Albany Ring Road Stages 2 and 3b, WA (EPBC 2020/8769)

Conservation Significant Fauna Environmental Management Plan

Main Roads

16 November 2021

The Power of Commitment

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Contents

Table index

Figure index

Acronyms

Acronyms/term	Term
ARR	Albany Ring Road
CoE	Clean on entry/exit
DAWE	Department of Agriculture, Water and Environment
DBH	diameter at breast height
CSFEMP	Conservation Significant Fauna Environmental Management Plan
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
MNES	Matters of National Environmental Significance
PD	preliminary documentation
RFI	request for information
TEC	Threatened Ecological Community
WoNS	Weeds of National Significance
WRP	Western Ringtail Possum

1. Introduction

1.1 Background

Main Roads is proposing to construct the Albany Ring Road (ARR) to provide for the long-term transport needs of Albany. The ARR will be a dedicated freight route around the City of Albany, in the Great Southern Region of Western Australia (WA) enabling the effective movement of freight to and from the Port of Albany.

The current alignment of the ARR consists of four stages:

– Stage 1 of the ARR is the east to west connection of Menang Drive linking Chester Pass Road to Albany Highway. Construction of one carriageway of Stage 1 was completed in March 2007
– Stage 2 of the ARR is the southern link of the ring road and is located between the Lower Denmark Road Link and Frenchman Bay Road.
– Stage 3 of the ARR is the western link of the ring road and is located between the intersection of Albany Highway and Lower Denmark Road. Stage 3 is separated into two sections for environmental approvals purposes:
    - Part a – from Albany Highway along Link Road to South Coast Highway
    - Part b – South Coast Highway to Lower Denmark Road
– Stage 4 of the ARR is the duplication of Princess Royal Drive from Hanrahan Road to York Street, including duplication of the existing Princess Royal Drive Bridge over rail east of Festing Street.

This document and the Proposed Action relate to Stages 2 and 3b of ARR only.

The Proposed Action was referred to the Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986* (EP Act). The EPA determined not to assess the Proposed Action. A clearing permit is being obtained under Part V of the EP Act to manage impacts to native vegetation (CPS 9179/1).

The Proposed Action was also referred to the Department of Agriculture, Water and Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 1 October 2020, a delegate of the Minister for the Environment determined that the action was a Controlled Action and further information was required to make a determination of the environmental significance of the Proposed Action under the EPBC Act. On 14 October 2020, DAWE submitted a request for information (RFI) to Main Roads for preliminary documentation (PD). Relevant controlling provisions included listed threatened species and communities (s18 and 18A).

Subsequent to the 'Controlled Action' decision on 1 October 2020, Main Roads undertook a comprehensive review of the design and revised infrastructure components to further reduce potential impacts to listed threatened fauna species and their habitat. The review identified reductions to the Proposed Action Area development envelope (DE), with the majority of the refinement occurring within south-east portion of the DE, between Hanrahan Road and Princess Drive. On the 17 June 2021, Main Roads submitted a variation request under section 156A of the EPBC Act to satisfy Parts 5.07 and 5.08 of the EPBC Regulations. Subsequently, on the 27 July 2021, DAWE accepted the variation to the proposal and issued a notice recording this decision.

Species listed under the EPBC Act with the potential to be impacted by the Proposed Action include:

– Carnaby's Cockatoo (*Calyptorhynchus latirostris*)
– Baudin's Cockatoo (*Calyptorhynchus baudinii*)
– Forest Red-tailed Black Cockatoo *(Calyptorhynchus banksii naso*)
– Western Ringtail Possum (WRP) (*Pseudocheirus occidentalis*).

1.2 Purpose and structure of this CSFEMP

This Conservation Significant Fauna Environmental Management Plan (CSFEMP) has been structured in accordance with the DAWE *Environmental Management Plan Guidelines* and has been prepared in support of the PD requested by DAWE.

This CSFEMP outlines the actions proposed to mitigate and manage the impacts of the Proposed Action on Matters of National Environmental Significance (MNES), spread of introduced species and spread of dieback (*Phytophthora cinnamomi*).

1.3 Objectives of this CSFEMP

This CSFEMP sets out the following objectives for environmental outcomes, to address the potential impacts and risks to MNES from the Proposed Action:

- To avoid unauthorised impacts to Black Cockatoo and WRP habitat
- To avoid injury or mortality to Black Cockatoo and WRP species during vegetation clearing and construction
- To avoid edge affects impacting adjacent areas of Black Cockatoo and WRP habitat
- To avoid indirect impacts to Black Cockatoo and WRP habitat from the introduction and/or spread of dieback (*Phytophthora cinnamomi*) and introduced species.

2. Project description

2.1 Proposed works

Stage 2 of the Proposed Action is located between the Lower Denmark Road Link and Frenchman Bay Road. Stage 3b is located between the South Coast Highway to Lower Denmark Road (Figure 1)

– Road construction and associated infrastructure for the Proposed Action includes the following components:
  - Road construction and associated infrastructure for the Proposed Action including the following components:
  - Approximately 7 km of new dual carriage road
  - Grade separated interchanges with at South Coast Highway and Frenchman Bay Road
  - Bridges and culverts
  - Water retention basins and other drainage structures
  - Landscaping and revegetation works
  - Modifications to local roads
– Realignment to the Albany-Wagin railway line between George Street and the Hanrahan / Frenchman Bay Interchange
– Other road infrastructure including, but not limited to lighting, noise barriers, fencing, road safety barriers, a fauna underpass and a rope bridge, and signs.

The location of the fauna underpass and rope bridge is presented in Figure 2.

2.2 Proposed schedule

Proposed Action construction works are scheduled to commence in 2021 pending environmental approvals and be completed by 2024. These dates are subject to change depending on several factors including processing approvals documentation.

Legend

- Major Road
- Minor Road
- Track
- Proposed Action Area

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Kilometres

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

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Main Roads

Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Site Location

Project No. **12539872**
Revision No. **1**
Date **9/06/2021**

FIGURE 1

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Print date: 09 Jun 2021 - 14:11

Data source: GHD: Action Area (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

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Legend
- Development footprint
- Fauna Underpass
- WRP drey
- WRP scats
- Western Ringtail Possum Observation

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Grid: GDA 1994 MGA Zone 50

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Main Roads

Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Development Footprint

Project No. **12539872**
Revision No. **0**
Date **12/11/2021**

FIGURE 2

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Print date: 12 Nov 2021 - 10:56

Legend
- Development footprint
- Fauna Rope Bridge
- WRP drey
- WRP scats
- Western Ringtail Possum Observation

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
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Main Roads

Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Development Footprint

Project No. **12539872**
Revision No. **0**
Date **12/11/2021**

Page 2 of 2
FIGURE 2

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Data source: GHD: Fauna Crossing (2021); MRWA: Actiona Area (2021); Landgate_Subscription_Imagery\WANow; Landgate / SLIP
OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Esri Community Maps contributors, Map layer by Esri
World Light Gray Canvas Base: Esri, HERE, Garmin, USGS. Created by: azepeda-ortega

3. Potential environmental impacts and risks

3.1 Threats to Matters of National Environmental Significance

3.1.1 Controlling provisions

The Proposed Action has the potential to impact four threatened fauna species listed under the EPBC Act, including:

– Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Endangered
– Baudin's Cockatoo (*Calyptorhynchus baudinii*) – Endangered
– Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) – Vulnerable
– Western Ringtail Possum (*Pseudocheirus occidentalis*) – Critically Endangered.

The EPBC Act Protected Matters Search Tool database search identified two Threatened Ecological Communities (TECs) and one threatened flora species within a 10 km radius of the Proposed Action Area (DAWE 2020). However, no EPBC Act listed TECs or flora species were identified during the detailed and targeted field surveys within the Proposed Action Area (Southern Ecology 2020a). Therefore, threatened flora and ecological communities are not considered further in this CSFEMP.

In addition to the MNES listed above, this CSFEMP also addresses potential impacts of introduced flora species and dieback that have the potential to reduce the environmental value of MNES.

3.1.2 Environmental values

Overview

The Proposed Action Area is located from the intersection of South Coast Highway and Link Road in the north to Frenchman Bay Road in the east, 390 km south east of Perth in the City of Albany, WA. The Proposed Action Area for the works is approximately 96.65 ha.

A number of biological field surveys have been completed to inform the Proposed Action, a summary of these is detailed in the Preliminary Documentation (GHD 2021).

Black Cockatoo habitat

The Proposed Action will require clearing up to 37.89 ha of Black Cockatoo habitat, representing less than 1% of the recorded 8,756 ha of locally available habitat (suitable remnant vegetation within a 12 km radius) (Figure 3)

Suitable foraging and potential breeding habitat was identified in the Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland, *Hakea spp* Shrubland/Woodland Complex, Marri/Jarrah Forest/Peppermint Woodland and various planted trees including *Pinus radiata*, Marri and Jarrah (Biota 2019).

No roosting sites were identified or observed during repeated visits to the Proposed Action Area during the Black Cockatoo habitat assessment (Biota 2019). Roosting sites for Carnaby's Cockatoo occur in Marri, Jarrah Forest, Peppermint Woodland outside of the Proposed Action Area on Mt Melville (Southern Ecology 2020a).

Two hundred and thirty-six (236) Suitable DBH Trees were identified within the Proposed Action Area. A total of 24 trees contained hollows, with 10 trees considered potentially suitable for nesting by Black Cockatoos (Southern Ecology 2020a). No known Nesting Hollows were recorded within the Proposed Action Area.

Western Ringtail Possum

The Proposed Action will require clearing up to 19.18 ha of WRP habitat, representing less than 1% of the 5,128 ha of Core and supporting habitat available within a 5 km radius of the Proposed Action Area (Figure 4).

A total of five dreys were identified within the Proposed Action Area, of which three were intact and appeared to be in use, one was intact but not occupied and one was half collapsed (Biota 2020).

Based on Biota (2020) density estimate of 0.14 individuals/ha to 0.36 individuals/ha for supporting habitat, and the density estimate of 2.45 individuals/ha used by the City of Albany (Biota 2019), it is predicted that less than nine WRP species would potentially have their home range reduced or impacted (to varying degrees) via the clearing and removal of habitat within the Proposed Action Area.

Introduced flora species

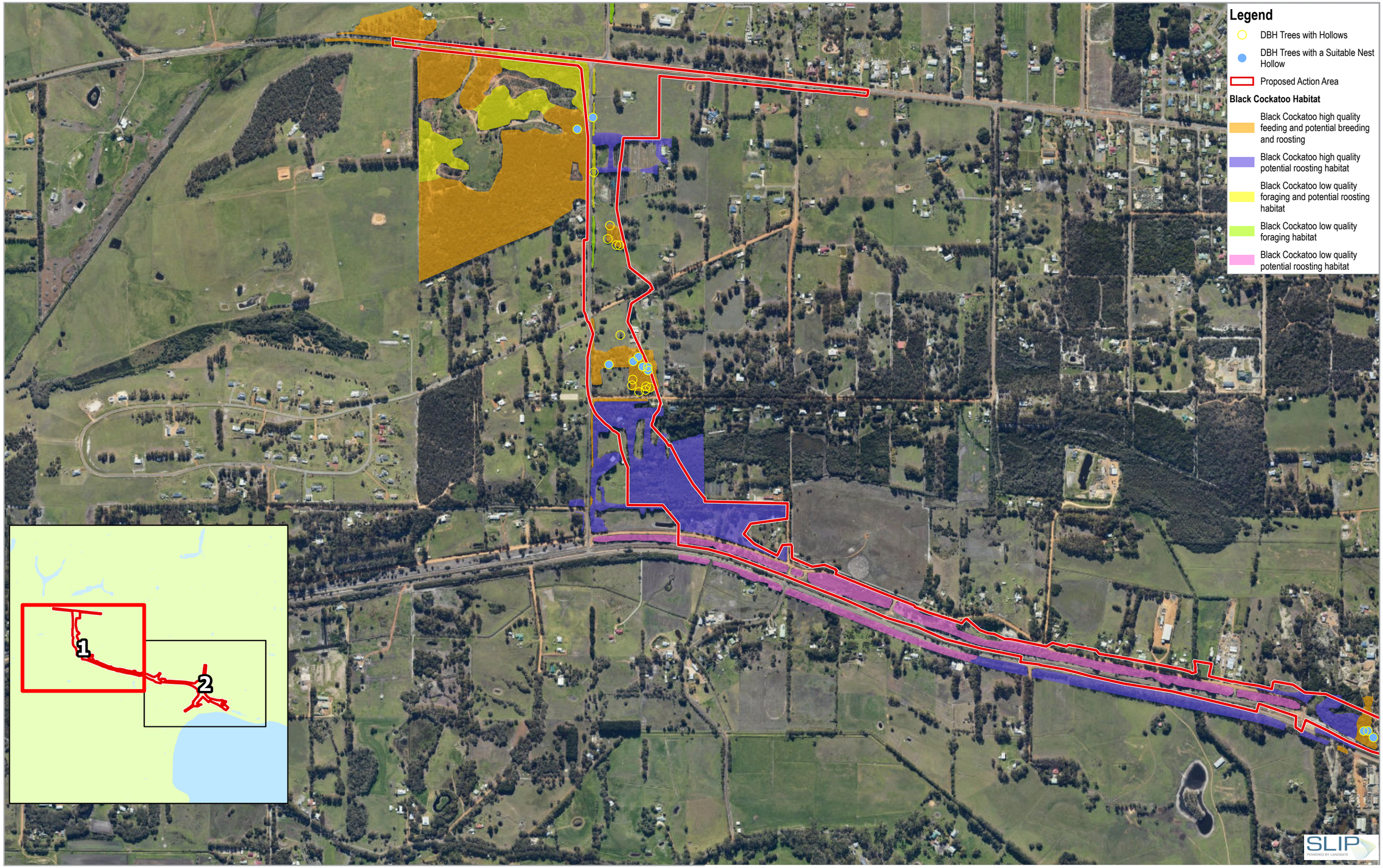
The field survey identified five introduced flora (weeds) species which are Weed of National Significance (WoNS) and/or a Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (Southern Ecology 2020a). Four of these weeds are in the Proposed Action Area including:

– Blackberry (*Rubus* species complex) – Weed of National Significance (WoNS)
– Bridal Creeper (*Asparagus asparagoides*) – WoNS
– Gorse (*Ulex europaeus*) – WoNS
– Arum Lily (Zantedeschia aethiopica).

Dieback

The Proposed Action is located in a dieback susceptible region, based on rainfall (within the 600 – 800 mm rainfall zone), soils, drainage and vegetation (CALM 2003).

In 2020, Southern Ecology prepared *Albany Ring Road: Phytophthora Dieback Management Plan* for the ARR Proposed Action Area (Southern Ecology 2020b). As part of the Dieback Management Plan, a dieback survey was undertaken by Southern Ecology (2020b) and identified the majority of the Proposed Action Area was located in excluded or uninterpretable dieback areas. This was due to existing road and agricultural disturbance, as well as lack of indicator species that could be impacted by the pathogen (Figure 5). The south west side of South Coast Highway was mapped as infested, as was vegetation to the west of Roundhay Street and east side of Hanrahan Road intersection (Southern Ecology 2020b).



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

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Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Black Cockatoo Mapping

Project No. **12539872**
Revision No. **1**
Date **9/06/2021**

FIGURE 3

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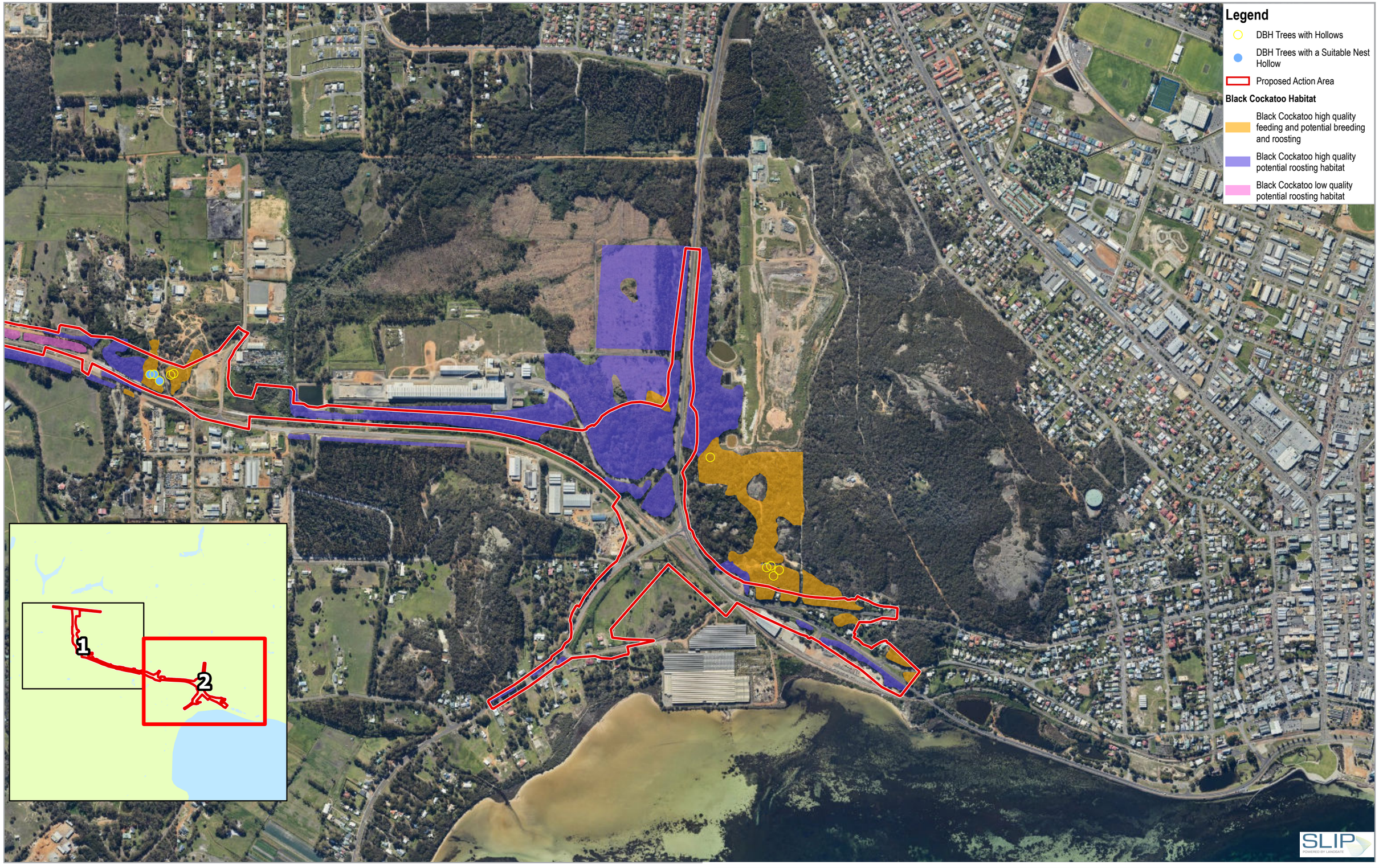
Data source: MRWA: Action Area, Black Cockatoo Trees, Black Cockatoo Habitat (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee



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Main Roads

Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Black Cockatoo Mapping

Project No. **12539872**
Revision No. **1**
Date **9/06/2021**

FIGURE 3

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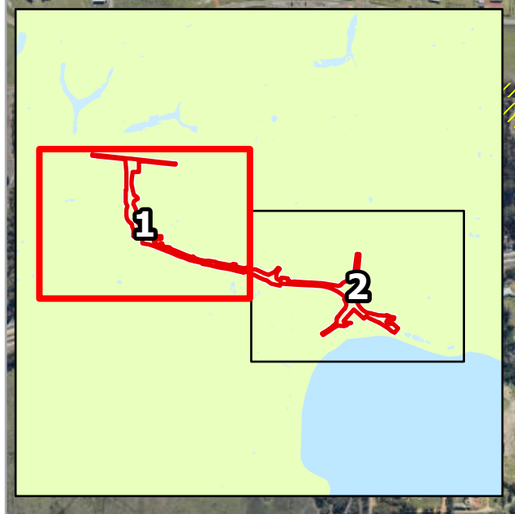
Data source: MRWA: Action Area, Black Cockatoo Trees, Black Cockatoo Habitat (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

Legend

- Proposed Action Footprint

Western Ringtail Possum Habitat

- Supporting
- Linkages



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Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Western Ringtail Possum Habitat

Project No. **12539872**
Revision No. **0**
Date **9/06/2021**

FIGURE 4

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Print date: 09 Jun 2021 - 14:39

Data source: GHD: Action Area, Western Ringtail Possum Habitat (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

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

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Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Western Ringtail Possum Habitat

Project No. **12539872**
Revision No. **0**
Date **9/06/2021**

FIGURE 4

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Print date: 09 Jun 2021 - 14:39

Data source: GHD: Action Area, Western Ringtail Possum Habitat (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

South Coast Hwy

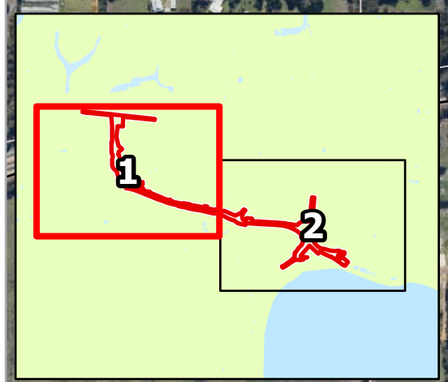
Lower Denmark Rd

Legend

- Major Road
- Minor Road
- Track
- Proposed Action Footprint

Dieback Status

- Infested
- Excluded
- Uninterpretable



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Map Projection: Transverse Mercator
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Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Dieback Mapping

Project No. **12539872**
Revision No. **1**
Date **9/06/2021**

FIGURE 5

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Data source: GHD: Dieback (2021); MRWA: Action Area (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

Legend

- Major Road
- Minor Road
- Track
- Proposed Action Footprint

Dieback Status

- Infested
- Excluded
- Uninterpretable

Albany Hwy

Hamrahan Rd

Lower Denmark Rd

Frenchman Bay Rd

Princess Royal Dr

SLIP POWERED BY LANDGATE

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Paper Size ISO A3

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Metres

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

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Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Dieback Mapping

Project No. **12539872**
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FIGURE 5

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Print date: 09 Jun 2021 - 14:43

Data source: GHD: Dieback (2021); MRWA: Action Area (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

3.2 Potential impacts

3.2.1 Direct impacts

This section provides a summary of potential direct (Table 1 and Table 2) impacts of the Proposed Action on MNES, based on the detailed assessment of impacts presented in the Preliminary Documentation (GHD 2021). Note that areas of habitat for Black Cockatoo overlap as per Figure 3.

Table 1 Summary of direct impacts to Black Cockatoos

Aspect	Impact
Black Cockatoo habitat (total)	37.89 ha
High quality foraging habitat	5.80 ha
Low quality foraging habitat	1.22 ha
Roosting habitat	37.75 ha
Breeding habitat	5.80 ha
Suitable DBH Trees	236
Suitable DBH Trees with hollows	24
Suitable DBH Trees with potentially suitable hollows for Black Cockatoo nesting	10
Potentially suitable hollows for Black Cockatoo nesting	14

Table 2 Summary of direct impacts to WRPs

Aspect	Impact
Core habitat	0.88 ha
Core (Urban) habitat	0.19 ha
Supporting habitat	18.11 ha
Number of home ranges within the Proposed Action Area	9
Dreys	5

3.2.2 Indirect impacts

The Proposed Action has the potential to cause indirect impacts to Black Cockatoos and WRP; and their habitat within or adjacent to the Proposed Action Area, as follows:

– The introduction and/or spread of introduced flora species leading to decline in Black Cockatoo habitat health
– The introduction and/or spread of dieback leading to decline in Black Cockatoo habitat health
– Fragmentation of WRP habitat
– Increased risk of vehicle strike to Black Cockatoos and WRP
– Traffic noise and light spill impacting Black Cockatoos and WRP.

3.3 Risk assessment

A risk assessment of the potential impacts identified for the Proposed Action construction activities was undertaken in accordance with the EMP Guidelines. The risk assessment adopts likelihood and consequence criteria and a risk matrix presented in Table 3, Table 4 and Table 5.

Table 6 presents the risk assessment results, incorporating management objectives and measures to generate a residual risk outcome for each identified risk. Section 4 provides implementation details for the management objectives and measures.

Table 3 Likelihood criteria

Likelihood	Criteria
Highly likely	Is expected to occur during the construction period
Likely	Will probably occur during the construction period
Possible	Might occur during the construction period
Unlikely	Could occur during construction but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table 4 Consequence criteria

Consequence	Criteria
Minor	Minor incident of environmental damage that can be reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental value and real danger of continuing
Critical	Severe widespread loss of environmental value and irrecoverable environmental damage

Table 5 Risk ranking matrix

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

Table 6 Risk assessment of the Proposed Action on MNES

Management Objective / Desired Outcome	Issue (Event or Circumstance)	Cause	Management Measures	Residual risk		
				Likelihood	Consequence	Risk rating
To avoid unauthorised impacts and minimise authorised impacts to Black Cockatoo and WRP habitat	Loss of Black Cockatoo habitat or WRP habitat	Poor or inappropriate management of clearing may result in additional clearing.	– Clearing of native vegetation will be avoided through consideration of potential impacts during the detailed design phase 8103-000-004 - Guideline Safety Ma – The disturbance area will be minimised by using retaining walls and steepening batters where appropriate – Black Cockatoo habitat (including Suitable DBH Trees) and WRP habitat within the construction site boundary that is not required to be cleared will be marked and identified as no-go areas and demarcated on relevant drawings – A ground disturbance permit process will be developed by the Contractor and signed off by the Main Roads Superintendent or delegate – Dieback protectable areas will be identified and established within the Proposed Action area and adjacent land to guide dieback hygiene practices including restrictions on equipment and vehicle movement, soil movement, and Clean on Entry and/or Exit (CoE) – Fire danger ratings and Shire vehicle movement are to be observed and their requirements implemented – Vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas – Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area – Clearing areas will be clearly demarcated and marked with flagging and approved by the Construction Contractor Environmental Management Representative prior to clearing commencing – Additional areas required for construction such as laydown areas, stockpile areas and vehicle turn around, will be located in areas cleared for permanent works or areas that do not contain Black Cockatoo habitat or WRP habitat – Clearing will be avoided for any temporary construction activities – Lighting will be taken into account during installation of the rope bridge, and located away from lighting structures if possible, If lighting is required near the rope bridge, lighting will be muted or shielded to the greatest extent possible. – Revegetation within the road reserve will use local native species. Species chosen will be selected based on habitat suitability for Black Cockatoo, WRP and potential to be resistant to drought. Key components to the revegetation are to include: • Species selection will be determined by a suitably qualitied expert with experience in rehabilitation and/or landscaping • Revegetation will involve a combination of tube stock and/or direct seeding • Weed control will occur during the establishment period of the revegetation within the first two years of establishment • Monitoring of use of rope bridge and underpass usage to determine success of mitigation measure • Monitoring activity of predators around rope bridge and underpass.	Unlikely	Moderate	Low
To avoid injury or mortality to Black Cockatoos and WRP species	Fauna mortality during construction	Vehicle interaction with fauna	– Directional clearing will occur to allow fauna to relocate to areas of existing vegetation – Temporary traffic management measures including management of vehicle speeds, and the use of variable message boards to alert road users to the possible presence of WRP on the roadway, will be implemented during construction/road works activities – Speed limits will be restricted to 40 km/hr during clearing operations to reduce the risk of vehicle strikes during construction – A list of local wildlife rescue organisations and carers will be maintained on site to contact in the event of fauna injury. Wildlife rescue organisations and carers will be notified at the commence of the project so they are aware that injured fauna may require care.	Possible	Minor	Low
		Clearing of Black Cockatoo breeding trees with suitable hollows	– A suitably experienced ecologist with specific experience in Black Cockatoo will be on-site at all times during clearing of breeding habitat for Black Cockatoos. The ecologist will maintain radio communication with machinery operators. The ecologist will be experienced with both Black Cockatoo – Where the trees with suitable nest hollow for Black Cockatoos will require clearing for the Proposal, the hollows will be visually inspected where safe and practicable via drone, pole camera or elevated	Rare	Major	Medium

Management Objective / Desired Outcome	Issue (Event or Circumstance)	Cause	Management Measures	Residual risk		
				Likelihood	Consequence	Risk rating
			platform. Where not in use the hollows will be 'blocked' to prevent breeding. Blocking can be undertaken with wood and nails or expanding non-toxic foam or similar – Where blocking of the nest hollow cannot be undertaken (e.g., timing, access), a pre-clearing fauna assessment will be undertaken by a suitably experienced ecologist with specific experience in WRP and Black Cockatoo survey to determine if the hollow is being used by Black Cockatoos. – Where a suitable nest hollow has been blocked prior to the Black Cockatoo breeding season, the tree may be felled as part of the standard vegetation clearing process – Where a suitable nest hollow has not been blocked and the pre-clearing fauna assessment has not identified any Black Cockatoo occupation of the nest hollow, prior to clearing the tree will be 'bumped gently' with a machine. The machine operator and ecologist will wait and observe the tree for a short time after. If no Black Cockatoo appears to be present following being bumped gently then the tree shall be pushed over slowly to minimise risk of injury to any undetected animal (if present) – If a Black Cockatoo nestling is present in the hollow, the tree will not be felled until the nestling has fledged. The tree will be marked off with exclusion tape, with a suitable buffer, to ensure the birds aren't disturbed by construction – Any Black Cockatoos showing signs of injury or illness will be recorded and taken by a qualified fauna handler to a veterinarian or qualified wildlife carer – Where trees that are known to be Black Cockatoo habitat are retained but are located within 10 m of the edge of the road seal the risk of vehicle strike will be assessed to determine if wildlife hazard signage is required – A post-clearing survey shall be undertaken to ensure no injured Black Cockatoo individuals are present – Revegetation shall not include foraging or breeding plant species within 10 m of the road – Within 7 days prior to clearing, trees with hollows used by or suitable for use by Black Cockatoo's will be inspected by a suitably qualified ecologist to confirm that there are no hollows being used by Black Cockatoo within the area to be cleared. Inspection will be undertaken via drone, pole camera or elevated platform			
		Clearing of active WRP dreys and hollows	– Pre-clearing fauna assessment and spotlighting will be undertaken by a suitably qualified person over two nights within the five nights prior to clearing. The assessment will include hollows, dreys, ground debris, dense ground-level vegetation, timber and logs – No night-time clearing of vegetation will occur – Vacant dreys will be removed prior to clearing where they are accessible, in accordance with the DBCA *Procedures to minimise the risk to Western Ringtail Possums during vegetation clearing and building demolition* (DPaW 2015) – Vacant tree hollows suitable for possums will be removed or blocked prior to clearing where they are accessible. Blocking may include wood nailed over the hollow, non-toxic expanding foam or similar – Cleared vegetation will be chipped immediately or transported at least 100 m from WRP habitat before further processing – Movement/disturbance of clearing stockpiles will be confined to the period between one hour after sunrise and one hour prior to sunset – Habitat clearing is to commence from existing edge lines/roads and progress towards habitat that will be retained, where possible – If WRPs are observed during clearing operations, the tree containing the animal will be left for up to 48 hours to allow for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied after 48 hours, the animal will be coerced/moved to a safe area outside of the clearing footprint by the appointed ecologist in accordance with *Procedures to minimise the risk to Western Ringtail Possums during vegetation clearing and building demolition* (DPaW 2015). This may include removal using an elevated platform or gently pushing over the tree as detailed below. The ecologist will be experienced with WTP and have a fauna handling licence – Trees, as noted above, that are observed to support WRP after 48 hours will be 'bumped gently' with a machine prior to felling. The operator and spotter will wait and observe the tree for a short time. If the animal remains in the tree, the tree shall be pushed over slowly onto vegetation within the clearing area that is yet to be cleared. The 'soft felling' of habitat trees will provide a 'cushion' for the vegetation being felled, minimising the risk of injury to the animal and allowing any WRP present with the opportunity to safely vacate – Felled trees with hollows will be checked immediately for WRPs after felling and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate – Any WRP showing signs of injury or illness will be recorded and taken by a qualified fauna handler to a veterinarian or qualified wildlife carer – A post-clearing survey shall be undertaken to ensure no injured WRP individuals are present.	Rare	Major	Medium

Management Objective / Desired Outcome	Issue (Event or Circumstance)	Cause	Management Measures	Residual risk		
				Likelihood	Consequence	Risk rating
	Fauna mortality during operation	Vehicle interaction with fauna	– A fauna underpass (ARR) and rope bridge (Hanrahan Road) is included in the design to minimise impact of fauna habitat clearing on landscape connectivity for the WRP. The fauna underpass and rope bridge will also minimise likelihood of fauna strike by providing alternative linkages between patches of remnant vegetation – Where trees that are known to be Black Cockatoo habitat are retained but are located within 10 m of the edge of the road seal, the risk of vehicle strike will be assessed to determine if wildlife hazard signage is required – Revegetation designs shall not include foraging or breeding plant species within 10 m of the road	Likely	Moderate	Medium
To avoid indirect impacts to Black Cockatoo and WRP habitat from the introduction and/or spread of dieback (*Phytophthora cinnamomi*) and introduced species	Degradation in condition of Black Cockatoo and WRP habitat quality	– Growth of introduced flora species in the Proposed Action Area during construction – Introduction or spread of introduced flora species and dieback impacting on vegetation health or condition from plant, machinery or offsite drainage – Introduction or spread of introduced flora species and dieback impacting on vegetation health or condition from unauthorised site access.	– Contractor induction will include familiarisation with and discussion of Black Cockatoos/WRP, *Phytophthora* dieback management and hygiene management – Heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material. Entry and exit records will be kept for CoE points – Effective clean down prior to accessing the CoE point will be conducted to remove soil and plant material (including weed seeds). The key components of a suitable washdown are: • Effluent is captured during washdown i.e. sump, for later transport and disposal, or diverted into excluded/infested areas • Cleaned objects exit washdown area without becoming re-contaminated • Safe entry, departure of vehicles by operators is maintained – Timing of operations and construction (particularly in Protectable Areas) will be conducted in dry soil conditions where possible (generally between November and April) – Transportation of cleaned plant, equipment and vehicles to Protectable Areas should be undertaken via sealed roads where possible. – Demarcation of Protectable Areas should be check/retaped shortly prior to construction – Basic raw material imported into Protectable areas should be low risk for Phytophthora contamination – WoNS and Declared Pests within the construction site boundary will be controlled according to the weed control management outlined by Weeds Australia (http://weeds.ala.org.au/) with the aim of controlling weed spread – Topsoil containing Declared Pests or WoNS shall not be reused in revegetation or revegetation – Topsoil from infected or potentially infected dieback areas shall be segregated and not used in non-infected areas – Sediment to be captured in stormwater runoff and treated within basins/swales prior to discharge to waterways to prevent spread of dieback on site – Topsoil within the Proposed Action Area will be harvested, stockpiled and reused in accordance with Main Roads Environmental Guideline Topsoil Management.	Possible	Moderate	Medium
To avoid edge affects impacting adjacent areas of Black Cockatoo and WRP habitat	Degradation in condition of Black Cockatoo and WRP habitat quality	– Introduction or spread of introduced flora species and dieback impacting on vegetation health or condition from plant, machinery or offsite drainage – Introduction or spread of introduced flora species and dieback impacting on vegetation health or condition from unauthorised site access.	– Sediment to be captured in stormwater runoff and treated within basins/swales prior to discharge to waterways to prevent spread of dieback – Heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material. Entry and exit records will be kept for CoE points.	Possible	Moderate	Medium
		Damage to fauna habitat from accidental fires caused by construction activities	– Hot work will be undertaken in accordance with Contractor's hot work procedure – Vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas unless involved in clearing operations – Fire danger ratings and Shire vehicle movement bans to be observed and the requirements of these implemented.	Rare	High	Low
		Damage to fauna habitat from changes to drainage flow	– Temporary drainage structures within or adjacent to Black Cockatoo or WRP will be designed and constructed such that scouring or erosion within adjacent vegetated areas does not occur.	Unlikely	Minor	Low

4. Environmental management measures

4.1 Implementation

Table 7 provides detail of the management measures to be put in place to achieve the outcomes identified in the risk assessment, including the performance targets/completion criteria, implementation timing, monitoring, reporting and corrective action.

4.1.1 Fauna connectivity and movement structures

A fauna underpass will be constructed along George Street, between Frederick Street and Cuming Road and a rope bridge will be constructed along Hanrahan Road, north of the Frenchman Bay Road intersection. Design of these structures will be undertaken as described below, with the location of the rope bridge and underpass provided in Figure 2. The Main Roads project manager will be responsible for the successful implementation of both structures.

Rope Bridge

There is no standard design for a rope bridge, however, the design will be consistent with other successful rope bridges constructed in the southwest. The rope bridge will consist of a canopy bridge, which is a rope netting suspended above the traffic from vertical poles, to provide connectivity (see Plate 1 and Plate 2). The rope bridge for the Proposed Action will be much shorter than that shown Plate 1, as the bridge will be located over a single carriageway. Evidence has been obtained of use of these structures following construction, as shown in Plate 2.

Plate 1 ***Rope bridge layout and components***

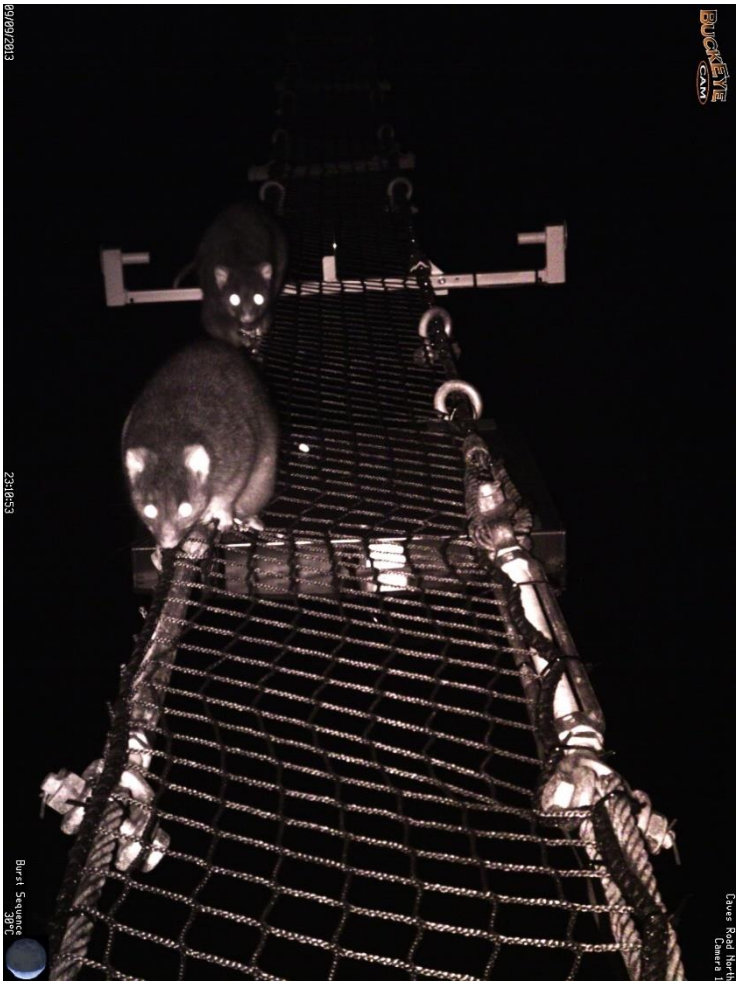


Plate 2 Evidence of rope bridge use (image by Yokochi and Bencini [2015])

At a minimum the design will consist of the following:

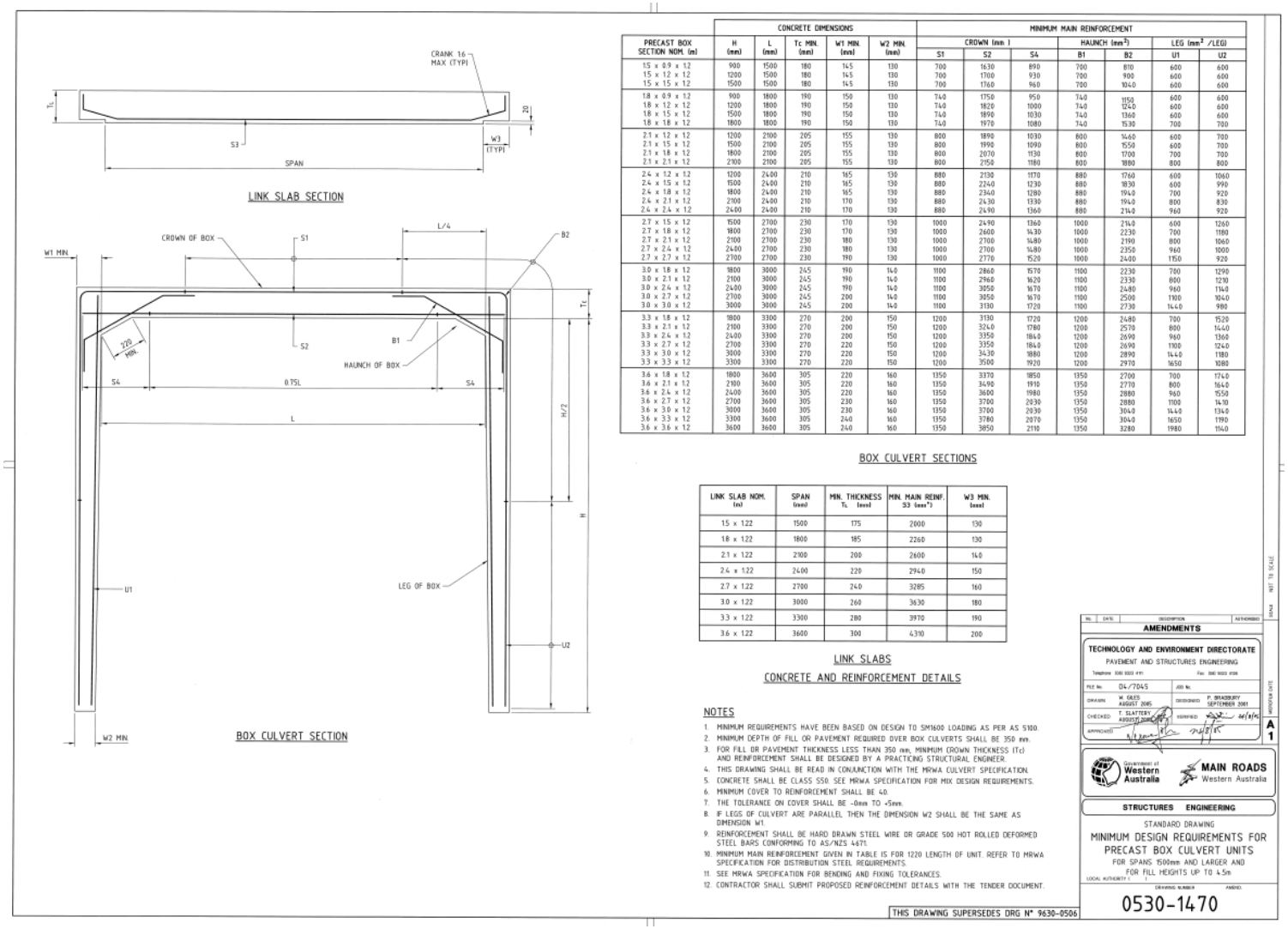
- Support poles constructed either side of the carriageway
- Minimum of seven metres clearance from the road (to allow for traffic to pass underneath as well as sufficient height above traffic noise). Some have been constructed 12 metres above the road
- Connected to adjacent vegetation via ropes
- Comply with safety requirements when structural supports are placed in the road edge
- Construction technique proposed:
  - Rope bridge constructed to resemble a ladder (Plate 3)
  - The Rope length between poles will be approximately 26 m in length
  - Screw eyelets into the pole and attach rope and attach 12-14 gauge marine grade silver (high UV rating) rope and stainless steel cables and frames (for rope ladder)
  - Appropriately tension canopy bridge
- Final heights, lengths and tie off locations will be decided by a WRP specialist onsite following the final design of the road
- Lighting will be taken into account during installation and located away from lighting structures, if possible, If lighting is required, lighting will be muted or shielded to the greatest extent possible.

Plate 3 Rope bridge layout

Fauna underpass

The fauna underpass will consist of an underground box culvert. Plate 4 and Plate 5 outline the design of the underpass. A rope bridge will be added to the inside of the box culvert, as presented illustratively in Plate 6. The design of the fauna underpass will also consider:

1. The use of rocks and concrete structures, inside and in the cleared areas leading up to the underpasses, to allow for cover for smaller mammals
2. Revegetation to areas approaching the underpass on either side to provide cover for mammals
3. Topography and avoiding extensive earthworks, visual impact and clearing required for underpasses
4. Groundwater table and placement of underpasses above the groundwater table
5. A skylight in the centre of the underpass to enable visibility and encourage use by small mammals.



PRECAST BOX SECTION NOM. (m)	CONCRETE DIMENSIONS H (mm)	L (mm)	Tc MIN. (mm)	W1 MIN. (mm)	W2 MIN. (mm)	MINIMUM MAIN REINFORCEMENT CROWN (mm²) S1	S2	S4	HAUNCH (mm²) B1	B2	LEG (mm³/LEG) U1	U2
1.5 x 0.9 x 1.2	900	1500	180	145	130	700	1630	890	700	810	600	600
1.5 x 1.2 x 1.2	1200	1500	180	145	130	700	1700	930	700	900	600	600
1.5 x 1.5 x 1.2	1500	1500	180	145	130	700	1760	960	700	1040	600	600
1.8 x 0.9 x 1.2	900	1800	190	150	130	740	1750	950	740	1150	600	600
1.8 x 1.2 x 1.2	1200	1800	190	150	130	740	1820	1000	740	1240	600	600
1.8 x 1.5 x 1.2	1500	1800	190	150	130	740	1890	1030	740	1360	600	600
1.8 x 1.8 x 1.2	1800	1800	190	150	130	740	1970	1080	740	1530	700	700
2.1 x 1.2 x 1.2	1200	2100	205	155	130	800	1890	1030	800	1460	600	700
2.1 x 1.5 x 1.2	1500	2100	205	155	130	800	1990	1090	800	1550	600	700
2.1 x 1.8 x 1.2	1800	2100	205	155	130	800	2070	1130	800	1700	700	700
2.1 x 2.1 x 1.2	2100	2100	205	155	130	800	2150	1180	800	1880	800	800
2.4 x 1.2 x 1.2	1200	2400	210	165	130	880	2130	1170	880	1760	600	1060
2.4 x 1.5 x 1.2	1500	2400	210	165	130	880	2240	1230	880	1830	600	990
2.4 x 1.8 x 1.2	1800	2400	210	165	130	880	2340	1280	880	1940	700	920
2.4 x 2.1 x 1.2	2100	2400	210	170	130	880	2430	1330	880	1940	800	830
2.4 x 2.4 x 1.2	2400	2400	210	170	130	880	2490	1360	880	2140	960	920
2.7 x 1.5 x 1.2	1500	2700	230	170	130	1000	2490	1360	1000	2140	600	1260
2.7 x 1.8 x 1.2	1800	2700	230	170	130	1000	2600	1430	1000	2230	700	1180
2.7 x 2.1 x 1.2	2100	2700	230	180	130	1000	2700	1480	1000	2190	800	1060
2.7 x 2.4 x 1.2	2400	2700	230	180	130	1000	2700	1480	1000	2350	960	1000
2.7 x 2.7 x 1.2	2700	2700	230	190	130	1000	2770	1520	1000	2400	1150	920
3.0 x 1.8 x 1.2	1800	3000	245	190	140	1100	2860	1570	1100	2230	700	1290
3.0 x 2.1 x 1.2	2100	3000	245	190	140	1100	2960	1620	1100	2330	800	1210
3.0 x 2.4 x 1.2	2400	3000	245	190	140	1100	3050	1670	1100	2480	960	1140
3.0 x 2.7 x 1.2	2700	3000	245	200	140	1100	3050	1670	1100	2500	1100	1040
3.0 x 3.0 x 1.2	3000	3000	245	200	140	1100	3130	1720	1100	2730	1440	980
3.3 x 1.8 x 1.2	1800	3300	270	200	150	1200	3130	1720	1200	2480	700	1520
3.3 x 2.1 x 1.2	2100	3300	270	200	150	1200	3240	1780	1200	2570	800	1440
3.3 x 2.4 x 1.2	2400	3300	270	200	150	1200	3350	1840	1200	2690	960	1360
3.3 x 2.7 x 1.2	2700	3300	270	220	150	1200	3350	1840	1200	2690	1100	1240
3.3 x 3.0 x 1.2	3000	3300	270	220	150	1200	3430	1880	1200	2890	1440	1180
3.3 x 3.3 x 1.2	3300	3300	270	220	150	1200	3500	1920	1200	2970	1650	1080
3.6 x 1.8 x 1.2	1800	3600	305	220	160	1350	3370	1850	1350	2700	700	1740
3.6 x 2.1 x 1.2	2100	3600	305	220	160	1350	3490	1910	1350	2770	800	1640
3.6 x 2.4 x 1.2	2400	3600	305	220	160	1350	3600	1980	1350	2880	960	1550
3.6 x 2.7 x 1.2	2700	3600	305	230	160	1350	3700	2030	1350	2880	1100	1470
3.6 x 3.0 x 1.2	3000	3600	305	230	160	1350	3700	2030	1350	3040	1440	1340
3.6 x 3.3 x 1.2	3300	3600	305	240	160	1350	3780	2070	1350	3040	1650	1190
3.6 x 3.6 x 1.2	3600	3600	305	240	160	1350	3850	2110	1350	3280	1980	1140

BOX CULVERT SECTIONS

LINK SLAB NOM. (m)	SPAN (mm)	MIN. THICKNESS T_L (mm)	MIN. MAIN REINF. S3 (mm²)	W3 MIN. (mm)
1.5 x 1.22	1500	175	2000	130
1.8 x 1.22	1800	185	2260	130
2.1 x 1.22	2100	200	2600	140
2.4 x 1.22	2400	220	2940	150
2.7 x 1.22	2700	240	3285	160
3.0 x 1.22	3000	260	3630	180
3.3 x 1.22	3300	280	3970	190
3.6 x 1.22	3600	300	4310	200

LINK SLABS
CONCRETE AND REINFORCEMENT DETAILS

NOTES

1. MINIMUM REQUIREMENTS HAVE BEEN BASED ON DESIGN TO SM1600 LOADING AS PER AS 5100.
2. MINIMUM DEPTH OF FILL OR PAVEMENT REQUIRED OVER BOX CULVERTS SHALL BE 350 mm.
3. FOR FILL OR PAVEMENT THICKNESS LESS THAN 350 mm, MINIMUM CROWN THICKNESS (Tc) AND REINFORCEMENT SHALL BE DESIGNED BY A PRACTICING STRUCTURAL ENGINEER.
4. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE MRWA CULVERT SPECIFICATION.
5. CONCRETE SHALL BE CLASS S50. SEE MRWA SPECIFICATION FOR MIX DESIGN REQUIREMENTS.
6. MINIMUM COVER TO REINFORCEMENT SHALL BE 40.
7. THE TOLERANCE ON COVER SHALL BE -0mm TO +5mm.
8. IF LEGS OF CULVERT ARE PARALLEL THEN THE DIMENSION W2 SHALL BE THE SAME AS DIMENSION W1.
9. REINFORCEMENT SHALL BE HARD DRAWN STEEL WIRE OR GRADE 500 HOT ROLLED DEFORMED STEEL BARS CONFORMING TO AS/NZS 4671.
10. MINIMUM MAIN REINFORCEMENT GIVEN IN TABLE IS FOR 1220 LENGTH OF UNIT. REFER TO MRWA SPECIFICATION FOR DISTRIBUTION STEEL REQUIREMENTS.
11. SEE MRWA SPECIFICATION FOR BENDING AND FIXING TOLERANCES.
12. CONTRACTOR SHALL SUBMIT PROPOSED REINFORCEMENT DETAILS WITH THE TENDER DOCUMENT.

THIS DRAWING SUPERSEDES DRG N° 9630-0506

NOT TO SCALE

AMENDMENTS

TECHNOLOGY AND ENVIRONMENT DIRECTORATE
PAVEMENT AND STRUCTURES ENGINEERING

FILE No. 04/7045 JOB No.
DRAWN W. GILES AUGUST 2005 DESIGNED P. BRADBURY SEPTEMBER 2001
CHECKED T. SLATTERY AUGUST 2005 VERIFIED
APPROVED

A1

Government of Western Australia — MAIN ROADS Western Australia

STRUCTURES ENGINEERING

STANDARD DRAWING
MINIMUM DESIGN REQUIREMENTS FOR PRECAST BOX CULVERT UNITS
FOR SPANS 1500mm AND LARGER AND FOR FILL HEIGHTS UP TO 4.5m

LOCAL AUTHORITY DRAWING NUMBER AMEND.

0530-1470

Plate 4 ***Fauna underpass culvert design***

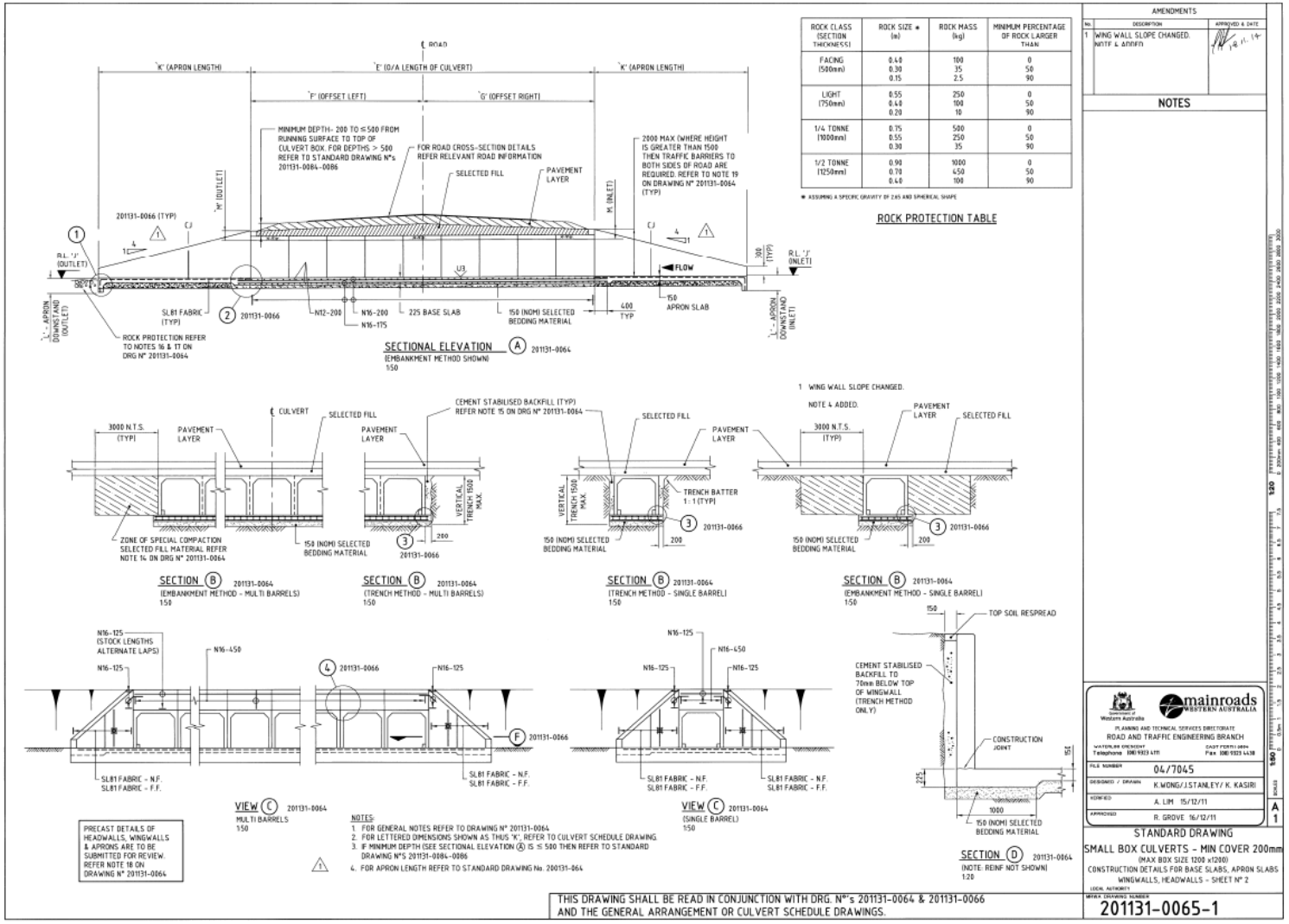


Plate 5 Fauna underpass culvert design

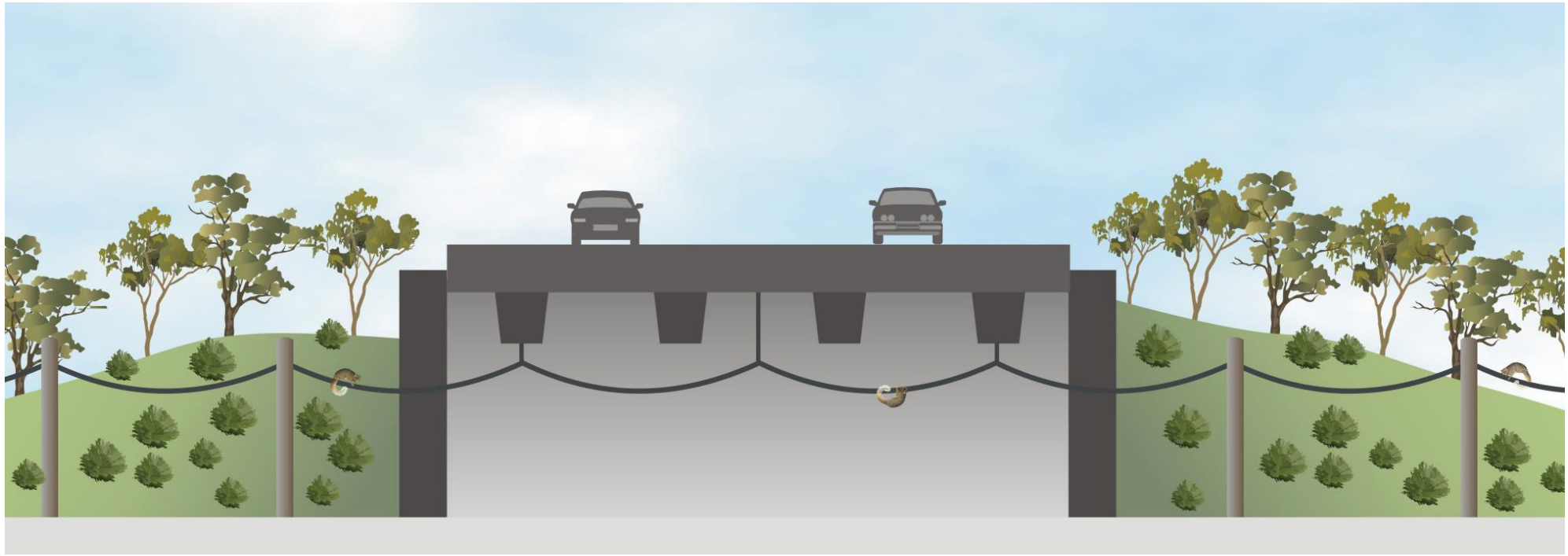


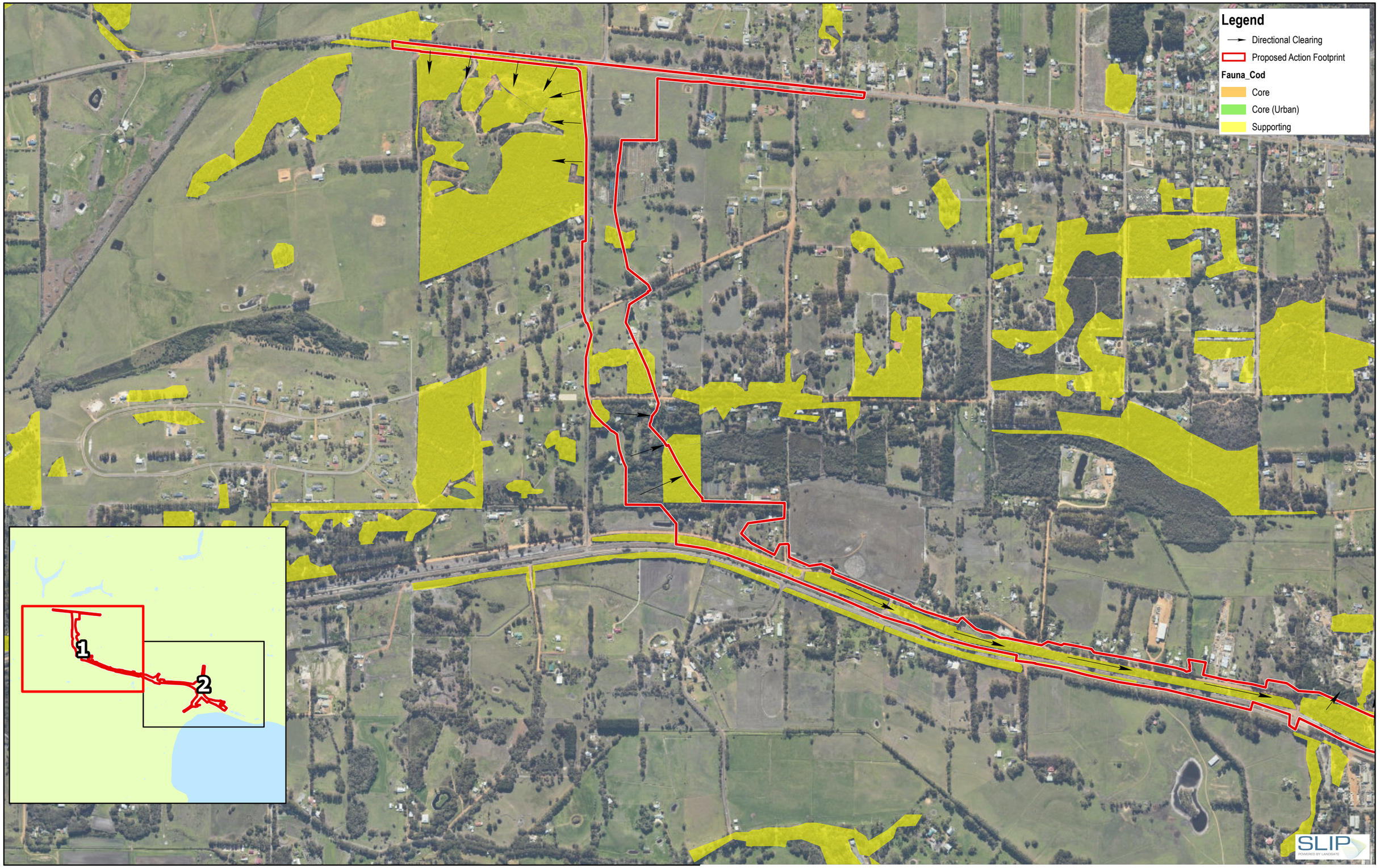
Plate 6 ***Fauna underpass culvert with rope bridge***

4.2 Monitoring program

A number of activities will be undertaken to monitor and report implementation of management measures and achievement of completion criteria. Monitoring activities are mapped to each management measure in Table 7 and Table 8. describes the monitoring in more detail and includes relevant monitoring guidelines or methods and responsible people.

4.3 Managing uncertainty

This CSFEMP has been developed based on varying data and information sources. This data and information has informed the risk assessments and management measures contained within the CSFEMP and therefore, any limitations or uncertainties with this data or information may impact the accuracy of this CSFEMP. Table 9 contains measures for managing uncertainty so that the CSFEMP continues to be based on the most up to date and relevant information and data.



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Metres

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

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GHD

Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Directional Clearing

Project No. **12539872**
Revision No. **1**
Date **9/06/2021**

FIGURE 6

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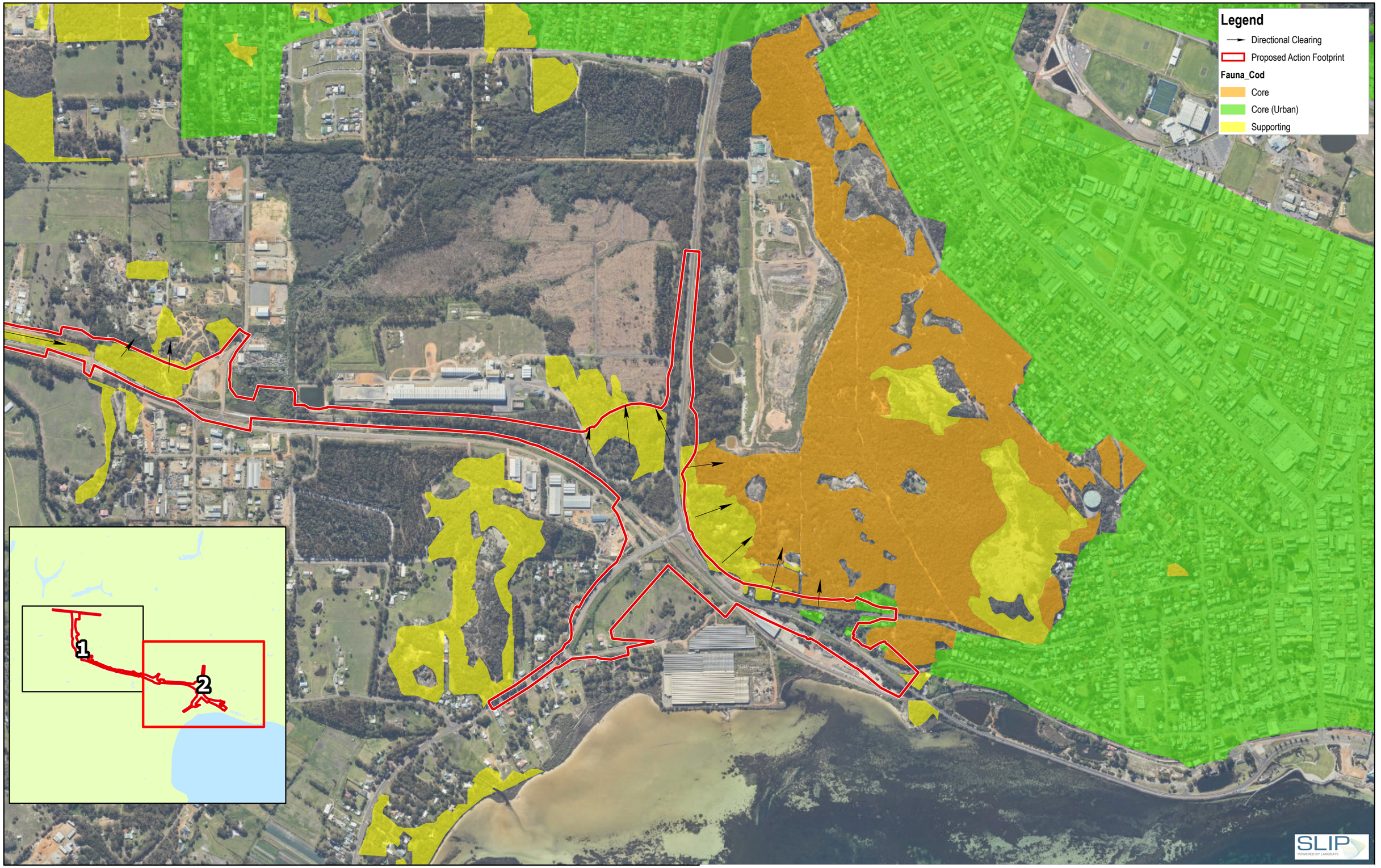
Print date: 09 Jun 2021 - 14:52

Data source: GHD: Directional Clearing (2021); MRWA: Action Area, Western Ringtail Possum Habitat (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee



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Metres

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

N

GHD

Main Roads
Albany Ring Road Project
Stages 2 and 3b: Environmental Management Plan

Directional Clearing

Project No. **12539872**
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FIGURE 6

G:\61\12539872\GIS\Maps\Working\12539872\12539872.aprx\12539872_EMP_008_Directional_Clearing_Rev2
Print date: 09 Jun 2021 - 14:52

Data source: GHD: Directional Clearing (2021); MRWA: Action Area, Western Ringtail Possum Habitat (2021); Landgate_Subscription_Imagery\WANow: Landgate / SLIP. Created by: xlee

Table 7 Management measures to mitigate construction impacts to MNES

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
To avoid unauthorised impacts and minimise authorised impacts to Black Cockatoo and WRP habitat	Clearing of native vegetation will be avoided through consideration of potential impacts during the detailed design phase The disturbance area will be minimised by using retaining walls and steepening batters where appropriate.	Detailed design does not increase the clearing extent of native vegetation	Detailed design phase	Detailed design drawings	Detailed design increases the extent of native vegetation to be cleared	Detailed designs are redrafted, and native vegetation considered in designs	Main Roads Project Manager
	Black Cockatoo habitat (including Suitable DBH Trees) and WRP habitat within the construction site boundary that is not required to be cleared will be marked and identified as no-go areas and demarcated on relevant drawings	Drawings showing environmental no-go areas developed	Contract award and prior to commencement of clearing (Clearing may be staged during construction)	Record of provision of drawings showing environmental no-go areas	Area on drawings exceeds MNES habitat permitted	Drawings are revised to reduce area of MNES habitat impacted to within approved limits	Main Roads Project Manager
	A ground disturbance permit process will be developed by the Contractor and signed off by the Main Roads Superintendent or delegate	Project ground disturbance permit process developed and approved by Main Roads	Prior to commencement of clearing	Contract correspondence Environmental audits.	Non conformance with ground disturbance permit process.	Environmental incident will be recorded and the cause investigated Review induction procedure.	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Dieback protectable areas will be identified and established within the Proposed Action area and adjacent land to guide dieback hygiene practices including restrictions on equipment and vehicle movement, soil movement, and CoE	Dieback areas clearly marked on site Inductions include dieback hygiene.	Prior to soil disturbance	Environmental audits	Dieback management areas not flagged Inductions don't include dieback hygiene. Hygiene practices not correctly implemented on site	Environmental incident will be recorded, and the cause investigated Amend flagging on site Review induction procedure.	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Fire danger ratings and Shire vehicle movement are to be observed and their requirements implemented	Fire danger ratings applied to works	During construction	Environmental audits	Works are not appropriately aligned with Fire danger ratings Works are not shut down if Fire danger rating requires it, e.g. total fire ban	Fire danger ratings applied to works	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas.	Vehicles fitted appropriately Vehicles in designated cleared areas.	During construction	Environmental audits	Vehicles not fitted with fire extinguishers Vehicles are identified in non-designated areas.	Non-compliant vehicles fitted appropriately Drivers in non-designated areas inducted.	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Prior to clearing, the final road design will be assessed against the proposed clearing area to ensure the required clearing area is no more than the approved area	Reduce clearing of Black Cockatoo/WRP habitat to the extent practicable in final design	Prior to commencement of clearing	Reporting showing the approved clearing area matches the required clearing area	Required clearing area is greater than approved clearing area	Stop works (temporary) Record environmental incident Investigate cause Update environmental training of personnel (if appropriate) Report incident to DAWE and DWER Undertake remediation works (if appropriate, following consultation with DAWE and DWER).	Main Roads Project Manager
	Clearing areas will be clearly demarcated and marked with flagging and checked and approved by the Construction Contractor Environmental Management Representative prior to clearing commencing	Environmental no-go areas clearly marked with flagging on site	Prior to commencement and during clearing	Incident reporting Monthly environmental site inspections.	Clearing exceeds the amount of MNES habitat permitted	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until no-go areas have been reviewed and confirmed to be in place correctly, and Main Roads	Construction Contractor Environmental Management Representative

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
			(Clearing may be staged during construction)		Clearing or other disturbance within retained habitat Clearing outside of marked clearing extent.	Superintendent provides approval to recommence Cleared areas outside of the permitted clearing area will be rehabilitated.	
	Additional areas required for construction such as laydown areas, stockpile areas and vehicle turn around, will be located in areas cleared for permanent works or areas that do not contain Black Cockatoo or WRP habitat Clearing will be avoided for any temporary construction activities.	Areas for ancillary services located in cleared areas or areas that do not contain Black Cockatoo or WRP habitat	During construction	Construction site plan and photos showing ancillary areas not located on land containing Black Cockatoo or WRP habitat Monthly environmental site inspections.	Areas required for construction such as laydown areas etc are located within areas of vegetation suitable for cockatoos or possums	Main Roads Superintendent is required to provide approval for clearing of native vegetation for construction laydown etc. and approval must only be given if there are no other practicable options. Cleared areas outside of the permitted clearing area will be rehabilitated.	Construction Contractor Environmental Management Representative Main Roads Superintendent
	Lighting will be taken into account during installation of the rope bridge, and located away from lighting structures if possible. If lighting is required near the rope bridge, lighting will be muted or shielded to the greatest extent possible.	Lighting is not directed at rope bridge	During and post construction	Completion photographs of lighting and rope bridge installation Design drawings	Lighting is identified pointing at rope bridge	Lighting placement is adjusted or shielding installed	Main Roads Superintendent
	Revegetation within the road reserve will use local native species. Species chosen will be selected based on habitat suitability for Black Cockatoo, WRP and potential to be resistant to drought. Key components to the revegetation will include: Species selection will be determined by a suitably qualitied expert with experience in rehabilitation and/or landscaping Revegetation will involve a combination of tube stock and/or direct seeding Weed control will occur during the establishment period of the revegetation within the first two years of establishment.	Revegetation of roadside with suitable native species	Prior to and during revegetation	Review species list	Species listed are not local Revegetation works do not meet completion criteria.	Remove non-compliant species from list/planting and replace with suitable alternatives Weed spraying to remove weed cover.	Construction Contractor Environmental Management Representative Main Roads Superintendent
	Monitoring of use of rope bridge and underpass usage to determine success of mitigation measure Monitoring of surrounding area to determine activity in the area, and identify percentage of animals that chose to use or not use the fauna infrastructure Monitoring activity of predators around rope bridge and underpass.	Monitoring will be undertaken yearly for a duration of 10 nights using camera traps. A minimum of 2 cameras will be applied to each end of the fauna infrastructure Monitoring identifies WRP using rope bridge and/or underpass	Yearly for duration of approval commencing one year after construction completion	Yearly Monitoring Report	Monitoring identifies possums not utilising rope bridge Monitoring identifies possums not utilising fauna underpass Monitoring identifies increased presence of predators compared to previous monitoring event	Construction of additional ropes to allow possums to access the rope bridge and underpass as required Adjustment to lighting surrounding the rope bridge and underpass as required Feral animal control in consultation with DBCA Monitoring results will inform future approvals and management measures proposed	Main Roads Environmental Representative Main Roads Superintendent
To avoid injury or mortality to Black Cockatoos and WRP species	A fauna underpass (ARR) and rope bridge (Hanrahan Road) is included in the design to minimise impact of fauna habitat clearing on landscape connectivity for the WRP. The fauna underpass and rope bridge will also minimise likelihood of fauna strike by providing alternative linkages between patches of remnant vegetation	Detailed design and construction includes a fauna underpass and rope bridge consistent with design in Section 4.1.1 and location in Figure 2	Detailed design phase	Detailed design drawings	Detailed design increases the extent of native vegetation to be cleared Fauna underpass and rope bridge not included in design drawings	Detailed designs are redrafted, and native vegetation considered in designs	Main Roads Project Manager
	Pre-clearing fauna assessment and spotlighting will be undertaken by a suitably qualified person over two nights within the five nights prior to clearing. Assessment is to include hollows, dreys, ground debris, dense ground-level vegetation, timber and logs	Reduce clearing of WRP habitat to the extent practicable in final design No direct impacts to WRP.	Prior to construction	Detailed reports of the pre-clearing fauna assessment undertaken by the suitably qualified person Record of number of possums identified in pre-clearing fauna assessment.	Results of the fauna assessment deemed important	If WRPs are observed, the location containing the animal shall be left for up to 48 hours to allow for the animal to vacate.	Main Roads Project Manager

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	Directional clearing will occur (Figure 6) to allow fauna to relocate to areas of existing vegetation	No direct impacts to Black Cockatoos/WRP	During construction	Monitoring of clearing direction during clearing activities	Clearing in the wrong direction occurs	Cease works immediately Resume works in approved direction with the consent of the Main Roads Superintendent.	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	No night-time clearing of vegetation will occur	No direct impacts to Black Cockatoos/WRP	During construction	Monitoring of construction works start and finish times	Construction works occur outside of approved times	Cease works immediately Resume works in approved construction times with the consent of the Main Roads Superintendent, upon advice by the ecologist.	Construction Contractor Environmental Management Representative
	A suitably experienced ecologist with WRP and Black Cockatoo specific experience will be on-site during clearing of breeding habitat for Black Cockatoos and supporting and core habitat for WRP. The ecologist will maintain radio communication with machinery operators. The ecologist will be experienced with both Black Cockatoo and WRP habitat	No direct impacts to Black Cockatoos/WRP	During construction	The ecologist will keep a record during clearing of habitat cleared	Clearing of habitat is deemed unacceptable by the ecologist due to presence of Black Cockatoo chicks or eggs or presence of WRP individuals	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until hollows have been assessed or possum presence verified, and Main Roads Superintendent and ecologist provides approval to recommence, upon advice by the ecologist	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Where the trees with suitable nest hollow for Black Cockatoos will require clearing for the Proposal, the hollows will be visually inspected where safe and practicable via drone, pole camera or elevated platform. Where not in use the hollows will be 'blocked' to prevent breeding. Blocking may include wood nailed over the hollow, non-toxic expanding foam or similar Where blocking of the nest hollow cannot be undertaken (e.g., timing, access), a pre-clearing fauna assessment will be undertaken by a suitably experienced ecologist with specific experience in WRP and Black Cockatoo survey to determine if the hollow is being used by Black Cockatoos.	Preclude potential breeding within the proposed Clearing Area prior to construction	Prior to construction	Detailed list of hollows to be cleared with information and photographic evidence of ‘blocked’ hollows	A hollow not previously blocked is cleared, or cleared without a pre-clearing fauna assessment	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until hollows have been assessed, and Main Roads Superintendent provides approval to recommence, upon advice by the ecologist	Main Roads Project Manager Main Roads Superintendent.
	Where a suitable nest hollow has been blocked prior to the Black Cockatoo breeding season, the tree may be felled as part of the standard vegetation clearing process Where a suitable nest hollow has not been blocked and the pre-clearing fauna assessment has not identified any Black Cockatoo occupation of the nest hollow, prior to clearing the tree will be ‘bumped gently’ with a machine. The machine operator and ecologist will wait and observe the tree for a short time after. If no Black Cockatoo appears to be present following being bumped gently then the tree shall be pushed over slowly to minimise risk of injury to any undetected animal (if present) If a Black Cockatoo nestling is present in the hollow, the tree will not be felled until the nestling has fledged. The tree will be marked off with exclusion tape, with a suitable buffer, to ensure the birds aren't disturbed by construction	No direct impacts to Black Cockatoos	During construction	Detailed monitoring and recording of nest hollows, and blocking of nest hollows, and presence of chicks	Black Cockatoo occupation of unblocked nest hollow	Where a suitable nest hollow has not been blocked and the pre-clearing fauna assessment identifies any Black Cockatoo occupation of the nest hollow (which may include nestlings), the tree with the nest hollow will not be cleared until after the completion of the breeding season. No vegetation within 10 m of the tree would be cleared until after the completion of the breeding season	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Vacant dreys will be removed prior to clearing where they are accessible, in accordance with the DBCA *Procedures to minimise the risk to Western Ringtail Possums during vegetation clearing and building demolition* (DPaW 2015) Vacant tree hollows suitable for possums will be removed or blocked prior to clearing where they are accessible. Blocking may include wood nailed over the hollow, non-toxic expanding foam or similar.	No direct impacts to WRP	During construction	Detailed list of dreys to be cleared with information and photographic evidence of ‘blocked’ dreys	A hollow not previously blocked is cleared, or cleared without a pre-clearing fauna assessment	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until drey/hollows have been assessed by a suitably qualified ecologist, and Main Roads Superintendent provides approval to recommence	Main Roads Project Manager Main Roads Superintendent.
	Temporary traffic management measures including management of vehicle speeds, and the use of variable message boards to alert road users to the possible presence of WRP on the roadway, will be implemented during construction/road works activities	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction	A WRP is located during construction activities WRP is hit by a vehicle.	Assessment of dreys/hollows by a species expert if WRP is located. Vehicle speeds re-assessed in the location where the WRP was hit.	Main Roads Project Manager Main Roads Superintendent.

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
						If injured, possum will be captured by a licenced fauna handler and taken to a rehabilitation facility	
	Cleared vegetation will be chipped immediately or transported at least 100 m from WRP habitat before further processing	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction	A WRP is located during construction activities A WRP is located during chipping or transportation of cleared vegetation.	Clearing or chipping in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until drey/hollows/hiding spot have been assessed, or the WRP has been relocated and Main Roads Superintendent provides approval to recommence, upon advice by the ecologist. Procedures for chipping and transporting cleared vegetation should be revisited in that location to ensure any possums present during chipping are identified and not injured	Main Roads Project Manager Main Roads Superintendent.
	Movement/disturbance of clearing stockpiles will be confined to the period between one hour after sunrise and one hour prior to sunset	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction A WRP is located during movement/disturbance of clearing stockpiles.	A WRP is located during movement of stockpiles	Movement of stockpiles is ceased. Movement of stockpiles not to commence until investigated by the ecologist and Main Roads Superintendent provides approval to recommence, upon advice by the ecologist	Main Roads Project Manager Main Roads Superintendent.
	Habitat clearing is to commence from existing edge lines/roads and progress towards habitat that will be retained, where possible	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction	Clearing is not being undertaken in correct directions, allowing possums to escape into adjacent bushland	Clearing direction is amended Any possums identified are assessed by ecologist and relocated or allowed to leave the vicinity on their own Clearing not to commence until investigated by the ecologist and Main Roads Superintendent provides approval to recommence, upon advice by the ecologist	Main Roads Project Manager Main Roads Superintendent.
	If WRPs are observed during clearing operations, the tree containing the animal shall be left for up to 48 hours to allow for the animal to vacate, while clearing continues in adjacent vegetation. If the tree continues to be occupied after 48 hours, the animal will be coerced/moved to a safe area outside of the clearing footprint by the appointed ecologist in accordance with *Procedures to minimise the risk to Western Ringtail Possums during vegetation clearing and building demolition* (DPaW 2015). This may include removal using an elevated platform or gently pushing over the tree as detailed below. The ecologist will be experienced with WRP and have a fauna handling licence.	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction	A WRP is located during clearing activities	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until drey/hollows have been assessed, or the WRP has been relocated by the suitably qualified ecologist, or allowed to leave the site on its own. Clearing will not continue until Main Roads Superintendent provides approval to recommence, upon advice by the ecologist	Main Roads Project Manager Main Roads Superintendent.
	Trees, as noted above, that are observed to support WRP after 48 hours will be 'bumped gently' with a machine prior to felling. The operator and suitably qualified ecologist will wait and observe the tree for a short time. If the animal remains in the tree, the tree shall be pushed over slowly onto vegetation within the clearing area that is yet to be cleared. The 'soft felling' of habitat trees will provide a 'cushion' for the vegetation being felled, minimising the risk of injury to the animal and allowing any WRP present with the opportunity to safely vacate	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction	A WRP is located during clearing activities	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until drey/hollows have been assessed, or the WRP has been relocated by the suitably qualified ecologist, or allowed to leave the site on its own. Clearing will not continue until Main Roads Superintendent provides approval to recommence, upon advice by the ecologist	Main Roads Project Manager Main Roads Superintendent.
	Felled trees with hollows will be checked by the ecologist immediately for WRPs after felling and prior to further processing. If it is not possible to fully inspect the hollow the tree will be left on the ground overnight to allow time for any undetected fauna to vacate	No direct impacts to WRP	During construction	Detailed reporting and monitoring of any WRP impacted during construction	A WRP is located during clearing activities	Clearing in the direct vicinity will cease immediately if trigger is met. Clearing will not recommence until drey/hollows have been assessed, or the WRP has been relocated and	Main Roads Project Manager Main Roads Superintendent.

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
						Main Roads Superintendent provides approval to recommence, upon advice by the ecologist	
	Any Black Cockatoos or WRP showing signs of injury or illness will be recorded and taken by a qualified fauna handler to a veterinarian or qualified wildlife carer	No direct impacts to Black Cockatoos or WRP	During construction	Records of injured or ill Black Cockatoos/WRP	Injured or ill Black Cockatoo/WRP	Stop works (temporary) within 50 m of the individual Engage a suitably experienced fauna handling specialist to remove individuals and transport the individual to a native fauna care facility Record environmental incident Modify pre-clearing fauna survey methodology (if appropriate) Wildlife will be promptly referred to an experienced wildlife veterinarian or approved wildlife rehabilitation facility.	Construction Contractor Environmental Management Representative
	Where trees that are known to be Black Cockatoo habitat are retained but are located within 10 m of the edge of the road seal the risk of vehicle strike will be assessed to determine if wildlife hazard signage is required	Black Cockatoo habitat retained within 10 m of the edge of the seal of the road will be risk assessed and wildlife hazard signage installed as required	During construction	Wildlife hazard signage risk assessment	Black Cockatoo habitat is retained within 10 m of the edge of the road seal and is not risk assessed to determine whether wildlife hazard signage is required	Risk assess retained Black Cockatoo habitat within 10 m of the edge of the road seal and install wildlife hazard signage if required.	Construction Contractor Environmental Management Representative
	Speed limits will be restricted to 40 km/hr during clearing operations to reduce the risk of vehicle strikes during construction	No incidents of speeding within the construction site boundary	During construction	Visual monitoring by all construction personnel Incident reporting.	Reported exceedance of site speed limits WRP or black cockatoo collision with construction vehicle.	Refresher training will be conducted within 1 week Instances of speeding are identified and offenders will be asked to immediately reduce speed Repeat offenders (ie. Caught speeding more than 2 times) will undergo further refresher training. Any WRP or black cockatoo hit by a vehicle is reported as an environmental incident, and in annual compliance reporting Re-assess speed limits, particularly in location of strike, and further reduce speed, as required.	
	A list of local wildlife rescue organisations and carers will be maintained on site to contact in the event of fauna injury. Wildlife rescue organisations and carers will be notified at the commence of the project so they are aware that injured fauna may require care.	A list of local wildlife rescue organisations and carers is on site at all times	During construction	Monthly environmental site inspections	A list of local wildlife rescue organizations and carers is not on site Wildlife rescue specialists not contacted immediately on discovery of an injured Black Cockatoo or injured/orphaned WRP. Wildlife rescue specialists not available to assist with injured/orphaned WRP or black cockatoo.	A list of local wildlife rescue organizations and carers is obtained immediately and kept on site Wildlife carer organisations are notified at the commencement of works Appropriate wildlife rescue organisations contacted regularly to ensure availability if injury assistance or relocation required Refresher training will be conducted.	

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	A post-clearing survey shall be undertaken to ensure no injured Black Cockatoo/WRP individuals are present	No direct impacts to Black Cockatoos/WRP	Post clearing	Post-clearing survey	Injured Black Cockatoos/WRP	Wildlife will be promptly referred to an experienced wildlife veterinarian or approved wildlife rehabilitation facility	Construction Contractor Environmental Management Representative
	Revegetation designs shall not include foraging or breeding plant species within 10 m of the road	Revegetation designs exclude foraging or breeding plant species within 10 m of the road	Prior to commencement of revegetation	Record of revegetation drawings showing species mix	Revegetation designs include foraging or breeding plant species within 10 m of the road Foraging or breeding plant species planted within 10 m of the road.	Design drawings amended to exclude revegetation with foraging or breeding plant species within 10 m of the road Foraging or breeding plant species removed from within 10 m of the road and replaced with non-habitat species.	Construction Contractor Environmental Management Representative Main Roads Superintendent.
	Within 7 days prior to clearing, trees with hollows used by or suitable for use by Carnaby's Cockatoo will be inspected by a suitably qualified ecologist to confirm that there are no hollows being used by Black Cockatoo within the area to be cleared. Inspection will be undertaken via drone, pole camera or elevated platform	Survey of trees with hollows used by or suitable for use by Black Cockatoo undertaken within 7 days prior to clearing events	Within 7 days prior to clearing events	Survey for hollows that are being used, or are capable of being used by Black Cockatoos Maintain a register of nesting trees.	Clearing event undertaken without pre-clearing survey Survey undertaken more than 7 days prior to clearing.	Contractor to provide evidence that a suitably qualified person is engaged to conduct surveys prior to subsequent clearing events Contractor to provide evidence that surveys are scheduled within 7 days prior to subsequent clearing events Clearing in the direct vicinity will cease immediately if trigger is met Clearing will not recommence until no-go areas have been reviewed and confirmed to be in place correctly, and Main Roads Superintendent provides approval to recommence.	Construction Contractor Environmental Management Representative
To avoid indirect impacts to Black Cockatoo and WRP habitat from the introduction and/or spread of introduced species and dieback (*Phytophthora cinnamomi*)	Contractor induction will include familiarisation with and discussion of Black Cockatoos/WRP, *Phytophthora* dieback management and hygiene management	No direct impacts to Black Cockatoo and WRP including habitat from the introduction and/or spread of introduced species and dieback	Prior to construction	Signed declaration of induction to ensure compliance	Contractor does not sign the induction	Contractor to review the induction	Construction Contractor Environmental Management Representative
	Heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material. Entry and exit records will be kept for CoE points	No breach of CoE protocols	For the duration of the approval	Entry and/or exit records for CoE points Monthly environmental site inspections.	Breach of CoE protocol	Refresher training will be conducted	Construction Contractor Environmental Management Representative
	Effective clean down prior to accessing the CoE point will be conducted to remove soil and plant material (including weed seeds) The key components of a suitable washdown are: • Effluent is captured during washdown i.e. sump, for later transport and disposal, or diverted into excluded/infested areas • Cleaned objects exit washdown area without becoming re-contaminated • Safe entry, departure of vehicles by operators is maintained Transportation of cleaned plant, equipment and vehicles to Protectable Areas should be undertaken via sealed roads where possible.	The key components of a suitable washdown are: Effluent is captured during washdown i.e. sump, for later transport and disposal, or diverted into excluded/infested areas Cleaned objects exit washdown area without becoming re-contaminated Safe entry, departure of vehicles by operators is maintained.	Prior to entering CoE point	Inspection of washdown facility during monthly inspections	CoE not being undertaken CoE not undertaken correctly CoE facility inadequate	Additional training Amendment of facilities	Environmental Management Representative

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	Timing of operations and construction (particularly in Protectable Areas) will be conducted in dry soil conditions where possible (generally between November and April)	Clearing in protectable areas undertaken in dry weather conditions	November to April	Monthly environmental site inspections.	Avoid clearing in wet weather conditions	Review of clearing timeline where possible	Construction Contractor Environmental Management Representative
	Demarcation of Protectable Areas should be check/retaped shortly prior to construction	Protectable Areas taped on site	Prior to construction	Monthly environmental site inspections	Protectable Areas not flagged appropriately	Protectable Areas flagged prior to continued construction activities	Construction Contractor Environmental Management Representative
	Basic raw material imported into Protectable areas should be low risk for Phytophthora contamination	Assessment of risk for raw materials Phytophthora contamination	Prior to construction/importing materials	Monthly environmental site inspections	Risk assessment for raw materials not undertaken	Undertake raw materials dieback risk assessment	Environmental Management Representative
	WoNS and environmental weeds within the construction site boundary will be treated according to the weed control management outlined by Weeds Australia (http://weeds.ala.org.au/) with the aim of controlling weed spread	No new occurrence or spread of WoNS or environmental weeds through construction activities	Construction activities	Monthly environmental site inspections Annual revegetation monitoring.	New occurrence or spread of a WoNS or environmental weed identified	Application of weed control for the weed species until completion criteria of weed cover at less than 30% is met Review CoE process.	Construction Contractor Environmental Management Representative
	Topsoil containing Declared Pests or WoNS shall not be reused for revegetation	Topsoil from Declared Pest or WoNS infested areas to be buried at a depth of at least 300 mm or disposed off-site at a certified landfill	During construction	Records of topsoil segregation and burial at licensed waste facilities	Topsoil from infested areas used in revegetation or revegetation	Topsoil removed from revegetation/revegetation areas and replaced with clean topsoil. Infested topsoil buried at depth or disposed at a licensed waste facility	
	Topsoil from infected or potentially infected dieback areas shall be segregated and not used in non-infected areas	Topsoil from infested and potentially infested dieback areas used in infested areas or disposed of at a licensed facility	During construction	Records of topsoil segregation and reuse from infested areas or licensed waste facilities	Topsoil from infested or potentially infested dieback areas used in non-infested areas	Topsoil sampled for dieback at sampling density according to WA contaminated site guidelines If topsoil found to contain dieback, the topsoil will be removed and placed on an infested area or a licensed waste facility.	
	Sediment to be captured in stormwater runoff and treated within basins/swales prior to discharge to waterways to prevent spread of dieback on site	No evidence of dieback spread in areas adjacent to the project resulting from stormwater runoff	During and post construction	Visual monitoring of runoff in monthly inspection Incident reporting.	Insufficient drainage or evidence of stormwater runoff off site Evidence of dieback deaths in area surrounding project believed to be uninfested and protectable.	Bunding to prevent movement of water off site Establishment or correction of faulty drainage structures.	
	Topsoil within the Proposed Action Area will be harvested, stockpiled and reused in accordance with Main Roads Environmental Guideline Topsoil Management	Topsoil is managed in accordance with Main Roads Guideline	Prior to and during construction and revegetation	Monthly environmental site inspections	Topsoil is not managed in accordance with Main Roads Guideline	Topsoil management amended to ensure compliance with Main Roads Guideline	Construction Contractor Environmental Management Representative
To avoid edge affects impacting adjacent areas of Black Cockatoo and WRP habitat.	Sediment to be captured in stormwater runoff and treated within basins/swales prior to discharge to waterways to prevent spread of dieback off site	No evidence of dieback spread in areas adjacent to the project resulting from stormwater runoff	During and post construction	Visual monitoring of runoff in monthly inspection Incident reporting.	Insufficient drainage or evidence of stormwater runoff off site Evidence of dieback deaths in area surrounding project believed to be uninfested and protectable.	Bunding to prevent movement of water off site Establishment or correction of faulty drainage structures.	Construction Contractor Environmental Management Representative

Management Objective / Desired Outcome	Management Measures	Performance Target/Completion Criteria	Timing	Monitoring/Reporting Activity	Corrective Action Trigger(s)	Corrective Action	Corrective Action Responsibility
	Heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material. Entry and exit records will be kept for CoE points	No indirect impacts to Black Cockatoo/WRP habitat as a result of invasive species/weeds	Prior to construction	Detailed monitoring and reporting of machinery Reports detailing the confirmation of machinery to enter or exit the site	Dirty or infested machinery	Any machinery not to standard must be cleaned immediately prior to site entry/exit	Construction Contractor Environmental Management Representative
	Hot work will be undertaken in accordance with Contractor's hot work procedure	No fires started as a result of hot works	During hot works such as welding	Monthly site inspections to confirm required controls are in place Incident reports related to fires.	Ignition / fire started as a result of hot works Ignition / fire started as a result of construction vehicles or equipment.	Incident investigation shall be initiated within 1 day and a report completed within 1 week Fire impacted areas within the Proposed Action Area will be included in the Landscape and Revegetation area for the Proposed Action for revegetation with Black Cockatoo and WRP habitat species Refresher training will be conducted.	Construction Contractor Environmental Management Representative
	Vehicles, plant and equipment to be fitted with fire extinguishers and restricted to designated cleared areas unless involved in clearing operations	No fires started as a result of construction vehicles or equipment	During construction				
	Fire danger ratings and Shire vehicle movement bans will be observed and the requirements of these implemented	No fires started as a result of construction vehicles or equipment	During construction				
	Temporary drainage structures within or adjacent to Black Cockatoo or WRP habitat will be designed and constructed such that scouring or erosion within adjacent vegetated areas does not occur	No evidence of erosion from construction activities within no-go areas or Black Cockatoo or WRP habitat to be retained	Prior to and during construction	Monthly environmental site inspections	Erosion identified in Black Cockatoo or WRP habitat	Review drainage to identify whether there are any failure points, and repair/address any failure points identified	Construction Contractor Environmental Management Representative

Table 8 Monitoring schedule

Monitoring Activity	Parameter Measures	Items Addressed	Applicable Method / Guideline	Responsibility
Pre-clearing surveys for hollows being used by Black Cockatoos or WRP and dreys	Presence of hollows and/or dreys being used by Black Cockatoo and WRP	– Confirm Suitable DBH Trees with suitable hollows for nesting that are being used by Black Cockatoo before clearing begins – Confirm that Black Cockatoo are no longer using suitable hollows before clearing begins – Maintain a register of nesting trees – Record the location of any known nesting hollow or suitable nesting hollow as no-go areas – Confirm list of wildlife rescue organization contact details is on site – Confirm that WRP are not in the dreys or trees to be cleared.	– Suitably qualified person with experience in hollow identification to visually inspect potential nesting trees and WRP dreys within the clearing area and record spatial co-ordinates for any trees identified that are being utilised, or are capable of being utilised, by Black Cockatoos or WRP – Monitoring will be conducted in line with best practice and monitoring methods used will be consistent with advice contained within the Carnaby's Cockatoo recovery plan (DPaW 2013) and the Baudin's Cockatoo and Forest Red-tailed Black Cockatoo recovery plan (Chapman 2008) and Procedures to minimise the risk to Western Ringtail Possums during vegetation clearing and building demolition (DPaW 2015) – Note: no-go areas are areas of vegetation that are not approved to be cleared, these include trees with hollows that are being used by Black Cockatoos and areas outside of the approval boundary. These areas are identified on the engineering drawings issued for construction.	– Suitably qualified person – Construction Contractor Environmental Management Representative – Main Roads Environmental Representative
Monthly environmental site inspection	Compliance with CSFEMP requirements	– Confirm vegetation to be retained is clearly marked with flagging on site – Confirm environmental no-go areas are clearly marked on site – Confirm that clearing outside of approved area or in excess of approved limits has not or will not occur – Confirm areas required for temporary construction activities, such as laydown, are only located on previously cleared areas – Confirm plant and machinery are verified clean on arrival at site – Confirm no new occurrences of WoNS or Environmental Weeds within the construction site boundary – Confirm no breach of CoE procedures – Confirm soil from known or potential dieback infested areas has been reused in infested areas or disposed off-site at a licensed waste facility – Confirm hot works procedures are in place and correctly implemented – Confirm no erosion or scouring within vegetation that is to be retained, within no-go areas or outside the approval boundary – Confirm topsoil is harvested, stockpiled and reused in accordance with Main Roads Environmental Guideline Topsoil Management – Confirm revegetation within the road reserve is compliant with approved revegetation plans and species mix – Confirm previous weed control measures been effective and is follow-up treatment required to eliminate the weeds – Confirm weed control measures been implemented as per this CSFEMP and in line with Weeds Australia Guidance (http://weeds.ala.org.au/WoNS/) – Confirm no topsoil from dieback infested soils is used in non-dieback infested areas – Sediment captured in stormwater runoff and treated within basins/swales prior to discharge to waterways to prevent spread of dieback – Confirm that no black cockatoo or WRP has been injured or killed – Confirm that pre-clearance surveys have been undertaken correctly (during clearing only).	Visual inspection to confirm that management measures in the CSFEMP are being implemented correctly	– Construction Contractor Environmental Management Representative – Main Roads Environmental Representative.
Site inspection during seeding/planting	Revegetation progress	– Revegetation must begin within one year of completion of construction within areas identified for revegetation – Confirm revegetation is planted in winter – Confirm topsoil is reused in accordance with Main Roads Environmental Guideline Topsoil Management – Confirm revegetation within the road reserve is compliant with approved revegetation plans and species mix – Confirm no foraging, nesting or roosting plant species for Black Cockatoo are planted within 10 m of the edge of the pavement.	Visual inspection by a suitable qualified person to confirm that revegetation is occurring/has occurred in accordance with approved plans and species mix	– Construction Contractor Environmental Management Representative – Main Roads Environmental Representative
Post – construction survey	Usage of fauna underpass and rope bridge by fauna, specifically WRP and predators	– Yearly monitoring to determine the use of the fauna underpasses and rope bridge by fauna in the region. – Monitoring to include records of general fauna use, predators (i.e. cats and foxes) and WRP.	Camera monitoring over a period of at least 10 nights will be undertaken yearly. Cameras will be placed to capture both predators and WRP, as well as any other fauna utilising the underpass and rope bridge. A minimum of two cameras will be placed at each end of the fauna infrastructure. Cameras will be placed to capture use by fauna, possums and predators in the vicinity of the underpass and rope bridge, to determine presence of animals that may chose to use the underpass or rope bridge but chose not to.	– Main Roads Environmental Representative

Monitoring Activity	Parameter Measures	Items Addressed	Applicable Method / Guideline	Responsibility
			Monitoring will commence 12 months following completion of construction, and continue for the duration of the approval. Contingency actions will be applied as required, upon advice of DBCA and may include feral animal control (i.e. foxes)	

Table 9 Managing uncertainty

Data	Limitations / Uncertainty	Risk presented by Limitations / Uncertainty	Risk Management Measures
WRP habitat assessment (Southern Ecology 2019)	Definitions of categories should be considered a draft and should be presented to the WRP Recovery Team for discussion and review	Low risk	n/a
Dieback assessment and EMP (Southern Ecology 2020b)	Difficulty in detecting pathogen impacts in long unburnt areas	Medium risk of unrecorded / un-expressed Phytophthora infestations	Dieback hygiene management adopted as a precautionary measure
Southern Ecology (2020c)	Possible to likely survey limitations including inconspicuous or cryptic species, dense vegetation, identification of post fire ephemeral species in long unburnt habitat, and inaccessible habitat	Low risk	n/a
Road Design	High level of certainty of maximum impact within Proposed Action Area	Low risk	n/a
Black Cockatoo habitat assessment (Biota 2019)	Some hollows were assessed from the ground due to access limitations with the remotely piloted aircraft, therefore reducing reliability of hollow suitability data	Potential for Black Cockatoos to nest in hollows not previously observed	Pre-clearing survey of suitable hollows for nesting
WRP habitat assessment (Biota 2020)	Approximately 10% probability of not detecting WRP presence in survey due to transect width	Potential for WRP species to be more frequent than population estimate indicates	Adhere to onsite speed limits to reduce likelihood of vehicle strike

5. CSFEMP implementation and review

5.1 Roles and responsibilities

All project personnel, including sub-contractors/sub-consultants, are responsible for complying with applicable Commonwealth and State legislation, local government requirements and the conditions of licences, permits and approvals. Specific responsibilities in relation to this CSFEMP are provided in Table 10.

Table 10 CSFEMP roles and responsibilities

Role	CSFEMP Responsibilities
Main Roads Project Manager	– The overall management and control of the CSFEMP – Reviewing and approving the CSFEMP – Assisting with implementation of the CSFEMP – Providing the necessary resources to ensure the CSFEMP is properly implemented – Ensuring all personnel are inducted into the project's environmental requirements prior to commencement of works on-site – Ensuring suppliers are made aware of the environmental objectives pertaining to them through conditions of contract – Taking strategic actions to continuously improve the CSFEMP – Participating in incident investigations – Management, implementation, monitoring and compliance of the CSFEMP and any approval conditions, including construction supervision and performance of all staff, contractors and subcontractors – Reviewing CSFEMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of CSFEMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project – Representing the project at community meetings.
Main Roads Superintendent	– Confirming all environmental requirements are implemented as outlined in the CSFEMP as required to avoid and minimise actual or potential environmental harm on-site – Assisting the Environmental Management Representative to develop and maintain the various registers and checklists – Supporting the Environmental Management Representative to plan and implement environmental requirements – Reporting activity that has resulted, or has the potential to result, in an environmental incident immediately to the Environmental Management Representative – Participating in incident investigations – Monitoring construction activities to ensure that identified and appropriate control measures are effective and in compliance with the CSFEMP – Managing CSFEMP performance and implementation of correction actions, or stop work procedures, in the event of breaches of CSFEMP conditions, that may lead to serious impacts on local communities, or affect the reputation of the project – Ensuring that all construction personnel and subcontractors are informed of the intent of the CSFEMP and are made aware of the required measures for environmental a compliance and performance – Ensuring effective communication and dissemination of the content and requirements of the CSFEMP to contractors and subcontractors – During construction, maintain traffic safety along access roads, with special emphasis on high trafficked areas.
Main Roads Environmental Representative	– Reviewing the CSFEMP – Developing monitoring programs required under this CSFEMP – Being the primary contact point in relation to the environmental performance of the construction phase – Managing procedures and practices for receiving and responding to complaints and inquiries in relation to the environmental performance

Role	CSFEMP Responsibilities
	– Reporting any activity that has resulted in, or has the potential to result in an environmental incident immediately to the Project Manager, Construction Manager and other relevant personnel – Considering and advising on matters specified in the conditions of licences and approvals relating to the environmental performance and impacts of the Proposed Action – Requiring reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment is likely to occur – Identifying environmental competence requirements for all staff and ensure delivery of environmental training to personnel within the team – Acting as main point of contact between the regulatory authorities and the Proposed Action on environmental issues – Providing advice and liaison with the construction teams to ensure that environmental risks are identified and appropriate controls are developed and included within method statements – Environmental auditing of subcontractors and suppliers – Updating and revision of the plan if management measures, triggers or corrective actions require revision
Contractor Representative	– Assisting with implementation of the CSFEMP for construction related activities – Providing the necessary resources to ensure the CSFEMP is properly implemented – Making sure all personnel are inducted into the Proposed Action's environmental requirements prior to commencement of works on-site – Participating in incident investigations – Management, implementation, monitoring and compliance of the CSFEMP and any approval conditions.
Construction Contractor Environmental Management Representative	– Implementation of the CSFEMP on-site – Coordinating and managing all the environmental activities during the construction phase – Being the primary contact point in relation to the environmental performance of the construction phase – Managing procedures and practices for receiving and responding to complaints and inquiries in relation to the environmental performance – Reporting any activity that has resulted in, or has the potential to result in an environmental incident immediately to the Main Roads Superintendent and other relevant personnel – Requiring reasonable steps to be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment is likely to occur – Identify environmental competence requirements for all staff and ensure delivery of environmental training to personnel within the team – Assistance in the development and delivery of environmental training for site personnel and subcontractors – Management of the construction contractor's environmental monitoring, inspection and audit program in so far as it relates to construction activities – Assisting with revision of the plan where management measures, triggers or corrective actions need to be updated or changed.
Ecologist	– An individual with recognised knowledge and practical experience in targeted and pre-clearance fauna surveys, specifically for Black Cockatoo and WRP – Fauna handling licence required.

5.2 Inspections, audits and reporting

5.2.1 Contractor inspections and audits

Aspects with a potential for environmental impact will be subject to environmental audits as detailed in this CSFEMP. Audits will be conducted by the Contractor (or qualified delegate). Audit objectives will be to verify compliance with the CSFEMP and applicable permits, approvals and regulations.

Environmental inspections will be conducted on a monthly basis during construction and on-ground revegetation works by the construction Contractor and/or Construction Contractor Environmental Management Representative.

Main Roads will conduct environment and heritage audits of the construction contract area on a six monthly basis during the construction phase.

5.2.2 Incident reporting

All environmental incidents shall be recorded in Main Roads incident management system “EQSafe”. Examples of environmental incidents include the following:

– Unauthorised clearing or impacts to vegetation outside the approved clearing area
– Fauna vehicle strike
– Fuel, oil and/or chemical spills
– Fire and/or explosions
– Major erosion and sediment control failure.

The Contractor Representative and Contractor Environmental Management Representative will be responsible for investigating environmental incidents and maintaining records of actions taken. All environmental incidents will be reported into EQSafe which will report to the relevant Main Roads representatives, DAWE and the relevant Administering Authority by the Project Manager, or in accordance with relevant contractual obligations.

In addition to EQSafe, the Contractor Environmental Management Representative may use internal HSE incident management systems for recording, investigation and close-out of incidents. Reporting shall include relevant information pertaining to environmental matters (e.g. records, monitoring results, incidents, complaints, audits and inspections, etc.) and shall be presented in a report containing the following elements:

– A description of the incident
– Actions taken to date to address the incident
– Further actions to be taken to address the incident
– Actions to be taken in the future to prevent reoccurrence of the incident.

If the Contractor Environmental Management Representative does not have sufficient internal HSE incident management systems in place (as determined by the Main Roads Project Manager and Main Roads Environmental Representative), the Contractor Environmental Management Representative may be required to follow the Main Roads Environmental Incident Reporting, Investigation and Management Procedure for incident reporting. This procedure provides a process for the reporting, investigation and management of environment incidents.

Corrective actions may also arise from audits, inspections and management reviews. Corrective actions are to be reviewed and endorsed by Main Roads before the action is implemented. Audits will follow to confirm satisfactory completion.

5.2.3 Communication protocols

The CSFEMP requirements will be included in task specific “tool box” meetings, which are to be performed prior to undertaking work. As part of the meeting, the tasks will be reviewed with consideration given to changes in construction activities and conditions.

All external communication pertaining to environmental management is to be considered by the Project Manager or in accordance with applicable contractual obligations.

5.2.4 Document control

Records will be kept to demonstrate compliance with this CSFEMP. These records include, but are not limited to:

- Risk assessments
- Audit results and reports, including the timing, location and spatial delineation of clearing, and periodic reconciliation against approved disturbance limits
- Black Cockatoo hollow pre-clearing inspection reports
- Monthly inspection results
- Environmental incident reports
- Monitoring data, results and reports
- Revegetation design and species mix approved for use
- Topsoil harvesting, storage and reuse from known/potential dieback infected areas records
- Records of revegetation activities including dates, location and area of revegetation, species mixes used and quantities
- Induction records
- Record of pre-clearing WRP survey including number of possums and location
- Pre-start and Toolbox meeting minutes
- Correspondence in relation to the requirements of this CSFEMP between Main Roads, construction contractors and/or regulators.

The Main Roads Superintendent and the Construction Environmental Management Representative are responsible for establishing and maintaining electronic and hardcopy filing systems for the above information. All documents kept on site during construction will be transferred to Main Roads head office as part of site demobilisation.

5.3 Environmental training

All personnel involved in the construction process will be required to attend a compulsory induction before commencing any work at the site. The environmental component of the induction shall include (but not be limited to) the following items:

- All staff will be made aware of their responsibilities as per the EPBC Act and the implications of failing to fulfil these duties
- All staff will be made aware of their environmental responsibilities under this CSFEMP in relation to implementing mitigation measures, reporting environmental incidents and complaints and implementing corrective actions
- All staff will be made aware of their environmental responsibilities towards surrounding vegetation including the boundaries of the clearing permit and requirement not to disturb the environment outside this area
- All staff will be given instructions on environmental emergency response procedures
- All staff will be made aware of site environmental controls and speed limits
- All staff will be made aware of the potential consequences of not meeting their environmental responsibilities.

5.4 Review

5.4.1 Risk review

The risk assessment will be reviewed periodically to confirm it remains relevant and captures all risks to MNES. Review triggers are:

– Changes to Proposed Action/ CSFEMP scope
– Following significant environmental incidents
– Where corrective actions or contingency management measures are implemented
– When new information regarding MNES becomes available.

5.4.2 CSFEMP audit and review

Throughout the life of the EPBC Act approval the CSFEMP will be reviewed and updated as required. The review will include an evaluation of the effectiveness of the plan and incorporate new data or information pertinent to the management of the Black Cockatoos and WRP. Review triggers are as follows:

– Annually on the anniversary of the approval of the CSFEMP
– Following significant incidents
– Anticipated changes to scope
– Following community or stakeholder complaints
– Identification of non-compliance with environmental approval conditions
– Monitoring results, inspections or audits indicate performance targets or completion criteria may not be achieved or maintained
– Monitoring results, inspections or audits indicate completion criteria have been achieved.

The CSFEMP will be updated by the Main Roads Environmental Representative or suitably qualified delegate and approved by the Main Roads Project Director.

Changes to the CSFEMP will be communicated to project personnel, contractors and sub-consultants via the regular pre-start and Toolbox meetings.

6. Emergency management

6.1 Emergency contacts

– In the event of an environmental emergency, key emergency personnel responsible for managing environmental emergencies should be contacted as follows:
– If the environmental emergency is determined not to cause immediate threat to human life and/or property by the Contractor Environmental Management Representative or Contractor Representative, key environmental emergency personnel should be contacted (Table 11)
– If the environmental emergency is deemed imminent and has the potential to threaten human life and/or property within or surrounding the Proposed Action Area, the Contractor Environmental Management Representative or Contractor Representative should dial 000 for emergency response services.

Table 11 Key environmental emergency contacts

Role	Name
Main Roads Project Manager	Lindsay McCartin
Main Roads Superintendent	David Clarkson
Contractor Environmental Management Representative	TBD
Contractor Representative	TBD

7. References

Biota (2019). Albany Ring Road Black-Cockatoo Habitat Assessment. Biota Environmental Sciences Pty. Ltd, Leederville, W.A. Draft report prepared for Main Roads Western Australia. October 2019.

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Department of Agriculture, Water and the Environment (DAWE) (2020). Protected Matters Search Tool [Online] https://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf

Department of Parks and Wildlife (2013). *Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan*. Department of Parks and Wildlife, Perth, Western Australia.

Department of Parks and Wildlife (2015), Procedures to minimise the risk to Western Ringtail Possums during vegetation clearing and building demolition, Perth, Western Australia.

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GHD scope and limitations

Main Roads Western Australia (Main Roads) commissions GHD Pty Ltd (GHD) to develop an Conservation Significant Fauna Environmental Management Plan (CSFEMP) in support of the Albany Ring Road Stage 2 and 3b (EPBC 2020/8769) Preliminary Documentation requested by DAWE. This CSFEMP outlines the actions proposed to mitigate and manage the impacts of the Proposed Action on Matters of National Environmental Significance (MNES), spread of introduced species and spread of dieback (*Phytophthora cinnamomi*).

This CSFEMP has been prepared by GHD for Main Roads and may only be used and relied on by Main Roads for the purpose agreed between GHD and the Main Roads. GHD otherwise disclaims responsibility to any person other than Main Roads arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

GHD has prepared this report on the basis of information provided by Main Roads and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD 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 assumptions made by GHD described in this report, and conditions encountered and information reviewed at the date of preparation of the report. GHD disclaims liability arising from any of the assumptions being incorrect, and 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.

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