where the SWREL is intersected is along the existing Bussell Highway, which already fragments the SWREL.

On a local scale, vegetation along road reserves, Five Mile Brook and Gynudup Brook provide local ecological linkages that are intersected by the Project Area. These linkages are likely to be used by conservation significant fauna (e.g. WRP) as well as a number of more common mammals, birds, reptiles and amphibians.

Fauna diversity

Biota (2019a) completed a desktop NatureMap database search on their Study Area and this has been used as an indicator of potential faunal diversity within the Project Area. The database search indicated a species inventory of 223 vertebrate fauna species, comprising 25 mammals (14 native non-volant, 1 bat and 10 non-native), 159 birds (63 of which are largely reliant on freshwater or marine habitats), 29 reptiles and 10 amphibians.

Conservation significant terrestrial fauna

The desktop review identified 20 conservation significant terrestrial fauna species within 10 km of the Biota (2019a) Study Area. Five conservation significant fauna are known to occur within the Biota Study Area, including:

- Western Ringtail Possum (Critically Endangered)
- Carnaby's Cockatoo (Endangered)
- Baudin's Cockatoo (Endangered)
- Forest Red-tailed Black Cockatoo (Vulnerable)
- Evidence of Quenda, Southern Brown Bandicoot (Priority 4), in the form of diggings.

A likelihood of occurrence assessment was undertaken for 12 conservation significant terrestrial fauna (Biota, 2019a). Conservation significant species considered likely or possibly occurring, and their habitat preferences, are summarised in Table 3-15. This likelihood of occurrence assessment on the Biota Study Area is assumed to apply within the wider Project Area.

Table 3-15 Likelihood of occurrence for terrestrial conservation significant fauna species and their habitat availability within the Project Area

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DPAW 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	-

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DPAW 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
Birds							
Calyptorhynchus banksia 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

Black Cockatoos

The Surveyed Area provides up to 38 ha of suitable foraging and potential breeding habitat for Black Cockatoos (Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo). Suitable foraging and potential breeding habitat for Black Cockatoos within the Study Area includes Jarrah/Marri Woodland and Scattered trees over introduced grasses.

During the field survey, Black Cockatoo individuals were recorded within the Biota Study Area, as described below:

- Four Forest Red-tailed Black Cockatoo individuals recorded from four observations
- Eight white-tailed Black Cockatoo individuals recorded from one observation (likely Carnaby's Cockatoo)
- Evidence of Baudin's Cockatoo (Marri nuts with chew marks).

Black Cockatoo breeding habitat, as defined in the Commonwealth referral guidelines (DotEE, 2017b), includes:

- Relevant tree species with a suitable Diameter at Breast Height (DBH) to develop a nest hollow, where DBH is greater than or equal to 500 mm (herein referred to as 'Suitable DBH Trees')
- Trees with a hollow that meets the DotEE (2017b) depth, width and angle criteria for nesting by Black Cockatoos, herein referred to a 'Trees with a Suitable Nest Hollow'
- 'Known Nesting Trees' are those trees that have secondary evidence of nesting i.e. feathers, eggs/ shells etc.

A total of 443 Suitable DBH Trees were identified within the Surveyed Area. Of these, the drone survey identified eight Trees with a Suitable Nest Hollow and four Known Nesting Trees. Three additional trees with hollows could not be assessed by drone. Survey observations and future potential breeding tree locations are shown in Figure 8.

Due to their breeding distribution, Forest Red-tailed Black Cockatoos are considered the most likely of the three cockatoo species to breed within the Project Area. However, all three species may potentially breed within the Project Area.

The unsurveyed area (~100 ha) is estimated to have an additional 33 ha of vegetation which is potential Black Cockatoo breeding and/or foraging habitat.

Western Ringtail Possum

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).

Using possum density, Biota (2019a) 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).

The estimated density and abundance of WRPs within the Biota Study Area is shown in Table 3-16. Based on the occurrence density, approximately 56 individuals are estimated to occur within the Surveyed Area (~38 ha). The unsurveyed 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 unsurveyed 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 Project 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.

A summary of WRP observations within the Biota Study Area and within the contextual sites are shown in Figure 9.

Table 3-16 Western Ringtail Possum densities estimated within the Study Area

Study Area	WRP Density Recorded
Strip sampling (per hectare)	1.78
Lot 1 (Distance sampling) – contextual site	0.31 ± 0.18
Jilley Road to Bussell Highway	2.22 ± 0.54
Average density (WRP per ha)	1.4
Predicted abundance (across 37.9 ha of Surveyed Area)	56

Quenda, Southern Brown Bandicoot

Evidence of Quenda was recorded within the Study Area, in the form of diggings. The Surveyed Area identifies suitable habitat for Quenda, which includes all three dominant fauna habitat types (Marri/Eucalyptus Woodland, Marri/Eucalyptus in paddocks and road reserves and Damplands with Melaleuca shrubland and/or woodland) (40.2 ha).

The unsurveyed area is estimated to have approximately 33 ha of potential Quenda habitat. From a review of aerial imagery, the remainder of the unsurveyed area appears to be cleared land, which is not likely to be significant habitat for Quenda (~68 ha).

Likely to occur

South-western Brush-tailed Phascogale, Wambenger

No South-western Brush-tailed Phascogales were observed within the Surveyed Area. However, six individuals were recorded in close proximity (Reserve 23,000). The Biota Study Area identifies suitable habitat for the South-western Brush-tailed Phascogale, namely; Marri/Eucalyptus Woodland (~30 ha).

Approximately 33 ha of the unsurveyed area is considered likely to provide habitat for South-western Brush-tailed Phascogale. From a review of aerial imagery, the remainder of the unsurveyed area appears to be cleared land and is not likely to represent suitable habitat for South-western Brush-tailed Phascogales (68 ha).

Conservation significant aquatic fauna

An aquatic fauna survey was undertaken by WRM in November 2018 (WRM, 2018a). The survey focused on species of conservation significance within specific wetlands and waterbodies that were identified from aerial imagery to provide potential aquatic fauna habitat. One survey site occurred within the Project Area (Southern 7), which was dry at the time of the survey. In addition, the WRM (2018b) survey of the Alternative Alignment surveyed wetlands adjacent to the Project Area.

Black -stripe Minnow and Western Mud Minnow

A total of 29 Black-stripe Minnow (listed as Endangered under the EPBC Act) were recorded at two wetlands sampled by WRM (2018b). These wetlands (site reference Wetland 2 and Wetland 3a) are hydrologically connected to up to 0.3 ha of potential habitat within the Project Area (Figure 10).

Black-stripe Minnows are known to disperse in years of high rainfall and have been historically recorded intermittently in some wetlands (MBS Environmental, 2009). Due to their high mobility and the high connectivity between wetlands in wetter years, it is likely that Black-stripe Minnow would migrate between wetlands, opportunistically utilising habitat within the Project Area.

Further field investigations will be undertaken if the alignment is chosen for development to further identify suitable habitat for Black-stripe Minnow and determine the likelihood of occurrence within the Project Area.

No Western Mud Minnows were recorded within the survey sites and are considered unlikely to occur within the Project Area.

Carter's Freshwater Mussel

Despite extensive survey effort, no Carter's Freshwater Mussel were recorded within the wider investigation area. This is likely due to the ephemeral nature of the sites sampled, and lack of suitable habitat (creek lines) within the investigation area.

Australian Water Rat

Despite extensive survey effort (motion sensor cameras and visual observations), no Australian Water Rats were identified at any of the sites within the wider investigation area.

South-Western Snake-Necked Turtle

The South-Western Snake-Necked Turtle (*Chelodina colliei*[1]) is endemic to the south-west of Western Australia and is listed on the IUCN Redlist of Threatened Species as Near Threatened (IUCN, 2018).

A total of 11 South-Western Snake-Necked Turtles were recorded within the WRM (2018a) Study Area.

This species is known to occur in both permanent and seasonal habitats, including rivers, lakes, farm dams, swamps, damplands and natural and constructed wetlands (Balla, 1994; Guyot & Kuchling, 1998). They can migrate relatively long distances overland if local conditions deteriorate (Dr Gerald Kuchling, UWA, pers. comm. (WRM, 2018a)) and can aestivate to avoid drought in seasonal waterbodies for up to five to six months (Kuchling, 1998; Kuchling, 1989).

Since their diet includes tadpoles, fish, and aquatic invertebrates, South-Western Snake-Necked Turtles only eat when open water is present. In permanent waters, this species has two nesting periods (September-October and December-January), but in seasonal systems, nesting will only occur in spring. The main threats to these turtles are road deaths during movement in the nesting season and predation by feral animals (Bencini & Turnball, 2012).

It is possible that South-Western Snake-Necked Turtles occur within the Project Area.

3.4.3 Potential impacts

The Project Area is predominantly cleared, with approximately 117 ha of the total 190 ha, cleared or highly modified. The Project has the potential to directly and indirectly impact on fauna and fauna habitat in remnant native vegetation areas during the construction and operational phases.

Potential direct impacts to species known to occur within the Project Area include:

- Clearing of an estimated 73 ha of potential fauna habitat types across the Project Area (190 ha), which includes approximately 40 ha of mapped fauna habitat (within the Surveyed Area), and a further 33 ha of potential fauna habitat (within the unsurveyed area)
- Clearing of approximately 71 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) breeding and foraging habitat (including 38 ha surveyed and 33 ha unsurveyed)
- A total of 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone
- Clearing of approximately 71 ha of WRP habitat (including 38 ha surveyed and 33 ha unsurveyed) and displacement of an estimated 100 individual WRPs, representing less than 2 % of the regional population

[1] This species was referred to as *Chelodina oblonga* in the past. However, there was some debate over species names and distributions. In 2013, the ICZN handed down its decision on nomenclature, with *C. colliei* given to the south-western snake-necked turtle, and *C. oblonga* given to the northern snake-necked turtle (previously *C. rugosa*).

- Clearing of up to 73 ha of Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 40 ha surveyed and 33 ha unsurveyed).

Potential direct impacts to species that have potential to occur within the Project Area include:

- Clearing of an estimated 63 ha of South-western Brush-tailed Phascogale habitat (including 30 ha surveyed and 33 ha unsurveyed)
- Potential loss of habitat for Black-stripe Minnow including up to 0.3 ha of Geomorphic Wetland intersected by the Project Area (where the species was recorded adjacent to the Project Area)
- Habitat for a further six conservation significant species that possibly occur within the Project Area.

Other potential direct impacts to fauna during construction and operations (to be mitigated through implementation of a CEMP and other mitigation measures detailed in the following sections) include:

- Temporary, localised impacts on aquatic fauna due to disturbance of wetlands and waterways
- Death or displacement of native fauna species from vehicle movements.

The Project may also result in the following indirect impacts to fauna including:

- Incremental loss of fauna habitat (fragmentation, barrier effects and edge effects)
- Displacement of native fauna species due to traffic noise exposure
- Displacement of native fauna species due to light spill from street lighting and traffic.

3.4.4 Assessment of impacts

Approximately 61 % the Project Area is predominantly cleared, with approximately 117 ha of the total 190 ha already cleared or highly modified. Reduction of potential impacts on the environment was a key consideration in the selection of the GBRS alignment. Further reduction in the potential impacts will occur through the detailed design phase should this alignment be selected for development.

Clearing and loss of habitat

The Project will result in the potential clearing of up to 73 ha of potential fauna habitat across the 190 ha Project Area. Further reduction to the clearing area associated with the Project will be achieved through consideration of impacts during the detailed design process.

Further discussion on potential impacts to conservation significant fauna is provided below.

Impact to conservation significant fauna

Clearing and operation of the Project has the potential to impact conservation significant fauna including:

- Black Cockatoos (approximately 71 ha of potential habitat), including Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)
- WRP (approximately 71 ha of potential habitat) (Critically Endangered)
- Black-stripe Minnow (less than 0.3 ha of potential habitat) (Endangered).

Black Cockatoos

The Project Area is located in what is generally considered to be the typical breeding distribution of the Forest Red-tailed Black Cockatoo, however all three Black Cockatoo species have breeding areas overlapping the Project Area (Biota, 2019a).

A total of 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone.

Western Ringtail Possum

Approximately 100 WRPs may potentially be displaced from the Project Area. Based on assessment of local and regional context sites covering 4,212 ha, the potentially displaced WRPs represent less than 2 % of the estimated regional population (Biota, 2019c).

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 considered to be conservative (i.e. lower than in reality).

Black-stripe Minnow

The Project Area intersects up to 0.3 ha of Geomorphic Wetlands, where the Black-stripe Minnow was recorded adjacent to the Project Area. However, the area of wetland potentially impacted by the Project is likely to be less than 0.3 ha, as part of the area mapped as wetland (section of wetland UFI1149) is an existing unsealed road.

The transverse drainage design will include culverts (or similar) to maintain fish passage movement (including Black-stripe Minnow) through the drainage network (i.e. the drainage design will be sympathetic to fish movement requirements).

Other potential impacts

There will be a temporary increase in secondary impacts on fauna through noise, vibration, light and dust during construction. Increased noise, vibration and dust may result in native fauna avoiding the area. However, this is unlikely to have a permanent impact on fauna species in the area.

Vehicle strike

Operation of the Project will result in an increase in traffic/vehicle movements and resulting in a greater risk of fauna strike from vehicle movements.

Habitat fragmentation

Incremental reduction in fauna habitat has restricted the distribution of a number of conservation significant species known to occur within the Project Area, including WRP and Black-stripe Minnow. As habitat is cleared, patch sizes decrease and the impact of 'edge effect' increases with likely introduction of weeds and dieback, ultimately changing the species composition of the vegetation community and reducing suitability of habitat for local fauna species.

The Project Area has been largely cleared in the past for agriculture purposes. This has resulted in fragmentation of both terrestrial and riparian/ wetland vegetation and ecological linkages, thereby reducing connectivity of fauna habitat.

3.4.5 Mitigation

As detailed in section 3.3.5, the mitigation and management measures for the Project will be developed and refined in consultation with key stakeholders if this alignment is selected as the preferred option. Impacts to fauna will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Installation of fauna exclusion fencing
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a CEMP that addresses issues specific to fauna including:
    - Complaints response and management
    - Vegetation management, and clearing procedures and processes
    - Fauna management
    - Wetlands, drainage and groundwater management

- Construction management (noise, vibration and dust)
- Fire risk management
- Environmental incident reporting and management

- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.4.6 Predicted outcome

The Project Area is predominantly cleared, with approximately 117 ha of the total 190 ha, cleared or highly modified. The Project has the potential to directly impact species known to occur within the Project Area. Based on the information available to support this assessment these potential direct impacts include:

- Clearing of an estimated 73 ha of potential fauna habitat types across the Project Area (190 ha), which includes approximately 40 ha of mapped fauna habitat (within the Study Area), and a further 33 ha of potential fauna habitat (within the unsurveyed area)
- Clearing of approximately 71 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) breeding and foraging habitat (including 38 ha surveyed and 33 ha unsurveyed)
- A total of 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone
- Clearing of approximately 71 ha of WRP habitat (including 38 ha surveyed and 33 ha unsurveyed) and displacement of an estimated 100 individual WRPs, representing less than 2 % of the regional population
- Clearing of approximately 73 ha of Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 40 ha surveyed and 33 ha unsurveyed).

Impacts to species that have potential to occur within the Project Area:

- Clearing of an estimated 63 ha of South-western Brush-tailed Phascogale habitat (including 30 ha surveyed and 33 ha unsurveyed)
- Potential loss of habitat for Black-stripe Minnow including less than 0.3 ha of Geomorphic Wetland intersected by the Project Area where the species was recorded adjacent to the Project Area (NB area of habitat potentially impacted by the Project is likely to be less than 0.3 ha, as part of the area mapped as wetland is an existing unsealed road)
- Habitat for a further six conservation significant species that possibly occur within the Project Area.

Given the potential for impacts to conservation significant fauna (particularly Black Cockatoo species and WRPs) and loss of under-represented fauna habitat, environmental offsets to counter-balance the residual impacts of the Project are likely to be required, should this alignment be selected for development. Additional surveys will be required to address information gaps in unsurveyed area and confirm the likely outcome for fauna if this alignment is selected as the preferred option.

3.5 Key Environmental Factor – Terrestrial Environmental Quality

3.5.1 Studies undertaken

Desktop assessments including DWER Contaminated Sites Database (DWER, 2018) and ASS Risk Mapping for the Swan Coastal Plain (GoWA, 2019a).

No additional studies are considered likely to be required for this aspect.

3.5.2 Receiving environment

Geology

The Swan Coastal Plain is comprised of five major geomorphological units, which lie more or less parallel to the coast, being the Quindalup, Spearwood and Bassendean Dunes, the Pinjarra Plain and the Ridge Hill Shelf (Churchward & McArthur, 1980; McArthur & Bettenay, 1960). The Project Area lies within the Spearwood and Bassendean Dunes and Pinjarra Plain elements, which are broadly described as:

- Bassendean dune and sandplain system: Pleistocene sand dunes with very low relief, leached grey siliceous sand intervening sandy and clayey swamps and gently undulating plains. These occur immediately west of, and partly overlie, the Pinjarra Plain
- Spearwood dune system: Pleistocene and aeolian sands overlying Tamala limestone. Low dunes and swales of shallow pale grey sands over yellow sands are characteristic of the Spearwood system. Wetlands are associated with peats and carbonate sands, occasionally with clay overlaying sands
- Pinjarra Plain: Broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. Major soils are naturally poorly drained with many swamps.

Desktop assessment of broad geological formations indicates that the Project Area occurs within three broad formations in addition to rivers and wetland areas (GSWA, 2009), which are outlined in Table 3-17.

Table 3-17 Geology, landform and soils information for the Project Area

Formation	Geological Type	Geological Description/ Landform
Tamala Limestone	Qts	Sand associated with Tamala Limestone, high dunes
Guildford Formation	Qpa	Mainly alluvial sandy clay
Bassendean Sand	Qpb	Low rounded dunes

Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). In an undisturbed state below the water table, these soils are benign. However, if the soils are drained, excavated or exposed by lowering of the water table, the sulphides will react with oxygen to form sulphuric acid. Disturbance of these soils can flush acidic leachate to groundwater and surface waters and cause off site environmental impacts.

ASS Risk Mapping for the Project Area indicated low to moderate risk of ASS, with minor areas of high risk associated with wetlands and watercourses and the Capel Golf Course (GoWA, 2019a). ASS Risk Mapping is shown in Figure 11.

Contaminated Sites

The DWER *Contaminated Sites Database* presents information on known contaminated sites that have been classified by the DWER as one of the following:

- Contaminated – remediation required
- Contaminated – restricted use

- Remediated for restricted use.

The DWER *Contaminated Sites Database* does not provide details of the Sites that are listed as 'Possibly contaminated – investigation required' (PC-IR).

A further limitation to the DWER *Contaminated Sites Database* is unreported contaminated sites.

A search of the DWER *Contaminated Sites Database* indicates that there are no listed contaminated sites within the Project Area (GoWA, 2018).

The Project Area traverses agricultural land that may contain sources of contamination such as dumped building materials, kill pits, landfill sites, and chemical storage sites. Additional investigations will be required to identify and remediate these sites prior to construction.

3.5.3 Potential impacts

Project activities that have the potential to impact the terrestrial environmental quality during construction include earthworks, and storage and handling of environmentally hazardous materials.

Potential construction impacts as a consequence of developing the Project are:

- Disturbance of ASS resulting in acid leachate into the receiving environment causing contamination of land and/or waters
- Disturbance of unknown contaminated sites resulting in spread of contamination
- Accidental release or spread of litter, hydrocarbons or chemicals resulting in contamination of land and water bodies.

Operational impacts to Terrestrial Environmental Quality resulting from the Project are mainly limited to road use, including pollution and waste. Road drainage will be designed to prevent direct discharge of road surface run-off to the adjacent environment.

Potential indirect impacts that could arise from the construction of the Project also include salinization and soil erosion. The risk of salinization on the Swan Coastal Plain is considered to be low and clearing associated with the Project in the context of local and regional water tables is unlikely to result in increased risk of salinization of soils. Soil erosion has the potential to occur during construction, associated with vegetation clearing and earthworks, and during operation as a consequence of stormwater runoff.

3.5.4 Assessment of impacts

Direct impacts

Acid Sulfate Soils

ASS can be disturbed either by excavation or lowering of the water table below natural seasonal levels (i.e. dewatering). Excavations occurring for the Project will be limited and associated with construction of bridge footings. It is likely that ASS will be encountered within excavations greater than 1.0 m depth, particularly within riparian zones. Dewatering may also be required during construction of bridge footings, which may expose Potential Acid Sulfate Soils (PASS).

When PASS are disturbed, sulfides present are exposed to air, allowing oxidisation and consequently, the formation of sulfuric acid (H_2SO_4). ASS are also capable of generating acidity in-situ in their natural state; disturbance is not required for acidic discharges to develop.

As a result of the presence of ASS, or the oxidation of PASS, surrounding land (soil) and nearby waterways may become acidic (pH<6.5). Under acidic conditions, metals such as aluminium (generally at pH<4.5) and iron, as well as trace heavy metals (including arsenic), become more mobile in the environment and can readily be transported offsite by infiltrating waters. As a result, concentrations of metals within surface and / or groundwater may reach concentrations, which have the potential to cause acute or chronic toxicity to sensitive terrestrial and aquatic plants and animals.

Hazardous material and waste disposal

Direct contamination of soils and land could occur as a result of release of hazardous materials (such as hydrocarbons, chemicals and reagents) from storage or handling areas. Storage of hazardous materials during the construction period will be limited to temporary storage areas holding minor quantities of oils and grease for maintenance, and fuel supply for small construction equipment.

Hazardous waste will be temporarily stored onsite prior to disposal to an appropriately licensed facility. All such materials will be stored within a sealed, covered and bunded area. Refuelling of larger equipment and generators will occur within the Project Area, but preference will be given to off-site refuelling for general vehicles, where practical, to limit storage and handling volumes within the Project Area. Due to the limited scale of hazardous material storage, any accidental releases are expected to be small. Further, any potential contamination will be localised and restricted to the surface of the soil profile. The depth of localised contamination could increase beyond the soil surface if releases are not rectified in a timely manner.

There will be no soil or land impacts within the Project Area relating to the disposal of waste products. Waste from all waste streams, including used oils/greases and municipal waste, will be disposed or recycled to an appropriate off-site waste management facility.

Contamination and erosion during operation

Stormwater is road run-off that occurs during and following rainfall. Stormwater runoff from the operational road is likely to include pollutants deposited on the tarmac by vehicles. Exhaust gases and lubricants release lead, hydrocarbons, nickel and bromine. Iron and chromium detach from corroded bodywork, while sulphur, chlorine and cyanide are dispersed via cooling liquids. In addition, tyres deposit rubber particles containing lead, cadmium and zinc on the tarmac (ENI School, n.d.).

Stormwater run-off can result in bank erosion and transport of contaminants to soils and water bodies if not managed appropriately. Drainage infrastructure will be in place to manage and control stormwater, therefore direct release to soils or land is unlikely. Volumes of hydrocarbons on the road are not likely to be significant, however if a large-scale discharge does occur it could be released beyond the road infrastructure if not adequately managed.

Loss of soil function

The constructed Project will be a permanent bituminised road surface which will result in impairment of soil function below the road surface. Soil function may be retained if topsoil is separated, stockpiled and re-used for landscaping.

Indirect impacts

Salinisation and erosion of soils

Clearing of deep-rooted native vegetation has the potential to increase salinisation and erosion of soils, particularly in agricultural areas, which are prone to salinity and erosion. Vegetation helps to stabilize soil and restrict upward movement of water tables which bring salts up the soil profile.

Salinisation is a potential impact within the Project Area, particularly in the poorly drained areas on Pinjarra Plain soils. However, the risk of dryland salinity on the Swan Coastal Plain as a result of clearing native vegetation is known to be low (Simons, George, & Raper, 2013).

Vegetation clearing and soil excavation can increase the potential for soil erosion because of altered surface water drainage patterns and the effect of wind on exposed dry soils. Erosion impacts can potentially lead to poor soil structure, reduced water infiltration and general loss of soil health.

3.5.5 Mitigation

Risks associated with potential impacts to Terrestrial Ecosystem Quality, particularly ASS and contaminated sites, are considered relatively minor and manageable. Main Roads has extensive experience with the

management of these risks in similar Projects throughout the south west of WA. Impacts will be avoided and minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues specifically related to terrestrial ecosystem quality including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - ASS management
  - Dieback and weed management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.5.6 Predicted outcome

Based on the information available to support the EIA the potential risks to the terrestrial ecosystem quality associated with construction and operation of the Project are likely to be able to be effectively managed through implementation of mitigation and management measures.

Additional surveys would be required if this alignment is selected as the preferred option, however it is considered that the Project would meet the EPA objective to maintain the quality of land and soils so that environmental values are protected.

3.6 Key Environmental Factor – Inland Waters

3.6.1 Studies undertaken

The following studies have been undertaken for this aspect:

- Water quality sampling was undertaken as part of BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018b)
- Desktop information has been assessed for this aspect including the DWER datasets (GoWA, 2019a).

3.6.2 Receiving environment

Desktop searches of the DWER datasets (GoWA, 2019a) were undertaken and are summarised in Table 3-18.

Table 3-18 Hydrology queries within the Project Area

ASPECT	DETAILS	RESULT
Groundwater Areas	Groundwater areas proclaimed under the RIWI Act.	Bunbury Groundwater Area Busselton-Capel Groundwater Area
Surface Water Areas	Surface water areas proclaimed under the RIWI Act.	Capel River System
Rivers	Rivers proclaimed under the RIWI Act.	None
Public Drinking Water Source Areas (PDWSAs)	PDWSA is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* or the *Country Area Water Supply Act 1947.*	None
Waterways Conservation Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.	None

Surface water

The southern half of the Project is in a Proclaimed Surface Water area, Capel River System. No rivers protected under the WC Act will be impacted by the Project (GoWA, 2019a). A number of minor drainage lines will be impacted, including Five Mile Brook, however these are not proclaimed under the RIWI Act (Figure 10).

Surface water quality

Four wetlands were sampled as part of BORR Alternative Alignment Aquatic Fauna Survey which intersects the Project Area (WRM, 2018b). In situ water quality was generally good and characterised by slightly acidic pH (6.23 to 6.68), variable dissolved oxygen (DO) (28.7 % to 170.8 %), and warm temperatures (18.5 ºC to 25 ºC). All wetlands were fresh with electrical conductivity (EC) ranging from 183 µs/cm to 1422 µs/cm.

The pH at all wetlands was slightly below the guidelines (ANZECC & ARMCANZ, 2000) for the protection of slightly/moderately disturbed wetland ecosystems in the southwest of WA (pH 7 – 8.5) (Table 3-19).

Table 3-19 *In situ* water quality results from all wetlands sampled

WETLAND	WETLAND CODE	TEMP (°C)	CONDUCTIVITY (µS/cm)	PH	OXYGEN %	OXYGEN (mg/L)	CONSERVATION CATEGORY/ UFI
1	1a	22.0	1422	6.51	28.7	2.09	MU UFI 1189
	1b	25.0	983	6.67	95.5	8.55	RE UFI 1170
2	2	21.1	855	6.68	170.8	15.01	RE UFI 1180
3	3a	22.7	596	6.62	57.7	5.03	Unmapped however assumed to be a combination of CCW UFI 16075, 16076, 16077 and 16088) (previously RE UFI 1149)
	3b	21.0	365	6.57	103.9	7.77	CCW UFI 16079 and UFI 16080 (previously MU UFI 1150)
	3c	19.0	380	6.61	100.0	7.80	MU UFI 1150
4	4a	18.8	278	6.42	49.5	4.43	MU UFI 1014
	4b	18.5	183	6.23	102.0	8.18	MU UFI 1014

Note: CCW – Conservation Category Wetland, RE – Resource Enhancement, MU – Multiple Use

Wetlands of international significance

There are no Ramsar wetlands located within 10 km of the Project Area. The nearest Ramsar wetland (Vasse-Wonnerup System) is located approximately 19 km to the south west of the Project Area (GoWA, 2019a).

Geomorphic Wetlands

Wetlands on the Swan Coastal Plain have been classified (Hill, Semeniuk, Semeniuk, & del Marco, 1996) using a geomorphic-hydrologic approach to wetland classification (Semeniuk & Semeniuk, 1995). Wetlands have also been evaluated and assigned an appropriate management category which provides guidance on the nature of wetland management and protection that the wetland should be afforded.

There are 15 Geomorphic Wetlands (approximately 33 ha) within the Project Area. The Project Area intersects six Conservation Category Wetlands (CCW), two Resource Enhancement and seven Multiple Use Geomorphic Wetlands (GoWA, 2019a). The mapped Geomorphic Wetlands include:

- Approximately 1 ha of CCW (0.5 % of the Project Area)
- < 1 ha of Resource Enhancement wetlands (0.2 % of the Project Area)
- Approximately 31 ha of Multiple Use wetlands (16.6 % of the Project Area).

The wetlands within the Project Area are described in Table 3-20 and mapped in Figure 10.

Table 3-20 Geomorphic wetlands and their vegetation condition within the Project Area

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
1019	Palusplain	Conservation	35.7	Unsurveyed – aerial photography shows this area is partially Cleared and located in the Bussell Highway road reserve, however vegetation is also located on the boundary of the wetland.	Unknown to Completely Degraded	0.3
14478	Sumpland	Conservation	59.5	VT08 Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland. Cleared.	Degraded to Completely Degraded	0.6
16075	Sumpland	Conservation	<0.1	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland.	Degraded	<0.1
16076	Sumpland	Conservation	0.2	VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland. Cleared.	Degraded to Completely Degraded	<0.1
16077	Sumpland	Conservation	2.4	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland. Cleared.	Degraded to Completely Degraded	<0.1
16078	Sumpland	Conservation	0.4	VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland. Cleared.	Degraded to Completely Degraded	<0.1
1149	Sumpland	Resource Enhancement	0.2	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland. Cleared.	Degraded to Completely Degraded	0.2

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
1180	Sumpland	Resource Enhancement	3.4	VT08 Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland. VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland.	Good to Completely Degraded	0.1
953	Sumpland	Multiple Use	15.4	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland. Cleared.	Degraded to Completely Degraded	0.2
1015	Sumpland	Multiple Use	23.9	VT08 Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland. VT09a Scattered remnant vegetation present in agricultural areas and along road reserves. Cleared.	Degraded to Completely Degraded	0.5
1016	Palusplain	Multiple Use	15.5	VT09a Scattered remnant vegetation present in agricultural areas and along road reserves. Cleared.	Degraded to Completely Degraded	1.1
1163	Sumpland	Multiple Use	21.1	VT08 Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland. VT10 Parkland cleared with occasional Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*) and Peppermint (*Agonis flexuosa*) trees or planted tree species over an understorey of weedy herbs and grasses. Cleared.	Degraded to Completely Degraded	1.0
1177	Sumpland	Multiple Use	2.4	VT08 Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland. Cleared.	Good to Completely Degraded	0.4

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
1179	Sumpland	Multiple Use	20.1	VT08 Low open forest of *Eucalyptus rudis* and *Melaleuca preissiana* over sedgeland. VT07 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* wetland. Cleared.	Good to Completely Degraded	0.4
13229	Palusplain	Multiple Use	114.8	Only a portion of this area was surveyed and identified as VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. Aerial photography shows cleared paddock, roads and scattered trees.	Likely to be Degraded to Completely Degraded	27.9
Total						**32.6**

* Wetland observations are based on field surveys carried out for flora and vegetation (BORR IPT 2019 a and b), fauna surveys (WRM, 2018a; Biota, 2019b) and aerial photographs (for wetlands not assessed during field surveys).

Groundwater

The Project is within the Bunbury Groundwater Area and the Busselton-Capel Groundwater Area, as proclaimed under the RIWI Act (GoWA, 2019a).

3.6.3 Potential impacts

Project activities that have the potential to impact on Inland Waters during construction include vegetation clearing, earthworks and construction of drainage structures.

In the absence of suitable mitigation and management, the potential impacts that may occur to Inland Waters as a consequence of developing the Project include:

- Loss of approximately 33 ha of mapped Geomorphic Wetlands, including
  - Approximately 1 ha of CCW (0.5 % of the Project Area)
  - less than 1 ha of RE wetlands (0.2 % of the Project Area)
  - Approximately 31 ha of MU wetlands (16.6 % of the Project Area)
- Direct impacts to the bed and banks of waterways (erosion, sedimentation and scouring) at Five Mile Brook, minor drainage lines, CCW and RE wetlands
- Impacts to surface water flows causing changes to wetland water quality, including the DBCA managed Roselands Nature Reserve which lies directly adjacent to the Project Area
- Indirect impacts from construction including dust and pollution
- Contamination of ground and/or surface water from exposure to PASS or contaminants.

3.6.4 Assessment of impacts

Direct Impacts

Dewatering for construction activities

Once detailed design has been completed, an analysis will be undertaken to determine final construction methods and dewatering requirements for construction of the Project. Dewatering activities will be temporary and impacts are likely to be restricted in spatial extent.

Changes to groundwater levels in the shallow aquifer associated with clearing

Vegetation clearing within the Project Area has the potential to allow the groundwater level to rise and flood the surrounding area. However, given that the majority of the Project Area has been cleared for farmland, proposed clearing requirements are linear and areas of contiguous vegetation outside of the Project Area will be retained. Groundwater level rise as a result of the Project activities is considered unlikely to occur.

Erosion and sedimentation

Clearing of vegetation, construction earthworks and altered surface water regimes have the potential to destabilise soils and, if unmanaged, result in erosion of the Project Area and sedimentation of surrounding drainage infrastructure, vegetation, wetlands and waterways.

Contamination of surface water and groundwater

Contamination of surface water and groundwater may result during the construction phase as a result of the accidental release of hazardous materials during onsite works (construction materials and hazardous materials stored onsite), runoff during stormwater events and contaminated sediment or settled dust.

Surface and/or groundwater may also become contaminated through the exposure of ASS during construction (excavation). ASS disturbance may have a range of impacts including enhanced phosphorus leaching, death of vegetation irrigated with affected water, the smothering of benthic aquatic animals by the precipitation of iron, and metal bioaccumulation in aquatic plants and animals.

Contaminated surface water and groundwater has the potential to impact sensitive receptors, including neighbouring properties, vegetation, fauna, wetlands and waterways. Impacts can also manifest downstream as loss of benthic habitat, fish deaths and damage to vegetation health. Further assessment of ASS/PASS risks will be undertaken if this alignment is selected for construction.

Alteration of hydrological flow to Geomorphic Wetlands and minor waterways

Construction of the Project will involve the loss of wetlands within the Project Area. Filling the wetlands and clearing the vegetation has the potential to directly alter the existing surface water flow regime within the Project Area and adjacent wetlands. This has the potential to adversely affect the function of surrounding wetland and river systems, including changes in the vegetation structure and surrounding agricultural properties.

Once constructed, the bituminised road will prevent infiltration from occurring. Road runoff and stormwater will be managed with the objective of maintaining local hydrological regimes. Stormwater management will aim to allow infiltration at the point of collection. It is not considered that the Project will significantly restrict rainfall recharge to the superficial aquifer such as to significantly lower groundwater levels and / or change the volume of water available to surrounding wetlands.

Climate change

The drying climate in the South West region could result in reduced groundwater and surface water availability, increased seawater intrusion and a greater risk of impacts of abstraction on groundwater dependent ecosystems (GDEs) (Department of Water, 2015). Sea level rise is also a major consideration of infrastructure Projects on the coastal zone.

In accordance with the Main Roads Guideline on Climate Change (MRWA Doc No. D10#97260), the impacts of climate change have been considered during planning for the Project. The Main Roads Guideline specifies that impacts of a 300 mm sea level rise is considered as part of planning, design and construction for all Projects near coastal areas.

The Main Roads Guideline specifically addresses the potential impacts on rainfall patterns as a result of climate change. The guideline recommends that Intensity Frequency Duration (IFD) rainfall data are adjusted for future climate change. This recommendation will be incorporated in a review of the effects of rainfall intensification for transverse drainage at the detailed design stage.

3.6.5 Mitigation

Impacts to inland waters will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues specific to inland waters including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - ASS management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.6.6 Predicted outcome

The existing hydrological processes are in a largely modified state due to historical clearing and draining of land within the Project Area for development including rural-residential development, road construction and agricultural purposes. Based the information available to support the EIA it is anticipated that the potential impacts to inland waters associated with the Project are manageable with the implementation of the mitigation measures proposed and no residual impacts are anticipated. This will be confirmed as part of the studies undertaken once the alignment is finalised.

3.7 Key Environmental Factor – Air Quality

3.7.1 Studies undertaken

The requirements to conduct an Air Quality Impact Assessment for new road Projects are detailed in Main Roads Environmental Guideline 6707/007 (Main Roads, 2004). An air quality assessment for the Project was completed as a consequence of private residences being located within 200 m of the Project centreline. Consequently, Main Roads engaged GHD to undertake an Air Quality Impact Assessment for the Project (GHD, 2012c). The 2012 Air Quality Impact Assessment modelled emissions using an AUSROADS Gaussian plume dispersion model predicting the concentration of pollutants at identified receptors, with the receptors used in the noise modelling used as a basis for assessing air quality. Automatic receptors were also used, which involved estimating concentrations at 50 and 100 m from the Project alignment.

Three scenarios were modelled, based on existing 2012 traffic counts, Projected 2021 and 2031 traffic counts.

3.7.2 Receiving environment

Climate

Bunbury is located on the south-western corner of Western Australia and the climate of the Project Area is broadly described as Mediterranean, with hot dry summers and cool wet winters. The nearest Bureau of Meteorology (BoM) official recording station is Bunbury (Station No. 9965), located approximately 8 km north of the Project Area (BoM, 2019).

The area has a mean annual rainfall of 726.1 mm and experiences a wide range of temperatures, with mean maximum temperatures of approximately 30°C in summer and 17°C in winter (Table 3-21).

Table 3-21 Climate data – Bureau of Meteorology Bunbury Station No 9965

CLIMATIC VARIABLE	RANGE
Mean Annual Maximum Temperature Range	17.3°C in July to 30°C in February
Mean Annual Minimum Temperature Range	7.1°C in July to 15.9°C in February
Mean Annual Rainfall	726.1 mm
Mean Annual Rain days per year	84.5

Sensitive receptors

Sensitive receptors are any place where people are likely to reside in a non-occupational setting. This may include dwellings, schools, hospitals or public recreational areas (NSW Department of Environment and Conservation, 2005). Residential areas are located within 20 m of the Project Area.

Bunbury Regional Airshed

The Project is within the Bunbury Regional Airshed, which encompasses an area approximately 38,610 km^2 and includes 22 Shires, including the entire City of Bunbury and Shire of Capel.

The major economic activities in the Bunbury Regional Airshed are very diverse and include mining, agriculture, tourism, forestry and manufacturing. Motor vehicles dominate the emissions of carbon monoxide (CO), volatile organic carbon (VOC) and nitrous oxides (NO_x) (SKM, 2003).

3.7.3 Potential impacts

Potential direct construction impacts that may occur to Air Quality as a consequence of developing the Project are:

- Increased construction vehicle emissions
- Dust generated from construction activities
- Smoke from bushfires proximate to the Project
- Increased greenhouse gas (GHG) emissions.

The construction of the Project has the potential to reduce air quality via increased road vehicle traffic and GHG emissions.

The operation of the Project may reduce vehicle emissions in the local and regional airshed as a consequence of improved traffic flows and improved vehicle efficiency.

Major vehicle pollutants include products of combustion, such as CO, particulate matter with an aerodynamic diameter of 10 microns or less (PM10), NOx, and VOCs. The human health effects of these air pollutants range from mild airway irritations to major organ damage. Many of the emissions from motor vehicles react together and with pollutants from other sources to form secondary pollutants, such as photochemical oxidants (ozone; O3), which can also have significant effects.

Potential indirect impacts from dust generated during construction may include impacts to vegetation and changes to vegetation communities directly adjacent to construction works.

Indirect impacts may also include GHG emissions associated with operation of Main Roads buildings, depots and light vehicle fleet (emission from power generation and vehicles).

3.7.4 Assessment of impacts

Increased construction vehicle emissions

Construction works for the Project will involve the operation of heavy machinery and vehicles. Some minor increase in emissions associated with the construction activities is anticipated but will be temporary – expected to occur for the duration of construction. The impacts associated with these emissions is not considered likely to be significant.

Dust impacts during construction

Construction works for the Project will involve the operation of loaders, dozers, graders, excavators and trucks to clear vegetation from the Project Area, and to excavate and remove material from areas of the site for use as fill within other areas of the site. There will also be miscellaneous vehicle movements around the Project Area as part of the construction works.

These activities can result in dust emissions due to:

- Movement of vehicles and heavy equipment on unsealed surfaces
- Excavating, spreading and compacting soils
- Wind erosion from exposed and disturbed soil surfaces.

Dust may be a nuisance to nearby sensitive receptors if unmitigated during construction activities, however it is not considered to have an adverse impact on local air quality.

Reduced air quality due to bushfire

Construction activities have the potential to ignite bushfires through hot work and vehicle movements, which could cause a temporary reduction in local air quality. Potential risks associated with bushfires are considered low and will be managed through appropriate mitigation as part of the CEMP. No significant impacts resulting from accidental bushfires are expected.

Impacts from car emissions

The 2012 model predicted that all emission concentrations, aside from Benzo(a)pyrene (BaP) were below the National Environmental Protection Measure (NEPM)/World Health Organisation criterion (Table 3-22). With conservatism built into the model, it was considered unlikely that BaP concentrations would exceed the relevant criteria (GHD, 2012c).

No significant impacts resulting from vehicle traffic are expected.

Greenhouse gas emission impacts

The operation of site offices, light diesel powered vehicles and heavy equipment for construction of the Proposal will result in generation of GHG emissions.

The GHG emissions associated with construction activities are expected to occur for the duration of construction.

An assessment of GHG emissions for the construction phase of the Proposal will be undertaken to quantify direct emissions and therefore, determine the requirement for management measures.

Table 3-22 Predicted maximum car emission concentrations 2031

POLLUTANT	BACKGROUND CONC. (µg/m3)	PREDICTED MAXIMUM CONCENTRATION (µg/m3)		AIR NEPM/ WHO CRITERION (µg/m3)	AVG. PERIOD	MAX % OF CRITERION
		DISCRETE RECEPTOR	AUTO RECEPTOR			
CO	375	471	592	11,254	8-Hours	5
NO_2[2]	51	19	27	247	1-Hour	11
PM_{10}	20.8	21	22	50	24-Hours	44
$PM_{2.5}$[3]	12.5	13	13.2	25	24-Hours	53
Volatile Organic Compounds						
Benzene	0	0.06	0.24	11	Annual	2.3
Toluene	0	0.33	0.83	4114	24-Hours	0.02
Xylene	0	0.22	2.1	1183	24-Hours	0.18
Formaldehyde	0	0.09	0.18	54	24-Hours	0.34
Acetaldehyde	0	0.45	0.79	2300	1-Hour	0.03
Benzo(A) Pyrene[4]	0	0.03 Ng/M^3	0.07 Ng/M^3	0.3 Ng/M^3	Annual	22

3.7.5 Mitigation

Main Roads has a carbon reduction target of 5 % of 2010 carbon emission by 2020, with a stretch target reduction of 15 % through improving energy efficiency. Opportunities to reduce ongoing energy include, but are not limited to the following, where practicable:

- Use of energy efficient electrical assets such as LED street lights
- Incorporating design treatments such as roundabouts or modified intersections to minimise the number of traffic lights required to manage congestion
- Use of renewable energy sources
- Use of materials with lower embodied energy.

Impacts to air quality will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues specific to air quality including:
  - Complaints response and management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management

[2] Assessed as 15 % NOx as NO_2
[3] Assessed as 60 % PM_{10} as $PM_{2.5}$
[4] Predicted total PAH concentrations multiplied by 0.009

- Environmental incident reporting and management

- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.7.6 Predicted outcome

Dust is anticipated to be generated during construction. This impact will be controlled using standard mitigation measures, such as watering trucks. Appropriate measures will be implemented to ensure the short term construction related air quality impacts are effectively managed.

It is considered unlikely that ongoing street lighting, traffic signals and road maintenance activities would produce significant GHG emissions for the Project. However, construction and operation of the Project will be subject to an assessment for direct GHG emissions.

Given these proposed measures, no residual impacts are expected for this aspect.

3.8 Key Environmental Factor – Social Surroundings

3.8.1 Studies undertaken

The following studies have been undertaken for this aspect:

- Noise Management Plan Bunbury Outer Ring Road Southern Section GBRS Corridor (Lloyd George Acoustics, 2014)
- Aboriginal Heritage Survey Report of the Proposed Bunbury Outer Ring Road Stage 2, Western Australia (Brad Goode & Associates, 2012).

3.8.2 Receiving environment

European heritage

The EPBC Protected Matters Search Tool did not identify any Commonwealth listed heritage sites within the Project Area, or within 10 km of the Project Area (DotEE, 2018). The State Heritage Office dataset indicated that there are no state heritage sites within the Project Area (GoWA, 2018) (Figure 12).

No European heritage sites will be directly impacted by the construction of the Project. As a result, no impacts were identified or recommendations warranted for this factor.

Aboriginal heritage

A search of the Aboriginal Heritage Inquiry System identified one Registered Aboriginal site; Capel Bussell Highway (Site 5813) (DPLH, 2019). This site will be directly impacted by the Project. Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Arch Deposit and Camp.

Two 'Other Heritage Places' were identified within the Project Area (DPLH, 2019), including:

- Place ID 37869 Paperbark Wetlands – Modified Tree, Birth Place, Hunting Place, Water Source
- Place ID 37870 The Gelorup Corridor – Artefacts/ Scatter, Ceremonial, Skeletal Material, Burial.

Aboriginal heritage surveys of BORR were conducted in 1995 (McDonald Hales and Associates, 1995) and updated in 2002. These earlier surveys were again updated in 2009 (Brad Goode & Associates, 2009) and again in 2012 (Brad Goode & Associates, 2012). The 2012 survey included both archaeological and ethnographic components, however did not assess Site 5813.

Additional Aboriginal and Archaeological surveys will be conducted if the GBRS alignment is selected as the preferred alignment.

Land use

The GBRS indicates the Project Area is zoned as "Primary Regional Road", with the eastern part also zoned as "Rural" (DPLH, 2018).

Demography and economy

The Project Area is 7.4 km south-east of the Bunbury CBD, 1.1 km from the suburb of Gelorup and 3.6 km from the town of Capel, in the Shire of Capel.

The Shire of Capel had an estimated resident population of 17,894 for June 2017 (ABS, n.d.). Health care and social assistance is the main industry accounting for 13 % of employment, followed by construction accounting for 12 %.

The Greater Bunbury Region which includes the Shire of Harvey, Dardanup and Capel, as well as the City of Bunbury, had a population of 89,628 in 2016 and the South West region had a total population of 172,179 (Shire of Capel, 2018). Construction is the main industry accounting for 12.8 % of employment, with manufacturing accounting for approximately 11.8 %.

Visual amenity

The Swan Coastal Plain is characterised as a low lying coastal plain mainly covered with woodlands, with rare landscape features such as Holocene dunes and wetlands. Bushland is often retained as a visual or spatial buffer between land uses (Mitchell, Williams, & Desmond, 2002). Changes to amenity are greatest in areas with a high perceived scenic amenity value which are visible from public locations, such as roads, walk trails and lookouts.

The existing amenity of the Project Area includes urban and semi-rural properties, pockets of native vegetation, rural / agricultural areas, existing roads (including Bussell Highway) and previously cleared areas.

Noise

Noise sensitive receptors include residences in the rural and semi-rural developments abutting the Project. The Project will result in a major highway and highway upgrade being located within 50 m of some existing residences.

3.8.3 Potential impacts

Project activities that have the potential to impact social surroundings during construction include vegetation clearing, earthworks and off-site transport.

The potential construction impacts include:

- Heritage site disturbance during clearing and/or excavation works
- Changes to visual amenity
- Noise impacts to sensitive receptors, from noise emissions generated by construction
- Vibration generated by construction
- Increased traffic on local road network.

The potential operational impacts on social surroundings as a consequence of developing the Project are:

- Changes in visual amenity
- Noise impacts to sensitive receptors through noise emissions from the road.

3.8.4 Assessment of impacts

Direct Impacts

Heritage site disturbance during clearing and/or excavation works

The Aboriginal Heritage Identification System (AHIS) identified one Registered Aboriginal heritage archaeological site intersected by the Project Area (ID 5813 Capel Bussell Highway) and two Other Heritage Places (ID 37869 Paperbark Wetlands and ID 37870 The Gelorup Corridor) which will be directly impacted by this Project (DPLH, 2019).

Additional Aboriginal and Archaeological surveys will be conducted if the GBRS alignment is selected as the preferred alignment.

Noise and vibration impacts from construction and operation

Noise and vibration impacts are expected to result from the construction phase, however these impacts are expected to be short in duration and are not considered significant. Noise and vibration impacts during construction will be managed under a Project specific CEMP.

The Project will result in the exposure of noise sensitive residences to traffic noise from the highway. The extent of impact will be determined through a Traffic Noise Assessment for the Project, should it be selected as the preferred alignment. Noise management will be implemented to comply with SPP 5.4 (WAPC, 2009). Management measures may include the installation of noise walls and / or treatments to individual properties

to comply with SPP 5.4 (WAPC, 2009). Noise mitigation measures will be developed during the detailed design phase for operation of the Project to be compliant with the requirements of SPP 5.4 (WAPC, 2009).

Reduced visual amenity

Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project. The impacts to visual amenity are expected to be greatest between South West Highway and Bussell Highway.

An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option. The results of the assessment and potential mitigation measures will be included in relevant documentation to support the formal referral and assessment of the Project through the EP Act as necessary.

Glare or light spill on sensitive receptors

There will be changes in the local light environment as a result of the Project. It is anticipated that only intersections and interchanges will be lit for safety reasons.

Indirect Impacts

Indirect impacts from the Project on social surrounds are anticipated. Construction of the Project will potentially affect the amenity of residents through changes to the landscape. These impacts will be further investigated during visual impact assessment and mitigation measures will be identified during design phase if this alignment is selected as the preferred option.

3.8.5 Mitigation

Impacts to social surroundings will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering solutions to avoid and minimise environmental impacts
- Compliance with State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues specific to social surroundings including:
  - Complaints response and management
  - Heritage site management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.8.6 Predicted outcome

Potential impacts on Aboriginal heritage sites associated with the Project will be managed through consultation with all relevant groups and undertaken in accordance with State and Commonwealth legislation. Potential impacts to Aboriginal heritage will be managed through AH Act.

Construction and operation of the Project is likely to result in impacts to visual amenity and localised change in the landscape. If selected as the preferred alignment option, the potential impact of these changes will be mitigated through consideration during the detailed design phase and implementation of the landscaping, and other mitigation measures during construction via the CEMP.

Mitigation measures identified in the Traffic Noise Assessment will be developed during the detailed design phase of the Project if the alignment is selected as the preferred option.

4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

A search of the Protected Matters Search Tool (PMST) identified Banksia Woodlands of the Swan Coastal Plain TEC, threatened Black Cockatoo species and Western Ringtail Possums as the key matters of national environmental significance that may be impacted by the Project. An assessment of these has been undertaken in Table 4-1.

Table 4-1 Assessment against Matters of National Environmental Significance

MATTER OF MNES	IMPACT ASSESSMENT
Threatened Species and ecological communities	Impacts to one Threatened Ecological Community (TEC) was confirmed within the Project Area during field investigations: • Banksia Woodlands of the Swan Coastal Plain (SCP) TEC (approximately 21 ha). No Threatened flora species 'known' or 'likely to occur' in the Project Area. Impacts to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and the Forest Red-Tailed Black Cockatoo (Vulnerable), including: • Removal of approximately 71 ha potential habitat (38 ha surveyed and 33 ha unsurveyed) • Removal of 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone Impacts to Western Ringtail Possums (Critically Endangered), including: • Removal of approximately 71 ha potential habitat (38 ha surveyed and 33 ha unsurveyed), providing habitat for an estimated 100 individuals, which represent less than 2 % of the regional population. Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
Migratory Species	The PMST identified 42 migratory species including: • 26 bird species (Inc. 9 wetland species) • 15 marine species • 1 terrestrial species.
Commonwealth Marine Areas	The Project will not impact any Commonwealth Marine Area. The closest is Geographe Commonwealth Marine Reserve, approximately 14 km west of Project Area.
World Heritage Properties	The Project will not impact any World Heritage Properties.
National Heritage Properties	The Project will not impact any National Heritage Properties.

MATTER OF MNES	IMPACT ASSESSMENT
Wetlands of International Importance	The Project will not impact any wetlands of international importance. The closest is the Vasse-Wonnerup System, approximately 20 km south of the Project Area.

5 SUMMARY

BORR Project has been divided into three sections (Northern, Central and Southern Sections). Two alignments for BORR Southern Section are currently being assessed by Main Roads (BORR Southern Section GBRS Alignment and BORR Southern Section Alternative Alignment) to determine the preferred alignment.

The findings in this EIA were used to identify and assess the environmental impacts associated with BORR Southern Section GBRS Alignment ('the Project'). Main Roads used the findings of this EIA to support the determination of the preferred southern alignment for BORR. The impacts of the Project have been summarised in Table 5-1 for the purposes of comparison. This document is not intended to be used for regulatory environmental approval processes.

Table 5-1 Summary of Environmental Impacts

ASPECT	BORR SOUTHERN SECTION GBRS ALIGNMENT
Total Area	190 ha
VEGETATION AND FLORA	
Total Native Vegetation	Approximately 73 ha (40 ha surveyed, 33 ha unsurveyed)
Total non-native / cleared area	Approximately 120 ha
Total native Good or better condition	Approximately 18 ha (~9 % of the Project Area)
Total areas in Good – Degraded or worse condition	An estimated 172 ha (~91 % of the Project Area) (includes Cleared/parkland areas, which are classified as Completely Degraded)
Threatened and Priority Communities	Present: 1. Banksia woodlands of the SCP TEC – approximately 21 ha 2. Banksia woodlands PEC – up to 3.5 ha 3. Tuart woodlands PEC – approximately 28 ha.
Other significant	Approximately 4 ha of riparian vegetation
Conservation significant flora	One Priority Flora recorded – *Caladenia speciosa* (Priority 4), of which 71 individuals occur within the Project Area. No Threatened flora recorded during the filed investigations.
FAUNA	
EPBC / BC Fauna - confirmed - Black Cockatoos	Approximately 71 ha of potential Black Cockatoo habitat (38 ha surveyed and 33 ha unsurveyed). Up to 443 Suitable DBH Trees, including eight Trees with a Suitable Nest Hollow, four Known Nesting Trees and three that could not be assessed by drone.

ASPECT	BORR SOUTHERN SECTION GBRS ALIGNMENT
- Western Ringtail Possum (Critically Endangered)	Approximately 71 ha of WRP habitat (including 37.9 ha surveyed and 32.6 ha unsurveyed) and displacement of an estimated 100 individual WRPs, representing less than 2 % of the regional population.
Priority Fauna – confirmed - Southern Brown Bandicoot / Quenda (Priority 4)	Approximately 73 ha of potential Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 40 ha surveyed and 33 ha unsurveyed).
Threatened species likely to occur - Black-stripe Minnow (Endangered)	Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
South-western Brush-tailed Phascogale (Schedule 6)	Clearing of an estimated 63 ha of South-western Brush-tailed Phascogale habitat (including 30 ha surveyed and 33 ha unsurveyed).
Migratory birds	A small number (< 50) of migratory bird species were considered to be potentially transient visitors to the Project Area at times when wetlands are inundated and are not expected to be significantly impacted by the Project.
TERRESTRIAL ENVIRONMENT QUALITY	
Acid Sulphate Soils	The Project has low to moderate risk of ASS, with minor areas of high risk associated with watercourses and the Capel Golf Course. Although the Project will widen an existing road adjacent to the Golf Course no impacts to ASS at that location are considered likely.
Contaminated Sites	No impact anticipated.
RIVERS AND WETLANDS	
Rivers	No rivers protected under the RIWI Act will be impacted by the Project, however a number of minor waterways will be impacted, including Five Mile Brook.
Geomorphic wetlands	Loss of up to 33 ha of mapped Geomorphic Wetlands including approximately: Conservation: 1 ha Resource Enhancement: <1 ha Multiple use: 31 ha
AIR QUALITY	
Air quality	No significant impacts anticipated.
SOCIAL	
State and Municipal heritage	No significant impacts anticipated.
Aboriginal Heritage	Capel Bussell Highway (ID 5813). Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Archaeological Deposit and Camp.

ASPECT	BORR SOUTHERN SECTION GBRS ALIGNMENT
	Paperbark Wetlands (ID 37869) is recorded as a Lodged Other Heritage Place, comprised of Modified Tree, Birth Place, Hunting Place, Water Source. The Gelorup Corridor (ID 37870) is recorded as a Lodged Other Heritage Place, comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material, Burial.
Noise	Noise and vibration impacts are expected to result from the construction phase. These impacts are not considered likely to be significant. If required noise mitigation measures will be developed during the detailed design phase to be compliant with the requirements of SPP 5.4 (WAPC, 2009).
Visual	Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project. An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option.
Amenity	Construction of the Project will potentially affect the amenity of residents through changes to the landscape. These impacts will be further investigated during visual impact assessment and mitigation measures will be identified during design phase if this alignment is selected as the preferred option.

It is considered likely that the Project will require the following environmental approvals:

- Referral to the EPA under Section 38 of the EP Act
- Referral to DotEE under the EPBC Act for assessment as a Controlled Action
- Native Vegetation Clearing Permit (DWER)
- Works approval and licence to operate an asphalt plant (DWER)
- Bed and Banks Permit (DWER)
- Licence to take water for construction purposes (DWER)
- Section 18 consent to disturb Aboriginal heritage sites (Minister for Aboriginal Heritage)
- Permission from the Shire of Capel to disturb the European heritage site.

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- Clearing Regulations – Environmentally Sensitive Areas (DWER-046)
- Directory of Important Wetlands in Australia – Western Australia (DBCA-045)
- EPA Redbook Recommended Conservation Reserves 1976-1991 (DBCA-029)
- Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)
- Groundwater Salinity Statewide (DWER-026)
- Heritage Council WA – State Register (SHO-003)
- Hydrographic Catchments – Catchments (DWER-028)

- Legislated Lands and Waters (DBCA-011)
- Pre-European Vegetation (DPIRD-006)
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- RIWI Act, Groundwater Areas (DWER-019)
- RIWI Act, Rivers (DWER-036)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
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- Threatened Ecological Communities (DBCA-038)
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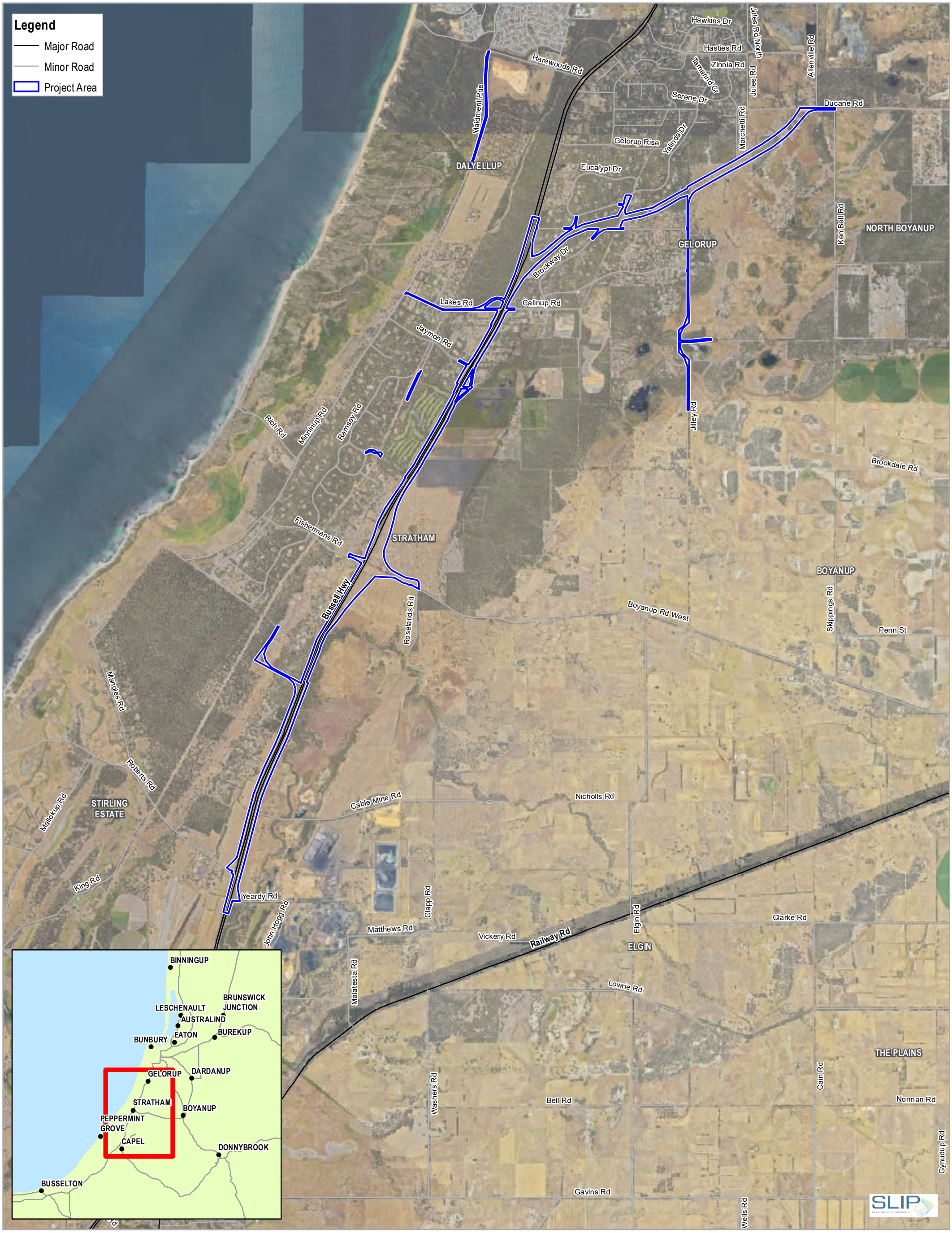

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Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

BORR Southern Section GBRS Alignment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 1

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
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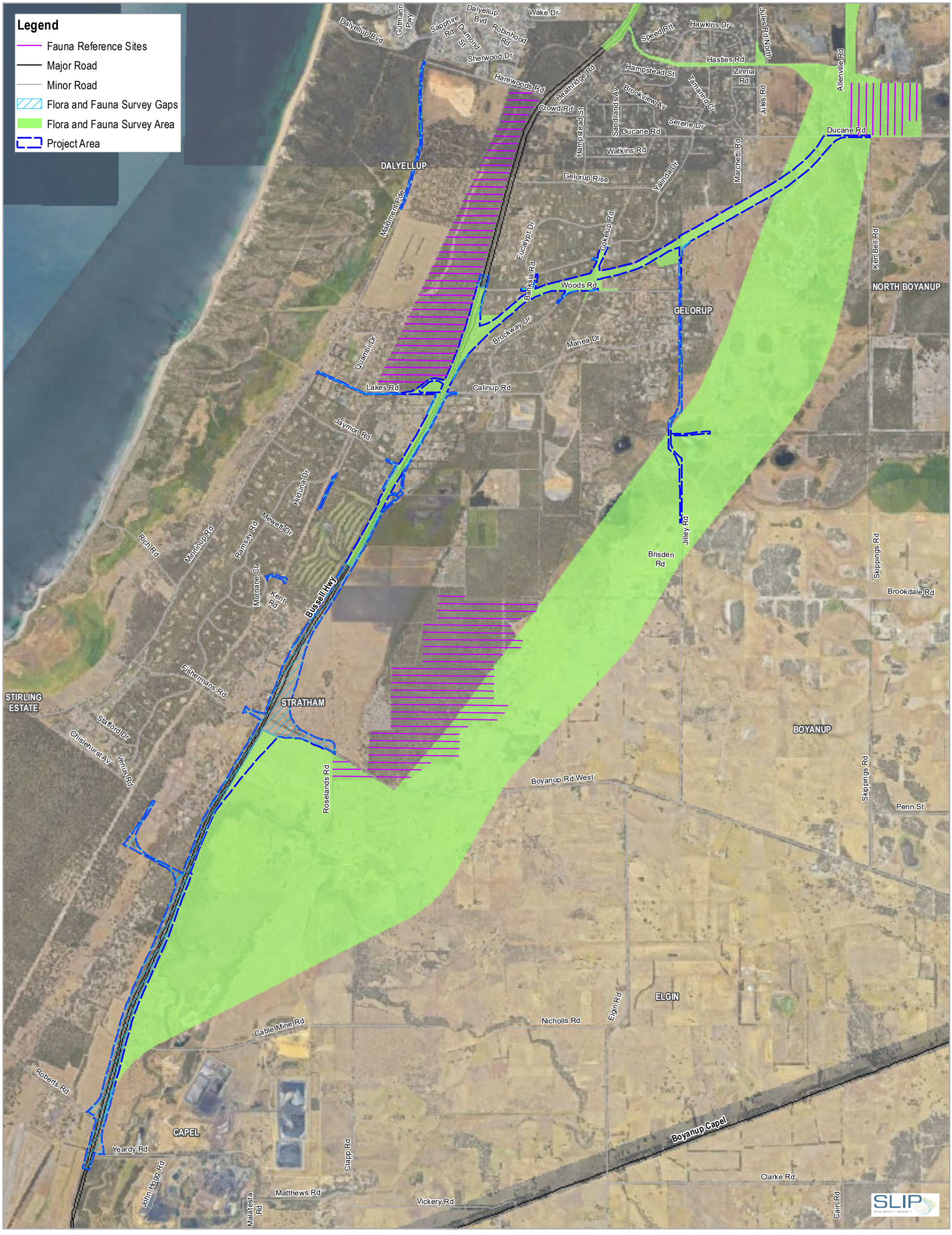

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Date	**24/06/2019**

Surveyed and Unsurveyed Areas

FIGURE 2

Data source: BORR: South Alternate Boundary - 20181212, Survey areas and gaps - 20190213, Fauna Reference Sites - 20190122; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415, Locality names - 2018; Geoscience Australia: Geodata Topo 250k.. Created by: slei

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Map 4
Bussell Hwy
STRATHAM
BOYANUP
STIRLING ESTATE
CAPEL
ELGIN
Railway Rd
THE PLAINS

Paper Size ISO A3
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Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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Vegetation Type

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OVERVIEW

FIGURE 3

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

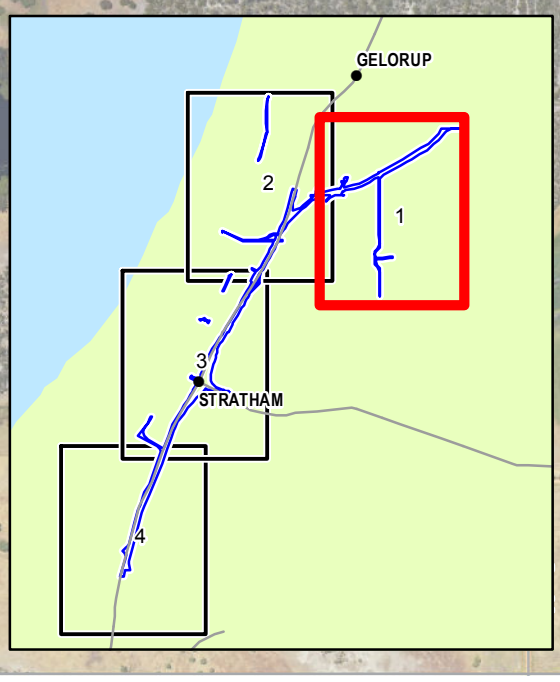
Crowd Rd
Mossdale Pl
Sandilands Av
Brookview Av
Serene Dr
Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Hampstead St
Watkins Rd
Ridge Pl
Tarrock Ct
Zanadu Ct
Marchetti Rd
Gelorup Rise
Yalinda Dr
Eucalypt Dr
Cokelup Rd
Cleared
9d
1
9a
9c
10
4
Woods Rd
Brockway Dr
St Clair Ct
Marri Pl
Stable Cl
Manea Dr
Rd No 308
Jilley Rd
8
*Zantedeschia aethiopica (DP/WONS)
1b
3
1a
7
2

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1 - Open forest of Jarrah, Marri and Banksia
- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 4 - Open forest of Banksia and Peppermint
- 7 - Woodland of Paperbark over tall sparse shrubland
- 8 - Woodland of Flooded Gum and Paperbark over sparse Melaleuca shrubland
- 9a - Marri and Jarrah +/- Peppermint with very occasional Tuart
- 9c - Peppermint stands
- 9d - Flooded Gum and Marri +/- Paperbark
- 10 - Parkland cleared with occasional Marri, Jarrah and Peppermint
- Cleared



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Vegetation Type

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Revision No. **0**
Date **24/06/2019**

FIGURE 3

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Print date: 24 Jun 2019 - 15:13

Data source: BORR: South Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Roads - 2018, Aerial imagery - WA Now accessed 20190522; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

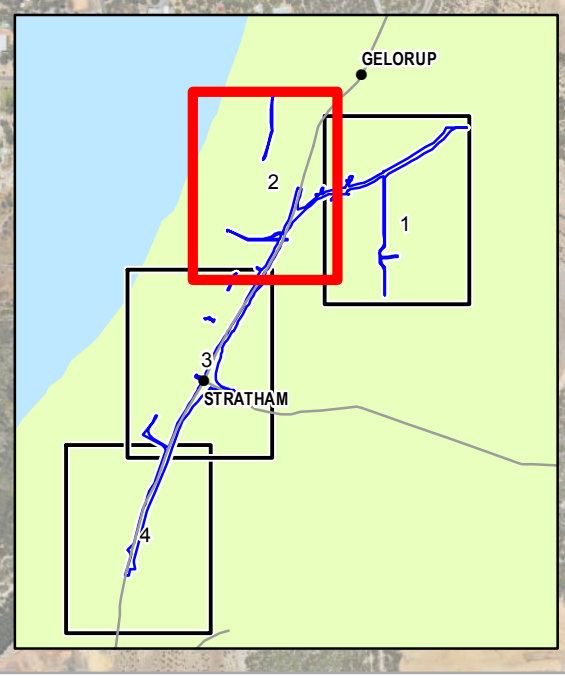
Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1 - Open forest of Jarrah, Marri and Banksia
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 4 - Open forest of Banksia and Peppermint
- 9a - Marri and Jarrah +/- Peppermint with very occasional Tuart
- 9c - Peppermint stands
- 10 - Parkland cleared with occasional Marri, Jarrah and Peppermint
- 10b - Revegetation/regrowth
- Cleared

Citrine St
Sherwood Dr
Jade Cr
Edwinstone Cl
Robinhood Rd
Trent Wy
Harewoods Rd
Heathridge Rd
Crowd Rd
Maidment Pde
Gelorup Rise
Bussell Hwy
Eucalypt Dr
Banksia Rd
Woods Rd
Brockway Dr
St Clair Ct
Manea Dr
Quambi Dr
Lakes Rd
Tamra Cl
Minninup Rd
Jaymon Rd
Rosemore Wy
Ramsay Rd
Hilduna Dr



Paper Size ISO A3

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Metres

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

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Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **0**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_003_SouthVegetationTypeMapbook_Rev0.mxd
Print date: 24 Jun 2019 - 15:17

Data source: BORR: South Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Roads - 2018, Aerial imagery - WA Now accessed 20190522; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

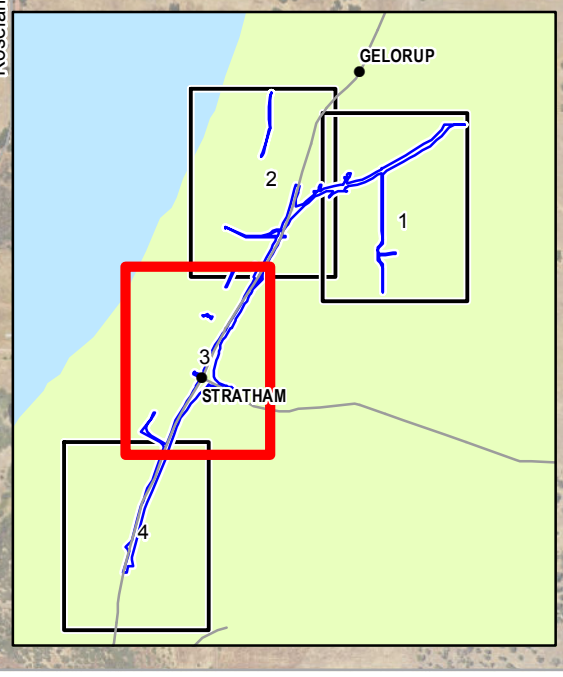
Hilduna Dr
Mewett Dr
Rich Rd
Ramsay Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Fishermans Rd
Stratham Cl
Chislehurst Av
Stafford Dr
Venus Rd
Bussell Hwy
Boyanup Rd West
Rosellands Rd
10
8
3
10b
9a
1b
1a
Cleared
*Zantedeschia aethiopica (DP/WONS)

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 8 - Woodland of Flooded Gum and Paperbark over sparse Melaleuca shrubland
- 9a - Marri and Jarrah +/- Peppermint with very occasional Tuart
- 10 - Parkland cleared with occasional Marri, Jarrah and Peppermint
- 10b - Revegetation/regrowth
- Cleared



Paper Size ISO A3

0 90 180 270 360

Metres

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

N

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **0**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_003_SouthVegetationTypeMapbook_Rev0.mxd
Print date: 24 Jun 2019 - 15:15

Data source: BORR: South Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Roads - 2018, Aerial imagery - WA Now accessed 20190522; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

*Zantedeschia aethiopica (DP/WONS)

*Zantedeschia aethiopica (DP/WONS)

*Asparagus asparagoides (DP/WONS)

8

1a

1b

Cleared

Mangles Rd

Roberts Rd

King Rd

Bussell Hwy

Cable Mine Rd

Yeardy Rd

John Hogg Rd

Matthews Rd

Hansen Rd

Urquhart Rd

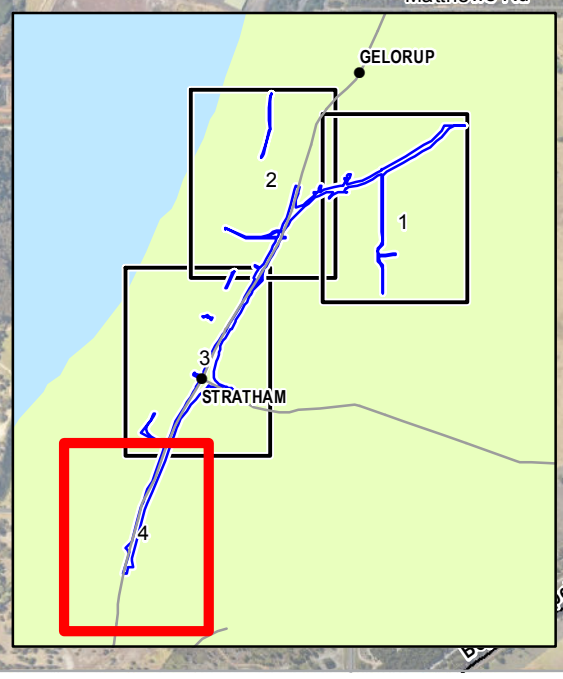
Bentley Dr

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 8 - Woodland of Flooded Gum and Paperbark over sparse Melaleuca shrubland
- Cleared



Paper Size ISO A3

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Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Vegetation Type

Project No. **61-37041**
Revision No. **0**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\61137041_003_SouthVegetationTypeMapbook_Rev0.mxd
Print date: 24 Jun 2019 - 15:15

Data source: BORR: South Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Roads - 2018, Aerial imagery - WA Now accessed 20190522; DPIRD: Native vegetation extent - 20171026, Landgate / SLIP. Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
Map 2
GELORUP
NORTH BOYANUP
Map 1
Bussell Hwy
Map 3
STRATHAM
BOYANUP
STIRLING ESTATE
Map 4
ELGIN
Railway Rd
CAPEL
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Vegetation Condition

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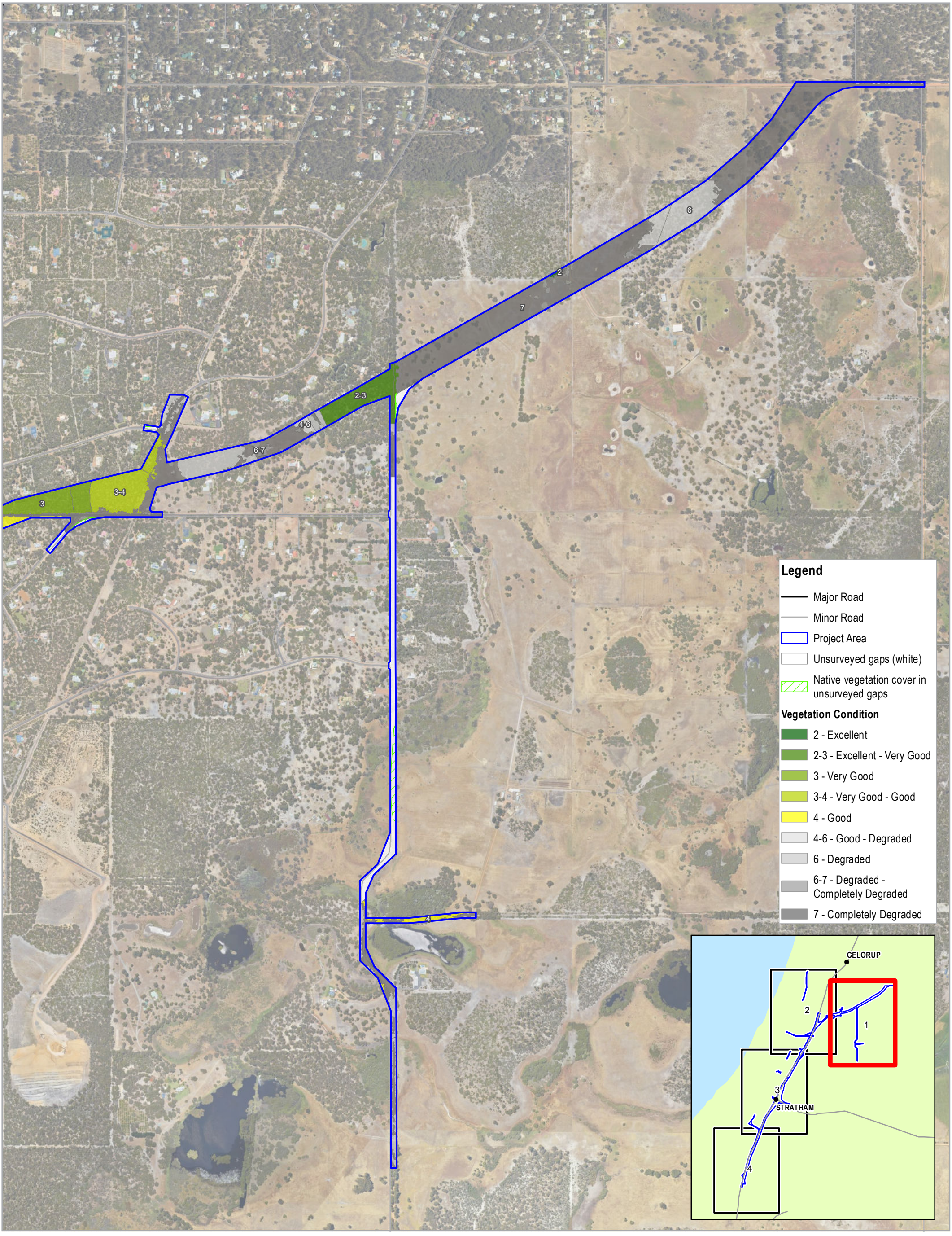
OVERVIEW

FIGURE 4

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



Paper Size ISO A3

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Metres

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

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Vegetation Condition

Project No. **61-37041**
Revision No. **2**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190415, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Native vegetation cover in unsurveyed gaps

Vegetation Condition

- 2-3 - Excellent - Very Good
- 3 - Very Good
- 3-4 - Very Good - Good
- 4 - Good
- 4-6 - Good - Degraded
- 6 - Degraded
- 6-7 - Degraded - Completely Degraded
- 7 - Completely Degraded

Bussell Hwy

2-3

6

3

3-4

4

4-6

6-7

7

GELORUP

STRATHAM

1

2

3

4

Paper Size ISO A3

0 90 180 270 360

Metres

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

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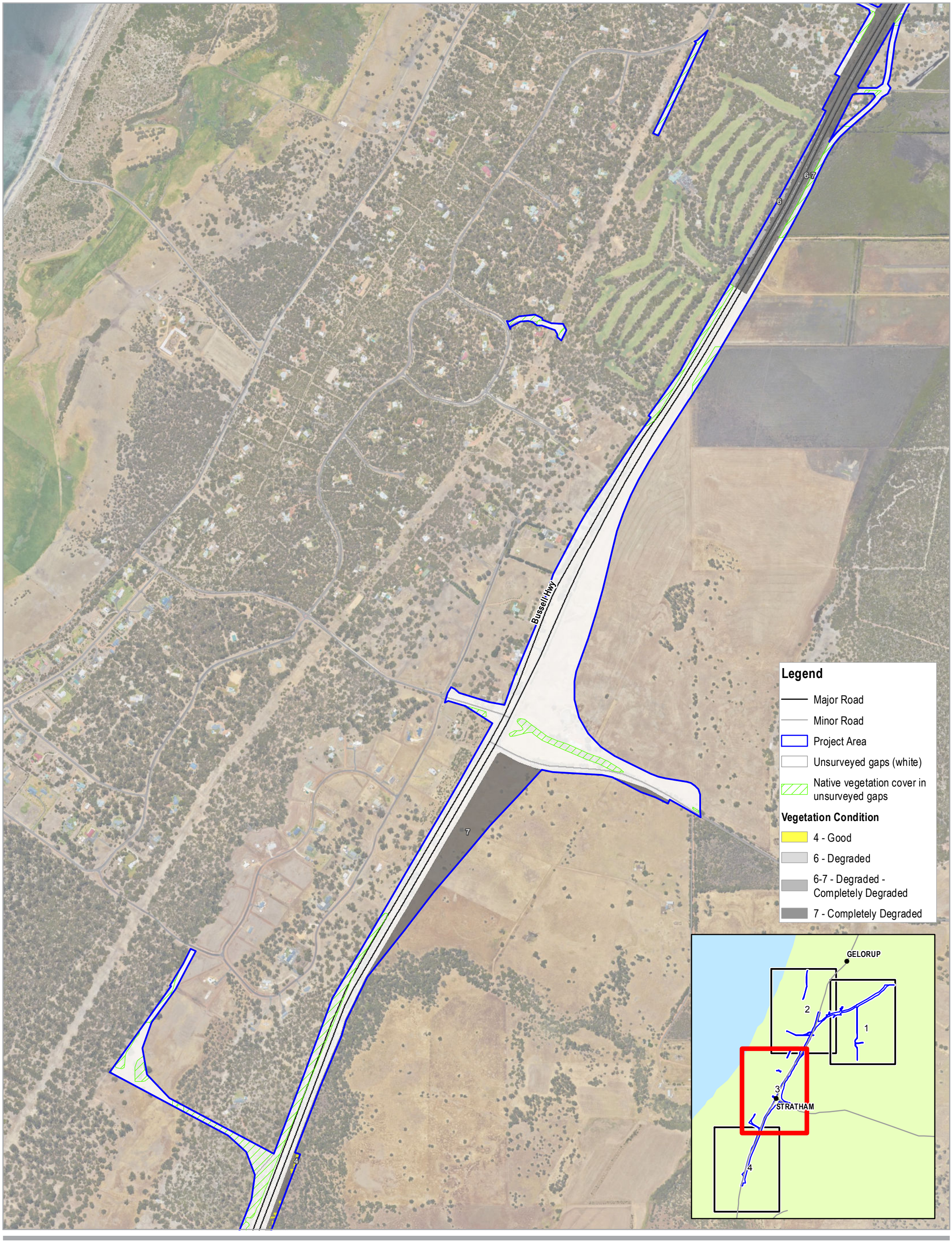
Vegetation Condition

Project No. **61-37041**
Revision No. **2**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190415, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190415, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Bussell Hwy

4

6

7

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Native vegetation cover in unsurveyed gaps

Vegetation Condition

- 4 - Good
- 6 - Degraded
- 7 - Completely Degraded

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Vegetation Condition

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FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190415, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 2
Map 1
Bussell Hwy
Map 3
STRATHAM
BOYANUP
STIRLING ESTATE
Map 4
ELGIN
Railway Rd
CAPEL
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Conservation Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

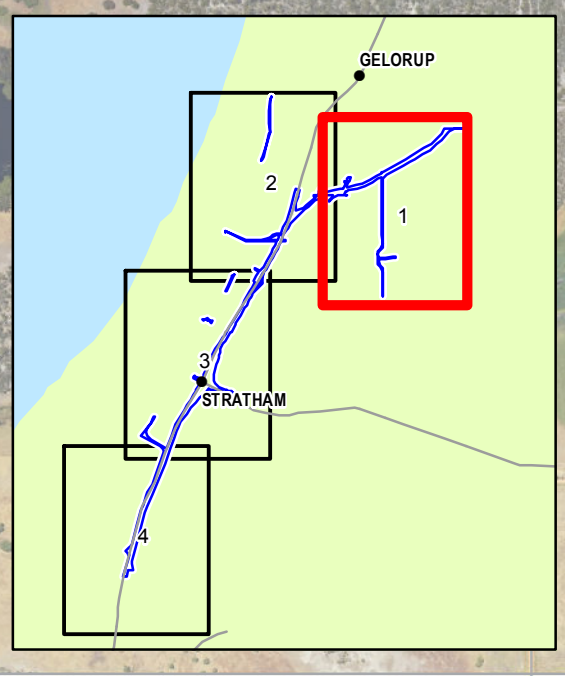
FIGURE 5

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

Conservation Significant Flora

- *Acacia semitrullata* (P4)
- Major Road
- Minor Road
- Project Area
- Banksia Woodlands TEC
- Banksia Woodlands PEC
- Tuart Woodlands PEC
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Conservation Significant Ecological Communities and Flora

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FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:40

Data source: BORR: South Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190523; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Banksia Woodlands TEC
- Banksia Woodlands PEC
- Tuart Woodlands PEC
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps (considered likely to represent Banksia Woodlands TEC and PEC)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)

Bussell Hwy

GELORUP

STRATHAM

1

2

3

4

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Conservation Significant Ecological Communities and Flora

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Revision No. **1**
Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:44

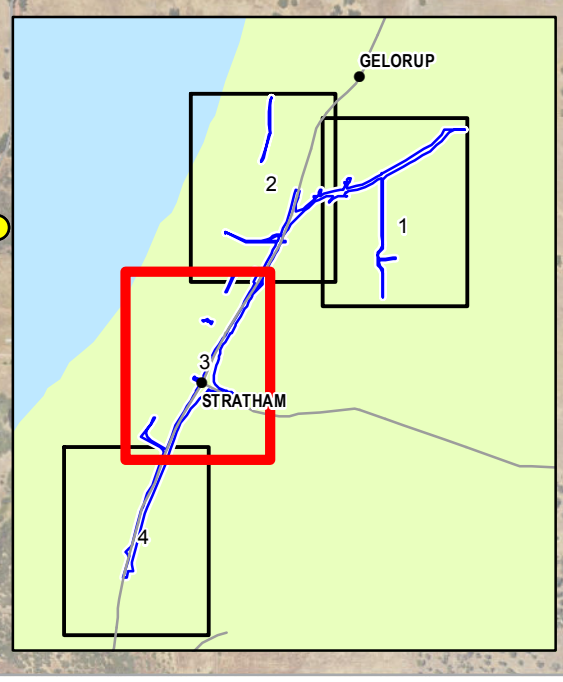
Data source: BORR: South Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190523; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Bussell Hwy

Legend

Conservation Significant Flora

- *Acacia semitrullata* (P4)
- *Chamaescilla gibsonii* (P3)
- Major Road
- Minor Road
- Project Area
- Banksia Woodlands TEC
- Banksia Woodlands PEC
- Tuart Woodlands PEC
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (considered likely to represent Banksia Woodlands TEC and PEC)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)



Paper Size ISO A3

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Metres

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

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Date **24/06/2019**

FIGURE 5

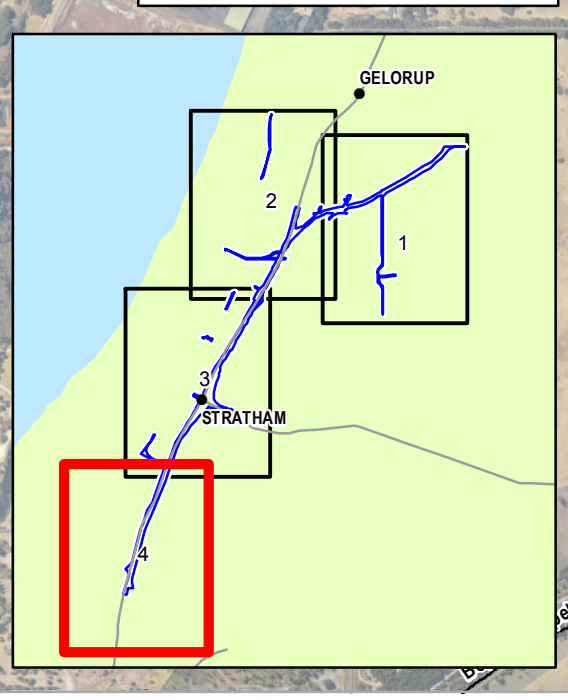
G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:41

Data source: BORR: South Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190523; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Bussell Hwy

Legend

- Major Road
- Minor Road
- Project Area
- Banksia Woodlands TEC
- Banksia Woodlands PEC
- Tuart Woodlands PEC
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (considered likely to represent Banksia Woodlands TEC and PEC)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)



Paper Size ISO A3

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Metres

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

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Conservation Significant Ecological Communities and Flora

Project No. **61-37041**
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Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:42

Data source: BORR: South Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190523; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

Conservation Significant Flora

- *Acacia semitrullata* (P4)
- *Chamaescilla gibsonii* (P3)
- Black-stripe Minnow observation
- Suitable DBH Trees (Black Cockatoo)
- Major Road
- Minor Road
- Project Area
- DBCA Nature Reserve
- Environmentally Sensitive Areas
- Threatened Ecological Community
- Priority Ecological Community

Geomorphic Wetlands category

- Conservation
- Resource Enhancement
- Multiple Use

DALYELLUP
NORTH BOYANUP
GELORUP
Bussell Hwy
STRATHAM
Roselands Nature Reserve
BOYANUP
Tuart Forest National Park
STIRLING ESTATE
CAPEL
ELGIN
Boyanup Capel
THE PLAINS
SLIP

Paper Size ISO A3

0 0.3 0.6 0.9 1.2

Kilometres

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

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Environmental Constraints

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Revision No. **1**
Date **24/06/2019**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_012_EnvConstraints_Rev1.mxd
Print date: 24 Jun 2019 - 16:32

Data source: BORR Team: Conservation significant flora - 20190212, Project Area - 201812; Biota: Cockatoo trees - 20190208; DBCA: TEC/PEC boundaries - 20180605, Geomorphic wetlands - 20190604, Nature Reserves - 20170730; DWER: ESAs - 20151012; Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190620. . Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
Map 2
GELORUP
NORTH BOYANUP
Map 1
Bussell Hwy
Map 3
STRATHAM
BOYANUP
STIRLING ESTATE
Map 4
ELGIN
Railway Rd
CAPEL
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Fauna Habitat

Project No. 61-37041
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OVERVIEW

FIGURE 7

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

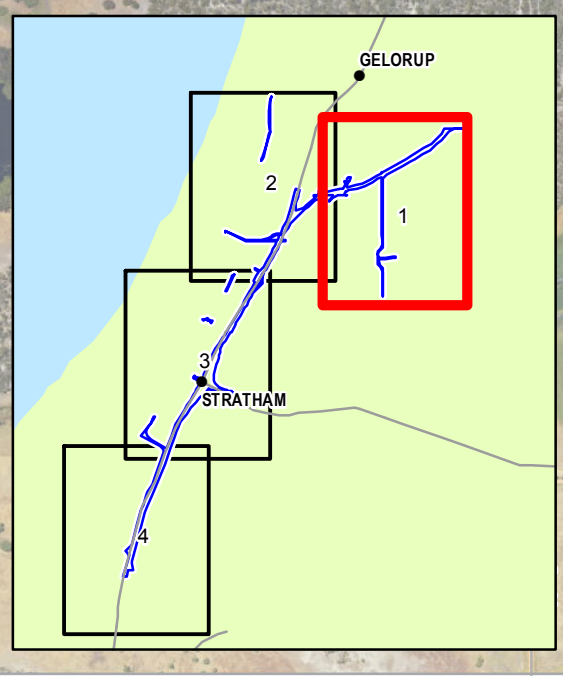
Crowd Rd
Mossdale Pl
Sandlands Av
Brookview Av
Serene Dr
Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Hampstead St
Watkins Rd
Ridge Pl
Tarrock Ct
Zanadu Ct
Marchetti Rd
Gelorup Rise
Yalinda Dr
Eucalypt Dr
Cokelup Rd
Woods Rd
Brockway Dr
St Clair Ct
Marri Pl
Stable Ct
Manea Dr
Rd No 308
Jilley Rd
Ken Bell Rd
Hair Pl

Legend

- Major Road
- Minor Road
- Project Area

Fauna Habitat

- Damplands and wetlands
- Jarrah/Marri woodland
- Scattered trees over introduced grasses
- Cleared
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Fauna Habitat

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_006_SouthFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:48

Data source: BORR: South Boundary - 20181212; Landgate: Roads - 2018, Imagery accessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area

Fauna Habitat

- Jarrah/Marri woodland
- Scattered trees over introduced grasses
- Cleared
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Citrine St
Garnet Wy
Sherwood Dr
Hornibrook Rd
Edwinstone Cl
Robinhood Rd
Jade Cr
Harewoods Rd
Trent Wy
Heathridge Rd
Crowd Rd
Maidment Pde
Gelorup Rise
Bussell Hwy
Eucalypt Dr
Banksia Rd
Woods Rd
Brockway Dr
St Clair Ct
Quambi Dr
Manea Dr
Lakes Rd
Tamra Cl
Minninup Rd
Jaymon Rd
Rosemore Wy
Ramsay Rd
Hiduna Dr

GELORUP
STRATHAM
1
2
3
4

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Fauna Habitat

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\61137041_006_SouthFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:51

Data source: BORR: South Boundary - 20181212; Landgate: Roads - 2018, Imagery accessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

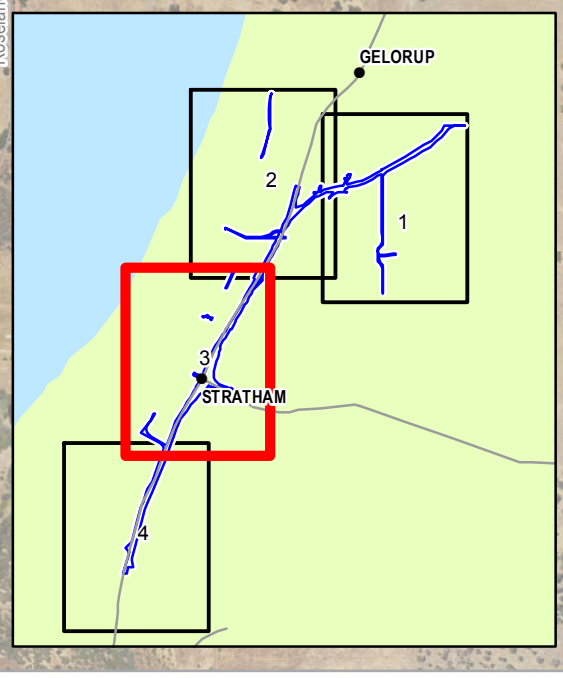
Hilcuma Dr
Mewett Dr
Rich Rd
Ramsay Rd
Child Pl
Mimmup Rd
Mumane Cr
Kent Rd
Cherion Ct
Fishermans Rd
Stratham Cl
Bussell Hwy
Chislehurst Av
Stafford Dr
Chislehurst Av
Venus Rd
Boyanup Rd West
Roselands Rd

Legend

- Major Road
- Minor Road
- Project Area

Fauna Habitat

- Damplands and wetlands
- Jarrah/Marri woodland
- Scattered trees over introduced grasses
- Cleared
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps



Paper Size ISO A3

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Metres

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

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Fauna Habitat

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_006_SouthFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:49

Data source: BORR: South Boundary - 20181212; Landgate: Roads - 2018, Imagery accessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

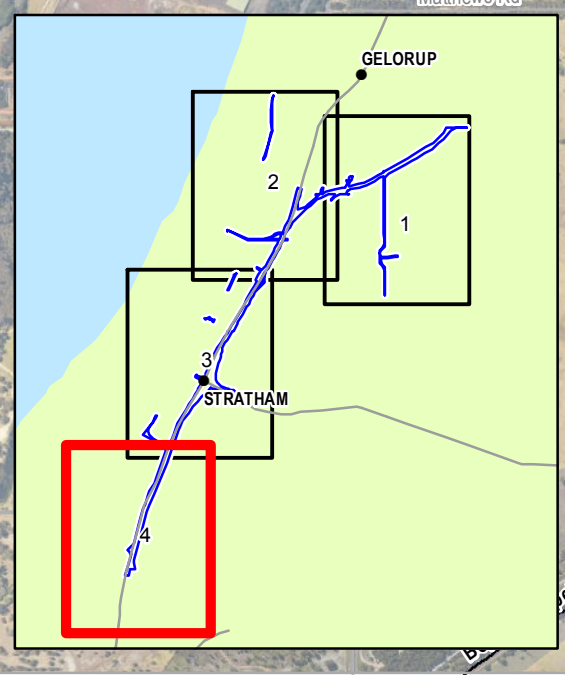
Mangles Rd
Roberts Rd
King Rd
Bussell Hwy
Cable Mine Rd
Yeardy Rd
John Hogg Rd
Matthews Rd
Hansen Rd
Urquhart Rd
Bentley Dr

Legend

- Major Road
- Minor Road
- Project Area

Fauna Habitat

- Damplands and wetlands
- Jarrah/Marri woodland
- Scattered trees over introduced grasses
- Cleared
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps



Paper Size ISO A3

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Metres

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

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Fauna Habitat

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_006_SouthFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 15:50

Data source: BORR: South Boundary - 20181212; Landgate: Roads - 2018, Imagery accessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Map 4
Bussell Hwy
STRATHAM
BOYANUP
STIRLING ESTATE
CAPEL
ELGIN
Railway Rd
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

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BUILDING OUR FUTURE
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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Black Cockatoos

Project No. **61-37041**
Revision No. **2**
Date **24/06/2019**

OVERVIEW

FIGURE 8

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

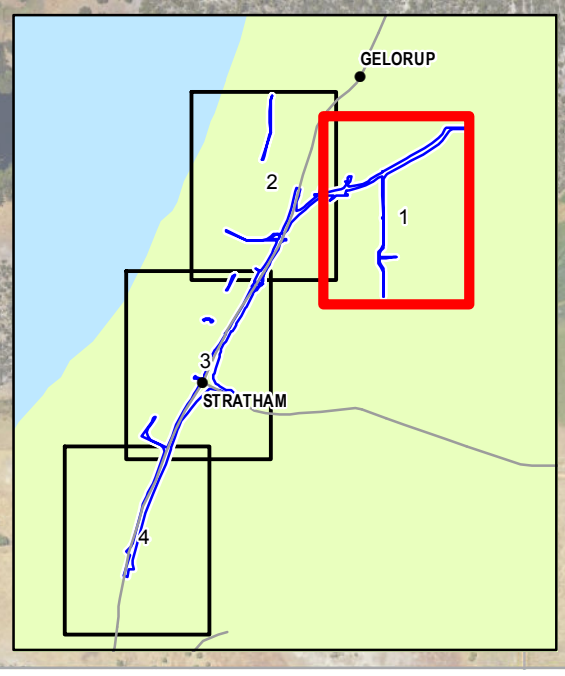
Crowd Rd
Mossdale Pl
Sandilands Av
Brookview Av
Serene Dr
Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Hampstead St
Ridge Pl
Zanadu Ct
Tarrock Ct
Watkins Rd
Marchetti Rd
Gelorup Rise
Yalinda Dr
Eucalypt Dr
Cokelup Rd
Woods Rd
Brockway Dr
St Clair Ct
Marri Pl
Stable Cl
Manea Dr
Rd No 308
Jilley Rd
Ken Bell Rd

Legend

- Black Cockatoo observation (Nov. 2017)

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat



Paper Size ISO A3

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Metres

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

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BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Black Cockatoos

Project No. **61-37041**
Revision No. **3**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_007_BCsMapbook_Rev3.mxd
Print date: 24 Jun 2019 - 16:16

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190507; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Black Cockatoo observation (Nov. 2017)

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

Citrine St
Sherwood Dr
Jade Cr
Edwinstone Cl
Robinhood Rd
Trent Wy
Harewoods Rd
Heathridge Rd
Crowd Rd
Maidment Pde
Gelorup Rise
Bussell Hwy
Eucalypt Dr
Banksia Rd
Woods Rd
Brockway Dr
St Clair Ct
Quambi Dr
Manea Dr
Lakes Rd
Tamra Cl
Minninup Rd
Jaymon Rd
Rosemore Wy
Ramsay Rd
Hilduna Dr

GELORUP
STRATHAM
1
2
3
4

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

BORR Team

Australian Government
BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Black Cockatoos

Project No. **61-37041**
Revision No. **3**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_007_BCsMapbook_Rev3.mxd
Print date: 24 Jun 2019 - 16:19

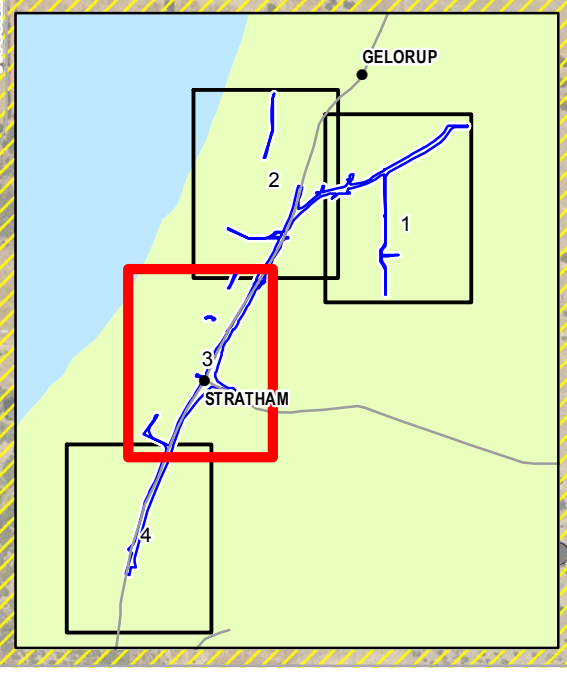
Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190507; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Hilduna Dr
Mewett Dr
Rich Rd
Ramsay Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Fishermans Rd
Chislehurst Av
Stafford Dr
Chislehurst Av
Venus Rd
Bussell Hwy
Boyanup Rd West
Rosellands Rd

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat



Paper Size ISO A3

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Metres

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

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Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Project No. **61-37041**
Revision No. **3**
Date **24/06/2019**

Black Cockatoos

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_007_BCsMapbook_Rev3.mxd
Print date: 24 Jun 2019 - 16:16

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190507; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

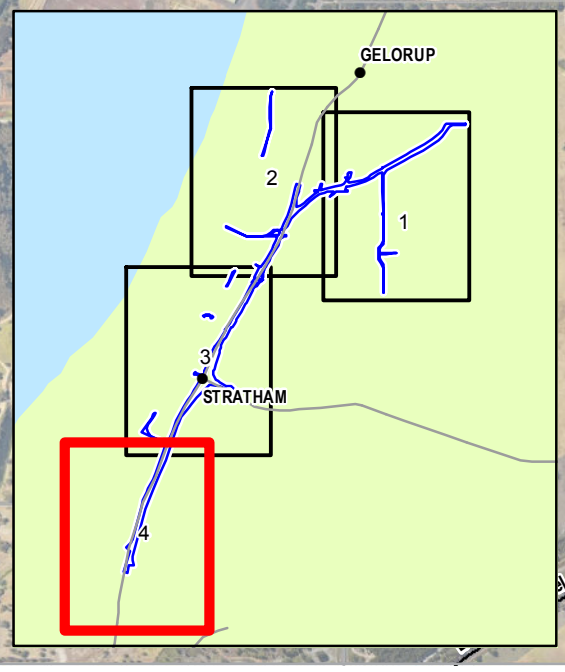
Mangles Rd
Roberts Rd
King Rd
Bussell Hwy
Cable Mine Rd
Yeardy Rd
John Hogg Rd
Hansen Rd
Urquhart Rd
Bentley Dr

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed

- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat



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Metres

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

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Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Black Cockatoos

Project No. **61-37041**
Revision No. **3**
Date **24/06/2019**

FIGURE 8

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Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
Map 2
GELORUP
NORTH BOYANUP
Map 1
Bussell Hwy
Map 3
STRATHAM
BOYANUP
STIRLING ESTATE
Map 4
CAPEL
ELGIN
Railway Rd
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUILDING OUR FUTURE
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

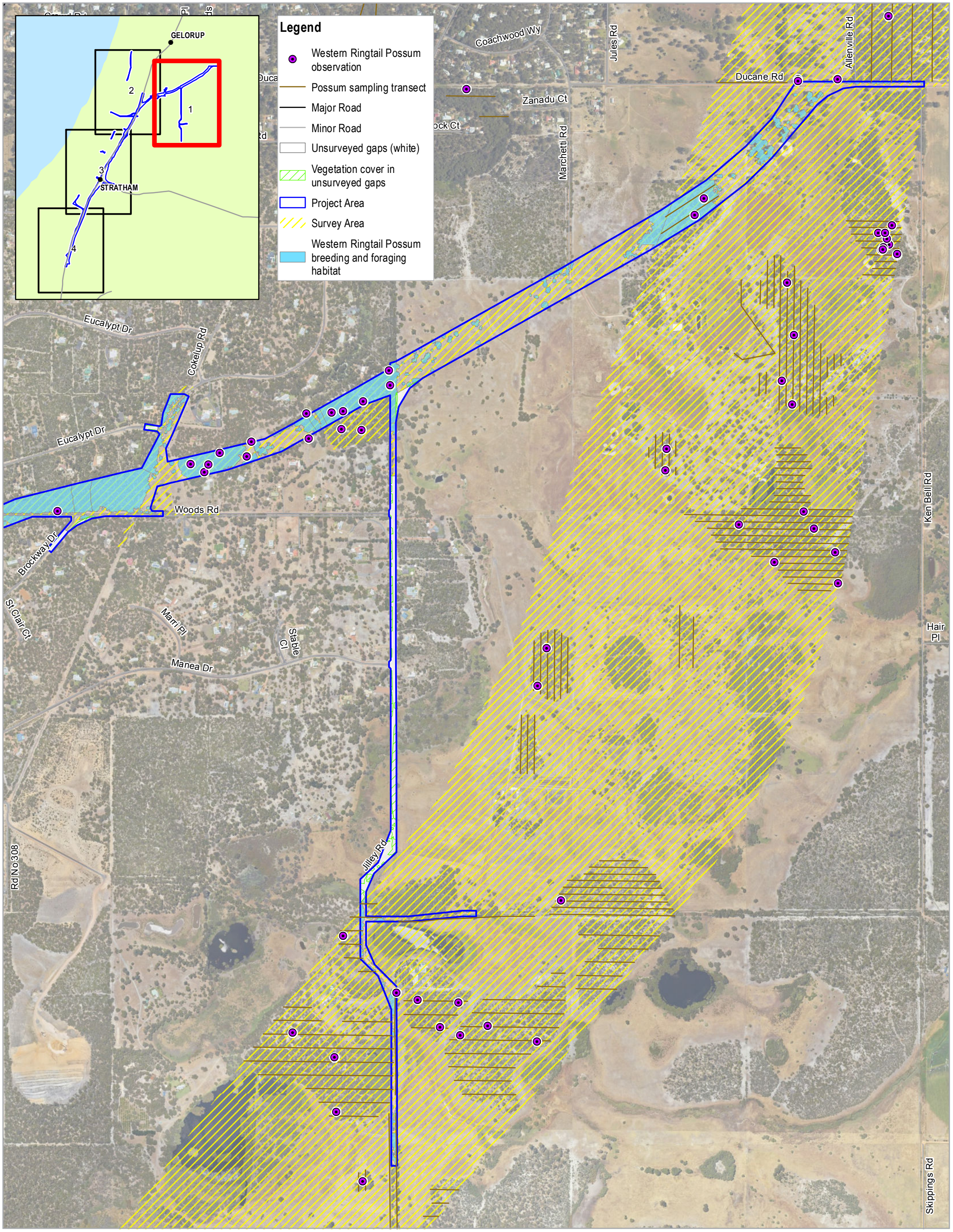
Western Ringtail Possums

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 9

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



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Metres

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

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Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

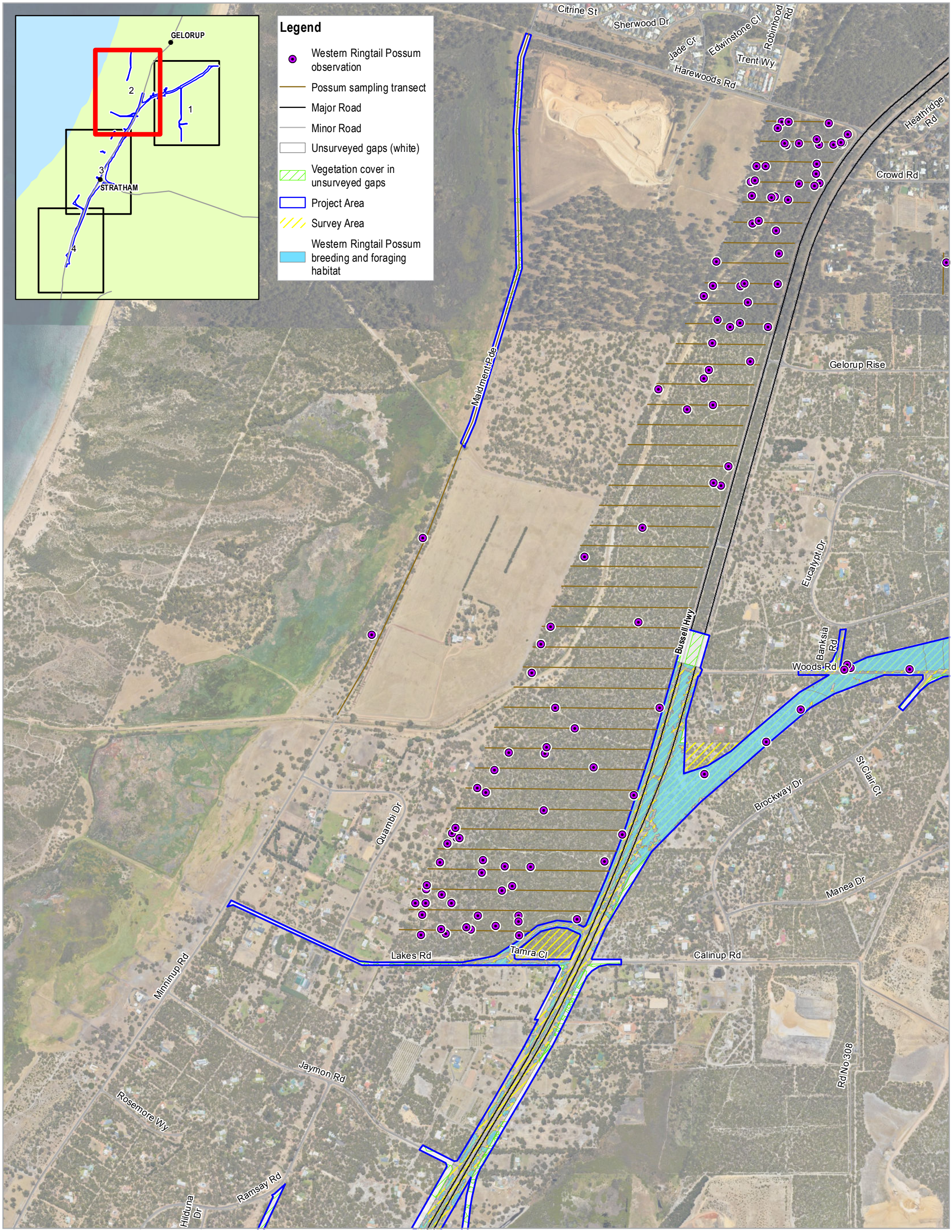
Western Ringtail Possums

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\61370 41_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:14

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190416; Biota: Fauna habitat, Possum observations - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

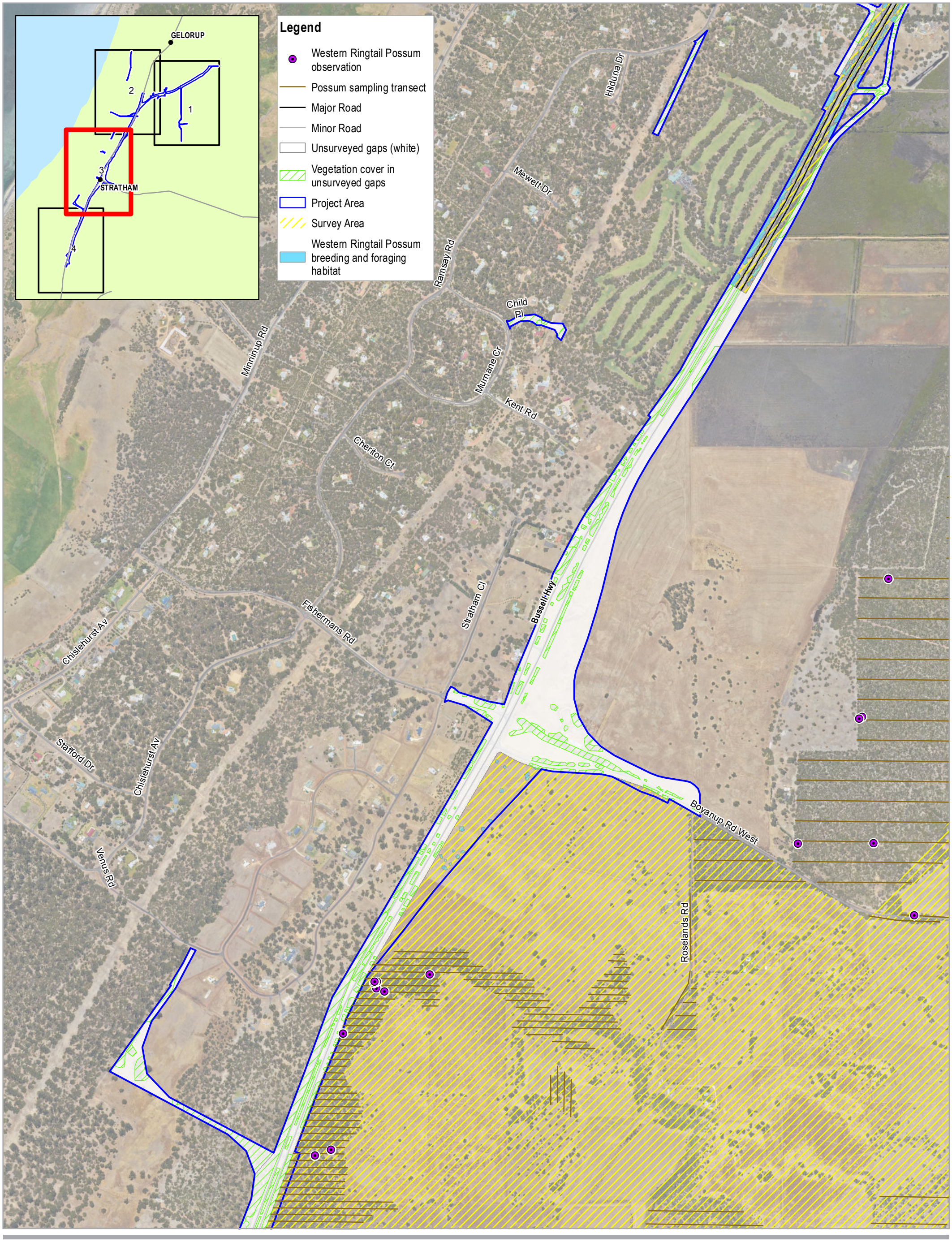
Western Ringtail Possums

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:14

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190416; Biota: Fauna habitat, Possum observations - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP: Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

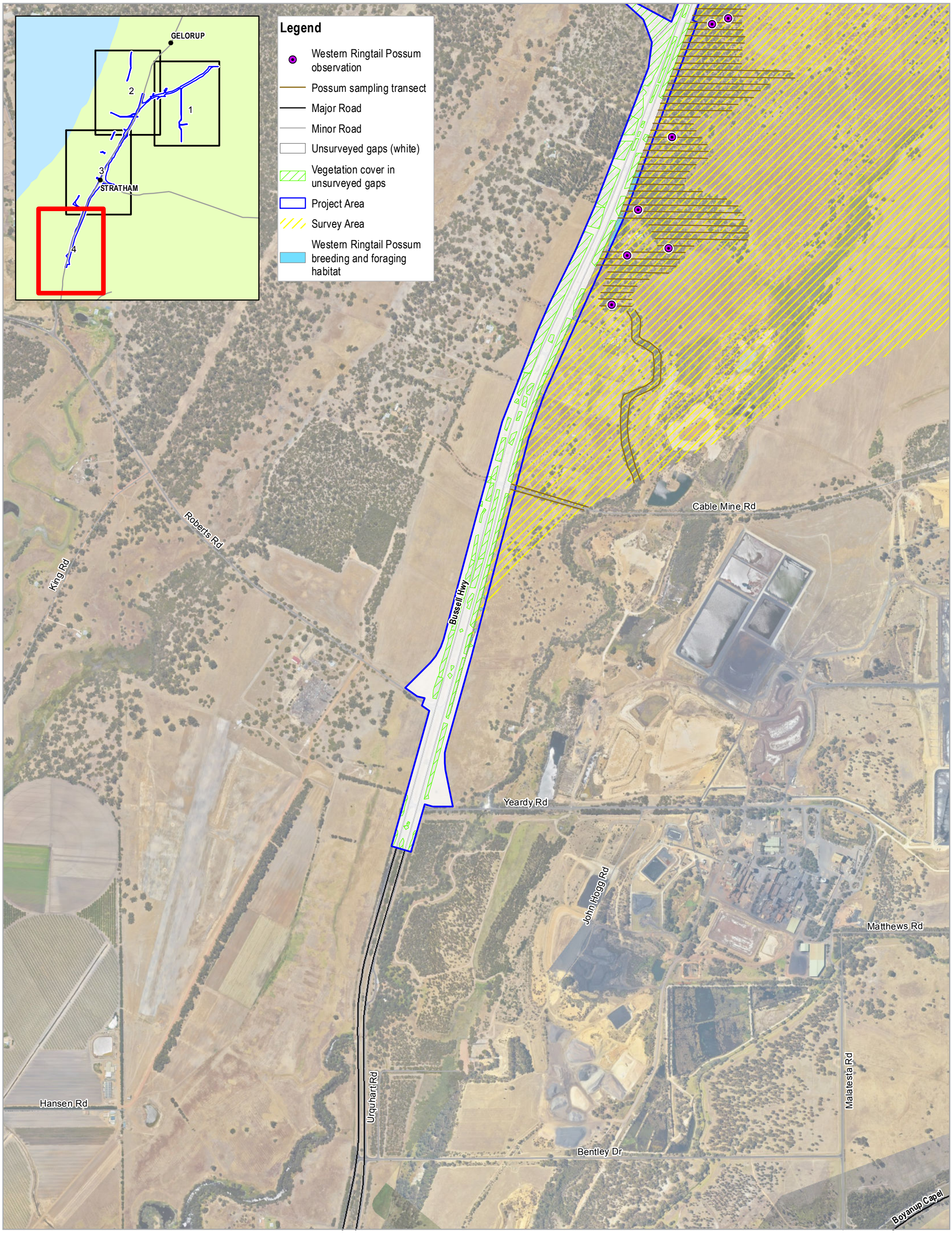
Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

Western Ringtail Possums

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:14

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190416; Biota: Fauna habitat, Possum observations - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Southern Section GBRS Alignment
Environmental Impact Assessment

Western Ringtail Possums

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:14

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190416; Biota: Fauna habitat, Possum observations - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
Map 2
GELORUP
NORTH BOYANUP
Map 1
Bussell Hwy
Map 3
STRATHAM
BOYANUP
STIRLING ESTATE
Map 4
ELGIN
Railway Rd
CAPEL
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

N

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

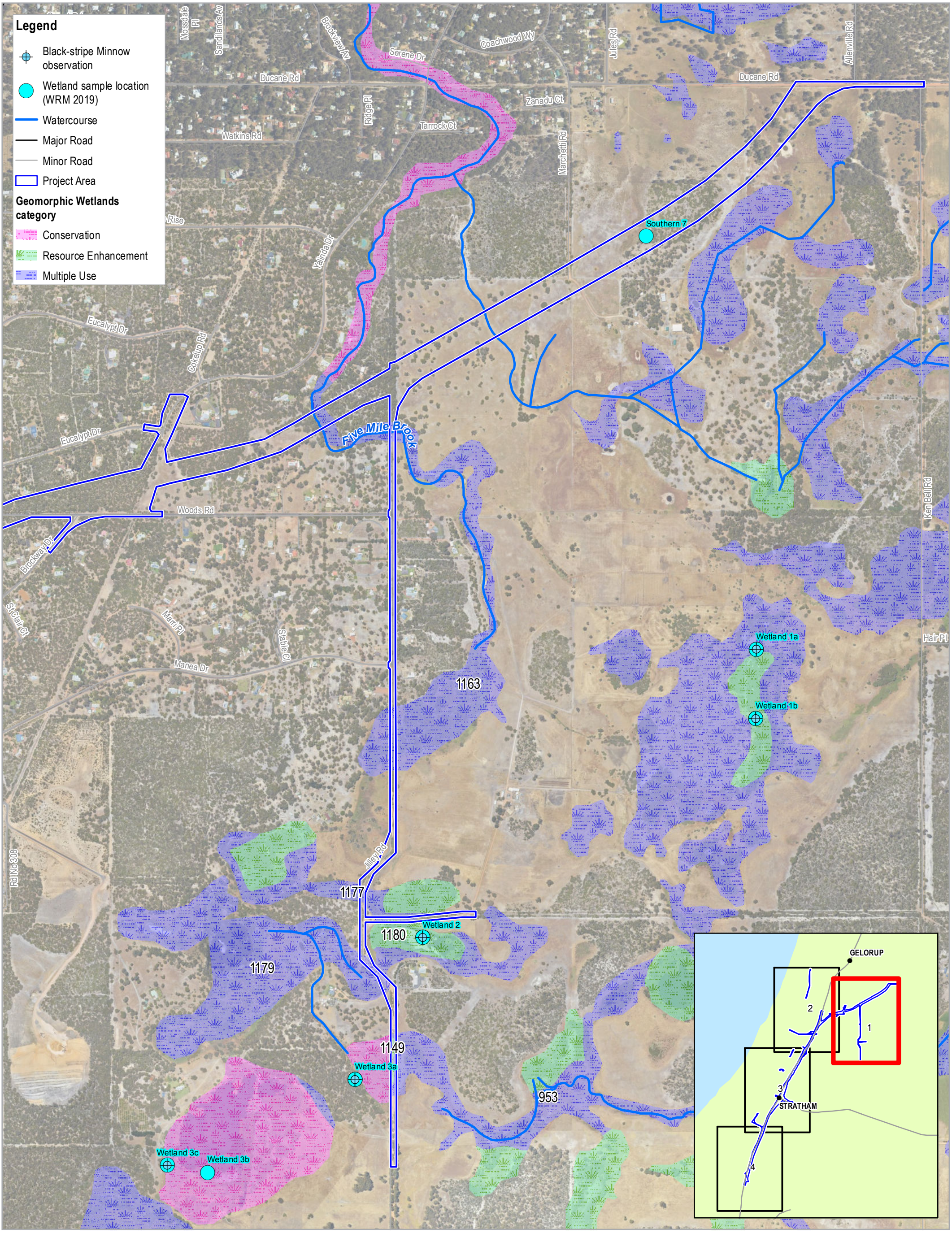
Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

OVERVIEW

FIGURE 10

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



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Metres

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

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BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 16:28

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations - 2019. Landgate / SLIP. Created by: mmikkonen

Legend

- Watercourse
- Major Road
- Minor Road
- Project Area

Geomorphic Wetlands category

- Conservation
- Resource Enhancement
- Multiple Use

Citrine St
Gamet Wy
Sherwood Dr
Jade Cr
Hornibrook Rd
Edwinstone Cl
Robinhood Rd
Trent Wy
Harewoods Rd
Heathridge Rd
Crowd Rd
Maidment Pde
Gelorup Rise
Bussell Hwy
Eucalypt Dr
Banksia Rd
Woods Rd
St Clair Ct
Brockway Dr
Quambi Dr
Manea Dr
Lakes Rd
Tamra Cl
Minninup Rd
Jaymon Rd
Rosemore Wy
Ramsay Rd
Hildina Dr
14478

GELORUP
STRATHAM
1
2
3
4

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

BORR Team

Australian Government
BUILDING OUR FUTURE

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 10

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Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations - 2019. Landgate / SLIP. Created by: mmikkonen

Legend

- Watercourse
- Major Road
- Minor Road
- Project Area

Geomorphic Wetlands category

- Conservation
- Resource Enhancement
- Multiple Use

Hilcuma Dr
Mewett Dr
Rich Rd
Ramsay Rd
Child Pl
Minninup Rd
Mumane Cr
Kent Rd
Cherlton Ct
Stratham Cl
Fishermans Rd
Chisiehurst Av
Stafford Dr
Venus Rd
Bussell Hwy
Boyanup Rd West
Roselands Rd

14478
1015
1016
1019
13229

GELORUP
STRATHAM
1
2
3
4

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

BORR Team

Australian Government
BUILDING OUR FUTURE

mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

Inland Waters

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 16:28

Data source: BORR: South Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations - 2019. Landgate / SLIP. Created by: mmikkonen

Legend

Watercourse

Major Road

Minor Road

Project Area

Geomorphic Wetlands category

Multiple Use

Mangles Rd

Roberts Rd

King Rd

Bussell Hwy

Cable Mine Rd

Yeardy Rd

John Higgs Rd

Matthews Rd

Urquhart Rd

Hansen Rd

Bentley Dr

GELORUP

STRATHAM

1

2

3

4

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

BORR Team

Australian Government

BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

Inland Waters

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 16:28

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Legend

- Major Road
- Minor Road
- Project Area

Acid Sulfate Soil Risk

- Moderate to low risk
- High to moderate risk

DALYELLUP
NORTH BOYANUP
GELORUP
Bussell Hwy
STIRLING ESTATE
STRATHAM
BOYANUP
ELGIN
Boyanup Capel
CAPEL
THE PLAINS

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

N

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

BORR Team

Australian Government
BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

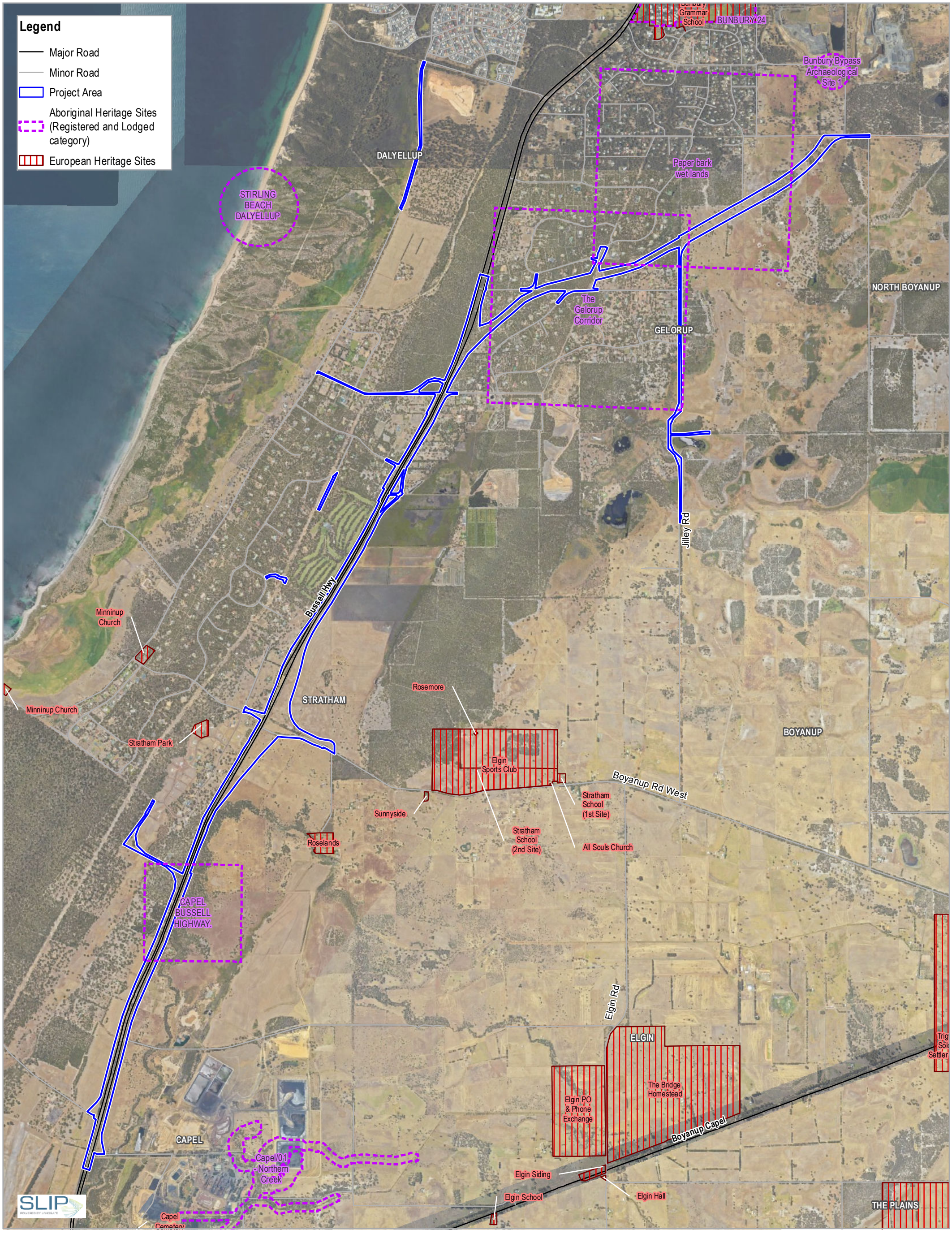
Acid Sulfate Soils

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 11

\\ghdnet.internal\ghd\AU\Perth\Projects\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_009_AcidSulfateSoils_Rev1.mxd
Print date: 24 Jun 2019 - 15:21

Data source: BORR: South Boundary - 20181212; Landgate: Imagery accessed on 20190416; MRWA: Road Network - 20180519; DWER: Acid sulphate soils - 201409, Contaminated Land - 20180615; Geoscience Australia: Geodata Topo 250k - 2006. . Created by: slei



Paper Size ISO A3

0 0.5 1 1.5 Kilometres

N

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section GBRS Alignment
Environmental Impact Assessment

Heritage Constraints

Project No. **61-37041**
Revision No. **1**
Date **27/06/2019**

FIGURE 12

G:\61\37041\19_0_GIS\Maps\Working\EIASouth\6137041_011_Heritage_Rev1.mxd
Print date: 27 Jun 2019 - 09:39

Data source: BORR Team: South Boundary - 201812; State Heritage Office: European heritage sites - 20190115; DAA: Aboriginal Heritage Sites - 20190627; Landgate: Aerial photography - Virtual Mosaic accessed 20190627, Roads - 2018. . Created by: mmikkonen

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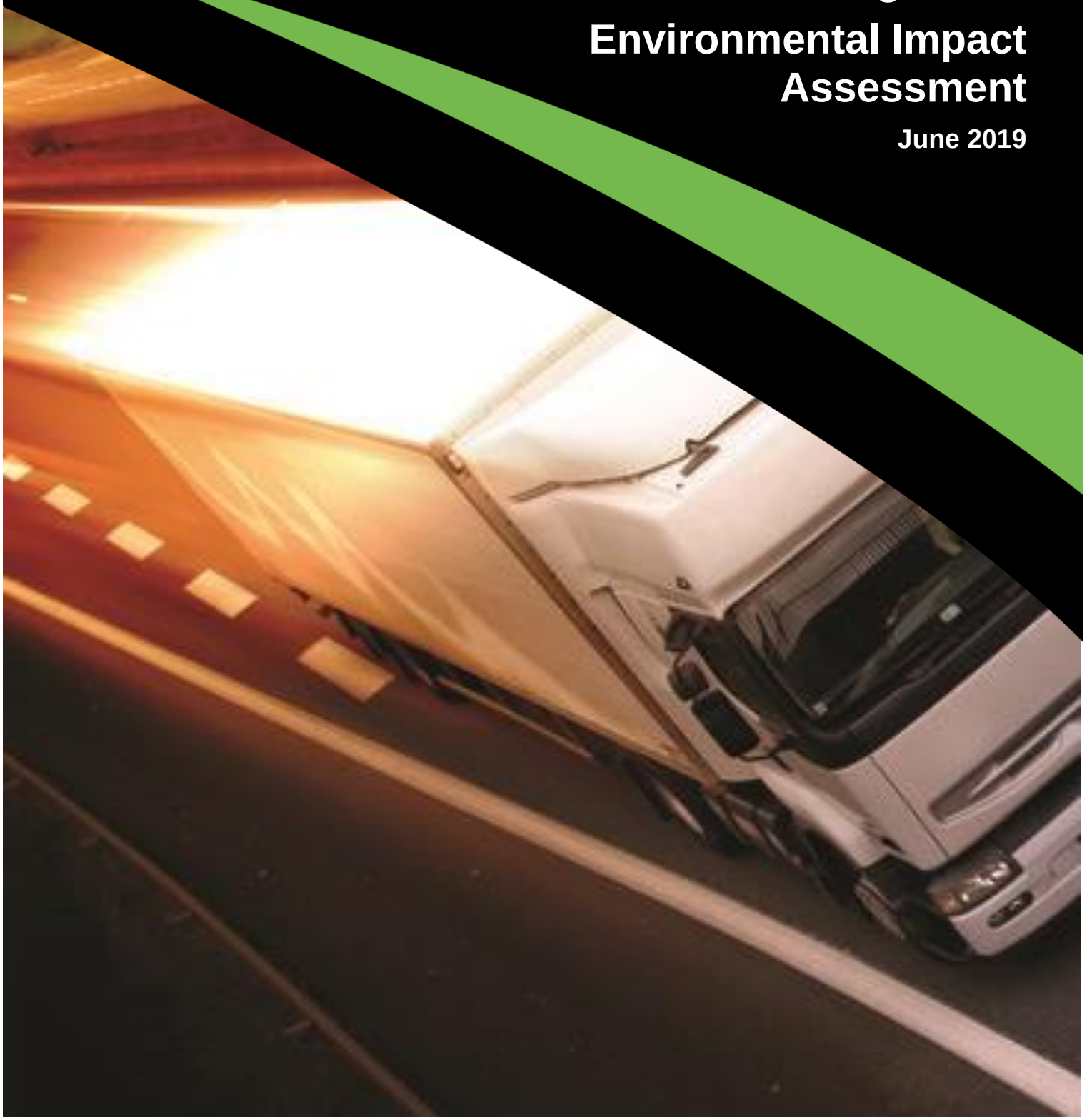
BORR Team

Bunbury Outer Ring Road Southern Section Alternative Alignment

Environmental Impact Assessment

June 2019



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Document *Control*

Revision	Date	Description	Prepared	Reviewed	Approved
A	15/2/2019	Draft for Main Roads Review	BORR Team	FH	PM
B	26/3/2019	Draft for Main Roads Review	BORR Team	FH	PM
C	18/6/2019	Draft for Main Roads Review	BORR Team	FH	FH
0	25/06/2019	Final Document	BORR Team	FH	FH
1	27/06/2019	Final Document Issued to Main Roads	BORR Team	FH	FH

1 INTRODUCTION

1.1 Background

The Commissioner of Main Roads Western Australia (Main Roads) is planning for the construction of the Bunbury Outer Ring Road (BORR). BORR is a planned Controlled Access Highway linking the Forrest Highway and Bussell Highway. The completed BORR will provide a high standard route for access to the Bunbury Port 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 land requirement for BORR was identified in the draft Greater Bunbury Region Scheme (GBRS), with the route advertised to the broader community as part of the GBRS assessment.

The proposed BORR comprises three sections:

- 'BORR Northern Section' – Forrest Highway to Boyanup-Picton Road
- 'BORR Central Section' – Boyanup-Picton Road to South Western Highway, an existing 4 km section which was completed in May 2013, along with a 3 km extension of Willinge Drive southwards to South Western Highway
- 'BORR Southern Section' – South Western Highway (near Bunbury Airport) to Bussell Highway.

The alignment of the BORR Northern and Central Sections are planned from Forrest Highway to South Western Highway and will be referred to the Environmental Protection Authority (EPA) in Q1 2019. The BORR Southern Section will provide a highway link between South Western Highway and Bussell Highway, and will link with BORR Northern Section and Port Access Road (PAR).

In November 2012, Main Roads referred the BORR Southern Section to the EPA for assessment under Section 38 of the *Environmental Protection Act 1986* (EP Act). In February 2013, the EPA determined that the BORR Southern Section did not require formal environmental assessment under Part IV of the EP Act and that the BORR Southern Section could progress under Part V of the EP Act and other relevant legislation. Clearing of native vegetation for the Southern Section would be approved under a Purpose Clearing Permit. An application for the clearing permit was submitted in December 2015 and withdrawn prior to a decision being made in June 2017. Main Roads also referred the BORR Southern Section to the Commonwealth Minister for the Environment through the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC, now DotEE) for a decision on the requirement for formal assessment under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In March 2013, the DotE (now DotEE) advised that the BORR Southern Section was considered a Controlled Action and would be assessed through preliminary documentation. Main Roads has since withdrawn the referral from DotEE assessment.

In response to changes to the EPBC Act's protection status of the Western Ringtail Possum in May 2018, from 'Vulnerable' to 'Critically Endangered', Main Roads identified that the approval to construct BORR Southern Section within the GBRS alignment may need to be reconsidered. To address this concern, Main Roads commissioned an Environmental Options Assessment of five options for BORR Southern Section (BORR IPT, 2018). The Environmental Options Assessment was a preliminary comparison document that was intended to be incorporated into the broader alignment selection planning process. The assessment confirmed that significant environmental factors for BORR Southern Section alignments included the clearing of native vegetation and the consequent removal of fauna habitat.

Two alignments were selected for further investigation, which were:

- BORR Southern Section GBRS Alignment
- BORR Southern Section Alternative Alignment.

A suite of field investigations was undertaken on both alignments in Q3 and Q4 of 2018. A 750 m wide corridor was investigated for the BORR Southern Section Alternative Alignment, in order to give the alignment flexibility to avoid any environmental constraints identified in the desktop and field investigations. This corridor was then narrowed down to approximately 100 m, which avoids the identified environmental constraints as far as practicable.

For the purposes of comparing the environmental impact of the two alignment options, this assessment considers a dual carriageway highway from Hasties Road in Gelorup to Yeardy Road in Stratham.

1.2 Purpose of this document

To inform the decision of the preferred project footprint, Main Roads commissioned an Environmental Impact Assessment (EIA) for each of the two alignments.

This EIA presents the environmental values and potential impact of the construction and operation of the BORR Southern Section Alternative Alignment (referred to as 'the Project' in this report).

Main Roads used the findings in this EIA to assist in their determination of the preferred BORR Southern Section alignment. The selected alignment will be subject to additional environmental assessment and reporting for the approvals process under the EP and EPBC acts.

This EIA addresses the Principles and Factors of Section 4A of the EP Act and is structured around the EPA's "*Instructions on how to prepare an Environmental Review Document"* (EPA, 2018a).

1.3 Project description

The Project is located 10 km south of Bunbury in the Shire of Capel and City of Bunbury. The Project is shown in Figure 1 and comprises the following elements:

- Construction of a 13.2 km dual carriageway highway between Hasties Road and Yeardy Mine Road
- Construction of interchanges at:
  - Bussell Highway (in the form of a Y-interchange)
  - Boyanup Road West (partial dumbbell interchange with north facing ramps only)
- Construction of two road underpasses to deal with access severance
- Upgrade of 23.5 km of service/local roads including:
  - Upgrade and sealing of Jilley Road
  - Upgrade and extension of Cable Mine Road to connect to Elgin Road
- Construction of drainage structures including basins and culverts
- Construction of 13.2 km of Principal Shared Path
- Installation of fencing and noise walls/treatments
- Service relocation and protection
- Construction of access roads to severed properties
- Pre-construction activities including geotechnical investigations and service utilities relocations
- Landscaping and rehabilitation works.

1.3.1 Project Area

The Project Area covers approximately 222 ha and is the boundary for this EIA (Figure 1). The Project Area includes an approximately 120-140 m wide corridor for the dual carriageway, as well as a number of ancillary roads. The majority of the land within the Project Area is cleared agricultural land with pockets of native vegetation present in road reserves or as isolated patches on agricultural land.

1.3.2 Surveyed and Unsurveyed areas

Access to the entire Project Area was not available when the environmental field surveys were completed in 2018 and the study areas differed slightly for each environmental field survey. As a result, approximately 21% of the Project Area was not surveyed during field investigations (Figure 2).

Unsurveyed Areas (identified in Sections 3.3.1 and 3.4.1) have undergone desktop investigations to inform this EIA. Additional field investigations will be completed in unsurveyed areas of the alignment if it is chosen for development as part of the formal environmental assessment.

The Southern Section (GBRS alignment) Study Area overlaps the Project Area by approximately 2 ha, therefore the total area surveyed within the Project Area was just over 174 ha.

Table 1-1 outlines the areas surveyed and gaps within the Project Area during the 2018 field surveys.

Table 1-1 Project Area, Surveyed and Unsurveyed Areas in the 2018 field surveys

DESCRIPTION	AREA
Project Area – Southern section (alternative alignment)	222.1 ha
Study Area – Southern section (alternative alignment) flora and fauna (excluding contextual sites) field surveys	Approx. 1,410 ha flora survey Approx. 1,463 ha fauna survey
Surveyed Area – (Southern section – alternative alignment) intersecting the Project Area	172.1 ha
Surveyed Area – (Southern section – GBRS alignment) intersecting the Project Area	2.2 ha
Unsurveyed Area – Gap in survey effort within the Project Area)	47.8 ha

1.4 Legislative framework

A summary of the anticipated regulatory approvals required for the establishment of the Project has been included in Table 1-2.

Table 1-2 Summary of regulatory approval requirements for the BORR Southern Section

PROJECT ACTIVITIES	TYPE OF APPROVAL	REGULATORY AGENCY	LEGISLATION REGULATING THE ACTIVITY
Potentially significant impacts to the environment	Division 1 of Part IV of the EP Act - referral and assessment of significant and strategic proposals Approval type to be determined if the Project is Assessed, Assessed on Referral Information or Not Assessed	Environmental Protection Authority (EPA)	EP Act
Impacts to matters of National Environmental Significance (MNES)	Referral of a Project to the Commonwealth – Approval type to be determined if the Project is deemed a Controlled Action	Department of the Environment and Energy (DotEE)	EPBC Act 1999
Clearing of Native Vegetation	Native Vegetation Clearing Permit 1	Department of Water and Environment Regulation (DWER)	EP Act 1986, Part V Div 2, EP (Clearing) Regulations 2004
Impacts to flora and fauna	Approval to take flora and fauna (if required)	Department of Biodiversity Conservation and Attractions	*Biodiversity Conservation Act 2016* (BC Act), Biodiversity Conservation Regulations 2018
Impacts to waterways	Bed and Banks Permit	DWER	*Rights in Water and Irrigation Act 1914* (RIWI Act)
Sourcing of construction water	Licence to take	DWER	RIWI Act
Impacts to Registered/Lodged Aboriginal Heritage sites	Section 18 consent	Department of Planning, Lands and Heritage (DPLH)	*Aboriginal Heritage Act 1972*
Impacts to Municipal heritage site	Consent from Shire	Shire of Capel	-

1.5 Limitations and assumptions

This report has been prepared by the Bunbury Outer Ring Road Integrated Project Team (BORR IPT) for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between BORR IPT and the Main Roads, as set out in section 1.2 of this Report.

BORR IPT otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. BORR IPT also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by BORR IPT in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. BORR IPT has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by BORR IPT described in this report. BORR IPT disclaims liability arising from any of the assumptions being incorrect.

BORR IPT has prepared this report on the basis of information provided by Main Roads and others who provided information to BORR IPT (including Government authorities), which BORR IPT has not independently verified or checked beyond the agreed scope of work. BORR IPT does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of infrastructure, services and vegetation, and access. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions may change after the date of this report. BORR IPT does not accept responsibility arising from, or in connection with, any change to the site conditions. BORR IPT is also not responsible for updating this report if the site conditions change.

This report has assessed the environmental impact within the Project Area, as shown in Figure 1. Should the Project Area change or be refined, further assessment may be required.

Approximately 21% (~48 ha) of the Project Area was inaccessible during the 2018 environmental field investigation and not surveyed. Desktop assessments were undertaken to identify potential impacts of the Project in the following unsurveyed locations:

- Jilley Road
- Fishermans Road
- Calinup Road
- Bussell Highway section (southern end of Project Area)
- Local roads north of Yeardy Road, including Cable Mine Road, Nicholls Road and Elgin Road.

If this alignment is chosen for development, additional field investigations will be completed of the unsurveyed areas as part of the formal environmental assessment process.

2 STAKEHOLDER CONSULTATION

Main Roads has been engaged in consultation with key stakeholders since the mid-1990s for the entire 'BORR Proposal'. Previous consultation undertaken by Main Roads with key stakeholders has included:

- Technical Working Group: with engineering and planning representatives from Main Roads, the City of Bunbury, the Department of Planning, the Department of Environment and Conservation, the Shire of Capel and the Shire of Dardanup
- The BORR Stakeholder Group: state and local government agencies that met as required and included: City of Bunbury (CEO, Mayor), Shire of Capel (CEO, Shire President), Shire of Dardanup (CEO, Shire President), Bunbury Port Authority, South West Development Commission (SWDC), Bunbury Chamber of Commerce and John Castrilli (Member for Bunbury)
- Consultation with: Department of Planning, Lands and Heritage (DPLH) (formerly Department of Planning), Public Transport Authority, Local Government, Service Authorities
- Consultation with environmental stakeholders including:
  - Commonwealth DotEE (formerly Department of Sustainability Environment, Water, Population and Communities)
  - DBCA (formerly Department of Environment and Conservation)
  - DWER (formerly Department of Water and Office of the EPA).

Stakeholder and community engagement is continuing with landowners and local residents, communities of interest, local government authorities and State Government agencies. During 2018 Main Roads consulted with key stakeholders to discuss 'BORR Project' issues and potential impacts, including environmental, heritage (Aboriginal and European), social and economic impacts.

A summary of consultation completed to date is shown in Table 2-1. Regulatory agencies that have been consulted to date are shown in Table 2-2. A summary of the key concerns raised during the stakeholder consultation to date is provided in Table 2-3, along with Main Roads responses.

Table 2-1 Consultation summary to date

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
Investment Logic Mapping (ILM) Workshop	4 December 2017	• Main Roads • South West Development Commission • Great Southern Ports • Qube (bulk minerals sand transporter).
Project Steering Committee	June 2018 – ongoing (bi-monthly)	• Chaired by MD Main Roads • Main Roads' Project Director • Department of Treasury • DPLH • Department of Infrastructure, Regional Development and Cities • Others by invitation.
Project Enabling Group	June 2018 – ongoing (bi-monthly)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
		• Shire of Dardanup • DPLH • BORR IPT.
BORR Regional Local Government Advisory Group (RLGAG)	August 2018 – ongoing (quarterly or at Key Milestones)	• Chaired by Main Roads' Executive Director Planning and Technical Services • City of Bunbury • Shire of Capel • Shire of Harvey • Shire of Dardanup • BORR IPT.
Economic Advisory Group	October 2018 – ongoing (at Key Milestones)	• City of Bunbury • Bunbury Geographe Economic Alliance (BGEA) • South West Development Commission (SWDC) • Regional Development Australia South West (RDASW) • Chamber of Minerals and Energy • Wespine • Bunbury Geographe Chamber of Commerce and Industry • Main Roads • BORR IPT.
Drainage Reference Group	August 2018 – ongoing (at Key Milestones)	• DBCA – Parks and Wildlife Service • DWER • Water Corporation • City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Department of Primary Industries and Regional Development (DPIRD) • Harvey Water • Leschenault Catchment Council • South West Catchments Council • BORR Team • Main Roads.
Freight and Road Users Group	August 2018 – ongoing (at Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • Department of Fire and Emergency Services (DFES) • DPLH • Department of Transport (DoT) • Freight and Logistics Council WA • Livestock and Rural Transport Association • PTA • RAC WA • WA Pilot Drivers Association.
Local Members meetings	Ongoing	• Member for Bunbury, Don Punch • Member for Collie- Preston, Mick Murray • Member for Murray- Wellington, Robyn Clarke • Nola Marino - Federal Member • Adele Farina, MLC.

STAKEHOLDER CONSULTATION	DATE	PARTICIPANT AGENCIES
BORR – Bunbury Freight Access Enhancement – Options workshop	25 January 2018	• DoT.
Presentation to Chamber of Commerce	14 November 2018	• Main Roads • Chamber of Commerce • BORR IPT.
Shire Project Briefing Meetings	May 2018 – ongoing (at Key Milestones)	• City of Bunbury • Shire of Capel • Shire of Dardanup • Shire of Harvey • Main Roads • BORR IPT.
Gnaala Karla Boodja WC1998/058 Native Title Claim group (GKB NTC) meeting	7 May 2018, 29 October 2018	• Brad Goode & Associates • Nine representatives from the GKB NTC group • DPLH • Main Roads • BORR IPT.
General public and local residents drop in sessions	24, 25, 30 and 31 October 2018	• Community members.
Project newsletter	2018	• Local community (distribution) • General public (via website) • Local Government Areas (distribution) • MLAs (distribution).
Community Reference Group Southern Alignment	July 2018 – ongoing (monthly)	• Community members.
Local landowners and residents	23 Oct 2018	• Landowners within BORR Southern Section Alternative Alignment • Residents (if renting within BORR Southern Section Alternative Alignment).
	11 December 2018	• Landowners meeting at Elgin Community Hall.
Local Community Group	December 2018	• Landowners within the BORR Southern Section Alternative Alignment.

Table 2-2 Agency consultation

AGENCY	DATE	PURPOSE
DWER – EPA	13/03/18	Project update
	05/09/18	Project update
	13/02/19	Project update
DotEE	25/5/18	Project briefing
	26/5/18	BORR site walk through – BORR Southern Section Gelorup
	17/07/18	Meeting at Main Roads head office, Don Aitken Centre (DAC) Perth- Project update
	08/10/18	Meeting at DAC - Project update
	14/2/19	Meeting at DAC - Project update
DWER – Environmental Regulation	25/5/18	Briefing South West Regional Office
	26/5/18	BORR site walk through – BORR Southern Section Gelorup
DBCA	25/5/17	BORR Project update
	13/11/17	Site visit BORR south wetlands
	30/7/18	BORR Project Update
	24/5/18	BORR and Western Ringtail Possum issues
	14/9/18	Western Ringtail Possum issues
	28/11/18	BORR Project update

Table 2-3 Summary of key concerns raised during consultation

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
CRG Members, Community members	CRG Meetings, Community Drop in Sessions,	**Need for BORR and Strategic Traffic Modelling Basis** There have been numerous enquiries by CRG members into the basis of population statistics used to inform the traffic model. More broadly there have been questions relating to the need for BORR.	There is already significant pressure on the road network around Bunbury, and this is projected to increase due to a number of factors including: • Population growth in Greater Bunbury • Proposed development in Wanju, Waterloo and surrounding areas • Increased freight movements, due to mining activity and associated growth in Bunbury Port activities. The existing road network in and around Bunbury supports a range of vehicle movements, including freight and light vehicles, regional and local traffic. These combinations of vehicles on local road networks impact on road safety and amenity. As a Port City, Bunbury plays an important role in the WA economy. Twelve per cent of the world exports of alumina leave from the Port of Bunbury. The current access to Bunbury Port is problematic, and impacts on freight efficiency. Currently, vehicles travelling between the Bussell Highway and Forrest Highway have to navigate 13 sets of traffic lights and one rail level crossing. When complete, between 10,000 and 15,000 vehicles per day on average are expected to use the new road. These regional / port movements would otherwise mix with local traffic on local roads. Population forecasts used in strategic traffic modelling come from the land use planning by the Department of Planning, Land and Heritage and it considers the City of Bunbury, Shire of Dardanup and Shire of Harvey and is based on planned land use changes forecast for the ultimate design life of BORR.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG members, impacted businesses	CRG Meetings, Community Drop in Sessions, Public Enquiries, Landowner Briefings	**Alternative Southern Alignment Investigations** Questions have been raised around why an alternative alignment has been investigated, what were the triggers and what investigations have been undertaken to assist in making a decision. Community members within the green alternative southern alignment voiced anxiety and mental health concerns in regards to the alignment uncertainty and potential for direct impact to their properties. Confusion between the Environmental Impact Assessment process for the southern alignment and the environmental referral process for the northern and central alignment.	Land for the southern alignment of BORR has been reserved within the Greater Bunbury Region Scheme for many years. It contains habitat for the Western Ringtail Possum, Black Cockatoo and Banksia Woodland Threatened Ecological Community (TEC), which are Federally listed. In May 2018, the Commonwealth changed the status of the Western Ringtail Possum under the EPBC Act from Vulnerable to Critically Endangered. This is the highest classification level possible before a species is declared extinct. When referring a project for environmental assessment it is necessary to demonstrate that there are not feasible alternatives with lesser environmental impact. As a result of the reclassification of the Western Ringtail Possum and the presence of other Matters of National Environmental Significance (MNES) such as the Black Cockatoo, investigations into an alternate alignment located further to the east (green alignment) have been undertaken to support the environmental referral process. These investigations including detailed site surveys have been undertaken in addition to those in the existing GBRS alignment to support preparation of Environmental Impact Assessments. The project team has consulted with landowners potentially affected by this alternative alignment. Following the completion of the consultation and the environmental surveys the findings will be presented to the landowners, the Community Reference Groups established for the BORR project and the wider community. Once an alignment has been selected based on the results of the selection study and design progressed, then the southern alignment will be submitted for referral.
CRG members, Community members	Norther & Central and Southern CRG meetings	**Western Ringtail Possum** Management of impacts to Western Ringtail Possums.	The Western Ringtail Possum (WRP) is critically endangered which means the Commonwealth Minister for the Environment is responsible for ensuring any approved actions by The Minister will not put the species at further risk.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		What studies were undertaken and by whom?	Regional surveys of the WRP were commissioned to more accurately estimate the population size and determine the potential impact of the BORR project on the WRP population. The methodology for these surveys was agreed with the Department of Biodiversity, Conservation and Attractions and the WRP Recovery Team. WRP studies were completed by specialist zoological consultants Biota Environmental Sciences and GHD. Investigations have been undertaken in the Southern SCP, Cape to Capes, Southern Forrest and Albany Areas to get a total estimate for the species.
		Will possums be relocated/translocated?	There are examples of successful relocations in the region. If we could do it successfully that would be wonderful but we and the federal regulator must be confident that any relocation would be successful. That confidence does not exist currently. This is something we need to better understand to ensure it is successful if adopted with no perfect solution available.
		Offset areas – have they been selected, what offset ratios will be applied and is there a maintenance budget for offsets?	Offsets have not been identified yet. This comes later in the process when the nature and extent of the impacts are known. Main Roads has a bank of offsets available with further acquisitions likely to be required depending upon values impacted. There is calculator used for determining offsets, which are generally greater in area than the impact. Budgets would depend on the offsets selected. There are examples where there are contributions to maintenance.
		If relocation fails what else is there? Are animals euthanised?	One of the challenges with the WRP is that there is no approved translocation program currently in operation. Other measures are available for birds, such as cockatoos. The first steps are to avoid or minimise impacts wherever possible. Native fauna are not euthanised.
		Fragmentation of possum/ fauna habitats.	Any alignment resulting in fragmentation will consider mitigation measures including bridges or underpasses.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG Members	Enquiries, Northern & Central and Southern CRG meetings, Drop in Sessions	**Longevity of GBRS Alignment** Queries about investigating an even more eastern alignment have been raised by numerous newly concerned communities including concerns about the redundancy of the GBRS alignment between Hasties Road and Bussell Highway. This has been raised specifically in the context of a future north south freeway grade road.	Currently there is no planning or consideration for a further outer ring road. The capacity provided by the BORR and existing roads will service the region well into the future. BORR is being designed to cater for the long term planning needs which includes catering for the transport movements of a future population of 200,000 people living in the Greater Bunbury area. The transport movement basis is built upon the Greater Bunbury Strategy (2013) report and includes consideration of the planned expansion of residential and industrial areas at Wanju, Waterloo Industrial Park and Picton Industrial Park as well as other investigation areas for potential urban development rezoning.
CRG members, Community members	Northern & Central and Southern CRG meetings, Drop in Sessions	**Environmental Approvals Process and Studies** The community has been highly interested in the types of environmental studies being completed to support the project.	An environmental impact assessment study including multiple investigations has been undertaken for the two proposed southern alignments. We are committed to ensuring that all environmental aspects of the project are completed with great sensitivity and in accordance with all State and Commonwealth legislative requirements. Detailed reports were completed for the Project Area including: • Targeted fauna (including Matters of National Environmental Significance MNES) assessment • Aquatic Fauna • Flora and Vegetation assessment • Wetland study • European Heritage survey. There are three opportunities in the environmental approvals process for the public to provide feedback, they are: • At the start of the process when the level of assessment is set; • In review of the information submitted by the BORR Team to the regulator/s; and

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			• In response to the Draft Ministerial Conditions that result if approval is granted.
		The process of submitting comments on the environmental referral. Concerns around the public comment period.	This is a formal process, managed by the responsible regulatory entity (Environmental Protection Authority) and is not a process managed by Main Roads. Detailed information can be found at www.epa.wa.gov.au .
CRG members, Community members	Northern & Central and Southern CRG meetings	**Flora and Fauna** How will impacts to flora and fauna be managed?	The alignment of BORR includes habitat for critically endangered species, as determined under the Commonwealth Governments *Environment Protection and Biodiversity Conservation Act 1999*. Avoidance is the first option for impacts, but where avoidance of impacts is not possible, minimisation of impacts is sought. In the BORR Northern Alignment selection report, the environmental criteria, alongside other criteria used in the multi criteria analysis, to assess options included: • Rare flora and native vegetation • Rare fauna, fauna habitat and TECs • Waterways or wetlands. When considering BORR interchange options and local connectivity options, assessment of the environmental criteria included: Wetlands (CCW and Resource Enhancement), remnant native vegetation, rare fauna (WRP), TEC's, European heritage and Aboriginal heritage.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
CRG members (local residents, road users and property owners/ farmers)	Northern and Central Community CRG Meetings (10/18, 11/18, 12/18)	**Social and Economic Bypass Impacts** Primacy of Bunbury and economic impacts of 'bypass'. Consideration of social and economic impacts on community business, particularly of severance on farmers. Formation of an economic advisory group was first discussed in the October North and Central CRG.	An Economic Advisory Group (EAG) was subsequently developed and chaired by the SWDC. KPMG has been commissioned by Main Roads to undertake a Social and Economic Study for the project as a whole. Impacts for the local farming community will be part of the assessment. The study will be in line with NSW Road Maritime Services Environmental Impact Assessment Practice Note – Socio-economic Assessment (EIA-N05)
		Economic impacts of BORR and impacts on businesses.	Bunbury is the gateway to the South West Region that has a strong economy built on mining, manufacturing, building and construction, agriculture, viticulture, aquaculture, forestry, tourism and emerging smart and creative industries, generating $13 billion in the 2016-2017 financial year. (SWDC, 2018) In addition, the Port of Bunbury is a large deep sea port which allows the berthing of commercial cargo vessels and is supporting the development of tourism by welcoming large tourist cruising passengers to our shores. The construction phase of the project will create jobs and provide economic benefits to the region. Once constructed, BORR will provide more efficient access for freight to the Bunbury Port, and enable the expansion of industrial centres, leading to more manufacturing, agricultural processing and local employment.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Noise Impacts** Community members along the alignment have raised concerns in regards to noise from vehicle traffic (particularly trucks), braking vehicles at interchanges and roundabouts and vehicles travelling over bridge joints.	The BORR Team is committed to managing the impacts of noise in line with the State Planning Policy 5.4 "Road and Rail Transport Noise and Freight Considerations in Land Use Planning" with the aim to protect communities from unreasonable levels of transport noise. The BORR Team has committed to undertake a noise study for the Ultimate Planning Design Concept of the southern section of the BORR. This noise study will be informed by the development of a noise model that will help to identify locations where noise mitigation may be required to comply with State Planning Policy 5.4. The noise model will consider topography, distances between properties and the road, road design levels, gradients and surface type and consideration of future projected traffic volumes and types. Existing noise in the study area will be recorded to be used in the model development.
Community members, CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Future Development Noise Mitigation** Impacts and management of noise to any future developments.	Where houses pre-date the road it is Main Roads' responsibility to mitigate. Where the road pre-dates the development, it is the developer's responsibility to comply with the policy.
CRG Members	Main Roads enquiries, CRG meetings and Community Drop In Sessions.	**Noise Modelling Assumptions** Assumptions used in developing the noise model in regards to exclusion of mitigation measures and choice of road surface treatments.	The noise modelling process is conservative and assumes a worst-case noise scenario to ensure likely noise exceedances are identified and appropriate management implemented.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Community members, CRG members	Main Roads Enquiries line, CRG Meetings, Community Drop In Sessions	**Light pollution and Visual Amenity** Impact of light pollution from street lights and vehicle headlights, as well as impacts to visual amenity as the result of construction of roads, associated interchanges, bridges and overpasses.	The EIA process considers impacts to visual amenity including lighting. This includes reporting potential visual impacts and identifying likely locations where design measures may be required to mitigate the impacts. Mitigation may include providing screening, which can take a variety of forms, including the construction of walls, earth mounds and planting of vegetation. Strategies will be developed to comply with the Australian Standard for lighting of public roads (AS/NZS 1158). 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. Visual amenity is also a key consideration of the Urban and Landscape Design Framework that has been prepared for the BORR Project.
Property owners	Main Roads Enquiries, Southern CRG (07/18, 12/18)	**Air and Water Quality.** Residents of some farming and residential properties, are not connected to scheme water and rely upon rainwater tanks as their primary source of potable water. Impact of traffic pollution particulate matter on water tank water quality is a concern to the community.	There is no comparative air quality policy or legislative requirement for pollutants from traffic in comparison to SPP 5.4 that deals with noise from traffic. Air quality modelling to the relevant standards will be completed to establish baseline conditions. National standards for air and water quality apply for land and water managed under the EP Act but not necessarily water in rainwater tanks. It is recognised that pollutants are emitted from diesel and petrol powered vehicles. The concentration levels of those chemicals have decreased with improved engine and fuel technology. Fuel used to have lead and sulphur additives but these have been removed or reduced in current vehicle fuels. Vehicle age is another factor with the average vehicle age around 10 or 11 years in Perth. As a result, the pollutants coming out of an exhaust pipe are steadily reducing over time. Pollutants in water tanks is a separate issue that is up to the land owner with various potential pollutant sources to consider.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Land Acquisition and Compensation Process** Property owners, particularly famers, are concerned about the impact of severance on their properties and businesses. Concerns include land compensation process and valuation, impacts to current and future business operations as well as social & mental health impacts that this will have on their families.	Main Roads appoints up to three independent land valuers and pays for the land owner to appoint a valuer of their choice. That valuation process includes business compensation. Main Roads can only compulsorily acquire land needed for the Project but can acquire small remnant land parcels through negotiations. We provide access to small parcels and if unviable it would be part of the compensation calculation.
		Timeline of land acquisition and ability for impact on broader project implementation timeline.	Main Roads are planning to deliver the Project and will progress the enabling tasks including talking to the owners of property required for the Project to try and agree an early settlement as part of a voluntary acquisition process.
Local community and road users CRG Members	Southern CRG meetings	**Local Access Changes on Journey Times** Is compensation payable as a result of impacts of local road severance on journey times?	Compensation is only payable where land is required for the Project. Main Roads will endeavour to ensure connectivity remains but it will change.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Property Severance** Property owners who are likely to have access to their properties altered or their land parcels split are concerned about how they will access their properties/land and how business as usual will take place.	Main Roads will provide access to the portions of land that are severed. Any associated economic loss is included as part of the compensation payable and depends on individual circumstances. Under the Act, we can't resume land that isn't required for road purposes. Main Roads often finds that if a convoluted route to provide access results, compensation will be payable. In some cases, other measures are considered to walk or even truck cattle.
Directly impacted property owners	Southern CRG meetings, Main Roads Enquiries	**Property Access** Property owners who are likely to have access to their properties altered are concerned about what form new access will take.	Any existing accesses affected by the ultimate design of the highway will require consideration of alternative routes. The planning, construction and funding of alternative routes will be undertaken by Main Roads WA as part of the Project scope. These works can include the provision of new service roads and upgrades or realignment of existing driveways.

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
			Main Roads do not generally provide slip lanes for individual properties as they are usually only provided for local roads. However, in some instances where there is a need due to higher traffic volumes or presence of trucks or a road safety risk, a slip lane can be provided. This will be assessed on a case by case basis. If access is required via adjacent privately owned land – we will undertake discussions with the landowners around access routes, acquisition and compensation.
Gelorup residents, local road users	Southern CRG Meeting (07/18, 9/18, 10/18, 11/18, 12/18, 2/19)	**Traffic and Safety** BORR connection to Gelorup via Hasties Rd due to increased traffic through community and past community infrastructure, interaction with school traffic and narrow road reserve. Concern was raised at numerous CRG meetings.	Centenary Road connection concepts options were subsequently developed and assessed as part of the Gelorup connectivity assessment. The Centenary Road connection is the preferred connection recommended by the BORR Team.
CRG Members, Fire Emergency Service, Shire of Capel	Southern CRG meetings	**Emergency Service Access and Emergency Egress** The effects of road severance on emergency access eg to allow firefighting and provide emergency egress to the community either side of the alignment.	BORR Team has undertaken consultation with the Shire of Capel and the Bush Fire Service to determine issues which will arise from severance to local roads and determined the requirements for the provision of additional water tanks and stand pipes. Local and access roads connections are being planned where existing local and access roads will be disrupted.
CRG members	Southern CRG meetings	**Impacts to Cultural Heritage** Potential for loss of cultural heritage.	Two European heritage sites intersect the Project Area (D.G. Burnside and Associates, 2019).
CRG members	Southern CRG Meetings (03/19)	**Impacts to Aboriginal Heritage** What was the source of data used to show aboriginal sites used to inform field investigations.	The source of mapped Aboriginal Heritage sites used to inform field investigations was publicly available data from DPLH. Consultation with representatives of the Gnaala Karla Booja WC 1988/058 Native Title Claim group were undertaken in May 2018 to discuss the northern alignment options in October 2018 to undertake archaeological

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		Concerns around the Aboriginal Heritage values and history of the assessment process and what additional studies are being completed.	surveys. Results of the studies identified that four river sites will be directly affected by bridge crossings. Two previously recorded archaeological sites and six heritage places were located, may be potentially be impacted. Archaeological reports will be submitted to the EPA alongside BORR Central and Northern referral documents.
CRG members	Southern CRG meetings	**Construction Impacts** Construction impacts on access to and from properties – particularly if there is an emergency such as a fire.	Bushfire and other emergency responses will be a prime consideration to manage during and after construction. Main Roads includes requirements to maintain emergency routes during construction in contracts. The same would apply to standpipes and other fire response assets.
		Construction noise/vibration and hours of works.	Point source noises (e.g. horns) and noises during construction are not subject to SPP 5.4. Details on the management of construction noises and vibrations will form part of the construction contract.
Drainage Reference Group (DRG)	DRG meetings	**Wetlands and Waterways** Concern in relation to two TEC (wetlands) located within the green alternative alignment. DBCA encouraged BORR Team to liaise with DBCA Wetlands unit.	The BORR Team has undertaken a wetland study within a portion of the Project Area as part of a survey located predominantly to the north. The BORR Team have liaised with DBCA officers where appropriate regarding TECs within the Project Area.
		Request for spill management for wetlands, outside of wetland buffers – and be based on risk based approach.	Main Roads has requirements around what is to be provided where spill control is required, but not around where spill control is required. Recommendations from DRG members were discussed.
Land owners	Landowner meetings	**Irrigation and Drainage** Concerns have been raised by landowners in relation to localised flooding impacting on access and egress to and from their properties under BORR.	BORR Team will undertake discussions with landowners to determine suitable alternate access where access will be directly impacted by BORR once a decision on the southern alignment has been made.
		Landowners have also raised concerns where investigations have been required in relation to use of	Prior to all investigations, landowners were contacted by BORR IPT for approval to access their land and landowners were consulted on the

AGENCY	FORUM	CONCERN RAISED	MAIN ROADS RESPONSE
		heavy machinery impacting on contours/ damaging drainage of their land.	proposed machinery details, size, weight etc to be used on their property. Investigations with machinery on land vulnerable to becoming waterlogged during wet months was timed to occur where possible prior to the onset of the wet season.
Drainage Reference Group (DRG) Members, Water Corporation	DRG (08/2018)	**Water Quality** Need for spill management (eg oil and chemical spills). Oil spill traps were initially only considered for water draining to sensitive environmental receptors (eg wetlands). Water Corporation indicated that spill protection was required upstream of their drains.	The BORR drainage strategy now includes the use of oil spill traps to Water Corporation drains.
DRG Members, Leschenault Catchment Council Inc.	DRG (08/2018)	**Water Quality** Nutrient stripping (via soil amendments using Iron Man Gypsum) in the buffer strip along the alignment.	Options were investigated, but it was identified that the major source of nutrients was farm land. Water, particularly in irrigated plots, is carefully managed on farms by paddock grading and is collected by drains and therefore, is unlikely to reach the road alignment. There is limited benefit and a very high cost for undertaking soil improvement measurements within the alignment.

3 ENVIRONMENTAL PRINCIPLES AND FACTORS

3.1 Principles

Section 4A of the EP Act establishes the object and principles of the Act. In accordance with the EPA's Statement of Environmental Principles, Factors and Objectives (EPA, 2018b), this section describes how each of the five principles of the EP Act has been applied to the Project (Table 3-1).

Table 3-1 *Environmental Protection Act 1986* Principles

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
The precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decision should be guided by: • Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and An assessment of the risk-weighted consequences of various options.	A wide range of comprehensive desktop and field studies were undertaken to assess the impact of the Project. Studies included: • Flora and vegetation • Terrestrial fauna • Inland waters • Amenity (noise and vibration) • Heritage (Aboriginal and European) • Air quality. Information gathered during these studies was used to inform the EIA and has reduced the uncertainty surrounding the prediction of impacts for the assessment. Main Roads has committed that the Project's design (where possible) avoids serious or irreversible damage to the environment. Various studies have been undertaken within and adjacent to the alignment for the last two decades. Impacts have been identified and described under each key environmental factor, and mitigation and management measures have been proposed to ensure they are environmentally acceptable.
The principle of intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Project will commit to maintain the health, diversity and productivity of the environment through retaining as much habitat as possible, establishing noise walls to reduce noise related impacts and maintaining access for property owners.
The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological	The Southern Alternative Alignment has large patches of limited biological diversity and ecological integrity. Main Roads has sought to preserve as much of the remnant biodiversity as possible by avoiding areas of native vegetation where practicable.

PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROJECT
integrity should be a fundamental consideration.	
Principles relating to the improved valuation, pricing and incentive mechanisms Environmental factors should be included in the valuation of assets and services. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	Main Roads acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors will greatly determine the location of road corridors, with the project having a strong focus on reducing its direct and indirect clearing footprint. Impacts on flora, vegetation and terrestrial fauna have been assessed and mitigation and management measures proposed. Main Roads accepts that the cost of the Proposal must include environmental impact mitigation, management and maintenance activities. These requirements will be incorporated into the overall Project costs. The Project will be subject to a sustainability rating, which will assess the environmental, social and economic impacts of the Project, including its waste stream and the resources utilised for construction. The Infrastructure Sustainability Council of Australia (ISCA) rating scheme is designed such that goals are established for a Project, then the Project is assessed against the achievement of those goals.
The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	The Project will be subject to an ISCA sustainability rating, which will assess the environmental, social and economic impacts of the Project, including waste minimisation and discharges resulting from the Project. Cut and fill principles will be utilised to minimise external fill requirements. Consideration of otherwise waste materials such as crushed concrete in road construction. The design for the Project includes drainage design to minimise the discharge of contaminated water into the environment. Management strategies will be implemented to ensure that the generation of waste during the construction phase is minimised. All activities shall be carried out with the principles of cleaner production and waste minimisation.

3.2 Identification of Key Environmental Factors

Environmental factors are those parts of the environment that may be impacted by an aspect of a Project. The EPA has 14 environmental factors, organised into five themes: Sea, Land, Water, Air and People.

The environmental factors and EPA objectives are provided in Table 3-2. The relevance of each factor to the Project is summarised and the Key Environmental Factors that require further consideration are identified.

Table 3-2 Identification of Key Environmental Factors

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR?
Sea			
Benthic communities and Habitat	To protect benthic communities and habitat so that biological diversity and ecological integrity are maintained.	No benthic communities or habitats will be impacted by this Project.	No
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	No coastal processes are expected to be impacted by this Project.	No
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected.	No impacts to marine environmental quality are expected from this Project.	No
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.	No impacts to marine fauna are expected.	No
Land			
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of native vegetation.	Yes
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	No significant changes to landforms are expected, as the Project will be constructed in a disturbed farmland area. Fill of palusplain will be required to ensure the road is dry and allow for water passage under the road, however no changes to significant landforms are expected.	No
Subterranean Fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	No impacts to subterranean fauna is expected from the road construction.	No

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR?
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	Construction will result in clearing of fauna habitat.	Yes
Terrestrial Environmental Quality	To maintain the quality of land and soils so that environmental values are protected.	Construction may impact one contaminated site. Some Acid Sulfate Soils are expected within the Project Area. The Project is not expected to result in an increased risk of salinization.	Yes
Water			
Inland Waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The Project area contains Conservation Category Wetland (CCW), Resource Enhancement (RE) and Multiple Use (MU) Geomorphic Wetlands, Gynudup Brook and File Mile Brook. The southern half of the Project Area occurs within a proclaimed Surface Water Area (the Capel River System) under the RIWI Act.	Yes
Air			
Air Quality	To maintain and minimise emissions so that environmental values are protected.	Dust will be generated during construction of the Project.	Yes
People			
Social Surroundings	To protect social surroundings from significant harm.	Aboriginal and European heritage aspects may be impacted during construction of the Project. Noise will be generated during construction and operation of the Project. Light spill will be generated during the construction and operation of the Project. Dust will be generated during construction of the Project. Visual amenity will be altered due to the construction and operation of the Project. Rural community amenity and agricultural production including loss	Yes

FACTOR	OBJECTIVE	RELEVANCE TO PROJECT	KEY ENVIRONMENTAL FACTOR?
		of productive land, reducing carrying capacity and restricted access are potential consequences of the Project.	
Human Health	To protect human health from significant harm.	No impacts to human health are expected.	No

3.3 Key Environmental Factor – Flora and Vegetation

3.3.1 Studies undertaken

The following field investigations have been undertaken for this aspect:

- BORR Southern Section Alternative Alignment Vegetation and Flora Study (BORR IPT, 2019a), which covered approximately 172 ha (~78%) of the Project Area
- BORR Southern Section Vegetation and Flora Study (BORR IPT, 2019b), which covered just over 2 ha (1%) of the Project Area.

The following locations were not field surveyed and have been assessed based on desktop information:

- Jilley Road
- Fishermans Road
- Calinup Road
- Bussell Highway section (BORR interchange to Cable Mine Road)
- Local roads north of Yeardy Road, including Cable Mine Road, Nicholls Road and Elgin Road.

The gaps in the survey effort total approximately 48 ha (22% of the Project Area) and are shown in Figure 2. Additional flora and vegetation survey effort at these locations will be undertaken if the BORR Southern Section Alternative Alignment is selected for development. For the purposes of this EIA, vegetation types and condition have been extrapolated for the gaps. This extrapolation was based on:

- DPIRD Native Vegetation Extent dataset (GoWA, 2019a) – used as the initial identification of vegetated / cleared area
- The areas that were not mapped by the DPIRD native vegetation dataset (GoWA, 2019a) were digitised based on aerial photography
- Assigning likely vegetation types / condition types based on nearby vegetation types assigned by BORR IPT (2019a and 2019b), aerial photograph and desktop information (soil type / broad vegetation mapping).

3.3.2 Receiving environment

Regional biogeography

The Project Area is located in the South West Botanical Province of WA (Beard, 1990) and experiences a Mediterranean climate, with hot dry summers and cool wet winters, with the majority of the rain falling in winter. The Project Area is located in the Swan Coastal Plain (SCP) bioregion and Perth (SWA2) subregion as described by the Interim Biogeographic Region of Australia (IBRA) (DotEE, 2016).

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and costal limestone. Heath and/or Tuart woodlands occur on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages and Marri on colluvial and alluvial soils. The subregion also includes a complex series of seasonal wetlands (Mitchell, Williams, & Desmond, 2002).

Broad scale (1:250,000) pre-European vegetation mapping (Beard, 1979) of the area has been completed at an association level. The mapping indicates that the Project Area intersects four vegetation associations:

- Medium woodland; Tuart and Jarrah (association 6) – occurs in the central and southern extents of the Project Area
- Shrublands; Teatree thicket (association 37) – very small portion in western extent of the Project Area
- Medium woodland; Jarrah, Marri and Wandoo (association 968) – occurs in the southern extent of the Project Area
- Mosaic: Medium forest; Jarrah-Marri / Low woodland; Banksia / Low forest; Teatree (*Melaleuca* spp.) (association 1000) – occurs predominantly in the northern extent of the Project Area.

Regional vegetation complex mapping, completed as an extension and consolidation of earlier mapping (Heddle, Loneragan, & Havel, 1980; Mattiske & Havel, 1998) indicates that four vegetation complexes are present within the Project Area (Webb, Kinloch, Keighery, & Pitt, 2016):

- Bassendean Complex – Central and South: Central and South: Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) – *Allocasuarina fraseriana* (Sheoak) – *Banksia* species to low woodland of *Melaleuca* species, and sedgelands on the moister sites
- Karrakatta Complex – Central and South: Central and South: Predominantly open forest of *Eucalyptus gomphocephala* (Tuart) – *Eucalyptus marginata* (Jarrah) – *Corymbia calophylla* (Marri) and woodland of *Eucalyptus marginata* (Jarrah) – *Banksia* species. *Agonis flexuosa* (Peppermint) is co-dominant south of the Capel River
- Guilford Complex: A mixture of open forest to tall open forest of *Corymbia calophylla* (Marri) - *Eucalyptus wandoo* (Wandoo) – *Eucalyptus marginata* (Jarrah) and woodland of *Eucalyptus wandoo* (Wandoo) (with rare occurrences of *Eucalyptus lane-poolei* (Salmon White Gum)). Minor components include *Eucalyptus rudis* (Flooded Gum) – *Melaleuca rhaphiophylla* (Swamp Paperbark)
- 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.

Vegetation communities

BORR IPT (2019a and 2019b) mapped vegetation over approximately 174 ha (79 %) of the Project Area. The majority of the Project Area (~145 ha) has been cleared for agriculture and comprises of paddocks with isolated stands of native trees. Pockets of native vegetation are scattered throughout the Project Area. However, most of these vegetation remnants appear to have been subject to periodic grazing which has affected the diversity and structure of the mid and lower strata.

The Project Area is mostly low relief, flat to undulating plains with low-lying seasonally inundated depressions. Prior to clearing, much of the now agricultural areas would have comprised of *Eucalyptus marginata*/ *Corymbia calophylla* / *Banksia* spp. woodlands in higher relief areas with *Eucalyptus rudis* / *Melaleuca* spp. woodlands in the low, seasonally inundated areas.

A summary of the vegetation types, including potential corresponding SCP Floristic Community Types (FCTs) (Gibson, Keighery, Keighery, Burbridge, & Lyons, 1994), recorded within the Project Area during the BORR IPT (2019a and 2019b) assessments is presented in Table 3-3 and mapping is provided in Figure 3.

A summary of the unsurveyed areas and their vegetation descriptions (from desktop information) is presented in Table 3-4. Based on DPIRD Native Vegetation Extent mapping (GoWA, 2019a) and aerial photography it is estimated that approximately 17 ha of the 48 ha of unsurveyed area is native vegetation (~ 35%).

Table 3-3 Vegetation communities within the Project Area

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Cleared / Highly Disturbed This area is predominately agricultural paddocks but also includes; firebreaks, tracks, buildings, landscaping and yards. These areas had occasional isolated clumps of native trees, such as; *Eucalyptus* spp. *Corymbia calophylla, Agonis flexuosa* and/ or *Melaleuca* spp. There was little to no mid storey and the groundcover was dominated by introduced grasses (**Avena barbata*, **Bromus* diandrus and **Hordeum leporinum* and **Lolium rigidum*) and herbs (**Arctotheca calendula, *Ursinia anthemoides, *Hypochaeris glabra, *Lotus subbiflorus* and **Trifolium* spp.). Seasonally inundated areas, including man-made drains and dams, located within the lower lying areas of agricultural paddocks included patches of *Juncus pallidus*, *Leptocarpus* spp. *Typha orientalis* and **Rumex crispus.* Some areas of open water had aquatic species including *Lemna disperma*, **Callitriche stagnalis* and **Crassula natans*.	**144.7 ha** Completely Degraded	N/A 
Isolated native trees over a weedy herbland/grassland (VT01a-VT01c, BORR IPT (2018b) – VT09a, VT10) These areas had patches of native trees within agricultural paddocks. There was little to no mid storey and the groundcover was dominated by introduced grasses (**Avena barbata*, **Bromus diandrus* and **Hordeum leporinum* and **Lolium rigidum*) and herbs (**Arctotheca calendula, *Ursinia anthemoides, *Hypochaeris glabra, *Lotus subbiflorus* and **Trifolium* spp.). Variations included: • Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) • Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* (VT01b) • Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Banksia* spp. (VT01c) • *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT9a) • Mixture of planted and native vegetation.	**9.3 ha** (1a: 3.5 ha 1b: 2.8 ha 1c: 2.5 ha 9a: 0.4 ha 10: 0.1) All Degraded / Completely Degraded	N/A 

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (BORR IPT 2019 b - VT01) Open forest of *Eucalyptus marginata* and *Corymbia calophylla +/- Agonis flexuosa* with isolated occurrences of *Eucalyptus gomphocephala* over low open forest of *Banksia attenuata* over shrubland of *Hibbertia hypericoides*, *Macrozamia riedlei* and *Xanthorrhoea brunonis* over grassland of **Ehrharta* spp., *Briza maxima* over herbland of *Dasypogon bromeliifolius*, *Lomandra* spp. and *Phlebocarya ciliata* over open sedgeland of *Lepidosperma pubisquameum*.	**0.07 ha** 57% (0.04 ha) Very Good 43% (0.03 ha) Degraded to Completely Degraded	Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands (FCT 25) 
Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (VT02) Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland of *M. teretifolia* or *M. lateritia* over open sedgeland of *Juncus* spp. over herbland of **Rumex acetosella*, **Plantago lanceolata*, **Lotus subbiflorus* with **Callitriche stagnalis* in open water	**7.9 ha** 7% (0.6 ha) Good 27% (2.1 ha) Degraded 66% (5.2 ha) Completely Degraded	Wet forests and woodlands (FCT 11) 

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* (VT03) Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland of *Astartea scoparia* +/-*M. lateritia* over sedgeland of *Juncus pallidus* / *Lepidosperma longitudinale* over herbland of **Cotula coronopifolia*, **Lotus subbiflorus* and *Isolepis cernua* var. *setiformis* with **Callitriche stagnalis* in open water	**5.3 ha** All Degraded / Completely Degraded	Wet forests and woodlands (FCT 11) 
Woodland of *Banksia attenuata*, *Eucalyptus marginata* +/- *Agonis flexuosa* (VT06) Woodland of *Banksia attenuata, Eucalyptus marginata* and occasional *Agonis flexuosa* over occasional tall open shrubland of *Kunzea glabrescens* over a low open shrubland of *Hibbertia hypericoides* subsp. *hypericoides* over a herbland of *Desmocladus fasciculatus, *Ursinia anthemoides* and* *Hypochaeris glabra*	**6.4 ha** 44.1% (2.8 ha) Good 0.1% (0.004 ha) Good to Degraded 50.8% (3.3 ha) Degraded 5% (0.3 ha) Completely Degraded	Likely to be a degraded form of central *Banksia attenuata – Eucalyptus marginata* woodland (FCT 21a) 

VEGETATION TYPE DESCRIPTION	EXTENT WITHIN PROJECT AREA AND CONDITION	POTENTIAL CORRESPONDING GIBSON *ET AL.* (1994) SWAN COASTAL PLAIN FLORISTIC COMMUNITY TYPES (FCTS) AND INDICATIVE PHOTO
Woodland of *Agonis flexuosa, Eucalyptus marginata* and *Banksia attenuata* (VT07) and BORR IPT (2019b) – VT3) Low woodland of *Agonis flexuosa*, *Eucalyptus marginata* +/- *Banksia attenuata* over a grassland/ herbland of **Briza maxima, *Ursinia anthemoides* and* *Hypochaeris glabra*	**0.6 ha** 52% (0.3 ha) Degraded 48% (0.3 ha) Completely Degraded	FCT: Historically may have represented FCT25– Southern SCP *E. gomphocephala – A. flexuosa* woodlands 
Total Surveyed		**174.3 ha** **Native Vegetation (29.6 ha)** **Cleared (144.7 ha)**

Note: * introduced species

Table 3-4 Survey gaps – description of potential vegetation communities within the Project Area

SURVEY GAP	EXTENT WITHIN PROJECT AREA	NATIVE VEGETATION EXTENT	EXTRAPOLATED VEGETATION COMMUNITY	EXTRAPOLATED VEGETATION CONDITION
Jilley Road	2.1 ha	1.0 ha	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (VT09a) South of Manea Drive there is a dampland which is likely to be either VT 3 (Low open forest of *Melaleuca preissiana* and *Melaleuca rhaphiophylla*)	Degraded (6) to Completely Degraded (7)
Fishermans Road / Boyanup Road West	9.9 ha	3.0 ha	Initial section adjacent to cleared paddocks – cleared and Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) 680m west of Ramsay Road – cleared and Open forest of *Eucalyptus marginata*, *Corymbia calophylla* and *Banksia attenuata* on Karrakatta deep sands (BORR IPT 2019b - VT 1). Section of Boyanup Road West – *Banksia attenuata*, *Eucalyptus marginata* woodland (BORR IPT 2019 a - VT6).	Degraded (6) to Completely Degraded (7) Sections may be Good (4) or better (approx. 1.3 ha) remainder likely to be Degraded (6) to Completely Degraded (7)
Calinup Road	0.6 ha	0.2 ha	Cleared and scattered native trees – *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* with very occasional *E. gomphocephala* (BORR IPT 2019 b – VT09a)	Degraded (6) to Completely Degraded (7)
Bussell Highway	21.3 ha	5.8	Appears to be mostly scattered trees with some landscape plantings. Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) / with some planted trees and revegetation.	Degraded (6) to Completely Degraded (7)
North of Yeardy Road, to Cable Mine Road and Nichols Road and up to Elgin Road	13.9 ha	6.8 ha	Cleared with a combination of Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* (VT01a) and Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* (VT01b) with the creekline likely to be woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (VT02)	Degraded (6) to Completely Degraded (7) Creekline may be Good (4) to Degraded (6) (approx. 1 ha)
Total Unsurveyed gaps with the Project Area			**47.8 ha** **(Approx. 16.8 ha of vegetation and 31.0 ha Cleared)**	

Vegetation condition

The vegetation condition of the Surveyed Area within the Project Area ranged from Very Good (3) to Completely Degraded (7) (BORR IPT 2019a). The majority of the Project Area was in Completely Degraded condition (~156 ha, 89%) and comprised agricultural paddocks with isolated patches of trees.

Good (or better) vegetation was represented by three vegetation types, isolated trees of *Corymbia calophylla* and *Eucalyptus marginata*, *Eucalyptus rudis* and *Melaleuca rhaphiophylla* woodland, and *Banksia attenuata* woodland, totalling just over 3 ha (2%).

From interpretation of aerial imagery, the majority of the Unsurveyed Area is likely to be in Degraded or worse condition, with the creek-line along Cable Mine Road and vegetated sections of Fishermans Road potentially in Good condition (4).

A summary of the likely vegetation condition within the Project Area is provided in Table 3-5 and vegetation condition mapping is shown in Figure 4.

Table 3-5 Vegetation condition mapped (surveyed and estimated) within the Project Area

VEGETATION CONDITION	EXTENT MAPPED IN PROJECT AREA (ha)	EXTRAPOLATED EXTENT WITHIN UNSURVEYED AREA (ha)	TOTAL ESTIMATED EXTENT (ha)
Very Good	0.1	0.0	0.1
Good	3.4	2.3*	5.7
Good – Degraded	0.004	0.0	0.004
Degraded	14.7	0.0	14.7
Degraded - Completely Degraded	0.3	45.5	45.8
Completely Degraded	155.8	0.00	155.8
Total	**174.3**	**47.8**	**222.1**

* Approximate based on aerial photography (Good or better)

Dieback

No project specific dieback assessments or detailed mapping has been undertaken for the Project Area. However, the Project Area is considered to be a dieback susceptible area as it has water gaining areas and lies within the 600 – 800 mm rainfall zone (CALM, 2003a), receiving a mean annual rainfall of 726.1 mm (BoM, 2019). Given the level of previous disturbance it is expected that much of the Project Area would be dieback infested and/ or uninterpretable.

Threatened and Priority Ecological Communities

One Threatened Ecological Community (TEC) and two Priority Ecological Communities (PECs) were confirmed within the Project Area (BORR IPT 2019):

- Banksia Woodlands of the SCP TEC
- Banksia dominated woodlands of the SCP IBRA region PEC (FCT 21a)
- The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC (FCT25).

The extent and condition of each of these communities within the surveyed portion of the Project Area is summarised in Table 3-6 and presented in Figure 5. The State PEC (FCT21a) forms part of the Federal Banksia Woodland TEC, when condition and size thresholds are met (see BORR IPT 2019b for further information). State FCT 25 can also form part of the Federal Banksia Woodland TEC when composition aligns with the TEC and condition and size thresholds are met.

A total of 3.5 ha of native vegetation within the surveyed portion of the Project Area is attributed to the 'Banksia Woodlands of the SCP' TEC. Of this vegetation, <0.1 ha is also representative of 'the Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC and approximately 3.4 ha is representative of 'Banksia dominated woodlands of the SCP IBRA region' PEC.

The vegetation types 'Open forest of *Eucalyptus marginata*, *Corymbia calophylla*, *Banksia attenuata* and *Agonis flexuosa* on Karrakatta deep sands' (VT1) and 'Open forest of *Banksia attenuata* and *Agonis flexuosa*' (VT4) were inferred to be equivalent to FCT 25 based on geographic location, landforms and the species recorded within these vegetation types. These vegetation types contained isolated occurrences of *Eucalyptus gomphocephala*; however this is likely to be related to disturbance factors and the species is likely to have previously occurred within this area.

Mapping of the Tuart woodlands by DBCA (CALM, 2003b) shows that *Eucalyptus gomphocephala* woodlands with 0 to 9 % canopy cover and highly disturbed visible native understorey condition, have been mapped within this section of the Study Area, inferred to be equivalent to the PEC FCT 25. Consultation with Mr. Andrew Webb from DBCA (pers. comm. 2011 and 2015) has stated that the vegetation types with the Study Area represent FCT 25.

Based on aerial photography, there is the potential for Banksia TEC / Banksia PEC / Tuart PEC to occur along Fishermans Road and Boyanup Road West (1.3 ha).

An additional 2.4 ha of the 'Banksia dominated woodlands of the SCP IBRA region' PEC occurs that are not representative of the 'Banksia Woodlands of the SCP' TEC (these areas do not meet the condition / size thresholds for the TEC).

Table 3-6 Threatened and Priority Ecological Communities identified within the Project Area

COMMUNITY TYPE	EPBC ACT	DBCA	EXTENT IN STUDY AREA (ha)	POTENTIAL EXTENT IN UNSURVEYED AREA (ha)	APPROX. EXTENT WITHIN THE PROJECT AREA (ha)
Banksia woodlands of the SCP(TEC)	Endangered	Priority 3	**3.5** Very Good: 0.1 Good: 2.8 Degraded: 0.6	Possible along Boyanup Road West – 1.3	4.8
Banksia dominated woodlands of the SCP IBRA region (PEC) (VT6)	-	Priority 3	**5.9** Good: 2.9 Good to Degraded: 0.004 Degraded 3.0	Boyanup Road West – 1.0	6.9
The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP (PEC)	-	Priority 3	**<0.1** Very Good: <0.1	Possible along Fishermans Road (0.3)	0.4

Other significant vegetation

The Project Area traverses a number of waterways including tributaries of Five Mile Brook, Gynudup Brook, creeklines, small drainage lines and man-made drains, as well as seasonally inundated areas (wetlands). Vegetation associated with the riverine and wetland areas included remnant trees and shrubs (e.g. *E. rudis, Melaleuca preissiana* and *Melaleuca rhaphiophylla*) over introduced grasses and herbs, with mixed native sedges present.

There is approximately 13 ha of vegetation within the Project Area that occurs in association with a watercourse and/or wetland and is considered riparian. This vegetation has a restricted distribution and has been historically

impacted by extensive clearing throughout the area. Vegetation types that represent riparian/ wetland vegetation included:

- Woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* (VT02) – approximately 8 ha (<1 ha in Good, approximately 7 ha in Degraded/ Completely Degraded condition)
- Woodland of *Melaleuca preissiana* and *M. rhaphiophylla* (VT03) – approximately 5 ha (all in Degraded/ Completely Degraded condition. It is expected additional occurrence of this vegetation will be present in the Unsurveyed Area along Cable Mine Road.

Conservation reserves and areas

There are three conservation reserves within 5 km of the Project Area (GoWA, 2019a). Two reserves are Crown Land, vested to the Conservation Commission of WA and managed by DBCA. These reserves are:

- 'Roselands Nature Reserve', located adjacent to the Project Area on Boyanup West Road
- 'Un-named Nature Reserve', located 1.4 km south of the Project Area at Fishermans Road.

The third reserve is the Tuart Forest National Park, which is located 1 km south of the Project Area at Fishermans Road.

Environmentally Sensitive Areas

There are numerous Environmentally Sensitive Areas (ESAs) within 5 km of the Project Area and three ESAs which intersect the Project Area (GoWA, 2019a). The Project Area intersects:

- The buffered extent of one ESA associated with Roselands Nature Reserve on Boyanup West Road (note: buffered extent only, does not include Roselands Nature Reserve itself)
- An ESA which is associated with a Conservation Category Wetland (UFI 955) and Gynudup Brook, north of Cable Mine Road
- An ESA which is associated with a Conservation Category Wetland (UFI 778), on Cable Mine Road.

Flora diversity

BORR IPT (2019a) completed a desktop NatureMap database search for the Southern Alternative Alignment Study Area (1,410 ha), of which approximately 174 ha intersects the Project Area. The database search identified 597 plant taxa, representing 88 families and 288 genera. This total comprised 497 native and 100 introduced flora taxa (DBCA, 2007-).

During the field assessment, BORR IPT (2019a) recorded 249 flora taxa (including subspecies and varieties) representing 54 families and 146 genera. This was recorded over 1,410 ha, of which 174 ha intersects the Proposal Area. Total flora taxa comprised of 172 native taxa and 77 introduced flora taxa.

Whilst the BORR IPT (2019a) Study Area did not cover the entire Project Area, it is considered it can be used as an indicator of flora diversity within the Project Area. The Project Area is considered to have moderate floristic diversity.

Conservation significant flora

No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys conducted in October and November 2018 (BORR IPT 2019a and b).

Roselands Nature Reserve, which lies adjacent to the Project Area (Figure 6), is known to support *Eleocharis keigheryi* (listed as Vulnerable) and five Priority listed flora (DBCA pers. comm 22 Jan 2019).The Priority flora recorded during the BORR IPT (2019a) field survey were *Acacia semitrullata* (P4) and *Chamaescilla gibsonii* (P3). The additional Priority flora reported to occur within the Study Area are *Wurmbea* sp. Cranbrook (A.R. Annels 3819) (P3), *Schoenus capillifolius* (P3), *Schoenus* sp. Waroona (G.J. Keighery 12235) (P3), *Ornduffia submersa* (P4) and *Aponogeton hexatepalus* (P4) (DBCA pers comms).

The location of Priority flora records within the vicinity of the Project Area is shown in Figure 5.

BORR IPT (2019a) completed a likelihood of occurrence assessment post-field survey for all conservation significant flora taxa identified in the desktop assessment. This assessment took into account previous records, habitat requirements, efficacy of the survey, intensity of the survey, flowering times and the cryptic nature of

species. The likelihood of occurrence assessment concluded that eight taxa are known, three are likely to occur, 15 taxa may possibly occur and the remaining 24 taxa are unlikely to occur within the Study Area.

The taxa that are known and likely to occur in the Study Area (1,410 ha) are listed in Table 3-7. Species that occur more than 5 km from the Study Area and had habitat present that was heavily grazed were considered unlikely to occur (BORR IPT, 2019a). As a conservative approach, it is considered that this likelihood of occurrence assessment also applies to the Project Area.

Table 3-7 Threatened flora known and likely to occur within the Project Area

TAXA	STATUS	LIKELIHOOD ASSESSMENT
Acacia semitrullata	P4	Known – recorded during GHD (2015) survey and this assessment.
Aponogeton hexatepalus	P4	Known – not recorded during the BORR IPT (2019a) survey but is recorded within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Caladenia speciosa	P4	Known – DBCA Database records show this species as occurring within the Study Area, however it was not located during this assessment.
Chamaescilla gibsonii	P3	Known – this species was recorded within Q23 (VT09). It is also recorded within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Eleocharis keigheryi	T	Known – not recorded during the GHD survey but is recorded within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Ornduffia submersa	P4	Known – not recorded during the GHD survey but is known to occur within Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).
Schoenus capillifolius	P3	Known – not recorded during the GHD survey but is known to occur within VT09.
Schoenus sp. Waroona (G.J. Keighery 12235)	P3	Known – not recorded during the GHD survey but is known to occur within VT09.
Schoenus benthamii	P3	Likely – this species occurs < 5 km from the Study Area and some habitat occurs within the Study Area.
Schoenus loliaceus	P2	Likely – this species occurs < 5 km from the Study Area and some habitat occurs within the Study Area.
Trithuria australis	P4	Likely – this species occurs < 5 km from the Study Area and some habitat occurs within the Study Area.
Wurmbea sp. Cranbrook (A.R. Annels 3819)	P3	Known – not recorded during the GHD survey but is known to occur with Roseland Nature Reserve (DBCA pers comm. 22 Jan 2019).

Introduced and invasive species

Two of the introduced taxa recorded by BORR IPT (2019a and b) within the Project Area, are listed as Declared Pests under the *Biosecurity and Management Act 2007* and one is also listed as a Weed of National Significance (WONS):

- **Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WONS
- **Zantedeschia aethiopica* (Arum lily) – Declared Pest.

Two additional Declared Pests (one of which is also a WONS) have been previously recorded within and to the north of the Project Area (approx. 2.3 km), however were not identified in the Project Area during the 2018 field survey. These species are also considered likely to be at risk of spread within the Project Area:

- * *Lantana camara* – Declared Pest and WONS
- * *Moraea flaccida*– Declared Pest.

**Moraea flaccida* was recorded during the survey undertaken in 2016 (Biota, 2016), however was not recorded in the current survey (BORR IPT 2019a and b). The locations of the Declared Pests are shown in Figure 3. The remaining introduced taxa recorded during the current survey are considered environmental weeds and all have been previously recorded on the SCP.

Comparison with other mapped vegetation

The vegetation within the Study Area broadly aligns with the mapped Beard (1979) vegetation associations and the Webb *et al*. (2016) vegetation complexes. Based on a review of species present, where possible, vegetation types were assigned a FCT. The FCT comparisons are provided in Table 3-3.

3.3.3 Potential impacts

The Project will potentially result in the direct loss of vegetation and flora through clearing of up to:

- The Project Area (222 ha), includes approximately 30 ha of mapped native vegetation (within the Surveyed Area of the Project Area), and a further estimated 17 ha of native vegetation identified via aerial imagery (within the Unsurveyed Area of the Project Area). The remainder of the Project Area (~176 ha) is considered to be cleared or highly modified
  - Within the Surveyed Area, 89% of native vegetation is in Completely Degraded condition, while only 2% is in Good or better condition
  - Within the Unsurveyed Area, native vegetation is expected (based on interpretation of aerial imagery) to be extensively in a Degraded to Completely Degraded condition. There is potential for a section of the watercourse along Cable Mine Road and Fishermans Road to be in Good or better condition (2.3 ha)
- A total of 3.5 ha of native vegetation within the Surveyed Area attributed to the 'Banksia Woodlands of the SCP' TEC (83 % in Good or better condition). Of this vegetation:
  - <0.1 ha is also representative of the 'Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC
  - 3.4 ha is representative of 'Banksia dominated woodlands of the SCP IBRA region' PEC
- An additional 2.4 ha of the 'Banksia dominated woodlands of the SCP IBRA region' PEC occurs that are not representative of the 'Banksia Woodlands of the SCP' TEC (these areas do not meet the condition / size thresholds for the TEC)
- 1.3 ha that may be representative of the 'Banskia Woodlands of the SCP' TEC in the unsurveyed area along Fishermans Road depending on the condition and vegetation type
- Approximately 13 ha of riparian vegetation, including < 1 ha (4 %) in Good and approximately 13 ha (96 %) in Degraded or worse condition
- No EPBC Act, BC Act or Priority listed flora species were identified within the Project Area, however 12 conservation significant species have been previously recorded or are likely to occur within the Study Area, including:
  - Known:
    - *Acacia semitrullata* (P4)
    - *Aponogeton hexatepalus* (P4)
    - *Caladenia speciosa* (P4)
    - *Chamaescilla gibsonii* (P3)
    - *Eleocharis keigheryi* (listed as Vulnerable)
    - *Ornduffia submersa* (P4)
    - *Schoenus capillifolius (P3)*
    - *Schoenus sp.* Waroona (G.J. Keighery 12235) (P3)
    - *Wurmbea sp.* Cranbrook (A.R. Annels 3819) (P3)
  - Likely:
    - *Schoenus benthamii* (P3)

- *Schoenus loliaceus* (P2)
- *Trithuria australis* (P4).

Clearing associated with the project may also impact:

- Native vegetation associations and complexes (Beard, 1979; Webb, Kinloch, Keighery, & Pitt, 2016) that have less than 30 % remaining at the local scale (Shire of Capel)
- Two ESAs (partial loss) associated with Conservation Category Wetlands.

The Project has the potential (if appropriate management and mitigation measures are not implemented) to result in the following indirect impacts to vegetation and flora:

- Fragmentation of native vegetation remnants within the local area
- Possible introduction and/or spread of dieback and weeds (WONS and Declared Pests) to adjacent native vegetation, including Roselands Nature Reserve
- Changes to vegetation structure and floristic composition in surrounding areas (including Roselands Nature Reserve) through altered surface water drainage patterns and flows
- Exposure of surrounding vegetation (including Roselands Nature Reserve) to greater indirect impacts, such as accidental generation of a bushfire.

3.3.4 Assessment of impacts

The assessment of impacts is presented (where possible) at a regional (Bioregion) and Local Government Area (LGA) scale. Information is also provided on the extent of vegetation within the broader BORR IPT (2019a) Study Area to supplement the local scale assessment.

For the purposes of this EIA, cumulative impacts have been assessed by comparing the known regional / local extents of vegetation associations / complexes and types against published information on their extent, to estimate the overall percent impact of the Project. Consideration of other future projects have not been included at this stage.

Regional and local significance

The pre-European vegetation mapping (Beard, 1979) has been adapted and digitised by Shepherd *et al.* (2002). The extent of the vegetation associations has been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (latest update March 2019 – GoWA 2019b).

The DPIRD Native Vegetation Extent database (GoWA, 2019a) was used as the basis to assess direct and cumulative impacts at a local, regional and bioregional scale for this EIA. To calculate the current extent remaining, intersects between the Native Vegetation Extent, and the Pre-European Vegetation and Vegetation Complexes – SCP datasets were completed (GoWA, 2019a).

As shown in Table 3-8, the current extents of vegetation associations 6, 37 and 1000 are less than 30% of their pre-European extent at the IBRA bioregion, IBRA subregion and within some of the Local Government Authority (LGA) levels. The current extent of vegetation association 968 is less than 10% of its pre-European extent at IBRA bioregion, IBRA subregion and within the Shire of Capel LGA.

GoWA (2019c) has assessed the vegetation complexes mapped by Webb *et al*. (2016) against presumed pre-European extents within the SWA IBRA bioregion (Table 3-9) and LGA levels (Table 3-10). All of the vegetation complexes within the Project Area have less than 30% of their pre-European extents remaining within the SWA IBRA bioregion. The Guildford Complex has less than 10% remaining within the SWA IBRA bioregion. Within the Shire of Capel, the Bassendean Complex – Central and South and the Southern River Complex both have less than 30% of their pre-European extents remaining. The Guildford Complex has less than 10% of its pre-European extent remaining within the Shire of Capel (GoWA, 2019c).

Table 3-8 Extent of vegetation associations mapped within the Project Area (GoWA, 2019b)

VEGETATION ASSOCIATION	SCALE	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING (%)	CURRENT EXTENT IN ALL DBCA MANAGED LAND (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Swan Coastal Plain IBRA Bioregion		1,501,221.9	579,813.5	38.6	38.5	26.2	<0.1	38.6
6	State: WA	56,343.0	13,362.3	23.7	39.8	2.3	<0.1	23.7
	IBRA Bioregion SCP	56,343.0	13,362.3	23.7	39.8	2.3	<0.1	23.7
	Sub-region: Perth	56,343.0	13,362.3	23.7	39.8	2.3	<0.1	23.7
	LGA: Shire of Capel	5,245.3	2,301.1	43.9	16.5	2.3	0.1	43.8
37	State: WA	39,296.5	24,727.2	62.9	20.9	<0.1	<0.1	62.9
	IBRA Bioregion SCP	15,617.9	5,404.7	34.6	41.0	<0.1	<0.1	34.6
	Sub-region: Perth	14,018.5	4,784.2	34.1	44.9	<0.1	<0.1	34.1
	LGA: Shire of Capel	1,737.0	484.6	27.9	9.9	<0.1	<0.1	27.9
968	State: WA	296,877.8	94,048.8	32.0	57.6	10.5	<0.1	31.7
	IBRA Bioregion SCP	136,188.2	9,017.3	6.6	21.6	10.5	0.1	6.6
	Sub-region: Perth	136,188.2	9,017.3	6.6	21.6	10.5	0.1	6.6
	LGA: Shire of Capel	6,657.3	660.4	9.9	3.5	10.5	1.6	9.8
1000	State: WA	99,835.9	27,768.8	27.8	18.6	13.5	<0.1	27.8
	IBRA Bioregion SCP	94,175.3	24,869.2	26.4	19.8	13.5	<0.1	26.4
	Sub-region: Perth	94,175.3	24,869.2	26.4	19.8	13.5	<0.1	26.4
	LGA: Shire of Capel	15,173.8	3,189.9	21.0	7.3	13.5	0.4	20.9

Table 3-9 Extent of vegetation complexes mapped within the Project Area (GoWA, 2019c)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING EXTENT (%)	CURRENT EXTENT REMAINING WITHIN ALL DBCA MANAGED LAND (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Bassendean Complex – Central and South	87,476.3	23,508.7	26.9	5.0	12.0	<0.1	26.9
Karrakatta Complex – Central and South	53,081.0	12,467.2	23.5	8.1	1.2	<0.1	23.5
Guildford Complex	90,513.1	4,607.9	5.1	0.3	10.6	0.2	5.1
Southern River Complex	58,781.5	10,832.2	18.4	1.6	2.4	<0.1	18.4

Table 3-10 Extent of vegetation complexes within the Project Area for the Shire of Capel (GoWA, 2019c)

VEGETATION COMPLEX	PRE-EUROPEAN EXTENT (ha)	CURRENT EXTENT (ha)	REMAINING EXTENT (%)	PROPORTION OF THE VEGETATION COMPLEX WITHIN THE LGA (%)	AMOUNT WITHIN THE PROJECT AREA (ha)	% OF CURRENT EXTENT WITHIN THE PROJECT AREA	% REMAINING AFTER PROJECT IMPACTS
Bassendean Complex – Central and South	4,946.6	1,162.2	23.5	5.7	12.0	1.0	23.3
Karrakatta Complex – Central and South	6,902.3	3,400.6	49.3	13.0	1.2	0.0	49.3
Guildford Complex	6,508.4	540.5	8.3	7.2	10.6	2.0	8.1
Southern River Complex	7,876.1	1,794.3	22.8	13.4	2.4	0.1	22.8

Note: red and orange indicate that less than 10% and 30%, respectively, of the pre-European extent remains before and after Project impacts.

Threatened and Priority Ecological Communities

Banksia Woodland TEC/ PEC

The Threatened Species Scientific Committee (TSSC 2016) provides information on the estimated extent of Banksia Woodland TEC within the SCP Bioregion. The TSSC advises that approximately 81,800 ha (~24 %) of the TEC occurs within reserves, most of which are in the Perth subregion of the SCP Bioregion (Table 3-11). This document also states that there is approximately 336,489.9 ha of Banksia TEC remaining within the SCP.

Table 3-11 Extent of the Banksia Woodlands ecological community estimated to be protected in reserves (TSSC, 2016)

SUBREGION	CURRENT EXTENT (ha)	EXTENT IN RESERVES (ha)	% PROTECTED
Dandaragan (SWA01)	81,067.8	24,671.2	30.4
Perth (SWA02)	253,540.6	57,054.9	23.0
Jarrah Forests (JAF01/02)	1,881.4	105.9	5.6
Total	336,489.9	81,832.2	24.3

Clearing associated with the Project would result in up to a 4.8 ha (0.001%) reduction in the reported extent of the Banksia TEC. Of this, 2.9 ha was rated as in Good or better condition. NB: Assessment of patches takes into account overall vegetation condition and therefore, areas of Banksia woodland can be included as part of a TEC patch if the condition is less than Good but the overall condition of the patch is rated Good or better.

This represents the maximum likely impact associated with the Project and includes 1.3 ha of potential Banksia woodland along Boyanup Road that requires additional survey to confirm if it meets the criteria for TEC condition and patch size.

Tuart Woodland PEC

The pre-European extent of the 'Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP' PEC is estimated to be 125,400 ha with approximately 17,060 ha (2015 indicative extent) or 14% of the pre-European extent remaining. Of this, 5,535 ha is reserved in 20 reserves (IUCN management categories I-IV) and comprise 22% of the remaining extent of the ecological community (DotEE, 2017a).

A total of 0.4 ha of native vegetation associated with this PEC is located within the Project Area. Clearing of this amount for the Project would represent a 0.002% reduction in the remaining extent of the PEC.

This total includes 0.3 ha along Fishermans Road which requires additional survey to confirm if it meets the criteria for TEC condition and patch size.

Threatened Flora

No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys undertaken in October and November 2018 (BORR IPT 2019a and b).

The Project is not expected to result in negative impacts on any EPBC Act or BC Act listed flora.

Priority Flora

No State listed Priority flora were recorded within the Project Area during the surveys undertaken in October and November 2018 (BORR IPT 2019a and b).

The Project is not expected to impact on any Priority listed flora.

3.3.5 Mitigation

The mitigation of impacts will be refined during the formal environmental assessment process and developed in consultation with Main Roads and key stakeholders if the alignment is selected as the preferred option. The following management and mitigation measures will be developed for this Project.

Impacts to flora and vegetation will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific Construction Environmental Management Plan (CEMP) that addresses issues specific to flora and vegetation including:
  - Complaints response site management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - ASS management
  - Dieback and weed management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.3.6 Predicted outcome

Based on the information available to support the EIA, the Project has the potential to result in residual impacts including:

- Clearing of approximately 46 ha of native vegetation, including:
  - Approximately 30 ha of mapped native vegetation, of which 2% is in Good or better condition and 89% is in Completely Degraded condition
  - Approximately 17 ha within the Unsurveyed Area that appears to include native vegetation (identified from aerial imagery), the majority of which is likely to be in Degraded or worse condition
- Clearing of vegetation associations (Beard, 1979) and complexes (Webb, Kinloch, Keighery, & Pitt, 2016) that are under-represented regionally and locally
- Permanent loss of TECs and PECs:
  - Banksia woodlands of the SCP (TEC) – approximately 3.5 ha
  - Banksia dominated woodlands of the SCP IBRA region (PEC) – approximately 6 ha
  - The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP (PEC) – less than 0.1 ha
- Loss of approximately 13 ha riparian vegetation associated with swamps and minor waterways / drainage lines
- Partial loss of two ESA's associated with Conservation Category Wetlands.

Given the extent of impacts to conservation significant communities (TECs/ PECs), loss of under-represented vegetation, riparian vegetation and Priority flora species, offsetting residual impacts may need to be investigated. Additional surveys will be required to address information gaps in unsurveyed area and confirm the likely outcome for flora and vegetation if this alignment is selected as the preferred option.

3.4 Key Environmental Factor – Terrestrial Fauna

3.4.1 Studies undertaken

The following field investigations have been undertaken for this aspect:

- BORR South GBRS Alignment Targeted Fauna Assessment and BORR Southern Alternative Alignment Targeted Fauna Assessment (Biota 2019a and 2019b respectively), which covered approximately 174 ha (77%) of the Project Area
- BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018).

The following locations were not surveyed and have undergone an assessment based on desktop information:

- Jilley Road
- Fishermans Road
- Calinup Road
- Bussell Highway section (BORR interchange to Cable Mine Road)
- North of Yeardy Road, around to Cable Mine Road and Nichols Road and up to Elgin Road.

The gaps in the survey effort total 47.82 ha and are shown in Figure 2. Additional fauna survey effort at these locations will be undertaken if the BORR Southern Section Alternative Alignment is selected as the preferred alignment option. For the purposes of the EIA, Biota 2019a and 2019b were used as the primary reference to identify fauna species occurring or likely to occur within the Project Area and fauna habitats occurring within the Project Area. The Biota field surveys included reference sites outside of the Project Area and all areas surveyed are referred to as the Biota Study Area. Parts of the Biota Study Area intersect the Project Area. These are referred to as Surveyed Areas. Sections of the Project Area were not covered by the Biota Study Area and are referred to as unsurveyed areas.

3.4.2 Receiving environment

Fauna habitat

Fauna habitat within the Surveyed Area were classified into three dominant habitat types (covering ~30 ha) (Biota 2019a and b) (Figure 7):

- Marri/Eucalyptus Woodland: Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) dominated over storey, varying understorey of Banksia (*Banksia attenuata* and *B. grandis*) or Peppermint (*Agonis flexuosa*) dominance
- Marri/Eucalyptus in paddocks and road reserves: Overstorey consisting of a scattering of mature Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) in upland areas, and Flooded Gum (*Eucalyptus rudis*) and Tuart (*Eucalyptus gomphocephala*) in low lying areas over introduced grasses
- Dampland with Melaleuca shrubland and/or woodland: dominated by *Melaleuca* spp. and sedges often in grazed paddocks. Vegetation comprised *Melaleuca raphiophylla* with scattered *Eucalyptus rudis* over mixed sedge species. In some wetland areas Peppermint *Agonis flexuosa* often co-dominant with *Melaleuca* spp.

The remainder of the Surveyed Area was classified as Cleared (~145 ha). The fauna habitat types are based on vegetation composition or features in the environment that fauna can utilise and includes scattered remnant paddock trees, as these are often suitable forging and or potential breeding (e.g. hollow-bearing trees) resources.

The description and area of each habitat type within the Surveyed Area is summarised in Table 3-12. A total area of approximately 30 ha fauna habitat occurs within the Surveyed Area. A total of approximately 17 ha of

potential fauna habitat has been estimated for the unsurveyed areas, based on interpretation of aerial imagery (Table 3-13). Therefore, the Project Area contains up to approximately 47 ha of fauna habitat.

Table 3-12 Fauna habitat types identified within the surveyed component of the Project Area

HABITAT TYPE AND DESCRIPTION	EXTENT WITHIN THE PROJECT AREA (ha)
Dampland with Melaleuca shrubland and/or woodland 	8.4
Marri/Eucalyptus woodland 	9.2
Marri/Eucalyptus in paddocks and road reserves 	12.0
Cleared	144.7
Total	174.3

Table 3-13 Survey gaps – description of potential fauna habitat within the Project Area

SURVEY GAP	EXTENT WITHIN PROJECT AREA	NATIVE VEGETATION EXTENT	POTENTIAL DESCRIPTION OF FAUNA HABITAT
Jilley Road	2.1 ha	1.0 ha	Marri/Eucalyptus in paddocks and road reserves. Dampland with Melaleuca shrubland and/or woodland (patch south of Manea Drive).
Fishermans / Boyanup West Road	9.9 ha	3.0 ha	Marri/Eucalyptus in paddocks and road reserves. Marri/Eucalyptus woodland (680 m west of Ramsay Road).
Calinup Road	0.6 ha	0.2 ha	Marri/Eucalyptus in paddocks and road reserves.
Bussell Highway (southern end of Project Area)	21.3 ha	5.8 ha	Marri/Eucalyptus in paddocks and road reserves.
North of Yeardy Road, around to Cable Mine Road and Nichols Road and up to Elgin Road	13.9 ha	6.8 ha	Marri/Eucalyptus in paddocks and road reserves. Dampland with Melaleuca shrubland and/or woodland (creekline).
Total Unsurveyed Gaps			**47.8 ha** (including an estimated 16.8 ha of fauna habitat and 31.0 ha Cleared/ High Modified land)

Fauna habitat value

The fauna habitat types recorded within the Project Area have both suitable foraging and potential breeding habitat for Black Cockatoos (Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo) and Western Ringtail Possum (Biota 2019a and b).

Approximately 21 ha of suitable native vegetation mapped within the Project Area was assessed as Very High Quality for Black Cockatoo species (Biota, 2019b). Only those areas comprising uniform stands of Melaleuca shrubs and Peppermint woodland were considered unlikely to contain foraging or breeding habitat.

Western Ringtail Possums were observed utilising habitats ranging from relatively isolated trees through remnant strips (along road reserves and riparian belts) surrounded by cleared land, to larger remnants of native vegetation.

The fauna habitat within the Unsurveyed Area is estimated to comprise approximately 17 ha of native vegetation which may provide additional habitat for conservation significant fauna species. The fauna habitat types within the Study Area and how they are used by conservation significant fauna species (possibly, likely or known to occur) are presented in Table 3-14.

Ecological linkages

The Project Area intersects a patch of remnant native vegetation that forms part of a South West Regional Ecological Linkage (SWREL) axis line (Molloy, Wood, Wallrodt, & Whisson, 2009). The ecological linkage connects large vegetation remnants west of Bussell Highway to large vegetation remnants in South Boyanup (approximately 7 km to the east). The vegetation patch intersected by the Project Area is approximately 19 ha and located between Jilley Road and Ken Bell Road. Within the vegetation patch, the Project Area is parallel to an existing Western Power corridor which also fragments the vegetation patch. The existing local roads (Cokelup, Jilley and Ken Bell roads) also intersect this SWREL.

On a local scale, vegetation along road reserves File Mile Brook and Gynudup Brook provide local ecological linkages that will be intersected by the Project Area. These linkages are likely to be used by conservation significant fauna (e.g. Western Ringtail Possum) as well as a number of more common mammals, birds, reptiles and amphibians.

Fauna diversity

Biota (2019b) completed a desktop NatureMap database search on their Study Area, which covers 77% of the Project Area, and has been used an indicator of potential faunal diversity within the Project Area. The database search indicated a species inventory of 220 vertebrate fauna species, comprising 24 mammals (13 native non-volant, one bat and 10 non-native), 160 birds (63 of which are largely reliant on freshwater or marine habitats), 27 reptiles and nine amphibians.

More than 1,250 individual fish were caught during the 2018 aquatic study (WRM, 2018), including three native and two introduced species. A total of 113 Black-stripe Minnow (listed as Endangered under the EPBC Act) were recorded across four wetlands sampled (comprising approximately 68 ha) in the Study Area, which are hydrologically connected to areas within the Project Area (Figure 8).

Other native aquatic fauna recorded included:

- Two freshwater fish species
  - South-western goby (*Afurcagobius suppositus*)
  - Swan River goby (*Pseudogobius olorum*)
- Two south-west endemic freshwater crustaceans
  - Gilgie (*Cherax quinquecarinatus*)
  - Koonac (*Cherax preissii*).

Conservation significant terrestrial fauna

The desktop review identified 22 conservation significant terrestrial fauna species within 10 km of the Biota Study Area (Biota, 2019b). Six conservation significant fauna species are known to occur within the Biota Study Area, including:

- Western Ringtail Possum (Critically Endangered)
- Carnaby's Cockatoo (Endangered)
- Baudin's Cockatoo (Endangered)
- Forest Red-tailed Black Cockatoo (Vulnerable)
- South-western Brush-tailed Phascogale, Wambenger (Vulnerable)
- Quenda, Southern Brown Bandicoot (Priority 4).

A likelihood of occurrence assessment was undertaken for 14 conservation significant terrestrial fauna (Biota, 2019b). Conservation significant species considered likely to possibly occur, and their habitat preferences, are summarised in Table 3-14. This likelihood of occurrence assessment on the Study Area is assumed to apply within the Project Area.

Table 3-14 Likelihood of occurrence for terrestrial conservation significant fauna species and their habitat availability within the Project Area

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DPAW PRIORITY LIST	LISTING UNDER EPBC ACT	LIKELIHOOD OF OCCURRENCE ASSESSMENT	FAUNA HABITAT TYPE		
					MARRI/EUCALYPTUS WOODLAND	MARRI/EUCALYPTUS IN PADDOCKS AND ROAD RESERVES	DAMPLAND WITH MELALEUCA SHRUBLAND AND/OR WOODLAND
Mammals							
Pseudocheirus occidentalis	Western Ringtail Possum	S1	CR	Occurs	Breeding, Foraging	Breeding, Foraging	-
Isoodon fusciventer	Southern Brown Bandicoot/ Quenda	P4		Occurs	Breeding, Foraging	Breeding, Foraging	Breeding, Foraging
Notamacropus irma	Western Brush Wallaby	P4		Likely to occur	Foraging	Foraging	-
Phascogale tapoatafa wambenger	South-western Brush-tailed Phascogale, Wambenger	S6		Occurs	Breeding, Foraging	-	-
Dasyurus geoffroii	Chuditch, Western Quoll	S3	VU	Possible	Foraging	Foraging	-
Falsistrellus mackenziei	Western False Pipistrelle, Western Falsistrelle	P4		Possible	Breeding, Foraging	Foraging	-
Hydromys chrysogaster	Water-Rat	P4		Possible	-	-	Foraging

SPECIES	COMMON NAME	LISTING UNDER BC ACT 2018 OR DPAW PRIORITY LIST	LISTING UNDER EPBC ACT	LIKELIHOOD OF OCCURRENCE ASSESSMENT	FAUNA HABITAT TYPE		
					MARRI/EUCALYPTUS WOODLAND	MARRI/EUCALYPTUS IN PADDOCKS AND ROAD RESERVES	DAMPLAND WITH MELALEUCA SHRUBLAND AND/OR WOODLAND
Reptiles							
Ctenotus ora	Coastal Plains Skink	P3		Possible	Breeding, Foraging	Breeding, Foraging	-
Birds							
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo	S3	VU	Occurs	Breeding, Foraging	Breeding, Foraging	-
Calyptorhynchus baudinii	Baudin's Cockatoo	S2	EN	Occurs	Breeding, Foraging	Breeding, Foraging	-
Calyptorhynchus latirostris	Carnaby's Cockatoo	S2	EN	Occurs	Breeding, Foraging	Breeding, Foraging	-
Falco peregrinus	Peregrine Falcon	S7		Likely to occur	Foraging	Foraging	-
Oxyura australis	Blue-billed Duck	P4		Possible	-	-	Foraging

Black Cockatoos

The Project Area (Surveyed Area) provides approximately 21 ha of suitable foraging and potential breeding habitat for Black Cockatoos (Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Cockatoo). During the field survey, Black Cockatoo individuals were recorded within the Study Area, as described below:

- 17 Forest Red-tailed Black Cockatoo individuals recorded from six observations
- 15 white-tailed Black Cockatoo individuals recorded from six observations (likely Carnaby's Cockatoo).

Black Cockatoo breeding habitat, as defined in the Commonwealth referral guidelines (DotEE, 2017b), includes:

- Relevant tree species with a suitable Diameter at Breast Height (DBH) to develop a nest hollow, where DBH is greater than or equal to 500 mm, herein referred to as 'Suitable DBH Trees'
- Trees with a hollow that meets the DotEE (2017) depth, width and angle criteria for nesting by Black Cockatoos, herein referred to as 'Trees with a Suitable Nest Hollow'
- 'Known Nesting Trees' are those trees that have secondary evidence of nesting i.e. feathers, eggs/ shells etc.

A total of 588 Suitable DBH Trees were identified within the surveyed component of the Project Area. The drone survey identified one Trees with a Suitable Nest Hollow. Two of these trees showed evidence as being Known Nesting Trees. Two trees with hollows were unable to be surveyed by the drone due to proximity to the road or foliage cover. Survey observations and future potential breeding tree locations are shown in Figure 9.

Due to their breeding distribution, Forest Red-tailed Black Cockatoo's are considered the most likely of the three cockatoo species to breed within the Project Area. However, all three species may potentially breed within the Project Area.

The unsurveyed area (~48 ha) is estimated to have approximately 17 ha of native vegetation which is potential Black Cockatoo breeding and/or foraging habitat.

Western Ringtail Possum

Biota (2019b) identified approximately 21 ha of suitable breeding and foraging habitat for Western Ringtail Possums within the Project Area (Surveyed Area), including Marri/Eucalyptus woodland and Marri/Eucalyptus in paddocks and road reserves. Western Ringtail Possums were recorded wherever woodland fragments (particularly mixed woodland) occurred (Biota 2019b).

Using possum density, Biota (2019b) assessed the importance of Western Ringtail Possum habitat within the targeted fauna Study Area, by direct comparison with habitat in four local contextual sites (within an 18 km radius of Bunbury town centre). Possum density was calculated based on the results of strip and distance sampling.

The estimated density and abundance of Western Ringtail Possums within the Biota Study Area is shown in Table 3-15. Based on the occurrence density, approximately nine individuals are estimated to occur within the Surveyed Area (~21 ha). The unsurveyed area (48 ha) is estimated to have approximately 17 ha of Western Ringtail Possum habitat. Based on a total potential habitat area of 38 ha (~21 ha within surveyed and ~17 ha within unsurveyed areas) and the occurrence density, the Project Area is conservatively estimated to support around 15 individual Western Ringtail Possums.

Biota (2019c) completed additional surveys to provide a regional context for the potential impacts from the Project on Western Ringtail Possums. At the time of writing, preliminary results from the additional surveys estimate the Western Ringtail Possum population for the southern SCP 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 Western Ringtail Possums, and is therefore considered to be a conservative estimate (i.e. lower than in reality). Based on the conservative estimate of Western Ringtail Possums within the Project Area (~15 individuals), the Project Area represents up to 0.3% of the regional population.

A summary of Western Ringtail Possum observations within the Study Area and within the contextual sites are shown in Figure 10.

Table 3-15 Western Ringtail Possum densities within the Study Area

STUDY AREA	WRP DENSITY RECORDED
Strip sampling (per hectare)	0.41
Lot 1 (Distance sampling) – contextual site	0.26 ± 0.16
Southern Lots	0.39 ± 0.11
Average density (WRP per ha)	0.4
Predicted abundance (across 21.2 ha surveyed area)	8.5

Quenda, Southern Brown Bandicoot

Evidence of Quenda was recorded within the Surveyed Area, in the form of diggings. The Surveyed Area provides suitable habitat for Quenda, which includes all three dominant fauna habitat types (Marri/Eucalyptus woodland, Marri/Eucalyptus in paddocks and road reserves and, Dampland with Melaleuca shrubland and/or woodland) (~30 ha).

The unsurveyed area (~48 ha) is estimated to have approximately 17 ha of potential Quenda habitat. From a review of aerial imagery, the remainder of the unsurveyed area (~31 ha) appears to be cleared land and is not likely to provide habitat for Quenda.

South-western Brush-tailed Phascogale, Wambenger

One South-western Brush-tailed Phascogale was observed within the Biota Study Area. The Surveyed Area provides approximately 9 ha of suitable habitat (Marri/Eucalyptus woodland) for the South-western Brush-tailed Phascogale.

Approximately 17 ha of native vegetation within the unsurveyed area (~48 ha) potentially represents South-western Brush-tailed Phascogale habitat. From a review of aerial imagery, the remaining 31 ha of the unsurveyed area appears to be cleared land and is not likely to provide habitat for South-western Brush-tailed Phascogales.

Conservation significant aquatic fauna

An aquatic fauna survey was undertaken by WRM in November 2018 (WRM, 2018). The survey focused on species of conservation significance within specific wetlands and waterbodies that were identified from aerial imagery to provide potential aquatic fauna habitat. No survey sites occurred within the Project Area, however all survey sites occurred within 600 m of the Project Area.

Black-Stripe Minnow and Western Mud Minnow

A total of 113 Black-stripe Minnow (*Galaxiella nigrostriata*) individuals were identified within the Study Area (WRM, 2018), although none were recorded within the Project Area. Two sites sampled recorded 29 Black-stripe Minnow from wetlands (site reference Wetland 2 and Wetland 3a) hydrologically connected to up to 0.3 ha of potential habitat within the Project Area (Figure 10).

The species population is known to disperse in years of high rainfall and have been historically recorded intermittently in some wetlands (MBS Environmental, 2009). Due to the high mobility of the species and high connectivity between wetlands in wetter years, it is likely that Black-stripe Minnow would migrate between wetlands, opportunistically utilising habitat within the Project Area.

Further field investigations will be undertaken if the alignment is chosen for development to further identify suitable habitat for Black-stripe Minnow and determine the likelihood of occurrence within the Project Area.

No Western Mud Minnows were recorded within the survey sites and are considered unlikely to occur within the Project Area.

Carter's Freshwater Mussel

Despite extensive survey effort, no Carter's Freshwater Mussel were recorded within the wider investigation area. This is likely due to the ephemeral nature of the sites sampled, and lack of suitable habitat (creek lines) within the investigation area.

South-Western Snake-Necked Turtle

The South-Western Snake-Necked Turtle (*Chelodina colliei*[1]) is endemic to the south-west of Western Australia and is listed on the IUCN Redlist of Threatened Species as Near Threatened (IUCN, 2018).

A total of seven South-Western Snake-Necked Turtles were recorded within the WRM Study Area.

This species is known to occur in both permanent and seasonal habitats, including rivers, lakes, farm dams, swamps, damplands and natural and constructed wetlands (Balla, 1994; Guyot & Kuchling, 1998). They can migrate relatively long distances overland if local conditions deteriorate (Dr Gerald Kuchling, UWA, pers. comm. (WRM, 2018)) and can aestivate to avoid drought in seasonal waterbodies for up to five to six months (Kuchling, 1998; Kuchling, 1989).

Since their diet includes tadpoles, fish, and aquatic invertebrates, South-Western Snake-Necked Turtles only eat when open water is present. In permanent waters, this species has two nesting periods (September-October and December-January), but in seasonal systems, nesting will only occur in spring. The main threats to these turtles are road deaths during movement in the nesting season and predation by feral animals (Bencini & Turnball, 2012).

Given the abundance of wetlands and surface water bodies in the area surrounding the Project Area, it is likely that South-Western Snake-Necked Turtles occur within the Project Area.

3.4.3 Potential impacts

The Project Area is predominantly cleared, with approximately 176 ha of the total 222 ha cleared or highly modified. The Project has the potential to directly and indirectly impact on fauna and fauna habitat in remaining areas during the construction and operational phases.

The potential direct impacts to species known to occur within the Project Area include:

- Clearing of approximately 46 ha of potential fauna habitat types across the Project Area (222 ha), which includes an estimated 30 ha of mapped fauna habitat (within the Surveyed Area), and a further approximate 17 ha of potential fauna habitat (within the unsurveyed area)
- Clearing of up to 38.0 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) breeding and foraging habitat (including 21.2 ha surveyed and 16.8 ha unsurveyed)
- A total of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two of which showed evidence of past use as Known Nesting Trees and two that could not be assessed by drone
- Clearing of up to 38.0 ha of Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed) and displacement of an estimated 15 individual Western Ringtail Possums, representing less than 0.3% of the regional population
- Clearing of up to 26.0 ha of South-western Brush-tailed Phascogale habitat (including 9.2 ha surveyed and 16.8 ha unsurveyed)
- Clearing of approximately 46 ha of Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 30 ha surveyed and 17 ha unsurveyed).

Potential direct impacts to species that have potential to occur within the Project Area include:

[1] This species was referred to as *Chelodina oblonga* in the past. However, there was some debate over species names and distributions. In 2013, the ICZN handed down its decision on nomenclature, with *C. colliei* given to the south-western snake-necked turtle, and *C. oblonga* given to the northern snake-necked turtle (previously *C. rugosa*).

- Potential loss of habitat for Black-stripe Minnow including up to 0.3 ha of Geomorphic Wetland intersected by the Project Area (where the species was recorded adjacent to the Project Area)
- Mapped fauna habitat for a further six conservation significant species that possibly occur within the Project Area.

Other potential direct impacts to fauna during construction and operations (to be mitigated through implementation of a CEMP and other mitigation measures detailed in the following sections) include:

- Temporary, localised impacts on aquatic fauna due to disturbance of wetlands and waterways
- Death or displacement of native fauna species from vehicle movements.

The Project may also result in the following indirect impacts to fauna including:

- Incremental loss of fauna habitat (fragmentation, barrier effects and edge effects)
- Displacement of native fauna species due to traffic noise exposure
- Displacement of native fauna species due to light spill from street lighting and traffic.

3.4.4 Assessment of impacts

Approximately 79% the Project Area is predominantly cleared, with approximately 175.7 ha of the total 222.1 ha already cleared or highly modified. Reduction of potential impacts on the environment was a key consideration in the selection of the alignment and identification of the Project Area. Further reduction in the potential impacts will occur through the detailed design phase should this alignment be selected for development.

Clearing and loss of habitat

The Project will result in the potential clearing of up to 46.4 ha of potential fauna habitat across the 222.1 ha Project Area. Further reduction to the clearing area associated with the Proposal will be achieved through consideration of impacts during the detailed design process.

Further discussion on potential impacts to conservation significant fauna is provided below.

Impact to conservation significant fauna

Clearing and operation of the Proposal has the potential to impact conservation significant fauna including:

- Black Cockatoos (up to 38.0 ha of potential habitat), including Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)
- Western Ringtail Possum (up to 38.0 ha of potential habitat) (Critically Endangered)
- Southern Brown Bandicoot (up to 46.4 ha of potential habitat) (Priority 4)
- South-western Brush-tailed Phascogale (up to 26.0 ha of potential habitat (Schedule 6)
- Black-stripe Minnow (less than 0.3 ha of potential habitat) (Endangered).

Black Cockatoos

The Project Area is located in what is generally considered to be the typical breeding distribution of the Forest Red-tailed Black Cockatoo, however all three Black Cockatoo species have breeding areas overlapping the Project Area (Biota, 2019b).

A total of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow. Two trees showed evidence of past use as Known Nesting Trees and two could not be assessed by drone.

Western Ringtail Possum

An estimated 15 Western Ringtail Possums may be displaced from the Proposal Area. Based on assessment of local and regional context sites covering 4,211.7 ha, the potentially displaced WRPs represent 0.3 % of the estimated regional population (Biota, 2019c). Furthermore, the 2019 southern SCP estimate does not include suitable habitat in the semi-urban and urban environment, which are known to be utilised be Western Ringtail Possums. As such, the 2019 estimate is considered to be conservative (i.e. lower than in reality).

Black-stripe Minnow

The Project Area intercepts up to 0.3 ha of Geomorphic Wetlands where the Black-stripe Minnow was recorded adjacent to the Project Area. However, the area of wetland potentially impacted by the Project is likely to be less than 0.3 ha, as part of the area mapped as wetland is an existing unsealed road.

The transverse drainage design will include culverts (or similar) to maintain fish passage movement (including Black-stripe Minnow) through the drainage network i.e. the drainage design will be sympathetic to fish movement requirements

Other potential impacts

There will be a temporary increase in secondary impacts such as noise, vibration, light and dust during construction. Increased noise, vibration and dust may result in native fauna avoiding the area. However, this is unlikely to have a permanent impact on fauna species in the area.

Vehicle strike

Operation of the Project will result in an increase in traffic/vehicle movements and therefore result in a greater risk of fauna strike from vehicle movements.

Habitat fragmentation

Incremental reduction in fauna habitat has restricted the distribution of a number of conservation significant species known to occur within the Project Area including Western Ringtail Possum and Black-stripe Minnow. As habitat is cleared, patch sizes decrease and the impact of 'edge effect' increases with likely introduction of weeds and dieback, ultimately changing the species composition of the vegetation community and reducing suitability of habitat for local fauna species.

The Project Area has been largely cleared in the past for agriculture purposes. This has resulted in fragmentation of both terrestrial and riparian/ wetland vegetation and ecological linkages, thereby reducing connectivity of fauna habitat.

3.4.5 Mitigation

As detailed in section 3.3.5, the mitigation and management measures for the Project will be developed and refined in consultation with key stakeholders if this alignment is selected as the preferred option. Impacts to fauna will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a CEMP that addresses issues specific to fauna including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Fauna management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.4.6 Predicted outcome

Approximately 79% the Project Area is predominantly cleared, with approximately 176 ha of the total 222 ha already cleared or highly modified. The Project has the potential to directly impact fauna species known to occur with the Project area including:

- Clearing of an estimated 46 ha of potential fauna habitat types across the Project Area (222 ha), which includes approximately 30 ha of mapped fauna habitat (within the Surveyed Area), and a further approximate 17 ha of potential fauna habitat (within the unsurveyed area)
- Clearing of approximately 38 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) breeding and foraging habitat (including 21 ha surveyed and 17 ha unsurveyed)
- A total of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone
- Clearing of up to 38 ha of Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed) and displacement of an estimated 15 individual Western Ringtail Possums, representing less than 0.3% of the regional population
- Clearing of approximately 26 ha of South-western Brush-tailed Phascogale habitat (including approximately 9 ha surveyed and 17 ha unsurveyed)
- Clearing of approximately 46 ha of Southern Brown Bandicoot, Quenda (Priority 4) habitat (including 30 ha surveyed and 17 ha unsurveyed).

Potential direct impacts to species that have potential to occur within the Project Area include:

- Potential loss of habitat for Black-stripe Minnow including less than 0.3 ha of Geomorphic Wetland intersected by the Project Area where the species was recorded adjacent to the Project Area (NB area of habitat potentially impacted by the Project is likely to be less than 0.3 ha, as part of the area mapped as wetland is an existing unsealed road)
- Mapped fauna habitat for a further six conservation significant species that possibly occur within the Project Area.

Given the potential for impact to conservation significant fauna (particularly Black Cockatoo species and Western Ringtail Possums) and loss of under-represented fauna habitat, environmental offsets to counter-balance the likely residual impacts of the Project will be investigated, should this alignment be selected for development. Additional surveys will be required to address information gaps in unsurveyed area and confirm the likely outcome for fauna if this alignment is selected as the preferred option.

3.5 Key Environmental Factor – Terrestrial Environmental Quality

3.5.1 Studies undertaken

Desktop data have been assessed for this aspect including DWER Contaminated Sites Database (DWER, 2018) and Acid Sulfate Soil risking mapping for the SCP (GoWA, 2019a).

No additional studies are considered likely to be required for this aspect.

3.5.2 Receiving environment

Geology

The SCP is comprised of five major geomorphological units, which lie more or less parallel to the coast. These geomorphological units are the Quindalup, Spearwood and Bassendean Dunes, the Pinjarra Plain and the Ridge Hill Shelf (McArthur & Bettenay, 1960; Churchward & McArthur, 1980). The Study Area lies within the Spearwood and Bassendean Dunes and the Pinjarra Plain. These three geomorphological units are broadly described as:

- Spearwood Dunes: Pleistocene and aeolian sands overlying Tamala limestone. Low dunes and swales of shallow pale grey sands over yellow sands are characteristic of the Spearwood system. Wetlands are associated with peats and carbonate sands, occasionally with clay overlaying sands
- Bassendean Dunes: Pleistocene sand dunes with very low relief, leached grey siliceous sand intervening sandy and clayey swamps and gently undulating plains. These occur immediately west of, and partly overlie, the Pinjarra Plain
- Pinjarra Plain: Broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. Major soils are naturally poorly drained with many swamps.

Desktop assessment of broad geological formations indicates that the Project Area occurs within three broad formations in addition to rivers and wetland areas (GSWA, 2009), which are outlined in Table 3-16.

Table 3-16 Geology, landform and soils information for the Project Area

FORMATION	GEOLOGICAL TYPE	GEOLOGICAL DESCRIPTION/ LANDFORM
Tamala Limestone	Qts	Sand associated with Tamala Limestone, high dunes
Guildford Formation	Qpa	Mainly alluvial sandy clay
Bassendean Sand	Qpb	Low rounded dunes

Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). In an undisturbed state below the water table, these soils are benign. However, if the soils are drained, excavated or exposed by lowering of the water table, the sulphides will react with oxygen to form sulphuric acid. Disturbance of these soils can flush acidic leachate to groundwater and surface waters, and cause off site environmental impacts.

ASS Risk Mapping for the Project Area indicated low to moderate risk of ASS, with minor areas of high risk associated with wetlands and watercourses (GoWA, 2019a). ASS Risk Mapping is shown in Figure 11.

Contaminated sites

The DWER *Contaminated Sites Database* presents information on known contaminated sites that have been classified by the DWER as one of the following:

- Contaminated – remediation required
- Contaminated – restricted use

- Remediated for restricted use.

The DWER *Contaminated Sites Database* does not provide details of the Sites that are listed as 'Possibly contaminated – investigation required' (PC-IR).

A further limitation to the DWER *Contaminated Sites Database* are unreported contaminated sites.

A search of the DWER *Contaminated Sites Database* indicates that one contaminated site may be impacted by the Project; Lot 105 on Plan 301891 at 105 Cable Mine Road. This site is part of a 15 parcel site that is classified as contaminated with restricted use. Groundwater beneath the site is impacted with elevated concentrations of ammonia, boron, manganese, magnesium and nitrate (DWER, 2018). The location of this contaminated site is shown in Figure 11.

The Project Area also traverses agricultural land that may contain sources of contamination such as dumped building materials, kill pits, landfill sites, and chemical storage sites. Additional investigations will be required to identify and remediate these sites prior to construction.

3.5.3 Potential impacts

Project activities that have the potential to impact terrestrial environmental quality during construction include earthworks and storage and handling of environmentally hazardous materials.

The potential construction impacts that may occur to terrestrial environmental quality as a consequence of developing the Project are:

- Disturbance of ASS resulting in acid leachate into the receiving environment causing contamination of land and/or waters
- Disturbance of unknown contaminated sites resulting in spread of contamination
- Accidental release or spread of litter, hydrocarbons or chemicals resulting in contamination of land
- Alteration of soil and loss of soil structure due to fill requirements in low lying areas.

Operational impacts to Terrestrial Environmental Quality resulting from the Project are mainly limited to road users, including pollution and waste. Road drainage will be designed to prevent contamination of Terrestrial Environmental Quality from the road surface run-off.

Potential indirect impacts that could arise from the construction of the Project also include salinization and soil erosion. The risk of salinization on the SCP is considered to be low and clearing associated with the Project in the context of local and regional water tables is unlikely to result in increased risk of salinization of soils. Soil erosion has the potential to occur during construction, associated with heavy machinery and vegetation clearing and during operation as a consequence of stormwater runoff.

3.5.4 Assessment of impacts

Direct impacts

Acid Sulfate Soils

ASS can be disturbed either by excavation or lowering of the water table below natural seasonal levels (i.e. dewatering). Excavations occurring for the Project will be associated with construction of bridge footings. It is likely that ASS will be encountered within excavations greater than 1.0 m depth, particularly within riparian zones. Dewatering may also be required during construction of bridge footings, which may expose PASS.

When PASS are disturbed, sulfides present are exposed to air, allowing oxidisation and consequently, the formation of sulfuric acid (H_2SO_4). ASS are also capable of generating acidity in-situ in their natural state; disturbance is not required for acidic discharges to develop.

As a result of the presence of ASS, or the oxidation of PASS, surrounding land (soil) and nearby waterways may become acidic (pH<6.5). Under acidic conditions, metals such as aluminium (generally at pH<4.5) and iron, as well as trace heavy metals (including arsenic), become more mobile in the environment and can readily be transported offsite by infiltrating waters. As a result, concentrations of metals within surface and/ or groundwater may reach concentrations, which have the potential to cause acute or chronic toxicity to sensitive terrestrial and aquatic plants and animals.

Hazardous material and waste disposal

Direct contamination of soils and land could occur as a result of releases of hazardous materials (such as hydrocarbons, chemicals and reagents) from storage or handling areas. Storage of hazardous materials during the construction period will be limited to temporary storage areas holding minor quantities of oils and grease for maintenance, and fuel supply for small construction equipment.

Hazardous waste will be temporarily stored onsite prior to disposal to an appropriately licensed facility. All such materials will be stored within a sealed, covered and bunded area. Refuelling of larger equipment and generators will occur within the Project Area, but preference will be given to off-site refuelling for general vehicles, where practical, to limit storage and handling volumes within the Project Area. Due to the limited scale of hazardous material storage, any accidental releases are expected to be small. Further, any potential contamination will be localised and restricted to the surface of the soil profile. The depth of localised contamination could increase beyond the soil surface if releases are not rectified in a timely manner.

There will be no soil or land impacts within the Project Area relating to the disposal of waste products. Waste from all waste streams, including used oils/greases and municipal waste, will be disposed or recycled to an appropriate off-site waste management facility.

Contamination and erosion during operation

Stormwater is road run-off that occurs during and following rainfall. Stormwater runoff from the operational road is likely to include pollutants deposited on the tarmac by vehicles. Exhaust gases and lubricants release lead, hydrocarbons, nickel and bromine. Iron and chromium detach from corroded bodywork, while sulphur, chlorine and cyanide are dispersed via cooling liquids. In addition, tyres deposit rubber particles containing lead, cadmium and zinc on the tarmac (ENI School, n.d.).

Stormwater run-off can result in bank erosion and transport of contaminants to soils if not managed appropriately. Drainage infrastructure will be in place to contain and control stormwater, therefore direct release to soils or land is unlikely. Volumes of hydrocarbons on the road are not likely to be significant, however if a large-scale discharge does occur it could be released beyond the road infrastructure if not adequately managed.

Loss of soil function

The constructed Project will be a permanent bituminised road surface which will result in impairment of soil function below the road surface. Soil function may be retained if topsoil is separated, stockpiled and re-used for landscaping. Significant fill may be required in low lying areas to provide suitable elevation for the Project in relation to flood risk. This will also result in the loss or alteration of soil structure.

Indirect impacts

Salinisation and erosion of soils

Clearing of deep-rooted native vegetation has the potential to increase salinisation and erosion of soils, particularly in agricultural areas, which are prone to salinity and erosion. Vegetation helps to stabilize soil and restrict upward movement of water tables which bring salts up the soil profile. Clearing of native deep-rooted vegetation is a major driver of salinity in the south-west of WA and this can affect the productivity of agricultural crops (GoWA, 2018a).

Salinisation is a potential impact within the Project Area, particularly in the poorly drained areas on Pinjarra Plain soils. However, the risk of dryland salinity on the SCP as a result of clearing native vegetation is known to be low (Simons, George, & Raper, 2013).

Vegetation clearing and soil excavation can increase the potential for soil erosion because of altered surface water drainage patterns and the effect of wind on exposed dry soils. Erosion impacts can potentially lead to poor soil structure, reduced water infiltration and general loss of soil health.

3.5.5 Mitigation

The risks associated with potential impacts to Terrestrial Ecosystem Quality, specifically ASS and contaminated sites are considered relatively minor and manageable. Main Roads has extensive experience with the management of these risks in similar projects throughout the south west of WA. Impacts will be avoided and minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues specifically related to terrestrial ecosystem quality including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - Acid Sulfate Soil (ASS) management
  - Dieback and weed management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.5.6 Predicted outcome

Based on the information available to support the EIA the potential risks to the terrestrial ecosystem quality associated with construction and operation of the Project are likely to be able to be effectively managed through implementation of mitigation measures.

Additional surveys would be required if this alignment is selected as the preferred option, however it is considered that the Project would meet the EPA objective to maintain the quality of land and soils so that environmental values are protected.

3.6 Key Environmental Factor – Inland Waters

3.6.1 Studies undertaken

The following studies have been undertaken for this aspect:

- Water quality sampling was undertaken as part of the BORR Alternate Alignment: Targeted Conservation Significant Aquatic Fauna Survey (WRM, 2018)
- Desktop information has been assessed for this aspect including the DWER datasets (GoWA, 2019a).

3.6.2 Receiving environment

Desktop searches of the DWER datasets (GoWA, 2019a) were undertaken and are summarised in Table 3-17.

Table 3-17 Hydrology queries within the Project Area

ASPECT	DETAILS	RESULT
Groundwater Areas	Groundwater areas proclaimed under the RIWI Act.	Bunbury Groundwater area Busselton-Capel Groundwater Area
Surface Water Areas	Surface water areas proclaimed under the RIWI Act.	Capel River System
Rivers	Rivers proclaimed under the RIWI Act.	None
Public Drinking Water Source Areas (PDWSAs)	PDWSA is a collective term used for the description of Water Reserves, Catchment Areas and Underground Pollution Control Areas declared (gazetted) under the provisions of the *Metropolitan Water Supply, Sewage and Drainage Act 1909* or the *Country Area Water Supply Act 1947.*	None
Waterways Conservation Areas	Areas proclaimed under the *Waterway Conservation Act 1976*.	None

Surface water

The southern half of the Project is in a proclaimed Surface Water Area; the Capel River System. Within the Project Area, the agricultural land is often flooded in the wetter months (i.e. palusplain wetlands) and is dissected with numerous minor drainage lines (GoWA, 2019a). Notably, two natural brooks are intersected by the Project Area; Gynudup Brook and Five Mile Brook, however these are not proclaimed under the RIWI Act (Figure 8).

Surface water quality

Four wetlands were sampled as part of the BORR Alternate Alignment Aquatic Fauna Survey (WRM, 2018). In situ water quality was generally good and characterised by slightly acidic pH (6.23 to 6.68), variable dissolved oxygen (DO) (28.7% to 170.8%), and warm temperatures (18.5 ºC to 25 ºC). All wetlands were fresh with electrical conductivity (EC) ranging from 183 µs/cm to 1422 µs/cm.

The pH at all wetlands was slightly below the guidelines (ANZECC & ARMCANZ, 2000) for the protection of slightly/moderately disturbed wetland ecosystems in the southwest of WA (pH 7 – 8.5) (Table 3-18).

Table 3-18 *In situ* water quality results from all wetlands sampled

WETLAND	WETLAND CODE	TEMP (°C)	CONDUCTIVITY (µS/cm)	PH	OXYGEN %	OXYGEN (mg/l)	CONSERVATION CATEGORY/ UFI
1	1a	22.0	1422	6.51	28.7	2.09	MU UFI 1189
	1b	25.0	983	6.67	95.5	8.55	RE UFI 1170
2	2	21.1	855	6.68	170.8	15.01	RE UFI 1180
3	3a	22.7	596	6.62	57.7	5.03	Unmapped however assumed to be a combination of CCW UFI 16075, 16076, 16077 and 16088) (previously RE UFI 1149)
	3b	21.0	365	6.57	103.9	7.77	CCW UFI 16079 and UFI 16080 (previously MU UFI 1150
	3c	19.0	380	6.61	100.0	7.80	MU UFI 1150
4	4a	18.8	278	6.42	49.5	4.43	MU UFI 1014
	4b	18.5	183	6.23	102.0	8.18	MU UFI 1014

Note: CCW – Conservation Category Wetland, RE – Resource Enhancement, MU – Multiple Use

Wetlands of international significance

There are no internationally significant (Ramsar) wetlands located within 10 km of the Project Area. The nearest Ramsar wetland (Vasse-Wonnerup System) is located approximately 13 km to the south west of the Project Area (GoWA, 2019a).

Geomorphic wetlands

Wetlands on the SCP have been classified (Hill, Semeniuk, Semeniuk, & del Marco, 1996) using a geomorphic-hydrologic approach to wetland classification (Semeniuk & Semeniuk, 1995). These wetlands have also been evaluated and assigned an appropriate management category which provides guidance on the nature of wetland management and protection that the wetland should be afforded.

There are 24 mapped Geomorphic Wetlands, comprising just under 75 ha, intersected by the Project Area including five Conservation Category Wetlands (CCW), three Resource Enhancement and 16 Multiple Use Geomorphic Wetlands (GoWA, 2019a). The mapped Geomorphic Wetlands include:

- Approximately 1 ha of Conservation Category Wetlands (0.5 % of the Project Area)
- < 1 ha of Resource Enhancement wetlands (0.1 % of the Project Area)
- Approximately 73 ha of Multiple Use wetlands (33 % of the Project Area).

In addition, the DBCA managed Roselands Nature Reserve lies directly adjacent to the Project Area. The Roselands Nature Reserve is known to support (BORR IPT, 2019a):

- Conservation Category Wetland
- *Eleocharis keigheryi* (listed as Vulnerable) and another five Priority listed flora taxa
- *Corymbia calophylla – Xanthorrhoea preissii* woodlands and shrublands (FCT3c) (TEC)
- Herb rich shrublands in clay pans (FCT08) (TEC).

The wetlands within the Project Area are detailed below in Table 3-19 and mapped in Figure 8.

Table 3-19 Geomorphic wetlands within the Project Area

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
955	Palusplain	Conservation	5.0	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. Cleared.	Degraded to Completely Degraded	1.2
16075	Sumpland	Conservation	<0.1	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland.	Degraded	<0.1
16076	Sumpland	Conservation	0.2	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	<0.1
16077	Sumpland	Conservation	2.4	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	<0.1
16078	Sumpland	Conservation	0.4	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT07 Woodland *Agonis flexuosa* and *Eucalyptus marginata* with scattered *Banksia attenuata*. Cleared.	Degraded to Completely Degraded	<0.1

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
1149	Sumpland	Resource Enhancement	0.2	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	0.2
1164	Sumpland	Resource Enhancement	3.3	Cleared.	Completely Degraded	<0.1
1180	Sumpland	Resource Enhancement	3.4	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland.	Good to Completely Degraded	0.1
777	Sumpland	Multiple Use	20.4	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla*. Cleared.	Degraded to Completely Degraded	3.7
935	Dampland	Multiple Use	2.0	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Completely Degraded	0.8
938	Dampland	Multiple Use	9.8	VT01a *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* over closed grassland. VT01c Isolated trees *Corymbia calophylla* and *Eucalyptus marginata* +/- Banksia spp. over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared	Degraded to Completely Degraded	0.7

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
953	Sumpland	Multiple Use	15.4	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Good to Completely Degraded	1.6
982	Dampland	Multiple Use	1.3	VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* over closed grassland. Cleared.	Completely Degraded	1.2
1044	Dampland	Multiple Use	2.0	Cleared.	Completely Degraded	1.4
1159	Dampland	Multiple Use	2.6	VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Completely Degraded	0.2
1163	Sumpland	Multiple Use	21.1	Unsurveyed – aerial photography shows that this is gravel road and vegetated.	Unknown to Completely Degraded	0.5
1168	Dampland	Multiple Use	2.8	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Degraded to Completely Degraded	0.2
1169	Dampland	Multiple Use	30.1	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland.	Degraded to Completely Degraded	2.5

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
				VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.		
1171	Dampland	Multiple Use	2.4	VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. Cleared.	Completely Degraded	0.8
1177	Sumpland	Multiple Use	2.4	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. Cleared.	Good to Completely Degraded	0.4
1178	Sumpland	Multiple Use	5.6	VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Completely Degraded	1.6
1179	Sumpland	Multiple Use	20.1	VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT07 Woodland *Agonis flexuosa* and *Eucalyptus marginata* with scattered *Banksia attenuata*. Cleared	Good to Completely Degraded	0.4
13229	Palusplain	Multiple Use	114.8	Unsurveyed – Aerial photography shows cleared paddock, roads and scattered trees.	Likely to be Degraded to Completely Degraded	3.8

GEOMORPHIC WETLAND IDENTIFICATION (UFI)	WETLAND TYPE	CLASSIFICATION	TOTAL AREA WETLAND (ha)	MAPPED WETLAND VEGETATION TYPE/ DESCRIPTION (BORR IPT 2019A AND B)	VEGETATION CONDITION (BORR IPT 2019A AND B)	EXTENT WITHIN PROJECT AREA (ha)
15809	Palusplain	Multiple Use	42,322.2	VT01a *Corymbia calophylla* and *Eucalyptus marginata* +/- *Agonis flexuosa* over closed grassland. VT01b Isolated trees *Eucalyptus rudis* and *Corymbia calophylla* closed grassland. VT02 Woodland *Eucalyptus rudis* and *Melaleuca rhaphiophylla* over sparse shrubland over open sedgeland. VT03 Woodland *Melaleuca preissiana* and *M. rhaphiophylla* over tall sparse shrubland over sedgeland. VT06 Woodland *Banksia attenuata*, *Eucalyptus marginata*, +/- *Agonis flexuosa* over occasional tall open shrubland. Cleared.	Degraded to Completely Degraded	53.6
Total						**74.8**

* Wetland observations are based on field surveys carried out for flora and vegetation (BORR IPT 2019 a and b), fauna surveys (WRM, 2018; Biota, 2019b) and aerial photographs (for wetlands not assessed during field surveys).

Groundwater

The Project is within the Bunbury Groundwater Area and the Busselton-Capel Groundwater Area, as proclaimed under the RIWI Act (GoWA, 2019a).

3.6.3 Potential impacts

The Project activities that have the potential to impact on Inland Waters during construction include vegetation clearing, earthworks and the construction of drainage structures.

In the absence of suitable mitigation and management, the potential impacts that may occur to Inland Waters as a consequence of developing the Project include:

- Loss of approximately 75 ha of mapped Geomorphic Wetlands, including:
  - Approximately 1 ha of Conservation Category Wetlands (0.5 % of the Project Area)
  - <1 ha of Resource Enhancement wetlands (0.1 % of the Project Area)
  - Approximately 73 ha of Multiple Use wetlands (33 % of the Project Area)
- Direct impacts to the bed and banks of waterways (erosion, sedimentation and scouring) at Five Mile Brook, Gynudup Brook, minor drainage lines, CCW and RE wetlands
- Impacts to surface water flows causing changes to wetland water quality, including the DBCA managed Roselands Nature Reserve which lies directly adjacent to the Project Area
- Indirect impacts from construction including dust and pollution
- Contamination of ground and/or surface water from exposure to PASS or contaminants.

3.6.4 Assessment of impacts

Direct Impacts

Dewatering for construction activities

Once detailed design has been completed, a detailed investigation will be carried out to determine final construction methods and dewatering requirements for construction of the Project. Dewatering activities will be temporary and impacts are likely to be restricted in spatial extent.

Changes to groundwater levels in the shallow aquifer associated with clearing

Vegetation clearing within the Project Area has the potential to allow the groundwater level to rise and flood the surrounding area. However, given that the majority of the Project Area has been cleared for farmland, proposed clearing requirements are linear and areas of contiguous vegetation outside of the Project Area will be retained, groundwater level rise as a result of the Project activities is considered unlikely to occur.

Erosion and sedimentation

Clearing of vegetation, construction earthworks and altered surface water regimes have the potential to destabilise soils and, if unmanaged, result in erosion of the Project Area and sedimentation of surrounding drainage infrastructure, vegetation, wetlands and waterways.

Contamination of surface water and groundwater

Contamination of surface water and groundwater may result during the construction phase as a result of the unintended release of environmentally hazardous materials during onsite works (construction materials and hazardous materials stored onsite), runoff during stormwater events and contaminated sediment or settled dust.

Surface and/or groundwater may also become contaminated through the exposure of ASS during construction (excavation). ASS disturbance may have a range of impacts including enhanced phosphorus leaching, death of vegetation irrigated with affected water, the smothering of benthic aquatic animals by the precipitation of iron, and metal bioaccumulation in aquatic plants and animals.

Contaminated surface water and groundwater has the potential to impact sensitive receptors including neighbouring properties, vegetation, fauna, wetlands and waterways. Impacts can also manifest downstream as loss of benthic habitat, fish deaths and damage to vegetation health.

Alteration of hydrological flow to Geomorphic Wetlands and minor waterways

Construction of the Project will involve the loss of wetlands within the Project Area. Filling the wetlands and clearing the vegetation will directly alter the existing surface water flow regime within the Project Area and adjacent wetlands. Significant fill may be required in low lying areas to provide suitable elevation for the Project in relation to flood risk. This has the potential to adversely affect the function of surrounding wetland and river systems, including changes in the vegetation structure of GDEs and surrounding agricultural properties.

Once constructed, the bituminised road will prevent infiltration from occurring, however, due to the localised management of stormwater where it will be collected, it is not considered that the Project will significantly restrict rainfall recharge to the superficial aquifer such as to significantly lower groundwater levels and/or change the volume of water available to surrounding wetlands.

Climate change

The drying climate in the South West region could result in reduced groundwater and surface water availability, increased seawater intrusion and a greater risk of impacts of abstraction on GDEs (DoW, 2015). Sea level rise is also a major consideration of infrastructure projects on the coastal zone.

In accordance with the Main Roads Guideline on Climate Change (MRWA Doc No. D10#97260), the impacts of climate change have been considered during the planning for the Proposal. The Main Roads Guideline specifies that the impacts of a 300 mm sea level rise is considered as part of planning, design and construction for all projects near coastal areas.

The Main Roads Guideline specifically addresses the potential impacts on rainfall patterns as a result of climate change. The guideline recommends that Intensity Frequency Duration (IFD) rainfall data are adjusted for future climate change. This recommendation will be incorporated in a review of the effects of rainfall intensification for transverse drainage at the detailed design stage.

3.6.5 Mitigation

Impacts to inland waters will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering and drainage solutions to avoid and minimise environmental impacts
  - In particular, detailed drainage design will maintain fish passage (Black-stripe Minnow) under the constructed road (culverts or other) to provide connection between Geomorphic Wetlands on either side of the road
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues related to inland waters including:
  - Complaints response and management
  - Vegetation management, and clearing procedures and processes
  - Topsoil management
  - Acid Sulfate Soil (ASS) management
  - Wetlands, drainage and groundwater management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.6.6 Predicted outcome

The existing hydrological processes are in a largely modified state due to historical clearing and draining of land within the Project Area for agricultural purposes Based the information available to support the EIA it is anticipated that the potential impacts to inland waters associated with the Project are manageable with the implementation of the mitigation measures proposed and no residual impacts are anticipated. This will be confirmed as part of the studies undertaken once the alignment is finalised.

3.7 Key Environmental Factor – Air Quality

3.7.1 Studies undertaken

No specific studies have been undertaken for air quality to date.

3.7.2 Receiving environment

Climate

Bunbury is located on the south-western corner of Western Australia and the climate of the Project Area is broadly described as Mediterranean, with hot dry summers and cool wet winters. The nearest Bureau of Meteorology (BoM) official recording station is Bunbury (Station No. 9965), located approximately 8 km north of the Project Area.

The area has a mean annual rainfall of 726.1 mm. The area experiences a wide range of temperatures, with mean maximum temperatures of approximately 30°C in summer and 17°C in winter (BoM, 2019).

Table 3-20 Climate data – Bureau of Meteorology Bunbury Station No 9965

CLIMATIC VARIABLE	RANGE
Mean Annual Maximum Temperature Range	17.3°C in July to 30°C in February
Mean Annual Minimum Temperature Range	7.1°C in July to 15.9°C in February
Mean Annual Rainfall	726.1 mm
Mean Annual Rain days per year	84.5

Sensitive receptors

Sensitive receptors are any place where people are likely to reside in a non-occupational setting. This may include dwellings, schools, hospitals or public recreational areas (NSW Department of Environment and Conservation, 2005). As the majority of the Project Area is situated in Rural zoned land with a minimal number of dwellings within proximity, it is anticipated there is a low number of sensitive receptors.

Bunbury Regional Airshed

The Project is within the Bunbury Regional Airshed, which encompasses an area approximately 38,610 km^2 and includes 22 Shires, including the entire City of Bunbury and Shire of Capel.

The major economic activities in the Bunbury Regional Airshed are very diverse and include mining, agriculture, tourism, forestry and manufacturing. Motor vehicles dominate the emissions of carbon monoxide (CO), volatile organic carbon (VOC) and nitrous oxides (NO_x) (SKM, 2003).

3.7.3 Potential impacts

Potential direct construction impacts that may occur to Air Quality as a consequence of developing the Project are:

- Increased construction vehicle emissions
- Dust generated from construction activities
- Smoke from bushfires proximate to the Project
- Impacts from car emissions

- Increased greenhouse gas (GHG) emissions.

The construction of the Project has the potential to reduce air quality via increased road vehicle and GHG emissions.

The operation of the Project may reduce vehicle emissions in the local and regional airshed as a consequence of improved traffic flows and improved vehicle efficiency.

Major vehicle pollutants include products of combustion, such as CO, particulate matter with an aerodynamic diameter of 10 microns or less (PM10), NOx, and VOCs. The human health effects of these air pollutants range from mild airway irritations to major organ damage. Many of the emissions from motor vehicles react together and with pollutants from other sources to form secondary pollutants, such as photochemical oxidants (ozone; O3), which can also have significant effects.

Potential indirect impacts from dust generated during construction may include impacts to vegetation and changes to vegetation communities directly adjacent to construction works.

Indirect impacts may also include GHG emissions associated with operation of Main Roads buildings, depots and light vehicle fleet (emission from power generation and vehicles).

3.7.4 Assessment of impacts

Construction vehicle emissions

Construction works for the Project will involve operation of heavy machinery and vehicles. Some minor increase in emissions associated with the construction activities is expected but will be temporary – expected to occur for 2-3 years during construction. The impacts associated with these emissions is not considered likely to be significant.

Dust impacts during construction

Construction works for the Project will involve the operation of loaders, dozers, graders, excavators and trucks to clear vegetation (where present) from the Project Area, and to excavate and remove material from areas of the site for use as fill within other areas of the site. There will also be miscellaneous vehicle movements around the Project Area as part of the construction works.

If unmanaged, these activities can result in dust emissions due to:

- Movement of vehicles and heavy equipment on unsealed surfaces
- Excavating, spreading and compacting soils
- Wind erosion from exposed and disturbed soil surfaces.

Dust may be a nuisance to nearby sensitive receptors if unmitigated during construction activities, however is not considered to have an adverse impact on local air quality.

Reduced air quality due to bushfire

Construction activities have the potential to ignite bushfires through hot work and vehicle movements, which could cause a temporary reduction in local air quality. Potential risks associated with bushfires are considered low and will be managed through appropriate mitigation as part of the CEMP. No significant impacts resulting from accidental bushfires are expected.

Impacts from car emissions

Pollutant concentrations emitted from a vehicle, depends on the type of vehicle (passenger, light or heavy vehicle), fuel type (petrol, diesel or LPG) and driving conditions (grade of slope, congestion and road conditions). Emissions profiles will also vary over time as new vehicle emission standards become effective.

An Air Quality Impact Assessment will be undertaken if this alignment is selected for development.

Greenhouse gas emissions impacts

The operation of site offices, light diesel powered vehicles and heavy equipment for construction of the Proposal will result in indirect generation of GHG emissions.

An assessment of GHG emissions for the construction phase of the Project will be undertaken to quantify direct emissions and therefore, determine the requirement for management measures.

3.7.5 Mitigation

Main Roads has a carbon reduction target of 5% of 2010 carbon emission by 2020, with a stretch target reduction of 15% through improving energy efficiency. Opportunities to reduce ongoing energy include, but are not limited to the following, where practicable:

- Use of energy efficient electrical assets such as LED street lights
- Reducing the expansion of traffic signals and Main Roads has adopted a policy of alternative design treatments such as roundabouts or modified intersections to assist with reducing congestion
- Use of renewable energy sources
- Use of materials with lower embodied energy.

Impacts to air quality will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- The selection of engineering solutions to avoid and minimise environmental impacts
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues related to air quality including:
  - Complaints response and management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.7.6 Predicted outcome

Dust is anticipated to be generated during construction. This impact will be controlled using standard mitigation measures, such as watering trucks. Appropriate measures will be implemented to ensure the short term construction related air quality impacts are effectively managed.

It is considered unlikely that ongoing street lighting, traffic signals and road maintenance activities would produce significant GHG emissions for the Project. However, construction and operation of the Project will be subject to an assessment for direct GHG emissions.

Given these proposed measures, no residual impacts are expected for this aspect.

3.8 Key Environmental Factor – Social Surroundings

3.8.1 Studies undertaken

The following studies have been undertaken for this aspect:

- European Heritage Assessment (D.G. Burnside and Associates, 2019).

3.8.2 Receiving environment

European heritage

A search of the EPBC Protected Matters Search Tool did not identify any Commonwealth listed heritage sites within the Project Area, or within 10 km of the Project Area (DotEE, 2018).

The State Heritage Office dataset indicated that there are no State Heritage sites within 200 m of the Project Area (GoWA, 2018b).

A European Heritage survey was undertaken of the BORR Southern Section Alternative Alignment in January 2019 (D.G. Burnside and Associates, 2019). The report was prepared using documentary information about the built heritage of the Gelorup-Stratham-Elgin area, and information provided from 13 interviews with landholders in the area. A total of eleven sites were identified that are of value to the interviewees, including two that occur in the Project Area (Figure 12) (and are listed on the Shire of Capel Municipal Heritage register):

- Elgin Sports Club, Boyanup West Road, Stratham
- Stratham School (2nd Site), Boyanup West Road, Stratham.

The remaining nine sites are also listed on the Shire of Capel Municipal Heritage register and occur in the local area surrounding the Project Area. These sites include:

- Stratham Park (corner Bussell Highway and Fishermans Road, Stratham)
- The Bridge Homestead, Elgin Road, Elgin
- All Souls Church, Boyanup West Road
- 'Roselands' former homestead
- 'Sunnyside', a current homestead
- Elgin Hall
- 'Rosemore' former homestead, Stratham
- Minninup Church, Lot 68 Minninup Road, Stratham
- Elgin PO and Phone Exchange, Elgin Road, Capel.

The complex family relationships in the area link back to an expressed strong sense of belonging to the land, and its agricultural use and features such as wetlands and drainage networks. The areas associated with this social heritage are the cultural traditions that were said to be important in sustaining the community (D.G. Burnside and Associates, 2019).

Aboriginal heritage

A search of the Aboriginal Heritage Inquiry System identified one Registered Aboriginal Heritage site; Capel Bussell Highway (Site 5813) (DPLH, 2019). This site will be directly impacted by the Project. Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Arch Deposit and Camp.

One 'Other Heritage Places' was identified within the Project Area (Place ID 37870) which is referred to as 'The Gelorup Corridor'. Place ID 37870 has been Lodged and is comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material/ Burial (DPLH, 2019).

Gynudup Brook is located in the southern section of the Project Area and is intersected by the Project Area in three locations. The name of this waterway means "*good campground near water*" and therefore, highlights its importance to Aboriginal people (GeoCatch, 2004).

Land use

The GBRS indicates the Project Area is zoned as "Special rural", with the eastern part also zoned as "Rural" (DPLH, 2018). Land use is predominantly agricultural.

The Project traverses the Mineral and Basic Raw Materials Strategic Resource Area identified under the GBRS in the section south of Boyanup West Road to Bussell Highway.

Demography and economy

The Project Area is 9 km south-east of the Bunbury CBD and 0.8 km from the suburb of Gelorup and 3.3 km from the suburb of Dalyellup, in the Shire of Capel.

The Shire of Capel had an estimated resident population of 17,894 for June 2017 (ABS, 2018). Health care and social assistance is the main industry accounting for 13% of employment, followed by construction accounting for 12%.

The Greater Bunbury region, which includes the Shires of Capel, Dardanup and Harvey as well as the City of Bunbury, had a population of 89,628 in 2016 (ABS, 2018). Construction is the main industry accounting for 12.8% of employment, with manufacturing accounting for approximately 11.8%.

Visual amenity

The SCP is characterised as a low lying coastal plain mainly covered with woodlands, with rare landscape features such as Holocene dunes and wetlands. Bushland is often retained as a visual or spatial buffer between land uses (Mitchell, Williams, & Desmond, 2002). Changes to amenity are greatest in areas with a high perceived scenic amenity value and are visible from public locations, such as roads, walk trails and lookouts.

The existing amenity of the Proposal Area includes pockets of native vegetation, rural/ agricultural areas, existing roads and previously cleared areas.

Noise

The Project will result in a major highway being located within an existing rural environment. Noise sensitive receptors include approximately 10 residences within 200 m of the Project, between Hasties Road and Bussell Highway.

3.8.3 Potential impacts

Project activities that have the potential to impact social surroundings during construction include vegetation clearing, earthworks and off-site transport.

The potential construction impacts include:

- Heritage site disturbance during clearing and/or excavation works
- Changes to visual amenity
- Noise impacts to sensitive receptors, from noise emissions generated by construction
- Vibration generated by construction
- Increased traffic on local road network.

The potential operational impacts on social surroundings as a consequence of developing the Project are:

- Separation of sections of rural properties potentially resulting in loss of economies of scale for agricultural production and reduced viability
- Loss of productive agricultural land
- Impacts to visual amenity
- Noise impacts to sensitive receptors through noise emissions from the road.

3.8.4 Assessment of impacts

Direct Impacts

Heritage Site disturbance during clearing and/ or excavation works

Two European Heritage places will be impacted by the development of the Project; the Elgin Sports Club and the Stratham School (2nd Site). The area of the Elgin Sports Club that was historically used for cricket matches will likely need to be removed. Further investigation is required to determine the full extent of the impact (i.e. the exact location of the cricket pitch). No structures associated with the Stratham School (2nd Site) will need to be removed.

The buffered extent of one Registered Aboriginal Heritage site (Capel Bussell Highway, Site ID 5813) and one Other Heritage Place (The Gelorup Corridor, Place ID 37870) are intersected by the Project Area. However, the values of these sites are unlikely to apply within the Project Area. Further investigation of these heritage sites will be required if this Project is selected for further investigation.

Noise and vibration impacts resulting from construction and operation

Noise and vibration impacts are expected to result from the construction phase, however these impacts are expected to be short in duration and are not considered significant. Noise and vibration impacts during construction will be managed under a Project specific CEMP.

The Project will result in the exposure of noise sensitive residences to traffic noise from the highway. The extent of impact will be determined through a Traffic Noise Assessment for the Project, should it be selected as the preferred alignment. Noise management will be implemented to comply with SPP 5.4 (WAPC, 2009). Management measures may include the installation of noise walls and / or treatments to individual properties to comply with SPP 5.4 (WAPC, 2009).

Noise mitigation measures will be developed during the detailed design phase for operation of the Project to be compliant with the requirements of SPP 5.4 (WAPC, 2009).

Reduced visual amenity

Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project.

An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option. The results of the assessment and potential mitigation measures will be included in relevant documentation to support the formal referral and assessment of the Project through the EP Act as necessary.

Glare or light spill on sensitive receptors

There will be minor change in the local light environment as a result of the Project. It is anticipated that only intersections and interchanges will be lit.

Indirect Impacts

Indirect impacts from the Project on social surrounds are anticipated. Loss of productive agricultural land and separation of sections of rural properties may affect the economic viability of affected agricultural properties.

3.8.5 Mitigation

Impacts to social surroundings will be minimised through the following mitigation and management measures:

- Developing a Project design to minimise environmental impacts as far as practicable
- Consider access to properties and separation of property sections through Project design
- The selection of engineering solutions to avoid and minimise environmental impacts
- Conduct a Traffic Noise Assessment and implement noise mitigation measures at noise sensitive receptors, to comply with State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning

- Conduct visual impact assessment and implement mitigation measures
- Compliance with State and Commonwealth environmental legal requirements
- Preparation and implementation of a Project specific CEMP that addresses issues related to social surroundings including:
  - Complaints response and management
  - Heritage site management
  - Construction management (noise, vibration and dust)
  - Hazardous materials management
  - Fire risk management
  - Environmental incident reporting and management
- The CEMP will include targets and key performance indicators, management actions, monitoring requirements and contingency measures.

3.8.6 Predicted outcome

Potential impacts on Aboriginal and European Heritage sites associated with the Project will be managed through consultation with all relevant groups and undertaken in accordance with State and Commonwealth legislation. Potential impacts to Aboriginal Heritage will be managed through the AH Act.

Construction and operation of the Project has potential to result in impacts to visual amenity and localised change in the landscape and land use. If selected as the preferred alignment option, the potential impact of these changes will be assessed and mitigation measures developed. Impacts to visual amenity will be considered during the detailed design phase and mitigated through the implementation of landscaping and other measures during construction via the CEMP.

Mitigation measures identified in the Traffic Noise Assessment will be developed during the detailed design phase of the Project if the alignment is selected as the preferred option.

Impacts on rural community amenity and agricultural production including sterilisation of productive land, reducing carrying capacity and restricted access will be considered through the detailed design phase of the project and investigated further if the alignment is selected as the preferred option.

4 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

A search of the Protected Matters Search Tool (PMST) identified several Matters of National Environmental Significance that may be impacted by the Project (DotEE, 2018). An assessment of these has been undertaken in Table 4-1.

Table 4-1 Assessment against Matters of National Environmental Significance

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE	IMPACT ASSESSMENT
Threatened Species and ecological communities	Impacts to a TEC was were confirmed within the Project Area during field investigations: • Banksia Woodlands of the SCP TEC (approximately 5 ha). No EPBC Act or BC Act listed flora were recorded within the Project Area during the surveys conducted in October and November 2018 (BORR IPT 2019a and b). Impacts to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and the Forest Red-Tailed Black Cockatoo (Vulnerable), including: • Removal of approximately 38 ha (21 ha surveyed and 17 ha unsurveyed) potential breeding and foraging habitat • Removal of 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone. Impacts to Western Ringtail Possums (Critically Endangered), including: • Removal of approximately 38 ha (21 ha surveyed and 17 ha unsurveyed) breeding and foraging habitat, providing habitat for an estimated 15 individuals, which represent up to 0.3% of the regional population. Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
Migratory Species	The desktop assessment (PMST) identified 42 migratory species potentially occurring within 5 km of the Project Area, including: • 26 birds (including 9 wetlands species) • 15 marine species • 1 terrestrial species. Impacts to these species are not considered likely from the Project.
Commonwealth Marine Areas	The Project will not impact any Commonwealth Marine Area. The closest is Geographe Commonwealth Marine Reserve, approximately 14 km west of Project Area.

MATTER OF NATIONAL ENVIRONMENTAL SIGNIFICANCE	IMPACT ASSESSMENT
World Heritage Properties	The Project will not impact any World Heritage Properties.
National Heritage Properties	The Project will not impact any National Heritage Properties.
Wetlands of International Importance	The Project will not impact any wetlands of international importance. The closest is the Vasse-Wonnerup System, approximately 20 km south of the Project Area.

5 SUMMARY

The BORR Project has been divided into three sections (Northern, Central and Southern Sections). Two alignments for the BORR Southern Section are currently being assessed by Main Roads (BORR Southern Section GBRS Alignment and BORR Southern Section Alternative Alignment) to determine the preferred alignment.

This data in this EIA were used to identify and assess the environmental impacts associated with the BORR Southern Section Alternative Alignment ('the Project'). Main Roads used the findings in this EIA to determine the preferred southern alignment for the BORR. The impacts of the Project have been summarised in Table 5-1 for the purposes of comparison.

Table 5-1 Summary of Environmental Impacts

ASPECT	BORR SOUTHERN SECTION ALTERNATIVE ALIGNMENT
Total Area	222 ha
VEGETATION AND FLORA	
Total Native Vegetation	Approximately 46 ha (30 ha surveyed, 17 ha unsurveyed)
Total non-native or cleared area	Approximately 176 ha
Total native Good or better condition	Approximately 6 ha (~3 % of the Project Area)
Total areas in Good – Degraded or worse condition	An estimated 216 ha (~97 % of the Project Area) (includes Cleared/parkland areas, which are classified as Completely Degraded)
Threatened and Priority Communities	Banksia Woodlands of the SCP TEC (up to 4.5 ha) Banksia dominated woodlands of the SCP IBRA region PEC (FCT 21a) (up to 6.9 ha) The Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP PEC (FCT25) (up to 0.4 ha).
Other significant	Approximately 13 ha of riparian vegetation
Conservation significant flora	12 conservation significant flora species previously recorded or likely to occur within the Project Area, from desktop investigations. No EPBC or BC Act species recorded during field investigations. No Priority Flora recorded during field investigations.
FAUNA	
EPBC / BC Fauna - confirmed - Black Cockatoos	Approximately 38 ha of potential Black Cockatoo habitat (including 21 ha surveyed and 17 ha unsurveyed)

ASPECT	BORR SOUTHERN SECTION ALTERNATIVE ALIGNMENT
	Up to 588 Suitable DBH Trees, one of which is a Tree with a Suitable Nest Hollow, two showed evidence of past use as Known Nesting Trees and two could not be assessed by drone.
- Western Ringtail Possum (Critically Endangered)	Approximately 38 ha of potential Western Ringtail Possum habitat (including 21 ha surveyed and 17 ha unsurveyed), supporting up to 15 individual possums.
- South-western Brush-tailed Phascogale (Schedule 6)	Approximately 26 ha of potential Southern Brush-tailed Phascogale (including 9 ha surveyed and 17 ha unsurveyed).
Priority Fauna – confirmed - Southern Brown Bandicoot / Quenda (Priority 4)	An estimated 46 ha of potential Southern Brown Bandicoot habitat (including 30 ha surveyed and 17 ha unsurveyed).
Threatened species likely to occur - Black-stripe Minnow (Endangered)	Loss of less than 0.3 ha wetland habitat hydrologically connected to wetlands where Black-stripe Minnow were recorded.
- Peregrine Falcon (Schedule 7)	Approximately 46 ha of potential Peregrine Falcon habitat (including 30 ha surveyed and 17 ha unsurveyed)
Migratory birds	A small number (< 50) of migratory bird species were considered to be potentially transient visitors to the Project Area at times when wetlands are supporting water.
TERRESTRIAL ENVIRONMENT QUALITY	
Acid Sulphate Soils	There is a low to moderate risk of ASS, with minor areas of high risk associated with watercourses.
Contaminated Sites	One site classified as contaminated with restricted use occurs within the Project Area, which is unlikely to be impacted by the Project.
RIVERS AND WETLANDS	
Rivers	No rivers protected under the RIWI Act will be impacted by the Project, however a number of minor waterways will be impacted including Gynudup Brook and Five Mile Brook.
Geomorphic wetlands	Loss of approximately 75 ha of mapped Geomorphic Wetlands including: Conservation: 1 ha Resource Enhancement: <1 ha Multiple use: 73 ha
AIR QUALITY	
Air quality	No significant impacts.
SOCIAL	
State and Municipal heritage	Land associated with two sites on the Shire of Capel Municipal Heritage register will be impacted.

ASPECT	BORR SOUTHERN SECTION ALTERNATIVE ALIGNMENT
	• Elgin Sports Club, Boyanup West Road, Stratham • Stratham School (2nd Site), Boyanup West Road, Stratham. No structures associated with these sites will be impacted.
Aboriginal Heritage	The buffered extent of 'Capel Bussell Highway' (ID 5813). Site 5813 is recorded as a Registered site, comprised of Artefacts / Scatter, Archaeological Deposit and Camp. The buffered extent of 'The Gelorup Corridor' (ID 37870) is recorded as an Other Heritage Place, comprised of Artefacts/ Scatter, Ceremonial, Skeletal Material/ Burial.
Noise	Noise and vibration impacts are expected to result from the construction phase, however the Project is in a rural location and these impacts are not considered significant. Noise mitigation measures will be developed during the detailed design phase to be compliant with the requirements of SPP 5.4 (WAPC, 2009).
Visual	Direct and permanent impacts to visual amenity of the existing rural area are expected to result from this Project. An assessment of the impacts to visual amenity will be completed if this alignment is selected as the preferred option.
Amenity	Impacts on rural community amenity and agricultural production including loss of productive land, reducing carrying capacity and restricted access are potential consequences of the Project. The detailed design phase will consider provision of access and separation of properties and impacts will be investigated further if the alignment is selected as the preferred option.

It is considered likely that the Project will require the following environmental approvals:

- Referral to EPA under Section 38 of the EP Act
- Referral to DotEE under the EPBC Act for assessment as a Controlled Action
- Native Vegetation Clearing Permit (DWER)
- Bed and Banks Permit (DWER)
- Licence to take water for construction purposes (DWER)
- Section 18 consent to disturb Aboriginal heritage sites (Minister for Aboriginal Heritage)
- Permission from the Shire of Capel to disturb European heritage sites.

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- Bush Forever Areas 2000 (DOP-071)
- CAWSA Part 2A Clearing Control Catchments (DWER-004)
- Clearing Regulations – Environmentally Sensitive Areas (DWER-046)
- Directory of Important Wetlands in Australia – Western Australia (DBCA-045)
- EPA Redbook Recommended Conservation Reserves 1976-1991 (DBCA-029)
- Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)
- Groundwater Salinity Statewide (DWER-026)
- Heritage Council WA – State Register (SHO-003)
- Hydrographic Catchments – Catchments (DWER-028)
- Legislated Lands and Waters (DBCA-011)
- Pre-European Vegetation (DPIRD-006)
- Public Drinking Water Source Areas (DWER-033)
- Ramsar Sites (DBCA-010)
- RIWI Act, Groundwater Areas (DWER-019)
- RIWI Act, Rivers (DWER-036)
- RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037)
- Soil Landscape Mapping – Best Available (DPIRD-027)
- Threatened Ecological Communities (DBCA-038)
- Vegetation Complexes – Swan Coastal Plain (DBCA-046)

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Legend

- Major Road
- Minor Road
- Project Area

DALYELLUP
GELORUP
NORTH BOYANUP
STRATHAM
BOYANUP
STIRLING ESTATE
ELGIN
THE PLAINS

Athena St
Driver Rd
Dalyellup Blvd
Sapphire Rd
Robinhood Rd
Sherwood Dr
Harewoods Rd
Heathridge Rd
Speed Rtt
Hawkins Dr
Hasties Rd
Zinnia Rd
Brookview Av
Tamarind Cr
Serene Dr
Jules Rd North
Allenville Rd
Jules Rd
Ducane Rd
Maidment Pde
Hampstead St
Watkins Rd
Gelorup Rise
Yalinda Dr
Marchetti Rd
Eucalypt Dr
Cokelup Rd
Banksia Rd
Woods Rd
Ken Bell Rd
Brockway Dr
Manea Dr
Quambi Dr
Lakes Rd
Calinup Rd
Jaymon Rd
Hilduna Dr
Rich Rd
Minninup Rd
Ramsay Rd
Mewett Dr
Murname Ct
Kent Rd
Jilley Rd
Brisden Rd
Brookdale Rd
Fishermans Rd
Chislehurst Av
Stafford Dr
Venus Rd
Bussell Hwy
Roselands Rd
Boyanup Rd West
Skippings Rd
Penn St
Mangles Rd
Roberts Rd
Dowgup Rd
Mallokup Rd
Edwards Rd
King Rd
Cable Mine Rd
Nicholls Rd
Yeardy Rd
John Hogg Rd
Clapp Rd
Matthews Rd
Vickery Rd
Railway Rd
Elgin Rd
Clarke Rd
Malatesta Rd
Lowrie Rd
Washers Rd
Bell Rd
Cain Rd
Norman Rd
Gynudup Rd
Summerfea Rd
Gavins Rd
Wells Rd

BINNINGUP
BRUNSWICK JUNCTION
LESCHENAULT
AUSTRALIND
EATON
BUREKUP
BUNBURY
GELORUP
DARDANUP
STRATHAM
BOYANUP
PEPPERMINT GROVE
CAPEL
DONNYBROOK
BUSSELTON

SLIP

Paper Size ISO A3

0 0.5 1 1.5

Kilometres

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

N

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

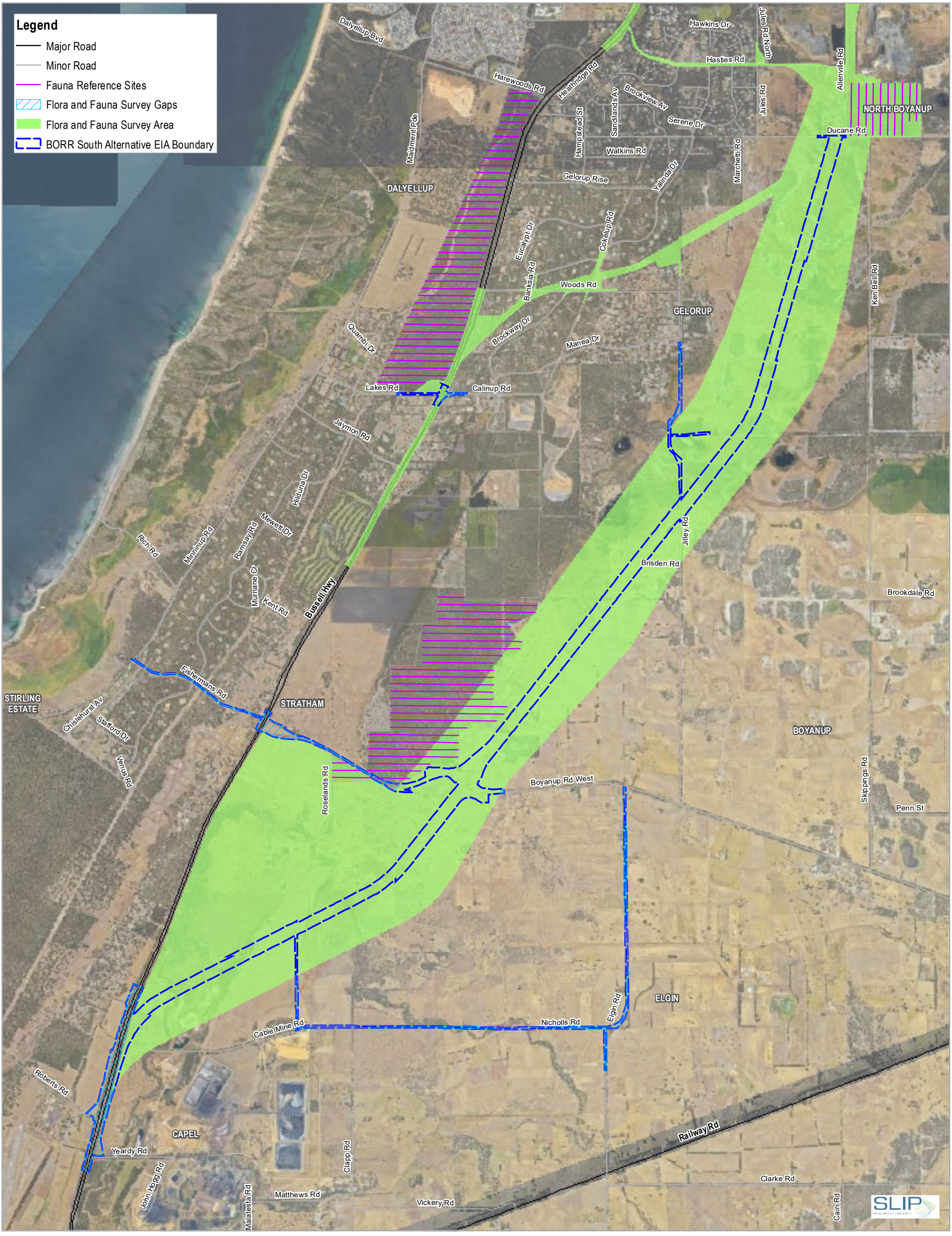
Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

BORR Southern Section Alternative Alignment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 1

Data source: BORR: South Alternate EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190507, Locality names - 2018; Geoscience Australia: Geodata Topo 250k.. Created by: slei



Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Surveyed and Unsurveyed Areas

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 2

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_002_GapsInSurveyEffort_Rev1.mxd
Print date: 24 Jun 2019 - 15:13

Data source: BORR: South Alternate Boundary - 20181212, Survey areas and gaps - 20190213, Fauna Reference Sites - 20190122; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415, Locality names - 2018; Geoscience Australia: Geodata Topo 250k.. Created by: slei

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 3

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

- Significant weed
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 1c - Isolated Marri and Jarrah +/- Banksia closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 6 - Woodland Banksia, Jarrah +/- Peppermint over occasional shrubland Kunzea
- 7 - Woodland of Paperbark over tall sparse shrubland
- Cleared

Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Zanadu Ct
Marchetti Rd
Woods Rd
Ken Bell Rd
Hair Pl
Manea Dr
Stable Ct
Jilley Rd
Skippings Rd
1a
1c
7
2
Cleared
*Zantedeschia aethiopica (DP/WONS)
1b
6
3

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:35

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Brockway Dr
Manea Dr
Calinup Rd
Rd No 308
Brisden Rd
Jilley Rd
Cleared
Roselands Nature Reserve
Boyanup Rd West
*Zantedeschia aethiopica (DP/WONS)
*Zantedeschia aethiopica (DP/WONS)
*Zantedeschia aethiopica (DP/WONS)
1
9a
10
7
3
2
1a
6
1b

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1 - Open forest of Jarrah, Marri and Banksia
- 1a - Marri and Jarrah +/- Peppermint over closed grassland
- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- 6 - Woodland Banksia, Jarrah +/- Peppermint over occasional shrubland Kunzea
- 7 - Woodland of Paperbark over tall sparse shrubland
- 9a - Marri and Jarrah +/- Peppermint with very occasional Tuart
- 10 - Parkland cleared with occasional Marri, Jarrah and Peppermint
- Cleared

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3
0 90 180 270 360
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:41

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hilduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd
Roselands Nature Reserve

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:43

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

1b

Cleared

3

2

Cable Mine Rd

Nicholls Rd

Elgin Rd

Clapp Rd

Vickery Rd

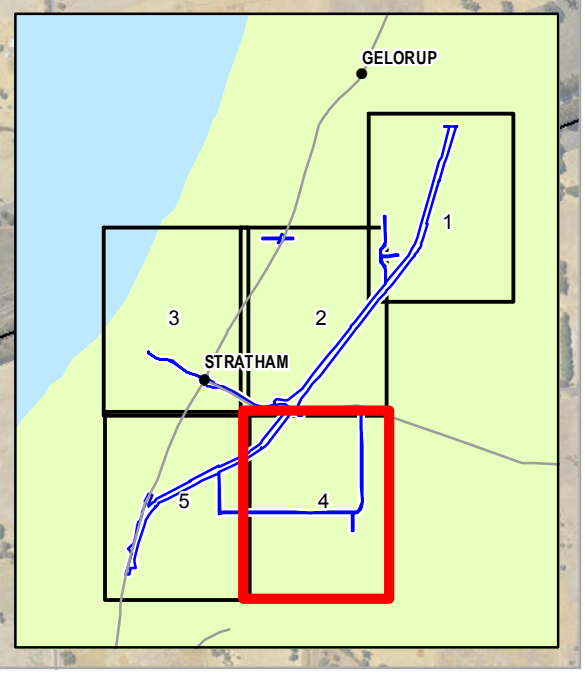
Boyanup Capel

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- 3 - Scattered Jarrah, Marri +/- Peppermint over tall open shrubland Banksia, Xylomelum, *Kunzea* sp.
- Cleared



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

Vegetation Type

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:44

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Legend

- Significant weed
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Type

- 1b - Isolated Flooded Gum and Marri closed grassland
- 2 - Open forest of Jarrah, Marri, Banksia and Peppermint
- Cleared

*Zantedeschia aethiopica (DP/WONS)

*Zantedeschia aethiopica (DP/WONS)

*Asparagus asparagoides (DP/WONS)

Roselands Rd

Bussell Hwy

Cable Mine Rd

Roberts Rd

Yeardy Rd

John Hogg Rd

Malatesta Rd

1b

2

Cleared

GELORUP

STRATHAM

1

2

3

4

5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Type

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 3

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_003_SouthAlternateVegetationTypeMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:36

Data source: BORR: South Alternate Boundary - 20181212, Vegetation type, Additional non-surveyed vegetation extent - 20190220, Significant Weeds - 2019; Landgate: Imagery accessed on 20190415, Roads - 2018; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 4

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 4 - Good
- 4-6 - Good - Degraded
- 6 - Degraded
- 7 - Completely Degraded

Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Zanadu Ct
Marchetti Rd
Woods Rd
Ken Bell Rd
Hair Pl
Manea Dr
Stable Cl
Jilley Rd
Skippings Rd
4-6
7
6
4

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Manea Dr
Brockway Dr
Calinup Rd
Rd No 308
Brisden Rd
Jilley Rd
Boyanup Rd West
3
6-7
4
1
7
6

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 3 - Very Good
- 4 - Good
- 6 - Degraded
- 6-7 - Degraded - Completely Degraded
- 7 - Completely Degraded

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

N

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT
mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614 , Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hillduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Mumane Cr
Kent Rd
Cherton Ct
Strathan Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd
Roselands Nature Reserve

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

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Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Jilley Rd

7

6

Elgin Rd

Cable Mine Rd

Nicholls Rd

Clann Rd

Vickery Rd

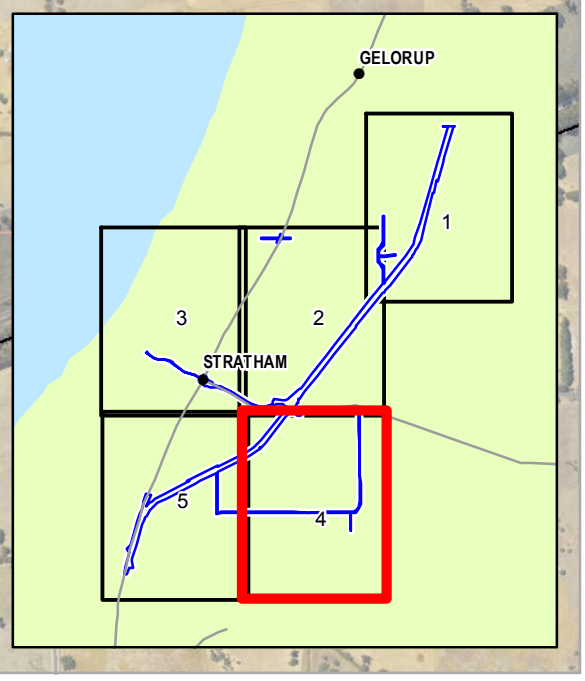
Boyanup Capel

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 6 - Degraded
- 7 - Completely Degraded



Paper Size ISO A3

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Metres

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

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

mainroads WESTERN AUSTRALIA

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Vegetation Condition

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614, Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Vegetation Condition

- 6 - Degraded
- 7 - Completely Degraded

Roselands Rd
Bussell Hwy
Cable Mine Rd
Roberts Rd
Yeardy Rd
John Hogg Rd
Malaresta Rd
6
7

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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Vegetation Condition

Project No. **61-37041**
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Date **24/06/2019**

FIGURE 4

Data source: BORR: South Boundary - 20181212, Vegetation Condition- 20190221; Landgate: Imagery accessed on 20190614 , Roads - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP.
Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT
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Southern Section Alternative Alignment
Environmental Impact Assessment

Conservation Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

FIGURE 5

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Legend

Conservation Significant Flora

- *Acacia semitrullata* (P4)
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Banksia Woodlands TEC
- Banksia Woodlands PEC

Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Zanadu Ct
Marchetti Rd
Gelorup Rise
Woods Rd
Ken Bell Rd
Hair Pl
Stable Cl
Manea Dr
Jilley Rd
Skippings Rd

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 16:59

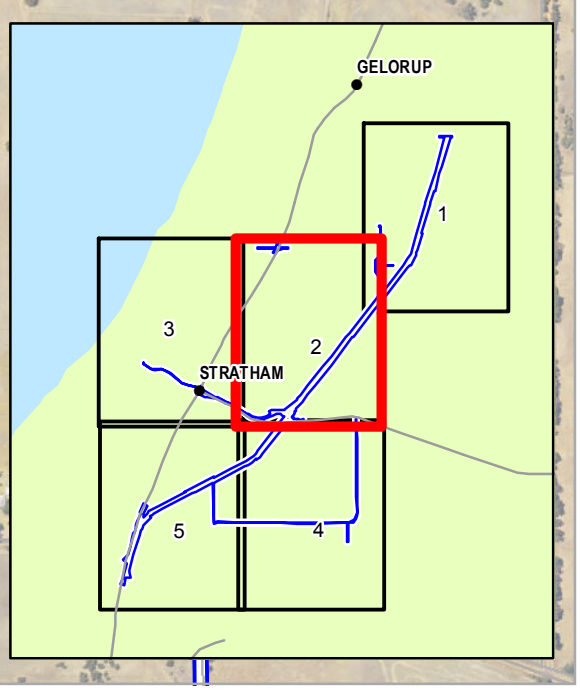
Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Manea Dr
Brockway Dr
Calinup Rd
Rd No 303
Brisden Rd
Jilley Rd
Boyanup Rd West

Legend

Conservation Significant Flora

- *Chamaescilla gibsonii* (P3)
- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Potentially Banksia dominated woodlands of the SCP IBRA region (PEC)
- Banksia Woodlands TEC
- Tuart Woodlands PEC



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BORR Team

Australian Government
BUILDING OUR FUTURE

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Southern Section Alternative Alignment
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Conservation Significant Ecological Communities and Flora

Project No. 61-37041
Revision No. 1
Date 24/06/2019

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:01

Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Potentially Banksia woodlands of the SCP(TEC)
- Potentially Tuart (*Eucalyptus gomphocephala*) woodlands of the SCP(PEC)

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hillduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cherion Ct
Strathan Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd
Roselands Nature Reserve

GELORUP
STRATHAM
1
2
3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

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Conservation Significant Ecological Communities and Flora

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 5

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Boyanup Rd West

Boyanup Rd West

Jilley Rd

Elgin Rd

Cable Mine Rd

Nicholls Rd

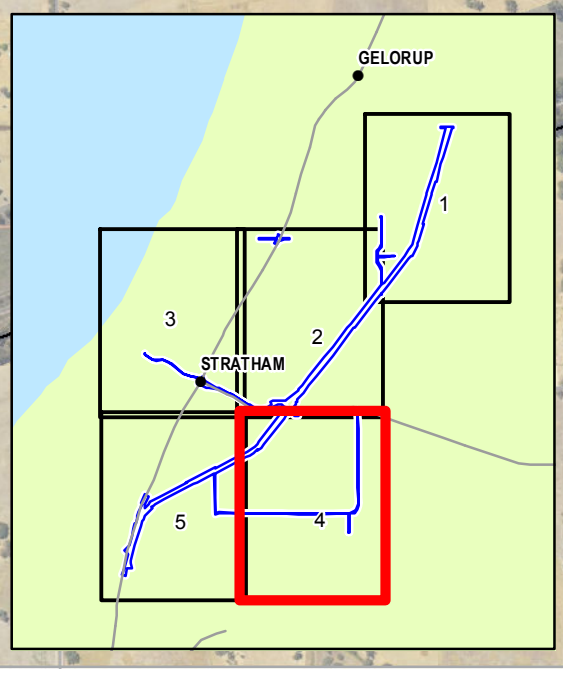
Clapp Rd

Vickery Rd

Boyanup Capel

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps (not considered likely to represent TEC/PEC)
- Potentially Banksia dominated woodlands of the SCP IBRA region (PEC)



Paper Size ISO A3

0 90 180 270 360

Metres

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

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BUILDING OUR FUTURE

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Environmental Impact Assessment

Conservation Significant Ecological Communities and Flora

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 5

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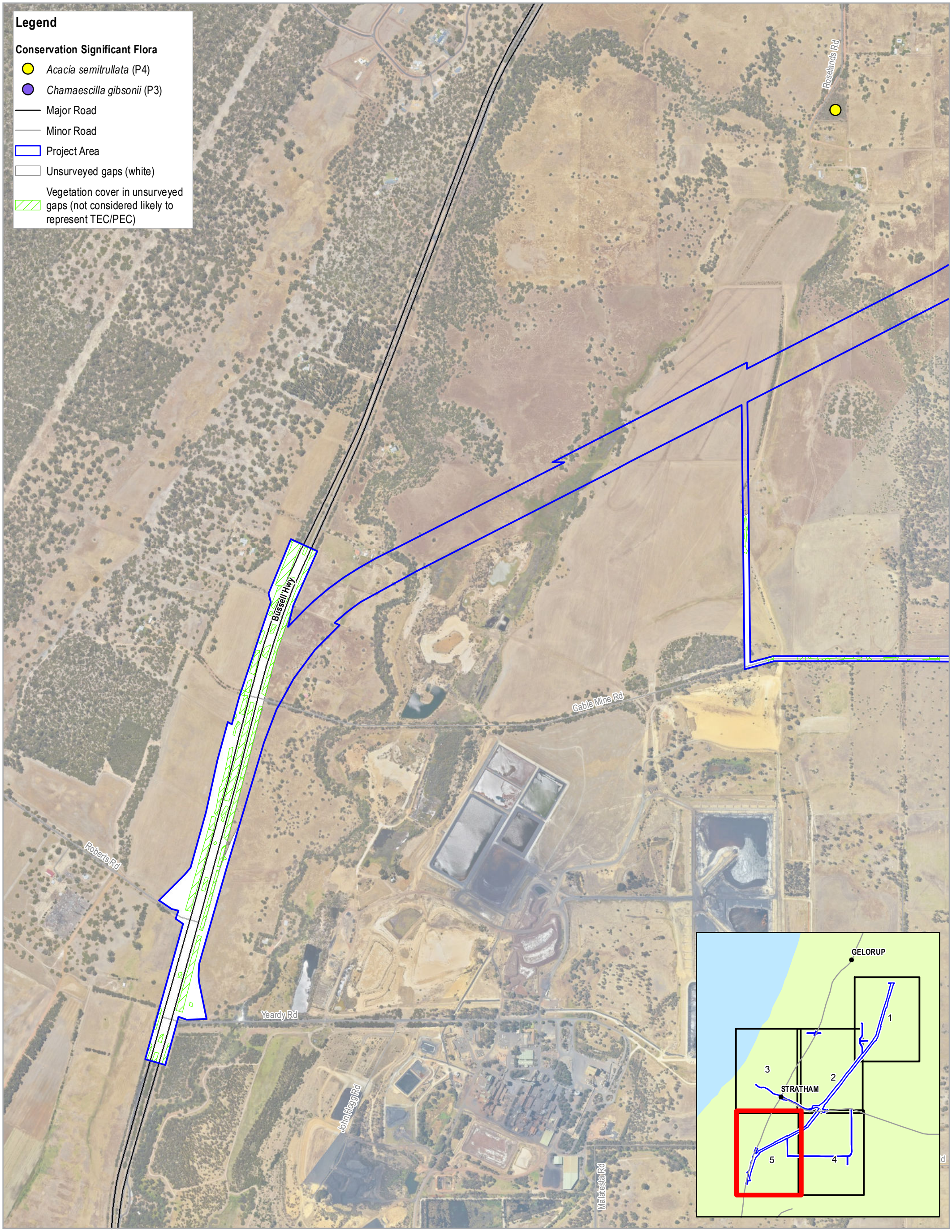
Print date: 24 Jun 2019 - 17:02

Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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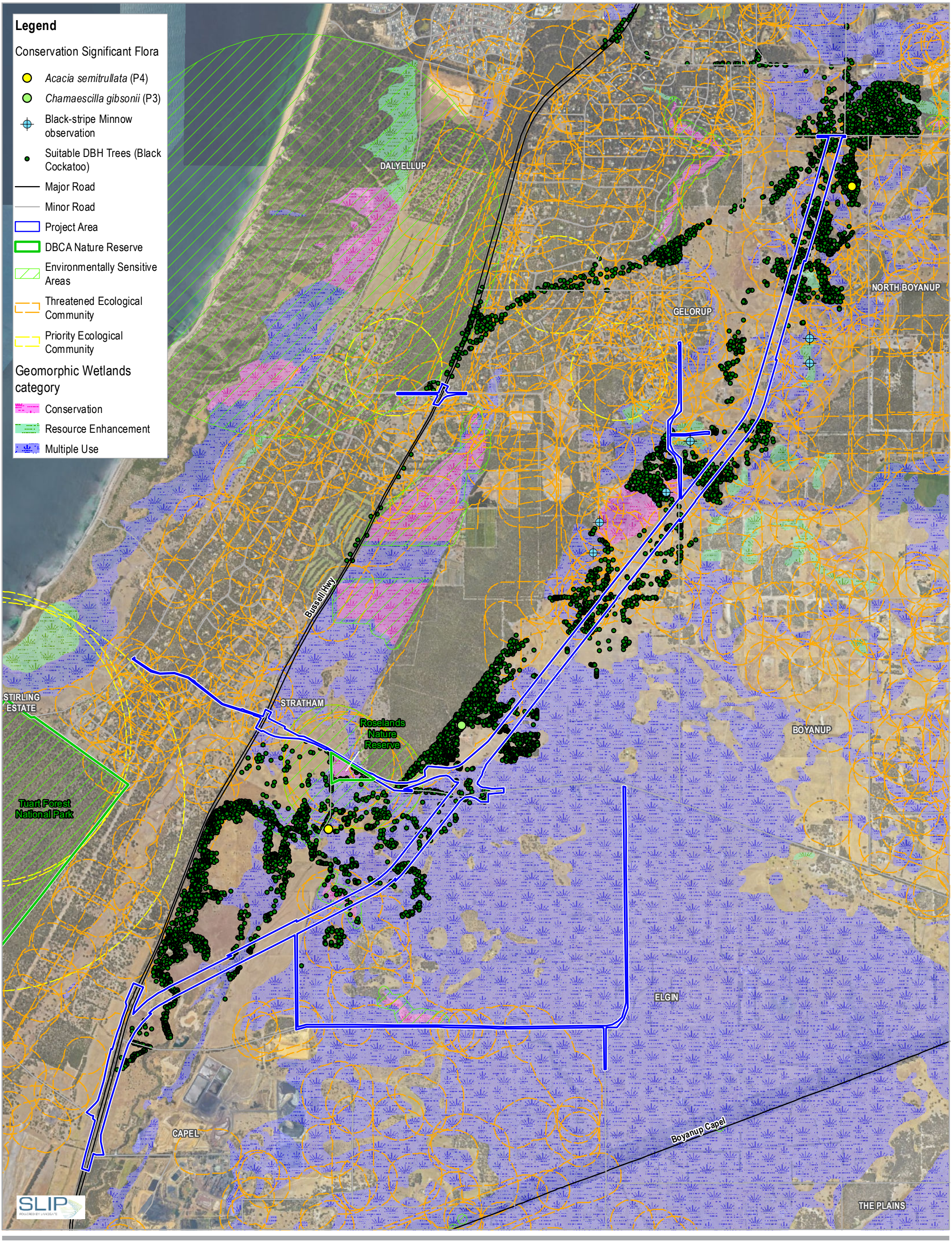
Conservation Significant Ecological Communities and Flora

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 5

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_005_TECPEC_Consigs_Mapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:00

Data source: BORR: South Alternative Boundary - 20181212, TEC/PEC - 201902; Landgate: Imagery accessed on 20190415; MRWA: Road Network - 20180519; Geoscience Australia: Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

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Kilometres

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

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Environmental Constraints

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 6

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_012_EnvConstraints_Rev1.mxd
Print date: 24 Jun 2019 - 17:50

Data source: BORR Team: Conservation significant flora - 20190212, Project Area - 201812; Biota: Cockatoo trees - 20190208; DBCA: TEC/PEC boundaries - 20180605, Geomorphic wetlands - 20190604, Nature Reserves - 20170730; DWER: ESAs - 20151012; Landgate: Roads, Localities - 2018, Imagery: WA Now accessed 20190620. . Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994

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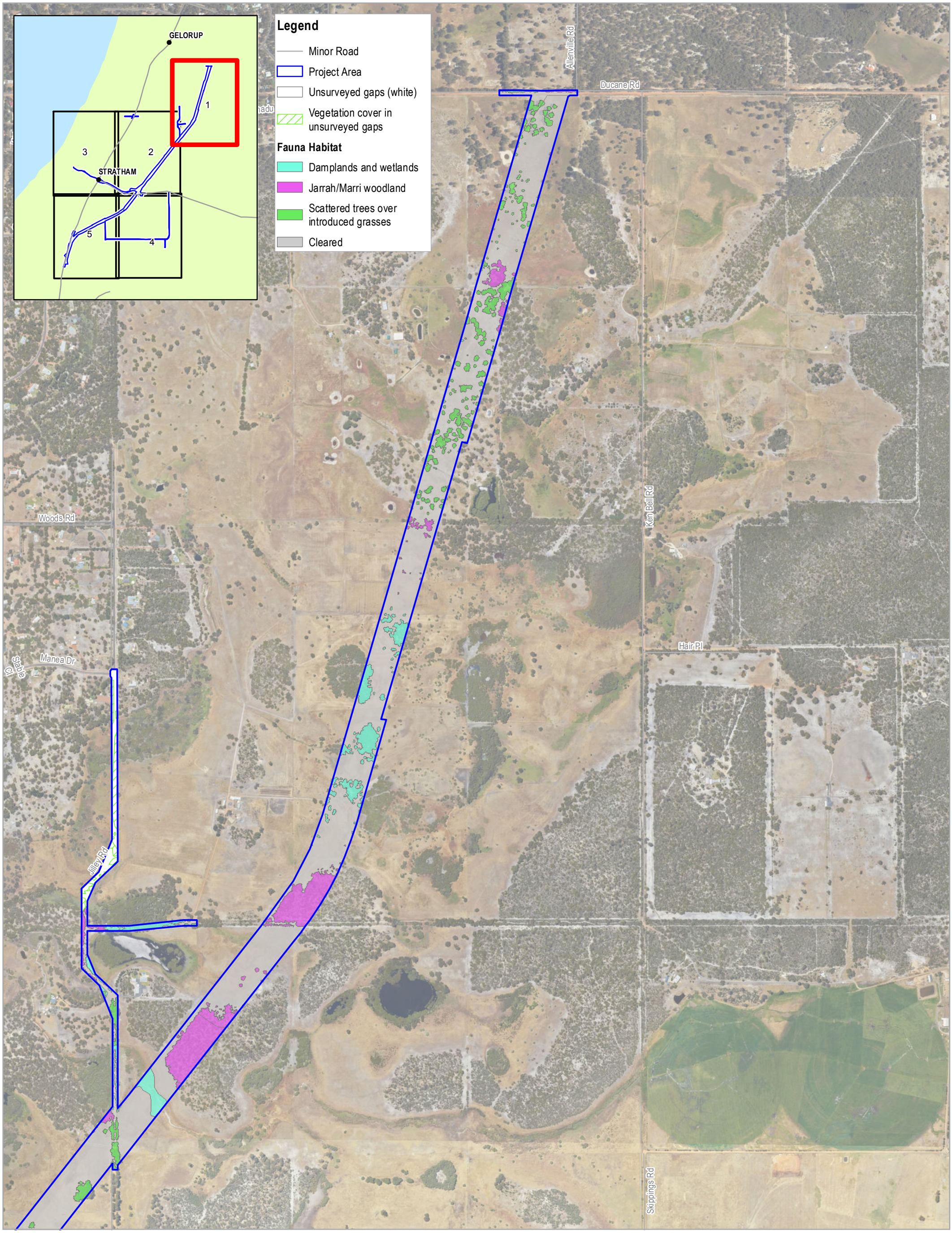
OVERVIEW

FIGURE 7

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



Paper Size ISO A3

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Metres

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

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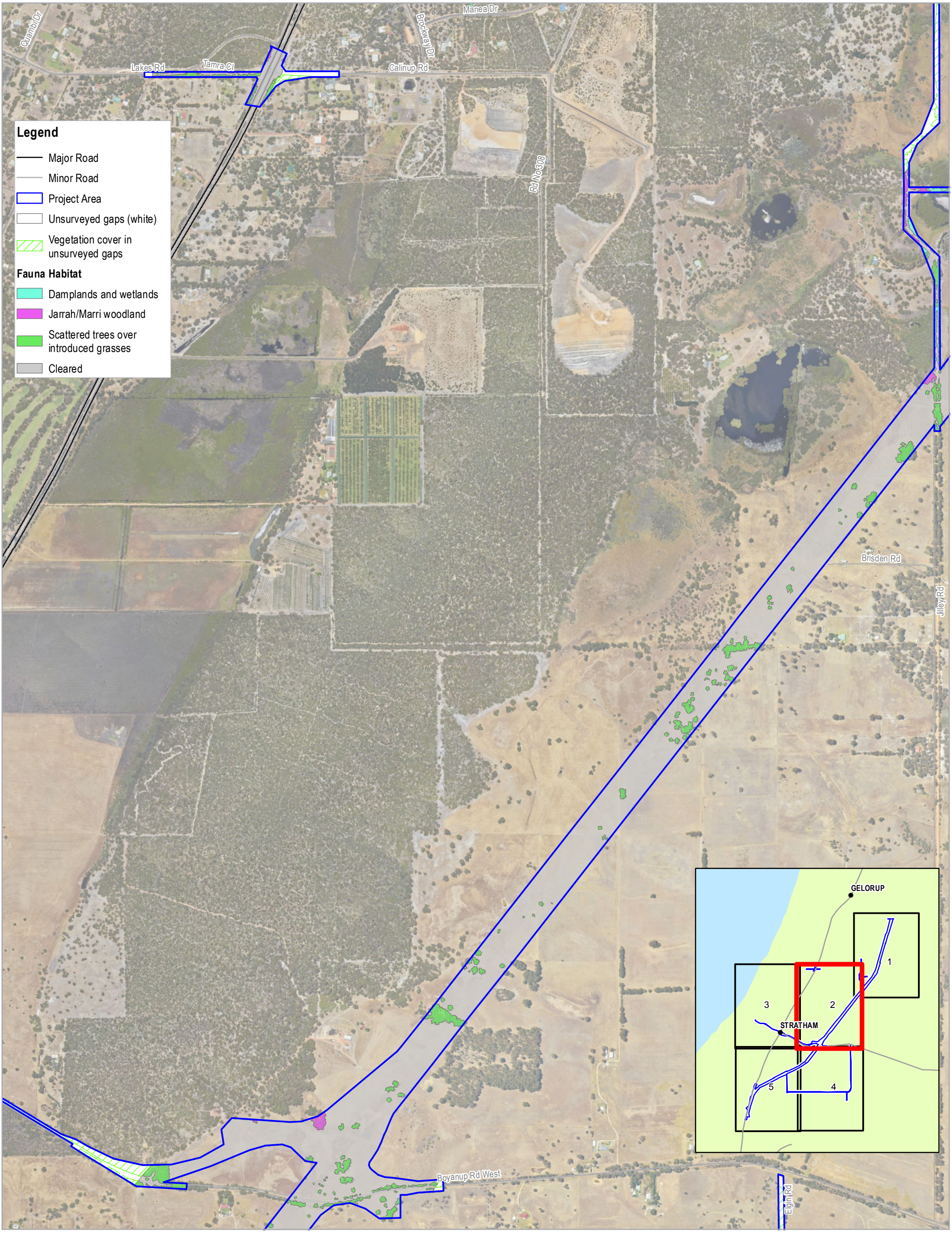
Revision No.	**1**
Date	**24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:05

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:07

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Paper Size ISO A3

0 90 180 270 360

Metres

N

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

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FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:05

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Jilley Rd

Elgin Rd

Cable Mine Rd

Nicholls Rd

Boyanup Capel

Clapp Rd

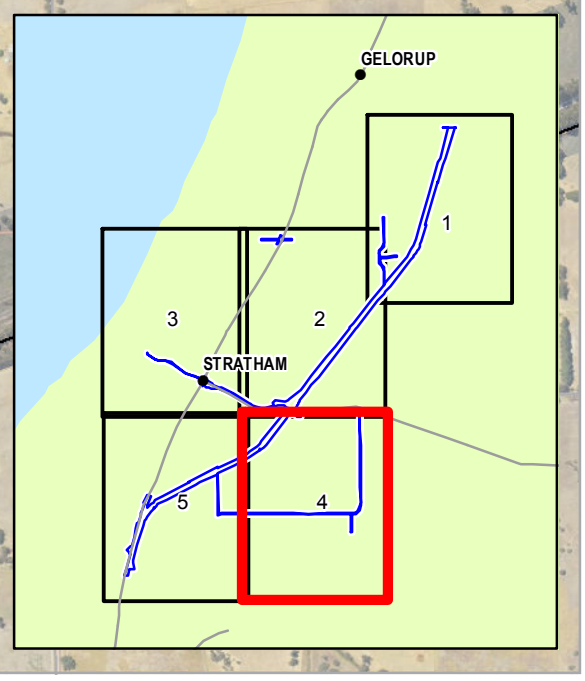
Vickery Rd

Legend

- Major Road
- Minor Road
- Project Area
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps

Fauna Habitat

- Jarrah/Marri woodland
- Scattered trees over introduced grasses
- Cleared



Paper Size ISO A3

0 90 180 270 360

Metres

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

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Revision No. **1**
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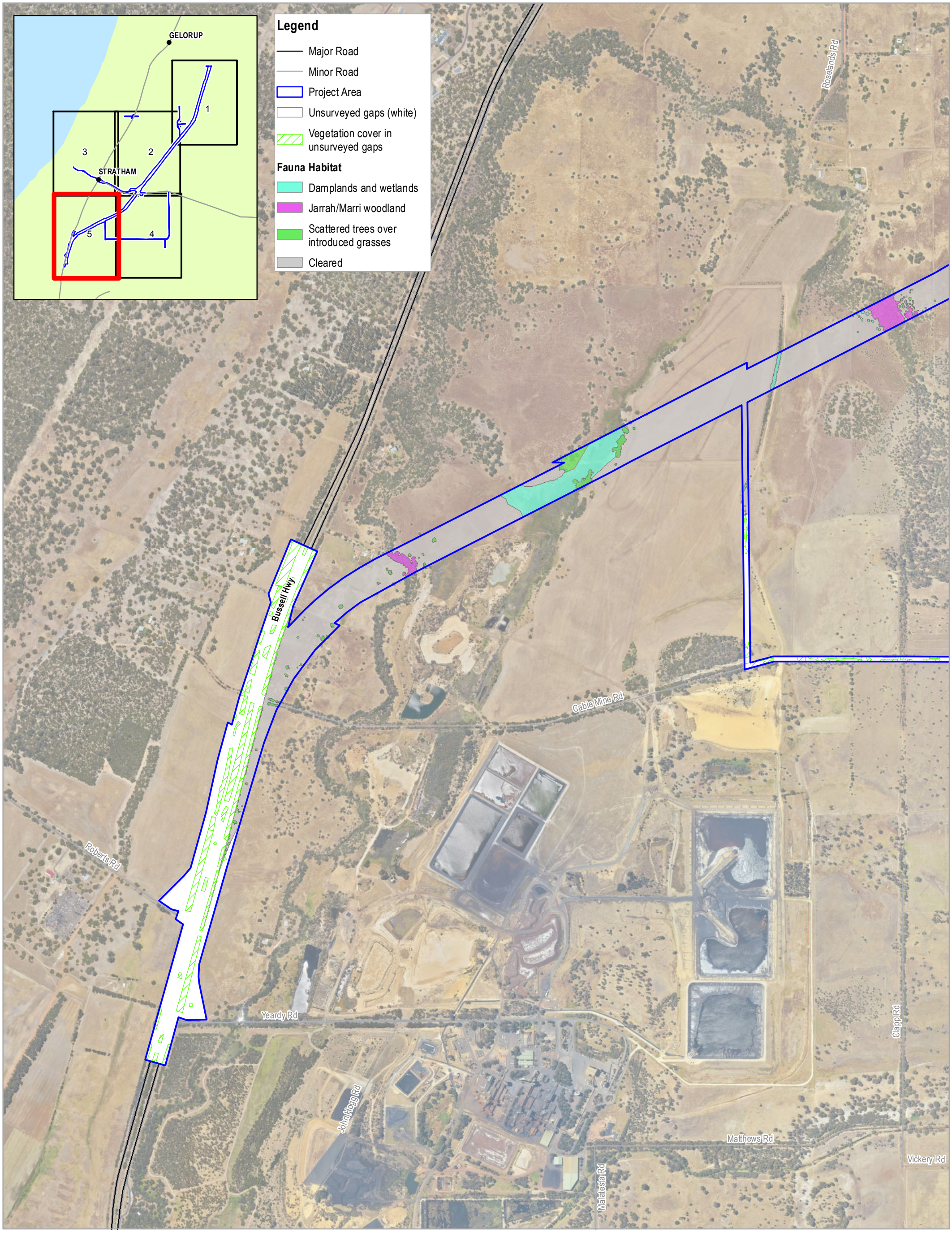
FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\61370 41_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:09

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

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Metres

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

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Australian Government
BUILDING OUR FUTURE

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Bunbury Outer Ring Road
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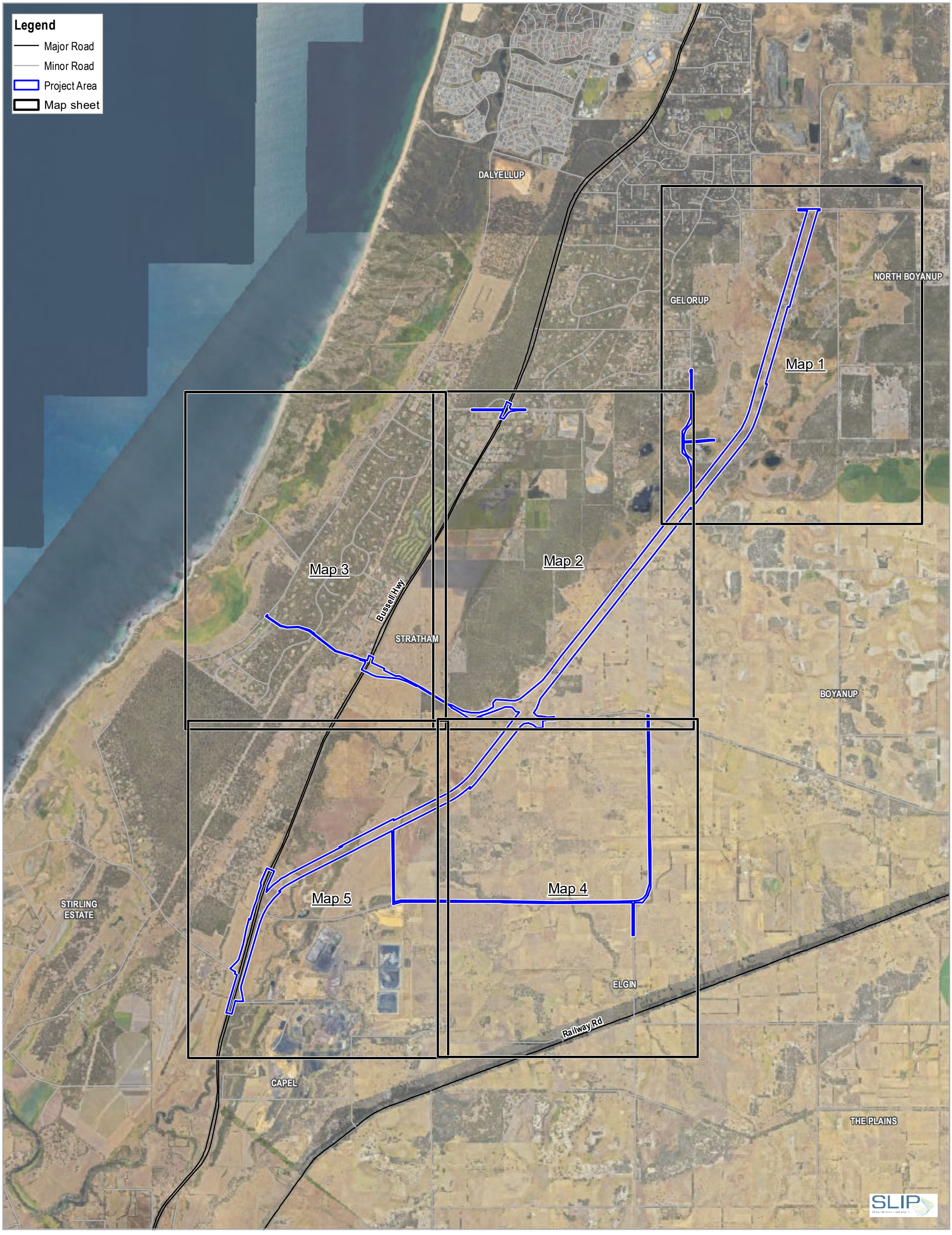
Revision No. **1**
Date **24/06/2019**

FIGURE 7

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_006_SouthAlternateFaunaHabitatMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:06

Data source: BORR: South Alternate Boundary - 20181212, Additional non-surveyed vegetation extent - 20190220; Landgate: Roads - 2018, imagery acessed on 20190415; Biota: Fauna habitat - 20190220; Geoscience Australia: Geodata Topo 250k - 2006; DPIRD: Native vegetation extent - 20171026. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 0.5 1 1.5

Kilometres

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

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mainroads WESTERN AUSTRALIA
BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

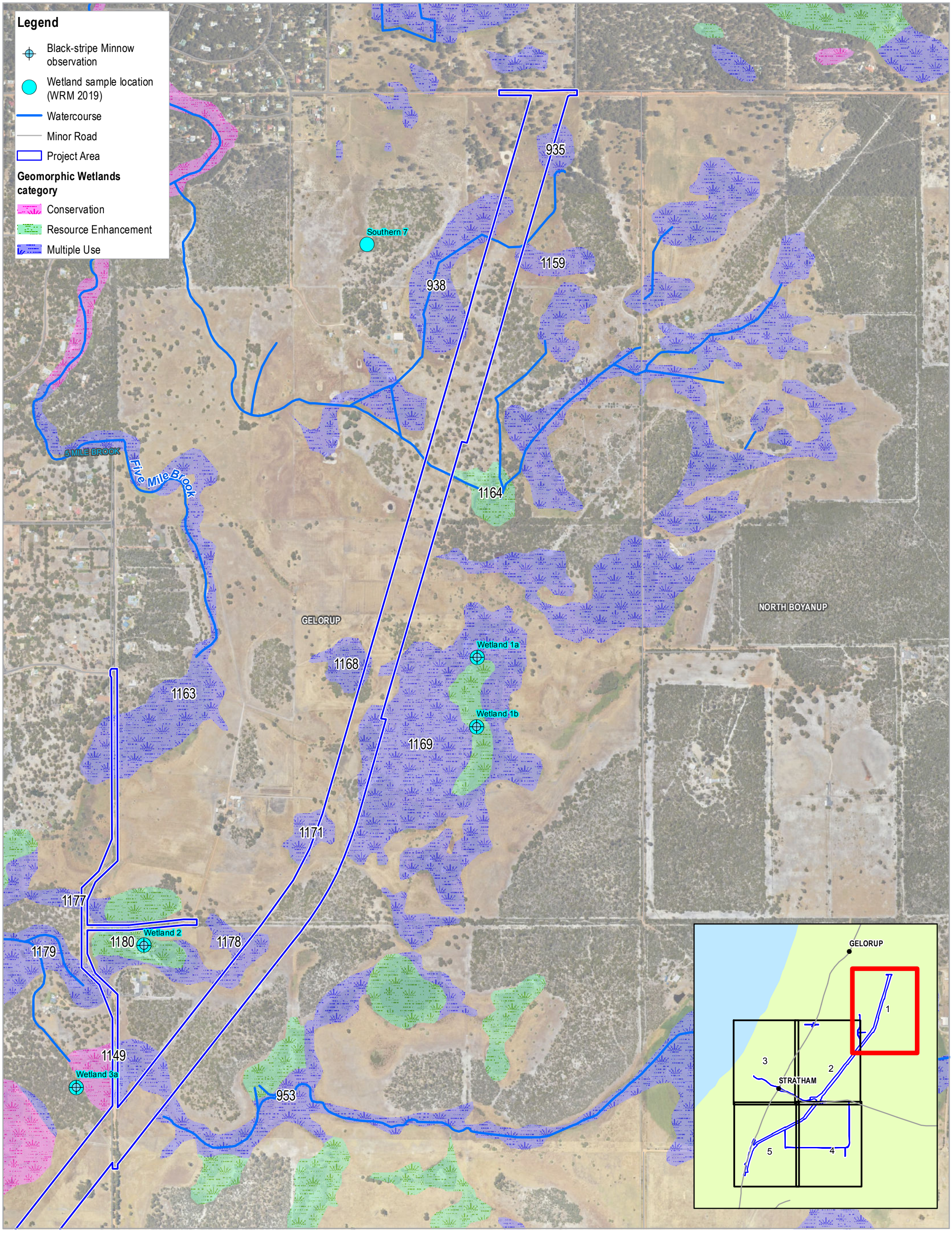
Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

OVERVIEW

FIGURE 8

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



Paper Size ISO A3

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Metres

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

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BUNBURY OUTER RING ROAD | PLANNING AND DEVELOPMENT

Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

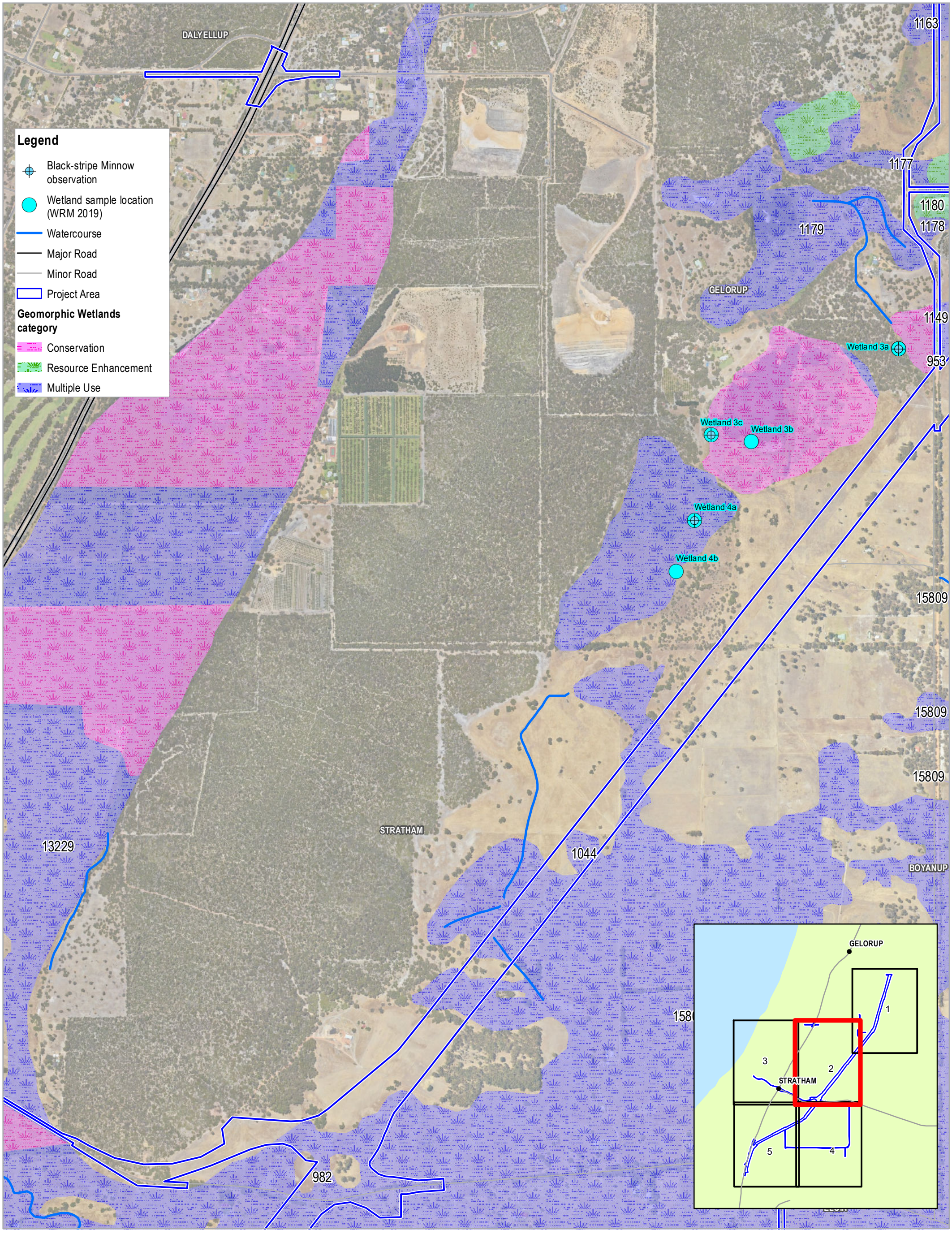
Inland Waters

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:37

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen



SLIP

Paper Size ISO A3

0 80 160 240 320

Metres

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

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Inland Waters

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Revision No. **1**
Date **24/06/2019**

FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:46

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen

Legend

- Watercourse
- Major Road
- Minor Road
- Project Area

Geomorphic Wetlands category

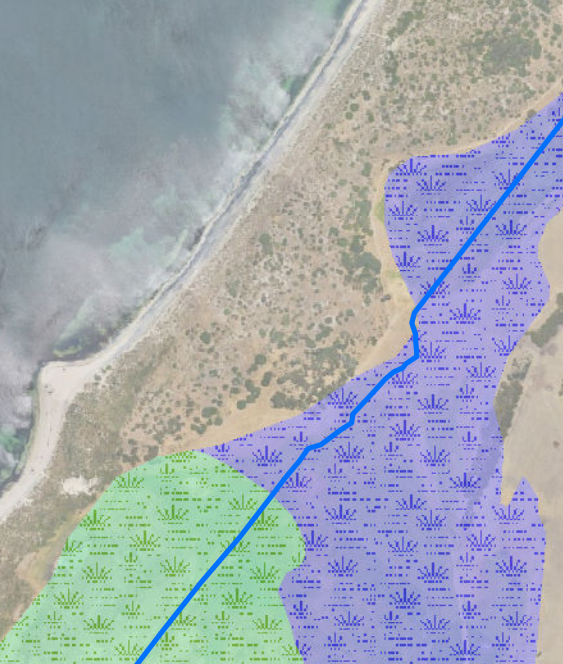
- Conservation
- Resource Enhancement
- Multiple Use

STRATHAM

Bussell Hwy

13229

15809



Paper Size ISO A3

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Metres

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

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Inland Waters

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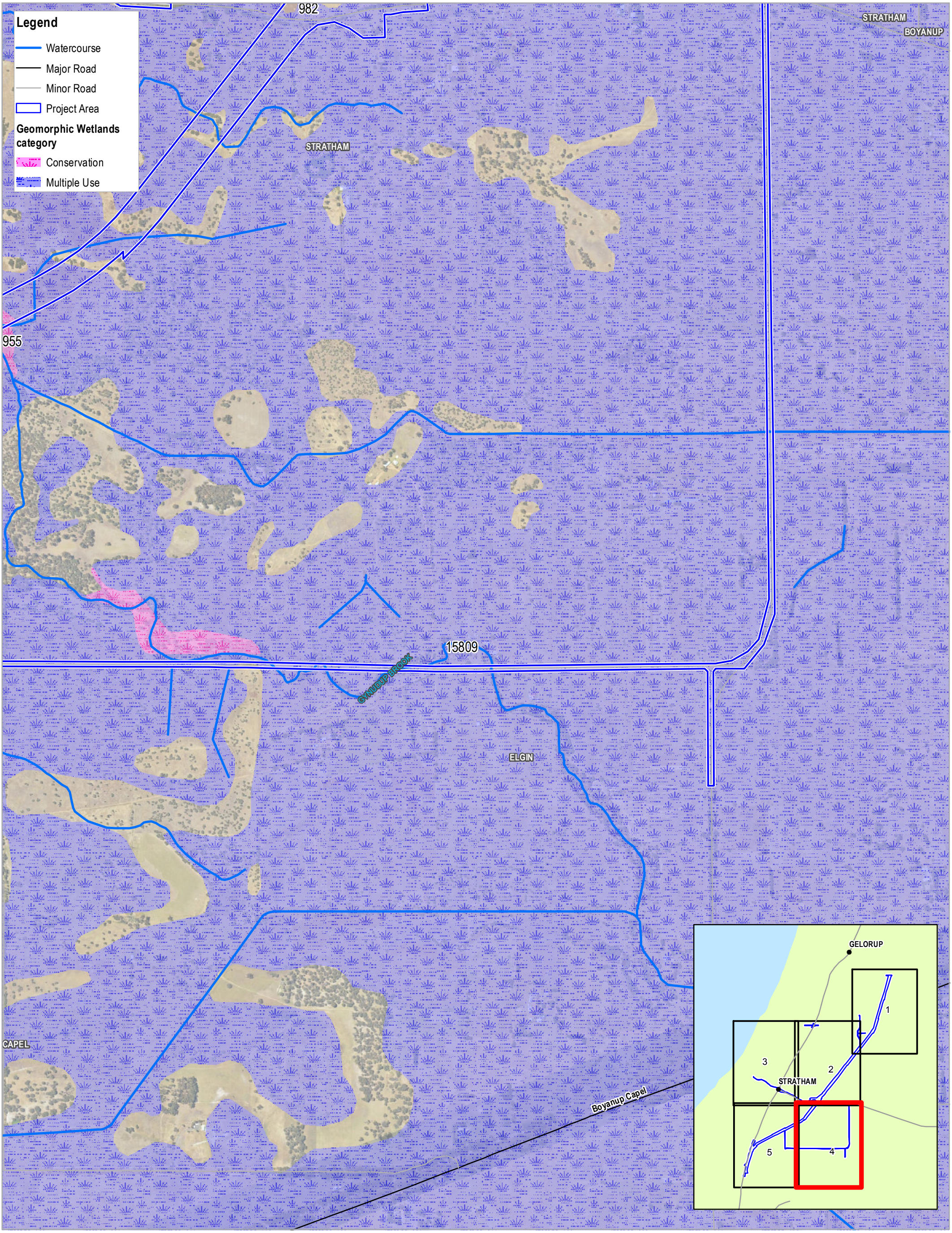
FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:47

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen



SLIP

Paper Size ISO A3

0 80 160 240 320

Metres

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

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Southern Section Alternative Alignment
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Inland Waters

Project No. **61-37041**
Revision No. **1**
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FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:38

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen

Legend

- Watercourse
- Major Road
- Minor Road
- Project Area

Geomorphic Wetlands category

- Conservation
- Multiple Use

STRATHAM

955

15809

Bussell Hwy

GYNUDUP BROOK

777

CAPEL

ELGIN

15809

15809

GELORUP

STRATHAM

1

2

3

4

5

SLIP

Paper Size ISO A3

0 80 160 240 320

Metres

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

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Inland Waters

Project No. **61-37041**
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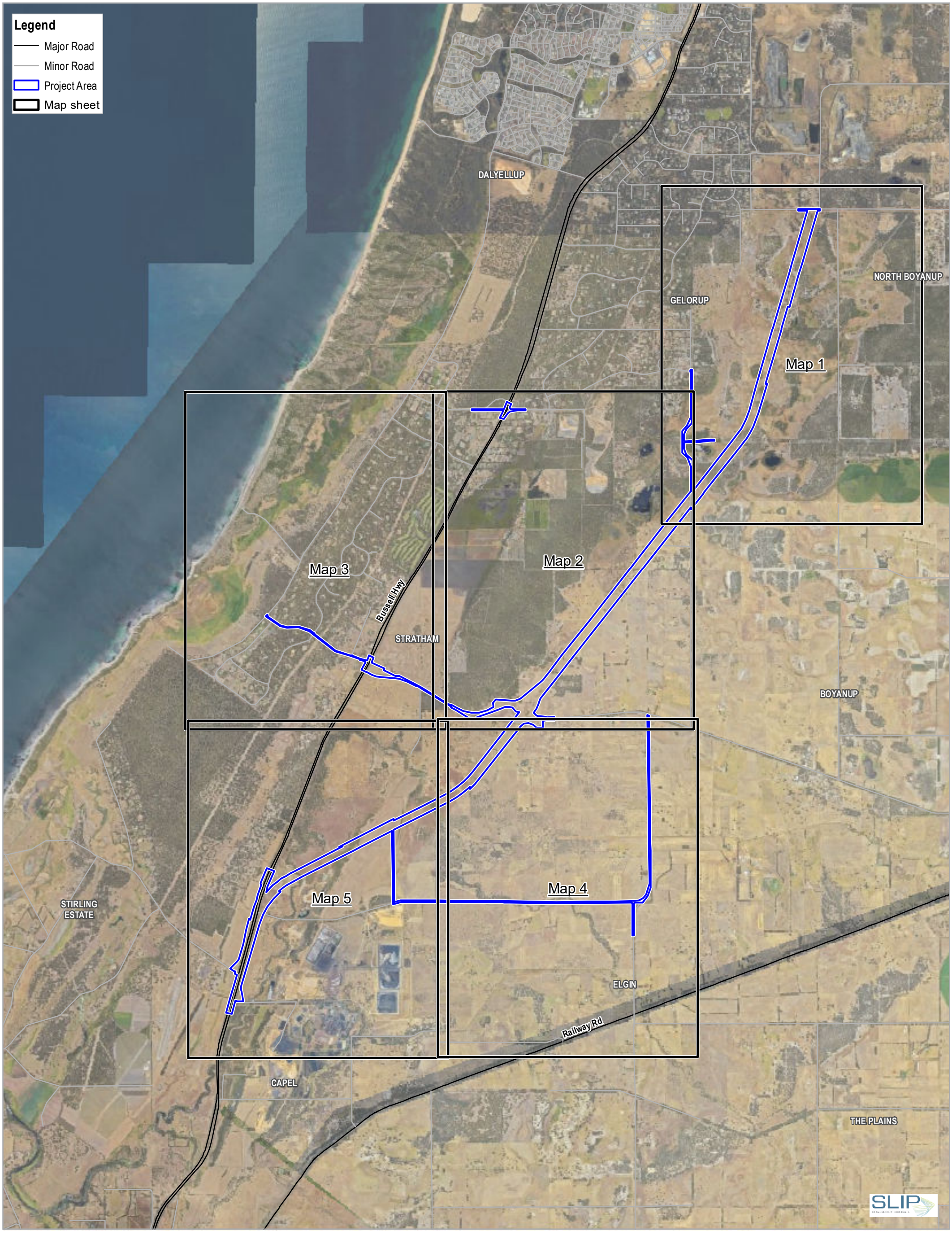
FIGURE 8

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_010_InlandWaters_Rev1.mxd
Print date: 24 Jun 2019 - 17:38

Data source: BORR: South Alt Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190620; DBCA: Geomorphic wetlands - 20190604; LGATE: Rivers - 2018; Geoscience Australia: Geodata Topo 250k - 2006; WRM: Minnow observations, Wetland samples - 2019. . Created by: mmikkonen



Paper Size ISO A3

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Kilometres

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

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Project No. **61-37041**
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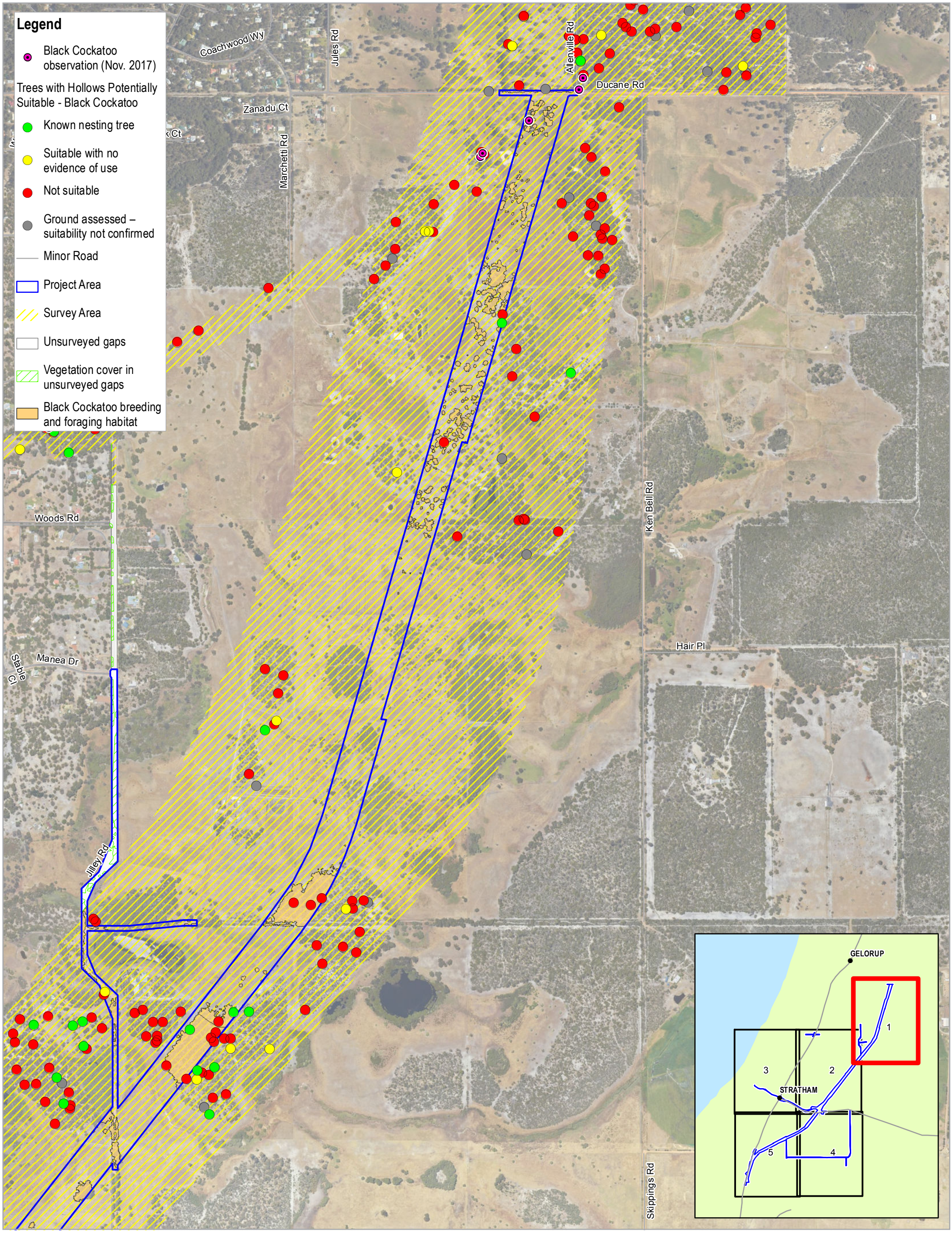
OVERVIEW

FIGURE 9

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei



Paper Size ISO A3

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Metres

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

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Black Cockatoos

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Revision No. **1**
Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:16

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Brockway Dr
Manea Dr
Calinup Rd
Rd No 308
Brisden Rd
Jilley Rd
Boyanup Rd West

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

GELORUP
STRATHAM
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Paper Size ISO A3

0 90 180 270 360

Metres

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

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Black Cockatoos

Project No. **61-37041**
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Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:18

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hilduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd

GELORUP
STRATHAM
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Paper Size ISO A3

0 90 180 270 360

Metres

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

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FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
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Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 20171; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Elgin Rd

Cable Mine Rd

Nicholls Rd

Clapp Rd

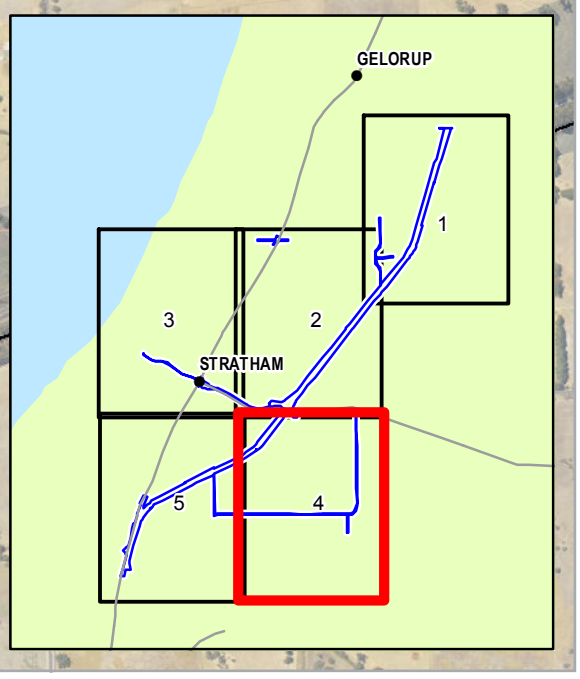
Vickery Rd

Boyanup Capel

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Black Cockatoo breeding and foraging habitat



Paper Size ISO A3

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Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road
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Black Cockatoos

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Date **24/06/2019**

FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:20

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 201711; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

Trees with Hollows Potentially Suitable - Black Cockatoo

- Known nesting tree
- Suitable with no evidence of use
- Not suitable
- Ground assessed – suitability not confirmed
- Major Road
- Minor Road
- Project Area
- Survey Area
- Unsurveyed gaps
- Vegetation cover in unsurveyed gaps
- Black Cockatoo breeding and foraging habitat

Roselands Rd
Bussell Hwy
Cable Mine Rd
Roberts Rd
Yeardy Rd
John Hogg Rd
Malatesta Rd
Rd

GELORUP
STRATHAM
1
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3
4
5

Paper Size ISO A3

0 90 180 270 360

Metres

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

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FIGURE 9

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_007_BCsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:17

Data source: BORR: South Alternative Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190415; Biota: Fauna habitat, BC trees - 20190220, BC observations - 20171; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend
Major Road
Minor Road
Project Area
Map sheet

DALYELLUP
GELORUP
NORTH BOYANUP
Map 1
Map 2
Map 3
Bussell Hwy
STRATHAM
BOYANUP
Map 4
Map 5
STIRLING ESTATE
ELGIN
Railway Rd
CAPEL
THE PLAINS
SLIP

Paper Size ISO A3
0 0.5 1 1.5
Kilometres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 Perth Coastal Grid 1994
N

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Western Ringtail Possums

Project No. 61-37041
Revision No. 1
Date 24/06/2019

OVERVIEW

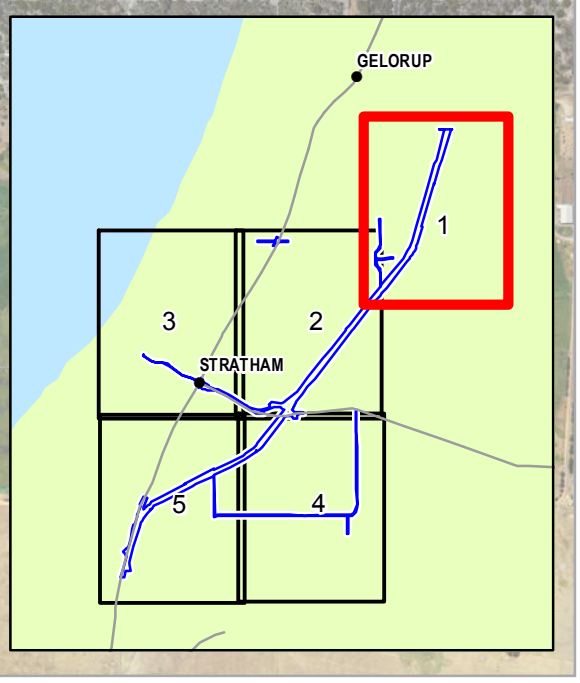
FIGURE 10

Data source: BORR: South EIA Boundary - 20181212; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190522, Locality names - 2018; Geoscience Australia: Geodata Topo 250k..
Created by: slei

Brookview Av
Serene Dr
Coachwood Wy
Jules Rd
Allenville Rd
Ducane Rd
Ducane Rd
Watkins Rd
Ridge Pl
Zanadu Ct
Tarrock Ct
Marchetti Rd
Yalinda Dr
Gelorup Rise
Woods Rd
Ken Bell Rd
Hair Pl
Stable Cl
Manea Dr
Jilley Rd
Skippings Rd

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat



SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 90 180 270 360

Metres

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

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Date **24/06/2019**

Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:25

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Quambi Dr
Lakes Rd
Tamra Cl
Calinup Rd
Brockway Dr
Manea Dr
Rd No 308
Jaymon Rd
Bussell Hwy
Brisden Rd
Jilley Rd
Boyanup Rd West

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat

GELORUP
STRATHAM
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SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 90 180 270 360
Metres

N

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

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Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:25

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat

Lakes Rd
Quambi Dr
Jaymon Rd
Rosemore Wy
Hilduna Dr
Mewett Dr
Ramsay Rd
Rich Rd
Minninup Rd
Child Pl
Murnane Cr
Kent Rd
Cheriton Ct
Stratham Cl
Bussell Hwy
Fishermans Rd
Boyanup Rd West
Venus Rd
Roselands Rd

GELORUP
STRATHAM
1
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SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 90 180 270 360
Metres

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

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Western Ringtail Possums

FIGURE 10

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Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Boyanup Rd West

Boyanup Rd West

Elgin Rd

Cable Mine Rd

Nicholls Rd

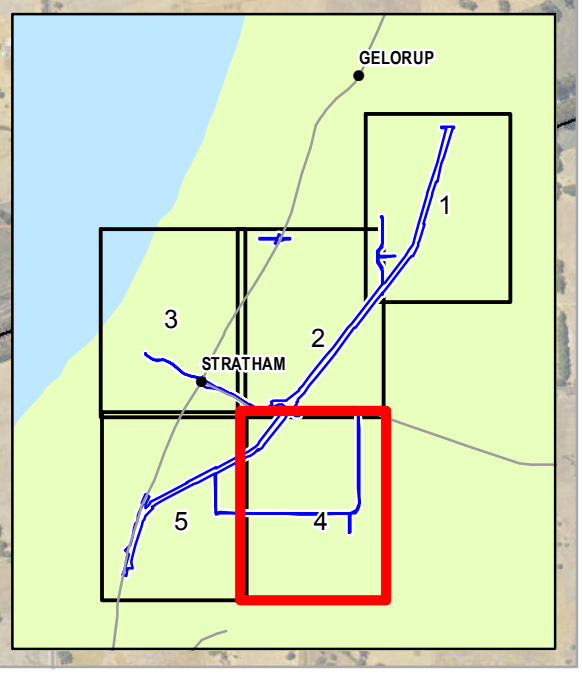
Clapp Rd

Vickery Rd

Boyanup Capel

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat



SLIP POWERED BY LANDGATE

Paper Size ISO A3

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Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

Western Ringtail Possums

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:30

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen

Legend

- Western Ringtail Possum observation
- Possum sampling transect
- Major Road
- Minor Road
- Unsurveyed gaps (white)
- Vegetation cover in unsurveyed gaps
- Project Area
- Survey Area
- Western Ringtail Possum breeding and foraging habitat

Roselands Rd
Bussell Hwy
Cable Mine Rd
Roberts Rd
Yeardy Rd
John Hogg Rd
Malatesta Rd

GELORUP
STRATHAM
1
2
3
4
5

SLIP POWERED BY LANDGATE

Paper Size ISO A3
0 90 180 270 360
Metres

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

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Main Roads Western Australia
Bunbury Outer Ring Road
Southern Section Alternative Alignment
Environmental Impact Assessment

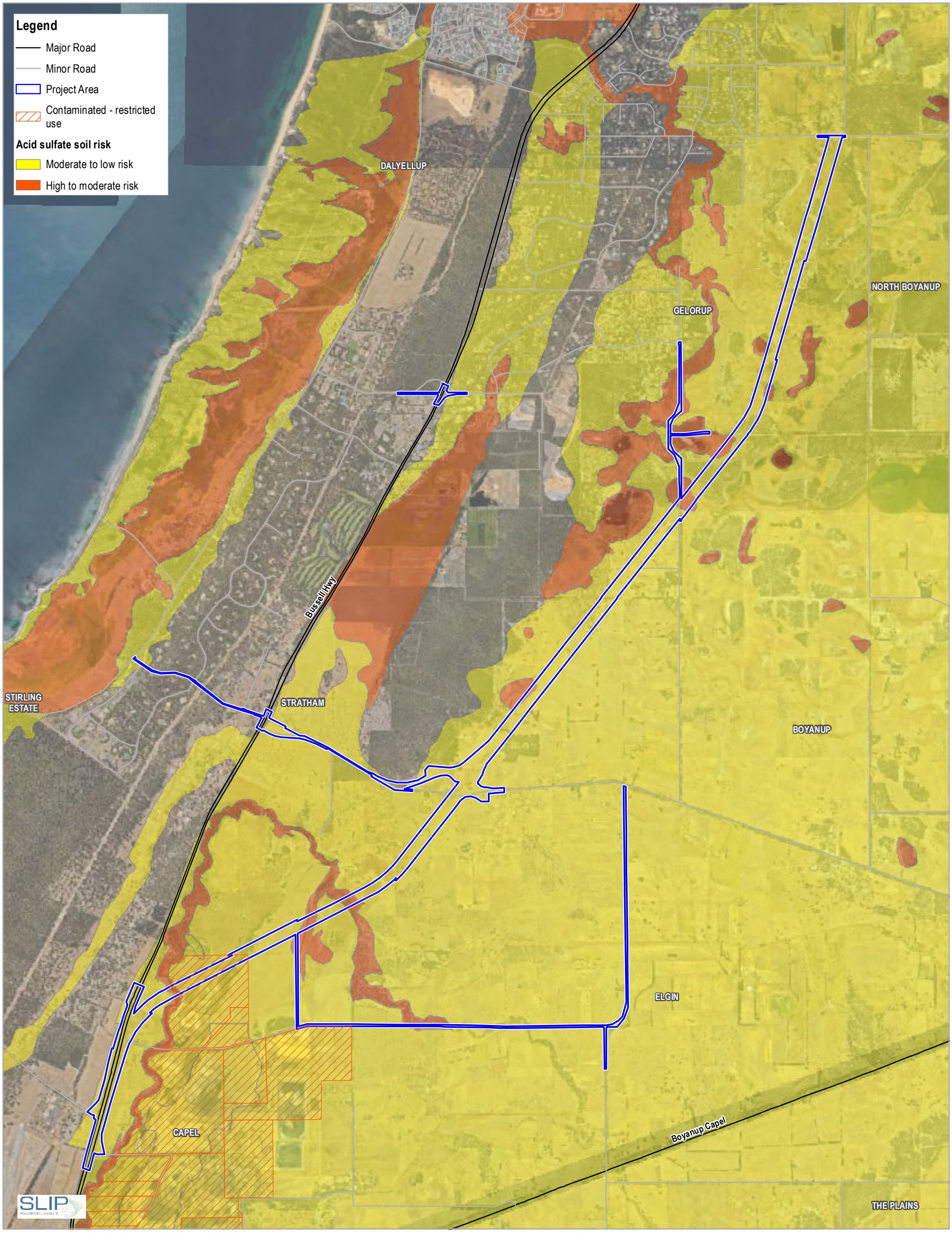
Western Ringtail Possums

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 10

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_008_WRPsMapbook_Rev1.mxd
Print date: 24 Jun 2019 - 17:31

Data source: BORR: South Alternative Boundary - 20181212, Gaps, Vegetation in gaps - 2019; MRWA: Road Network - 20180519; Landgate: Imagery accessed on 20190417; Biota: Fauna habitat, Possum observations, Sampling transects - 20190220; Geoscience Australia: Geodata Topo 250k - 2006. Landgate / SLIP. Created by: mmikkonen



Paper Size ISO A3

0 0.25 0.5 0.75 1

Kilometres

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

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Environmental Impact Assessment

Acid Sulfate Soils and Contaminated Sites

Project No. **61-37041**
Revision No. **1**
Date **24/06/2019**

FIGURE 11

G:\61\37041\19_0_GIS\Maps\Working\EIASouthAlternative\6137041_009_ASSContam_Rev1.mxd
Print date: 24 Jun 2019 - 15:18

Data source: BORR: South Alternative Boundary - 20181212; Landgate: Imagery accessed on 20190612; MRWA: Road Network - 20180519; DWER: Acid sulphate soils - 201409, Contaminated Land - 20180615; Geoscience Australia: Geodata Topo 250k - 2006. . Created by: slei

Legend

- Major Road
- Minor Road
- Project Area
- Aboriginal Heritage Sites (Registered and Lodged category)
- European Heritage Sites

DALYELLUP
STIRLING BEACH DALYELLUP
Paper bark wetlands
Bunbury Grammar School
BUNBURY 24
Bunbury Bypass Archaeological Site 1
NORTH BOYANUP
The Gelorup Corridor
GELORUP
Jilley Rd
Bussell Hwy
Minninup Church
Minninup Church
Stratham Park
STRATHAM
Rosemore
Elgin Sports Club
Boyanup Rd West
Stratham School (1st Site)
Sunnyside
Stratham School (2nd Site)
All Souls Church
Roselands
BOYANUP
CAPEL BUSSELL HIGHWAY.
Elgin Rd
ELGIN
Trig Sol Settler
Elgin PO & Phone Exchange
The Bridge Homestead
Boyanup Capel
CAPEL
Capel/01 - Northern Creek
Elgin Siding
Elgin School
Elgin Hall
THE PLAINS
Capel Cemetery

SLIP POWERED BY LANDGATE

Paper Size ISO A3

0 0.5 1 1.5 Kilometres

N

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

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Southern Section Alternative Alignment
Environmental Impact Assessment

Heritage Constraints

Project No. **61-37041**
Revision No. **1**
Date **27/06/2019**

FIGURE 12

Data source: BORR Team: South Alternative Boundary - 201812, Investigation Corridor - 20180706; State Heritage Office: European heritage sites - 20190115; DAA: Aboriginal Heritage Sites - 20190627; Landgate: Aerial photography - Virtual Mosaic accessed 20190627, Roads - 2018. . Created by: mmikkonen

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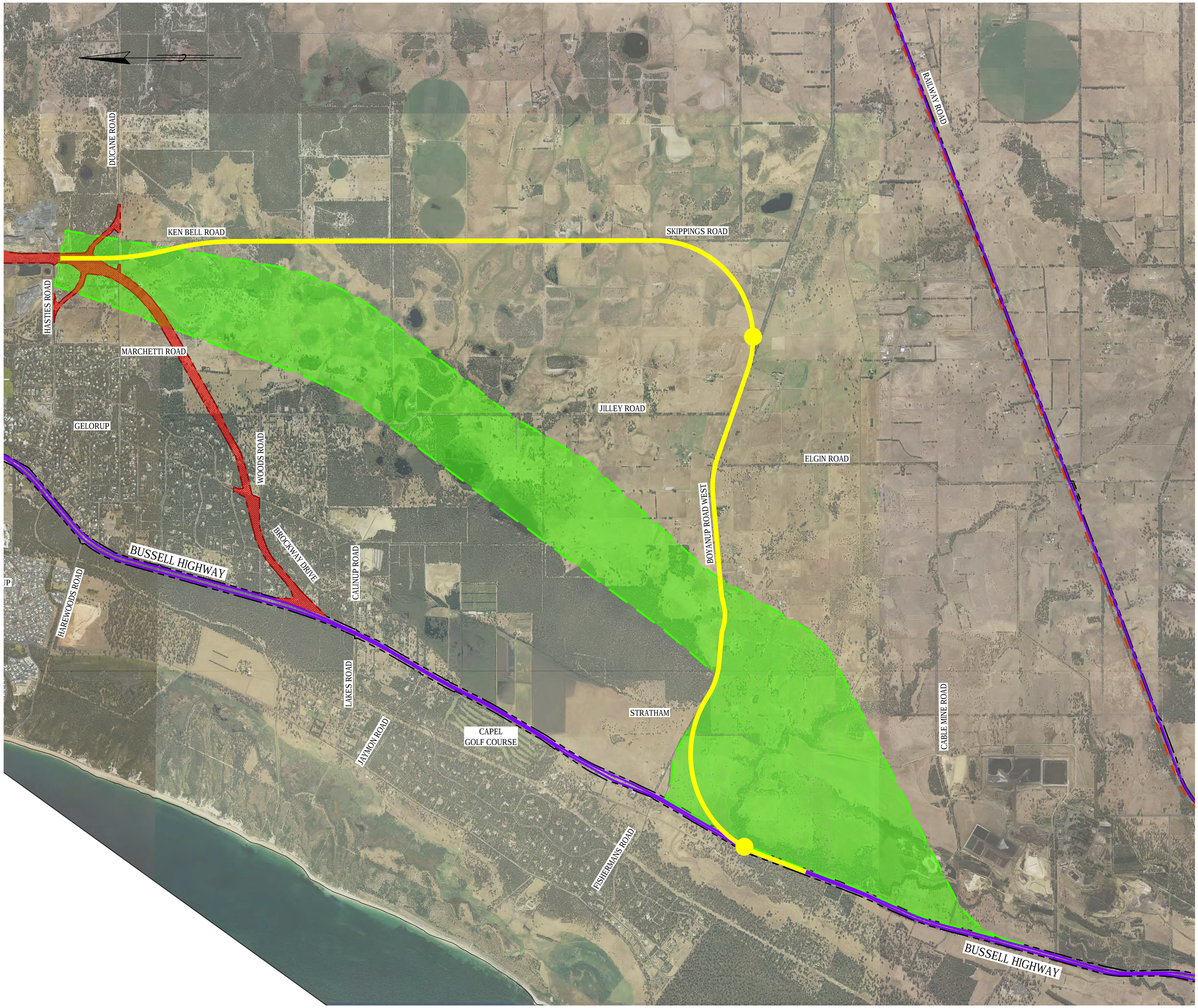
APPENDIX H STAKEHOLDER OPTION SKETCHES



LEGEND:

- BUNBURY OUTER RING ROAD SOUTHERN CORRIDOR - GREATER BUNBURY REGION SCHEME
- ALTERNATIVE CORRIDOR UNDER INVESTIGATION
- DESIGN OPTION 1
- PRIMARY REGIONAL ROAD
- RAIL RESERVE
- INTERCHANGE OR FLYOVER

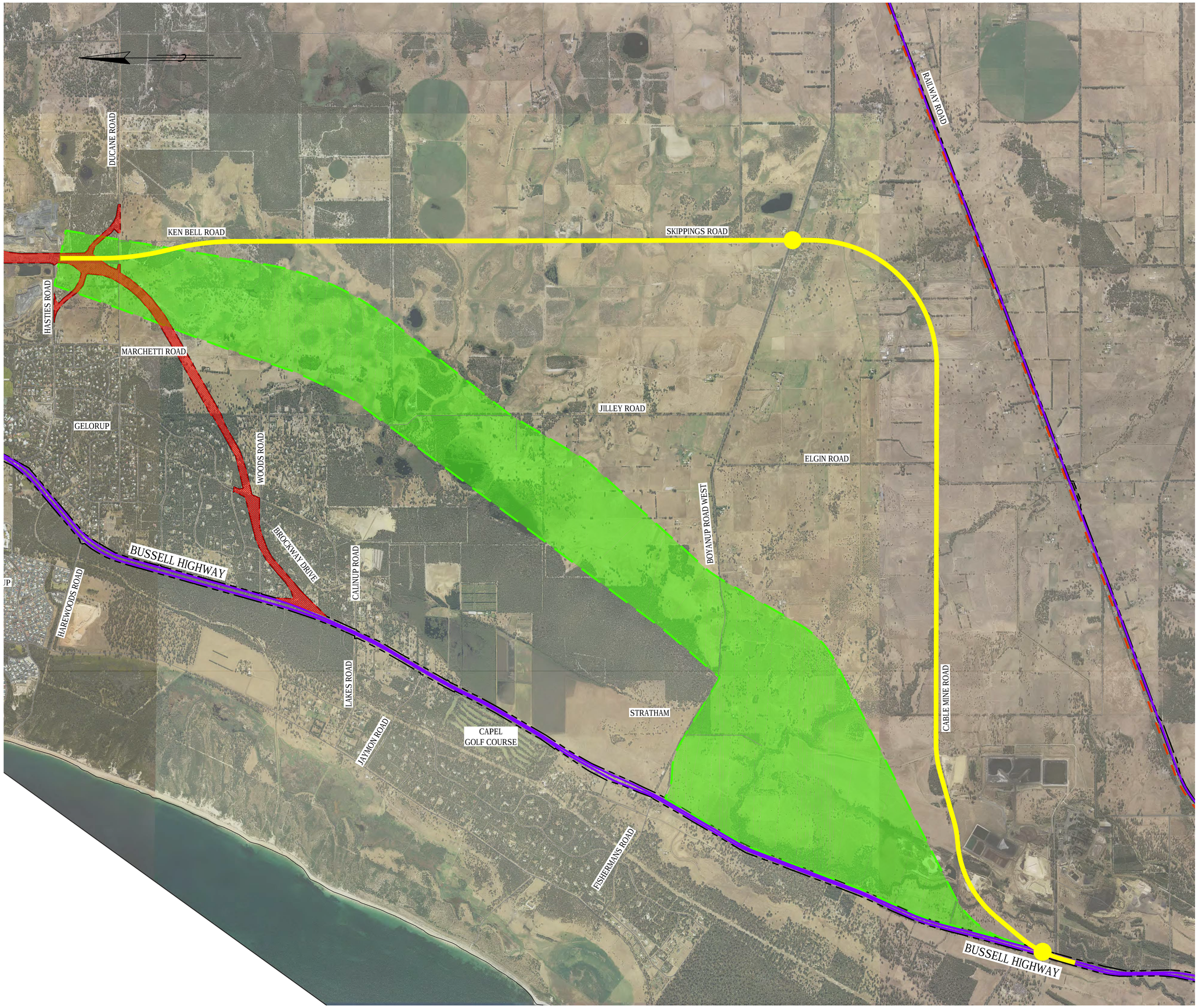
NOTES:

* PARTIAL INTERCHANGE REQUIRED AT BOYANUP ROAD WEST
* SERVICE ROADS REQUIRED ON BOTH SIDES OF BOYANUP ROAD WEST FOR LOCAL ACCESS
* FULL INTERCHANGE REQUIRED AT BUSSELL HIGHWAY
* TOTAL LENGTH OF ROAD APPROX. 15.5km
* GREEN CORRIDOR ROAD LENGTH APPROX. 12.5km
* AROUND 2 MINUTES INCREASED JOURNEY TIME COMPARED TO GREEN CORRIDOR

SCALES 1:20000

A1

DATE 03/10/2018	PREPARED
SCALE 1:20000m @ A1	GRID PCG 94
TITLE OPTION 1 - KEN BELL RD BOYANUP RD WEST	
SKETCH No. SKETCH 1	REV A



LEGEND:

- BUNBURY OUTER RING ROAD SOUTHERN CORRIDOR - GREATER BUNBURY REGION SCHEME
- ALTERNATIVE CORRIDOR UNDER INVESTIGATION
- DESIGN OPTION 2
- PRIMARY REGIONAL ROAD
- RAIL RESERVE
- INTERCHANGE OR FLYOVER

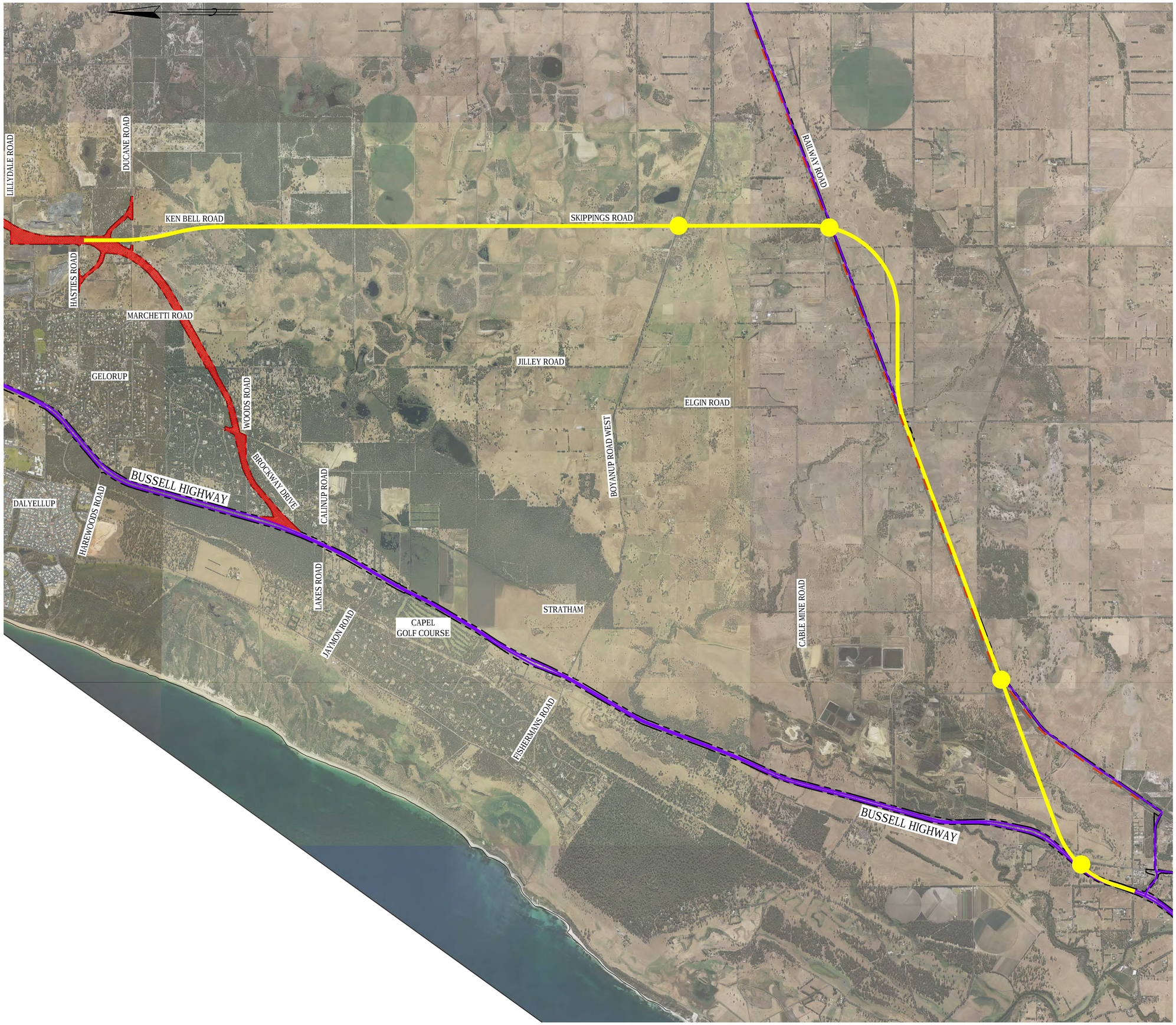
NOTES:

* SERVICE ROADS REQUIRED ALONG CABLE MINE ROAD
* TOTAL LENGTH OF ROAD APPROX. 18km
* GREEN CORRIDOR ROAD LENGTH APPROX. 12.5km
* AROUND 3 MINUTES INCREASED JOURNEY TIME COMPARED TO GREEN CORRIDOR

SCALES 1:20000

A1

DATE 03/10/2018	PREPARED
SCALE 1:20000m @ A1	GRID PCG 94
TITLE OPTION 2 - KEN BELL RD CABLE MINE RD	
SKETCH No. SKETCH 2	REV A



LEGEND:

- BUNBURY OUTER RING ROAD SOUTHERN CORRIDOR - GREATER BUNBURY REGION SCHEME
- ALTERNATIVE CORRIDOR UNDER INVESTIGATION
- DESIGN OPTION 3
- PRIMARY REGIONAL ROAD
- RAIL RESERVE
- INTERCHANGE OR FLYOVER

NOTES:

* 2 x FLYOVER STRUCTURES AT RAILWAY ROAD
* SERVICE ROADS REQUIRED ALONG RAILWAY ROAD
* TOTAL LENGTH OF ROAD APPROX. 21km
* GREEN CORRIDOR ROAD LENGTH APPROX. 12.5km
* AROUND 5 MINUTES INCREASED JOURNEY TIME COMPARED TO GREEN CORRIDOR

SCALES 1:25000

A1

DATE 03/10/2018	PREPARED
SCALE 1:25000m @ A1	GRID PCG 94
TITLE OPTION 3 - KEN BELL RD RAILWAY RD	
SKETCH No. SKETCH 3	REV A

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