



Main Roads Western Australia

Albany Ring Road Stage 2 and 3b (EPBC 2020/8769)

Offset Strategy

September 2021

Executive summary

The Proposed Action is the development and operation of the ARR Stage 2 and 3b, which includes approximately 7 km of new dual carriageway. The Commissioner of Main Roads is proposing to commence the construction of Stage 2 and 3b of the ARR in 2021 pending environmental approvals.

The Proposed Action will comprise a dual carriageway road that connects the intersection of the South Coast Highway with ARR in the north and Hanrahan Road with ARR in the south. This will connect the intersection of South Coast Highway and Link Road, to the Port of Albany, bypassing the City of Albany. Stage 2 of the ARR is the southern link of the ring road located between the Lower Denmark Road George Street Intersection and Frenchman Bay Road. The end of the proposed Stage 2 works occurs west of Festing Street. Stage 3b proposes to connect South Coast Highway to Lower Denmark Road.

It is likely the Proposed Action Area will be staged. The initial phase of this Proposed Action involves the construction of a two-way single lane carriage way only. The completion of the two-way dual carriageway is likely to occur around 2050.

The Proposed Action works include:

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

As the Proposed Action may 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 Proposed Action. The Preliminary Documentation was prepared in response to a request by Department of Agriculture, Water, and Environment (DAWE) on 14 October 2020 for additional information to support assessment of impacts for the Proposed Action (EPBC 2020/8769) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth Government of Australia 1999). The Preliminary Documentation has been subsequently revised to reflect a varied Proposed Action development envelope reduction. This has been documented via a section 156a request.

The Proposed Action will result in significant residual impacts to:

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

This draft Offset Strategy has been prepared to support the Preliminary Documentation, to demonstrate Main Roads' commitment to offset the Proposed Actions' significant residual impacts to Black Cockatoos and WRP. Main Roads are investigating the purchase of several private land parcels to develop an offset to counterbalance these residual impacts. The proposed direct offset involves acquisition of land by the Crown and vesting of the land management to Department of Biodiversity Conservation and Attractions (DBCA) as the lead agency in WA responsible for conservation management. Main Roads intends to have the required offsets in place within 12 months of commencement of construction, taking into account the time required to identify appropriate parcels of land, survey the parcel for the environmental attributes to be offset, negotiate with the landowner and then transfer the parcel/s into DBCA reserve. Main Roads also propose an indirect research proposal which will account for 10% of the offset proposed for Black Cockatoos.

As the site has yet to be purchased, the offset remains commercially confidential at this time. Main Roads will develop a detailed Offset Proposal for submission and approval under the EPBC Act once an agreement has been made with the landowner. This offset proposal will include:

- Baseline data to establish the quality and condition of the offset land parcel/s
- Monitoring and management measures that will maintain or improve the offset site for the life of the impact and ensure success of the offset.

Overview of offset package under consideration

The table below provides a summary of the potential for the offset package to counterbalance the potential significant residual impacts to Black Cockatoo and WRP.

The draft Offset Strategy will be refined subject to commercial negotiations with the property owners, and consultation with DBCA.

Offset type	Offset summary	Property Location	Existing tenure
Direct (90 – 100 %)	Land transfer to DBCA: <ul style="list-style-type: none"> • 38 ha of Black Cockatoo foraging and breeding habitat suitable for all three species • 145 ha of Black Cockatoo roosting habitat suitable for all three species, which may comprise part or all of the 38 ha of Black Cockatoo breeding and foraging habitat suitable for all three species • 135 ha of WRP habitat 	Confidential pending survey and negotiation with property owners	Freehold owned by third parties
Black Cockatoo compensatory offset measures	Installation of 42 artificial hollows to offset the loss of 10 trees (with 14 hollows) potentially suitable for Black Cockatoo nesting. The hollows will be installed in accordance with the DBCA <i>fauna notes on how to design and place artificial hollows</i> (DPAW 2015).		

Offset type	Offset summary	Property Location	Existing tenure
Indirect – Research proposal (10%) for Black Cockatoo	Main Roads is currently providing a funding contribution to Murdoch University to finance Black Cockatoo research. Funding for research is intended to comprise 10% of the total Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC offset requirement for this project.		

Summary of preliminary offset calculations

Preliminary offset calculations were completed using the EPBC Act Offset Assessment Guide to determine the offset packages being considered. As presented in the below table, the offset package for the Proposed Action will provide adequate compensation for significant residual impacts to the protected matters. The details are inferred as the offset properties under consideration has not been surveyed.

MNES	Habitat	Residual impacts	Offset Package
Carnaby's Cockatoo	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	38 ha = 91.42% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	145 ha = 90.82% of impact offset
Baudin's Cockatoo	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	38 ha = 91.42% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	145 ha = 90.82% of impact offset
FRTBC	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	35 ha = 91.25% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	133 ha = 90.27% of impact offset
WRP		19.18 ha x quality 6 = 11.51 ha	135 ha = 100.42% of impact offset

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1. Introduction

1.1 Proposed Action background

Main Roads is proposing to construct the Albany Ring Road (ARR) to provide for the long-term transport needs of Albany. The ARR will be a dedicated freight route around the City of Albany, in the Great Southern Region of Western Australia (WA) enabling the effective movement of freight to and from the Port of Albany. The ARR will cater for the travel demands associated with growth in grain, woodchip and other agricultural industries, increased mining production, increased population growth, urban expansion and the expected increase in tourists.

The location of the Port of Albany, adjacent to the Central Business District, presents a challenge for the movement of freight. The current access to the Port of Albany through the Albany townsite is inefficient due to the presence of major intersections and local traffic conditions. It passes through residential areas, commercial and light industrial zones which is also a safety concern.

The ARR alignment will allow for improved safety and efficient access to the Port of Albany, facilitate future growth in agricultural production and mining across the Great Southern Region by improving freight productivity and access to freight gateways. In addition to improving connectivity between major freight infrastructure, including airports and commercial and industrial areas, the construction of the ARR will also reduce the number of heavy vehicles sharing roads with local residents and tourists.

The current alignment of the ARR consists of four stages:

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

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

1.2 Proposed Action description

The Proposed Action is the development and operation of the ARR Stage 2 and 3b (Figure 1), which includes approximately 7 kilometres (km) of new dual carriageway. The Commissioner of Main Roads is proposing to commence the construction of Stage 2 and 3b of the ARR in 2021 pending environmental approvals.

The Proposed Action will comprise a dual carriageway road that connects the intersection of the South Coast Highway with ARR in the north and Hanrahan Road with ARR in the south. The

Proposed Action Area will connect the intersection of South Coast Highway and Link Road, to the Port of Albany around the City of Albany.

The Proposed Action Area aligns with the ultimate Stage 2 and 3b design disturbance footprint where the final phase of development will include a two-way dual carriageway. The Proposed Action Area has been revised and its extent reduced during the design phase post referral. The Preliminary Documentation, including this Offset Strategy, have been revised to reflect this reduction in impact, consistent with the submitted section 156a request.

The completion of the two-way dual carriageway is likely to occur around 2050. The initial phase of this Proposed Action involves the construction of a two-way single lane carriage way only.

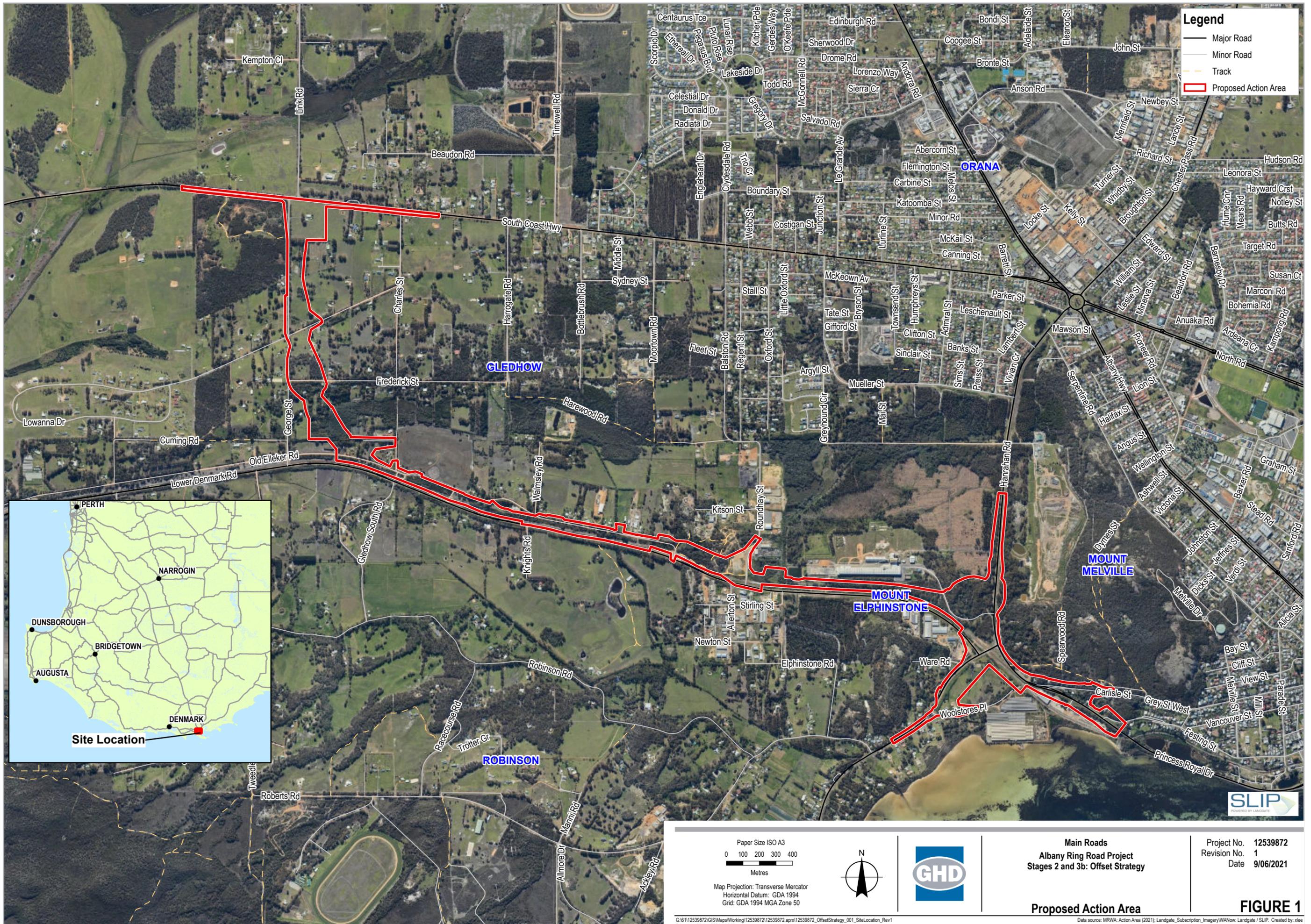
The Proposed Action involves road construction and associated infrastructure including the following components:

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

1.3 Purpose of this strategy

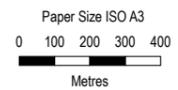
This draft Offset Strategy has been prepared to support the Preliminary Documentation for EPBC 2020/8769 Albany Ring Road Stages 2 and 3b, to demonstrate Main Roads' commitment to offset the Proposed Action's significant residual impacts to MNES.

This draft Offset Strategy will be refined subject to commercial negotiations with the property owner(s), and consultation with the WA Department of Biodiversity, Conservation and Attractions (DBCA). Once land has been adequately assessed and/or acquired, Main Roads will develop a detailed Offset Proposal for submission and approval under the EPBC Act. Main Roads intends to have the required offsets in place within 12 months of commencement of construction to satisfy Commonwealth and State environmental approval requirements. It is anticipated the required offset will reduce as more detailed information is provided.



Legend

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



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

Main Roads
Albany Ring Road Project
Stages 2 and 3b: Offset Strategy

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

Proposed Action Area

FIGURE 1

2. Predicted impacts of Proposed Action

2.1 Controlling provisions

The Proposed Action has been determined a Controlled Action under the EPBC Act due to the likelihood of significant impacts on listed threatened species and communities (Sections 18 and 18A of the EPBC Act (Commonwealth Government of Australia 1999)). The Preliminary Documentation (GHD 2021a) concludes the Proposed Action will result in significant residual impacts to the following listed threatened species:

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

The Preliminary Documentation (GHD 2021a) provides details of the predicted impacts of the Proposed Action to the above MNES. This information is summarised below.

2.2 Existing environment

2.2.1 Survey effort

A number of field assessments were undertaken for the Proposed Action. A summary of survey effort and methodology relevant to MNES is detailed in Table 2-1 below.

Table 2-1 Survey effort and methodology

Report name	Survey methodology and findings
Biological Survey: Albany Ring Road (Southern Ecology 2018)	A biological survey was undertaken in February 2018 by Southern Ecology over a 247.4 ha survey area. Field visits were conducted over several weeks from October 2017 to January 2018. Targeted flora surveys were conducted in October and November 2017. Fauna habitat surveys and habitat tree measuring occurred in October 2017; November 2017; December 2017 and January 2018.
Memorandum to Main Roads Western Australia, Defining habitat categories for Western Ringtail Possum in the South Coast population. (Southern Ecology 2019)	Southern Ecology zoologist Sandra Gilfillan completed a review of WRP habitat categories for the sub population. These habitat categories were applied across the vegetation found within the Proposed Action Area. The review was conducted in collaboration with the University of Western Australia, Biota Environmental Sciences and the WRP Working Group.
Biological Survey: Albany Ring Road (Southern Ecology 2020)	Southern Ecology completed a survey in August 2019 of additional areas (67.6 ha) outside of the 2018 Southern Ecology (2020) biological survey area, following the same methods as the 2018 survey. The 2019 survey focused on vegetation and habitat mapping, with a specific focus

Report name	Survey methodology and findings
	on habitat for WRP and Black Cockatoos. A spring survey was completed in September - October 2019 to identify conservation significant flora.
Albany Ring Road Project: Western Ringtail Possum Assessment (Biota 2018)	Following on from the biological assessment, Biota was commissioned to provide both local and regional context to the WRP habitat found within the ARR Proposed Action Area. A total area of 247.25 ha was assessed using a combination of strip and line transects. The results were modelled to yield the expected density and estimate possum numbers. Results within the Proposed Action Area were compared to those in nearby reserves and more broadly to develop estimates for the Albany area.
Albany Ring Road Black-Cockatoo Habitat Assessment (Biota 2019a)	Biota completed a targeted Black Cockatoo Habitat Assessment where a total of 572 Suitable Diameter at Breast Height (DBH) Trees were assessed (254 from within the Proposed Action Area). From these trees, all hollows with entrance diameters of 10 cm or greater were investigated during a dedicated hollow assessment. The assessment included the use of a remotely piloted aircraft mounted with a camera. Potential foraging habitat within the Study Area was also assessed using existing detailed vegetation mapping and aerial imagery.
Albany Ring Road Western Ringtail Possum Assessment (Biota 2020a)	Biota completed a targeted WRP assessment. The purpose of the assessment was to provide wider, local and a regional context to the WRP habitat found within the Proposed Action Area. The Study Area targeted the Down Road Nature Reserve (777.3 ha), areas of suitable habitat within the Proposed Action Area (92.2 ha) and areas mapped as suitable habitat around Albany in the Albany Regional Vegetation Survey (124,415 ha).
Western Ringtail Possum <i>Pseudocheirus occidentalis</i> Regional Surveys (Biota 2020b)	Biota completed a targeted WRP regional survey to estimate the density of WRP across over 40 study sites which covered the species' documented geographic range (as defined in Burbidge and Zichy-Woinarski (2017)). It is also aimed at fulfilling the most significant of the 10 Threatening Processes affecting the conservation status of the species, as defined in <i>The Western Ringtail Possum Recovery Plan: "Gaps in Knowledge"</i> (DPaW 2017a).

2.2.2 Black Cockatoo habitat

An assessment of Black Cockatoo habitat categories undertaken by Southern Ecology (2020a) identified 37.89 ha of vegetation as suitable Black Cockatoo habitat in the Proposed Action Area. Habitat types for Black Cockatoos overlapped within the Proposed Action Area, with 5.8 ha categorised as high-quality foraging, potential breeding and roosting habitat; and 1.1 ha categorised as low quality foraging and roosting habitat (Southern Ecology 2020). The type, value and extent of the Black Cockatoo habitat is detailed in Table 2-2.

Foraging habitat

Biota (2019a) recorded foraging evidence from all three species of Black Cockatoo. Suitable foraging habitat was identified for all three species of Black Cockatoo (Carnaby's Cockatoo,

Baudin’s Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC)) in the Proposed Action Area in the Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/*E.staeri* Sandy Woodland, *Hakea spp* Shrubland/Woodland Complex, Marri/Jarrah Forest/Peppermint Woodland and various planted trees including *Pinus radiata*, Marri and Jarrah (Biota 2019a).

The Proposed Action Area comprises 5.80 ha of high quality and 1.22 ha of low quality foraging habitat.

Breeding habitat

Two hundred and thirty six potential breeding trees were recorded in the Proposed Action Area, including 24 with hollows. Ten trees were considered potentially suitable for use by Black Cockatoos, 14 trees were considered unsuitable after inspection by drone. There was no evidence of current or past use of these hollows by Black Cockatoos.

Roosting habitat

No known roosting sites were identified or observed during repeated visits to the Proposed Action Area during the Black Cockatoo habitat assessments (Biota 2019a, Southern Ecology 2020). A total of 37.75 ha of roosting habitat was identified.

Table 2-2 Black Cockatoo habitat type and value

Aspect	Habitat extent / number
Black Cockatoo habitat (total)	37.89 ha
High quality foraging habitat	5.80 ha
Low quality foraging habitat	1.22 ha
Breeding habitat	5.80 ha
Roosting habitat	37.75 ha
Suitable DBH Trees for Black Cockatoo breeding	236
Suitable DBH Trees with hollows	24
Potentially suitable hollows for Black Cockatoo nesting	10 trees (14 hollows)

2.2.3 Western Ringtail Possum

The DAWE Significant Impact Guidelines for the Western Ringtail Possum (WRP) pertain only to the population occurring on the southern SCP (DEWHA 2009). No guidelines have been developed for the South Coast population, which can be defined as a significant population under these guidelines. The Recovery Plan for the species indicates that all remnant habitat should be considered as important (DPaW 2017a).

Southern Ecology (2020) and Biota (2020a) have conducted a significant amount of work on the South Coast population to inform accurate assessment of the impacts of the Proposed Action. This included defining habitat categories for the South Coast population on the basis that some of the ecology for the South Coast WRP population is different to the Swan Coastal Plain population.

The Significant Impact Guidelines for the WRP identified three areas as important for the WRPs within the southern SCP: Core habitat, Primary corridors and Supporting habitat. As the definitions in themselves are not SCP specific they can be used interchangeably to some

degree. Using these habitat categories as a guide, plus currently available data on WRP ecology, draft habitat categories were defined for the South Coast population and applied to the Proposed Action Area (Southern Ecology 2019).

WRP individuals were observed by Southern Ecology and Biota ecologists within the Proposed Action Area (Biota 2020a, Southern Ecology 2020). WRP scats were observed widely across the biological survey area (Southern Ecology 2020), in multiple habitats of varying condition. A total of 14 dreys were also recorded in the biological survey, of which five are present within the Proposed Action Area.

An assessment of WRP habitat categories undertaken by Southern Ecology (2020), identified approximately 19.18 ha of vegetation potential suitable for WRPs in the Proposed Action area as presented in Table 2-3. A total of 1.07 ha of this habitat is classified as Core or Core (urban). All habitat is considered high value to this species which is known to occur in isolated trees in poor condition vegetation.

Table 2-3 Western Ringtail Possum habitat

Aspect	Habitat extent / number
WRP habitat (total)	19.18 ha
Core habitat	0.88 ha
Core (Urban) habitat	0.19 ha
Supporting habitat	18.11 ha
Number of home ranges within the Proposed Action Area	9
Dreys	5

Based on Biota (2020a) density estimate of 0.14 to 0.36 individuals/ha for Supporting habitat, and 2.45 individuals/ha for Core and Core (Urban) habitat (Biota 2019b), it is predicted that approximately nine WRPs would potentially have their home range reduced or impacted (to varying degrees) via the clearing and removal of habitat.

2.3 Predicted significant residual impacts

The below predicted residual impact estimates are conservative, representing the full extent of MNES values within the Proposed Action Area disturbance footprint. The actual clearing footprint is expected to be less and will be refined through the detailed design and construction planning process.

2.3.1 Direct impacts to Black Cockatoos

Up to 7.02 ha of Black Cockatoo foraging habitat will be cleared by the Proposed Action, of which 5.8 ha is also breeding habitat. On a regional scale, native foraging habitat within the Proposed Action Area, represents 0.07 % of the recorded 8,756 ha of locally available native foraging habitat within a 12 km radius (Biota 2019a). The 12 km radius was chosen as it represents the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (DSEWPC 2012). Although foraging habitat in the Proposed Action Area represents a small proportion of the surrounding extent, Main Roads proposed to offset the loss of this Black Cockatoo habitat.

The Proposed Action will not result in impacts to known nesting hollows or roosting sites for Carnaby's Cockatoo, Baudin's Cockatoo or FRTBC (GoWA 2019a, 2019b). No hollows showed

signs of being used in the past. The Proposed Action Area includes 37.75 ha of potential roosting habitat, which will also be offset. As Black Cockatoo habitat types overlap in the Proposed Action Area, a total of 37.89 ha will be offset.

The Proposed Action will also remove 10 trees with 14 potentially suitable hollows for Black Cockatoo nesting.

2.3.2 Direct impacts to WRP

Critical habitat as defined by the Recovery Plan (DPaW 2017) includes any remnant habitat where WRPs occur naturally. The Proposed Action may result in the loss of up to 0.88 ha of Core habitat, 0.19 ha of Core (Urban) habitat, 18.11 ha of Supporting habitat and five dreys.

There is approximately 5,128 ha of Core and Supporting habitat available within a 5 km radius of the Proposed Action Area (Southern Ecology 2020). Proposed impacts to Core, Core (Urban) and Supporting habitat will have limited impacts on the overall WRP habitat in the local area as clearing represent less than 0.37% of these habitat types available within the 5 km radius. The 5 km radius was chosen as it represents the typical maximum distance a WRP will travel in any direction for foraging or breeding. WRP home ranges are typically no greater than 5 ha (DPaW 2017b).

2.3.3 Indirect impacts to Black Cockatoo and WRP

The Proposed Action has potential to cause indirect impacts to Black Cockatoo and WRP including:

- The introduction and/or spread of introduced flora species leading to decline habitat health that lies adjacent to the Proposed Action Area
- The introduction and/or spread of dieback leading to decline in habitat health that lies adjacent to the Proposed Action Area
- Increased risk of vehicle strike
- Traffic noise and light spill impacting Black Cockatoo and WRP species.

However, with the implementation of the management measures committed in the Albany Ring Road Stage 2 and 3b (EPBC 2020/8769) Environmental Management Plan, the residual risk rating for indirect impacts are Low (GHD 2021b). No offset is proposed for indirect impacts.

3. Proposed environmental offsets

In order to offset the significant residual impacts of the Proposed Action to the listed Black Cockatoos and WRP, this draft Offset Strategy identifies proposed offset actions comprising land acquisition, funding of land management and research. The proposed environmental offsets will be fully funded and implemented by Main Roads (with the assistance of external technical experts, where appropriate), with the implementation of the environmental offsets to be reported on under the provisions of the EPBC Act.

3.1 Overview of offset package

Main Roads are investigating the purchase of several private land parcels to develop an offset to counterbalance the significant residual impacts of the Proposed Action to Black Cockatoo and WRP.

Identification and acquisition of land to counterbalance significant residual environmental impacts associated with Main Roads infrastructure projects is now being managed through a Memorandum of Understanding (MoU) between Main Roads and DBCA. The MoU commits Main Roads funding to assist DBCA in identifying and acquiring suitable land offsets to be added to the conservation estate.

Main Roads and DBCA must locate properties that meet the requirements of the project offset as well as meet the criteria of properties which DBCA seek to manage. Following the identification of a suitable offset, the property is surveyed and acquired by the DBCA. Once the land is acquired, Main Roads will reimburse DBCA the land acquisition costs. Acquisition of suitable offset land aims to satisfy Commonwealth and State environmental compliance requirements.

The direct offsets involve acquisition of land by the Crown and land transfer to the conservation estate, which will enable land management by DBCA as the lead agency in WA responsible for conservation management. DBCA will be responsible for vesting the land with the Conservation and Parks Commission of WA, which will provide a conservation mechanism to maintain the offset ecological values in perpetuity. For each of the land offsets acquired, Main Roads will fund seven years of DBCA land management activities. These land management costs are negotiated on a site by site basis, and costs are formalised through a separate Memorandum of Understanding. Potential management actions on the property include removal of old fencing, installation of new fencing, installation of firebreaks and weed control.

Main Roads is liaising with DBCA regarding acquisition of suitable land in order to meet offset requirements and intends to have all required offsets in place within 12 months of commencement of construction. This timing incorporates all phases of the offset process from land acquisition through to a MoU for land management of the properties.

In addition to direct offset through land acquisition, Main Roads proposed to install artificial Black Cockatoo hollows as a compensatory measure and Black Cockatoo research funding as an indirect offset.

3.2 Description of offset

3.2.1 Confidential property acquisition

Properties are currently under investigation by DBCA in collaboration with Main Roads, but have yet to be negotiated with land owners and will also be subject to confirmation of the habitat types and presence of the relevant EPBC Act listed species. Based on consultation with DBCA,

and the location and vegetation expected to be present, the properties are expected to comprise the following:

- 38 ha of Black Cockatoo foraging and breeding habitat suitable for all three species
- 145 ha of Black Cockatoo roosting habitat suitable for all three species, which may comprise part or all of the 38 ha of Black Cockatoo breeding and foraging habitat suitable for all three species
- Approximately 135 ha of habitat for WRP.

An overview of the direct offsets offered are detailed in Table 3-1.

Table 3-1 Overview of offset package under consideration

MNES	Habitat	Residual impacts	Offset Package
Carnaby's Cockatoo	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	38 ha = 91.42% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	145 ha = 90.82% of impact offset
Baudin's Cockatoo	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	38 ha = 91.42% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	145 ha = 90.82% of impact offset
FRTBC	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	35 ha = 91.25% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	133 ha = 90.27% of impact offset
WRP		19.18 ha x quality 6 = 11.51 ha	135 ha = 100.42% of impact offset

3.2.2 Black Cockatoo artificial hollows

Main Roads proposed to install 42 artificial hollows to offset the loss of 10 trees (with 14 hollows) potentially suitable for Black Cockatoo nesting. Installation will be in accordance with the DBCA *Fauna notes on how to design and place artificial hollows* (DPAW 2015).

3.2.3 Research proposal

Main Roads is providing funding to Murdoch University to finance Black Cockatoo research (Warren et al. 2019) (Appendix B). Funding for research is intended to comprise 10% of the total Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC offset requirement, when delivered in addition to the land acquisition component outlined in this Offsets Strategy.

Provision of research funding is classified by the Commonwealth as an 'other compensatory measure' anticipated to lead to benefits for the impacted protected matter, in this instance, to Black Cockatoo species. The research proposal is utilising innovative tracking methodologies to undertake a movement ecology study of Western Australia's three threatened Black Cockatoo species, to determine habitat use and threatening processes in modified landscapes. This includes tracking the three species of Black Cockatoos on the Perth-Peel Coastal Plain and

tracking Carnaby's Cockatoos at key breeding sites to better understand movement dynamics of this species across its distribution range.

The research proposal (Warren et al. 2019) commenced in 2019 and is ongoing, with the purpose of generating data to identify key habitats and areas for conservation/revegetation, determining threatening processes for Black Cockatoo species across their range, and information decision making in relation to conservation and land management planning at both State and Commonwealth government levels. The research proposal addresses major priority actions in the recovery plans for the three Black Cockatoo species and is fully supported by the chairs of the Carnaby's Cockatoo and the Forest Black Cockatoo recovery teams.

4. Offset inputs and justification

4.1 Assumptions

The preliminary offset calculations undertaken have been based on the available information for the anticipated properties to be acquired. For this draft Offset Strategy, it is assumed the vegetation present on the property is consistent with vegetation association mapping and on that basis, suitable habitat for Black Cockatoo and WRP.

The suitability of the offset properties will be confirmed through survey and consultation with DBCA.

4.1.1 Offset properties start quality

It has been assumed that vegetation in the offset properties will be in Very Good or better condition for the offset calculation. A score of 7 has been applied as the habitat value (start quality) for the offset area, assuming the offset property contains:

- Suitable native vegetation in Very Good or better condition
- Foraging, potential roosting and potential breeding habitat for Black Cockatoo
- Core habitat and Supporting habitat for WRP.

4.2 Carnaby's Cockatoo

4.2.1 Foraging and breeding habitat

Table 4-1 and Table 4-2 provides the inputs used in the EPBC Offset Assessment Guide in relation to offsetting residual impacts to Carnaby's Cockatoo for foraging and breeding habitat.

Table 4-1 Foraging and Breeding Impact Calculator Carnaby's Cockatoo

Attribute	Value	Justification
Area of impact	7.02 ha	7.02 ha of foraging and breeding habitat is mapped within the Proposed Action Area for Carnaby's Cockatoo during ecological survey (Southern Ecology 2020).
Quality	7	<p>Moderate - High score based on an area-weighted scoring of foraging and breeding habitat quality across the Proposed Action Area with score 7 out of 10 as a summation of site condition (score 4 out of 6), site context (score 2 out of 3) and species density (score 1 out of 1).</p> <p>Site condition</p> <p>Site condition is based on the quality of the habitat in the Proposed Action Area</p> <ul style="list-style-type: none"> • High quality breeding and foraging habitat– Score 4 x 83% (5.80 ha) • Low quality foraging – Score 2 x 17% (1.22 ha) <p>A score of 3.65 was obtained out of 6 (rounded up to 4).</p> <p>Site context</p>

Attribute	Value	Justification
		<p>Site context was scored 2 out of 3 as the Proposed Action Area is located between existing linear infrastructure, vegetated areas and surrounded by farmland. The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The Proposed Action Area is anticipated to be susceptible to dieback disease.</p> <p>The Proposed Action Area represents approximately 0.07% of available Black Cockatoo habitat remaining within 12 km of the Proposed Action Area (estimated to be 8,756 ha (Biota 2019a).</p> <p>Stocking rate</p> <p>Stocking rate was scored 1 out of 1 due to evidence of occupation and foraging within the Proposed Action Area.</p> <p>There is an absence of known breeding and roosting evidence. A total of 24 trees contained hollows, of which 10 trees contain hollows that may be suitable for nesting by Black Cockatoos. These showed no evidence of past use.</p>

Table 4-2 Foraging and Breeding Offset Calculator Carnaby's Cockatoo

Attribute	Value	Justification
Offset area	38 ha	An approximate 38 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action Area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is 'rural freehold' land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would have continued resulting in increased loss of habitat quality in the long term.</p> <p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the WA <i>Environmental Protection Act 1986</i> (EP Act). Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.

Attribute	Value	Justification
		Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , taking into account background rates of deforestation in this local government area.
Risk of loss with offset	0%	Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , specifically: <ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community Tenure status will be changed to secure protection of the proposed offset site Allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.2.2 Roosting habitat

Table 4-3 and Table 4-4 provides the inputs used in the EPBC Offset Assessment Guide in relation to offsetting residual impacts to Carnaby's Cockatoo for roosting habitat.

Table 4-3 Roosting Habitat Impact Calculator Carnaby's Cockatoo

Attribute	Value	Justification
Area of impact	37.75 ha	37.75 ha of roosting habitat is mapped within the Proposed Action Area for Carnaby's Cockatoo during ecological survey (Southern Ecology 2020).
Quality	5	Moderate score based on an area-weighted scoring of roosting habitat quality across the Proposed Action Area with score 5 out of 10 as a summation of site condition (score 4 out of 6), site context (score 1 out of 3) and species density (score 0 out of 1). Site condition

Attribute	Value	Justification
		<p>Site condition is based on the quality of the habitat in the Proposed Action Area</p> <ul style="list-style-type: none"> • High-quality roosting habitat – Score 4 x 80% (30.38 ha) • Low quality roosting – Score 2 x 20% (7.37 ha) <p>A score of 3.6 was obtained out of 6 (rounded up to 4).</p> <p>Site context</p> <p>Site context was scored 1 out of 3 as the Proposed Action Area is located between existing linear infrastructure, vegetated areas and surrounded by farmland. The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The majority of the roosting habitat is non native species, which means they are not suitable for foraging.</p> <p>Stocking rate</p> <p>Stocking rate was scored 0 out of 1 due to no evidence of roosting within the Proposed Action Area.</p>

Table 4-4 Roosting Habitat Offset Calculator Carnaby's Cockatoo

Attribute	Value	Justification
Offset area	145 ha	An approximate 145 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action Area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is 'rural freehold' land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would have continued resulting in increased loss of habitat quality in the long term.</p> <p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the <i>WA Environmental Protection Act 1986</i> (EP Act). Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.

Attribute	Value	Justification
		Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , taking into account background rates of deforestation in this local government area.
Risk of loss with offset	0%	Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , specifically: <ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community Tenure status will be changed to secure protection of the proposed offset site Allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.3 Baudin's Cockatoo

4.3.1 Foraging and breeding habitat

Table 4-5 and Table 4-6 provides the inputs used in the EPBC Offset Assessment Guide in relation to offsetting residual impacts to Baudin's Cockatoo foraging and breeding habitat.

Table 4-5 Foraging and Breeding Impact Calculator Baudin's Cockatoo

Attribute	Value	Justification
Area of impact	7.02 ha	7.02 ha of foraging and breeding habitat is mapped within the Proposed Action Area for Baudin's Cockatoo during ecological survey (Southern Ecology 2020).
Quality	7	Moderate - High score based on an area-weighted scoring of foraging and breeding habitat quality across the Proposed Action Area with score 7 out of 10 as a summation of site condition (score 4

Attribute	Value	Justification
		<p>out of 6), site context (score 2 out of 3) and species density (score 1 out of 1).</p> <p>Site condition</p> <p>Site condition is based on the quality of the habitat in the Proposed Action Area</p> <ul style="list-style-type: none"> • High quality breeding and foraging habitat– Score 4 x 83% (5.80 ha) • Low quality foraging – Score 2 x 17% (1.22 ha) <p>A score of 3.65 was obtained out of 6 (rounded up to 4).</p> <p>Site context</p> <p>Site context was scored 2 out of 3 as the Proposed Action Area is located between existing linear infrastructure, vegetated areas and surrounded by farmland. The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The Proposed Action Area is anticipated to be susceptible to dieback disease.</p> <p>The Proposed Action Area represents approximately 0.07% of available Black Cockatoo habitat remaining within 12 km of the Proposed Action Area (estimated to be 8,756 ha (Biota 2019a).</p> <p>Stocking rate</p> <p>Stocking rate was scored 1 out of 1 due to evidence of occupation and foraging within the Proposed Action Area.</p> <p>There is an absence of known breeding and roosting evidence. A total of 24 trees contained hollows, of which 10 trees contain hollows that may be suitable for nesting by Black Cockatoos. These showed no evidence of past use.</p>

Table 4-6 Foraging and Breeding Offset Calculator Baudin’s Cockatoo

Attribute	Value	Justification
Offset area	38 ha	An approximate 38 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is ‘rural freehold’ land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would</p>

Attribute	Value	Justification
		<p>have continued resulting in increased loss of habitat quality in the long term.</p> <p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the WA EP Act. Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	<p>Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.</p> <p>Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.</p>
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , taking into account background rates of deforestation in this local government area.
Risk of loss with offset	0%	<p>Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i>, specifically:</p> <ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community Tenure status will be changed to secure protection of the proposed offset site Allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.3.2 Roosting habitat

Table 4-7 and Table 4-8 provides the inputs used in the EPBC Offset Assessment Guide in relation to offsetting residual impacts to Baudin's Cockatoo for roosting habitat.

Table 4-7 Roosting Habitat Impact Calculator Baudin's Cockatoo

Attribute	Value	Justification
Area of impact	37.75 ha	37.75 ha of roosting habitat is mapped within the Proposed Action Area for Baudin's Cockatoo during ecological survey (Southern Ecology 2020).
Quality	5	<p>Moderate score based on an area-weighted scoring of roosting habitat quality across the Proposed Action Area with score 5 out of 10 as a summation of site condition (score 4 out of 6), site context (score 1 out of 3) and species density (score 0 out of 1).</p> <p>Site condition</p> <p>Site condition is based on the quality of the habitat in the Proposed Action Area</p> <ul style="list-style-type: none"> • High-quality roosting habitat – Score 4 x 80% (30.38 ha) • Low quality roosting – Score 2 x 20% (7.37 ha) <p>A score of 3.6 was obtained out of 6 (rounded up to 4).</p> <p>Site context</p> <p>Site context was scored 1 out of 3 as the Proposed Action Area is located between existing linear infrastructure, vegetated areas and surrounded by farmland. The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The majority of the roosting habitat is non native species, which means they are not suitable for foraging.</p> <p>Stocking rate</p> <p>Stocking rate was scored 0 out of 1 due to no evidence of roosting within the Proposed Action Area.</p>

Table 4-8 Roosting Habitat Offset Calculator Baudin's Cockatoo

Attribute	Value	Justification
Offset area	145 ha	An approximate 145 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action Area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is 'rural freehold' land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would have continued resulting in increased loss of habitat quality in the long term.</p>

Attribute	Value	Justification
		<p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the WA <i>Environmental Protection Act 1986</i> (EP Act). Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	<p>Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.</p> <p>Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.</p>
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act</i> (UoQ, 2017), taking into account background rates of deforestation in this local government area.
Risk of loss with offset	0%	<p>Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act</i> (UoQ, 2017), specifically:</p> <ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community Tenure status will be changed to secure protection of the proposed offset site Allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.4 Forest Red-tailed Black Cockatoo

4.4.1 Foraging and breeding habitat

Table 4-9 and Table 4-10 provides the inputs used in the EPBC Offset Assessment Guide in relation to offsetting residual impacts to FRTBC for breeding and foraging habitat.

Table 4-9 Foraging and Breeding Impact Calculator FRTBC

Attribute	Value	Justification
Area of impact	7.02 ha	7.02 ha of foraging and breeding habitat is mapped within the Proposed Action Area for FRTBC during ecological survey (Southern Ecology 2020).
Quality	7	<p>Moderate - High score based on an area-weighted scoring of foraging and breeding habitat quality across the Proposed Action Area with score 7 out of 10 as a summation of site condition (score 4 out of 6), site context (score 2 out of 3) and species density (score 1 out of 1).</p> <p>Site condition</p> <p>Site condition is based on the quality of the habitat in the Proposed Action Area</p> <ul style="list-style-type: none"> High quality breeding and foraging habitat– Score 4 x 83% (5.80 ha) Low quality foraging – Score 2 x 17% (1.22 ha) <p>A score of 3.65 was obtained out of 6 (rounded up to 4).</p> <p>Site context</p> <p>Site context was scored 2 out of 3 as the Proposed Action Area is located between existing linear infrastructure, vegetated areas and surrounded by farmland. The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The Proposed Action Area is anticipated to be susceptible to dieback disease.</p> <p>The Proposed Action Area represents approximately 0.07% of available Black Cockatoo habitat remaining within 12 km of the Proposed Action Area (estimated to be 8,756 ha (Biota 2019a).</p> <p>Stocking rate</p> <p>Stocking rate was scored 1 out of 1 due to evidence of occupation and foraging within the Proposed Action Area.</p> <p>There is an absence of known breeding and roosting evidence. A total of 24 trees contained hollows, of which 10 trees contain hollows that may be suitable for nesting by Black Cockatoos. These showed no evidence of past use.</p>

Table 4-10 Foraging and Breeding Offset Calculator FRTBC

Attribute	Value	Justification
Offset area	35 ha	An approximate 35 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is 'rural freehold' land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would have continued resulting in increased loss of habitat quality in the long term.</p> <p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the WA EP Act. Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	<p>Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.</p> <p>Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.</p>
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , taking into account background rates of deforestation in this local government area.
Risk of loss with offset	0%	<p>Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i>, specifically:</p> <ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community

Attribute	Value	Justification
		<ul style="list-style-type: none"> Tenure status will be changed to secure protection of the proposed offset site Allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.4.2 Roosting habitat

Table 4-11 provides the inputs used in the EPBC Offset Assessment Guide in relation to offsetting residual impacts to FRTBC Cockatoo for roosting habitat.

Table 4-11 Roosting Habitat Impact Calculator Baudin's Cockatoo

Attribute	Value	Justification
Area of impact	37.75 ha	37.75 ha of roosting habitat is mapped within the Proposed Action Area for FRTBC during ecological survey (Southern Ecology 2020).
Quality	5	<p>Moderate score based on an area-weighted scoring of roosting habitat quality across the Proposed Action Area with score 5 out of 10 as a summation of site condition (score 4 out of 6), site context (score 1 out of 3) and species density (score 0 out of 1).</p> <p>Site condition</p> <p>Site condition is based on the quality of the habitat in the Proposed Action Area</p> <ul style="list-style-type: none"> High-quality roosting habitat – Score 4 x 80% (30.38 ha) Low quality roosting – Score 2 x 20% (7.37 ha) <p>A score of 3.6 was obtained out of 6 (rounded up to 4).</p> <p>Site context</p> <p>Site context was scored 1 out of 3 as the Proposed Action Area is located between existing linear infrastructure, vegetated areas and surrounded by farmland. The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The majority of the roosting habitat is non native species, which means they are not suitable for foraging.</p> <p>Stocking rate</p> <p>Stocking rate was scored 0 out of 1 due to no evidence of roosting within the Proposed Action Area.</p>

Table 4-12 Roosting Habitat Offset Calculator FRTBC Cockatoo

Attribute	Value	Justification
Offset area	133 ha	An approximate 133 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action Area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is 'rural freehold' land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would have continued resulting in increased loss of habitat quality in the long term.</p> <p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the <i>WA Environmental Protection Act 1986</i> (EP Act). Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	<p>Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.</p> <p>Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.</p>
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act</i> (UoQ 2017), taking into account background rates of deforestation in this local government area.
Risk of loss with offset	0%	Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act</i> (UoQ 2017), specifically:

Attribute	Value	Justification
		<ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community Tenure status will be changed to secure protection of the proposed offset site Allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.5 Black Cockatoo artificial hollows

Main Roads proposed to install 42 artificial hollows to offset the loss of 10 trees (with 14 hollows) potentially suitable for Black Cockatoo nesting (applying a 1:1 ratio for hollows). The hollows will be installed in accordance with the DBCA fauna notes on how to design and place artificial hollows (DPAW 2015). These hollows will be installed at sites suitable for Black Cockatoo breeding, with the location determined in consultation with DBCA. Note that DBCA, including the Black Cockatoo Recovery Team, have a strong preference for artificial hollows to be placed outside urban areas, with risks to breeding birds and their chicks higher than in native bushland.

Installation

A suitably qualified person with experience in Black Cockatoos will be engaged to assist with the planning of artificial hollow installation to determine the appropriate installation and location for the hollows. Appropriate trees will be identified taking into consideration the following:

- Trees should be within Crown lands (e.g. DBCA-managed lands, Local Government Reserves etc) to facilitate ease of access for monitoring and maintenance
- Located in proximity to impacted potentially suitable hollow, or existing potentially suitable hollows which will not be impacted
- Located within or adjacent to foraging habitat
- Located in proximity to water
- Trees should be mature and well shaded
- Trees should be accessible with a cherry picker, without requiring additional disturbance, to allow installation of the artificial hollows.

Main Roads will fund ten years of monitoring and maintenance activities for artificial hollows.

Monitoring

Artificial hollows will be surveyed during September/October to coincide with the peak of the breeding season for the Black Cockatoo species. Surveys are to be undertaken by a suitably qualified person. Hollows should initially be viewed from the ground using binoculars to check for signs of use. A drone or remotely operated camera on a pole may also be used. Surveys will identify:

- If hollows are currently in use or show evidence of previous use
- Maintenance requirements for artificial hollows (such as replacement of the sacrificial wooden post or removal of feral bees)

- If hollows are no longer able to be used by Black Cockatoo, for example they have been invaded by feral bees, the hollow has been damaged, or the limb has fallen.

Maintenance

Maintenance of artificial hollows will be scheduled to occur outside of the breeding season. Maintenance may include:

- Replacement of sacrificial chewing post
- Replacement/repair of attachment points
- Repairs to the base of hollows
- Repair of cracks in the artificial hollow. If crack form that are too large to be repaired the hollow may need to be replaced
- Removal of pest species, such as feral bees.

Adaptive management

If after three years there is no evidence of use of any of the installed artificial hollows, Main Roads is to implement adaptive management measures including:

- Review density of hollows in selected locations, assess if hollows should be clustered to increase density or moved to an alternative location
- Review/modify location selection parameters in consultation with DBCA and move hollows if required.

4.6 Black Cockatoo indirect offset

Application of Commonwealth criteria for research (Australian Government 2012a) to the research proposal (Warren et. al. 2019) is summarised in Table 4-13.

Table 4-13 Black Cockatoo indirect offset assessment

Commonwealth criteria for research	Application of criteria to Murdoch University research proposal
A suitable research program must endeavour to improve the viability of the impacted protected matter.	The objectives of the research proposal are summarised in Section 3.2.3 and endeavour to improve the viability of Black Cockatoos and inform future Black Cockatoo offset options.
A suitable research program must be targeted toward key research as identified in the relevant Commonwealth approved recovery plan, threat abatement plan, conservation advice, ecological character description, management plan or listing document. Where Commonwealth approved guidance documents are not available or are insufficient in detail, the department will consider additional information sources such as state management plans or peer reviewed scientific	The proposal has been developed in collaboration with DBCA to meet the requirements of the EPBC Act referral guidelines for three Black Cockatoo species (Australian Government 2012b), as well as priority actions and recommendations from the national Carnaby’s Cockatoo (<i>Calyptorhynchus latirostris</i>) Recovery Plan (DPaW 2013), Baudin’s Cockatoo (<i>Calyptorhynchus baudinii</i>) and Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>). Recovery Plan (Chapman 2008), MNES Significant Impact Guidelines (Commonwealth of Australia 2013) and the Consideration of Matters of National

Commonwealth criteria for research	Application of criteria to Murdoch University research proposal
literature to inform priority offset activities.	Environmental Significance by the WA land use planning system Discussion Paper (DEWHA 2009).
A suitable research program must be undertaken in a transparent and scientifically robust and timely manner.	<p>The research program will be:</p> <ul style="list-style-type: none"> • Transparent as regular reporting will be provided to Main Roads and the results will be published and made publicly accessible • Scientifically robust as it has been based on similar research programs conducted by the same team since 2015. This includes the successful deployment of 84 tags and production of over 140,000 GPS location fixes, 33,000 km of track movement and over 2.8M accelerometer records. The methodology is proven and facilitates individual and flock movement characterisation at spatial and temporal scales previously unattainable • Conducted over a period of five years.
A suitable research program must be undertaken by a suitably qualified individual or organisation in a manner approved by the department	<p>The research program will be undertaken by suitably qualified and experienced Murdoch University research scientists and has been developed in collaboration with DBCA to meet the requirements of the EPBC Act referral guidelines for three Black Cockatoo species (Australian Government 2012b), as well as priority actions and recommendations from the national Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) Recovery Plan (DPaW 2013), Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) and Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) Recovery Plan (Chapman 2008), MNES Significant Impact Guidelines (Commonwealth of Australia 2013) and the Consideration of Matters of National Environmental Significance by the WA land use planning system Discussion Paper (DEWHA 2009).</p>
A suitable research program must consider best practice research approaches.	<p>The research proposal will consider best practice research approaches. Main Roads will not be using an open market tender to award this work; instead, it will award funding direct to Murdoch University based on its existing successful Black Cockatoo research prior experience undertaking similar research and proposal.</p>
The proponent is required to select an institution through an internationally available open tender process or provide evidence that the program can be undertaken in-house. Where appropriate, the tender	<p>Main Roads will not be using an open market tender to award this work; instead, it will award funding direct to Murdoch University based on its existing successful Black Cockatoo research program, prior experience undertaking similar research and proposal.</p>

Commonwealth criteria for research	Application of criteria to Murdoch University research proposal
<p>should complement an existing research institution's work program as it relates to the MNES. This will be the responsibility of the proponent; however, the department will require that the proponents follow the department's guidelines.</p>	
<p>The proponent is required to provide updates on progress and key findings to the department through periodic reporting.</p>	<p>Main Roads requires regular progress reports to be submitted to track research progress, with annual progress reports provided to regulators.</p>
<p>The proponent is required to ensure that funds are managed appropriately and that auditable financial records are kept and maintained.</p>	<p>Main Roads will require that annual progress reports include tracking of funding, and that auditable financial records are kept and maintained.</p>
<p>The proponent is required to apply a 'no surprises' policy to the publication, whereby research publications and outputs are provided to the department at least five working days before release.</p>	<p>Research publications and outputs will be provided to the department at least five working days before release.</p>
<p>Research programs will be tailored to at least a postgraduate level; however, there will be scope to engage other educational levels in educational programs.</p>	<p>The research proposal is tailored to at least a postgraduate level.</p>
<p>Research programs will present findings that can be peer reviewed.</p>	<p>The research proposal will present findings that can be peer reviewed.</p>
<p>Research programs will publish findings in an internationally recognised peer-reviewed scientific journal or be of a standard that would be acceptable for publication in such a journal. Publications should be submitted to free open access journals. Data and information collected should have creative commons licensing and be free and accessible.</p>	<p>The research proposal will publish findings in an internationally recognised peer-reviewed scientific journal or be of a standard that would be acceptable for publication in such a journal. Data and information collected will have creative commons licensing and be free and accessible.</p>
<p>Research outputs should inform future management decisions on the protected matter and, where possible, be readily applicable to</p>	<p>Research outputs will inform future management decisions for Black Cockatoos</p>

Commonwealth criteria for research	Application of criteria to Murdoch University research proposal
other similar matters (species groupings etc.)	

4.7 Western Ringtail Possum

Table 4-14 and Table 4-15 provides the inputs used in the EPBC Offset Assessment Guide in relation to WRP.

Table 4-14 Impact Calculator WRP

Attribute	Value	Justification
Area of impact	19.18 ha	19.18 ha of core and supporting habitat is mapped within Proposed Action Area during ecological survey (Southern Ecology 2020).
Quality	6	<p>Moderate score based on an average score of habitat quality across the Proposed Action Area with score 6 out of 10 as a summation of site condition (score 3 out of 6), site context (score 2 out of 3) and species density (score 1 out of 1).</p> <p>Site condition</p> <p>Site condition is based on the categories of the 19.18 ha of core and supporting WRP in the Proposed Action Area, including:</p> <ul style="list-style-type: none"> Core habitat – Score 6 x 0.45% (0.88 ha) Core (urban) habitat – Score 4 x 0.9% (0.19 ha) Supporting habitat – Score 3 x 94% (18.11 ha) <p>This results in a weighted score of 3.14 out of 6 (rounded down to 3).</p> <p>Possums are known to prefer canopy to allow for movement across the landscape however are also known to utilise habitats that are degraded.</p> <p>Site context</p> <p>A moderate to high score of 2 out of 3 was applied to reflect the location of the Proposed Action Area in an area that is part of a linkage corridor to the surrounding landscape, with areas of high value core habitat for possums being recorded in the Albany region. The score also took into account the location of the road project, being predominantly in an existing disturbed area.</p> <p>Biota (2020b) has completed a regional WRP assessment, which identified a population estimate of 3,340 individual WRPs within 30 km of the Albany townsite.</p> <p>The Proposed Action Area is subject to threatening processes to habitat associated with informal access and weed invasion along the interface with the disturbed areas. The Proposed Action Area is</p>

Attribute	Value	Justification
		<p>anticipated to be susceptible to dieback disease, however this is unlikely to significantly alter habitat availability.</p> <p>Stocking rate</p> <p>Stocking rate was scored 1 out of 1 due to evidence of occupation and presence of 5 dreys. The Proposed Action Area is estimated to provide habitat for up to 9 WRP. Given the estimate of 3,340 possums within 30 km of Albany (Biota 2020b), approximately 0.27% of the population is considered likely to be impacted.</p>

Table 4-15 Offset Calculator WRP

Attribute	Value	Justification
Offset area	135 ha	An approximate 135 ha is proposed to offset residual impacts.
Start quality	7	Habitat quality will be equivalent or better than the habitat within the Proposed Action area therefore a score of 7 has been assigned.
Future quality without offset	6	<p>As the proposed offset site is 'rural freehold' land, it is reasonable to assume the vegetation may deteriorate without management. The site will benefit from transfer to the conservation estate. A score of 6 reflects the context of the site under consideration, which is part of a patch of contiguous vegetation of approximately 28,000 ha.</p> <p>As private owned rural zoned property a number of activities including incremental clearing, grazing and firewood collection would have continued resulting in increased loss of habitat quality in the long term.</p> <p>Clearing of up to 5 ha per annum of native vegetation may not require a clearing permit under the WA EP Act. Clearing of up to 1ha per annum was unlikely to be assessed under the EPBC Act.</p> <p>Feral animal control, particularly for foxes was unlikely to be undertaken regularly by the previous owner.</p>
Future quality with offset	7	<p>Land will be managed for conservation of existing values. The properties will be purchased for addition to the conservation estate to be managed by DBCA.</p> <p>Private landowner activities will be halted. Site management (fencing and access management, weed control, firebreaks and feral animal control) will be undertaken as required. The property will be managed in the long term for conservation purposes.</p>
Time over which loss is averted	20 years	Land will be transferred to conservation estate so long term protection is afforded. Twenty years is the maximum value that can be input.
Time until ecological benefit	2 years	Land will be acquired and transferred to conservation estate, time until ecological benefit is two years.
Risk of loss without offset	7.43%	Risk of loss over 20 years taken from <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i> , taking into account background rates of deforestation in this local government area.

Attribute	Value	Justification
Risk of loss with offset	0%	<p>Very low risk through protection of conservation estate, the risk of loss is 0% in accordance with the <i>Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act (UoQ 2017)</i>, specifically:</p> <ul style="list-style-type: none"> Proposed offset site contains an EPBC Act listed threatened species or ecological community tenure status will be changed to secure protection of the proposed offset site allowable development (not prevented by the protection mechanism) would trigger an offset requirement.
Confidence in result	90%	High degree of confidence, land will be surveyed to confirm habitat values and then purchased for transfer to the conservation estate.

4.8 Offset contingency measures

Main Roads will ensure contingency measures are in place to meet the offset success criteria defined in Section 5.1.

Table 4-16 and

Table 4-17 outline potential risk/triggers of the offsets and the contingency measures in place to mitigate this risk.

Table 4-16 Land transfer to the DBCA contingency measures

Risk/trigger	Contingency measure
Suitable land parcels are not available	<ul style="list-style-type: none"> Main Roads will continue to search for suitable land parcels until they are determined If no suitable land parcels available within the timeframe given, Main Roads will continue to look for land parcels in the Albany LGA and surrounding LGAs.
Quality of the land parcels are lower than required to meet the offset	<ul style="list-style-type: none"> If the land is lower quality than required to meet the offset, more land will be purchased to ensure a counterbalance of quality with the requirements of the offset or an alternative parcel of land will be identified Surveys will be undertaken to determine the land meets the qualities required for the offset.
<p>Acquired land does not fall within the distribution of all three Black Cockatoos</p> <p>The land does not meet the requirements for all three species of Black Cockatoo and/or WRP</p>	<ul style="list-style-type: none"> If acquired land does not meet the requirements for all three Black Cockatoo species or WRP, additional land will be acquired until the requirements of all four Threatened species are met.

Table 4-17 Funding contribution contingency measures

Risk/trigger	Contingency measure
Murdoch University is unable to secure enough funding to commence the research proposal	<ul style="list-style-type: none">• Main Roads will consider future proposals that may be able to contribute additional funding.

5. Counterbalance of significant residual impact

Table 5-1 provides a summary of the offset proposed to counterbalance the significant residual impacts to Black Cockatoos and WRP. The land extents presented in Table 5-1 are based on preliminary offset calculations using the EPBC Act Offset Assessment Guide, as presented in Section 4 and Appendix A. The offset package is expected to provide adequate compensation for significant residual impacts to those environmental attributes noted above.

Table 5-1 Summary of preliminary offset calculations

MNES	Habitat	Residual impacts	Offset Package
Carnaby's Cockatoo	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	38 ha = 91.42% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	145 ha = 90.82% of impact offset
Baudin's Cockatoo	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	38 ha = 91.42% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	145 ha = 90.82% of impact offset
FRTBC	Foraging and breeding	7.02 ha x quality 7 = 4.91 ha	35 ha = 91.25% of impact offset
	Roosting	37.75 ha x quality 5 = 18.88 ha	133 ha = 90.27% of impact offset
WRP		19.18 ha x quality 6 = 11.51 ha	135 ha = 100.42% of impact offset
Black Cockatoo compensatory offset measures		Installation of 42 artificial hollows to offset the loss of 10 trees (with 14 hollows) potentially suitable for Black Cockatoo nesting. The hollows will be installed in accordance with the <i>DBCA fauna notes on how to design and place artificial hollows</i> (DPAW 2015).	
Black Cockatoo Indirect offset – Research proposal (10%)		Main Roads proposed to provide a funding contribution to Murdoch University to finance Black Cockatoo research (Appendix B). Funding for research is intended to comprise 10% of the total Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC offset requirement.	

5.1 Offset success criteria

5.1.1 Land transfer to the DBCA

For the transfer of land to the DBCA offset to be considered successful, the following criteria will be met:

- Determine suitable land parcels that meet the requirements of the offset
- Survey the land to ensure the land possesses the qualities needed for (at least) the requirements of the 90% counterbalance to residual impacts for Black Cockatoos and 100% for WRP
- Ensure the land to be acquired falls within the range of Black Cockatoo and WRP species and is currently being used by Black Cockatoos and WRP species or is suitable habitat for all four species.
- Agreement with the DBCA on the funding package to ensure the land can be maintained such that it will benefit Black Cockatoos and WRP
- Overall, demonstration that the DBCA has acquired land with suitable ecological values so that it meets the requirements of the offset calculation.

5.1.2 Installation of artificial hollows

Main Roads will ensure the installation of artificial hollows is successful, and the condition of the hollows maintained to advocate use by Black Cockatoos. This will be considered to be achieved when:

- All artificial hollows are checked and maintained to a high standard every three years for a ten year period
- If condition has deteriorated, the hollows are reinstalled or repaired
- Use of the artificial hollows are monitored and recorded for a ten year period and contingency actions applied as required.

5.1.3 Funding contribution to Murdoch University

- Contribute funding to Murdoch University to finance Black Cockatoo research
- Murdoch University conducts research proposal
- The State obtains data and deliverables which contribute to Black Cockatoo protection.

6. Application of EPBC Act environmental offsets policy

The specific outcomes of the offset to be achieved is for a 100% offset to be offered in the form of the transfer of land to conservation estate to offset residual impacts to WRP. A 90% offset in the form of transfer of land to conservation estate will be made for residual impacts to Black Cockatoos, plus installation of 42 artificial hollows. The remaining 10% offset will be obtained via the research proposal attached.

This draft Offset Strategy is consistent with the principles of the EPBC Act Environmental Offsets Policy (DSEWPaC 2012) as presented in Table 6-1.

Table 6-1 Consistency with EPBC Act Environmental Offsets Policy

Policy overarching principles	Comment
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	<p>The offsets will provide a conservation outcome that maintains or improves the viability of Black Cockatoo and WRP. The draft Offset Strategy provides at least 100% offset for all protected matters.</p> <p>The conservation outcome will be achieved through protecting the protected matters through transfer of land containing Black Cockatoo habitat and WRP habitat to DBCA.</p>
Suitable offsets must be built around direct offsets but may include other compensatory measures	The draft 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, Baudin's Cockatoo, FRTBC and 100% for WRP.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	<p>All 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.</p> <p>The quantum of offsets proposed are in proportion to the level of statutory protection applied to Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered), FRTBC (Vulnerable) and WRP (Critically Endangered) as presented in the preliminary offset calculations (Appendix A).</p>
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	<p>The offsets will be of a size and scale proportional to the residual impacts Carnaby's Cockatoo, Baudin's Cockatoo, FRTBC and WRP. The draft Offset Strategy provides at least 100% offset for all impacted MNES.</p> <p>The provision of direct offsets is based on completed offset assessment guide calculations, incorporating evidence based justification for all inputs.</p>

Policy overarching principles	Comment
<p>Suitable offsets must effectively account for and manage the risks of the offset not succeeding</p>	<p>The estimation of direct offsets is based on completed offset assessment guide calculations, incorporating a conservative assessment of risk of the offset not succeeding.</p> <p>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.</p>
<p>Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs</p>	<p>The proposed offsets are additional to any other requirements.</p>
<p>Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable</p>	<p>The proposed offsets identified in the draft Offset Strategy will be acquired and implemented in consultation and agreement with DBCA as the State agency with lead responsibility for conservation.</p> <p>The offsets will involve an efficient and timely transfer of land to DBCA. Main Roads, working with DBCA, is experienced in and has the resources to fund acquisition and transfer of properties to DBCA for ongoing management and conservation.</p> <p>Main Roads is liaising with DBCA regarding acquisition of suitable land in order to meet offset requirements and intends to have all required offsets in place within 12 months of commencement of construction, taking into account the time required to identify appropriate parcels of land, survey the parcel for the environmental attributes to be offset, negotiate with the landowner and then transfer the parcel/s into DBCA reserve.</p> <p>The offsets will be scientifically robust, based on surveys of the Proposed Action Area and offset properties.</p> <p>The Offset Proposal will be a transparent document developed in consultation with DBCA and relevant local stakeholders.</p>
<p>Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.</p>	<p>All offset sites will be managed by DBCA through conservation tenure.</p> <p>The Offset Proposal will be based on a Memorandum of Understanding between Main Roads and DBCA, including requirements for land management and monitoring.</p>

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Appendices

Appendix A – Offset Calculations

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin's Black Cockatoo
EPBC Act status	Endangered
Annual probability of extinction <small>Based on IUCN category definitions</small>	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Foraging and breeding habitat (this extent includes roosting habitat that overlaps with the foraging and breeding habitat, which has been offset separately)	Area	7.02	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	4.91	Adjusted hectares	
<i>Threatened species</i>						
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																				
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
<i>Ecological Communities</i>																				
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
							Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)												
							Time until ecological benefit	Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)									
<i>Threatened species habitat</i>																				
Area of habitat	Yes	4.91	Adjusted hectares	Land offset	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	38	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
									Future area without offset (adjusted hectares)	35.2	Future area with offset (adjusted hectares)	38.0								
									Time until ecological benefit	2	Start quality (scale of 0-10)	7								
<i>Threatened species</i>																				
Birth rate <small>e.g. Change in nest success</small>	No																			
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																			
Number of individuals <small>e.g. Individual plants/animals</small>	No																			

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	4.914	4.49	91.42%	Yes	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012
This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Baudin's Black Cockatoo
EPBC Act status	Endangered
Annual probability of extinction <small>Based on IUCN category definitions</small>	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Foraging and breeding habitat (this extent includes roosting habitat that overlaps with the foraging and breeding habitat, which has been offset separately)	Area	37.75	Hectares	
			Quality	5	Scale 0-10	
			Total quantum of impact	18.88	Adjusted hectares	
<i>Threatened species</i>						
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																																	
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source													
<i>Ecological Communities</i>																																	
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0																					
																					Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)									
Area of habitat	Yes	18.88	Adjusted hectares	Land offset	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	145	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	10.77	90%	9.70	7.64	17.14	90.82%	Yes														
																						Time until ecological benefit	2	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	7	1.00	90%	0.90	0.88
<i>Threatened species habitat</i>																																	
<i>Threatened species</i>																																	
Birth rate <small>e.g. Change in nest success</small>	No																																
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																																
Number of individuals <small>e.g. Individual plants/animals</small>	No																																

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	18.875	17.14	90.82%	Yes	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012
This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Carnaby's Black Cockatoo
EPBC Act status	Endangered
Annual probability of extinction <small>Based on IUCN category definitions</small>	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Foraging and breeding habitat (this extent includes roosting habitat that overlaps with the foraging and breeding habitat, which has been offset separately)	Area	7.02	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	4.91	Adjusted hectares	
<i>Threatened species</i>						
Protected matter attributes						
Number of features <small>e.g. Nest hollows, habitat trees</small>	No					
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No					
<i>Threatened species</i>						
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																									
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source					
<i>Ecological Communities</i>																									
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset	Future area with offset (adjusted hectares)	0.0													
																						Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)
<i>Threatened species habitat</i>																									
Area of habitat	Yes	4.91	Adjusted hectares	Land offset	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	38	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	2.82	90%	2.54	2.00	4.49	91.42%	Yes						
																						Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)
																						2	7	6	7
<i>Threatened species</i>																									
Protected matter attributes																									
Number of features <small>e.g. Nest hollows, habitat trees</small>	No																								
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No																								
<i>Threatened species</i>																									
Birth rate <small>e.g. Change in nest success</small>	No																								
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																								
Number of individuals <small>e.g. Individual plants/animals</small>	No																								

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	4.914	4.49	91.42%	Yes	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Carnaby's Black Cockatoo
EPBC Act status	Endangered
Annual probability of extinction <small>Based on IUCN category definitions</small>	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Roosting habitat (this extent includes foraging and breeding habitat that overlaps with the roosting habitat, which has been offset separately)	Area	37.75	Hectares	
			Quality	5	Scale 0-10	
			Total quantum of impact	18.88	Adjusted hectares	
<i>Threatened species</i>						
Number of features <small>e.g. Nest hollows, habitat trees</small>	No					
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No					
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																					
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source	
<i>Ecological Communities</i>																					
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source	
							Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)													
							Time until ecological benefit	Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)										
<i>Threatened species habitat</i>																					
Area of habitat	Yes	18.88	Adjusted hectares	Land offset	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	145	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source	
								Future area without offset (adjusted hectares)	134.2	Future area with offset (adjusted hectares)	145.0										
								Time until ecological benefit	2	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)									6
<i>Threatened species</i>																					
Number of features <small>e.g. Nest hollows, habitat trees</small>	No																				
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No																				
Birth rate <small>e.g. Change in nest success</small>	No																				
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																				
Number of individuals <small>e.g. Individual plants/animals</small>	No																				

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	18.875	17.14	90.82%	Yes	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012
This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	FRTBC
EPBC Act status	Vulnerable
Annual probability of extinction <small>Based on IUCN category definitions</small>	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Foraging and breeding habitat (this extent includes roosting habitat that overlaps with the foraging and breeding habitat, which has been offset separately)	Area	7.02	Hectares	
			Quality	7	Scale 0-10	
			Total quantum of impact	4.91	Adjusted hectares	
<i>Threatened species</i>						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Number of features <small>e.g. Nest hollows, habitat trees</small>	No					
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No					
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																									
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source					
<i>Ecological Communities</i>																									
Area of community	No				Risk-related time horizon (max. 20 years)	Start area (hectares)	Risk of loss (%) without offset	Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset	Future area with offset (adjusted hectares)	0.0													
																					Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)	
<i>Threatened species habitat</i>																									
Area of habitat	Yes	4.91	Adjusted hectares	Land offset	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	35	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	2.61	90%	2.35	2.26	4.48	91.25%	Yes						
																						Time until ecological benefit	Start quality (scale of 0-10)	Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)
																						2	7	6	7
<i>Threatened species</i>																									
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start value		Future value without offset		Future value with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source					
Number of features <small>e.g. Nest hollows, habitat trees</small>	No																								
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No																								
Birth rate <small>e.g. Change in nest success</small>	No																								
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																								
Number of individuals <small>e.g. Individual plants/animals</small>	No																								

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	4.914	4.48	91.25%	Yes	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	FRTBC
EPBC Act status	Vulnerable
Annual probability of extinction <small>Based on IUCN category definitions</small>	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Roosting habitat (this extent includes foraging and breeding habitat that overlaps with the roosting habitat, which has been offset separately)	Area	37.75	Hectares	
			Quality	5	Scale 0-10	
			Total quantum of impact	18.88	Adjusted hectares	
<i>Threatened species</i>						
Number of features <small>e.g. Nest hollows, habitat trees</small>	No					
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No					
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																					
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source	
<i>Ecological Communities</i>																					
Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)	Risk of loss (%) without offset	Risk of loss (%) with offset	Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0								
								Time until ecological benefit	Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)	Future quality with offset (scale of 0-10)									
								<i>Threatened species habitat</i>													
Area of habitat	Yes	18.88	Adjusted hectares	Land offset	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	133	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	9.92	90%	8.93	8.58	17.04	90.27%	Yes		
						Future area without offset (adjusted hectares)		123.1	Future area with offset (adjusted hectares)	133.0											
						Time until ecological benefit		2	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6									
<i>Threatened species</i>																					
Number of features <small>e.g. Nest hollows, habitat trees</small>	No																				
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No																				
Birth rate <small>e.g. Change in nest success</small>	No																				
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																				
Number of individuals <small>e.g. Individual plants/animals</small>	No																				

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	18.875	17.04	90.27%	Yes	\$0.00	#DIV/0!	#DIV/0!
Area of community	0				\$0.00		\$0.00
					\$0.00	#DIV/0!	#DIV/0!

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	Western Ringtail Possum
EPBC Act status	Critically Endangered
Annual probability of extinction <small>Based on IUCN category definitions</small>	6.8%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator						
Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
<i>Ecological communities</i>						
Area of community	No		Area			
			Quality			
			Total quantum of impact	0.00		
<i>Threatened species habitat</i>						
Area of habitat	Yes	Possum core, supporting and linkage	Area	19.18	Hectares	
			Quality	6	Scale 0-10	
			Total quantum of impact	11.51	Adjusted hectares	
<i>Threatened species</i>						
Number of features <small>e.g. Nest hollows, habitat trees</small>	No					
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No					
Birth rate <small>e.g. Change in nest success</small>	No					
Mortality rate <small>e.g. Change in number of road kills per year</small>	No					
Number of individuals <small>e.g. Individual plants/animals</small>	No					

Offset calculator																					
Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source	
<i>Ecological Communities</i>																					
Area of community	No					Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset		Risk of loss (%) with offset									
						Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0												
						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)									
<i>Threatened species habitat</i>																					
Area of habitat	Yes	11.51	Adjusted hectares	Land offset	20	Time over which loss is averted (max. 20 years)		Start area (hectares)	135	Risk of loss (%) without offset	7%	Risk of loss (%) with offset	0%	10.03	90%	9.03	2.42	11.56	100.42%	Yes	
						Future area without offset (adjusted hectares)	125.0	Future area with offset (adjusted hectares)	135.0												
						Time until ecological benefit	2	Start quality (scale of 0-10)	7	Future quality without offset (scale of 0-10)	6	Future quality with offset (scale of 0-10)	7	1.00	90%	0.90	0.79				
<i>Threatened species</i>																					
Number of features <small>e.g. Nest hollows, habitat trees</small>	No																				
Condition of habitat <small>Change in habitat condition, but no change in extent</small>	No																				
Birth rate <small>e.g. Change in nest success</small>	No																				
Mortality rate <small>e.g. Change in number of road kills per year</small>	No																				
Number of individuals <small>e.g. Individual plants/animals</small>	No																				

Summary							
Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost (\$)		
					Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
Birth rate	0				\$0.00		\$0.00
Mortality rate	0				\$0.00		\$0.00
Number of individuals	0				\$0.00		\$0.00
Number of features	0				\$0.00		\$0.00
Condition of habitat	0				\$0.00		\$0.00
Area of habitat	11.508	11.56	100.42%	Yes	\$0.00	N/A	\$0.00
Area of community	0				\$0.00		\$0.00
					\$0.00	\$0.00	\$0.00

Appendix B – Murdoch University Black Cockatoo 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

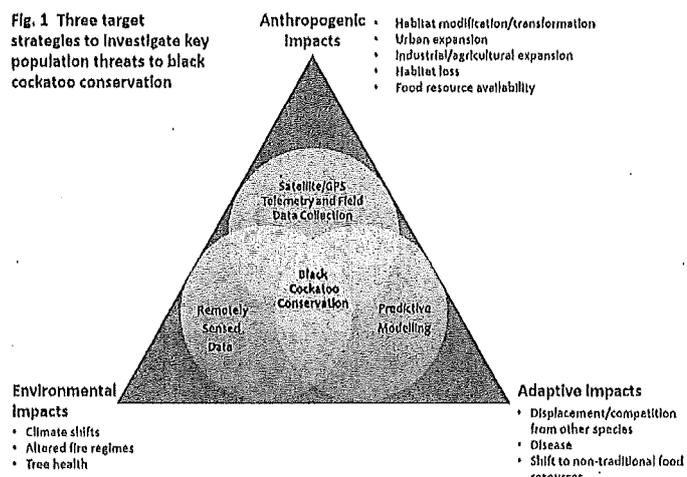
A/Professor Kristin Warren¹, Dr Jill Shephard¹, Dr Lian Yeap¹, Dr Bethany Jackson¹, Dr Rebecca Vaughan-Higgins¹, Rebecca Donaldson¹, Dr David Mitchell², Dr Geoff Barrett², Rick Dawson², Dr Peter Mawson², Dr Denis Saunders³, Professor Willem Bouten⁴

¹ Harry Butler Institute, Murdoch University, ² Department of Biodiversity, Conservation and Attractions, ³ CSIRO, ⁴ University of Amsterdam.

Summary

Western Australia's three endemic black cockatoo species, Carnaby's cockatoos (*Calyptorhynchus latirostris*), Baudin's cockatoos (*Calyptorhynchus baudinii*) and forest red-tailed black cockatoos (*Calyptorhynchus banksii naso*) are threatened and receive special protection as Matters of National Environmental Significance (MNES) under the Environment Protection and Biodiversity Conservation Act (1999)¹⁻⁷. Threats to species survivorship for these black cockatoos are well documented, and include habitat loss and modification, urban and industrial expansion, disease, displacement by competing species, and climate shifts¹⁻² (Figure 1). Despite significant research to date⁸⁻¹³, key information required to address the National Recovery Plan remains outstanding.

Fig. 1 Three target strategies to investigate key population threats to black cockatoo conservation



Background and Significance

Black cockatoos are iconic species in the Western Australian landscape. People hold strong cultural associations with them, and they are well placed to function as flagship species for habitat conservation. All three species occupy a large area of habitat in the south-west of Western Australia, including populations that inhabit the Perth-Peel Coastal Plain; with Carnaby's cockatoos typically migrating from inland breeding areas to coastal habitat during the non-breeding season, Baudin's cockatoos migrating from wintering sites in the Darling Ranges to southern breeding sites, and forest red-tailed black cockatoos moving between the Perth-Peel Coastal Plain and the Darling Ranges. All three species also have populations that inhabit the south-west forests in the southern part of their distribution range, which do not migrate to the Perth-Peel Coastal Plain.

Carnaby's cockatoos are listed as Endangered under Australian Federal law (*Environment Protection and Biodiversity Conservation Act 1999*) and internationally by the IUCN^{1,4}. At the state level they are listed as Endangered under the Western Australia *Biodiversity Conservation Act 2016*⁵. The species has undergone an estimated 50% decline over the last 5 decades¹, including an estimated average decline of 5% per annum across the Perth-Peel Coastal Plain over the last nine years¹³. Overall this has contributed to a suggested 30% range contraction¹, and significant loss of breeding populations^{1,13}.

Forest red-tailed black cockatoos have declined in range by 30% as a result of habitat loss and have suffered a marked decline in population numbers since the 1950s^{2,9,10}. The species is listed as Vulnerable under Australian Federal law (*Environment Protection and Biodiversity Conservation Act 1999*) and under the Western Australia *Biodiversity Conservation Act 2016*⁵. The forest red-tailed black cockatoo fits the IUCN Red List Criteria for Vulnerable due to a projected or suspected decline in the population of more than 30% within the next 10 years or three generations².

Baudin's cockatoos are listed as Endangered at the Federal Level (*Environment Protection and Biodiversity Conservation Act 1999*), and at the State Level (*Biodiversity Conservation Act 2016*)⁵. The population has been in decline over the last 50 years, however in the last eleven years there has been a dramatic decline (over 90%) in the numbers recorded at traditional autumn-winter roost sites in the northern Darling Range¹⁵. Additionally, in 2017 there were unexpectedly few records of large flocks of this species in the south-west¹⁵.

The Carnaby's Cockatoo Recovery Plan¹ lists six priority Actions that must be undertaken to meet the Plan's objectives; and the Forest Black Cockatoo Recovery Plan² lists 13 Actions. The Actions listed in both these Recovery Plans have remained largely out of reach, as they have required information about the species' ecology, movement patterns and habitat use/selection which can only be obtained by large-scale tracking of wild flocks. Our team has developed and tested an approach enabling us to track wild flocks using satellite and GPS tags at both local population and landscape scales; allowing us to collect a suite of hitherto unknown ecological information. Accordingly, this proposed project will address and inform all six priority Actions from the Carnaby's Cockatoo Recovery Plan, and seven of the priority Actions in the Forest Black Cockatoo Recovery Plan.

Threatening processes for Western Australia's black cockatoos are exacerbated by the rapidly increasing urban and industrial development in the Perth-Peel region and the south-west of Western Australia³. Perth's human population is projected to nearly double to 3.5 million by 2050³, emphasising the need to understand flock movements and habitat use, and identify critical feeding and breeding sites; which still remain largely unknown despite early attempts using direct observation^{8-13,16-19}. There is an apparent mismatch between legislative intent and management action as insufficient knowledge exists about basic behavioural ecology across spatial scales, and which habitats are integral to long-term retention of black cockatoos.

Our tracking research, which identifies habitat use and flock movements through the landscape, can assist with identifying key habitats and areas for conservation/revegetation. Our research team is in a strong position to work alongside government to identify areas of habitat that are high-use, and to inform decisions regarding which areas are most appropriate to conserve and manage to halt black cockatoo population declines.

Our research team at Murdoch University has developed a novel tracking methodology for black cockatoos using GPS and satellite telemetry²⁰⁻²¹. Together this will enable researchers to obtain movement, behavioural and ecological data at both the extent and spatial scale (local population and landscape scales) required to inform conservation and land management planning.

Three industry partners have proposed funding for this project in relation to their offset packages – Main Roads Western Australia, the Public Transport Authority (PTA) of Western Australia and Talison Lithium.

Main Roads WA are responsible for the building and provision of road infrastructure and operations in relation to improvement in road efficiency, as well as maintenance of the State's major government roads, bridges and road verges. *It is proposed that Main Roads WA would provide funding for Year 1 of this research project.*

The Government of Western Australia has embarked on the delivery of METRONET, considered to be Perth's most ambitious public transport program, which aims to address sustainability issues in the city through the optimisation of existing rail capacity and building new rail systems. The rail extensions currently underway, and those that are proposed, will impact on remnant vegetation that our current tracking work indicates is important black cockatoo habitat. Various rail projects will affect all three black cockatoo species as follows: Thornlie-Cockburn Link - Carnaby's cockatoo, forest red-tailed black cockatoo; Yanchep Rail Extension Part 1 - Carnaby's cockatoo, forest red-tailed black cockatoo; Yanchep Rail Extension Part 2 - Carnaby's cockatoo, forest red-tailed black cockatoo; Morley-Ellenbrook Line - Carnaby's cockatoo, forest-red-tailed cockatoo; Byford Rail Extension - Carnaby's cockatoo, forest-red tailed cockatoo, Baudin's cockatoo; Midland Line Rail Extension and new Midland Station - Carnaby's cockatoo, forest-red tailed cockatoos; and, Karnup Station - Carnaby's cockatoo, forest red-tailed black cockatoo. *The funding component from PTA in Year 2-5 is linked to proposed rail extension projects for the Thornlie Cockburn Link, Yanchep Rail Extension Part 2 and Morley-Ellenbrook Line.*

Talison Lithium Australia Pty Ltd has been operating the Greenbushes Lithium mine, in the Greenbushes region in south-west WA, for over 30 years. Talison Lithium is proposing to expand its operations at this mine site to increase the production of spodumene ore and lithium mineral concentrate. *The funding component from Talison Lithium in Year 2-5 is linked to the proposed expansion of the Greenbushes Lithium mine.*

These industry partners have indicated that they are committed to sustainable development; they aim to minimise and manage potential environmental impacts and work with the Federal Department of Environment and Energy in relation to environmental approval and offset requirements.

Development and biodiversity conservation are not mutually exclusive. Perth is undergoing rapid and extensive development, and could be a strong model for how development and conservation can be managed synergistically. A large part of what makes Perth special is its unique and endemic biodiversity, which we are fortunate to have in our urban areas; including endangered and iconic black cockatoos. As Perth develops, it will be important to implement effective efforts to ensure the conservation management of our threatened species. For black cockatoos, this will mean identifying and protecting important habitat on the Perth-Peel Coastal Plain, alongside creation of replacement habitat, to ensure no net habitat loss across their distribution range.

Proposed Research

This project aims to utilise innovative tracking methodologies to undertake a movement ecology study of Western Australia's three threatened black cockatoo species, to determine habitat use and threatening processes in modified landscapes. We will track the three species of black cockatoos on the Perth-Peel Coastal Plain and in the south-west forest region of Greenbushes; and additionally – given the importance of the Perth-Peel Coastal Plain for Carnaby's cockatoos during the non-breeding season – we will track Carnaby's cockatoos at key breeding sites to better understand migratory movement dynamics of this species across its distribution range. We will also undertake health research on Carnaby's cockatoos to better understand the potential role of disease as a threatening process for this species. Several potential pathogens associated with avian disease have been found in wild Carnaby's cockatoo nestlings in south-western Australia, including: (1) psittacine beak and feather disease (a listed Key Threatening Process for endangered parrots, Commonwealth EPBC Act 1999); (2) polyoma virus; and, (3) *Chlamydia* sp. The clinical significance of these diseases for species survival remains unknown²². The Murdoch team has also been involved in the investigation of Carnaby's cockatoo Hindlimb Paralysis Syndrome (CHiPs) in adult Carnaby's cockatoos, likely associated with toxicity events involving birds exposed to agricultural chemicals at breeding sites. Each year a number of Carnaby's cockatoos that have migrated back to the Perth-Peel Coastal Plain following the breeding season, are observed with clinical symptoms suggestive of delayed organophosphate neuropathy. This disease is also suspected to have caused two mass mortality events at a key Wheatbelt breeding site (2009, 2012), resulting in a population crash at this site of > 90% of breeding birds, and functional extirpation of this important breeding population²³.

This research will use remote sensing to produce predictive modelling of black cockatoo population movements and habitat use, in association with existing and emerging threats across key range areas. The project offers a novel approach: it combines (a) satellite/GPS derived movement data from our innovative tracking system; (b) other remotely sensed landscape data (e.g. vegetation, water); and (c) existing fire and climate models, to identify crucial habitat characteristics and regions most resilient to impacts of threatening processes (fire, climate shifts, habitat modification, tree health, disease, urban expansion). The data and information they generate will allow collaborators to develop policies and take action to manage land changes, and build resilience into modified landscapes to address black cockatoo declines.

Objectives of the Study

In this study we adopt a multidisciplinary approach (Fig. 1) to meet the following five objectives: 1) Characterise black cockatoo movement and habitat use across the Perth-Peel Coastal Plain and in the south-west forest region of Greenbushes for all three black cockatoo species; 2) Study known Carnaby's cockatoo breeding sites, focussing on characterising habitat suitability, food resource availability and selection, nestling health, specific threatening processes and fledgling dispersal routes; 3) Identify new breeding sites in inland or southern areas for all three species based on migratory movement of birds to breeding grounds; 4) Apply new ecotoxicology methods to investigate CHiPs toxicity cases, particularly in the agricultural zone; and 5) predictively model survivorship scenarios for all three species of black cockatoo using movement, habitat use and threats.

Methods and Analytical Framework to meet Objectives

Obj 1 and Obj 3 – Flock Movements and Habitat Use across the PPCP; south-west forest region of Greenbushes; New Breeding Sites (Carnaby's cockatoo, Baudin's cockatoo and forest red-tailed black cockatoo)

- Double mounted Satellite and GPS tracking – 16 black cockatoos tracked on the Perth-Peel Coastal Plain per annum for four years - 8 Carnaby's cockatoos (4 individuals released into two different resident flocks), 4 Baudin's cockatoos and 4 forest red-tailed black cockatoos released into resident wild flocks on the Perth-Peel Coastal Plain and in south-west forest region of Greenbushes* – use of Switching State-Space Models²⁴, First-Passage Time Analysis²⁵ and GIS to model movement behaviour, habitat selection and foraging strategies. *The number of releases of black cockatoos equates to a total of 10 releases on the Perth-Peel Coastal Plain i.e. 6 for Carnaby's cockatoos, 2 for forest red-tailed black cockatoos, 2 for Baudin's cockatoos) and 6 releases in the south-west forest region of Greenbushes i.e. 2 for Carnaby's cockatoos, 2 for forest red-tailed black cockatoos, 2 for Baudin's cockatoos; fewer Baudin's cockatoos present for rehabilitation and whilst it is likely there will be birds from this species undergoing rehabilitation that will enable a number of release groups, in the event that there are insufficient Baudin's cockatoos to have four release groups over the duration of the project, additional Carnaby's cockatoos or forest red-tailed black cockatoos will be released instead based on discussion with the industry partners and DBCA.

Obj 2 – Known Breeding Sites and Dispersal Routes (Carnaby's cockatoo)

- GPS tracking and Satellite tracking – 9 breeding sites across the distribution range – 3 sites per annum for three years, with each site monitored in the subsequent year through field observations by research staff. Numbers of birds tracked: 4 adult breeding birds per site per year (i.e. 12 birds per year), each double mounted (UVA-BITS and Telonics tags). This will include sites currently monitored by DBCA and Birdlife Australia (e.g. Coomallo Creek, Borden, Lake King, Stennetts Lake), and new sites (e.g. Kojonup and 4 additional sites identified by the tracking work) – Use of Switching State-Space Models, Calculation of Utilisation Distributions and associated Home Range estimators to identify and quantify high use habitat for feeding and watering; Examination of ecological linkages across identified habitat parameters using spatially explicit models (e.g. GLMs, GAMs, Maxent, Random Forests) to assess linkages between bird movement and specific habitat features (including travel

distances to foraging and watering sites). These data will also be used in comparative studies between sites/regions and to inform predictive modeling.

- Energetics – combined analysis using GPS accelerometer derived activity budgets and caloric benefit of identified food species determined by Bomb Calorimetry.
- Nestling health - 20 nestlings per site - 60 nestlings per year. Screening for: i) psittacine beak and feather disease (key threatening process), ii) polyoma virus, iii) *Chlamydia* sp. (present in nestlings in south-western Australia).
- Ground surveys – Identification of new nest hollows, assessment of hollow condition, inventory of current and potential future threats at each site.

Obj 3 – Identify new breeding sites – see Obj 1 above

Obj 4 – CHIPs toxicity (Carnaby's cockatoo)

- Application of new ecotoxicology methods to investigate CHIPs toxicity – catastrophic mass mortality events in 2009 and 2012 led to functional extirpation of a key breeding site in the Wheatbelt²³. Separation Science (e.g. GC-MS) targeting agricultural pesticides undertaken. Samples will include environmental samples, eggshells and cadavers (in the event of further mortality events; CHIPs clinical cases).

Obj 5 – Predictive modelling of perturbation scenarios (Carnaby's cockatoo, forest red-tailed black cockatoo and Baudin's cockatoo)

- Realised movement, habitat use, food and water resources will be modelled in a predictive framework (e.g. using Ensemble Species Distribution Modelling²⁶ against various perturbation scenarios including: habitat loss, habitat modification due to climate shifts, fire impacts, and forecast land-use transformation through urban and industrial expansion to identify landscape critical for supporting species survivorship in the long-term [modelled in 10yr increments for 50-100yrs]). Existing fire and climate models exist. Ensemble modelling allows the prioritisation of habitat according to competing ecological hypotheses and is an excellent tool for guiding conservation management under large-scale disturbance scenarios.

Projected Conservation Management Outcomes

This project will deliver major new flock movement and habitat use information and conservation outcomes. Since 2015, our research team has successfully deployed 84 tags and generated over 140,000 GPS location fixes, 33,000 km of track movement and over 2.8M accelerometer records. The methodology is proven, and facilitates black cockatoo flock movement characterisation at spatial and temporal scales previously unattainable. The proposed research builds on this existing success, with a clear focus on conservation and management of all three black cockatoo species on the Perth-Peel Coastal Plain and the south-west forest region of Greenbushes, as well as at key Carnaby's cockatoo breeding sites across the species distribution range.

We envisage the following direct conservation management outcomes:

1. Identification and prioritisation of key habitat resources, including food, water and vegetation corridors, to maximise the retention of critical conservation value habitat for the long-term retention of Carnaby's cockatoos, Baudin's cockatoos and forest red-tailed black cockatoos across their distribution range.
2. Characterisation of appropriate roosting habitat for all three species of black cockatoo, particularly on the Perth-Peel Coastal Plain – this is important as it is not necessarily synonymous with appropriate feeding or nesting habitat.
3. Characterisation of optimal provisioning distances based on energetics work to inform future offset purchases.
4. Identification of new breeding sites (and nest hollow identification) for all three species of black cockatoo, facilitating additional long-term monitoring and protection of stronghold populations, and informing the purchase of off-set land.
5. Additional knowledge about key threatening processes (disease, displacement spp., pesticide exposure etc) on Perth-Peel Coastal Plain, in the south-west forest region and at breeding sites.
6. Additional knowledge about critical habitat resources and the overall health of breeding populations at key Carnaby's cockatoo breeding sites, which is required to ensure appropriate long-term conservation management of these sites.
7. Correlation of realised species movement ecology with existing PVA models.
8. Facilitation of consultation with local government to maximise future urban and peri-urban design to retain birds on the Perth-Peel Coastal Plain and maximise conservation management.
9. Continued liaison with stakeholder groups which consult with private landowners and industry, to manage properties and to maximise landscape and habitat integrity suitable to sustain black cockatoo populations over the long-term.

This project has been developed in collaboration with DBCA to meet the requirements of the EPBC Act Referral Guidelines for the three black cockatoo species⁴, as well as priority Actions and recommendations from the national Carnaby's Cockatoo Recovery Plan¹; Forest Black Cockatoo Recovery Plan²; Matters of National Environmental Significance (MNES) Significant Impact Guidelines⁴⁻⁷; and the Consideration of MNES by the WA land use planning system Discussion Paper⁶.

In addition, this project will meet the following recommendations from the MNES Paper:

- Will address the Government of Western Australia's MNES Discussion Paper recommendations⁴⁻⁷ to identify key areas within a region to sustain threatened populations, including collecting sufficient spatial information to inform assessments

GHD Scope and limitations

Main Roads Western Australia (Main Roads) commissioned GHD Pty Ltd (GHD) to develop a draft Offset Strategy to support the Preliminary Documentation for EPBC 2020/8769 Albany Ring Road Stages 2 and 3b for submission to the Department of Agriculture, Water and the Environment (DAWE).

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