**GHD scope and limitations**

Main Roads commissioned GHD Pty Ltd (GHD) to develop the Preliminary Documentation for EPBC 2018/8367 Mitchell Freeway Extension (Hester Avenue to Romeo Road) for submission to the Australian Department of the Environment and Energy.

This report has been prepared by GHD for Main Roads Western Australia and may only be used and relied on by Main Roads Western Australia for the purpose agreed between GHD and the Main Roads Western Australia. GHD otherwise disclaims responsibility to any person other than Main Roads Western Australia 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 Western Australia 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.
Executive summary

Main Roads Western Australia (Main Roads) proposes to extend Mitchell Freeway from Hester Avenue to Romeo Road, including an upgrade to Wanneroo Road from Dunstan Road to Trian Road (the Proposal).

The Proposal will extend the Mitchell Freeway north a further 5.6 kilometres (km) from Hester Avenue to Romeo Road, as well as upgrading Wanneroo Road to a dual carriageway for 5.5 km from Dunstan Road to Trian Road.

The Proposal will improve accessibility, travel times and road safety as well as sustaining jobs and enabling regional development in Perth’s northern suburbs.

As the Proposal was considered to have a significant impact on Matters of National Environmental Significance (MNES), Main Roads was required to prepare Preliminary Documentation to inform the assessment of the relevant impacts of the Proposal.

This Preliminary Documentation is prepared in response to a request by Department of the Environment and Energy (DEE, 1 May 2019) for additional information to support assessment of impacts for the Mitchell Freeway Extension and Wanneroo Road Upgrade, WA (EPBC 2018/8367) under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The Proposal will result in significant residual impacts to Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BWSCP TEC), Carnaby’s Cockatoo (Calyptorhynchus latirostris) and Forest Red-tailed Black Cockatoo (FRTBC, Calyptorhynchus banksii naso), due to the following direct impacts:

- Clearing of up to 50.07 ha of BWSCP TEC
- Clearing of up to 328 potential breeding trees for Carnaby’s Cockatoo
- Clearing of up to eight trees, each containing between one and four potentially suitable hollows for Carnaby’s Cockatoo nesting (totalling 22 potentially suitable hollows in eight trees)
- Clearing of up to 104.17 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for Carnaby’s Cockatoo
- Clearing of up to 76.34 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for FRTBC.

The Proposal will not result in impacts to known nesting hollows of Carnaby’s Cockatoo.

The Proposal is not expected to result in impacts to FRTBC breeding habitat, as it lies well away from FRTBC breeding areas and does not include large, mature Marri or Jarrah trees with suitable hollows.

The Proposal is not expected to result in significant indirect impacts to BWSCP TEC, Carnaby’s Cockatoo or FRTBC. The Proposal will not fragment TEC or Black Cockatoo habitat, with clearing being limited to the edges of existing disturbed corridors and the Butler urban residential area.

Main Roads proposes an offset to counterbalance the potential significant residual impacts to BWSCP TEC, Carnaby’s Cockatoo and FRTBC.

Implementation of the Proposal:

- Is consistent with the Regional Road reserve under the Metropolitan Region Scheme
- Provides substantial social and economic benefits
- Has been developed with consideration to appropriate stakeholder consultation
- Incorporates substantial impact avoidance and established, effective construction management measures
- Includes design and construction measures that protect and enhance the integrity of adjacent Class A reserves (Neerabup National Park and Neerabup Nature Reserve)
- Is not inconsistent with the Objects of the EPBC Act and principles of economically sustainable development (ESD) including the precautionary principles
- Is not inconsistent with relevant Commonwealth Recovery Plans, Threat Abatement Plans and Conservation Advice
- Will include an offset to counterbalance significant residual impacts.
# Table of contents

1. Introduction .................................................................................................................. 1  
   1.1 Proposal ................................................................................................................... 1  
   1.2 Purpose and scope .................................................................................................... 1  
   1.3 Proponent ................................................................................................................ 2  

2. Preliminary Documentation ............................................................................................. 4  

3. Listed threatened species and ecological communities .................................................. 7  
   3.1 Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community .................................................. 7  
   3.2 Black Cockatoos ......................................................................................................... 15  
   3.3 Potential Impacts ......................................................................................................... 26  
   3.4 Mitigation and management measures ........................................................................ 35  

4. Acceptability of impacts .................................................................................................. 37  
   4.1 Significance of impact assessment - Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community .................................................................................................. 37  
   4.2 Significance of impact assessment - Carnaby’s Cockatoo and Forest Red-tailed Black Cockatoo ................................................................................................................. 41  
   4.3 Significance guideline assessment - Carnaby’s Cockatoo and Forest Red-tailed Black Cockatoo ................................................................................................................. 43  
   4.4 Objects of the EPBC Act, principles of ecologically sustainable development and precautionary principle ........................................................................................................... 45  
   4.5 Justification for undertaking the proposal in the manner proposed including avoidance and mitigation ......................................................................................................................... 49  
   4.6 Residual impacts and compensatory measures ............................................................. 49  
   4.7 Application of Recovery Plans and Threat Abatement Plans ...................................... 49  

5. Offsets ............................................................................................................................... 56  
   5.1 Proposed offset strategy .............................................................................................. 56  
   5.2 EPBC Act Environmental Offsets Policy ..................................................................... 59  

6. Economic and Social Matters .......................................................................................... 61  
   6.1 Public consultation activities and outcomes ............................................................... 61  
   6.2 Consultation with indigenous stakeholders ................................................................. 62  
   6.3 Monitoring ongoing changes to economic and social characteristics ..................... 63  
   6.4 Projected economic costs and benefits and basis for estimation ............................... 64  
   6.5 Employment opportunities ......................................................................................... 65  
   6.6 Benefits to the local and wider community ................................................................. 65  
   6.7 Alternatives ................................................................................................................. 66  

7. Conclusion ......................................................................................................................... 67  

8. References ......................................................................................................................... 72
Table index

Table 1  Proponent and Proposal key contact ................................................................. 2
Table 2  Information requested for Preliminary Documentation and corresponding section in this report ................................................................. 4
Table 3  Banksia Woodlands of the Swan Coastal Plain TEC – patches within the total survey area ................................................................. 13
Table 4  Banksia Woodlands of the Swan Coastal Plain TEC – patches within the Development Envelope ................................................................. 13
Table 5  Banksia Woodlands of the Swan Coastal Plain TEC – local context .................. 15
Table 6  Potential Black Cockatoo breeding trees within the Development Envelope .... 17
Table 7  Black Cockatoo foraging habitat ........................................................................ 22
Table 8  Local and regional context of habitat loss ......................................................... 23
Table 9  Assessment against Objects of the EPBC Act ..................................................... 46
Table 10 Assessment against ESD principles .................................................................. 47
Table 11 Assessment against Recovery and Threat Abatement Plans .......................... 50
Table 12 Overview of offset package under consideration ............................................. 56
Table 13 Summary of offset package compensation for potential significant residual impacts .................................................................................. 57
Table 14 Consistency with EPBC Act Environmental Offsets Policy .............................. 59
Table 15 Outcomes of DBCA Consultation .................................................................... 62
Table 16 Outcomes of indigenous stakeholder consultation .......................................... 63
Table 17 Summary of information requested for Preliminary Documentation .................. 67

Figure index

Figure 1  Proposal location and Development Envelope .................................................. 3
Figure 2  Banksia Woodlands of the Swan Coastal Plain TEC ........................................ 9
Figure 3  Banksia Woodlands of the Swan Coastal Plain TEC – local context ................ 14
Figure 4  Black Cockatoo foraging and breeding habitat ............................................... 18
Figure 5  Potential Carnaby’s Cockatoo Habitat – local context .................................... 24
Figure 6  Potential Forest Red-tailed Black Cockatoo Habitat – local context ............... 25
Figure 7  Significant Weeds ............................................................................................ 29
Appendices

Appendix A Mitchell Freeway Extension Hester Avenue to Romeo Road Biological Survey
Appendix B Phytophthora Dieback occurrence assessment
Appendix C Construction Environmental Management Plan
Appendix D Draft Offset Strategy
1. **Introduction**

1.1 **Proposal**

Main Roads Western Australia (Main Roads) proposes to extend Mitchell Freeway north from Hester Avenue to Romeo Road, including an upgrade to Wanneroo Road from Dunstan Road to Trian Road (the Proposal). Figure 1 presents the Proposal location and Development Envelope (DE). The DE comprises an area of approximately 249 ha and represents the preliminary impact footprint.

Mitchell Freeway is the main arterial road that connects the northern suburban areas with Perth’s central business district. The freeway currently terminates at Hester Avenue. Perth’s northern suburbs have experienced continuing strong growth, with the population of Yanchep, Alkimos and Eglinton forecast to reach 118,000 by 2031¹.

The Proposal will extend the Mitchell Freeway a further 5.6 kilometres (km) from Hester Avenue to Romeo Road, as well as upgrading Wanneroo Road to a dual carriageway for 5.5 km from Dunstan Road to Trian Road. The Proposal will improve accessibility, travel times and road safety as well as sustaining jobs and enabling regional development in Perth’s northern suburbs.

The Mitchell Freeway extension works include:

- Constructing a new 5.6 km four lane freeway (two lanes in each direction)
- Completion of northbound on ramp and southbound off ramp at Hester Avenue interchange
- Grade separated interchange at Lukin Drive
- Rail tunnel for the existing rail to exit the freeway median to Butler train station
- Terminate freeway at Romeo Road with a grade separated interchange
- Principal Shared Path on the western side of the freeway
- Romeo Road constructed as dual carriageway with 2 lanes east to Wanneroo Road
- Footpaths/shared paths proposed for Romeo Road
- New/upgraded at-grade intersections at Romeo Road/Wanneroo Road.

The Wanneroo Road upgrade works include:

- Constructing a 5.5 km dual carriageway from Dunstan Road to Trian Road. Existing carriageway to be used where possible
- Intersection improvement to Wanneroo Road and Nowergup Road
- Improvements to the old Wanneroo Road alignment currently acting as a service road
- Modifications to formalise the service road providing safe access and egress to adjoining properties.

1.2 **Purpose and scope**

On 5 April 2019, a delegate of the Minister for the Environment determined the proposed action was a controlled action and that it will be assessed by Preliminary Documentation. In the

decision advice, the Department of the Environment and Energy (DEE) advised it considered the proposed action likely to have a significant impact on MNES including:

- Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BWSCP TEC)
- Carnaby’s Cockatoo (Calyptorhynchus latirostris)
- Forest Red-tailed Black Cockatoo (FRTBC, Calyptorhynchus banksii naso).

On 1 May 2019, DEE requested additional information to inform the assessment of the relevant impacts of the proposed action.

This Preliminary Documentation presents the additional information requested by DEE, to support assessment of the extension of the Mitchell Freeway Extension and upgrade of Wanneroo Road, WA (EPBC 2018/8367, the Proposal) under the EPBC Act.

The structure and content of this report aligns with DEE’s request for additional information.

1.3 **Proponent**

The proponent for the proposed action is the Commissioner of Main Roads and formal contact details are listed in Table 1.

**Table 1 Proponent and Proposal key contact**

<table>
<thead>
<tr>
<th>Proponent/Contact</th>
<th>Contact details</th>
</tr>
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</table>
| **Proponent**              | Commissioner of Main Roads
|                            | Main Roads Western Australia
|                            | PO Box 6202
|                            | East Perth WA 6002
|                            | ABN/ACN 50 860 676 021                                                       |
| **Proposal Key Contact**   | Marni Baetge
|                            | Environment Officer
|                            | Infrastructure Delivery Directorate
|                            | Main Roads Western Australia
FIGURE 1

Proposal location and Development Envelope

Main Roads Western Australia
SR155 Mitchell Fwy Extension EPBC PD

Project No. 01-38302
Revision No. 0
Date 08/09/2019

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

G:\61\38302\GIS\Maps\Working\Figures\6138302_001_Locality_Rev0.mxd
Print date: 10 Sep 2019 - 13:03

Legend
Major Road
Minor Road
Development Envelope

0
0.25
0.5
0.75
1
Kilometres

Paper Size ISO A3

GHD

JINDALEE
QUINNS ROCKS
CLARKSON
NEERABUP
MINDARIE
RIDGEWOOD
MERRIWA
NOWERGUP
YANCHEP
BUTLER
CARABOODA
ALKIMOS
Trian Rd
Lukin Dr
Hester Av
Romeo Rd
Wanneroo Rd
MitchellFwy
Landgate / SLIP

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2. Preliminary Documentation

Table 2 presents a summary of the information requested as part of the Preliminary Documentation and the corresponding section in this report.

Table 2  Information requested for Preliminary Documentation and corresponding section in this report

<table>
<thead>
<tr>
<th>Information Requested</th>
<th>Section</th>
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<tbody>
<tr>
<td><strong>Listed threatened species and ecological communities</strong></td>
<td></td>
</tr>
<tr>
<td>1. The Department understands that further surveys have been, and will be undertaken to determine the presence and extent of the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BWSCP TEC) (Endangered) within the proposal site. Please advise, including a map, of the hectares and condition of BWSCP TEC that occurs within the proposal site that will be cleared as part of this proposal.</td>
<td>Section 3.1.3</td>
</tr>
<tr>
<td>2. Please advise the hectares, including a map, of foraging, breeding and roosting habitat for the Carnaby’s Black Cockatoo (Calyptrorhynchus laticriss) (Endangered) and the Forest Red-tailed Black Cockatoo (Calyptrorhynchus banksii naso) (Vulnerable) that occurs within the proposal site and that will be cleared as part of this proposal. Additionally, please advise and provide a map of the number of potential breeding trees (including the number of trees with suitable hollows) that occur within the proposal site and will be cleared as part of this proposal.</td>
<td>Section 4</td>
</tr>
<tr>
<td>3. Please confirm whether the BWSCP TEC that occurs within the proposal site forms part of a larger patch. If the BWSCP TEC forms part of a larger patch, please provide details of any potential impacts to the BWSCP TEC in these adjoining and surrounding areas. When discussing potential impacts, please give consideration to the local, regional, state and national scale and the precautionary principle. This discussion should include (but not be limited to) consideration, including appropriate avoidance and mitigation of, fragmentation and edge effect risks, changes in surface water run-off, changes in nutrient cycling, mobilisation of acid sulfate soils and the potential introduction of pathogens and weeds. The discussion should include reference to the 'Banksia Woodland' which was described in the referral as 'well represented' in the Neerabup National Park, which is adjacent to the proposal site.</td>
<td>Section 3.1.3, Section 3.3.2</td>
</tr>
<tr>
<td>4. The referral noted that a ‘suspected infestation’ of Dieback (Phytophthora cinnamoni) had previously been identified at Marmion Avenue (8 km south-west of the proposal site). While the potential infestation was outside the proposal site, and only suspected, the Department considers that there is a possibility that the proposal may increase the risk of Dieback infestation in the proposed site and surrounding areas due to the potential of the proposal to disturb soils and vegetation. Please describe the measures that will be undertaken to avoid and/or mitigate the potential impacts of Dieback to the BWSCP TEC at the proposal site and in adjoining areas. This discussion should reference Candlestick Banksia (Banksia attenuata), which is present in the proposal site and highly susceptible to Dieback due to its clustered roots.</td>
<td>Section 3.3.2</td>
</tr>
<tr>
<td>5. The referral noted the presence of weeds including Bridal Creeper (Asparagus asparagoides), Apple of Sodom (Solanum linnaeanum) and Arum Lily (Zantedeschia aethiopica) within the proposal site. Please identify the measures that will be undertaken to avoid and/or mitigate the impacts of weeds on EPBC Act listed species and ecological communities.</td>
<td>Section 3.4.3</td>
</tr>
</tbody>
</table>
### Information Requested

<table>
<thead>
<tr>
<th>Section</th>
<th>Information Requested</th>
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<tbody>
<tr>
<td>6.</td>
<td>The referral noted that the proposed measures to be undertaken to avoid and/or mitigate impacts on EPBC Act listed species and ecological communities will be detailed in an Environmental Management Plan (EMP). Please ensure that the EMP is consistent with the Department's Environmental Management Plan Guidelines (2014) (available on the Department's website at <a href="http://www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines">http://www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines</a>). Additionally and if available, please provide a copy of the draft EMP to the Department for review. Note: Management plans must use terms such as 'will' and 'must' when committing to management actions, instead of 'where possible', 'as required', 'should' or 'may'. The Department will consider the terms used when assessing the proposed management measures within the management plan and may require further assurance in relation to measures which reduce potential impacts to EPBC Act listed species.</td>
</tr>
</tbody>
</table>
| 7. | For the EPBC Act listed species and ecological communities proposed to be impacted by this proposal, please provide an overall conclusion as to the environmental acceptability of the proposal including:  
  - A discussion on the consideration against the requirements of the EPBC Act, including the objects of the EPBC Act, the principles of ecologically sustainable development and the precautionary principle  
  - Reasons justifying undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures  
  - If relevant, a discussion of residual impacts and any compensatory measures (e.g. offsets) proposed or required for significant residual impacts on EPBC Act listed species and ecological communities, and the relative degree of compensation and acceptability. |
| 8. | Recovery plans / Threat abatement plans  
  - Please demonstrate that the action is not inconsistent with any relevant recovery plan or threat abatement plan, including (but not limited to):  
    - Please demonstrate that the action has had regard to any relevant conservation advice, including (but not limited to):  
      - Threatened Species Scientific Committee (2016). Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community. Canberra: Department of the Environment and Energy  
| 9. | Offsets  
  - To the extent that impacts to EPBC Act listed species and ecological communities cannot be avoided or mitigated, provide details of an |
### Information Requested

<table>
<thead>
<tr>
<th>offset(s) intended to compensate for residual significant impacts on EPBC Act listed species and ecological communities (if any), including:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The type of offset/s proposed</td>
</tr>
<tr>
<td>• The extent to which the proposed offset correlates to, and adequately compensates for, the residual significant impacts on EPBC Act listed species and communities</td>
</tr>
<tr>
<td>• Suitability of the location of any proposed offset site for EPBC Act listed species and communities</td>
</tr>
<tr>
<td>• Conservation gain to be achieved by the offset i.e. positive management strategies that improve the site or averting the future loss, degradation or damage of the protected matter</td>
</tr>
<tr>
<td>• Time it will take to achieve the proposed conservation gain</td>
</tr>
<tr>
<td>• Level of certainty that the proposed offset will be successful</td>
</tr>
<tr>
<td>• Current land tenure of any proposed land-based offset and the method of securing and managing that offset for 20 years or the period of impact (whichever is less).</td>
</tr>
</tbody>
</table>

10. Please demonstrate how any proposed offset is consistent with the Department's EPBC Act Environmental Offsets Policy (October 2012), and provide a completed offsets assessment guide and justification for the figures used to complete the offsets assessment guide.

---

### Social and Economic Considerations

<table>
<thead>
<tr>
<th>Social and economic considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. The Preliminary Documentation must address the economic and social impacts (both positive and negative) of the proposal. Consideration of economic and social matters may include:</td>
</tr>
<tr>
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<tr>
<td>• Details of any public consultation activities undertaken and the outcomes</td>
</tr>
<tr>
<td>• Details of any consultation with Indigenous stakeholders including any cultural and/or traditional activities in or relating to the proposal site</td>
</tr>
<tr>
<td>• Any monitoring programs to monitor ongoing changes to economic and social characteristics potentially affected by the proposal</td>
</tr>
<tr>
<td>• Projected economic costs and benefits of the proposal including the basis for their estimation through cost/benefit analysis or similar studies</td>
</tr>
<tr>
<td>• Employment opportunities expected to be generated by the proposal at each phase of the proposal</td>
</tr>
<tr>
<td>• Benefits to the local and wider community as a result of the proposal.</td>
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</tbody>
</table>

Economic and social impacts should be considered at the local, regional and national levels. Details of the relevant cost and benefits of any alternative options to the proposal may also be requested.
3. **Listed threatened species and ecological communities**

3.1 **Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community**

3.1.1 **Background**

The BWSCP TEC is listed as Endangered under the EPBC Act and a Priority Ecological Community (PEC) by the Department of Biodiversity, Conservation and Attractions (DBCA).

The BWSCP TEC is a woodland restricted to Western Australia’s Swan Coastal Plain (SCP) and adjacent areas including Dandaragan Plateau in the north and Darling Scarp in the east. The TEC has ongoing threats predominantly through clearing and fragmentation for urban development, as well as mining, fire regime and climate change, invasive species and Phytophthora dieback (TSSC 2016).

A key diagnostic feature is a prominent tree layer of *Banksia* species, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The TEC is characterised by a high level of endemism and considerable localised variation in species composition across its range (TSSC 2016). The TEC listing covers approximately 20 sub-communities or Floristic Community Types (FTCs), some of which are more common while others are highly restricted and listed as Threatened or Priority ecological communities (PEC) in Western Australia (TSSC 2016). Banksia Woodlands provide habitat for nationally threatened flora/fauna species including Carnaby’s Cockatoo and FRTBC (TSSC 2016). Carnaby’s Cockatoo is expected to forage on the canopy and understorey of the community, whereas FRTBC is expected to forage on eucalypts, where these are present in the community (see Sections 3.2.1 and 3.2.2).

3.1.2 **Survey**

Main Roads commissioned GHD (2019) to complete a biological survey during spring 2018 over the DE and its vicinity, which included:

1. A single season detailed and targeted vegetation and flora survey that encompassed the DE with a 50 m approx. buffer (400 ha), which was defined as the survey area in GHD (2019)

2. Reconnaissance vegetation and flora survey over an extended survey area as defined in GHD (2019) (646.5 ha) including:
   - Land between Mitchell Freeway and Wanneroo Road, within Neerabup National Park, between Hester Avenue and Karaborup Road
   - Approximate 1.7 km long by 600 m wide corridor east of Wanneroo Road including part of Neerabup Nature Reserve
   - Approximate 1.9 km long by 700 m wide corridor around Romeo Road to the north.

The extended survey was undertaken to provide local context of environmental values, consistent with Environmental Protection Authority (EPA) *Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment* (2016) for linear corridor surveys. The extended survey also enabled definition of the wider extent and condition of patches of BWSCP TEC that occur within the DE.
Appendix A presents the biological survey report.

### 3.1.3 Extent and condition

To assist in the assessment of potential impacts to BWSCP TEC, the GHD (2019) survey and extended survey areas have been combined to present a total survey area.

The biological survey identified two vegetation types as representing the BWSCP TEC:

- VT01 – Banksia low woodland
- VT02 – Tuart / Banksia open woodland.

The biological survey concluded the two vegetation types were most likely representative of FCT 28: Spearwood Banksia attenuata or Banksia attenuata – Eucalyptus woodlands. FCT 28 is a relatively common sub-community of the BWSCP TEC and is not listed in Western Australia as a TEC under the *Biodiversity Conservation Act 2016* (BC Act). However FCT 28 is considered a component of the Commonwealth TEC due to key structural features as detailed by the TSSC (2016).

Figure 2, Table 3 and Table 4 present the extent and condition of patches of BWSCP TEC within the total survey area and DE. These patches meet the diagnostic criteria for the TEC including patch size and condition, using the condition rating scale devised by Keighery (1994) and adapted by EPA (2016). The patches are dissected by dirt roads, tracks and firebreaks which are less than 30 m wide and are not expected to significantly alter the functionality of the communities.

In summary, the BWSCP TEC covers approximately 350 ha over 13 patches within and in the vicinity of the DE. The TEC is predominantly (285.40 ha or 82% of total) contained within a single large patch (Patch 4), which is primarily located within Neerabup National Park. The remaining 12 patches are relatively small in area, varying from approximately 1 to 14 ha.

The DE covers approximately 50 ha of BWSCP TEC over seven patches. The TEC within the DE is relatively degraded compared to the TEC in the wider Survey Area, particularly that of Neerabup National Park. Within the DE, 57% of the TEC is in relatively poorer condition (Good to Completely Degraded), while in the Survey Area outside the DE, the vegetation is in much better condition with only 8% in Good to Completely Degraded condition (refer to Table 3 and Table 4). The relatively degraded condition of the TEC within the DE is expected given the DE lies over and is adjacent to existing disturbed areas along transport corridors and urban residential areas.

### 3.1.4 Local context

The local context for the BWSCP TEC was assessed through mapping of remnant vegetation complexes (Heddle *et al* 1980) associated with the TEC, as identified in the Conservation Advice (TSSC 2016). The results of the assessment are presented in Table 5 and Figure 3.

As presented in Table 5 and Figure 3, there are large areas of remnant vegetation complexes that may contain TEC in the vicinity of the DE, including large areas protected under Bush Forever and/or DBCA managed lands. Of the 5075 ha of remnant vegetation that may contain TEC mapped within 5 km of the DE, approximately 3047 ha (60%) lies within reserved lands.
### Table 3 Banksia Woodlands of the Swan Coastal Plain TEC – patches within the total survey area

<table>
<thead>
<tr>
<th>Patch No.</th>
<th>Extent within total survey area (ha)</th>
<th>Area of VT01 (ha)</th>
<th>Area of VT02 (ha)</th>
<th>Vegetation Condition – Area (ha)</th>
<th>Patch area within DE to be potentially cleared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Excellent</td>
<td>Excellent-Very Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>12.04</td>
<td>12.04</td>
<td>-</td>
<td>-</td>
<td>7.41</td>
</tr>
<tr>
<td>2</td>
<td>2.90</td>
<td>2.90</td>
<td>-</td>
<td>-</td>
<td>1.86</td>
</tr>
<tr>
<td>3</td>
<td>5.90</td>
<td>5.90</td>
<td>-</td>
<td>-</td>
<td>5.90</td>
</tr>
<tr>
<td>4</td>
<td>285.40</td>
<td>284.18</td>
<td>1.22</td>
<td>50.22</td>
<td>109.22</td>
</tr>
<tr>
<td>5</td>
<td>14.14</td>
<td>10.03</td>
<td>4.11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>0.07</td>
<td>0.07</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>1.71</td>
<td>1.71</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>1.37</td>
<td>1.37</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>10.74</td>
<td>10.74</td>
<td>-</td>
<td>-</td>
<td>9.46</td>
</tr>
<tr>
<td>10</td>
<td>1.29</td>
<td>1.29</td>
<td>-</td>
<td>-</td>
<td>1.29</td>
</tr>
<tr>
<td>11</td>
<td>4.43</td>
<td>3.81</td>
<td>0.50</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>3.81</td>
<td></td>
<td>3.81</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>5.84</td>
<td>5.84</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TEC total</td>
<td>349.64</td>
<td>337.46</td>
<td>12.18</td>
<td>50.22</td>
<td>110.51</td>
</tr>
<tr>
<td>Proportion of TEC total</td>
<td>100%</td>
<td>97%</td>
<td>3%</td>
<td>14%</td>
<td>32%</td>
</tr>
<tr>
<td>TEC within DE to be potentially cleared</td>
<td>50.07</td>
<td>47.27</td>
<td>2.80</td>
<td>0.00</td>
<td>4.41</td>
</tr>
<tr>
<td>Proportion of total within DE to be potentially cleared</td>
<td>14%</td>
<td>14%</td>
<td>23%</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>TEC outside DE to be avoided (ha)</td>
<td>299.57</td>
<td>290.19</td>
<td>9.38</td>
<td>50.22</td>
<td>106.10</td>
</tr>
<tr>
<td>Proportion of TEC outside DE</td>
<td>100%</td>
<td>97%</td>
<td>3%</td>
<td>17%</td>
<td>35%</td>
</tr>
</tbody>
</table>

### Table 4 Banksia Woodlands of the Swan Coastal Plain TEC – patches within the Development Envelope

<table>
<thead>
<tr>
<th>Patch No.</th>
<th>Area within DE (ha)</th>
<th>Area of VT01 (ha)</th>
<th>Area of VT02 (ha)</th>
<th>Vegetation Condition – Area (ha)</th>
<th>Proportion of TEC within DE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Excellent</td>
<td>Excellent-Very Good</td>
</tr>
<tr>
<td>3</td>
<td>5.73</td>
<td>5.73</td>
<td>-</td>
<td>-</td>
<td>5.73</td>
</tr>
<tr>
<td>4</td>
<td>37.57</td>
<td>36.35</td>
<td>1.22</td>
<td>-</td>
<td>4.41</td>
</tr>
<tr>
<td>8</td>
<td>0.43</td>
<td>0.43</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>0.26</td>
<td>0.26</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>2.76</td>
<td>1.38</td>
<td>1.38</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>0.20</td>
<td></td>
<td>0.20</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>3.11</td>
<td>3.11</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>50.07</td>
<td>47.27</td>
<td>2.80</td>
<td>-</td>
<td>4.41</td>
</tr>
<tr>
<td>Proportion of TEC within DE</td>
<td>100%</td>
<td>94%</td>
<td>6%</td>
<td>0%</td>
<td>9%</td>
</tr>
</tbody>
</table>
Table 5 Banksia Woodlands of the Swan Coastal Plain TEC – local context

<table>
<thead>
<tr>
<th>Complex</th>
<th>Association with TEC as per TSSC (2016)</th>
<th>Extent remaining within DE (ha)</th>
<th>Extent remaining within 5km of DE (ha)</th>
<th>Extent within 5km and within DBCA lands and/or Bush Forever</th>
<th>Proportion within DBCA lands and/or Bush Forever</th>
<th>DE as a proportion of extent within 5km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cottesloe Complex Central And South</td>
<td>Minor</td>
<td>121</td>
<td>4734</td>
<td>2716</td>
<td>57%</td>
<td>2.55%</td>
</tr>
<tr>
<td>Cottesloe Complex North</td>
<td>Strong</td>
<td>0</td>
<td>158</td>
<td>148</td>
<td>93%</td>
<td>nil</td>
</tr>
<tr>
<td>Karrakatta Complex Central And South</td>
<td>Moderate</td>
<td>0</td>
<td>183</td>
<td>183</td>
<td>100%</td>
<td>nil</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>121</strong></td>
<td><strong>5075</strong></td>
<td><strong>3047</strong></td>
<td><strong>60%</strong></td>
<td><strong>2.38%</strong></td>
</tr>
</tbody>
</table>

3.2 Black Cockatoos

3.2.1 Carnaby’s Cockatoo

Carnaby’s Cockatoo is listed as Endangered under the EPBC Act and Schedule 2 under the BC Act. The species is endemic to the south-west of Western Australia. Its range and abundance has significantly reduced due to land clearing for agriculture, forestry and urban development. It faces continuing threats on the SCP as important feeding habitat is cleared.

Carnaby’s Cockatoos breed in eucalypt woodlands between the Stirling Range and Three Springs. The Proposal is within the known breeding range of the species (DSEWPaC 2012). The species nests in hollows in live or dead trees of *Eucalyptus salmonophloia* (Salmon Gum), *E. wandoom* (Wandoom), *E. gomphocephala* (Tuart), *E. marginata* (Jarrah), *E. rudis* (Flooded Gum), *E. loxophleba* subsp. *loxophleba* (York Gum), *E. accedens* (Powderbark), *E. diversicolor* (Karri) and *Corymbia calophylla* (Marri). Breeding occurs mainly from July to mid-December.

There has been a shift in the breeding range of this species since the middle of the last century to the west and south, with a more rapid shift in the past 10 to 30 years, moving into the Tuart forests of the SCP and the Jarrah Marri forests of the Darling Scarp (Johnstone and Kirkby 2009). The closest recorded breeding site is located approximately 14 km to the south of the Proposal, at Joondalup (Johnstone, R 2019, pers. comm.).

Breeding success for Carnaby’s Cockatoo is largely dependent on suitable feeding habitat adjacent to the nest site, to provide the necessary food for the survival of the chick. Breeding individuals forage no more than approximately 20 km from their nesting hollows, so having sufficient foraging resources close to breeding areas (particularly within a 12 km radius) is critical to its breeding success.

The species is a post-nuptial nomad with many individuals spending the non-breeding season on the SCP (including the Perth metropolitan region) from December to July. Some non-breeding individuals (usually juveniles) will remain on the SCP during the breeding season. The species feeds in the canopy and understorey. On the SCP, important foraging species consist of *Banksia attenuata*, *B. menziesii*, *B. grandis*, *B. ilicifolia*, *B. sessilis*, *B. prionotes*, Marri, Jarrah and non-native *Pinus* species (Valentine and Stock 2008, Higgins 1999).
3.2.2 Forest Red-tailed Black Cockatoo

The FRTBC is listed as Vulnerable under the EPBC Act and Schedule 3 under the BC Act. This subspecies is endemic to the southwest of Western Australia. It displays erratic breeding activity in the summer and winter seasons (Kirkby 2018). These birds primarily nest in hollows of large, mature Marri trees and to a lesser extent Jarrah, Blackbutt Bullich and Wandoo (Johnstone, Kirkby and Sarti 2013). Key breeding areas are within the Jarrah-Marri forest of the Darling Scarp/Plateau or adjacent areas of the SCP, with limited records on the western extent of the SCP (e.g. at Murdoch University and possibly Perry Lakes) (Johnstone, Kirkby and Sarti 2017). The closest recorded breeding site is approximately 30 km to the east of the Proposal, at Ellenbrook (Johnstone, R 2019, pers. comm.).

The FRTBC is a canopy feeder, with a diet primarily consisting of seeds of Marri and Jarrah and, in recent times, the seeds of Melia azedarach (Cape Lilac) (Johnstone, Kirkby and Sarti 2017). Other, less important foods include E. patens (Blackbutt), Karri, Allocasuarina fraseriana (Sheok), Persoonia longifolia (Snotty Gobble), Hakea spp., Tuart and E. decipiens (Johnstone, Kirkby and Sarti 2017).

3.2.3 Survey

The biological survey commissioned by Main Roads for the DE and its vicinity included a Level 2 fauna assessment and targeted habitat assessment for Carnaby’s Cockatoo and FRTBC. The habitat assessment included assessment of the presence, quality and extent of habitat, using definitions of breeding, foraging and night roosting habitat in accordance with DSEWPaC (2012) Black Cockatoo referral guidelines (GHD 2019). The survey included identification of potential breeding trees within an area that encompassed the DE with a buffer, which was defined as the survey area in GHD (2019). The initial survey was completed in August 2018, with follow-up monitoring in November 2018 and January/February 2019 for trees with potential Black Cockatoo breeding hollows. Twenty nine tree plots were employed in the extended survey area (as defined in GHD (2019)) in August 2019 to extrapolate Black Cockatoo habitat and potential for trees with potential Black Cockatoo breeding hollows.

Appendix A presents the biological survey report.

3.2.4 Habitat assessment

Carnaby’s Cockatoo and FRTBC individuals were recorded flying and foraging within the DE and extended survey area (GHD 2019). The largest group of Carnaby’s Cockatoo recorded consisted of 17 birds, while the largest group of FRTBC recorded consisted of 7 birds (GHD 2019).

Breeding habitat

Black cockatoo breeding habitat is considered to consist of tree species known to support breeding within the range of the species, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow (being greater than 500 mm DBH for most Eucalypts or 300 mm in the case of Wandoo and Salmon Gum) (DSEWPaC 2012). The suitable DBH trees are referred to within this Preliminary Documentation as ‘potential breeding trees’, however this does not mean that such trees contain hollows or suitable hollows for nesting.

GHD (2019) identified a total of 328 potential breeding trees within the DE, as presented in Table 6 and Figure 4. Of these trees, eight had hollows with sufficient external/internal dimensions suitable for breeding or demonstrating signs of use. These trees had between one to four potentially suitable hollows present for a total of 22 suitable hollows, which were assessed via visual inspection and/or via a pole camera (if within 12 m from the ground). The 22
suitable hollows were monitored in August, November and January/February 2018/2019, during which no Black Cockatoo use was evident or recorded (GHD 2019).

**Table 6 Potential Black Cockatoo breeding trees within the Development Envelope**

<table>
<thead>
<tr>
<th>Tree species</th>
<th>Number of potential breeding trees</th>
<th>Number of trees with suitable hollows (large or signs of use)</th>
<th>Number of suitable hollows (large/medium or signs of use)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuart</td>
<td>256</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>Jarrah</td>
<td>58</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Marri</td>
<td>11</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Flooded Gum</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other eucalypt species</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>328</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>

The biological survey included 29 tree plots in the extended survey area, recording a total of 151 potential breeding trees for an average of approximately 5.2 trees per 0.25 ha plot or approximately 20.8 trees/ha (GHD 2019). This density of trees was comparable to the density recorded in the targeted black cockatoo habitat assessment of the DE. The tree plot data suggests the survey area outside the DE may support in the order of 2800 potential breeding trees, based on an average of 20.8 trees per ha over the 134.56 ha of Tuart forest and Jarrah woodland mapped in the survey area outside the DE. The extent of potential breeding trees may be greater including scattered trees in other vegetation/fauna habitat types such as Banksia woodlands and cleared/disturbed areas.

The DE is considered to represent breeding habitat for Carnaby’s Cockatoo, given it is located within the modelled breeding range (DSWEPaC 2012), the availability of potential breeding trees with suitable hollows, and the availability of quality foraging resources in the vicinity. No evidence of breeding was recorded within the DE during the monitoring of potentially suitable hollows over the 2018/19 breeding period, despite the occupation and foraging by Carnaby’s Cockatoos in the DE and extended survey area.

The DE is not considered to represent breeding habitat for the FRTBC as the DE is beyond the mapped breeding area for this species, which is predominantly within Jarrah-Marri forest of the Darling Scarp/Plateau (approximately 30 km to the east). Breeding on the SCP has been limited to isolated locations to the south (e.g. Murdoch University) or to the east closer to the Darling Scarp (e.g. Ellenbrook and Mundijong). FRTBC breeding habitat typically comprise very large and very old Marri trees (Johnstone, Kirkby and Sarti 2013). The Marri trees within the DE do not have suitable hollows for Black Cockatoos. While the species has more recently been utilising and persisting in the northern portions of the SCP (Johnstone, Kirby and Sarti 2017) this has been related to foraging rather than breeding (Johnstone R. 2019, pers. comm.).
Legend
Black Cockatoo potential breeding trees
- Flooded Gum
- Eucalyptus sp.
- Jarrah
- Marri
- Tuart
- Trees with suitable hollows (monitored sites)

Forest Red-tailed Black Cockatoo
- Quality
- Low Quality

Carnaby's Cockatoo
- Quality
- Low Quality

Black Cockatoo Foraging and Breeding Habitat

Neerabup National Park
Neerabup Nature Reserve
Lake Nowergup
Wanneroo Rd

FIGURE 4

Data source: GHD: EPBC Development Envelope - 20190531, Black Cockatoo Potential Breeding Trees, Trees with suitable hollows (monitored sites) - 20190225, Black Cockatoo Foraging Habitat - 20190305; LGATE: Imagery - August 2018; MRWA: Road network - 20190114. Created by: afeeney

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Print date: 10 Sep 2019 - 13:47
Foraging Habitat

Carnaby’s Cockatoo feeding evidence was recorded within the DE on Banksia sessilis, B. attenuata, B. grandis and Jarrah species. FRTBC feeding evidence was recorded on Sheoak, Marri and Jarrah species (GHD 2019).

The 2018 survey mapped approximately 132.07 ha of foraging habitat for Carnaby’s Cockatoo and approximately 104.24 ha of foraging habitat for FRTBC within the DE (GHD 2019), as presented in Figure 4 and Table 7.

Table 7 Black Cockatoo foraging habitat

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>Carnaby's Cockatoo Foraging habitat (ha)</th>
<th>Forest Red-tailed Black Cockatoo Foraging habitat (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quality</td>
<td>Low Quality</td>
</tr>
<tr>
<td>Banksia woodland</td>
<td>61.50</td>
<td>-</td>
</tr>
<tr>
<td>Tuart forest</td>
<td>8.56</td>
<td>-</td>
</tr>
<tr>
<td>Jarrah woodland</td>
<td>6.29</td>
<td>-</td>
</tr>
<tr>
<td>Mixed Heathland</td>
<td>27.82</td>
<td>-</td>
</tr>
<tr>
<td>Scattered natives over weeds,</td>
<td>-</td>
<td>20.59</td>
</tr>
<tr>
<td>Cleared/highly disturbed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revegetation</td>
<td>-</td>
<td>7.31</td>
</tr>
<tr>
<td>Total foraging habitat</td>
<td>104.17</td>
<td>27.90</td>
</tr>
</tbody>
</table>

The foraging habitat for Carnaby’s Cockatoo comprised 104.17 ha of quality habitat and 27.90 ha of low quality habitat. The foraging habitat for FRTBC comprised 76.34 ha of quality habitat and 27.90 ha of low quality habitat.

Roosting habitat

Roosting habitat is defined as a suitable tree (generally the tallest) or group of tall trees, native or introduced, usually close to an important water source, and within an area of quality foraging habitat within the range of the species.

Five potential roosting trees were recorded within the buffer zone but outside of the DE, close to the intersection of Wanneroo Road and Romeo Road. No roosting was recording during the biological survey (GHD 2019).

The Great Cocky Count includes annual monitoring of roosting sites adjacent to Lakes Neerabup, Nowergup and Carabooda, at approximately 500 m east of the DE. Annual counts at these sites has indicated limited roosting over the past five years, including roosting by FRTBC in 2018 (2 birds) and white-tailed black cockatoos (expected to be Carnaby’s Cockatoo) in 2016 (3 birds) and 2017 (4 birds). Earlier counts have recorded roosting by white-tailed black cockatoos, including 35 birds in 2012 and 10 birds in 2013 (Peck et al 2018).

Given the presence of large trees, the proximity to water sources to the east, and the presence of foraging habitat, the Tuart forest and Jarrah woodland areas of the DE have potential to support roosting habitat for Black Cockatoos.

3.2.5 Local and Regional context

The Department of Parks and Wildlife (now DBCA) mapped potential Black Cockatoo habitat on the SCP as part of the Strategic Assessment of Perth and Peel Regions (SAAPR) (DPC 2015). The mapping for SAAPR identified 529,893 ha of potential Carnaby’s Cockatoo habitat and 205,647 ha of potential FRTBC habitat on the SCP (DPC 2015).
Figure 5 presents the local context for the Proposal, including potential habitat for Carnaby’s Cockatoo mapped for SAAPR (DPC 2015) and reserved areas within a 5-10 km distance. This indicates a potential habitat of 6047 ha within a distance of 5 km from the DE.

The mapping of FRTBC habitat for SAAPR did not extend over the DE, but ended approximately 5 km to the east and south-east (DPC 2015). Given the continued expansion of FRTBC foraging over the SCP including that recorded over the survey area (GHD 2019), the FRTBC potential habitat has been mapped using the Carnaby’s Cockatoo habitat mapping but removing the Quindalup and Cottesloe North Complexes as mapped by Heddle et al (1980). These two complexes have been removed as they contain heathland and Banksia dominated woodland which are not expected to include the key foraging species for FRTBC. Figure 6 presents the mapping of FRTBC potential foraging habitat based on this approach.

As presented in Figure 5 and Figure 6, there are large, relatively contiguous areas of remnant vegetation comprising Black Cockatoo habitat in the vicinity of the DE, including large areas protected under Bush Forever and/or DBCA managed lands. Of the 6047 ha of Carnaby’s Cockatoo habitat mapped within 5 km of the DE, approximately 3060 ha (51%) lies within reserved lands. Of the 5533 ha of FRTBC habitat mapped within 5 km of the DE, approximately 2847 ha (51%) lies within reserved lands.

The wider Carnaby’s Cockatoo habitat is expected to contain extensive stands of potential breeding trees. As noted in Section 3.2.4, the approximate 135 ha of Tuart forest and Jarrah woodland mapped in the near vicinity of the DE is estimated to contain in the order of 2800 potential breeding trees. Assuming similar tree densities, the estimated 4734 ha of the Tuart-dominated Cottesloe Complex Central and South within 5 km of the DE (see Section 3.1.4) may contain in the order of 100,000 potential breeding trees for Carnaby’s Cockatoo.

Table 8 presents the impact of the Proposal on habitat loss at a local scale (within 5 km of the DE) and a regional scale (within the SCP), to enable an assessment of the cumulative impact of the Proposal with urbanisation on the SCP.

Table 8  Local and regional context of habitat loss

<table>
<thead>
<tr>
<th>Species</th>
<th>Habitat loss due to proposal</th>
<th>Proportion of habitat loss at a local scale 1</th>
<th>Proportion of habitat loss at a regional scale 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carnaby’s Cockatoo</td>
<td>104.17 ha quality foraging habitat, 27.90 low quality foraging habitat, 328 potential breeding trees, 8 trees with 22 suitable hollows</td>
<td>2.18% of 6047 ha within 5 km</td>
<td>0.025% of 529,893 ha on SCP</td>
</tr>
<tr>
<td>Forest Red-tailed Black Cockatoo</td>
<td>76.34 ha quality foraging habitat, 27.90 low quality foraging habitat</td>
<td>1.88% of 5535 ha within 5 km</td>
<td>0.051% of 205,647 ha on SCP</td>
</tr>
</tbody>
</table>

1 Local scale represents Carnaby’s Cockatoo habitat within 5 km, mapped under the Strategic Assessment of Perth and Peel Regions (DPC 2015).
FRTBC habitat has been mapped as Carnaby’s Cockatoo habitat excluding Quindalup and Cottesloe-North Complexes.

2 Regional scale represents Black Cockatoo habitat on the SCP, mapped under the Strategic Assessment of Perth and Peel Regions (DPC 2015).
3.3 Potential Impacts

3.3.1 Direct impacts

The Proposal will result in the following direct impacts:

- Clearing of up to 50.07 ha of BWSCP TEC
- Clearing of up to 328 potential breeding trees for Carnaby’s Cockatoo
- Clearing of up to eight trees containing between one and four potentially suitable hollows for Black Cockatoo nesting (up to 22 potentially suitable hollows total)
- Clearing of up to 104.17 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for Carnaby’s Cockatoo
- Clearing of up to 76.34 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for FRTBC

The Proposal will not result in impacts to known nesting hollows of Carnaby’s Cockatoo. The Proposal is not expected to result in impacts to FRTBC breeding habitat.

The above estimates are conservative, representing the full extent of MNES values within the 249 ha DE which represents the preliminary impact footprint. The actual clearing footprint is expected to be less and will be refined through the detailed design and construction planning process.

**BWSCP TEC**

The Proposal will result in clearing of up to 50.07 ha of BWSCP TEC over seven patches. The vegetation is representative of FCT 28, which is a more common sub-community of the TEC. The majority (37.57 ha or approximately 75%) of the BWSCP TEC potential clearing will occur within Patch 4, representing approximately 13% of that patch’s area. Clearing will be relatively greater (> 30% of patch area) in Patch 3 (5.73 ha of 5.90 ha), Patch 8 (0.43 ha of 1.37 ha), Patch 11 (2.76 ha of 4.43 ha) and Patch 13 (3.11 ha of 5.84 ha). Clearing in the other three patches will be less than 15% of the total patch areas. Six other patches were located within the survey area, however these will not be impacted upon by the Proposal.

Banksia Woodland within the DE represents approximately 2.3% of 5075 ha of remnant vegetation complexes mapped within 5 km of the DE that may contain the BWSCP TEC. Of this 5075 ha, approximately 60% is protected in DBCA managed lands and/or Bush Forever sites.

**Black Cockatoos**

The DE includes 328 potential Black Cockatoo breeding trees, with approximately 2800 potential breeding trees estimated to occur in the 135 ha of Tuart forest and Jarrah woodland surveyed in the vicinity of the DE. Locally, the Tuart-dominated Cottesloe Complex Central and South may contain in the order of 100,000 potential breeding trees within 5 km of the DE.

The DE includes potential breeding habitat for Carnaby’s Cockatoo, lying within the known breeding range of the species and comprising eight Tuart trees with potentially suitable hollows. However no evidence of breeding was recorded during the species breeding period, despite the species occupying and foraging in the area. The DE does not provide breeding habitat for FRTBC, lying outside the species breeding range.

DE does not contain any known roosting sites.

The DE represents approximately 2.18% of the local habitat (within 5 km of the Proposal) and approximately 0.025% of the regional habitat for Carnaby’s Cockatoos within the SCP.
Approximately 51% of local habitat within 5 km is reserved in Bush Forever or DBCA managed lands.

The DE represents approximately 1.88% of the local habitat (within 5 km of the Proposal) and approximately 0.051% of the regional habitat for FRTBC within the SCP. Approximately 51% of local FRTBC habitat within 5 km is reserved in Bush Forever or DBCA managed lands.

3.3.2 Indirect impacts

The Proposal has potential to cause indirect impacts to BWSCP TEC patches and Black Cockatoo habitat that lies adjacent to the DE (see Section 3.1.3 and 3.2.4). Potential indirect impacts may be caused from:

- Fragmentation and edge effects
- Introduction and/or spread of pathogens, such as Dieback (*Phytophthora cinnamomi*)
- Spread and/or introduction of weeds
- Surface water runoff
- Nutrient cycling
- Mobilisation of acid sulfate soils
- Fire.

The Proposal is not expected to cause significant indirect impacts to BWSCP TEC and Black Cockatoo habitat, with discussion provided for each indirect impact below.

**Fragmentation and edge effects**

The DE is predominantly limited to the Regional Road reserve under the Metropolitan Region Scheme (MRS) and therefore much of the Proposal is comprised of existing cleared areas of Wanneroo Road, Romeo Road and the Perth-Butler railway corridor. Accordingly, although three of the smaller patches of TEC predominantly occur within the DE, as presented in Figure 2, the DE does not fragment any of the thirteen patches of BWSCP TEC identified within or adjacent to the DE.

All associated infrastructure for the Proposal will be contained within the DE, including road pavements, footpaths, pedestrian shared path (PSP), noise walls, stormwater drainage, fencing, and electrical power reticulation.

The DE will be provided with 1.8 m high fencing along the boundary with Neerabup National Park, as discussed with and approved by DBCA (see Section 6.1). The fencing will prevent uncontrolled access to Neerabup National Park and minimise the spread of weeds, dieback or fire from the DE, including existing uncontrolled access that may occur from Wanneroo Road and Romeo Road.

Accordingly, the Proposal will not fragment patches of BWSCP TEC or Black Cockatoo habitat and minimises edge effects to surrounding native vegetation including from existing uncontrolled access.

**Dieback**

Glevan Consulting (2019) undertook a *Phytophthora* Dieback occurrence assessment of the DE (Appendix B). The assessment classified all assessable vegetation as Uninfested, with three of twelve samples showing the presence of *P. nicotianae* and the other nine samples negative for *Phytophthora* species (Glevan 2019). No samples recorded *P. cinnamomi*. Previous surveys (2000, 2001 and 2013) recorded *P. multivora* at two locations along the western boundary of the DE, adjacent to the Butler and Ridgewood suburbs, and *P. nicotianae* at one location along
Wanneroo Road (Glevan 2019). The closest record of *P. cinnamomi* is approximately 5 km to the north-east of the DE (Glevan 2019).

The Proposal lies on Spearwood Dunes, which comprises calcareous / alkaline soils that are typically antagonistic to *P. cinnamomi* though micro environments may be more favourable to the pathogen (Glevan 2019). Areas with calcareous soils are not considered ‘protectable’ areas vulnerable to Dieback (CALM 2003, DEE 2014b).

Vegetation within the DE is dominated by susceptible species that would exhibit Dieback disease symptoms if *Phytophthora* was present (Glevan 2019). This includes *B. attenuata* (Candlestick Banksia) which is known to be particularly vulnerable to Dieback. If Dieback has already been introduced, *Phytophthora* would be expected to occur through disturbance along the existing Wanneroo Road reserve, railway corridor, numerous existing access tracks, and the interface with adjacent urban residential areas. These edge effects have resulted in the spread of weeds and degradation of vegetation condition within the DE (see Section 3.1.3 and Figure 2). However, despite this disturbance and degradation currently occurring there is no evidence of the presence of *P. cinnamomi* or expression of Dieback within the DE and its vicinity, including in the highly vulnerable Candlestick Banksia. This suggests that the presence of calcareous soils (and dry, elevated sands) of the Spearwood Dunes may retard the introduction and/or spread of *Phytophthora* and provide a degree of resistance to Dieback expression.

Irrespective of the potential resistance to Dieback, as a precautionary measure the Proposal Construction Environmental Management Plan (CEMP) incorporates Dieback hygiene management measures (see Section 3.4.2 and Appendix C).

The DE will be fenced preventing uncontrolled access to Neerabup National Park and minimising the spread of Dieback from the DE, including existing uncontrolled access that may occur from urban residential areas, Wanneroo Road and Romeo Road.

### Weeds

GHD (2019) recorded 80 introduced taxa within the total survey area that covers the DE, eight of which are Declared Pests under the Western Australian *Biosecurity and Management Act 2007*, and four are Weeds of National Significance (WoNS):

- *Moraea flaccida* (One-leaf Cape Tulip) – Declared Pest
- *Gomphocarpus fruticosus* (Narrowleaf Cottonbush) – Declared Pest
- *Echium plantagineum* (Paterson's Curse) – Declared Pest
- *Solanum linnaeanum* (Apple of Sodom) – Declared Pest
- *Opuntia stricta* (Common Prickly Pear) - Declared Pest and WoNS
- *Lantana camara* (Common Lantana) - Declared Pest and WoNS
- *Asparagus asparagoides* (Bridal Creeper) – Declared Pest and WoNS
- *Zantedeschia aethiopica* (Arum lily) – Declared Pest and WoNS

The remaining introduced taxa are considered environmental weeds and all have been previously recorded on the SCP.

Figure 7 presents the locations of Declared Pests and WoNS recorded within the total survey area and DE. As presented in Figure 7, the predominant Declared Pests recorded in the DE are *A. asparagoides* and *M. flaccida*, with isolated records of other Declared Pests.
**Significant Weeds**

- Asparagus asparagoides DP/WoNS
- Echium plantagineum DP
- Gomphocarpus fruticosus DP
- Lantana camara DP/WoNS
- Moraea flaccida DP
- Opuntia stricta DP/WoNS
- Solanum linnaeanum DP

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**Vegetation Conditions**

- Excellent
- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Cleared
Significant Weeds

- *Asparagus asparagoides DP/WoNS*
- *Echium plantagineum DP*
- *Moraea flaccida DP*
- *Solanum linnaeum DP*

Vegetation Conditions

- Excellent
- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Cleared

Legend

**Significant Weeds**

**Vegetation Conditions**

- Excellent
- Excellent - Very Good
- Very Good
- Very Good - Good
- Good
- Good - Degraded
- Degraded
- Degraded - Completely Degraded
- Cleared
The Proposal may result in the spread of Declared Pests and WoNS from the DE to adjacent, un-infested native vegetation through clearing and earthworks activities that spread weeds and seeds, and wind-blown spread of seeds from weeds establishing in the DE.

The Proposal will incorporate rehabilitation with native species on local harvested topsoil, which will reduce the potential spread of weeds in the DE.

Access controls, weed treatment, hygiene and monitoring will be implemented during and after construction to prevent the introduction and spread of weeds within the DE and to adjacent vegetation (see Section 3.4). Established control methods for all Declared Pests recorded within the DE, including A. asparagoides and M. flaccida, are outlined in the CEMP and will be implemented from the pre-construction through to post-construction phases of the Proposal.

The Proposal is not expected to spread weeds and seeds in stormwater runoff, as stormwater will be captured and infiltrated within basins/swales in the road reserve. Weeds may become established in the infiltration basins/swales, which may then facilitate the spread via wind-blown seeds to adjacent un-infested native vegetation. Accordingly, ongoing weed management will occur in drainage areas adjacent to un-infested native vegetation as part of ongoing standard road maintenance.

Topsoil containing declared weeds or WONS will not be reused in the landscaping and revegetation of the project.

The DE will be provided with fencing which will prevent uncontrolled access to Neerabup National Park and minimise the spread of weeds from the DE, including existing uncontrolled access that may occur from urban residential areas, Wanneroo Road and Romeo Road.

Through construction and operational management, the Proposal is not expected to result in the introduction or spread of weeds that could result in significant impacts to BWSCP TEC or Black Cockatoo habitat.

**Surface runoff**

The Proposal lies on sandy, well drained soils of the Spearwood Dunes. Due to the high permeability and high depth to groundwater, there are no waterways or major drainage lines through the DE all natural drainage is through infiltration to groundwater. Wetlands to the east (e.g. Nowergup Lake and Neerabup Lake) are expressions of the regional groundwater table (‘through flow wetlands’) rather than being substantially fed through surface runoff.

The Proposal will involve construction of new and upgraded road pavements. Surface runoff generated from the new and upgraded pavements will drain into adjacent infiltration basins and/or swales constructed within the DE. The infiltration basins/swales will be designed to capture and infiltrate runoff from a 1 in 100 year Average Recurrence Period rainfall event, to prevent stormwater runoff into adjacent areas of native vegetation and flooding of properties. The infiltration basins/swales will be planted with native vegetation. No infiltration areas will be located outside the DE.

Due to the high permeability soils, the high depth to groundwater, and provision of infiltration basins/swales, the Proposal is not expected to cause surface water runoff into adjacent areas that could indirectly impact BWSCP TEC or Black Cockatoo habitat.

**Nutrient cycling**

The Proposal will result in clearing of remnant, planted and regrowth vegetation and replacement with road pavements and rehabilitated road verges. The replacement of remnant vegetation with planted vegetation has potential to cause runoff and/or leaching of nutrients from inappropriate use of fertilisers. The runoff/leaching of nutrients can encourage weed growth which can then impact native vegetation including Banksia woodlands.
The Proposal will incorporate rehabilitation using native species planted on topsoil harvested from the DE, which will minimise the requirement for fertilisers.

Nutrients from stormwater runoff will be captured and infiltrated in basins and/or swales within the road reserve, which will be planted with native vegetation to assist with nutrient uptake during infiltration.

This strategy is consistent with Western Australia’s Better Urban Water Management Framework (WAPC 2008). Stormwater infiltration will be as close to source as possible in order to mimic the natural processes.

Due to the use of native species on local topsoil for rehabilitation and the localised treatment and infiltration of stormwater runoff, the Proposal is not expected to result in a substantial change in nutrient cycling that would result in significant impacts to BWSCP TEC or Black Cockatoo habitat.

**Acid sulfate soils**

The DE lies on calcareous, well drained soils of the Spearwood Dunes. Mapping by CSIRO indicates that the DE has an ‘Extremely Low Probability of Occurrence’ of acid sulfate soils (ASS) (GHD 2018), which is typical of Spearwood Dunes.

The Proposal lies on elevated, well drained dune landforms and will not involve deep excavations that require dewatering. The clearing of vegetation will occur in thin strips adjacent to existing cleared corridors and is not expected to be of sufficient scale to cause substantial hydrological changes in the area. Due to the extreme low probability of ASS occurring, the lack of dewatering and hydrological impacts from clearing, it is highly unlikely that the Proposal will result in oxidation of ASS that could impact BWSCP TEC or Black Cockatoo habitat.

**Fire**

The DE lies adjacent to areas of native vegetation, including Banksia woodlands, which are susceptible to impacts from high frequency fire regimes (TSSC 2016). These areas of woodland include Neerabup National Park and Neerabup Nature Reserve, which may be subject to existing uncontrolled access from Wanneroo Road, Romeo Road and urban residential areas to the west, which increase the likelihood of fire outbreaks.

The DE will be provided with 1.8 m high fencing along the boundary with Neerabup National Park, which will prevent uncontrolled access to Neerabup National Park and minimise the potential spread of fire from the DE, including existing uncontrolled access that may occur from urban residential areas, Wanneroo Road and Romeo Road.

The Proposal CEMP incorporates fire control measures to minimise the likelihood of fires arising within the DE during construction (see Section 3.4.2 and Appendix C).

Through the provision of construction fire controls and ongoing access controls, the Proposal is not expected to result in increased frequency of fire events that cause significant impacts to BWSCP TEC or Black Cockatoo habitat.
3.4 Mitigation and management measures

3.4.1 Impact avoidance

The Proposal has been designed to avoid impacts to BWSCP TEC and Black Cockatoo habitat as far as is practicable. Avoidance measures undertaken by Main Roads for the Proposal include:

1. The DE is largely located within the existing road reserve, with only minor deviations outside the road reserve into Neerabup National Park/Nature Reserve, equating to approximately 5% of the DE. These deviations have been discussed and agreed with DBCA (Section 6.1.2).

2. The DE incorporates an upgrade of Wanneroo Road and Romeo Road, avoiding more extensive clearing of a greenfield road corridor.

3. The DE incorporates a predominantly cleared corridor about the Perth-Butler railway, including an existing stormwater infiltration basin. This substantially reduces the clearing required for the southern portion of the freeway extension.

4. The DE excludes a median and incorporates steeper 1:3 batter slopes for the northern section of Mitchell Freeway. This ensures the freeway extension is contained within the road reserve, minimising clearing within Neerabup National Park.

5. The DE lies over BWSCP TEC in relatively degraded condition compared to the TEC in the wider Survey Area, particularly that of Neerabup National Park. As noted in Section 3.1.3, the TEC within the DE is approximately 9% in Excellent to Very Good, 33% Very Good, 11% Very Good to Good, 27% Good, 13% Good to Degraded and 6% Degraded to Completely Degraded condition. By comparison, in the Survey Area outside the DE the TEC is approximately 17% in Excellent, 35% Excellent to Very Good, 33% Very Good, 8% Very Good to Good, 5% Good, 2% Good to Degraded and 1% Degraded condition. Clearing will avoid the best condition vegetation within the largest TEC patch (Patch 4).

6. The DE avoids intrusion into or bisection of patches of native vegetation, including Neerabup National Park and Neerabup Nature Reserve. The DE is limited to land adjacent to existing cleared areas of Wanneroo Road, Romeo Road, the Perth-Butler Railway and urban residential areas. As shown in Figure 2, the DE does not fragment any of the thirteen patches of BWSCP TEC identified in the Survey Area.

7. All associated infrastructure for the Proposal will be contained within the DE, including road pavements, footpaths, noise walls, stormwater drainage, fencing, and electrical power reticulation.

8. The DE will be provided with 1.8 m high fencing along the boundary with Neerabup National Park, as discussed with and approved by DBCA (see Section 6.1). The fencing will prevent uncontrolled access to Neerabup National Park and minimise the spread of weeds, Dieback and fires from the DE.
3.4.2 Construction environmental management

The Proposal construction works will be managed in accordance with a CEMP, which is presented in Appendix C. The CEMP includes strict access and fire controls and dieback and weed hygiene requirements, protecting adjacent areas of BWSCP TEC and Black Cockatoo habitat.

3.4.3 Efficacy of mitigation measures

The measures proposed in Appendix C are established management requirements Main Roads applies to most projects of this scale and nature within the SCP. Such projects are audited regularly to continually improve the effectiveness of the measures that are applied. Main Roads considers the mitigation measures proposed will effectively manage all risks and ensure compliance with approval related conditions.
4. **Acceptability of impacts**

This section provides an assessment of the environmental acceptability of the Proposal, including:

- Significance of impacts to BWSCP TEC and Black Cockatoos
- Consideration of the Objects of the EPBC Act and principles of ecologically sustainable development
- Justification for undertaking the Proposal in the manner proposed, including avoidance mitigation measures
- Residual impacts and compensatory measures.

This section includes an assessment of significance of impacts against the significant impact criteria in the Commonwealth Significant Impact Guidelines 1.1 (DotE 2013), to provide DEE with supporting information in considering the acceptability of the Proposal.

This section also provides information to demonstrate that the Proposal is not inconsistent with relevant recovery plans or threat abatement plans.

4.1 **Significance of impact assessment - Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community**

The potential impacts of the Proposal on the BWSCP TEC have been assessed against the significant impact criteria for endangered ecological communities in the Significant Impact Guidelines 1.1 (DotE 2013). The Guidelines state that an action is likely to have a significant impact on an endangered ecological community if there is a real chance or possibility that it will:

- reduce the extent of an ecological community
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines
- adversely affect habitat critical to the survival of an ecological community
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community’s survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established, or
  - causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or
  - interfere with the recovery of an ecological community.
4.1.1 Reduce the extent of an ecological community

The Proposal will reduce the area of occurrence of the TEC but will not reduce the TEC’s regional distribution.

The Proposal will reduce the area of occurrence of the TEC by up to 50.07 ha, avoiding the best condition vegetation in the vicinity, including a core area of Excellent to Very Good condition vegetation (Patch 4) within Neerabup National Park (see Section 3.1.3 and Figure 2).

Approximately 75% of the clearing will occur within Patch 4 and will remove 13% of the patch’s area. The clearing will occur within relatively degraded vegetation on the edges of Patch 4 and will not intrude into or bisect the patch’s interior. The Proposal will result in a 3% increase in the perimeter to area ratio of Patch 4 and adjacent remnant vegetation (from 28.8 m/ha to 29.6 m/ha). The Proposal will not impact the areas of best condition within the patch. Outside of Patch 4, the remaining clearing will occur over smaller patches ranging from 1-14 ha in size with a higher perimeter to area ratio and more degraded condition.

The Proposal will not reduce the regional distribution of the TEC, lying well within the range of the TEC (which extends from Dongara to Dunsborough) and with extensive areas of potential TEC lying to the north, south and east of the DE (see Section 3.1.4 and Figure 3). The DE lies adjacent and parallel to existing cleared corridors and will not disrupt linkages between the TEC and adjacent green corridors. The TEC is well reserved locally with approximately 60% of potential TEC areas within 5 km in Bush Forever sites or DBCA managed lands, and the sub-community to be cleared is the relatively common FCT28 community.

The Proposal incorporates design and construction measures to protect and enhance the integrity of BWSCP TEC within Neerabup National Park and Neerabup Nature Reserve, including:

1. Planting of native vegetation within the road reserve, stormwater drainage basins/swales and temporary construction areas, which will provide a maintained buffer to adjacent BWSCP TEC areas.
2. Capture, treatment and infiltration of stormwater runoff within the DE, minimising runoff into adjacent TEC areas. This represents an improvement over the existing drainage condition along Wanneroo Road and Romeo Road as semi-rural roads.
3. Installation of fencing (1.8 m high) along the boundary of Neerabup National Park, to restrict uncontrolled access and associated potential to spread weeds, dieback and fire into adjacent TEC areas.

4.1.2 Fragment or increase fragmentation of an ecological community

The Proposal will not fragment or increase fragmentation of the BWSCP TEC. As presented in Figure 2, the DE will not fragment any of the 13 patches of BWSCP TEC identified intersecting or adjacent to the DE.

The Proposal avoids intrusion into or bisection of patches of native vegetation, including Neerabup National Park and Neerabup Nature Reserve. Clearing will be limited to the edges of existing disturbed corridors along Wanneroo Road, Romeo Road, Perth-Butler Railway and the Butler urban residential area.

All associated infrastructure for the Proposal will be contained within the DE, including road pavements, footpaths, noise walls, stormwater drainage, fencing, and electrical power reticulation.
4.1.3 Adversely affect habitat critical to the survival of an ecological community

The Conservation Advice defines all patches of TEC and a buffer of 20 - 50m, as critical for the survival of the TEC (TSSC 2016).

The Proposal will directly impact up to 50.07 ha of BWSCP TEC patches. As noted above, the Proposal will avoid the best condition vegetation in the vicinity, including a core area within the Neerabup National Park. Locally, there is approximately 5075 ha of remnant vegetation within 5 km of the DE that may contain the TEC, of which approximately 60% is protected.

The Proposal incorporates design and construction measures to protect and enhance the integrity of BWSCP TEC within the conservation areas of Neerabup National Park and Neerabup Nature Reserve, as listed in Section 4.1.1.

4.1.4 Modify or destroy abiotic factors necessary for an ecological community's survival, including hydrology

The Proposal will not substantially modify or destroy abiotic factors necessary for the survival of the BWSCP TEC, including hydrology, nutrients or soil resources.

As noted in Section 3.3.2, the Proposal will incorporate infiltration basins and/or swales within the DE to capture, treat and infiltrate surface water runoff from the new and upgraded road pavements. The Proposal will minimise runoff outside the DE that could impact adjacent TEC patches.

As noted in Section 3.3.2, the Proposal is not expected to require dewatering and the clearing of vegetation within the DE is not expected to be of sufficient scale to cause substantial hydrological changes in the area. The infiltration of surface water runoff within the DE will maintain the existing hydrological regime within the Spearwood Dunes, which is characterised by high infiltration of rainfall and lack of surface drainage features.

As noted in Section 3.3.2, the Proposal will use of native species on local topsoil for revegetation, restrict the use of fertilisers to the establishment phase and a case by case basis, incorporate treatment of stormwater during infiltration. Accordingly, the Proposal is not expected to result in a substantial change in nutrient cycles that could impact TEC patches in the area.

As noted Section 3.3.2, the Proposal will incorporate harvesting and reuse of topsoil within the DE to ensure that local soil resources are maintained and support buffers of native vegetation within the road reserve, to enhance protection of adjacent TEC patches. The CEMP (Appendix C) includes erosion and sediment controls to maintain the quality of soil within the DE and adjacent areas. Accordingly, the Proposal is not expected to substantially modify or destroy soil resources that could impact adjacent TEC patches.

4.1.5 Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species

As noted in Section 3.3.2, the Proposal avoids fragmentation of TEC patches and intrusion into adjacent TEC areas including Neerabup National Park and Neerabup Nature Reserve. All associated infrastructure for the Proposal will be contained within the DE, including road pavements, footpaths, noise walls, stormwater drainage, fencing, and electrical power reticulation.

As noted in Section 3.4.1, the Proposal incorporates fencing along the boundary of Neerabup National Park, to prevent unauthorised access into the National Park.
The above measures avoid the requirement for any access or maintenance activities outside the DE and in particular within Neerabup National Park or Neerabup Nature Reserve. Management of these Class A reserves will remain the responsibility of DBCA.

The treatment of weeds and planting of native vegetation within the road reserve will help provide a buffer to adjacent TEC patches.

Accordingly, the proposal is not expected to cause a decline or loss of functionally important species in TEC patches retained outside the DE.

4.1.6 Cause a substantial reduction in the quality or integrity of an ecological community

The Proposal is not expected to result in a substantial reduction in quality or integrity of TEC patches retained outside the DE, including those within Neerabup National Park or Neerabup Nature Reserve.

As noted in Section 4.1.1, the Proposal incorporates design and construction measures to maintain and enhance the integrity of BWSCP TEC patches within the conservation areas of Neerabup National Park and Neerabup Nature Reserve.

As noted in Section 3.3.2, the Proposal is not expected to result in the introduction or spread of weeds that results in significant impacts to BWSCP TEC. This is due to construction management including weed treatment and hygiene, and revegetation with native species on local harvested topsoil with restricted use of fertiliser. Ongoing weed management will be undertaken in road drainage basins/swales to prevent spread of weeds into adjacent TEC patches.

As noted in Section 3.3.2, the DE is expected to be resilient to Dieback expression due to the presence of well drained, calcareous soils of the Spearwood Dunes. However, as a precautionary measure the CEMP includes Dieback hygiene management measures to prevent the introduction and spread of Dieback (see Section 3.4.2).

4.1.7 Interfere with the recovery of an ecological community

There is no recovery plan in place for the TEC, as the conservation advice outlines priority research and conservation actions (TSSC 2016).

The Proposal has been planned and will be developed to align with relevant protection and recovery measures in the conservation advice, including:

- Identification and retention of high conservation value, unmodified areas of the TEC within Neerabup National Park and Neerabup Nature Reserve
- Preventing impacts to native vegetation, fauna, hydrology and soil structure from construction, through clearing controls, revegetation with native species, fauna handling, stormwater drainage and topsoil management
- Establishing native vegetation using local native species within the road reserve to provide a buffer to adjacent TEC patches and contributing to TEC restoration outcomes
- Construction access controls and installation of fencing (1.8 m high) along the boundary of Neerabup National park to prevent unauthorised access and the potential spread of Dieback and weeds
- Avoiding disruption to any TEC linkages with vegetation and wildlife corridors
- Mapping of existing weed and Phytophthora infestations, and construction treatment, hygiene and monitoring to spread of Dieback and weeds within the TEC.
Given the above planning, design and construction measures, the Proposal is not expected to interfere with the recovery of the TEC.

4.2 Significance of impact assessment - Carnaby’s Cockatoo and Forest Red-tailed Black Cockatoo

4.2.1 Assessment framework

The Commonwealth Significant Impact Guidelines 1.1 adopts criteria for assessment of impact to threatened species relating to ‘populations’ and/or ‘important populations’ (DotE 2013). However, these terms have not been defined for Black Cockatoos, due to the mobile and widely-distributed nature of these species, and the variation in flock compositions (e.g. between breeding and non-breeding seasons). For Black Cockatoos, it is more appropriate to consider significance in terms of impacts on habitat rather than a resident population (DSWEPaC 2012, DEE 2017).

Species recovery, as defined by the Carnaby’s Cockatoo Recovery Plan (DPaW 2013), is dependent upon stopping the further decline in the distribution and abundance of Carnaby’s Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for their survival throughout their breeding and non-breeding range, and ensuring that the reproductive capacity of the species remains stable or increases. Habitat critical to the survival of Carnaby’s Cockatoo is defined as (DPaW 2013):

- Known breeding and nearby feeding habitat
- Former breeding habitat that has hollows intact
- Vegetation that provides habitat for feeding, watering and regular night roosting.

Critical habitat for FRTBC includes Marri, Karri and Jarrah forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall (DEC 2008).

4.2.2 Assessment of impacts

The Proposal will result in the clearing of up to 104.17 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for Carnaby’s Cockatoo. The Proposal will result in clearing of up to 76.34 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for FRTBC.

The Proposal will not result in clearing of any known breeding tree or hollow for Carnaby’s Cockatoo, nor any known important roosting tree. The closest recorded breeding site for Carnaby’s Cockatoo is approximately 14 km to the south. Up to 328 potential breeding trees (DBH > 500 mm) for Carnaby’s Cockatoo will be cleared, of which up to eight trees have hollows suitable for nesting, with a total of 22 potentially suitable hollows being present. The DE lies in the vicinity of similar habitat, with approximately 2800 potential breeding trees estimated to occur in 135 ha of Tuart forest and Jarrah woodland surveyed in the area. Locally, the Tuart-dominated Cottesloe Complex Central and South may contain in the order of 100,000 potential breeding trees within 5 km of the DE.

The Proposal will not result in clearing of breeding habitat for FRTBC, as it lies outside the known breeding range for the species and does not comprise large Marri or Jarrah trees with potentially suitable hollows for nesting.

The Proposal is not expected to directly or indirectly impact habitat critical to the survival of Carnaby’s Cockatoo, as the DE does not comprise known or former breeding habitat or vegetation that provides habitat for watering, with no wetlands or waterways being present.
The Proposal is not expected to directly or indirectly impact habitat critical to the survival of FRTBC, as the DE lies outside the core species habitat of the Darling Scarp/Plateau and does not comprise Marri, Karri or Jarrah forest. The 6.29 ha of Jarrah woodland to be cleared predominantly comprises minor patches surrounded by Banksia, Tuart or heathland vegetation. Foraging expansion by FRTBC onto the SCP has occurred primarily through opportunistic foraging of Cape Lilac trees (Johnstone, Kirkby and Sarti 2017).

The clearing areas are conservative and represent the full extent of black cockatoo habitat that will possibly be impacted within the 249 ha DE. The actual clearing footprint is expected to be less and will be refined through the detailed design and construction planning process.

The proposed clearing within the DE represents a minor loss of Black Cockatoo foraging habitat at both the local and bioregional context. The Proposal will result in a maximum clearing of approximately 2.18% of local habitat within 5 km of the Proposal for Carnaby’s Cockatoos and approximately 0.025% of the regional habitat for Carnaby’s Cockatoos within the SCP. Approximately 51% of local habitat for Carnaby’s Cockatoos within 5 km is reserved in Bush Forever or DBCA managed lands.

The Proposal will result in a maximum clearing of approximately 1.88% of local habitat within 5 km of the Proposal for FRTBC and approximately 0.051% of the regional habitat for FRTBC within the SCP.

As noted in Section 3.3.2, the Proposal will not result in fragmentation of existing habitat, with clearing being limited to habitat along the edges of existing cleared and disturbed corridors along Wanneroo Road, Romeo Road, Perth-Butler Railway and the Butler urban residential area. The Proposal will not bisect adjacent patches of native vegetation, including the Neerabup National Park or Neerabup Nature Reserve.

As noted in Section 3.3.2, the Proposal is not expected to result in the introduction or spread of weeds or dieback that results in significant impacts to Black Cockatoo habitat. This is due to construction management including weed treatment and hygiene, and revegetation with native species on local harvested topsoil. Ongoing weed management will be undertaken in roadside revegetation and drainage basins/swales to prevent spread of weeds into adjacent native vegetation. The DE is expected to be resilient to Dieback expression due to the presence of well drained, calcareous soils of the Spearwood Dunes. However, as a precautionary measure the CEMP includes Dieback hygiene management measures to prevent the introduction and spread of Dieback (see Section 3.4.2).

4.2.3 Summary

In summary, the Proposal will result in significant residual impacts to Carnaby’s Cockatoo and Forest Red-tailed Black Cockatoo, due to the following direct impacts:

- Clearing of up to 328 potential breeding trees for Carnaby’s Cockatoo
- Clearing of up to eight trees, each containing between one and four potentially suitable hollows for Carnaby’s Cockatoo nesting (totalling 22 potentially suitable hollows)
- Clearing of up to 104.17 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for Carnaby’s Cockatoo
- Clearing of up to 76.34 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for FRTBC.

The Proposal will not result in impacts to known nesting hollows of Carnaby’s Cockatoo. The Proposal is not expected to result in impacts to FRTBC breeding habitat. The Proposal will not result in clearing of any known roost tree.
Although the direct impacts are significant, the Proposal is not expected to impact on habitat critical to the survival of Black Cockatoos. The clearing of Carnaby’s Cockatoo habitat comprises 1.72% of local habitat (within 5 km of the Proposal) of which 51% is reserved in Bush Forever and DBCA managed lands, and 0.025% of regional habitat on the SCP. The local habitat (within 5 km of the Proposal) is estimated to contain in the order of 100,000 potential breeding trees for Carnaby’s Cockatoo.

The Proposal is not expected to result in significant indirect impacts to Black Cockatoos.

The potential significant residual (direct) impact to Black Cockatoos will be counterbalanced by an offset.

4.3 Significance guideline assessment - Carnaby’s Cockatoo and Forest Red-tailed Black Cockatoo

Although not considered to be relevant for Black Cockatoos given their highly mobile nature, the impacts of the Proposal on Black Cockatoos have also been broadly assessed against the Commonwealth Significant Impact Guidelines 1.1 (DotE 2013).

4.3.1 Lead to a long-term decrease in the size of a population

The Proposal is not expected to lead to a long-term decrease in the size of Black Cockatoo populations as:

- The Proposal will not result in clearing of known breeding trees or hollows, nor any known roosting tree
- The Proposal occurs at least 14 km away from recorded breeding sites for Carnaby’s Cockatoo and approximately 30 km away from recorded breeding sites for FRTBC
- The Proposal will result in the clearing of up to 104.17 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for Carnaby’s Cockatoos, representing 2.18% of local habitat (within 5 km of the Proposal) and 0.025% of regional habitat within the SCP
- The Proposal is surrounded by extensive areas of foraging habitat, with approximately 51% of habitat within 5 km reserved in Bush Forever or DBCA managed lands
- The Proposal will result in the clearing of up to 76.34 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for FRTBC, representing 1.88% of local habitat (within 5 km of the Proposal) and 0.051% of regional habitat within the SCP
- The Proposal incorporates design and construction measures to protect and enhance the integrity of Black Cockatoo habitat within Neerabup National Park and Neerabup Nature Reserve.

4.3.2 Reduce the area of occupancy of the species

The Proposal is not expected to reduce the area of occupancy of Black Cockatoos, as:

- Clearing will occur over linear patches adjacent to existing cleared and disturbed areas along Wanneroo Road, Romeo Road, Perth-Butler Railway and the Butler urban residential area
- Black Cockatoos are highly mobile species and are expected to forage outside the DE amongst extensive foraging resources in the vicinity, and are not dependent on a particular patch of foraging habitat within the DE
- The proposed action will not result in clearing of important roosting or breeding habitat, with these habitats identified in the vicinity but outside of the DE
• The closest breeding records for Black Cockatoos are approximately 14 km to the south for Carnaby’s Cockatoo and approximately 30 km to the east for FRTBC.

4.3.3 Fragment an existing population into two or more populations

The Proposal is not expected to fragment populations of Black Cockatoos, as:

• Clearing will occur over linear patches adjacent to existing disturbed areas along Wanneroo Road, Romeo Road, Perth-Butler Railway and the Butler urban residential area

• Black Cockatoos are highly mobile species and are expected to forage over the DE amongst extensive foraging resources in the vicinity, rather than being dependent on a particular patch of foraging habitat within the DE

• The closest breeding records for Black Cockatoos are approximately 14 km to the south for Carnaby’s Cockatoo and approximately 30 km to the east for FRTBC

• The Proposal will not result in clearing of any important roosting or breeding habitat.

4.3.4 Adversely affect habitat critical to the survival of a species

The Proposal is not expected to directly or indirectly impact habitat critical to the survival of Carnaby’s Cockatoo, as the DE does not comprise known or former breeding habitat or vegetation that provides habitat for watering. The closest recorded breeding site for Carnaby’s Cockatoo is approximately 14 km to the south.

The Proposal is not expected to directly or indirectly impact habitat critical to the survival of FRTBC, as the DE lies outside the core species habitat of the Darling Scarp/Plateau.

4.3.5 Disrupt the breeding cycle of a population

The Proposal is not expected to disrupt the breeding cycle of a population of Black Cockatoos as no known breeding of Black Cockatoos occurs in the DE. A targeted Black Cockatoo habitat assessment identified eight trees that contained between one to four hollows (22 potentially suitable hollows in total) with sufficient external/internal dimensions suitable for current breeding. These hollows were assessed via visual inspection and/or via a pole cam in August 2018, November 2018 and January/February 2019, during which no Black Cockatoo use was evident or recorded (GHD 2019).

The Proposal will not result in clearing of any known breeding tree or hollow, nor any known important roosting tree. The closest recorded breeding site for Carnaby’s Cockatoo is approximately 14 km to the south.

The Proposal will not result in clearing of breeding habitat for FRTBC, as it lies outside the known breeding range for the species and does not comprise large Marri or Jarrah trees with potentially suitable hollows for nesting. The closest breeding records for FRTBC is approximately 30 km to the east of the DE.

The DE is adjacent to extensive areas of habitat in protected reserves, which contains extensive stands of potential breeding trees. As noted in Section 3.2.4, the approximate 135 ha of Tuart forest and Jarrah woodland mapped in the near vicinity of the DE is estimated to contain in the order of 2800 potential breeding trees for Carnaby’s Cockatoo.

4.3.6 Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Proposal is not expected the impact the availability or quality of habitat to the extent that Black Cockatoos are likely to decline, as:
The Proposal will not result in clearing of known breeding trees or hollows, nor any known roosting tree.

The Proposal occurs at least 14 km away from recorded breeding sites for Carnaby’s Cockatoo and at approximately 30 km away from recorded breeding sites for FRTBC.

The Proposal will not result in clearing of any FRTBC breeding habitat.

The Proposal will result in maximum clearing of foraging habitat that represents approximately 2.18% of local habitat (within 5 km of the Proposal) and approximately 0.025% of the regional habitat for Carnaby’s Cockatoos within the SCP.

The Proposal is surrounded by extensive areas of foraging habitat, with approximately 51% of habitat within 5 km reserved in Bush Forever or DBCA managed lands.

The Proposal incorporates design and construction measures to protect and enhance the integrity of Black Cockatoo habitat within Neerabup National Park and Neerabup Nature Reserve.

4.3.7 Result in invasive species that are harmful to the species becoming established in the species’ habitat

As noted in Section 3.3.2, the Proposal is not expected to result in the introduction or spread of weeds that results in significant impacts to Black Cockatoo habitat. This is due to construction management including weed treatment and hygiene, and revegetation with native species on local harvested topsoil. Ongoing weed management will be undertaken in road drainage basins/swales to prevent spread of weeds into adjacent habitat.

4.3.8 Introduce disease that may cause the species to decline

As noted in Section 3.3.2, the DE is expected to be resilient to Dieback expression due to the presence of well drained, calcareous soils of the Spearwood Dunes. However, as a precautionary measure the CEMP includes Dieback hygiene management measures to prevent the introduction and spread of Dieback.

4.3.9 Interfere with the recovery of the species

The Proposal is consistent with the recovery plans for Carnaby’s Cockatoo and FRTBC, as presented in Section 4.7.

4.4 Objects of the EPBC Act, principles of ecologically sustainable development and precautionary principle

4.4.1 Objects of the EPBC Act

Table 9 summarises an assessment of the Proposal against the Objects of the EPBC Act, as specified in Section 3(1) of the Act. As presented in Table 9, the Proposal has been planned and designed and will be implemented consistent with the Objects of the Act.
<table>
<thead>
<tr>
<th>Object</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance</td>
<td>The Proposal will be implemented to protect the environment, especially MNES, by avoiding as much remnant vegetation as possible. The Proposal incorporates design and management to protect and enhance the environmental values to adjacent A Class reserves (Neerabup National Park and Neerabup Nature Reserve). The Proposal lies within and adjacent to existing disturbed areas along Wanneroo Road, Romeo Road, Perth-Butler railway and the Butler urban residential area. Clearing occurs within areas of relatively degraded vegetation and avoids areas of high conservation value within adjacent A Class reserves. Offsets will also be implemented as appropriate.</td>
</tr>
<tr>
<td>(b) to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources</td>
<td>Refer to Table 10 for assessment against the ESD principles In accordance with Main Roads policy, the Proposal will be formally assessed and rated by the Infrastructure Sustainability Council of Australia (ISCA) for the Design and Build phase. The ISCA Design and Build rating includes implementation of sustainable resource initiatives to minimise energy, water and material consumption and waste generation.</td>
</tr>
<tr>
<td>(c) to promote the conservation of biodiversity</td>
<td>Refer to Table 10 for assessment against this ESD principle</td>
</tr>
<tr>
<td>(ca) to provide for the protection and conservation of heritage</td>
<td>The Proposal is not expected to impact any Aboriginal heritage sites of significance protected under the Aboriginal Heritage Act 1972 (AH Act) (see Section 6.2). Main Roads undertook consultation with representatives of the Whadjuk WC 2011/009 Native Title Claim (NTC) group as part of an ethnographic survey under the AH Act. Main Roads will implement the Proposal in accordance with recommendations made by the Whadjuk NTC group representatives (see Table 16). The Proposal will not impact any recorded European or natural heritage areas.</td>
</tr>
<tr>
<td>(d) to promote a co-operative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples</td>
<td>Main Roads has commenced a program of broad consultation with government, community and indigenous stakeholders (Sections 6.1 and 6.2). Main Roads will implement the Proposal with consideration to recommendations of stakeholders, including DBCA and Whadjuk NTC group representatives (see Table 15 and Table 16).</td>
</tr>
<tr>
<td>(e) to assist in the co-operative implementation of Australia’s international environmental responsibilities</td>
<td>Main Roads has undertaken planning, design and stakeholder consultation to enhance protection of the environment, especially MNES, to assist with the implementation of Australia’s international environmental responsibilities and specifically those respect to threatened species and ecological communities.</td>
</tr>
<tr>
<td>(f) to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia’s biodiversity</td>
<td>Main Roads undertook consultation with representatives of the Whadjuk NTC group and will implement the Proposal in accordance with the group’s recommendations (see Table 16). This includes recommendations made with respect to protection, salvage and rehabilitation of flora and vegetation.</td>
</tr>
<tr>
<td>g) to promote the use of indigenous peoples’ knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge</td>
<td>Refer to consideration of Object (f).</td>
</tr>
</tbody>
</table>
4.4.2 Principles of ecologically sustainable development

The National Strategy for Ecologically Sustainable Development (1992) sets out the policy framework for the Australian Government to make decisions and take actions to pursue ecologically sustainable development (ESD).

The National Strategy defines ESD as ‘development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations to develop ways of using those environmental resources which form the basis of our economy in a way which maintains and, where possible, improves their range, variety and quality. At the same time we need to utilise those resources to develop industry and generate employment’ (Commonwealth of Australia 1992).

The National Strategy requires government departments to develop institutional arrangements to ensure that the principles and objectives of ESD are delivered and sets out the following core objectives for achieving ESD to:

- Enhance individual and community well-being by following a path of economic development that safeguards the welfare of future generations
- Provide for equity within and between generations
- Protect biological diversity and maintain essential ecological processes and life-support systems.

Table 10 summarises the assessment of the Proposal against the EPBC Act principles of ESD, which includes the Precautionary Principle.

**Table 10 Assessment against ESD principles**

<table>
<thead>
<tr>
<th>ESD Principle</th>
<th>Consideration</th>
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<tbody>
<tr>
<td>Decision making processes should effectively integrate both long and short term economic, environmental, social and equity considerations</td>
<td>The Proposal planning has considered social and environmental matters raised through stakeholder consultation, as presented in Sections 6.1 and 6.2. The Proposal provides long term economic, social and equity benefits for the metropolitan region north of Perth, as presented in Sections 6.4, 6.5 and 6.6. This includes improved road safety, reduced travel time, economic growth and employment generation. The Proposal is consistent with the Regional Road Reserve within the Metropolitan Region Scheme. The Proposal has been planned and designed to avoid impacts to and enhance environmental values at Class A Reserves at Neerabup National Park and Neerabup Nature Reserve.</td>
</tr>
</tbody>
</table>
| Precautionary Principles | The Proposal has been subject to comprehensive studies to assess the environmental values and potential impacts of the Proposal, including:  
<table>
<thead>
<tr>
<th>ESD Principle</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The principle of intergenerational equity--that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</strong></td>
<td>The Proposal will ensure the health, diversity and productivity of the environment by avoiding as much remnant vegetation as possible. The Proposal incorporates design and management to protect and enhance the environmental values to adjacent A Class reserves (Neerabup National Park and Neerabup Nature Reserve). The Proposal lies within and adjacent to existing disturbed areas along Wanneroo Road, Romeo Road, Perth-Butler railway and the Butler urban residential area. Clearing has been avoided as far as is practicable, occurs within areas of relatively degraded vegetation, and avoids areas of high conservation value within adjacent A Class reserves. Offsets will also be implemented as appropriate.</td>
</tr>
<tr>
<td><strong>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.</strong></td>
<td>The Proposal lies within and adjacent to existing disturbed areas along Wanneroo Road, Romeo Road, Perth-Butler railway and the Butler urban residential area. Clearing has been avoided as far as is practicable, occurs within areas of relatively degraded vegetation, and avoids areas of high conservation value within adjacent A Class reserves. The Proposal incorporates design considerations and management measures to maintain and enhance the biological diversity and ecological integrity of adjacent A Class reserves.</td>
</tr>
<tr>
<td><strong>Improved valuation, pricing and incentive mechanisms should be promoted.</strong></td>
<td>Main Roads acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors have played a role in determining infrastructure planning and design, including the avoidance of clearing within A Class Reserves, the capture/treatment of stormwater within the road reserve, and the provision of fencing along the boundary with Neerabup National Park.</td>
</tr>
</tbody>
</table>
4.5 Justification for undertaking the proposal in the manner proposed including avoidance and mitigation

The Proposal is considered justified based on the following:

- The Proposal is consistent with the Regional Road Reserve under the Metropolitan Region Scheme
- The Proposal provides substantial social and economic benefits (see Section 6.4)
- The Proposal has been developed with consideration to appropriate stakeholder consultation (see Sections 6.1 and 6.2)
- The Proposal incorporates substantial impact avoidance (see Section 3.4.1) and established, effective construction management measures (see Sections 3.4.2 and 3.4.3)
- The Proposal includes design and construction measures that protect and enhance the integrity of adjacent Class A reserves (Neerabup National Park and Neerabup Nature Reserve) (see Section 4.1.1)
- The Proposal is consistent with EPBC Act objects and principles of ESD including the precautionary principles (see Section 4.4)
- The Proposal is not inconsistent with relevant Commonwealth Recovery Plans, Threat Abatement Plans and Conservation Advice (see Section 4.7).

4.6 Residual impacts and compensatory measures

The Proposal may cause significant residual impacts to BWSCP TEC and/or Black Cockatoos and Main Roads proposes an offset to counter balance these potential impacts, as presented in Section 5.

4.7 Application of Recovery Plans and Threat Abatement Plans

The Proposal is not inconsistent with the relevant recovery and threat abatement plans and conservation advice as identified by DEE, as presented in Table 11.
Table 11  Assessment against Recovery and Threat Abatement Plans

<table>
<thead>
<tr>
<th>Recovery Plan / Abatement Plant</th>
<th>Assessment against Plan</th>
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</table>
| Department of Parks and Wildlife 2013, Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan, Department of Parks and Wildlife, Perth, Western Australia. | The objective of this Recovery Plan is to stop further decline in the distribution and abundance of Carnaby's Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases. The recovery actions within the plan include:  
- Protect and manage breeding habitat and associated feeding habitat  
- Protect and manage of non-breeding habitat  
- Undertake regular monitoring  
- Conduct research to inform management  
- Manage other impacts  
- Engage with the broader community  
- Undertake information and communication activities.  
The Recovery Plan specifies activities that will adversely affect Carnaby's Cockatoo should be avoided, and then minimised or mitigated if avoidance cannot be achieved.  
The Proposal will not involve clearing of any known breeding trees/hollows and lies 14 km from the closest breeding record for Carnaby's Cockatoo. The Proposal will not involve clearing of any known roosting trees.  
The Proposal has been subject to survey to identify Black Cockatoo habitat; and consideration of Carnaby's Cockatoo habitat mapping by DBCA. The Proposal has been planned and designed to minimise clearing of potential breeding habitat and foraging habitat for Carnaby's Cockatoo. The Proposal incorporates design and management measures to protect potential breeding habitat and foraging habitat in adjacent native vegetation, including within A Class reserves (Neerabup National Park and Neerabup Nature Reserve). Accordingly, the Proposal is not inconsistent with the Carnaby's Cockatoo Recovery Plan (2013). |
| Department of the Environment and Energy 2014, Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi, Commonwealth of Australia. | The goal of this Threat Abatement Plan is to minimise the impacts of dieback on MNES under the EPBC Act and priority biodiversity assets identified by the actions of this plan. The plan has three objectives: 1. Identify and prioritise for protection biodiversity assets that are, or may be, impacted by dieback.  
2. Protect priority biodiversity assets through reducing the spread and mitigating the impacts of dieback.  
3. Communication and training.  
The Threat Abatement Plan identifies road construction as a high risk activity requiring dieback education, restricting access to infected locations, and enforcing hygiene procedures to minimise the spread of dieback in the landscape. |
Recovery Plan / Abatement Plant | Assessment against Plan
--- | ---

The Proposal lies on Spearwood Dunes, which comprises calcareous / alkaline soils that are typically antagonistic to *P. cinnamomi*. Dieback survey (Glevan 2019) found no evidence of *P. cinnamomi* and no expression of Dieback despite records of *P. nicotianae* and *P. multivora* within the DE, and the predominance of susceptible species and extensive disturbance within the DE. The closest record of *P. cinnamomi* is approximately 5 km to the north-east of the DE (Glevan 2019).

The lack of Dieback expression and *P. cinnamomi* records despite the existing disturbance and susceptible species suggests that the presence of calcareous soils (and dry, elevated sands) of the Spearwood Dunes may retard the introduction and/or spread of *Phytophthora* and provide a degree of resistance to Dieback expression.

Irrespective of the potential resistance to Dieback, as a precautionary measure the Proposal CEMP incorporates dieback hygiene management measures, including vehicle/plant hygiene, Clean on Entry/Exit points and communication/training of construction personnel. The Proposal also avoids intrusion into adjacent high conservation values of A Class Reserves, and incorporates design and construction measures (e.g. fencing, access controls) to prevent unauthorised access into the A Class Reserves, which will minimise the potential for introduction and spread of *Phytophthora*.

Given the potential resistance to Dieback, the precautionary management measures and the protection of high conservation values, the Proposal is not inconsistent with the Dieback Threat Abatement Plan (2014).

Chapman, T 2008, Forest Black Cockatoo (*Baudin’s Cockatoo Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan, Department of Environment and Conservation, Western Australia.

The objective of this Recovery Plan is to stop further decline in the breeding populations of Baudin’s Cockatoo and FRTBC and to ensure their persistence throughout their current range in the south-west of Western Australia.

Critical habitat has been identified in this Recovery Plan as areas:
- Currently occupied by the cockatoos
- Not currently occupied by the cockatoos due to recent fire but capable of supporting cockatoo populations when sufficiently recovered
- Of natural vegetation in which the cockatoos nest, feed and roost
- Of natural vegetation through which the cockatoos can move from one occupied area to another
- Of suitable vegetation within the recorded range in which undiscovered cockatoo populations may exist.

Priority actions within the plan include (listed in highest to lowest priority):
- Seek the funding required to implement future recovery actions
- Determine and promote non-lethal means of mitigating fruit damage by Baudin’s Cockatoo in orchards
- Eliminate illegal shooting
- Develop and implement strategies to allow for the use of noise emitting devices in orchards
- Determine and implement ways to remove feral Honeybees from nesting hollows
Identify factors affecting the number of breeding attempts and breeding success and manage nest hollows to increase recruitment
Determine and implement ways to minimise the effects of mining and urban development on habitat loss
Determine and implement ways to manage forests for the conservation of Forest Black Cockatoos
Identify and manage important sites and protect from threatening processes
Map feeding and breeding habitat critical to survival and important populations, and prepare management guidelines for these habitats
Monitor population numbers and distribution
Determine the patterns and significance of movement.

With respect to urban development, the following recovery actions are specified:
- Fauna survey to identify presence of Commonwealth listed threatened fauna species and referral of any proposed impacts to DEE
- Wherever possible, retention of habitats known to be used for feeding, breeding and roosting by Forest Black Cockatoos
- Obtain advice from State Government and Western Australian Museum on protection of remaining habitat.

The Proposal is not related to mining, orchards or forest management, nor is the Proposal expected to increase the prevalence of feral honeybees or risk of illegal shooting.

As a component of urban development, the Proposal has been subject to survey to identify Black Cockatoo habitat (including consideration of Black Cockatoo habitat mapping by DBCA and breeding records from WA museum).

The DE avoids known breeding and roosting sites for FRTBC, and does not comprise breeding habitat for FRTBC. The DE has been planned and designed to minimise clearing of FRBTC foraging habitat. The Proposal incorporates design and management to protect and enhance the integrity of adjacent A Class reserves (Neerabup National Park and Neerabup Nature Reserve) which include FRTBC habitat.

Accordingly, the Proposal is not inconsistent with the Forest Black Cockatoo Recovery Plan (2008).

The Conservation Advice states the main ongoing threats to BWSCP TEC are:
- Clearing and fragmentation, including urban development especially in the Perth metropolitan region
- Dieback diseases, especially Phytophthora
- Invasive species
- Fire regime change, particularly increased fire frequency
- Hydrological degradation
<table>
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<tr>
<th>Recovery Plan / Abatement Plant</th>
<th>Assessment against Plan</th>
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<tr>
<td></td>
<td>• Climate change</td>
</tr>
<tr>
<td></td>
<td>• Grazing</td>
</tr>
<tr>
<td></td>
<td>• Decline in pollinating and seed dispersing fauna</td>
</tr>
<tr>
<td></td>
<td>• Loss of keystone Banksia species.</td>
</tr>
</tbody>
</table>

The Conservation Advice recommends the following priority protection and restoration actions:

1. Prevent vegetation clearance and direct habitat damage, through:
   - Identify and map priority areas for protection/restoration
   - Prevent further clearance, fragmentation particularly for high conservation value, unmodified and old growth areas
   - Consider important landscape connections for reservation or other conservation tenure
   - Reduce cumulative impacts through liaison and planning with Local and State Government
   - Avoiding and mitigating impacts before offsetting, and match offsets to the same sub-community
   - Protect soil seed bank
   - Retain fauna habitat features and protect fauna during construction.

2. Prevent weeds, feral animals, dieback and other diseases, though:
   - Minimise soil disturbance
   - Avoid introduction and spread of weeds
   - Prevent introduction of feral and domestic animals
   - Monitor *P. cinnamomi* and manage early for local eradication
   - Appropriate weed and disease hygiene
   - Monitoring and treatment of weeds for new roads, for several years after construction
   - Avoid impacts on non-target species from control actions.

3. Manage groundwater abstraction.

4. Manage fire, through identifying appropriate fire regimes, weed control and implementing fire management.

5. Preventing grazing damage, through fencing and managing populations.

6. Revegetation, including:
   - Use local seeds for canopy/understorey and species resilient to climate change
   - Site specific restoration with appropriate FCT
   - Restore wildlife corridors and linkages
   - Habitat for conservation significant species, including Carnaby's Cockatoo
   - Adaptive management regimes
### Recovery Plan / Abatement Plant

<table>
<thead>
<tr>
<th>Assessment against Plan</th>
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<tbody>
<tr>
<td>– Weed management.</td>
</tr>
<tr>
<td>7. Communication and support, including a communication strategy, education programs, local participation, promotion of awareness with agencies and industries, and measures for new residential areas.</td>
</tr>
<tr>
<td>The Proposal is not expected to alter the fire regime, hydrological regimes or introduce grazing pests or feral/domestic animals within BWSCP TEC patches.</td>
</tr>
<tr>
<td>The Proposal is not inconsistent with the recommendations of the Conservation Advice, through the following:</td>
</tr>
<tr>
<td>• Survey and mapping of TEC extent and condition</td>
</tr>
<tr>
<td>• Minimised clearance of TEC and avoiding fragmentation of any TEC patches</td>
</tr>
<tr>
<td>• Avoiding clearance of TECs in high conservation value, unmodified areas (Excellent condition vegetation) within adjacent A Class reserves</td>
</tr>
<tr>
<td>• Avoided and mitigated impacts to TEC (see Sections 3.4.1 and 3.4.2), and provision of offsets from the same sub-community.</td>
</tr>
<tr>
<td>• Local harvesting and reuse of topsoil for revegetation within the road reserve</td>
</tr>
<tr>
<td>• Revegetation to use local, native species</td>
</tr>
<tr>
<td>• Weed and Dieback surveys, treatment and hygiene to avoid the introduction and spread of weeds and Dieback</td>
</tr>
<tr>
<td>• Fire controls to prevent the outbreak and spread of fire during construction</td>
</tr>
<tr>
<td>• Access controls and fencing to prevent unauthorised access that could introduce or spread weeds, Dieback or fire</td>
</tr>
<tr>
<td>• Main Roads undertake ongoing monitoring and treatment of weeds in their road reserves, consistent with the Conservation Advice.</td>
</tr>
</tbody>
</table>

Accordingly, the Proposal is consistent with the priority protection and restoration actions of the Approved Conservation Advice for BWSCP TEC (2016).

The Conservation Advice states that the main identified threats to the FRTBC are illegal shooting, habitat loss, nest hollow shortage and competition from other species, and injury or death from European Honeybees.

The Conservation Advice recommends the following regional priority recovery and threat abatement actions:

• Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary
• Determine and implement ways to minimise the effects of mining on habitat loss
• Determine and implement ways to manage forests for the conservation of the subspecies
• Develop and implement a management plan for the control and reduction of non-managed European Honeybees in the region

Department of the Environment, Water, Heritage and the Arts 2009, Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo), Department of the Environment, Water, Heritage and the Arts.

Draft
<table>
<thead>
<tr>
<th>Recovery Plan / Abatement Plant</th>
<th>Assessment against Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Develop and implement a communication strategy to stop illegal shooting of FRTBCs and improve compliance with the relevant legislation.</td>
</tr>
<tr>
<td></td>
<td>The Proposal is not related to mining or forest management, nor is it expected to result in an increased prevalence of European Honeybees or illegal shooting of Black Cockatoos.</td>
</tr>
<tr>
<td></td>
<td>The Proposal is not inconsistent with the priority recovery and threat abatement actions within the Approved Conservation Advice for FRTBC (2009).</td>
</tr>
</tbody>
</table>
5. **Offsets**

5.1 **Proposed offset strategy**

Main Roads have pursued a number of options to develop an offset strategy to counterbalance the potential significant residual impacts of the Proposal to BWSCP TEC, Carnaby’s Cockatoo and FRTBC. These investigations have considered acquisition of vegetated land and provision of funding. Table 12 provides an overview of the offset package under consideration. Details of Offset 3 remains commercial in confidence at this time and will be provided upon the outcome of commercial negotiations.

Table 13 provides a summary of the potential for the offset package to counterbalance the potential significant residual impacts to BWSCP TEC, Carnaby’s Cockatoo and FRTBC. Appendix D provides a draft offset strategy with supporting information on each offset (except Offset 3 as noted above) and a completed offsets assessment guide and justification for each direct offset.

**Table 12 Overview of offset package under consideration**

<table>
<thead>
<tr>
<th>No.</th>
<th>Offset type</th>
<th>Offset summary</th>
<th>Property location</th>
<th>Existing tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct</td>
<td>Land transfer to DBCA</td>
<td>Lot 1 on Plan 62729, Banovich Road, Hill River WA</td>
<td>Freehold owned by Main Roads</td>
</tr>
<tr>
<td>2</td>
<td>Direct</td>
<td>Land transfer to DBCA</td>
<td>Lots 1921 and 2342, Ashworth Road, Gingin WA</td>
<td>Crown Reserve 24560 C Class – Gravel</td>
</tr>
<tr>
<td>3</td>
<td>Direct</td>
<td>Land transfer to DBCA</td>
<td>Confidential pending survey and commercial negotiations</td>
<td>Freehold owned by third party</td>
</tr>
<tr>
<td>4</td>
<td>Direct</td>
<td>Funding contribution to WA Offsets Fund Provisional sum $422,400 based on a 120 ha unimproved rural freehold property in Shire of Gingin, providing BWSCP TEC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 5   | Indirect    | Funding contribution to Murdoch University Research Proposal: Conservation Management for the long-term survivorship of Black Cockatoos endemic to the south-west of Western Australia: the application of telemetry to determine spatial ecology on the Perth-Peel Coastal Plain, south-west forest region and key breeding sites in response to a changing environment.
Table 13  Summary of offset package compensation for potential significant residual impacts

<table>
<thead>
<tr>
<th>No.</th>
<th>Offset</th>
<th>MNES values confirmed</th>
<th>Carnaby’s Black Cockatoo Residual impact: 132 ha x quality 6 = 79.24 ha total</th>
<th>Forest Red-tailed Black Cockatoo Residual impact: 105 ha x quality 6 = 63.00 ha total</th>
<th>Banksia Woodland TEC Residual impact: 50.1 ha x quality 6 = 30.06 ha total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Offset area (ha)</td>
<td>% of impact offset</td>
<td>Offset area (ha)</td>
</tr>
<tr>
<td>1</td>
<td>Banovich Road, Hill River</td>
<td>Confirmed: surveyed</td>
<td>200</td>
<td>35%</td>
<td>Site not suitable</td>
</tr>
<tr>
<td>2</td>
<td>Ashworth Road, Gingin</td>
<td>Inferred: survey underway</td>
<td>100</td>
<td>49%</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Confidential</td>
<td>Inferred: survey underway</td>
<td>225</td>
<td>38%</td>
<td>225</td>
</tr>
<tr>
<td>4</td>
<td>WA offset fund contribution</td>
<td>Provisional sum $422,400</td>
<td>Purchased land likely to contain Carnaby’s Cockatoo habitat but is not accounted for in the offset.</td>
<td>Purchased land may contain FRTBC habitat but is not accounted for in the offset.</td>
<td>120</td>
</tr>
<tr>
<td>5</td>
<td>Research offset</td>
<td>n/a</td>
<td>n/a</td>
<td>10%</td>
<td>n/a</td>
</tr>
<tr>
<td>Total potential offset</td>
<td></td>
<td></td>
<td>132%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
**Extent to which offset package compensates potential significant residual impacts**

As presented in Table 13, the offset package is expected to provide adequate compensation for potential significant residual impacts to Carnaby’s Cockatoo, FRTBC and BWSCP TEC.

Offsets 1 to 3 involve transfer of identified properties to DBCA, to provide at least 90% direct offset for significant residual impacts to Carnaby’s Cockatoo and FRTBC. Offset 5 will contribute 10% indirect offsets to ensure a total of at least 100% offset for significant residual impacts to Carnaby’s Cockatoo and FRTBC.

Offset 2 will involve transfer of an identified property to DBCA, to provide an estimated 55% direct offset for significant residual impacts to BWSCP TEC. Main Roads are working with DBCA to identify and acquire a suitable offset for the remaining 45% significant residual impacts to BWSCP TEC. In the interim, the offset strategy includes a provisional sum of $422,400 to the WA Offsets Fund. This sum provides for acquisition of an approximately 120 ha rural freehold property on the northern Swan Coastal Plain, which comprises approximately 120 ha of BWSCP TEC and provides the remaining 45% direct offset for significant residual impacts to the TEC.

The acquisition of an additional property for BWSCP TEC is likely to provide an additional offset for Carnaby’s Cockatoo and potentially for FRTBC. Such additional offsets are not accounted for in the offset package in order to provide maximum flexibility for securing a suitable offset for the BWSCP TEC.

Main Roads is investigating further land acquisition options to satisfy both the conservation priorities of DBCA and DEE offset requirements, and biological surveys are underway to confirm the suitability of various land parcels as offsets. This offset strategy will be refined based on the findings of surveys underway, consultation with DBCA and pursuit of additional offsets for BWSCP TEC. The refined offset strategy will inform preparation of an Offset Proposal, to achieve a minimum 90% direct offset and up to 10% indirect offset for all three MNES.

**Suitability of potential offset sites for BWSCP TEC and Black Cockatoos**

Offsets 1 to 3 are suitable offsets for Carnaby’s Cockatoo, located well within the distribution of the species and with confirmed or likely habitat values. The offsets lie within 5 km of other large habitat areas, providing habitat connectivity for the species across its range. Offset 4 is likely to comprise Carnaby’s Cockatoo habitat, but is not accounted for in the offset calculation.

Offsets 2 and 3 are suitable offsets for FRTBC, located within the distribution of species and with confirmed or likely habitat values. The offsets also lie within 5 km of other large habitat areas, providing habitat connectivity for the species across its range. Offset 1 is not a suitable offset, lying to the north and outside of the current FRTBC distribution. Offset 4 may potentially comprise FRTBC habitat, but is not accounted for in the offset calculation.

Offset 2 is a suitable offset for BWSCP TEC, lying within the distribution of the TEC and having a likely presence of the TEC. Offsets 1 and 3 are not suitable offsets as they comprise vegetation communities that do not support the TEC. Offset 4 provides sufficient funding to acquire land of a suitable size and located well within the distribution of the TEC on the northern Swan Coastal Plain.

**Conservation gain, timing and certainty**

Offsets 1 to 3 involve transfer of land to DBCA, with conservation gain through protection against loss and land management to maintain MNES values. The time to achieve conservation gain will be effective immediately upon land transfer and the level of certainty is high (90%).

Offset 4 involves contribution to the WA Offsets Fund to purchase land for transfer to the conservation estate, with conservation gain through protection against loss and land
management to maintain MNES values. The time to achieve conservation gain will be effective immediately upon land transfer and the level of certainty is high (90%).

**Land tenure, acquisition and management**

Options 1 to 4 will involve acquisition and transfer of land to DBCA. Main Roads does not have the authority to create conservation reserves. Main Roads will provide funds to DBCA for the acquisition of offset land and DBCA is responsible for arranging the land acquisition process. DBCA and the Conservation and Parks Commission are then responsible for the management of the land and creation of the conservation reserve.

Options 1 and 2 involve direct transfer of land owned by or vested in Main Roads. Options 3 and 4 involve acquisition of land from a third party, with DBCA arranging the acquisition and Main Roads providing funding either directly or via the WA Offsets Fund. Once Main Roads has provided the funds to DBCA for acquisition and management of the land, DBCA will be responsible for the ongoing management and conservation of the offset land.

### 5.2 EPBC Act Environmental Offsets Policy

The proposed offset strategy is consistent with the principles of the EPBC Act Environmental Offsets Policy (DSEWPaC 2012) as presented in Table 14.

**Table 14 Consistency with EPBC Act Environmental Offsets Policy**

<table>
<thead>
<tr>
<th>Policy overarching principles</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter</td>
<td>The offsets will provide a conservation outcome that maintains or improves the viability of the BWSCP TEC, Carnaby’s Cockatoo and FRTBC. The offset strategy provides at least 100% offset for all three protected matters. The conservation outcome will be achieved through protecting the protected matters through transfer of BWSCP TEC and Carnaby’s Cockatoo and FRTBC habitat to DBCA.</td>
</tr>
<tr>
<td>Suitable offsets must be built around direct offsets but may include other compensatory measures</td>
<td>The offset strategy is built around direct offsets, involving a package of suitable offset properties to provide at least 90% direct offsets for Carnaby’s Cockatoo and FRTBC, and suitable offset properties and funding to provide 100% direct offsets for BWSCP TEC. The offset strategy includes up to 10% indirect offsets for Carnaby’s Cockatoo and FRTBC through funding a Murdoch University Research Proposal.</td>
</tr>
<tr>
<td>Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter</td>
<td>All direct offsets will be transferred to DBCA. DBCA and the Conservation and Parks Commission are then responsible for the management of the land and creation of the conservation reserve, providing in perpetuity protection and management. The quantum of offsets proposed are in proportion to the level of statutory protection applied to the BWSCP TEC (Endangered), Carnaby’s Cockatoo (Endangered) and FRTBC (Vulnerable), as presented in the offset assessment guide calculations.</td>
</tr>
<tr>
<td>Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter</td>
<td>The offsets will be of a size and scale proportional to the residual impacts on BWSCP TEC, Carnaby’s Cockatoo and FRTBC. The offset strategy provides at least 100% offset for all three protected matters. The provision of direct offsets is based on completed offset assessment guide calculations, incorporating evidence based justification for all inputs. The provisional sum for the WA Offset Fund, if required, is also based on completed offset assessment guide calculations.</td>
</tr>
<tr>
<td>Policy overarching principles</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Suitable offsets must effectively account for and manage the risks of the offset not succeeding</td>
<td>The estimation of direct offsets is based on completed offset assessment guide calculations, incorporating a conservative assessment of risk of the offset not succeeding. Main Roads has a history of offset management, including provision of land to DBCA for ongoing management and conservation. The transfer of land to DBCA is expected to have a high chance (90%) of successfully delivering the required conservation outcomes.</td>
</tr>
<tr>
<td>Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs</td>
<td>The proposed offsets are additional to any other requirements.</td>
</tr>
<tr>
<td>Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable</td>
<td>The proposed offsets identified in the offset strategy will be acquired and implemented in consultation and agreement with DBCA as the State agency with lead responsibility for conservation. Contribution to the WA Offsets Fund, if required, will support an established fund used by the State Government for the strategic acquisition of land for the conservation estate. The direct offsets will involve an efficient and timely transfer of land to DBCA. Main Roads, working with DBCA, is experienced and has the resources to fund acquisition and transfer of properties to DBCA for ongoing management and conservation. The direct offsets will be scientifically robust, based on surveys of the Proposal DE and offset properties. Indirect offsets will involve research by established researchers in the field of Black Cockatoo conservation. The Offset Proposal will be a transparent document developed in consultation with DBCA and relevant local stakeholders.</td>
</tr>
<tr>
<td>Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced</td>
<td>All offset sites will be managed by DBCA through conservation tenure. The Offset Proposal will be based on a Memorandum of Understanding between Main Roads and DBCA, including requirements for land management and monitoring.</td>
</tr>
</tbody>
</table>
6. Economic and Social Matters

6.1 Public consultation activities and outcomes

6.1.1 Communication and stakeholder engagement strategy

Main Roads have developed a Communication and Stakeholder Engagement Strategy which identifies stakeholders to be consulted for the Proposal, including:

- Federal Government Minister for Infrastructure and Transport and Regional Development
- State Government Minister for Transport and Planning
- Alkimos Integration Group (AIP) and Yanchep Rail Communications Coordination Group (YRCCG) (City of Wanneroo, Landcorp, PTA, Metronet, Water Corporation)
- Government agencies such as Main Roads, Public Transport Authority, Metronet, Department of Transport
- Emergency services
- Federal and State members of Parliament
- Wanneroo and Joondalup Local Government Authorities
- Businesses
- Schools
- Local resident organisations
- Special interest groups
- Landowners.

Main Roads has commenced the consultation process, including a State Government funding announcement, project meetings with the AIG and YRCCG, and creation of an information webpage.

Consultation is proceeding to a presentation to City of Wanneroo, MP briefings, emails/letters to stakeholders, newsletters and social media/online survey, to be undertaken in June/July 2019.

Community drop off sessions are planned for August 2019. A Community Reference Group (CRG) will be formed, with the meetings scheduled for September and November 2019.

Stakeholder feedback will be considered and incorporated into design and construction where relevant and practicable.

6.1.2 Engagement with DBCA

Main Roads have undertaken detailed consultation with DBCA given the Proposal’s location adjacent to the Neerabup National Park and Neerabup Nature Reserve.

Table 15 presents matters discussed with DBCA and Main Roads responses.

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3 https://project.mainroads.wa.gov.au/home/Pages/Mitchell-Freeway-Extension.aspx
### Table 15 Outcomes of DBCA Consultation

<table>
<thead>
<tr>
<th>No.</th>
<th>DBCA matter raised</th>
<th>Main Roads response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DBCA to delay development of walk trail and car park at Neerabup Nature Reserve until Proposal is completed, with an interim informal car park to be constructed prior to the Proposal.</td>
<td>Carpark access to be addressed in Proposal scope.</td>
</tr>
<tr>
<td>2</td>
<td>Provision of an underpass (pedestrian/fauna combined) under Wanneroo Road linking the Neerabup Nature Reserve walk trail with the existing Yaberoo Budjara Heritage Trail within Neerabup National Park.</td>
<td>Included in Proposal scope.</td>
</tr>
<tr>
<td>3</td>
<td>Agreement to consolidation of multiple informal accesses off Wanneroo Road to a single access at a safe location on Wanneroo Road, as part of the Proposal.</td>
<td>Consolidation of access off Wanneroo Road included in Proposal scope.</td>
</tr>
<tr>
<td>4</td>
<td>Provision of a pedestrian underpass or footpath/pedestrian crossing of Romeo Road to connect trails to the north and south.</td>
<td>Pedestrian access included in Proposal scope.</td>
</tr>
<tr>
<td>5</td>
<td>Provision of a pedestrian gated link to the National Park / Heritage Trail from Lukin Drive.</td>
<td>Included in Proposal scope.</td>
</tr>
<tr>
<td>7</td>
<td>Provision of fencing along Neerabup National Park.</td>
<td>1.8 m standard fencing included in Proposal scope.</td>
</tr>
</tbody>
</table>
| 8   | Concern regarding surface runoff from Burns Beach to Romeo Road section, which has overtopped culverts and flowed into National Park.  
DBCA request to review drainage designs.                                                                                                              | Main Roads to provide draft drainage design to DBCA for review for stormwater adjacent and uphill of reserves.  
Culverts and infiltration areas to be sized for 1 in 100 Average Recurrence Period event.                                                                                                            |
| 9   | Current lack of delineation between National Park and road reserve.  
DBCA requested a fire break on both sides of proposed boundary fence (4 m width).                                                                                                                               | Further discussion required with DBCA to determine approach for development of firebreaks.                                                                                                              |

### 6.2 Consultation with indigenous stakeholders

Main Roads undertook consultation with representatives of the Whadjuk WC 2011/009 Native Title Claim (NTC) group on 19 February 2019, as part of an ethnographic survey under the *Aboriginal Heritage Act 1972* (AH Act). The NTC group representatives were nominated by the South West Aboriginal Land and Sea Council, in response to an Activity Notice submitted by Main Roads under their Noongar Standard Heritage Agreement with the Whadjuk people.

The NTC group did not identify any ethnographic sites of significance as identified under Section 5 of the AH Act. No approval is required under the AH Act for the Proposal.

Table 16 presents requests made by the NTC group representatives during the ethnographic survey and Main Roads responses.
Table 16 Outcomes of indigenous stakeholder consultation

<table>
<thead>
<tr>
<th>No.</th>
<th>NTC group request</th>
<th>Main Roads response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limit the loss of flora in the northern portion of the DE and retain native vegetation along the margins of roads.</td>
<td>Main Roads has and will continue to limit clearing of native vegetation to the minimum extent practicable.</td>
</tr>
<tr>
<td>2</td>
<td>Balga trees containing commercial value to be salvaged by specialists and on-sold for landscaping thereby preserving some of these culturally important plants.</td>
<td>Balga trees will be salvaged where practicable and economically feasible.</td>
</tr>
<tr>
<td>3</td>
<td>Rehabilitation after construction to use local indigenous species.</td>
<td>Main Roads will use local native species in rehabilitation.</td>
</tr>
<tr>
<td>4</td>
<td>Main Roads to provide the Whadjuk working party further information on:</td>
<td>Main Roads will provide the Whadjuk working party with the requested information as this becomes available, and prior to the commencement of construction.</td>
</tr>
<tr>
<td></td>
<td>- Proposed maintenance of the Yaberoo Budjara Heritage Trail</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Modelling of groundwater flow and any impacts from the Proposal to lakes to the east.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Main Roads to endeavour to avoid standing limestones located within Place ID 37478 (Pinnacles) during the extension work to connect Romeo Road to Marmion Avenue.</td>
<td>Place ID 37478 has been determined by the WA Aboriginal Cultural Materials Committee to not be a significant site under the AH Act. No approval is required to disturb the site under the AH Act.</td>
</tr>
<tr>
<td>6</td>
<td>Monitors to be present for clearing of dunes to manage the risk of uncovering skeletal remains.</td>
<td>Main Roads will engage monitors during ground disturbing works in dunes.</td>
</tr>
</tbody>
</table>

6.3 Monitoring ongoing changes to economic and social characteristics

Monitoring of ongoing changes to economic and social benefits is undertaken on a broad basis across the Perth metropolitan area and includes the following:

1. Traffic monitoring and modelling, which is incorporated into reviews of predicted travel time and traffic congestion levels upon opening to traffic. After 12 months of operation, Main Roads will review the travel times and congestion levels to confirm whether or not targets have been met. A detailed traffic analysis report has been commissioned and will be sent to Infrastructure Australia and Department of Transport for review.

2. Vehicle crash data, which is collected and analysed for trends and future investment allocation. The Proposal is predicted to achieve certain crash reduction benefits after completion. After 12 month period, a full crash audit is undertaken to determine the extent of the crash savings. This report is sent to Department of Transport and to Infrastructure Australia.

3. Vehicle Operating Costs are a key component of the determination of a projects benefit profile. After 12 months of the Proposal being open, modelling will be undertaking to determine the network wide benefits of the Proposal. This report is sent to Department of Transport and to Infrastructure Australia.
6.4 Projected economic costs and benefits and basis for estimation

6.4.1 Projected costs and benefits
Main Roads engaged Ernst & Young (2019) to an economic cost benefit analysis (CBA) of the Proposal, to support a Business Case submission to Infrastructure Australia. The CBA analysed costs and benefits over a 4 year construction period and 30 year operating period, with a 7% real discount rate\(^4\).

Ernst & Young (2019) estimated the present value of benefits at $374 million, with the majority (72%) occurring through travel time savings. EY (2019) estimated present value of costs at $195 million, resulting in a net present value (NPV) of $179 million and benefit cost ratio (BCR) of 1.9. Sensitivity analysis (4% to 10% discount rate, ± 30% construction cost, ± 30% benefits), indicated a BCR above one, suggesting the NPV result is robust.

6.4.2 Basis for estimation
The CBA included the following categories (Ernst & Young 2019):

- **Costs**
  - Construction
  - Maintenance
  - Renewal

- **Benefits**
  - Travel time savings
  - Vehicle operating cost savings
  - Crash cost impacts
  - Reliability improvements
  - Rest of network maintenance impacts
  - Externalities
  - Residual value (resource correction)

Construction costs were estimated from engineering design and current construction rates provided by the construction industry in Perth. Maintenance and renewal costs were estimated from Main Roads’ operational data for the Mitchell Freeway.

Benefits were estimated through outputs from Main Roads’ Regional Operations Model v24 (ROM24), which is a multi-modal strategic transport model. ROM24 incorporates trip generation, trip distribution, modal split and traffic assignment. This enables calculation of benefits as a function of vehicle trips, travel time, travel distance, speed, vehicle type and trip purpose. For example, externalities were calculated on the basis of changes in vehicle kilometres travelled (VKT) by vehicle types and the value of associated air pollution impacts and greenhouse gas emissions.

6.4.3 Non-monetised benefits
In addition to the monetised costs and benefits analyses through the CBA, the Proposal is expected to benefit the local economy by (Main Roads 2019):

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\(^4\) Real discount rate is the nominal discount rate minus inflation.
• Optimising existing rail and road infrastructure (including the extension of the Joondalup Line to Yanchep) to increase capacity required to meet the growing population in the north west subregion

• Improving access to passenger transport in the outskirts of northern Perth, particularly the emerging Yanchep City, which is forecast to become the second biggest city within the greater Perth and Peel Region

• Supporting sustainable, higher density development in the northwest subregion through improving connectivity and encouraging business development and associated employment opportunities in areas of high population growth

• Promoting private investment in key economic centres in the north west by accelerating land use outcomes through a reduction in congestion and improved access to jobs, services and social opportunities for people living and working in the north west subregion and corridor

• Promoting greater levels of subregional employment self-sufficiency through improved connectivity between growing residential areas and local employment hubs.

6.5 Employment opportunities

The Business Case to Infrastructure Australia (Main Roads 2019) identified the Proposal objectives as including:

“Support key activity centres and employment nodes to meet the future needs of industry, commerce and the community through improving connectivity.”

The Business Case identifies lack of key infrastructure as preventing Alkimos and Yanchep City Centres from becoming important, connected employment areas. This will ultimately hinder the performance of these critical community hubs, as well as surrounding suburbs, resulting in potentially lower levels of economic activity that would have otherwise been enjoyed if appropriate investment into necessary transport infrastructure had taken place.

The Business Case identifies that the Proposal will support high density development, investment and connectivity in the northwest suburbs, encouraging business development and subregional employment self-sufficiency.

Further to the evaluation of the Business Case, the Australian Government has committed $107.5 million towards the Proposal.

In addition to the ongoing employment benefits during the operational period, the Proposal will provide direct employment benefits during the construction period.

6.6 Benefits to the local and wider community

The Proposal will provide benefits to the local and wider community through the following:

• Employment and expenditure for road construction, maintenance and renewal

• Reduced travel time, vehicle operating cost and vehicle crashes

• Optimised existing rail and road infrastructure (including the extension of the Joondalup Line to Yanchep) to meet the growing population in the north west subregion

• Improved access to passenger transport in the outskirts of northern Perth, particularly the emerging Yanchep City, which is forecast to become the second biggest city within the greater Perth and Peel Region

• Support for sustainable, higher density development in the northwest subregion through improving connectivity and encouraging business development and associated employment
• Promotion of private investment by accelerating land use outcomes through reduced congestion and improved access to jobs, services and social opportunities

• Promotion of greater levels of subregional employment self-sufficiency through improved connectivity between growing residential areas and local employment hubs

• Protection and enhancement of the integrity of A Class reserves of Neerabup National Park and Neerabup Nature Reserve, including enhanced access to the Neerabup Nature Reserve and Yaberoo Budjara Heritage Trail.

### 6.7 Alternatives

The Proposal is consistent with strategic transport planning for the Perth metropolitan region, including planning for Metronet and the Perth-Yanchep railway, and reflects the Metropolitan Region Scheme corridors for Mitchell Freeway and Wanneroo Road.

The alternative to the Proposal is no development, with the consequent loss of social and economic benefits presented in this section.
7. Conclusion

A summary of the information requested by DEE is provided in Table 17.

The Proposal is considered to be acceptable and justifiable given the extent of impact avoidance, effective impact mitigation, protection of high conservation value areas, lack of significant indirect impacts, provision of an offset to counterbalance significant direct impacts, consistency with Government policies and strategies, consideration of key stakeholder requirements, and net economic and social benefits to the local and wider community.

Table 17 Summary of information requested for Preliminary Documentation

<table>
<thead>
<tr>
<th>Information Requested</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listed threatened species and ecological communities</td>
<td>Figure 2 and Table 4 present the extent and condition of patches of BWSCP TEC within the DE. The DE covers 50.07 ha of BSWSCP TEC over seven patches. Within the DE, approximately 9% of the TEC is in Excellent to Very Good, 33% is in Very Good, 11% is in Very Good to Good, 27% is in Good, 13% is in Good to Degraded and 6% is in Degraded to Completely Degraded condition.</td>
</tr>
<tr>
<td>The Department understands that further surveys have been, and will be undertaken to determine the presence and extent of the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (BWSCP TEC) (Endangered) within the proposal site. Please advise, including a map, of the hectares and condition of BWSCP TEC that occurs within the proposal site that will be cleared as part of this proposal.</td>
<td>Table 7 and Figure 4 present the Black Cockatoo habitat within the DE. The DE comprises potential breeding habitat for Carnaby’s Cockatoo, including 328 potential breeding trees (DBH &gt; 500 mm) of which eight trees have hollows suitable for nesting, with 22 suitable hollows total. No evidence of breeding was recorded. The DE does not comprise potential breeding habitat for FRTBC. The DE includes 104.17 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for Carnaby’s Cockatoo. The DE includes 76.34 ha of quality foraging habitat and 27.90 ha of low quality foraging habitat for FRBTC. No roost sites were observed within the DE.</td>
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<td>Please advise the hectares, including a map, of foraging, breeding and roosting habitat for the Carnaby’s black Cockatoo (Calyptorhynchus latirostris) (Endangered) and the Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso) (Vulnerable) that occurs within the proposal site and that will be cleared as part of this proposal. Additionally, please advise and provide a map of the number of potential breeding trees (including the number of trees with suitable hollows) that occur within the proposal site and will be cleared as part of this proposal.</td>
<td>The BSWSCP TEC within the DE occurs as wider patches outside the DE. Figure 2 and Table 3 present the extent and condition of patches of BWSCP TEC within the wider survey area. The BWSCP TEC covers approximately 350 ha over 13 patches within the Survey Area which extends beyond the DE. The TEC is predominantly (285.40 ha or 82% of total) contained within a single large patch (Patch 4), which is primarily located within Neerabup National Park. The remaining 12 patches are relatively small in area, varying from approximately 1 to 14 ha. The Proposal is not expected to cause significant indirect impacts to the BWSCP TEC</td>
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<td>Please confirm whether the BWSCP TEC that occurs within the proposal site forms part of a larger patch. If the BWSCP TEC forms part of a larger patch, please provide details of any potential impacts to the BWSCP TEC in these adjoining and surrounding areas. When discussing potential impacts, please give consideration to the local, regional, state and national scale and the precautionary principle. This discussion should include (but not be limited to) consideration, including appropriate avoidance and mitigation of, fragmentation and edge effect risks, changes in surface water run-off, changes in nutrient cycling, mobilisation of acid sulfate soils and the</td>
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The referral noted that a 'suspected infestation' of Dieback (*Phytophthora cinnamomi*) had previously been identified at Marmion Avenue (8 km south-west of the proposal site). While the potential infestation was outside the proposal site, and only suspected, the Department considers that there is a possibility that the proposal may increase the risk of Dieback infestation in the proposed site and surrounding areas due to the potential of the proposal to disturb soils and vegetation. Please describe the measures that will be undertaken to avoid and/or mitigate the potential impacts of Dieback to the BWSCP TEC at the proposal site and in adjoining areas. This discussion should reference Candlestick Banksia (*Banksia attenuata*), which is present in the proposal site and highly susceptible to Dieback due to its clustered roots.

The referral noted the presence of weeds including Bridal Creeper (*Asparagus asparagoides*), Apple of Sodom (*Solanum linnaeanum*) and Arum Lily (*Zantedeschia aethiopica*) within the proposal site. Please identify the measures that will be undertaken to avoid and/or mitigate the impacts of weeds on EPBC Act listed species and ecological communities.

The referral noted that the proposed measures to be undertaken to avoid and/or mitigate impacts on EPBC Act listed species and ecological communities will be detailed in an Environmental Management Plan (EMP). Please ensure that the EMP is consistent with the Department's Environmental Management Plan Guidelines (2014) (available on the Department's website at http://www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines). Additionally and if available, please provide a copy of the draft EMP to the Department for review.

Note: Management plans must use terms such as 'will' and 'must' when committing to

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<td>potential introduction of pathogens and weeds. The discussion should include reference to the 'Banksia Woodland' which was described in the referral as 'well represented' in the Neerabup National Park, which is adjacent to the proposal site.</td>
<td>patches within the Survey Area, as discussed in detail in Section 3.3.2. The Proposal includes fencing along Neerabup National Park, which will prevent unauthorised access and reduce the potential for spread of weeds, Dieback and fire from the DE, including from existing unauthorised access from urban residential areas, Wanneroo Road and Romeo Road.</td>
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<td>The referral noted that a 'suspected infestation' of Dieback (<em>Phytophthora cinnamomi</em>) had previously been identified at Marmion Avenue (8 km south-west of the proposal site). While the potential infestation was outside the proposal site, and only suspected, the Department considers that there is a possibility that the proposal may increase the risk of Dieback infestation in the proposed site and surrounding areas due to the potential of the proposal to disturb soils and vegetation. Please describe the measures that will be undertaken to avoid and/or mitigate the potential impacts of Dieback to the BWSCP TEC at the proposal site and in adjoining areas. This discussion should reference Candlestick Banksia (<em>Banksia attenuata</em>), which is present in the proposal site and highly susceptible to Dieback due to its clustered roots.</td>
<td>No Dieback expression or <em>P. cinnamomi</em> samples were found in the DE despite predominance of susceptible species (including Candlestick Banksia) and substantial existing site disturbance. The DE is expected to be resilient to Dieback expression due to the presence of well drained, calcareous soils of the Spearwood Dunes. As a precautionary measure the Proposal construction management includes hygiene measures to prevent the introduction and spread of Dieback. The Proposal includes fencing along Neerabup National Park, which will prevent unauthorised access and reduce the potential for spread of Dieback from the DE, including from existing unauthorised access from urban residential areas, Wanneroo Road and Romeo Road.</td>
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<td>The referral noted the presence of weeds including Bridal Creeper (<em>Asparagus asparagoides</em>), Apple of Sodom (<em>Solanum linnaeanum</em>) and Arum Lily (<em>Zantedeschia aethiopica</em>) within the proposal site. Please identify the measures that will be undertaken to avoid and/or mitigate the impacts of weeds on EPBC Act listed species and ecological communities.</td>
<td>The Proposal construction management includes weed treatment and hygiene, and revegetation with native species on local harvested topsoil with restricted use of fertiliser. Ongoing weed management will be undertaken in road drainage basins/swales to prevent spread of weeds into adjacent native vegetation. The Proposal includes fencing along Neerabup National Park, which will prevent unauthorised access and reduce the potential for spread of weeds from the DE, including from existing unauthorised access from urban residential areas, Wanneroo Road and Romeo Road. A CEMP has been prepared and is presented in Appendix C.</td>
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<td>The referral noted that the proposed measures to be undertaken to avoid and/or mitigate impacts on EPBC Act listed species and ecological communities will be detailed in an Environmental Management Plan (EMP). Please ensure that the EMP is consistent with the Department's Environmental Management Plan Guidelines (2014) (available on the Department's website at <a href="http://www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines">http://www.environment.gov.au/epbc/publications/environmental-management-plan-guidelines</a>). Additionally and if available, please provide a copy of the draft EMP to the Department for review. Note: Management plans must use terms such as 'will' and 'must' when committing to</td>
<td>The CEMP adopts such terminology.</td>
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<td>management actions, instead of 'where possible', 'as required', 'should' or 'may'. The Department will consider the terms used when assessing the proposed management measures within the management plan and may require further assurance in relation to measures which reduce potential impacts to EPBC Act listed species.</td>
<td>The Proposal will result in significant residual impacts to BWSCP TEC, Carnaby's Cockatoo or FRTBC due to direct impacts from clearing. Main Roads propose an offset to counterbalance potential significant residual impacts to BWSCP TEC, Carnaby's Cockatoo or FRTBC. The Proposal is considered acceptable and justifiable given:</td>
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<td>For the EPBC Act listed species and ecological communities proposed to be impacted by this proposal, please provide an overall conclusion as to the environmental acceptability of the proposal including:</td>
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<td>• A discussion on the consideration against the requirements of the EPBC Act, including the objects of the EPBC Act, the principles of ecologically sustainable development and the precautionary principle</td>
<td>• Substantial impact avoidance</td>
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<td>• Reasons justifying undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures</td>
<td>• Effective impact mitigation</td>
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<td>• If relevant, a discussion of residual impacts and any compensatory measures (e.g. offsets) proposed or required for significant residual impacts on EPBC Act listed species and ecological communities, and the relative degree of compensation and acceptability.</td>
<td>• Protection and enhancement of high conservation value areas</td>
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<td>Recovery plans / Threat abatement plans</td>
<td>• Consistency with EPBC Act objects and principles of ESD including the precautionary principle</td>
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<td>Please demonstrate that the action is not inconsistent with any relevant recovery plan or threat abatement plan, including (but not limited to):</td>
<td>• Consistency with Government policies and strategies, including the Metropolitan Region Scheme</td>
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<td>• Department of Parks and Wildlife (2013). Carnaby’s Cockatoo (Calyptorhynchus latirostris) Recovery Plan.</td>
<td>• Consideration of stakeholder requirements</td>
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<td>• Department of the Environment and Energy (2018). Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi.</td>
<td>• Provision of an offset to counterbalance potential significant residual impacts.</td>
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<td>Please demonstrate that the action has had regard to any relevant conservation advice, including (but not limited to):</td>
<td>The Proposal was assessed against and demonstrated to not be inconsistent with the identified Commonwealth Recovery Plans, Threat Abatement Plans and Conservation Advice.</td>
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<td>Threatened Species Scientific Committee (2016). Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community.</td>
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**Offsets**

To the extent that impacts to EPBC Act listed species and ecological communities cannot be avoided or mitigated, provide details of an offset(s) intended to compensate for residual significant impacts on EPBC Act listed species and ecological communities (if any), including:

- The type of offset(s) proposed
- The extent to which the proposed offset correlates to, and adequately compensates for, the residual significant impacts on EPBC Act listed species and communities
- Suitability of the location of any proposed offset site for EPBC Act listed species and communities
- Conservation gain to be achieved by the offset i.e. positive management strategies that improve the site or averting the future loss, degradation or damage of the protected matter
- Time it will take to achieve the proposed conservation gain
- Level of certainty that the proposed offset will be successful
- Current land tenure of any proposed land-based offset and the method of securing and managing that offset for 20 years or the period of impact (whichever is less).

Please demonstrate how any proposed offset is consistent with the Department's EPBC Act Environmental Offsets Policy (October 2012), and provide a completed offsets assessment guide and justification for the figures used to complete the offsets assessment guide.

**Social and economic considerations**

The Preliminary Documentation must address the economic and social impacts (both positive and negative) of the proposal. Consideration of economic and social matters may include:

- Details of any public consultation activities undertaken and the outcomes
- Details of any consultation with Indigenous stakeholders including any cultural and/or traditional activities in or relating to the proposal site
- Any monitoring programs to monitor ongoing changes to economic and social characteristics potentially affected by the proposal
- Projected economic costs and benefits of the proposal including the basis for their

Main Roads has undertaken consultation with key stakeholders including DBCA and Indigenous stakeholders and incorporated the outcomes into Proposal design and construction where relevant.

The Proposal has been subject to a Business Case and Cost Benefit Analysis, which demonstrates robust net economic benefits due to reduced travel time, reduced vehicle operating costs and reduced vehicle crashes, as well as a range of non-monetised benefits.

The Proposal provides employment during construction as well as supporting subregional employment through high density development, investment and connectivity in the north-west suburbs of Perth.

Main Roads has not been able to avoid and mitigate all impacts to threatened species and ecological communities. Main Roads propose to offer a package of offsets to counterbalance the potential significant residual impacts of the Proposal to BWSCP TEC, Carnaby’s Cockatoo and FRTBC. A draft offset strategy is provided in Appendix D.

The offset package is expected to provide adequate compensation for potential significant residual impacts to BWSCP, Carnaby’s Cockatoo and FRTBC. Main Roads will refine the offset strategy based on the findings of surveys underway and consultation with DBCA. The refined offset strategy will inform preparation of an Offset Proposal, to achieve a minimum 90% direct offset and up to 10% indirect offset for all three MNES.

The proposed offset strategy is consistent with the principles of the EPBC Act Environmental Offsets Policy.
### Information Requested

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<td>estimation</td>
<td>The Proposal provides a broad range of economic, social and environmental benefits to the local and wider community. The Proposal is consistent with strategic transport planning for the Perth metropolitan region and the alternative to the Proposal is no development, with a consequent loss of the forecast economic, social and environmental benefits.</td>
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<td>through cost/benefit analysis or similar studies</td>
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<td>• Employment opportunities expected to be generated by the proposal at each phase of the proposal</td>
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<td>• Benefits to the local and wider community as a result of the proposal</td>
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Economic and social impacts should be considered at the local, regional and national levels. Details of the relevant cost and benefits of any alternative options to the proposal may also be requested.
8. References


Chapman T 2008, Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan, Department of Environment and Conservation, Western Australia.


Department of Conservation and Land Management (CALM) 2003, Phytophthora cinnamomi and disease caused by it, Volume I – Management Guidelines, Government of Western Australia.


Department of the Environment and Energy (DEE) 2017, Revised draft referral guideline for three threatened Black Cockatoo species: Carnaby's Cockatoo (Endangered) Calyptorhynchus latirostris, Baudin's Cockatoo (Vulnerable) Calyptorhynchus baudinii, Forest Red-tailed Black Cockatoo (Vulnerable) Calyptorhynchus banksia naso, Commonwealth of Australia.


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Department of Premier and Cabinet (DPC) 2015, Perth and Peel @ 3.5 Million, Strategic Assessment of the Perth and Peel Regions Strategic advice, Draft EPBC Act Strategic Impact Assessment Report, Part D: MNES Assessment - Chapter 15, December 2015.


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GHD 2019, Mitchell Freeway Extension Hester Avenue to Romeo Road, Biological Survey, report prepared for Main Roads Western Australia, June 2019.


Heddle EM, Havel JJ and Loneragan OW 1980, Vegetation Complexes of the Darling System, Western Australia, In: Atlas of natural resources darling system, Western Australia, Department of Conservation and Environment, Perth, WA.


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Johnstone RE, Kirkby T and Sarti K 2017, The distribution, status movements and diet of the Forest red-tailed Black Cockatoo in the South-West with emphasis on the Greater Perth Region, Western Australia, The Western Australian Naturalist, Vol. 30 No. 4.


Main Roads 2019, Mitchell Freeway Extension, Business Case to Infrastructure Australia.


