EPBC 2020/8833 Preliminary Documentation

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Mitchell Fwy PSP Gaps – Ocean Reef Road to Hepburn Avenue

August 2021

D21#154527

EXECUTIVE SUMMARY

The Commissioner of Main Roads Western Australia (Main Roads) proposes to install a Principal Shared Path (PSP) and noise walls along the eastern side of the Mitchell Freeway at various sections between Ocean Reef Road and Hepburn Avenue, in the northern suburbs of Perth, Western Australia (Proposed Action).

The Proposed Action involves the construction of a continuous PSP along the Mitchell Freeway between Ocean Reef Road and Hepburn Avenue in order to improve the efficiency of the Perth bicycle network and potentially increase the uptake of cycling as a method of commuting. Sections of PSP already exist but require upgrade to current design standards and to facilitate the upgrade of Ocean Reef Road and Whitfords Avenue on-ramps to the Mitchell Freeway and the construction of new emergency stopping bays, which are required to improve the safe and efficient use of the freeway. Noise walls will also be constructed in order to improve the amenity of the adjacent residential properties, as there is currently no noise mitigation from the traffic noise of the Mitchell Freeway.

The project works described in this Proposed Action will be delivered as part of a larger contract involving the widening of Mitchell Freeway southbound from Hodges Drive to Hepburn Avenue, and on ramp upgrades and Intelligent Transport System (ITS) works between Hester Avenue to Warwick Road. The freeway widening works preferentially include disturbance into the median where it is mostly cleared with isolated planted scattered trees and involve no impacts to Matters of National Environmental Significance (MNES). The packages of works (PSP, widening and ITS works) have been rolled into a single contract to simplify construction.

The Proposed Action was formally referred to the Department of Agriculture, Water and Environment (DAWE) in November 2020 (EPBC Act referral 2020/8833) as a potential Controlled Action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to potential impacts on Matters of Nation Environmental Significance (MNES). On 11 December 2020, a delegate of the Minister for the Environment determined that the Proposed Action is a Controlled Action and that it would be assessed by Preliminary Documentation. This Preliminary Documentation is to inform the assessment of the relevant impacts of the Proposed Action.

MNES listed under the EPBC Act that may be impacted by the Proposed Action include the Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Ecological Community (Tuart TEC), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Forest Red-tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*). The Proposed Action is predicted to have the following impacts to MNES:

- Clearing of up to 8.75 ha of Tuart TEC
- Clearing of up to 177 Potential Breeding Trees (>500 mm at breast height), including two trees that contain a total of two hollows suitable for nesting by Black Cockatoos
- Clearing of up to 3.02 ha of foraging habitat for Carnaby's Cockatoo
- Clearing of up to 0.62 ha of foraging habitat for FRTBC.

The Proposed Action will not result in impacts to known Black Cockatoo nesting hollows or roosting sites of Black Cockatoo species.

Substantial changes to the Proposed Action design were made to reduce impacts on Tuart TEC and Black Cockatoo habitat as appropriate and necessary to avoid and minimise impacts on the environment. This process principally occurred through minor adjustments to the infrastructure positioning and structure, resulting in a reduction to the impacts to these species and communities.

Main Roads is proposing an offset to counterbalance the potential significant residual impacts to Tuart TEC and Black Cockatoos from the Proposed Action.

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Document Control

Report Compilation & Review	Name and Position	Document Revision	Date
Author:	Amy Dalton Environment Officer	Rev A	03/02/21
Reviewer:	John Braid Principal Environment Officer	Rev A	04/02/21
Author:	Amy Dalton Environment Officer	Rev B	16/02/21
Reviewer:	John Nielsen Environmental Advisor	Rev C	08/03/21
Reviewer:	Freea Itzstein-Davey Senior Environment Officer	Rev C	15/03/21
Author:	Amy Dalton Environment Officer	Rev 0	22/03/21
Author:	Amy Dalton Environment Officer	Rev 1	14/04/21
Author:	Cliff Bennison Environment Officer	Rev 2	02/06/21
Author:	Cliff Bennison Environment Officer	Rev 3	16/06/21
Author:	Cliff Bennison Environment Officer	Rev 4	06/08/21

1 INTRODUCTION

1.1 Background

The Commissioner of Main Roads Western Australia (Main Roads) proposes to upgrade existing and install a new continuous Principal Shared Path (PSP) and noise walls along the eastern side of the Mitchell Freeway at various sections between Ocean Reef Road and Hepburn Avenue, in the northern suburbs of Perth, Western Australia (Proposed Action) (Figure 1).

The Western Australian Department of Transport has a hierarchy of paths for the cycle network within the Perth Metropolitan Area. PSPs form the highest level of this hierarchy for the primary cycling routes and are built to a higher standard than other shared paths in the network. PSPs are shared pedestrian and cycle paths that are intended to maximise cycling accessibility whilst minimising the potential for adverse cyclist/pedestrian interaction.

The Proposed Action includes:

- The installation of a new PSP along the eastern side of the Mitchell Freeway, including the upgrading of existing PSPs to current design standards
- The construction of noise walls to mitigate freeway noise on nearby residential areas, stretching from Hepburn Avenue to Ocean Reef Road
- Verge side emergency stopping bays, modification of freeway on-ramps to accommodate Intelligent Transport Systems (ITS) works and drainage works on the Mitchell Freeway.

The Proposed Action involves the construction of a continuous PSP along Mitchell Freeway between Ocean Reef Road and Hepburn Avenue in order to improve the efficiency of the Perth bicycle network and potentially increase the uptake of cycling as a method of commuting. Noise walls will also be constructed in order to improve the amenity of the adjacent residential properties as there is currently no noise mitigation from the traffic noise of the Mitchell Freeway. Works will also include the upgrade of Ocean Reef Road and Whitfords Avenue on-ramps to the Mitchell Freeway and the construction of new emergency stopping bays, which is required to improve the safe and efficient use of the freeway. The Proposed Action will be implemented in a Development Envelope (DE) of 13.68 ha and extends for more than four kilometres along the eastern side of the Mitchell Freeway.

The project works described in this Proposed Action will be delivered as part of a larger contract involving the widening of Mitchell Freeway southbound from Hodges Drive to Hepburn Avenue and on ramp upgrades and Intelligent Transport System (ITS) works between Hester Avenue to Warwick Road. The freeway widening works preferentially include disturbance into the median where it is mostly cleared with isolated planted scattered trees and involve no impacts to Matters of National Environmental Significance (MNES). The packages of works (PSP, widening and ITS works) have been rolled into a single contract to simplify construction.

The Proposed Action was referred to the Department of Agriculture, Water and the Environment (DAWE) on the 13th November 2020. The Proposed Action was determined to be a Controlled Action under section 75 of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) to be assessed by preliminary documentation.

1.2 Purpose of this document

This document was prepared to address DAWE's 11 December 2020 request for further information to support assessment of a Controlled Action by preliminary documentation. The general location of the requested information is outlined in Table 1-1, while specific sections that address the required content are detailed in Appendix B.

Table 1-1 Additional information requirements reference table

SPECIFIC CONTENT TO BE INCLUDED	SECTION NUMBER
1. Description of the action	Section 1.3
2. Description of the environment and MNES	Section 2
3. Assessment of impacts	Section 3
4. Avoidance and mitigation measures	Section 4
5. Offsets	Section 5
6. Economic and social matters	Section 6
7. Ecologically sustainable development	Section 7
8. Environmental record of the person proposing to take the action	Section 8
9. Other approvals and conditions	Section 9

1.3 Description of the action

The Proposed Action is located approximately 20 km northwest of Perth, within the Local Government Area of the City of Joondalup, within the Perth Metropolitan Region of Western Australia (WA). The Proposed Action intersects to the Mitchell Freeway, which is the primary road distributor for the northern suburbs of Perth and is approximately 36 km in length.

The area referred by Main Roads is 13.68 ha within the DE (Figure 1).

The Proposed Action is predicted to have the following impacts to MNES:

- Clearing of up to 8.75 ha of Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plan Threatened Ecological Community (Tuart TEC)
- Clearing of up to 177 Potential Black Cockatoo Breeding Trees (>500 mm at breast height), including two trees that contain a total of two hollows suitable for nesting by Black Cockatoos
- Clearing of up to 3.02 ha of foraging habitat for Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
- Clearing of up to 0.62 ha of foraging habitat for and Forest Red-tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*).

1.3.1 Pre-construction, construction and operation of the Proposed Action

1.3.1.1 Pre-construction

The Proposed Action is currently at the concept stage (concept design). The concept design has been developed to minimise environmental impacts as far as practicable. The Proposed Action is located in a constrained urban environment, within a narrow road verge between the existing freeway and residential properties, which limits the extent to which environmental impacts can be avoided.

Due to the early stages of design for the Proposed Action, a layout plan has not yet been created. Detailed design during delivery will address key constraints, which may result in further amendments to the concept design. The concept design is displayed in Figure 2.

1.3.1.2 Construction

Construction of the Proposed Action is planned to commence in Quarter 3, 2021 and is expected to continue for a period of up to two years.

Construction of the PSP, noisewalls, on-ramps and emergency bays will be undertaken using standard earth moving equipment and construction techniques. Excavated material suitable for use as fill will be placed directly into the fill location by trucks and spread using loaders, graders or compactors. In order to facilitate upgrades to the existing PSP, an existing embankment will be excavated and a retaining wall constructed to achieve the required clearance.

Construction fencing will be installed to prevent inadvertent access by the public. Main Roads will also install a new permanent fence along the edge of Woodvale Nature Reserve, adjacent to the PSP.

Laydown areas for material will be established by the Contractor in consultation with Main Roads and the Local Government Authority. All laydown areas, stockpiles and access tracks will be constructed within existing cleared areas or within the permanent footprint of the works. No native vegetation will be cleared for temporary works outside the permanent footprint.

1.3.1.3 Operation

The Proposed Action will be subject to normal routine, recurrent and periodic maintenance during operation of the PSP, noisewalls, on-ramps and emergency bays. The maintenance operations will be confined to the road corridor and the PSP itself, typically including vegetation, drainage, lighting, signs and pavement.

1.3.2 Anticipated timing

Construction is expected to start in Quarter 3, 2021 and continue up to two years.

1.3.3 Rehabilitation activities

Revegetation along the DE would comply with *MRWA Vegetation Placement within the Road Reserve* Document No. 6707/022 (MRWA). Revegetation will utilise locally native species that will be resilient within three years after the rehabilitation works are completed.

1.3.4 Feasible alternatives considered

The "no-build" option was not considered feasible as it would result in ongoing and increased noise impacts on the local community and the loss of an opportunity to construct a vital missing link in the Perth PSP network.

No feasible alternatives for the Proposed Action were identified. Main Roads has reduced the footprint much as possible to avoid MNES within a highly restricted urban area, constrained within the road verge. Prior to referral, the original DE (Preliminary DE) was 15.42 ha and spanned the entire road verge along the Mitchell Freeway between Ocean Reef Road and Hepburn Avenue (Figure 3).

Main Roads has revised the DE during the design process to avoid patches of Tuart TEC, by realigning the PSP and only impacting areas that are essential for project works. Areas of Black Cockatoo habitat, including potential breeding trees and trees with suitable hollows for breeding were also avoided where possible. Main Roads will only clear vegetation occurring in areas within the planned permanent footprint. The DE has now been reduced to 13.68 ha, resulting in a reduction of impact of 2.84 ha for Tuart TEC and 30 potential breeding trees for Black Cockatoos.

Impacts to MNES and other environmental values have been reduced to the maximum extent possible. Opportunities for further refinement of the alignment within the Proposed Action area will be explored to minimise impacts to MNES and other environmental values during the detailed design process.

2 DESCRIPTION OF THE ENVIRONMENT AND MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

2.1 Description of Protected Matters within the Proposed Action Area

MNES listed under the EPBC Act that are, or have the potential to be in the DE and surrounds comprise:

- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community (Tuart TEC) – Critically Endangered
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- Forest Red-tailed Black Cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) – Vulnerable.

2.2 Existing environment

The Proposed Action is located within the Perth Metropolitan Region, which has undergone extensive native vegetation clearing for urbanisation. The current condition of the environment relevant to the DE is degraded due to heavy disturbance from road construction and residential development.

2.2.1 Existing land use

The DE is zoned as Primary Regional Roads or Urban under the Metropolitan Region Scheme. The existing land use for the land zoned Primary Regional Roads is road reserve for the Mitchell Freeway. Areas zoned as Urban within the DE are currently road verge alongside local roads, abutting the road reserves for the Mitchell Freeway.

2.2.2 Topography

The DE generally consists of a combination of low hilly to gently undulating terrain with yellow sand over limestone. Topography ranges from 15 to 33 m AHD across the DE.

2.2.3 Geology

Geology in the region is described as Mesozoic to recent sediments of the Perth Basin with topography comprised of a low-lying coastal plain, which is often swampy, with sandhills (Beard 1990). The surface geology of the DE is comprised of two geological units:

- Coastal dunes (Qdc): Beach sand, sand dunes, coastal dunes, beaches and beach ridges; calcerous and siliceous, locally shelly and/or cemented (beach rock); locally reworked
- Tamala limestone (Qdct): Unconsolidated to strongly lithified calcarenite with calcrete/Kankar soils: Aeolian. Locally quartzose, feldspathic, or heavy mineral-bearing.

2.2.4 Soils

Soils in the DE consist of aeolian sands and coastal limestone (Mitchell et al. 2002). The DE occurs across one land system (as mapped by the Department of Agriculture and Food [DAFWA]) (DAFWA 2001), which is described as:

- Spearwood System: Sand dunes and plains. Yellow deep sands, pale deep sands and yellow/brown shallow sands.

Natural Resource Management Soil Systems (DPIRD 2018) and DAFWA (2019) risk mapping indicate the soils of the DE have a low risk of land degradation from water erosion and a high risk of wind erosion. A risk assessment of the project encountering Acid Sulfate Soils (ASS) indicates that the majority of the DE has a low to extremely low probability of ASS occurring (DWER 2017).

2.2.5 Groundwater

The Proposed Action is within the Spearwood Dunes of the Swan Coastal Plain. These limestone and yellow sand dunes allow for the rapid infiltration of rainfall to the unconfined aquifer, with very few channelised drainage features in the Spearwood Dunes. Hydrology primarily consists of groundwater flowing from east to west towards the coast. There are no major or minor watercourses mapped within the DE. Depth to groundwater ranges from 16 m to 28 m (DWER 2020).

The DE is located within the Perth Coastal and Gwelup Underground Pollution Control Area, which is a Priority 3 Protection Zone for drinking water protection.

2.2.6 Surface water

The Proposed Action does not intersect any wetlands or watercourses. No Wetlands of International Importance will be impacted by the Proposed Action. The closest Wetland of National Importance and Geomorphic Wetland of the Swan Coastal Plain, Lake Joondalup (Conservation Category Wetland) is located approximately 1.2 km east of the DE. No direct impacts will occur to this wetland as a result of the Proposed Action. There is no risk of indirect impacts, such as changes to hydrology or surface water flows, as Lake Joondalup lies in a different watershed and groundwater flows are in the opposite direction. The hydrology of the DE will be maintained in its current regime with appropriate drainage design.

2.2.7 Vegetation and flora

2.2.7.1 Broad vegetation

The DE occurs in the Perth (SWA02) subregion of the Swan Coastal Plain bioregion and is described as:

- Perth (SWA02): Composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, *Banksia* sp. and *Eucalyptus marginata* (Jarrah) – *Banksia* sp. woodlands on Quaternary marine marine dunes of various ages, *Corymbia calophylla* (Marri) on colluvial and alluvials. Includes a complex series of seasonal wetlands.

There are two pre-European vegetation units mapped by Beard (1990) in the DE:

- Spearwood 6: Medium woodland; Tuart and Jarrah with 24% Pre-European extent remaining (GoWA 2020a)
- Spearwood 998: Medium woodland; Tuart with 36% Pre-European extent remaining (GoWA 2020a).

One broad scale (1:250,000) vegetation complex within the DE as defined by Heddle et al. (1980) and is based on vegetation in association with landforms and underlying geology:

- Karrakatta Complex – Central and South: Predominantly open forest of Tuart, Jarrah, Marri and woodland of Jarrah with 23% Pre-European extent remaining (GoWA 2020b).

2.2.7.2 Flora

A detailed flora and vegetation assessment was conducted by Astron (2020) along the Mitchell Freeway in a 49.6 ha survey area, which included the area of the DE. The survey included a single-phase flora survey and targeted searches for significant flora species. The Astron Biological Survey Report is presented in Appendix C.

Astron (2020) noted that the DE has considerable levels of disturbance and limited floristic diversity.

Desktop searches of the EPBC Protected Matters Search Tool (EPBC PMST), NatureMap, Department of Biodiversity, Conservation and Attractions (DBCA) and WA Herbarium and Threatened and Priority flora spatial datasets identified the potential occurrence of 14 significant flora species within a 5 km radius of the DE. Astron (2020) conducted a pre-survey likelihood of occurrence assessment and concluded that no Threatened or Priority flora species were likely to occur in the DE.

No Threatened flora were recorded by Astron (2020) during the biological survey. One state DBCA Priority listed species, *Grevillea olivacea* (Priority 4) was recorded in the DE, but was assumed to have been planted, as it was outside of its natural biogeographical range and is commonly used in landscaping. No Threatened or Priority flora species identified in the desktop assessment were considered possibly or likely to occur post-survey.

2.2.7.3 Introduced and invasive species

Two species listed as Weeds of National Significance (WoNs), *[1]*Asparagus asparagoides* (Bridal Creeper) and **Lantana camara* (Lantana) were recorded in the DE. Several common grass weed species, such as **Ehrharta calycina* and **Eragrostis curvula*, were recorded along Mitchell Freeway within the DE. One Declared pest, **Moraea flaccida*, listed under the state *Biosecurity and Agriculture Management Act 2007* (BAM Act) was also recorded within the DE.

This level of weed incursion is expected, considering the high level of previous disturbance and lack of native vegetation within the DE.

2.2.7.4 Vegetation types

The DE comprises 3.02 ha of native vegetation, with the majority of the vegetation in the DE comprising planted vegetation (6.99 ha) (Astron 2020). The remainder of the DE comprises cleared areas. Where remnant vegetation does occur, the majority consists of remnant trees over an understorey of weeds and planted species. Two native vegetation units, 'Tuart Forest 2' and 'Jarrah Woodland 2' were mapped in the DE by Astron (2020) (Figure 4) (Table 2-1).

[1] *denotes introduced species

Table 2-1 Vegetation types and extent within the DE

VEGETATION TYPE	VEGETATION TYPE DESCRIPTION	CONDITION	EXTENT WITHIN THE DE (HA)
Tuart Forest 2	*Eucalyptus gomphocephala* mid open to closed forest over *Eucalyptus marginata* (+/- *Banksia attenuata, Allocasuarina fraseriana, Corymbia calophylla*) mid to low woodland to open woodland over *Xanthorrhoea preissii* (+/- *Acacia rostellifera, Jacksonia sternbergiana, Allocasuarina humilis*) mid shrubland to isolated shrubs over *Mesomelaena pseudostygia* and *Lepidosperma calcicola* sparse sedgeland over an introduced tussock grassland.	Degraded – Completely Degraded	2.4
Jarrah Woodland 2	*Eucalyptus gomphocephala* isolated trees to isolated clumps of trees over *Eucalyptus marginata* (+/- *Banksia attenuata* and/or *Allocasuarina fraseriana*) woodland to open woodland over +/- *Acacia rostellifera* +/- *Calothamnus quadrifidus*, +/- *Melaleuca nesophila* tall shrubland to tall open shrubland over *Xanthorrhoea preissii* mid sparse to open shrubland over closed tussock grassland of introduced grasses.	Good – Completely Degraded	0.62 ha
Planted	Planted vegetation.	Completely Degraded	6.99 ha
Completely Cleared	**-**	-	3.67 ha
Total			**13.68 ha**

Vegetation in the DE is mostly planted (70%) and ranges in condition from 'Completely Degraded' to 'Good', with the majority of the vegetation in 'Completely Degraded' condition (Figure 5). Astron (2020) noted high levels of disturbance to vegetation in the DE. The following vegetation conditions apply to vegetation in the DE:

- Good – 0.05 ha
- Degraded – 0.18 ha
- Degraded to Completely Degraded – 1.11 ha
- Completely Degraded – 8.68 ha.

Native vegetation types 'Tuart Forest 2' and 'Jarrah Woodland 2' and some 'Planted' areas (5.81 ha) mapped by Astron (2020) were considered representative of the Tuart TEC. Two patches of the Tuart TEC, (TP12 and TP20) were mapped in the DE (Figure 6).

2.2.8 Fauna

An initial desktop search of the EPBC PMST identified the potential occurrence of up to 24 Threatened fauna species.

A fauna survey, including a desktop assessment and targeted Black Cockatoo survey, was conducted by Astron (2020) (Appendix C) in 49.6 ha survey area along the Mitchell Freeway, which included the DE. The desktop assessment undertaken by Astron (2020) identified the following species as potentially occurring due to suitable habitat and nearby records:

- *Falco peregrinus* (Peregrine Falcon), Other Specially Protected Fauna under the *Biodiversity Conservation Act 2016* (BC Act) (WA)
- *Isoodon fusciventer* (Quenda), Priority 4 state listed by DBCA
- Carnaby's Cockatoo, listed as Endangered under the EPBC Act
- FRTBC, listed as Vulnerable under the EPBC Act.

Of the species identified in the desktop assessment, Carnaby's Cockatoo, FRTBC and the Quenda were recorded in the Astron (2020) survey.

Astron's (2020) targeted Black Cockatoo survey assessed the presence of Black Cockatoo foraging, roosting and breeding habitat. The Black Cockatoo habitat assessment recorded 3.02 ha and 0.62 ha of potential foraging habitat for Carnaby's Cockatoo and FRTBC respectively and 177 trees with a DBH >500 mm.

Kirkby (2020) carried out a follow up targeted assessment of trees occurring in the DE potentially used by Black Cockatoos (Appendix D). Of the 177 trees with DBH >500 mm, two were identified as containing potentially suitable hollows for use by Black Cockatoos. While chew marks on the hollows were evident, Tony Kirkby in personal communication stated that the hollows are likely to be occupied by either *Cacatua roseicapilla* (Galah) or *Cacatua sanguinea* (Little Corella). Photos of hollows occurring in the DE assessed by Kirkby (2020) are presented in Appendix E.

As the DE is mostly comprised of the Mitchell Freeway road reserve, the vegetation has been impacted through historical clearing and ongoing disturbance and is mostly in 'Degraded' to 'Completely Degraded' condition. As such, the natural flora assemblage has been altered and there is a reduced number and quality of foraging species for Black Cockatoos. The habitat in the DE was therefore not considered to be quality foraging habitat under DSEWPaC's (2012a) EPBC Act referral guidelines (Astron 2020).

2.3 Technical reports

The biological studies relevant to the DE are described in Table 2-2.

Table 2-2 Studies and surveys relevant to the Proposed Action

SURVEY / REPORT NAME	LOCATION / EXTENT IN SURVEY AREA	METHODS
Vegetation and Flora		
Mitchell Freeway Widening Biological Survey (Astron 2020)	Entire DE surrounding area	Detailed single-phase flora and vegetation assessment.
Fauna		
Mitchell Freeway Widening Biological Survey (Astron 2020)	Entire DE and surrounding area	Targeted Black Cockatoo habitat assessment.
Targeted Black Cockatoo Habitat Assessment (Kirkby 2020)	Entire DE	Targeted Black Cockatoo Habitat Assessment.

2.4 Threatened ecological communities

2.4.1 Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain

A description of the Tuart TEC, within the Proposed Action area is presented in Table 2-3.

Table 2-3 Tuart TEC – Critically Endangered

ASPECT	DESCRIPTION
Ecology, abundance, distribution and habitat preferences	Ecology The Tuart TEC occurs on the Swan Coastal Plain, along the Spearwood or Quindalup dunes. The primary defining feature is the presence of the *Eucalyptus gomphocephala* (Tuart) in the uppermost canopy, although this may occur with various other tree species. It can occur in a variety of forms; most commonly open forest, woodland and open woodland. There may be a substantial sub-canopy, dominated by *Agonis flexuosa*. The understorey is often relatively open, including many non-woody species from the Asteraceae, Cyperaceae, Restionaceae and Orchidaceae families (TSSC 2019). Abundance Utilising current native vegetation extent data (DPIRD 2019) and data from the Atlas of Tuart Woodlands on the Swan Coastal Plain (CALM 2003), it is estimated that approximately 20,796.5 ha of the Tuart TEC remains. Distribution The Tuart TEC occurs on the Swan Coastal Plain in Western Australia, from Jurien, approximately 200 km north of Perth, to the Sabina River, near Busselton, 225 km south of Peth. Critical Habitat The Tuart TEC Conservation Advice (TSSC 2019) states that the following areas are critical to the survival of the Tuart TEC: • Areas within secure conservation reserves • Large patches that are not yet reserved • Areas maintaining ecological connectivity between significant patches. Threats Key threats to the community (TSSC 2019) include: • Land clearance • Novel biota and their impact on biodiversity • Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants • Predation, habitat degradation, competition and disease transmission by feral pigs • Predation by feral cats • Predation by European red fox

ASPECT	DESCRIPTION
	• Competition and land degradation by rabbits • Dieback caused by *Phytophthora cinnamomi* • Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases. <u>Description of this TEC vegetation within the DE</u> Vegetation types 'Tuart Forest 2' and 'Jarrah Woodland 2' and areas mapped by Astron (2020) as 'Planted' were considered representative of the Tuart TEC. Two distinct patches of the Tuart TEC, (TP12 and TP20) were mapped in the DE (Figure 6). <u>Extent within and adjacent to the DE</u> The DE contains 8.75 ha of degraded Tuart TEC, of which the majority was planted by Main Roads. The two distinct Tuart TEC patches and their condition (as per the Conservation Advice condition scale) in the DE are described below: • Patch TP12 – This patch has a total area of 35.2 ha, the majority of which is within the Woodvale Nature Reserve. The DE contains 2.77 ha of vegetation associated with this patch, representing 7.87% of the total area of TP12. The condition of this patch ranges from 'Poor', within the DE to 'Very High' in Woodvale Nature Reserve. TP12 in the DE comprises 2.15 ha (77.90%) planted vegetation and 0.62 ha (22.38%) native vegetation • Patch TP20 – Located between Whitsford Avenue and Hepburn Avenue, TP20 has a total patch size of 9.4 ha, of which 5.98 ha (63.61%) is within the DE. This patch ranges from 'Moderate' to 'Poor' condition. The area of 'Moderate' condition is associated with the 0.05 ha of vegetation in 'Good' condition. TP20 in the DE comprises 3.66 ha (61.20%) planted vegetation and 2.32 ha (38.63%) native vegetation.
Quality and importance of known or potential habitat within the proposed action area and surrounds	The Tuart TEC within the DE comprises, 5.81 ha (66%) planted vegetation and 2.93 ha (34%) of remnant native vegetation, 99% of which is in 'Poor' condition. A further 35.85 ha of Tuart TEC was mapped by Astron (2020) in areas surrounding the DE. The Tuart TEC Conservation Advice (TSSC 2019) states that the following areas are critical to the survival of the Tuart TEC: • Areas within secure conservation reserves • Large patches that are not yet reserved • Areas maintaining ecological connectivity between significant patches.

ASPECT	DESCRIPTION
	The Proposed Action is unlikely to affect habitat critical to the survival of the Tuart TEC, given that none of the vegetation proposed to be cleared meets critical habitat defined in the Conservation Advice (TSSC 2019). The vegetation adjacent to the DE within Woodvale Nature Reserve that will not be cleared is likely to be significantly better in condition and more likely to meet the criteria of critical habitat, than the heavily degraded roadside vegetation present in the DE.
Known extent within a 1 km buffer	There is approximately 32.44 ha of TP12 and 3.43 ha of TP20 within 1 km of the DE, mapped by Astron (2020). The majority of TP12 within 1 km of the DE is in 'High' to 'Very High' condition and is mostly located within Woodvale Nature Reserve (29.56 ha) and the 3.43 ha of TP20 outside of the DE is in 'Poor' condition, located along the road verge. An assessment of current native vegetation extent data (DPIRD 2019) and data from the Atlas of Tuart Woodlands of the Swan Coastal Plain (CALM 2003) indicates approximately 80 ha of Tuart TEC is located within 1 km of the DE, with the majority located in conservation reserves, Woodvale Nature Reserve and Craigie Bushland (Figure 7).
Known extent within a 10 km buffer	Native vegetation extent data (DPIRD 2019) and data from the Atlas of Tuart Woodlands of the Swan Coastal Plain (CALM 2003) indicates that approximately 733.4 ha remains within 10 km of the DE, with approximately 186.3 ha in conservation reserves (Figure 7).
Adequacy of any surveys undertaken	Astron (2020) undertook a flora and vegetation assessment in accordance with the EPA Technical Guidance – Flora and Vegetation Surveys (EPA 2016a). Astron (2020) completed a review of limitations that may have affected a complete assessment of the data collected. The review identified that there were only minor limitations based on the EPA Technical Guidance that could have affected the survey findings and thus the findings are considered reliable. Astron (2020) undertook an assessment of the Tuart TEC as per the diagnostic criteria in the Tuart TEC Conservation Advice (TSSC 2019). A desktop assessment was undertaken to determine potential areas of Tuart TEC and areas of vegetation identified were visited to ground truth the accuracy. The location of all Tuart individuals and the canopy of individuals was recorded. Patch assessments were also undertaken in vegetation adjacent to the Astron (2020) survey area to assist with interpretation of potential Tuart TEC areas, as per the key diagnostic criteria in the Conservation Advice (TSSC 2019). A total of 52 patch assessments were conducted.

ASPECT	DESCRIPTION
	Following the field survey, Tuart canopy boundaries were digitised and buffered by 30m and excluded areas, such as large roads, existing buildings and gardens, were removed. Separation of patches was determined using the 30m buffering of Tuart trees, and where tree buffers overlapped, the polygon boundaries were dissolved to be one inclusive patch.
Methods, data analysis and scientific literature used to identify and assess the environmental values	The significance of the Tuart TEC occurrences within and adjacent to the DE was assessed based on data collected during field surveys and consideration of the Conservation Advice (TSSC 2019). The flora and vegetation survey was undertaken in accordance with the EPA Technical Advice (EPA 2016a).

2.5 Threatened fauna

2.5.1 Black Cockatoos (Carnaby's Black Cockatoo – Endangered; Forest Red-tailed Black Cockatoo – Vulnerable)

A description of both Carnaby's Cockatoo and FRTBC, within the Proposed Action area is presented in Table 2-4.

Table 2-4 Carnaby's Cockatoo – Endangered; Forest Red-tailed Black Cockatoo - Vulnerable

ASPECT	DESCRIPTION
Ecology, abundance, distribution and habitat preferences	Ecology Carnaby's Cockatoo is 53-58 cm in length and is mostly black, with white cheek patches, large white panels on the tail and a curved beak. Carnaby's Cockatoo are a very mobile species with movements throughout the year determined by nesting and feeding. From early Summer through Autumn to Winter the species live in higher rainfall coastal or near coastal areas in large flocks. July is the beginning of the move back out to Wheatbelt in search of suitable nesting hollows. Up to 12 km is a reasonable distance for the species to fly from the hollow in search of food and they are assisted in their navigation between sites by corridors or patches of vegetation (DAWE 2020). The FRTBC is 55 - 60 cm in length and are mostly glossy black with a pair of black central tail feathers, a crest, robust beak and bright red, orange and yellow barring in the tail. The male is distinguished by broad red tail panels that are only visible when alighting. The female is distinguished by yellow or whitish spots on the feathers of the head and upper wing (DEWHA 2009). The movements of FRTBC are irregular and they can now be found on the Swan Coastal Plain at any time of year in search of food. The species leave roosts at sunrise and feed in small family groups of up to 10 birds, usually within 4 km of the roost. The young of the species are fed by the parents for three to four months after fledging (DEC 2013). Abundance The total population of Carnaby's Cockatoo has been estimated between 11,000 and 60,000 individuals and is considered to exist as one large interconnected population (DPaW 2013). FRTBC occurs in one population of approximately 15,000 individuals (DEWHA 2009). Distribution Carnaby's Cockatoo distribution extends into the Wheatbelt north to Kalbarri and east to Esperance. FRTBC generally occur within forested areas southeast of Perth to Albany, however in recent years their distribution has expanded on to the Swan Coastal Plain north to around Mindarie (DWEHA 2009). Habitat Preferences Black Cockatoos are known to utilise a range of habitats and plant species for foraging (including introduced species such as pines, **Pinus* spp.), although Marri and Jarrah woodlands are particularly important to FRTBC.

ASPECT	DESCRIPTION
	Proteaceous heaths (i.e. shrublands dominated by *Banksia, Hakea* and *Grevillea* spp.) are also utilised by Carnaby's Cockatoo (DSEWPaC 2012a). Black Cockatoo breeding habitat, as defined in the Commonwealth referral guidelines (DSEWPaC 2012a) includes: • Relevant tree species with a suitable Diameter at Breast Height (DBH) to develop a nest hollow, where DBH is greater than or equal to 500 mm (herein referred to as 'Suitable DBH Trees') • Trees with a hollow that meets the DSEWPaC (2012a) criteria for nesting Black Cockatoos (Herein referred to as trees with 'Suitable Hollows') • Known Nesting Trees are those that have secondary evidence of nesting. <u>Breeding Parameters</u> Carnaby's Cockatoo nest in hollows in live or dead trees of Salmon Gum, Wandoo, Tuart, Jarrah, Flooded Gum, York Gum, Powderbark, Karri and Marri with a hollow depth ranging from 0.5 to over 2 m (Saunders 2015). FRTBC nest in hollows in live or dead trees of Karri, Bullich, Swan River Black Blackbutt, Tuart and Jarrah with a hollow depth ranging from 1 -5 m (Johnstone 2011). The breeding timing of the two species is as follows (DSEWPaC 2012a): • Carnaby's Cockatoo breeds from July/August (in the interior) and September/October on the Swan Coastal Plain • FRTBC breeds in October/November, however in years with good autumn rainfall, may breed in March/April. <u>Species presence and habitat extent within the DE</u> The DE falls within the known non-breeding range of Carnaby's Cockatoo, but outside of the species known modelled breeding range. The DE falls within the distribution range of FRTBC. Individuals of Carnaby's Cockatoo and FRTBC were recorded in the DE, along with evidence of foraging for both species. The DE contains 3.02 ha of potential foraging habitat for Carnaby's Cockatoo from vegetation units 'Jarrah Woodland' and 'Tuart Woodland'. The DE also contains up to 0.62 ha of foraging habitat for FRTBC in vegetation unit 'Jarrah Woodland' (Figure 8). A total of 177 Suitable DBH Trees, containing two Tuart trees with Suitable Hollows (Tree 190 adjacent to Woodvale Nature Reserve and Tree 290 adjacent to Whitton Court) are also within the DE (Figure 8).

ASPECT	DESCRIPTION
	Threats Primary threats to Black Cockatoos as listed in DSEWPaC (2012a) are: • Habitat loss and habitat degradation (loss of foraging habitat, breeding hollows, habitat connectivity, habitat quality) • Interactions with humans (vehicle strikes, agriculture protection measures, disturbance from noise/light, unauthorised taking (poaching)) • Invasive species (competition for nest hollows with European honey bees and bird invading taxa, injury/death from European honey bees).
Extent of habitat within 6km to 12km	Within 6 km of the DE exists the Woodvale Nature Reserve, Hepburn Heights Conservation area, Craigie Bushland, Shepherds Bushland Reserve and Yellagonga Regional Park, each containing relatively large areas of remnant vegetation consisting of better-quality foraging habitat than that within the DE. Regional mapping indicates that a total of 1,542 ha and 6,582 ha of potential Carnaby's Cockatoo and FRTBC foraging habitat occurs within 6 km and 12 km of the project area, respectively, the majority of which occurs within the previously listed nature reserves (Figure 9).
Extent of habitat across distribution	The Proposed Action is located within the mapped distribution of Carnaby's Cockatoo and FRTBC (DSEWPaC 2012a, DotEE 2017). The habitat within the DE represents between 0.0003% and 0.0008% of the estimated post-2003 area of occupancy for Carnaby's Cockatoo (DPaW 2013) and 0.0002% for FRTBC (Garnett et al. 2011).
Quality and importance of known or potential habitat within the proposed action area and surrounds	Astron (2020) identified that the natural flora assemblage in the DE has been altered to an extent that there is a reduced number and quality of the foraging species for Carnaby's Cockatoo and FRTBC. Therefore, the vegetation in the DE is not considered to be quality foraging habitat under the DSEWPaC (2012a) referral guidelines. Higher quality habitat for Black Cockatoos exists in reserves adjacent to the DE (Woodvale Nature Reserve and Craigie Bushland) (Figure 9). Additionally, research obtained from Murdoch University of Black Cockatoo satellite-tracking data collected as part of an ongoing movement ecology research, indicates that the general area surrounding the DE is an occasional transit corridor for Carnaby's Cockatoo (Appendix F). The data suggests that individuals are frequently utilising habitat north of the DE within Neerabup National Park, with occasional trips transiting the area surrounding the DE. This suggests a preference for higher quality foraging habitat north of the DE in Neerabup National Park, which is more likely to support the Carnaby's Cockatoo breeding individuals at Edith University Campus than habitat within the DE.

ASPECT	DESCRIPTION
Known breeding within 6 km buffer	There are limited breeding records within 6 km of the DE. Kirkby (2020) noted that Carnaby's Cockatoo are known to breed at the Edith Cowan University Campus, approximately 1 km NE from the DE. While foraging habitat in the DE may be utilised by individuals from breeding or roosting sites in the local area, given the presence of better quality foraging habitat in adjacent and nearby reserves, the removal of this relatively small area is not considered significant.
Adequacy of any surveys undertaken	Astron (2020) undertook the targeted Black Cockatoo assessment in accordance with the EPA Technical Guidance – Terrestrial Fauna Surveys (EPA 2016b) and the referral guidelines for the three Black Cockatoo species (DSEWPaC 2012a). Astron (2020) completed a review of limitations based on those in the EPA Technical Guidance that may have affected a complete assessment of the data collected. The review identified that there were only minor limitations that could have affected the survey findings and thus the findings are considered reliable. To determine if the vegetation in the Astron (2020) survey area constituted foraging habitat as specified under the referral guidelines, the flora were identified and compared with a list of known foraging species. In addition, the ground was also searched for any evidence of Black Cockatoo foraging. To determine the breeding habitat classification of the site in accordance with the referral guidelines (DSEWPaC 2012a), a habitat assessment of each tree was undertaken. Any tree species with a DBH of 500 mm or greater was classified as a mature tree with the potential for breeding hollows to develop in time. Hollows were assessed from ground level by an experienced observer and classified according to guidance criteria. This survey also included searches for roosting trees. A follow up targeted Black Cockatoo assessment was undertaken by Kirkby (2020). Tony Kirkby is an experienced Black Cockatoo researcher and consultant. Tony Kirkby has conducted extensive work and research on Black Cockatoos for numerous government departments, such as the Western Australian Museum. The Kirkby (2020) assessment included an inspection of all of the Suitable DBH Trees located in the Astron (2020) survey for the presence of Black Cockatoo breeding hollows. Hollows of the correct size and angle were inspected for signs of use such as chewing and wear around the entrance.
Methods, data analysis and scientific literature used to identify and assess the environmental values	The significance of potential foraging and breeding habitat was assessed based on data collected from within and surrounding the DE during field surveys, consideration of EPBC Act referral guidelines (DSEWPaC 2012a) and the Carnaby's Cockatoo Recovery Plan (DPaW 2013).

3 ASSESSMENT OF IMPACTS

This section addresses the potential direct and indirect impacts from the Proposed Action on protected matters that are likely to be present within the DE and surrounds, examining each protected matter in a separate subsection. Each protected matter is assessed consistent with the EPBC guideline *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* which identifies 'significant impact criteria' to assist in determining whether the environmental impacts of a Proposal are likely to be significant (DotE 2013). Conservation advice, recovery plans, and other relevant guidance have been applied where applicable to specific protected matters. Table 3-1 provides a summary of the impacts on MNES.

Table 3-1 Summary of direct and indirect impacts on MNES

MNES	Direct Impact	Indirect Impact
Tuart TEC	8.75 ha in 'Poor' Condition	3.41 ha due to un-cleared Tuart TEC vegetation from patch TP20 no longer meeting the TEC criteria
Black Cockatoo Suitable DBH Trees	177 Suitable DBH Trees containing two Suitable Hollows (Tree No 190 and 290), with no evidence of Black Cockatoo breeding	Nil
Carnaby's Cockatoo Foraging Habitat	3.02 ha	Nil
FRTBC Foraging Habitat	0.62 ha	Nil

3.1 Threatened Ecological Communities (TEC)

3.1.1 Tuart TEC – Critically Endangered

3.1.1.1 Potential direct impacts

A total of up to 8.75 ha of the Tuart TEC will be directly cleared as a result of the Proposed Action implementation, as detailed in Table 3-1. This estimate is conservative (over-estimate), representing the full extent of Tuart TEC within the 13.68 ha DE. The actual clearing footprint is expected to be less and will be refined through the detailed design and construction planning process.

An assessment of the loss of Tuart TEC within the local and regional scales was made by comparing the extent within the DE to that published for the community.

Utilising the native vegetation extent data (DPIRD 2019) intersected with the Tuart woodlands atlas data (CALM 2003), approximately 9,229 ha of vegetation associated with the Tuart TEC is estimated to be within DBCA-managed land at the regional scale. No clearing as a result of the Proposed Action will directly impact vegetation considered to represent the Tuart TEC within the conservation estate either directly or indirectly.

The Proposed Action will not significantly reduce the total extent of the Tuart TEC. It is estimated that at the regional level (Perth subregion) 20,796 ha remains, while at the local level (10 km

radius), approximately 733 ha of the Tuart TEC remains. Noting this, when considered at the regional and local level, approximately 0.04% and 1.19%, respectively of Tuart TEC is proposed to be cleared for the Proposed Action, leaving approximately 99.96% (regional scale) and 98.8% (local scale) of the current Tuart TEC extent remaining. The relatively small area of clearing of the Tuart TEC, which is mostly planted, in 'Poor' condition and located within the road verge, is not expected to result in a significant impact to the Tuart TEC at a regional or local level.

The TEC contains 8.69 ha (99%) of vegetation in 'Completely Degraded' to 'Degraded' condition. As the TEC contained within the DE constitutes a fragmented, linear patch, and does not represent or form part of a diverse native vegetation remnant, it is considered highly unlikely that the area to be cleared exhibits higher diversity than other examples of the TEC within the region.

None of the Tuart TEC within the DE meets any of the critical habitat criteria for the community as per the Conservation Advice (TSSC 2019) given:

- None of the Tuart TEC vegetation to be cleared is in conservation reserves
- None of the patches of Tuart TEC are likely to be reserved in the future, given their small size, the current levels of degradation and location within a road reserve
- The areas of Tuart TEC in the DE do not maintain ecological connectivity between significant patches.

As all of the Tuart TEC in the DE is within the road verge, with the majority being planted vegetation (66%), it is unlikely that the Tuart TEC mapped within the DE, is a significant remnant of the community.

3.1.1.2 Potential indirect impacts

The Proposed Action has potential to cause indirect impacts to Tuart TEC that lies adjacent to the DE.

DAWE, in their request for additional information, considered that the Proposed Action may result in indirect impacts to Tuart TEC including:

- Edge effects
- Habitat degrading processes such as weed invasion and *Phytophthora cinnamomi* Dieback
- Illegal rubbish dumping and litter.

Additionally, Main Roads considers that the loss of Tuart TEC status for the remainder of TP20 (3.43 ha) outside of the DE is a potential indirect impact.

Main Roads' standard construction practices combined with the management actions detailed in Section 4.1.1.2 will specifically and effectively manage the potential for these indirect impacts to occur.

The Proposed Action is not expected to cause significant indirect impacts to Tuart TEC with discussion provided for each indirect impact below.

Loss of Tuart TEC status

The viability of the remaining occurrences of TP20 and TP12 post clearing is considered unlikely to change as a result of the Proposed Action, given the remainder of TP20 is mostly planted trees with limited native understorey and the remainder of TP12 will be protected in Woodvale Nature Reserve. The parts of TP12 and TP20 within the DE were largely cleared as part of the Mitchell Freeway construction in the 1980's and as a result comprise highly disturbed patches of vegetation. The Proposed Action will not significantly fragment larger continuous patches of Tuart TEC, as vegetation within the DE is already fragmented and exists in two distinct patches (TP12 and TP20). These patches of Tuart TEC provide no direct linkage to other areas of significant remnant vegetation.

Approximately 5.97 ha of the Tuart TEC patch mapped by Astron (2020) will be cleared from patch TP20. As shown in Table 3-2, the remaining occurrence of TP20 will no longer meet the 5 ha threshold post-clearing which currently qualifies it as a TEC due to its 'Poor' condition, as per the TEC criteria in the Conservation Advice (TSSC 2019). Patch TP20 exists as an isolated patch that provides no direct connection to other significant occurrences of the Tuart TEC or other remnant vegetation. While the clearing will remove the majority of this patch, it is already isolated in nature and is comprised mostly of planted vegetation with a weedy understorey. Given this, the Proposed Action is not expected to reduce the viability of any remaining occurrences of Tuart woodland vegetation as the existing patch provides limited habitat value, is not showing signs of regeneration and has a limited landscape role and was only classified as Tuart TEC due to area.

Table 3-2 Tuart TEC occurrences status before and after Proposal implementation

TEC PATCH	ORIGINAL AREA (HA) AND CONDITION	HA TO BE CLEARED AND CONDITION	HA TO BE RETAINED AND CONDITION	MET CRITERIA PRIOR TO CLEARING	MEETS CRITERIA AFTER CLEARING
TP12	35.2 ha in 'Poor' to 'Very High' condition	2.77 ha in 'Poor' condition	32.44 ha in 'Poor' to 'Excellent' condition	Yes	Yes
TP20	9.4 ha in 'Poor' to 'Moderate' condition	5.97 ha in 'Poor' to 'Moderate' condition	3.43 ha in 'Poor' condition	Yes	No

Edge Effects

The construction and operation of the Proposed Action is unlikely to significantly increase any edge effects to Tuart TEC, given that the vegetation is already located adjacent to a major freeway along a narrow strip of road reserve and is already subject to edge effects. The majority of the Tuart TEC remaining adjacent to the DE, outside of Woodvale Nature Reserve is planted, consisting of planted trees and shrubs over weeds. Edge effects to vegetation within Woodvale Nature Reserve are unlikely to be increased given that the Proposed Action involves replacing the existing PSP, adjacent to a 5m firebreak buffer in the reserve. Main Roads will also replace the existing fence along the edge of the reserve, which will reduce the potential for edge effects and unauthorised access to the retained remnant vegetation in better condition.

The Proposed Action will not cause edge effects nor increase current edge effect impacts. The Proposed Action is considered highly unlikely to cause significant impacts to Tuart TEC as a result of edge effects.

Habitat degrading processes such as weed invasion and *Phytopthora cinnamomi* Dieback

The construction and operation phases of the Proposed Action have the potential to result in the spread of introduced weeds through activities such as clearing, and the increased movement of vehicles, or earth-moving machinery.

Astron (2020) identified two significant weed species listed as WoNs, **Asparagus asparagoides* (Bridal Creeper) and **Lantana camara* (Lantana) in the DE. Due to the high levels of disturbance, several common grass weed species such as **Ehrharta calycina* and **Eragrostis curvula* occur within and adjacent to the DE. Figure 10 presents the locations of Declared Pests and WoNs recorded within the Astron (2020) survey area and the DE.

The Proposed Action has the potential to result in the spread of WoNs from the DE to adjacent, un-infested native vegetation through clearing and earthwork activities that spread weeds and seeds, and wind-blown spread of seeds from weeds establishing in the DE. The Proposed Action will incorporate revegetation / landscaping with native species, and weed control following the completion of the works, which will reduce the potential spread of weeds in the DE. Access controls, weed treatment, hygiene and monitoring will be implemented during and after construction to prevent the introduction and spread of weeds within the DE to adjacent vegetation (see Section 4).

Due to its currently 'Poor' condition, it is unlikely that the Proposed Action will spread or introduce weeds into the remnants of TP20, as those weeds are likely already present. The Proposed Action will not spread weeds and seeds in stormwater runoff or through soil movement into higher quality sections of TP12. There are no surface water features in the vicinity of TP12, as almost all run off is infiltrated directly to groundwater through the highly transmissible sands. The remaining sections of TP12 are generally topographically higher than the areas to be cleared in the road reserve. There will be no movement of soil within the Woodvale Nature Reserve. Stormwater will be maintained in its current regime with appropriate drainage design. Weed management will occur in drainage areas adjacent to un-infested native vegetation as part of ongoing standard road maintenance.

Terratree (2020) conducted a *Phytophthora* Dieback assessment within the DE and a wider survey area (Appendix G). The assessment identified that the majority of the area was excluded due to being in a 'Degraded' to 'Completely Degraded' condition and lacked indicator species to enable assessment. An area of infestation was identified outside the DE, between the northern and southern sections of the DE (Figure 10). There is potential that the implementation of the Proposed Action may cause indirect impacts to Tuart TEC in the adjacent Woodvale Nature Reserve that contains intact vegetation however the rest of the DE is predominately Tuart over grasses and Tuart are not susceptible to Dieback (Groves et al. 2012).

Any risk of spread or introduction of Dieback to adjacent vegetation will be managed through project-specific management actions (See Section 4). The adjacent 5 m firebreak along the edge of Woodvale Nature Reserve, the permanent fence along the edge of the reserve and the PSP make an effective barrier for Dieback between the impacted parts of TP12 and the 'High' or 'Very High' condition TEC within Woodvale Nature Reserve. No soil or water will be moved into the vegetation

within the Woodvale Nature Reserve and therefore there will be no transmission of potentially Dieback infested soil or water to the reserve off offsite.

Tuart Woodland vegetation within the adjacent Woodvale Nature Reserve is unlikely to be impacted by weeds or Dieback given that the existing 5 m firebreak along the edge of the reserve will remain and hydrological conditions will not change. The reinstallation of the fence along the edge of the reserve will continue to separate the reserve from the PSP and prevent any uncontrolled access which may have the potential to spread weeds or disease. Through construction and operational management, the Proposed Action is not expected to result in the introduction or spread of weeds that could result in significant impacts to Tuart Woodland vegetation.

Illegal rubbish dumping and litter

Main Roads does not consider that the Proposed Action will increase the impacts of illegal rubbish dumping and litter in surrounding Tuart TEC, given the vegetation to be cleared is within the road reserve. Vegetation within Woodvale Nature Reserve will be protected through the buffer of the 5m firebreak along the edge of the reserve and the boundary fence adjacent to the DE. Any risk of rubbish dumping and littering during construction will be managed through project specific management actions (See Section 4).

3.1.1.3 Assessment against MNES Significant Impact Guidelines

The potential impacts of the Proposed Action on Tuart TEC was assessed against the significant impact criteria for Critically Endangered ecological communities (Table 3-3) from the Significant impact Guidelines 1.1 (DotE 2013).

Table 3-3 Assessment of the potential impact of the Proposed Action to the Tuart TEC

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR TUART TEC
Reduce the extent of an ecological community	Potentially significant The Proposed Action will require clearing of 8.75 ha of Tuart TEC, of which 99% is in 'Poor' (Completely Degraded) condition (Table 3-2). When considered at the regional and local level approximately 0.04% and 1.19% respectively of vegetation considered to represent the Tuart TEC is proposed to be cleared for the Proposed Action, leaving approximately 99.96% (regional scale) and 98.8% (local scale) of the current Tuart TEC extent remaining. The geographical extent of the Tuart TEC is from Jurien (Karakin Lakes), approximately 200 km north of Perth, to the Sabina River near Busselton, approximately 225 km south of Perth (TSSC 2019). The Proposed Action is 100 km from the northern extent of the Tuart TEC and 216 km from the southern extent and will therefore not affect the north-south distribution of the Tuart TEC. The Tuart TEC is only known from a thin west to east zone parallel to the coast within this north-south extent. The Proposed Action is 3.5 km from the western extent and 5 km from the eastern extent of the Tuart TEC in this zone. As the Tuart TEC is known to occur to the east and west of the DE, the Proposed Action will not affect the geographic extent of the Tuart TEC within the west to east zone parallel to the coast. The Proposed Action will result in the remaining occurrence of TP20 no longer meeting the 5 ha threshold post clearing, which currently qualifies it as a TEC due its 'Poor' condition (TSSC 2019). However, the Proposed Action is unlikely to reduce the viability of the remainder of TP20 given it is mostly planted vegetation with a weedy understorey.
Fragment or increase fragmentation of an ecological community, for example by clearing for roads or transmission lines	Potentially significant The Proposed Action may potentially increase fragmentation of the Tuart TEC within the local area. Vegetation associated with the TEC in the DE currently exists as two distinct patches (TP12 and TP20). The Proposed Action will remove the western edge of Tuart TEC patch TP 12 that consists of planted vegetation that is in 'Completely Degraded' (Poor) in condition compared to 'Moderate' to 'Excellent' condition remnant vegetation in the remainder of the patch to be retained within Woodvale Nature Reserve (outside of DE). The narrow western strip of patch TP12 that is proposed to be cleared is separated from the rest of the Nature Reserve by a firebreak and the existing PSP. The vegetation proposed to be cleared has little landscape function due to the 'Completely Degraded' (Poor) condition. Furthermore, the area to be cleared is not homogenous with the remainder of the patch and will not further increase edge effects that already exist due to the firebreak and existing PSP.

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR TUART TEC
	In contrast, patch TP20 exists as an isolated patch that provides no direct connection to other significant occurrences of remnant vegetation or the TEC. While the clearing will remove the majority of patch TP20, it is already isolated in nature. The patch itself does not provide an important landscape function and as such clearing of patch TP20 will not significantly increase the fragmentation of an occurrence of the TEC overall.
Adversely affect habitat critical to the survival of an ecological community	Potentially significant The Proposed Action is unlikely to affect habitat critical to the survival of the TEC. The Tuart TEC Conservation Advice (TSSC 2019) states that the following areas are critical to the survival of the Tuart TEC: • Areas within secure conservation reserves • Large patches that are not yet reserved • Areas maintaining ecological connectivity between significant patches. None of the vegetation to be cleared by the Proposed Action is considered to meet the areas listed above. The Proposed Action will not result in any direct impacts to the occurrence of the TEC within conservation reserves. The TEC within the DE comprises narrow strips of vegetation in land designated for road reserve. Of the 8.75 ha to be cleared, 5.81 ha (66%) consists of planted vegetation in 'Completely Degraded' (Poor) condition. The remaining 2.88 ha (33%) proposed to be cleared is remnant vegetation in 'Completely Degraded' (Poor) condition with only 0.05 ha in 'Moderate' condition within the DE. The areas of vegetation have a small area to boundary ratio and are subject to significant edge effects and ongoing degrading processes. It is considered unlikely that the area of TEC to be removed would be viable long term or improve in condition. Furthermore, within 1 km of the DE, there is approximately 80 ha of Tuart TEC, with the majority in conservation reserves, Woodvale Nature Reserve and Craigie Bushland. Within 10 km, in conservation reserves, there is approximately 186.13 ha of the TEC present. The vegetation within these reserves is likely to be in significantly better condition than the heavily degraded roadside vegetation present in the DE, and more representative habitat critical to the survival the TEC as per the Conservation Advice. Whilst part of the Tuart TEC patch TP12 is adjacent to Woodvale Nature Reserve and considered part of the same patch, the vegetation composition within the DE is 'Completely Degraded' (Poor) in condition compared to 'Moderate' to 'Excellent' condition in the remainder of the patch to be retained. The rest of the Tuart TEC in the DE

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR TUART TEC
	consists as isolated patches in 'Completely Degraded' (Poor) condition that provides no direct connection to other significant ecological linkages to significant patches or other areas of remnant vegetation. The Proposed Action will not adversely affect habitat critical to the survival of an ecological community, as the DE does not contain critical habitat for the TEC.
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	Not significant The Proposed Action will not modify or destroy abiotic factors necessary for the survival of the TEC outside of the DE including hydrology, nutrients or soil resources. The DE consists entirely of road verge vegetation and will not result in any alteration to hydrological regimes or stripping of soil nutrients. Groundwater is at least 21m below ground level adjacent to the Woodvale Nature Reserve. Any excavation for the Proposed Action is unlikely to require dewatering or encounter groundwater, given depth to groundwater ranges from 16m to 28m (DWER 2020). There are no surface water features in the DE. The Proposed Action will use native species on local topsoil for revegetation, restrict the use of fertilisers to the establishment phase and a case by case basis, and incorporate treatment of storm water during infiltration. Accordingly, the Proposed Action is not expected to result in a substantial change in nutrient cycles that could impact adjacent Tuart TEC. The Proposed Action will incorporate environmental management during construction (see Action Management Plan, Appendix H). It is therefore unlikely that there will be indirect impacts on abiotic factors from the Proposed Action on adjacent Tuart TEC vegetation.
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	Not significant The Proposed Action will not result in a substantial change in the species composition of the occurrence of the overall TEC. Vegetation comprising the TEC in the DE has been predominantly assessed to be in 'Poor' (Completely Degraded') condition (99%) (Astron 2020). The extent of the TEC within the DE is mostly planted (70%) and has been subject to high levels of disturbance from weeds and extensive edge effects resulting in low native species richness. Astron (2020) noted the high levels of TEC degradation were mostly due to the following factors:

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR TUART TEC
	• Aggressive weeds (particularly grasses such as **Ehrharta calycina* and **Eragrostis curvula* that smother the ground) • Self-sown originally planted species such as *Acacia rostellifera, Melaleuca nesophila* and *Chamelaucium uncinatum* forming dense monocultures • Dumping of hard rubbish and garden waste • Lack of linkage to intact remnant vegetation has likely resulted in a decline in the number of species • Loss of species richness and vegetation structure due to lack of movement of seeds and pollen and lack of regeneration of key species • Use of herbicide or mowing to control weeds along edges. The treatment of Declared Plants, WoNs and planting of native vegetation within the road reserve will provide a buffer to retained adjacent TEC patches. The Proposed Action will implement Dieback hygiene (see Action Management Plan, Appendix H) to prevent the introduction or spread of Dieback into adjacent Tuart TEC patches. It is unlikely that any indirect impacts will occur to the occurrences of the TEC in the adjacent Woodvale Nature Reserve due to the presence of the buffer of the existing PSP and firebreak, which is approximately 5m. Accordingly, the Proposed Action is not expected to cause a decline or loss of functionally important species in TEC patches retained outside the DE. Considering the above, the Proposed Action is not expected to result in an action that may cause a substantial change in the species composition or the occurrence of the overall TEC.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • **assisting invasive species, that are harmful to the listed**	Not significant The Proposed Action will not result in a substantial reduction in the quality or integrity of the Tuart TEC outside of the DE. The Proposed Action will not result in a change of land use or introduce additional land uses that may significantly increase threatening processes that would cause a substantial reduction in the quality or integrity of an occurrence of an ecological community.

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR TUART TEC
ecological community, to become established, or • **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**	The potential for the introduction and/or spread of Declared Plants and WoNs into adjacent patches of TEC beyond which has already occurred due to existing disturbance is low. It is unlikely that there is any potential for the mobilisation of fertilisers, herbicides or other chemicals or pollutants into adjacent 'High' or 'Very High' patches of TEC due to existing physical barriers. These potential impacts will be managed through standard hygiene management practices outlined in the Tuart Action Management Plan (Appendix H).
Interfere with the recovery of an ecological community	Not significant Currently there is no recovery plan in place for this TEC. However, given that the vegetation is mostly planted (66%) and in 'Poor' condition (99%) and that it is does not provide a significant overall ecological function in the landscape, it is considered unlikely that the Proposed Action will interfere with the recovery of the Tuart TEC.

3.2 Threatened fauna

3.2.1 Black Cockatoos (Carnaby's Cockatoo – Endangered, Forest Red-tailed Black Cockatoo - Vulnerable)

3.2.1.1 Potential direct impacts

The Proposed Action will result in the following direct impacts to Black Cockatoo habitat values:

- Clearing of up to 177 Suitable DBH Trees for Black Cockatoos, including up to two trees containing a total of two potentially Suitable Hollows in Tree 190 and Tree 290
- Clearing of up to 3.02 ha of foraging habitat for Carnaby's Cockatoo
- Clearing of up to 0.62 ha of foraging habitat for FRTBC.

The Proposed Action will not result in impacts to known nesting hollows or roosting sites for Carnaby's Cockatoo or FRTBC.

The above estimates are conservative (an over-estimate), representing the maximum extent of Black Cockatoo values within the 13.68 ha DE. The actual clearing footprint is expected to be less and will be refined through the detailed design and construction planning process.

Regional mapping (DPIRD 2019) indicates that a total of 1,542 ha and 6,582 ha of potential Carnaby's Cockatoo and FRTBC foraging habitat occurs within 6 km and 12 km of the DE, respectively, the majority of which occurs within nature reserves. Clearing as a result of the Proposed Action will result in a potential reduction of foraging habitat for Carnaby's Cockatoo by 0.2% in the local area (6 km) and 0.045% within the regional area (12 km). For FRTBC, clearing of up to 0.62 ha will result in a potential reduction of foraging habitat by 0.04% in the local area and 0.01% in the regional area.

3.2.1.2 Potential indirect impacts

The Proposed Action has potential to cause indirect impacts to Black Cockatoo habitat adjacent to the DE.

DAWE (2020) considered the Proposed Action may result in indirect impacts including:

- Habitat degrading processes such as weed invasion and *Phytophthora cinnamomi* Dieback
- Increased predation from introduced species
- Increased risk of vehicle strike.

The Proposed Action is not expected to cause significant indirect impacts to Black Cockatoos, with discussion provided for each indirect impact below.

Habitat degrading processes such as weed invasion and *Phytopthora cinnamomi* Dieback

As discussed in Section 3.1.1, the construction and operation phases of the Proposed Action have the potential to result in the spread of introduced weeds and Dieback through activities such as clearing, and the increased movement of vehicles, or earth-moving machinery. Through construction and operational management of vehicle hygiene, the Proposed Action is not expected to result in the introduction or spread of weeds or Dieback that could result in significant impacts to Black Cockatoo habitat.

Increased predation from introduced species

There is a low risk of increased predation to Black Cockatoos from introduced species as a result of the Proposed Action. The Proposed Action is not expected to increase the threat of Feral Cats or Red Foxes in the area, which may pose a risk to Black Cockatoos.

The Proposed Action will not provide a destination or increase public access to surrounding vegetation, nor will it increase food sources that may attract feral species. Additionally, the DE is not existing breeding habitat for Black Cockatoos, therefore predation of chicks from nesting hollows is unlikely to occur. As such, the Proposed Action is unlikely to increase predation to Black Cockatoos from introduced species and is not inconsistent with the Threat Abatement Plans for Feral Cats or Red Foxes (DotE 2015, DEWHA 2008).

Increased risk of vehicle strike

The Mitchell Freeway poses an existing risk of vehicle strike to fauna. However, given Black Cockatoos are not ground dwelling fauna, the Proposed Action is highly unlikely to cause significant impacts to Black Cockatoos due to vehicle strike during construction or operation of the Proposed Action.

Main Roads is removing vegetation directly adjacent to the Mitchell Freeway in the road reserve. A buffer from the PSP and noise walls will exist between remaining vegetation and the Mitchell Freeway, which is likely to decrease the risk of vehicle strikes to Black Cockatoos flying between foraging trees on the roadside.

To minimise the likelihood of vehicle strike to Black Cockatoos, Main Roads will not revegetate or landscape the DE with flora species that are foraging species for Black Cockatoos within 10m of the edge of the road. Landscaping and revegetation greater than 10m from the edge of the road will likely comprise Black Cockatoo foraging species.

3.2.1.3 Assessment against MNES Significant Impact Guidelines

The potential impacts of the Proposed Action on Black Cockatoos have been assessed against the significant impact criteria for Endangered species (Carnaby's Cockatoo) (Table 3-4) and Vulnerable species (FRTBC) (Table 3-5) from the Significant Impact Guidelines 1.1 (DotE 2013).

Table 3-4 Assessment of the potential impact of the Proposed Action to Carnaby's Cockatoo species

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR CARNABY'S COCKATOO SPECIES
Lead to a long-term decrease in the size of a population	Not significant The Proposed Action will not lead to a long-term decrease in the size of the population of Carnaby's Cockatoo. The Proposed Action will require the clearing of 3.02 ha of foraging habitat, representing approximately 0.20% of the total available potential foraging habitat within 6 km. The natural flora assemblage has been altered to an extent that there is a reduced number and quality of foraging species for Carnaby's Cockatoo in the DE with 98% in 'Completely Degraded' condition. Higher quality foraging habitat occurs in reserves adjacent to and within the local area of the DE. Regional data indicates that the nearest roosting site is approximately 1 km to the west of the DE. A known breeding site is approximately 1 km to the north-east of the DE, within the Edith Cowan University (ECU) campus, comprising eight to nine breeding pairs of Carnaby's Cockatoo. This indicates that the foraging habitat in the northern section of the DE may support local breeding and roosting. However, given the presence of better quality foraging habitat in adjacent and nearby reserves, the removal of this relatively small area is not considered significant. The Proposed Action will require the removal of up to 177 Suitable DBH Trees. Two of the trees contain hollows considered suitable for Black Cockatoos (Kirkby 2020). No known breeding or roosting habitat will be removed for the Proposed Action. The hollows within the DE could be occupied by either Galah (*Cacatua roseicapilla*) or Little Corella (*Cacatua sanguinea*) (Tony Kirkby, pers. comm). Noting the above, the Proposed Action is not expected to result in a long-term decrease on the population of Carnaby's Cockatoo, nor significantly reduce the availability of foraging habitat required to support a breeding or roosting site such that species viability is impacted.
Reduce the area of occupancy of the species	Possibly significant The Proposed Action will have a minor reduction to the area of occupancy of Carnaby's Cockatoo. Clearing for the project will require the removal of 3.02 ha of foraging habitat which may have some value for the breeding population at ECU within 1 km. However, as outlined by IUCN (2019), the 'area of occupancy' can be defined as "a scaled metric that represents the area of suitable habitat currently occupied by the taxon". The current area of occupancy estimates for Carnaby's Cockatoo are between 34,500 km^2 and 86,800 km^2 (DAWE 2020). Clearing as a

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR CARNABY'S COCKATOO SPECIES
	result of the Proposed Action represents between 0.0003% and 0.0008% of the estimated post-2003 area of occupancy (DPaW 2013). Based on the survey findings, vegetation within the DE meets two of the criteria for 'critical habitat' (DPaW 2013), being the presence of foraging habitat nearby to known breeding or roosting sites and vegetation that provides habitat for feeding. Considering the above and noting the degraded nature of the vegetation present, the lack of quality foraging habitat and no evidence of breeding, the Proposed Action is not likely to reduce the area of occupancy of this species. Nonetheless, the Proposed Action may be possibly significant given the breeding population is within 7 km of the area (EPA 2019).
Fragment an existing population into two or more populations	Not significant The Proposed Action will not fragment an existing population of Carnaby's Cockatoo as they are highly mobile species and are not dependent on the habitat in the DE for foraging, roosting or breeding. All Carnaby's Cockatoos are considered to be part of the same population throughout their distribution. EPA (2019) outlines that when moving between roosting, water and food resources, flocks will follow vegetation corridors and actively avoid cleared and open areas, including dense urban areas. Habitat fragmentation has the potential to increase the distances Black Cockatoos need to travel between resources. The proximity of foraging habitat and water has been demonstrated to be critical to support roosting and breeding sites. In the Perth-Peel region, individual night roosts and breeding areas need food and water within 6 km to remain viable. The removal of a relatively narrow strip of vegetation, will not lead to the fragmentation of Carnaby's Cockatoo habitat. These species are expected to forage outside the Proposed Action area amongst large patches of higher quality foraging habitat within 6 km of the DE, including Woodvale Nature Reserve, Hepburn Heights Conservation Area and Craigie Bushland. The Proposed Action will not create a gap greater than 4 km between patches of habitat and will not fragment the existing population in two or more populations.
Adversely affect habitat critical to the survival of a species	Possibly significant

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR CARNABY'S COCKATOO SPECIES
	The Proposed Action is not expected to significantly impact habitat critical to the survival of the species. Species recovery, as defined by the Carnaby's Cockatoo Recovery Plan (DPaW 2013), is dependent upon stopping the further decline in the distribution and abundance of Carnaby's Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for their survival throughout their breeding and non-breeding range and ensuring that the reproductive capacity of the species remains stable or increases. Habitat critical to the survival of Carnaby's Cockatoo is defined as (DPaW 2013): • Known breeding and nearby feeding habitat • Former breeding habitat that has hollows intact • Vegetation that provides habitat for feeding, watering and regular night roosting. Based on the survey findings, vegetation within the DE meets two of the criteria for 'critical habitat', being the presence of foraging habitat nearby to known breeding or roosting sites and vegetation that provides habitat for feeding. Clearing for the project will require the removal of 3.02 ha of foraging habitat which may have some value for the breeding population at ECU within 1 km. The heavily altered state of the vegetation and low quality foraging habitat, particularly in comparison to higher quality habitat in nearby reserves (e.g. Woodvale Nature Reserve, Craigie Bushland and Neerabup National Park), means the habitat is unlikely to be preferable for the species. High quality habitat will remain within critical distances of 6 and 12 km of the known breeding site at Edith Cowan University.
Disrupt the breeding cycle of a population	Not significant The Proposed Action will not disrupt the breeding cycle of a population of Carnaby's Cockatoo. No known breeding habitat was identified in the DE. The known Carnaby's Cockatoo breeding site at the Edith Cowan Campus is approximately 1 km to the north of the DE, indicating that the recorded foraging habitat may support local breeding and roosting. The DE contains up to 177 Suitable DBH Trees. Two of those trees were identified as containing potentially Suitable Hollows for use by Black Cockatoos from Tree 190 and Tree 290 (Astron, 2020). In his assessment, Kirkby (2020) noted that due to the high proportion of planted vegetation, most trees with DBH > 500 mm have not yet reached sufficient age to form hollows large enough for Black Cockatoos. Additionally, despite observed chew marks and the use of a pole and camera to assess the hollows, there was insufficient evidence to confirm Black Cockatoos usage and these hollows may be used by the Galah or Little Corella for breeding (Kirkby 2020).

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR CARNABY'S COCKATOO SPECIES
	The removal of potential breeding trees and foraging habitat is not considered to result in a disruption to the species breeding cycle as there is no confirmed current or historic breeding within the DE. Given the presence of better quality foraging habitat and potential breeding habitat in adjacent and nearby reserves, the removal of this relatively small area is unlikely to disrupt the breeding cycle of Carnaby's Cockatoo.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Not significant The Proposed Action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Carnaby's Cockatoo will decline. The vegetation in the DE is highly disturbed and modified to an extent that there is a reduced number and quality of foraging species. The clearing of approximately 3.02 ha of Carnaby's Cockatoo foraging habitat represents a reduction in potential foraging by 0.2% in the local area (6 km) and 0.045% within 12 km. Noting the above, the Proposed Action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species habitat	Not significant The Proposed Action is unlikely to introduce harmful or invasive species to the DE. See Section 4.2.1 for proposed management of the potential spread of weeds, Dieback and feral animals into adjacent retained vegetation that could comprise habitat for Carnaby's Cockatoo.
Introduce disease that may cause the species to decline	Not significant The Proposed Action will not involve any actions that could potentially introduce infectious disease that could cause Carnaby's Cockatoo to decline. Terratree (2020) determined that the majority of the DE was uninterpretable/excluded assessment due its degraded nature. The potential for the introduction and/or spread of Dieback can be appropriately managed through standard hygiene procedures outlined in Section 4.2.1 to ensure plant pathogens are not introduced or spread to adjacent retained vegetation that may provide habitat. The implementation of standard hygiene procedures will ensure the Proposed Action will not introduce or spread disease to an extent which may cause a reduction in the quality of habitat adjacent to the DE, which could in turn cause the species to decline.

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR CARNABY'S COCKATOO SPECIES
Interfere with the recovery of the species	Not significant The Proposed Action will not interfere with the recovery of the species. The Carnaby's Cockatoo recovery plan (DBCA 2013) provides measures for the species recovery. These include identifying, protecting and managing important habitat. The removal of roadside vegetation, which is mostly planted is not inconsistent with the recovery plan for the species.

Table 3-5 Assessment of the potential impact of the Proposed Action to FRTBC species

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR FRTBC SPECIES
Lead to a long-term decrease in the size of an important population	Not significant The Proposed Action will not lead to a long-term decrease in the size of an important population of FRTBC as the Proposed Action will require the clearing of 0.62 ha of potential foraging habitat, representing only approximately 0.04% of the total available foraging habitat within 6 km. The natural flora assemblage has been altered to an extent that there is a reduced number and quality of foraging species for FRTBC in the DE. It is expected that higher quality foraging habitat extends into reserves adjacent to the DE and in the surrounding local area. No breeding or roosting by FRTBC in the DE was observed during the biological surveys and Kirkby (2020) notes that the closest known breeding site for FRTBC is approximately 30 km north east, in the Darling Range. On this basis, it is highly unlikely that the Proposed Action will lead to a long-term decrease in the size of a population.
Reduce the area occupancy of an important population	Not significant The Proposed Action will not significantly reduce the area of occupancy of an important population of FRTBC's. Estimated area of occupancy for the species is approximately 20,000 km^2 (Garnett et al. 2011). While the Proposed Action is located within the mapped distribution of FRTBC (DSEWPaC 2012a, DotEE 2017), clearing as a result of the Proposed Action represents 0.0002% of the estimated area of occupancy (Garnett et al. 2011).

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR FRTBC SPECIES
	Considering the above and noting the degraded nature of the habitat present, the lack of quality foraging and evidence of breeding, the Proposed Action will not reduce the area of occupancy of this species.
Fragment an existing important population into two or more populations	Not significant The Proposed Action will not fragment an existing important population of FRTBC as they are highly mobile species and are not dependent on the habitat in the DE for foraging, roosting or breeding. FRBTC are considered to be a single population across their range (DEWHA 2009). The removal of a long, relatively narrow strip of vegetation, along the edge of the Mitchell Freeway will not lead to the fragmentation of FRTBC habitat, as the Proposed Action will not create a gap greater than 4 km between patches of habitat. Noting the above, the Proposed Action will not fragment an existing population in two or more populations.
Adversely affect habitat critical to the survival of a species	Not significant The Proposed Action will not affect habitat critical to the survival of the species. The Forest Black Cockatoo Recovery Plan (DEC 2008) defines habitat critical to the survival of important populations of FRTBC's as: • All Marri (*Corymbia calophylla*), Karri (*Eucalyptus diversicolor*) and Jarrah (*Eucalyptus marginata*) forests, woodlands and remnants in the south-west of Western Australia. While the DE comprises suitable foraging species and potential breeding habitat, only 0.62 ha is proposed to be cleared and the quality of this habitat is 'low' (Astron, 2020). FRTBC's are considered unlikely to breed in the DE due to a preference for larger stands of woodland or forest (Johnstone et al. 2010). Astron (2020) and Kirby (2020) did not record any evidence of current or historic breeding within the DE.
Disrupt the breeding cycle of an important population	Not significant The removal of potential breeding trees and foraging habitat is not considered to result in a disruption to the species breeding cycle as there is no confirmed breeding by FRTBC within or near the DE. Kirkby (2020) noted that the closest known breeding site for FRTBC is approximately 30 km northeast in the Darling Range. For FRTBC, Marri is the most important nesting tree throughout their range, however they will also utilise suitable hollows in Karri, Wandoo, Bullich, Blackbutt, Tuart and Jarrah trees (DSEWPaC 2012a). The most important breeding

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR FRTBC SPECIES
	trees for the species are large, mature Marri trees of 120-150 years in age (Johnston et al. 2013). No Marri trees within the DE contained suitable hollows, and the surveys did not record any evidence of current or historic breeding (Astron 2020, Kirkby 2020). The Proposed Action will not disrupt the breeding cycle of an important population of FRTBC as no known breeding occurs within or close to the DE.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Not significant The vegetation in the DE is highly disturbed and modified to an extent that there is a reduced number and quality of foraging species. The clearing of approximately 0.62 ha of 'low' quality FRTBC foraging habitat represents a reduction in potential foraging by 0.04% and 0.01% in the local (6km) and regional (12km) area. On this basis, given the small amount of clearing proposed and the absence of quality habitat within the DE, the Proposed Action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that FRTBC will decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Not significant The Proposed Action will not introduce harmful or invasive species within or adjacent to the DE. Measures to manage the potential spread of weeds, Dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species will be undertaken during construction.

SIGNIFICANT IMPACT CRITERIA (DotE 2013)	ASSESSMENT FOR FRTBC SPECIES
Introduce disease that may cause the species to decline	Not significant The Proposed Action will not involve any actions that could potentially introduce infectious disease that could cause FRTBC to decline. Terratree (2020) determined that the DE was uninterpretable/excluded due to its degraded nature. The potential for the introduction and/or spread of Dieback can be appropriately managed through standard hygiene procedures to ensure plant pathogens are not introduced or spread to adjacent retained vegetation that could comprise habitat for the species. Both Tuart and Marri (being the most important species in the DE for FRTBC) are not susceptible to Dieback (Groves et al. 2012) and therefore FRTBC are unlikely to be impacted by Dieback. The implementation of standard hygiene procedures will ensure the Proposed Action will not introduce or spread disease to an extent that may cause a reduction in the quality of foraging habitat adjacent to the DE that could in turn cause the species to decline.
Interfere substantially with the recovery of the species	Not significant The Proposed Action will not interfere with the recovery of the species. The recovery plan for the species (DEC 2008) provides measures for the species recovery. These include identifying, protecting and managing important habitat such as forest/woodland areas. The removal of roadside vegetation, which is mostly planted is not inconsistent with the recovery plan for the species.

4 AVOIDANCE AND MITIGATION MEASURES

Substantial changes to the Proposed Action design have been made in the project planning and design phase to reduce impacts on the Tuart TEC and Black Cockatoo habitat as appropriate and necessary to avoid and minimise impacts on the environment.

4.1 Threatened ecological communities

4.1.1 Tuart TEC – Critically Endangered

4.1.1.1 Avoidance

Changes to the Proposed Action to reduce impacts to the Tuart TEC include primarily refining the project footprint to minimise clearing requirements (Figure 3). Under the current design configuration, direct impacts to MNES and other environmental values have been reduced to the maximum extent possible and the remaining impact cannot be avoided if the Proposed Action is to proceed.

Main Roads has avoided parts of Tuart TEC patches TP12 and TP20 where possible. Clearing has been reduced to only those areas essential for project works. Parts of TP20 have been excluded from the DE in order to reduce the loss of actual Tuart trees. This has resulted in 2.84 ha of Tuart TEC and at least 30 large trees (DBH >500 mm), being retained due to avoiding this area. The DE also avoids better quality Tuart TEC in 'High' and 'Very High' condition, within Woodvale Nature Reserve.

Main Roads will ensure that all laydown areas, stockpiles and access tracks are constructed within existing cleared areas or within the permanent footprint of the works. No remnant native vegetation will be cleared for temporary works.

Main Roads has consolidated its measures to avoid impacts to the Tuart TEC into the Tuart TEC Action Management Plan (Appendix H). Implementation of the Tuart TEC Action Management Plan will facilitate the avoidance of impacts to the Tuart TEC to as low as reasonably practicable.

4.1.1.2 Mitigation / Management

As detailed in Section 3.1.1, implementation of the Proposed Action is not expected to reduce the viability of any remaining occurrences of Tuart TEC.

Main Roads has consolidated its measures to mitigate indirect impacts to the remaining Tuart TEC vegetation immediately adjacent to the DE into the Tuart TEC Action Management Plan (Appendix H).

Main Roads intends to further mitigate the residual impacts of the Proposed Action through implementation of an environmental offset strategy (see Section 5).

4.1.1.3 Monitoring

Key actions and processes have been identified to monitor the potential impacts of the Proposed Action to Tuart TEC during detailed design and all construction activities. The monitoring program has been designed to assess the effectiveness of management actions on potentially indirect impacted occurrences of TEC vegetation adjacent to the DE, and enable the detection of a decline

in vegetation condition. The proposed monitoring program for managing Tuart TEC for the Proposed Action is detailed in Appendix H.

4.2 Threatened fauna

4.2.1 Carnaby's Cockatoo – Endangered; Forest Red-tailed Black Cockatoo - Vulnerable

4.2.1.1 Avoidance

Main Roads has made substantial changes to the Proposed Action design in order to reduce potential impacts on Black Cockatoos, by reducing the footprint (Figure 3).

The DE for the Proposed Action was reduced in order to avoid a number of Suitable DBH Trees and foraging habitat. Originally, the DE encompassed the entire road verge, from the edge of the freeway to eastern edge of the DE (Figure 3). Main Roads has reduced the DE in parts resulting in the avoidance of at least 30 DBH trees. All opportunities to further reduce the clearing of DBH trees will be considered during the detailed design phase, but cannot be reduced at the current planning and design stage.

Main Roads will ensure that all laydown areas, stockpiles and access tracks will be constructed within existing cleared areas or within the permanent footprint of the works. No remnant native vegetation will be cleared for temporary works.

The DE also avoids better quality habitat located adjacent to the DE, within Woodvale Nature Reserve.

4.2.1.2 Mitigation / Management

Table 4-1 identifies the key management objectives, risks and actions that Main Roads will implement to manage the potential impacts of the Proposed Action to Black Cockatoo individuals and habitat.

Table 4-1 Black Cockatoo management actions

MANAGEMENT OBJECTIVE	KEY IMPACTS/RISKS	MITIGATION/MANAGEMENT ACTIONS
Prevent clearing of Black Cockatoo habitat	Clearing of Black Cockatoo habitat exceeding approved limits.	• The final design will be assessed against the DE to ensure the required clearing area is no more than the approved area • Site induction will include Black Cockatoo habitat clearing requirements and procedures • Black Cockatoo habitat not required to be cleared will be marked and identified as no-go areas, demarcated on relevant drawings and provided to the Construction Contractor Representative • Vegetation to be retained will be clearly marked with flagging on site • Laydown areas, stockpile areas and vehicle turn around, will be located in areas cleared for permanent works • Clearing will be avoided for any temporary construction activities.

MANAGEMENT OBJECTIVE	KEY IMPACTS/RISKS	MITIGATION/MANAGEMENT ACTIONS
Prevent and treat the introduction and/or spread of weeds in the Black Cockatoo habitat adjacent to the DE during construction works.	Indirect impacts to condition of Black Cockatoo habitat adjacent to the DE through introduction and/or spread of weeds.	• Site induction will include information on Declared Plants and WoNS identification and reporting requirements • Topsoil containing Declared Pests or WoNS will not be reused in landscaping or revegetation • All heavy plant and machinery will be inspected by the contractor prior to entry at the work site and be confirmed to be clean and free of vegetation and soil material • Movement of machines and other vehicles will be restricted to the limits of the areas cleared with the DE or on designated tracks outside the DE.
Prevent the introduction and/or spread of dieback in the Black Cockatoo habitat adjacent to the DE during construction work.	Indirect impacts to condition of Black Cockatoo habitat adjacent to the DE through introduction and/or spread of dieback.	• Site induction will include information on Dieback management requirements • The entire of the DE will be assumed Infested and managed in accordance with DBCA Management Guidelines (CALM 2003) including the establishment of a Clean on Entry/Exit (CoE) point • Construction site drainage will be directed away from adjacent Black Cockatoo habitat • Phosphite will be applied in infested areas to Dieback susceptible species within 30 m of potential infested areas identified as a result of unauthorised access or drainage, in accordance with DBCA guidance • Movement of machines and other vehicles will be restricted to the limits of the areas cleared within the DE or on designated tracks outside the DE.
Prevent injury and mortality to Black Cockatoos.	Injury or mortality to Black Cockatoos caused by project activities.	• The final design will avoid trees with suitable hollows where possible • A pre-clearing fauna assessment will be undertaken by a suitably experienced expert to determine if the hollows are being used by Black Cockatoos. • A suitably experienced expert will be on site during clearing of breeding habitat for Black Cockatoos • Where the pre-clearing fauna assessment identifies any Black Cockatoo occupation of nest hollows, the tree with the nest hollow will not be cleared until after the completion of the breeding season. No vegetation within 10 m of the tree would be cleared until after the completion of the breeding season • Any Black Cockatoos showing signs of injury or illness will be promptly referred to an experienced wildlife veterinarian or approved wildlife rehabilitation facility • Revegetation designs shall not include foraging or breeding plant species within 10 m of the Mitchell Freeway.

Main Roads intends to further counterbalance the residual impacts of the Proposed Action through the implementation of an environmental offset strategy (see Section 5).

4.2.1.3 Monitoring

Key actions and processes have been identified to monitor the potential impacts of the Proposed Action to Black Cockatoo individuals and habitat during detailed design and all construction activities. The proposed monitoring program for the Proposed Action is identified in Table 4-2.

Table 4-2 Black Cockatoo monitoring and reporting

KEY IMPACT/RISKS	MONITORING CRITERIA	REPORTING
Clearing of Black Cockatoo habitat exceeding approved limits.	Prior to construction: • Detailed design drawings limit clearing of Black Cockatoo habitat to approved limits and show environmental no-go areas • Record of provision of drawings showing environmental no-go areas • Site inspection by Construction Contractor Environmental Management Representative prior to and following clearing to confirm no-go areas are appropriately flagged/fenced and that clearing remains within limits. During construction: • Construction site plan showing all ancillary areas are not located on land containing Black Cockatoo habitat outside of areas to be cleared for permanent works.	Area of Black Cockatoo habitat cleared recorded by Contractor Environmental Management Representative. Report annually to DAWE as part of annual compliance reporting.
Indirect impacts to condition of Black Cockatoo habitat adjacent to the DE through introduction and/or spread of weeds or Dieback.	During construction: • Monthly inspection to determine new occurrence or spread of Declared plants or WoNs within the construction site boundary or immediately adjacent areas • Records identifying plant and machinery arriving on site is clean • Visual inspection opportunistically to monitor evidence of unauthorised vehicle access • Potentially infested areas arising from access or drainage will be sampled for Phytophthora Post construction: • Weedy survey at completion of works	Records of inspection including details of occurrence of Declared plants and WoNs. Evidence of unauthorised vehicle access will be recorded as an environmental incident and the cause investigated. Report annually to DAWE as part of annual compliance reporting.
Injury or mortality to Black Cockatoos caused by project activities.	Prior to clearing: • Visual inspection to confirm any potential nesting hollows are not in use by Black Cockatoos	Records of inspection including details of presence/absence of nesting kept by construction contractor.

KEY IMPACT/RISKS	MONITORING CRITERIA	REPORTING
	• Records of inspection, including details of presence/absence of nesting kept by construction contractor During construction: • Evidence of injury or death to Black Cockatoos monitored by visual inspection post each clearing event and opportunistically • Revegetation and landscaping plans show foraging and breeding plant species are not within 10m of the Mitchell Freeway.	Injury or death of Black Cockatoos recorded as an environmental incident occurring and the cause investigated. Report annually to DAWE as part of annual compliance reporting.

4.3 Effectiveness of avoidance and mitigation measures

Main Roads has a strong track-record for developing and implementing best practice environmental management measures. The measures proposed herein have been successfully implemented on past projects subject to EPBC conditions and management measures, including the following projects for which Compliance Reports have been issued in the past year:

- Great Northern Highway Upgrade Stage 2 (EPBC 2016/7761)
- Bowelling Curves Realignment (EPBC 2016/7757)
- Northam Pithara Road Widening (EPBC 2015/7454)
- Mitchell Freeway Extension - Burns Beach to Hester Avenue (EPBC 2013/7091)
- Broome - Cape Leveque Road Upgrade (EPBC 2013/6984)
- Dampier Highway Duplication project (EPBC 2010/5419)
- Gateway WA – Perth Airport and Freight Access Project (EPBC 2010/5384).

Main Roads is a State agency with an assured record of responsible environmental management and environmental management systems. Main Roads is not subject to any past or present proceedings under Commonwealth or State law for protection of the environment or conservation and sustainable use of natural resources. Main Roads track record indicates a history of effective implementation and monitoring of management measures to ensure effectiveness and implementation of corrective actions when effectiveness does not meet completion criteria.

5 OFFSETS

5.1 Background

Environmental offsets are conservation actions that provide environmental benefits intended to counterbalance the significant residual environmental impacts associated with a Proposal. Main Roads intends to mitigate the residual impact of the Proposed Action through implementation of an environmental offset. The offset strategy (Appendix I) was prepared in accordance with the Australian Government's EPBC Act Environmental Offset Policy (DSEWPaC 2012b). The proposed offset will be proportionate to the level of impact and significance of the environmental impact.

Main Roads operates on a hierarchy of avoid, minimise, reduce, rehabilitate and offset environmental impacts. This hierarchy is achieved primarily through changes in scope and design, development and implementation of avoidance and mitigation measures and finally, an offset proposal.

5.2 EPBC Act Environmental Offsets Policy (DSEWPaC 2012b)

The EPBC Act Environmental Offsets Policy (DSEWPaC 2012b) requires that offsets satisfy the following Principles:

- Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter
- Suitable offsets must be built around direct offsets but may include other compensatory measures
- Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter
- Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter
- Suitable offsets must effectively account for and manage the risks of the offset not succeeding
- Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs
- Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable
- Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

5.3 Mitigation of significant residual impacts

Residual impacts associated with the Proposed Action have been determined through application of the significant impact guidelines 1.1 (DEWHA 2013). The EPBC Offset Calculator Tool was used to calculate the quantum of offsets required to mitigate the significant residual impacts on Tuart TEC and Black Cockatoo habitat. Table 5-1 summarises the calculated offset package required to mitigate the significant residual impacts to Tuart TEC and Black Cockatoos.

As presented in Table 5-1, the offset package is expected to provide adequate compensation for significant residual impacts to Tuart TEC and Black Cockatoos. While Main Roads is only proposing to have a permanent residual impact to 8.95 ha of Tuart TEC, Main Roads is offsetting 12.16 ha, which includes an offset for the entire TP20 patch.

Table 5-1 Summary of offset package to mitigate significant residual impacts

Residual Impacts to MNES	Offset 1 Lake Clifton Offset Site	Offset 2 Installation of Artificial Hollows
Tuart TEC 12.16 ha x quality 2 = 28 ha total	31.9 ha = 114.71 % of impact offset	n/a
Black Cockatoos 3.02 ha x quality 4 = 12 ha total	27.9 ha = 238.37% of impact offset	Six artificial hollows = 3 to 1 ratio of hollows within the DE

5.4 Proposed offset strategy

Main Roads has pursued a number of options in developing a package of offsets to counterbalance residual impacts. The options investigated have comprised acquisition of land and the installation of artificial Black Cockatoo breeding hollows. Table 5-2 provides an overview of the offset package under consideration, with the offset property location (Offset 1) presented in Figure 11. The detailed offset proposal is provided in Appendix I. The proposed offset site will address the requirement for more than one offset attribute, including provision of Tuart TEC and habitat for Black Cockatoos.

Table 5-2 Overview of proposed offset package

NO.	OFFSET TYPE	OFFSET SUMMARY	PROPERTY LOCATION	EXISTING TENURE
1	Land Acquisition	31.9 ha of existing native vegetation providing: • Tuart TEC • Black Cockatoo habitat	Preston Beach Road	DBCA managed freehold land owned by the State of WA
2	Installation of Artificial Hollows	Six artificial hollows providing nesting habitat for Black Cockatoos	To be determined in consultation with DBCA	NA

5.5 Description of offsets

The components of the offset package are described below. Offset calculations have been based on the EPBC offset calculator tool to evaluate impacts from the Proposed Action on MNES. The offset strategy, which includes the offset calculator inputs is provided in Appendix I.

5.5.1 Offset 1 – Lake Clifton Property Acquisition

The primary offset for the Proposed Action relates to mitigating the significant residual impacts to the Tuart TEC and Black Cockatoo Habitat. The offsets calculation has determined that 29 ha of land is required to offset the residual impacts from the Proposed Action.

For the purposes of providing an offset for the Proposed Action, a portion of previously acquired land within a 1000 ha property located on Preston Beach Road, Lake Clifton (Lake Clifton site) (Figure 11) will be used to offset impacts from the Proposed Action. This land parcel has already been transferred to DBCA, forming part of the state's conservation estate, with DBCA now responsible for ongoing land management. Not all of the land within the Lake Clifton site has been utilised as an offset to date, with approximately 380 ha banked for future offsets. Main Roads proposes to use 31.9 ha of vegetation within the Lake Clifton site (Proposed offset area) to offset impacts from the Proposed Action to impacts on MNES. The vegetation within the Proposed offset area contains vegetation representative of the Tuart TEC, along with habitat for Carnaby's Cockatoo and FRTBC. At the Lake Clifton Site, a biological survey, which included a Black Cockatoo assessment was conducted by AECOM (2016), along with an additional targeted Tuart woodlands TEC survey (AECOM 2020).

The AECOM (2016) assessment mapped seven vegetation communities within the proposed offset area (Table 5-3). Most of the proposed offset site comprises vegetation community EgXpTd, which is characterised by *Eucalyptus gomphocephala*, *Agonis flexuosa* and *Banksia attenuata* tall open forest. The AECOM (2020) survey confirmed the 31.9 ha of vegetation within the proposed offset site is representative of the Tuart TEC.

Vegetation condition ranged from Excellent to Completely Degraded based on the Keighery (1994) scale (AECOM, 2016). Vegetation was mostly in Excellent (11.96 ha; 37.5%) or Very Good (14.21 ha; 44.6%) condition. The remaining vegetation was in Good (5.68 ha; 17.8%) or Completely Degraded (0.02 ha; 0.07%) condition. AECOM (2020) determined this patch of Tuart TEC has High condition according to Tuart Woodlands Conservation advice (DoEE, 2019).

Table 5-3 Vegetation Communities in the Proposed Offset Site (AECOM, 2016)

Vegetation Community .	Description	Area in Proposed Offset Site (ha)
EgXpTd	*Eucalyptus gomphocephala*, *Agonis flexuosa* and *Banksia attenuata* tall open forest over *Xanthorrhoea preissii*, *Macrozamia riedlei* and *Hibbertia cuneiformis* mid to tall *shrubland* over **Trachyandra divaricata*, **Solanum nigrum* and **Geranium molle* low isolated forbs.	16.81
ArMsTd	*Acacia rostellifera*, *Spyridium globulosum* and *Clematis linearifolia* tall shrubland over *Melaleuca systena*, *Phyllanthus calycinus* and *Acanthocarpus preissii* mid heathland to open heathland over low sparse to closed forbland of **Trachyandra divaricata*, **Solanum nigrum* and **Geranium molle*.	4.03
AfXpHh	Low to mid open to closed forest of *Agonis flexuosa*, *Eucalyptus gomphocephala* and occasional *Banksia grandis* over *Xanthorrhoea preissii*, *Templetonia retusa* and occasional *Banksia sessilis* var. *cygnorum* tall open shrubland over *Hibbertia hypericoides* and *Macrozamia riedlei* sparse to open low shrubland.	5.54
AfHcEp	*Agonis flexuosa* mid open forest with emergent *Eucalyptus gomphocephala* over *Hibbertia cuneiformis*, *Xanthorrhoea preissii* and *Clematis linearifolia* mid sparse shrubland over **Euphorbia peplus*, **Geranium molle*, *and **Trachyandra divaricata* low sparse forbland.	0.02

Vegetation Community .	Description	Area in Proposed Offset Site (ha)
Xp	*Xanthorrhoea preissii* tall shrubland over common weeds.	0.92
MrGtTd	*Melaleuca rhaphiophylla* and *Melaleuca cuticularis* low closed forest over *Gahnia trifida*, *Juncus kraussii* subsp. *australiensis* and *Lepyrodia drummondiana* mid to tall sedgeland over **Trachyandra divaricata*, **Geranium molle* and **Lysimachia arvensis* low isolated forbs.	3.33
MsTd	Mid to tall heathland to closed heathland of *Melaleuca systena, Hibbertia cuneiformis* and *Templetonia retusa* over **Trachyandra divaricata, *Hypochaeris glabra* and **Arctotheca calendula* low forbland.	1.20

The proposed offset site also contains foraging habitat suitable for the Black Cockatoos (Table 5-4). 27.9 ha of the proposed offset site is representative Carnaby's Cockatoo foraging habitat. Most of the proposed offset site represented High quality or Valued foraging habitat. FRTBC habitat comprised 1.2 ha of vegetation community MsTDm, which contained up to 10% of Hakea species, a foraging species for FRTBC (Johnstone 2011).

The proposed offset site contains 22.4 ha of potential breeding habitat suitable for Black Cockatoos (Table 5-5). The quality of potential breeding habitat ranged from Low to High. The majority of breeding habitat was characterised by vegetation community EgXpTd and comprised High Quality potential breeding habitat. AECOM (2016) estimated that Black Cockatoo habitat in the Lake Clifton survey area comprised up to 3,900 suitable DBH trees (Table 5-5). Based on the amount of habitat present, approximately 700 suitable DBH trees would occur in the proposed offset area. AECOM (2016) also noted that there is a confirmed Carnaby's Cockatoo breeding site approximately 3 km to east of the Lake Clifton site.

To offset 12.16 ha of impact (including 8.75 ha of direct impacts and 3.41 ha of indirect impacts) to the Tuart TEC and 3.02 ha of impact to Black Cockatoos, Main Roads proposes an allocation of 31.9 ha of land containing:

- 31.9 ha of Tuart TEC
- 27.9 ha of Carnaby's Cockatoo foraging habitat
- 1.2 ha of FRTBC foraging habitat
- 22.4 ha of Black Cockatoo breeding habitat containing approximately 700 suitable DBH trees.

Table 5-4 Black Cockatoo Foraging Habitat in the Proposed Offset Site (AECOM, 2016)

Species	Quality	Area in Proposed Offset Site (ha)
Carnaby's Black Cockatoo	High	16.81
	Valued	5.51
	Low	5.56
Forest Red-tailed Black Cockatoo	Low	1.20
Baudin's Black Cockatoo	Valued	16.81

Table 5-5 Black Cockatoo Breeding Habitat in the Proposed Offset Site (AECOM, 2016)

Quality	Vegetation Community	Habitat Area in Survey Area (ha)	Habitat Area in Proposed Offset Site (ha)	Proportion in Proposed Offset Site (%)	Approximate Number of Trees in Survey Area	Approximate Number of Trees in Offset Area
High	EgXpTd	39.3	16.81	43	1,400	600
Valued	AfXpHh	116.4	5.54	4.8	2,100	100
Low	AfHcEp	138.6	0.02	0.02	400	0

5.5.2 Offset 2 – Installation of Artificial Hollows

Main Roads proposes to install six artificial hollows to offset the significant residual impact to two potentially Suitable Hollows for Black Cockatoo nesting. These artificial Black Cockatoo nesting hollows will be installed at a site suitable for Black Cockatoo breeding, with the location determined in consultation with DBCA. The design and placement of the artificial hollows will based on DBCA's guidelines for installing Black Cockatoo hollows (DPaW 2015).

6 ECONOMIC AND SOCIAL MATTERS

6.1 Financial investment

Approximately $20 million of funding has been jointly committed from the State and Federal government for the construction of the Proposed Action, including costs for property acquisition, environmental management and the environmental offset package.

6.2 Costs and benefits

As a primary distributor, the Mitchell Freeway forms part of the Perth Freeway system, providing a vital artery in the Perth metropolitan road network. Mitchell Freeway is currently characterised by its poor and unreliable traffic performance during peak periods and congestion, resulting in significant avoidable social and economic costs, highlighting a growing need for improved freeway function. As the city has continued to develop and grow over the past two decades, demand has outstripped the capacity of the freeway system, highlighting the need to manage flow of people onto, through and out of the freeway corridor. As the freeway network currently exceeds its capacity, it is important that other sustainable modes of transport (such as cycling) are considered. The discontinuous PSP is narrower than current design standards in the DE and currently forces cyclists on to local roads and increases interaction with motorists. The Proposed Action will reduce noise emissions for local residents and allow a continuous PSP that is constructed to current design standards, thereby minimising safety risks involved with pedestrian interactions with vehicles.

6.3 Stakeholder consultation

Stakeholder consultation has been an integral consideration in the development of the Proposed Action. Main Roads has commenced initial consultation with key state government stakeholders, with in principle support of the project provided by the Department of Transport (DoT), Public Transport Authority (PTA), the Department of Planning, Lands and Heritage (DPLH) and the Water Corporation, during the early development of the project. Further consultation with these stakeholders will be undertaken as the project progresses.

Main Roads will liaise with the City of Joondalup in relation to specific requirements regarding strategic connections to shared paths in local government managed areas. Main Roads will also liaise closely with local stakeholders and the wider community as the project progresses. This includes residents directly abounding the freeway reserve, schools and businesses.

6.4 Scale of social and economic impacts

The current problems experienced on Mitchell Freeway Southbound has resulted in significant avoidable social and economic costs, highlighting a growing need for improved freeway function. The Proposed Action aims to create sustainable traffic solutions, reduced local congestion and improvements to public safety.

The key benefits for the Proposed Action include:

- A continuous upgraded PSP network adjacent to the Mitchell Freeway, minimising the risks involved for pedestrian interactions with vehicles on local roads
- Improvements to the liveability of the Perth region by minimising congestion on a major distributor

- Improved urban amenity for local residents, from the reduction in noise emissions from the construction of noise walls
- Provision of sustainable, innovative and integrated transport solutions
- Greater use of healthier transport opportunities through the provision of active transport modes including walking and cycling
- Controlled traffic flow onto the freeway from ITS systems and modified onramps, which will enable vehicles to enter the freeway and merge safely, whilst allowing efficient traffic flows
- Significant economic benefits across the whole of the road network, primarily derived from private vehicle travel time savings and reduced vehicle operating costs on the Mitchell Freeway and surrounding network
- Increased direct and indirect employment opportunities for the local population during the construction phase. This includes increased Aboriginal employment and procurement of Aboriginal businesses.

6.4.1.1 Aboriginal Participation

Main Roads recognises that the Proposed Action is on the traditional lands of the Whadjuk people of the Noongar nation. Main Roads aims to deliver sustainable working relationships with Aboriginal communities and individuals, and to offer a wide range of career and business opportunities to Aboriginal People.

Mains Roads will adopt a whole of project approach to Aboriginal participation for the Proposed Action and will implement the project specific Aboriginal Participation Plan (H2H 2020). The plan includes targets for Aboriginal employment, Aboriginal business procurement and training and mentorship opportunities for Aboriginal people.

6.4.1.2 Aboriginal heritage

A database search did not identify any known Aboriginal heritage sites registered under the *Aboriginal Heritage Act 1972* (WA) in or adjacent to the DE (DPLH 2020). A number of Aboriginal heritage surveys have been undertaken over the DE (DPLH 2020), with no Aboriginal sites identified. No impacts to Aboriginal heritage are expected to occur from the Proposed Action.

7 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

Section 3A of the EPBC Act defines the principles of ecologically sustainable development. Table 7-1 outlines how each of the five principles has been applied to the Proposed Action.

Table 7-1 EPBC Act Principles of Ecologically Sustainable Development

NO.	PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROPOSAL
a)	Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	A holistic decision making process has been established for the Proposed Action with the aim to provide an integrated and transparent approach. The Proposed Action will promote greater use of healthier transport opportunities through the provision of active transport modes and improve urban amenity for local residents from the construction of noise mitigating walls. A detailed business case was used to make a number of significant design decisions, through comparative analysis of design options with consideration of environmental, social and economic factors.
b)	If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation	A wide range of comprehensive desktop and field studies were undertaken to assess the impact of the Proposed Action. Information gathered during these studies was used to inform the project and has reduced the uncertainty surrounding the prediction of impacts for the assessment. Main Roads has ensured that the Proposed Action's design avoids serious or irreversible damage to the environment as far as possible. Impacts have been identified and described under each key environmental factor. Mitigation and management measures have been proposed to ensure they are environmentally acceptable. Offsets have been proposed to mitigate significant residual impacts.
c)	The principle of intergenerational equity That the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The Proposed Action will ensure the health, diversity and productivity of the environment is maintained through retaining as much habitat as possible, improving cycling infrastructure and establishing noise walls to reduce noise related impacts.
d)	The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	The Proposed Action lies within and adjacent to existing disturbed areas along the Mitchell Freeway. Clearing occurs within areas of relatively degraded vegetation. The Proposed Action has sought to avoid the remnant biodiversity as much as possible by avoiding areas of native vegetation and Woodvale Nature Reserve.
e)	Improved valuation, pricing and incentive mechanisms should be promoted	Main Roads acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors will greatly determine the location of the final footprint, with the project having a strong focus on reducing its direct and indirect clearing footprint.

NO.	PRINCIPLE	CONSIDERATION OF PRINCIPLE IN THE PROPOSAL
		Impacts on flora, vegetation and terrestrial fauna have been assessed and mitigation and management measures proposed. Main Roads accepts that the cost of the Proposed Action must include environmental impact mitigation, management and maintenance activities. These requirements will be incorporated into the overall Proposed Action costs. The Proposed Action will be subject to an Infrastructure Sustainability rating through the Infrastructure Sustainability Council of Australia (ISCA). This will assess the environmental, social and economic impacts and benefits of the Proposed Action, including its waste stream and the resources utilised for construction. The ISCA rating scheme is designed such that goals are established for a Proposed Action, then the Proposed Action is assessed against the achievement of those goals.

8 ENVIRONMENTAL RECORD OF THE PERSON PROPOSING TO TAKE THE ACTION

Main Roads is a State agency with an assured record of responsible environmental management and a certified environmental management system. Main Roads is not subject to any past or present proceedings under Commonwealth or State law for protection of the environment or conservation and sustainable use of natural resources. All work undertaken by Main Roads is completed in accordance with their Environmental Policy and Environmental Management System (EMS), which is certified with the requirements of ISO 14001:2015 Environmental management systems comprising 'Activities, products and services associated with delivering Road Management (planning, building and maintaining) on Western Australia's State Road Network' (Certificate #MRWQ51-CCE04). Main Roads' environmental policy can be found at https://www.mainroads.wa.gov.au/OurRoads/Environment/Pages/environmentalmanagement.aspx#policy

Main Roads EMS is independently certified and covers the processes and activities that have the potential to impact the environment, including mitigation and management measures proposed as part of the Proposed Action. The EMS ensures compliance with Main Roads environment and heritage compliance obligations, providing the framework for driving environmental requirements through leadership, planning, support, operation, performance evaluation and improvement actions. The Proposed Action, therefore, will be undertaken, monitored and measured in accordance with the Main Roads EMS.

Main Roads EMS covers processes and activities that have the potential to impact on the environment and ensures compliance with environment and heritage compliance obligations. The EMS responsibilities includes appropriate resource allocation to ensure compliance costs are appropriately budgeted and assessed as part of the overall business case for the project. This ensures that the costs of proposed management measures and offsets is considered in the budget approvals and ensures compliance is appropriately funded and resourced.

9 OTHER APPROVALS AND CONDITIONS

Other than an approval under the EPBC Act, requirements for approval or conditions that apply, or that are likely to apply, to the Proposed Action include various approvals from Western Australia State agencies, as outlined below.

9.1 *Environmental Protection Act 1986,* Part V Environmental Regulation - Clearing of Native Vegetation

Main Roads is currently applying for a clearing permit under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations) and Part V of the *Environmental Protection Act 1986* (EP Act).

9.2 Other approvals and regulation

Additional regulatory approvals will be required to develop and operate the Proposed Action. This includes obtaining a licence to take from the state Department of Water and Environmental Regulation, for the sourcing of groundwater under the *Rights in Water and Irrigation Act 1914*.

9.3 Planning approvals

The alignment of the Proposed Action will be located within land currently zoned as Primary Regional Roads or Urban under the Metropolitan Region Scheme. No development (planning) approval is required for the construction works.

10 APPLICATION OF RECOVERY PLANS AND THREAT ABATEMENT PLANS

The Proposed Action is not inconsistent with the relevant Recovery Plans and Conservation Advice relating to the MNES identified in the DE, as presented in Table 10-1, nor is it inconsistent with the significance factors from the Tuart TEC Conservation Advice (TSSC 2019) (Table 10-2).

Table 10-1 Assessment against Recovery Plans

RECOVERY / ABATEMENT PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
Carnaby's Cockatoo Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (DPaW 2013)	The objective of this Recovery Plan is to stop further decline in the distribution and abundance of Carnaby's Cockatoo by protecting the species throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases. The recovery actions within the plan include: • Protect and manage breeding habitat and associated feeding habitat • Protect and manage non-breeding habitat • Undertake regular monitoring • Conduct research to inform management • Manage other impacts • Engage with the broader community • Undertake information and communication activities. The Recovery Plan specifies activities that will adversely affect Carnaby's Cockatoo and should be avoided, and then minimised or mitigated if avoidance cannot be achieved.	The Proposed Action is not inconsistent with the recommendations of the Recovery Plan through the following: • The Proposed Action will not involve clearing of any known breeding trees/hollows, but will clear two trees with potentially Suitable Hollows. Main Roads proposes to install six artificial hollows to replace the two hollows to be removed • The Proposed Action will not involve the removal of any known roosting habitat • The Proposed Action has been subject to multiple, targeted Carnaby's Cockatoo assessments and DBCA habitat mapping has also been considered • The Proposed Action has been planned and designed to minimise clearing of potential breeding and foraging habitat for Carnaby's Cockatoo • The Proposed Action incorporates design and management measures to protect potential breeding and foraging habitat in adjacent vegetation • Planning and design of the Proposed Action has involved consultation with relevant stakeholders including the broader community.
FRTBC Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo	The objective of this Recovery Plan is to stop further decline in the breeding populations of Baudin's Cockatoo and FRTBC and to ensure their persistence throughout their current range in the south-west of Western Australia. Priority actions within the plan include (listed in highest to lowest priority): • Seek the funding required to implement future recovery actions • Eliminate illegal shooting	The Proposed Action is not inconsistent with the recommendation objectives of the Recovery Plan through the following: • The Proposed Action is not related to mining, orchards or forest management, nor is the Proposed Action expected to increase the prevalence of feral honeybees or risk of illegal shooting • As a component of urban development, the Proposed Action has been subject to survey to identify FRTBC habitat (including consideration of Black Cockatoo habitat mapping by DBCA and breeding records from the Western Australian museum)

RECOVERY / ABATEMENT PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
(*Calyptorhynchus banksii naso*) Recovery Plan	• Develop and implement strategies to allow for the use of noise emitting devices in orchards • Determine and implement ways to remove feral honeybees from nesting hollows • Identify factors affecting the number of breeding attempts and breeding success and manage nest hollows to increase recruitment • Determine and implement ways to minimise the effects of mining and urban development on habitat loss • Determine and implement ways to manage forests for the conservation of Forest Black Cockatoos • Identify and manage important sites and protect from threatening processes • Map feeding and breeding habitat critical to survival and important populations, and prepare management guidelines for these habitats • Monitor population numbers and distribution • Determine the patterns and significance of movement. With respect to urban development, the following recovery actions are specified: • Fauna survey to identify presence of Commonwealth-listed threatened fauna species and referral of any proposed impacts to DotE • Wherever possible, retention of habitats known to be used for feeding, breeding and roosting by FRTBC • Obtain advice from State Government and Western Australian Museum on protection of remaining habitat.	• The Proposed Action will not involve clearing of any known breeding trees for FRTBC, but will clear two suitable hollows. The DE is 30 km from the closest known breeding record for FRTBC • The Proposed Action will not involve clearing of any known roosting trees • The DE has been planned and designed to minimise clearing of FRTBC foraging and potential breeding habitat.

RECOVERY / ABATEMENT PLAN	PRIORITY ACTIONS	ASSESSMENT AGAINST PLAN
Dieback Threat Abatement Plan for Disease in Natural Ecosystems Caused by *Phytophthora cinnamomi* (DotEE 2014)	The goal of this Threat Abatement Plan is to minimise the impacts of Dieback on MNES under the EPBC Act and priority biodiversity assets identified by the actions of this plan. The plan has three objectives: • Identify and prioritise for protection biodiversity assets that are, or may be, impacted by Dieback • Protect priority biodiversity assets through reducing the spread and mitigating the impacts of Dieback • Communication and training.	The Proposed Action is not inconsistent with the goal or objectives of the Threat Abatement Plan. A Dieback assessment was undertaken for the Proposed Action, which identified that the majority of the DE was excluded due to the 'Completed Degraded' condition of the vegetation and lack of indicator species. The biological assessment enabled the identification of potential impacts to adjacent areas of vulnerable vegetation and fauna habitat including Tuart TEC and Black Cockatoo habitat. The Proposed Action will incorporate Dieback hygiene during construction to protect adjacent vegetation that contains TECs and Black Cockatoo habitat to ensure that dieback does not spread further as a result of implementation of the project.
Introduced species (Cats) Threat Abatement Plan for Predation by Feral Cats (DotEE 2015)	Threat abatement plan has the following objectives: Effectively control feral cats in different landscapes • Improve effectiveness of existing control options for feral cats. • Develop or maintain alternative strategies for threatened species recovery. • Increase public support for feral cat management and promote responsible cat ownership.	The Threat Abatement Plan is not directly relevant to this Proposed Action, however the Proposed Action is not inconsistent with this plan. The Proposed Action will not increase the prevalence of feral cats in the area, as it will not increase food sources that may attract cats. The DE is not considered to be existing breeding habitat for Black Cockatoos, therefore predation of chicks from nesting is unlikely to occur.
Introduced species (Fox) Threat Abatement Plan for Predation by the European Red Fox (DEWHA 2008b)	Threat abatement plan has the following objectives: • Prevent foxes occupying new areas in Australia and eradicate foxes from high-conservation-value 'islands' • Promote the maintenance and recovery of native species and ecological communities that are affected by fox predation • Improve knowledge and understanding of fox impacts and interactions with other species and other ecological processes Improve the effectiveness, target specificity, integration and humaneness of control options for foxes.	The Threat Abatement Plan is not directly relevant to the Proposed Action, however the Proposed Action is not inconsistent with the plan. The Proposed Action will not increase the prevalence of the Red Fox in the area, as it will not increase food sources that may attract the Red fox. The DE is not considered to be existing breeding habitat for Black Cockatoos, therefore predation from chicks from nesting hollows is unlikely to occur.

Table 10-2 Consideration of significance indicators for the Proposed Action against the Conservation Advice for Tuart TEC (TSSC 2019)

TSSC (2019) Significance Indicator	Assessment	Outcome
Large size and/or a large area to boundary ratio.	Vegetation within the DE, associated within TP12, is part of the larger extent within the Woodvale Nature Reserve, which is in 'Very High' condition (Astron 2020). Currently, vegetation within the DE associated with TP12 is separated from the larger extent by the existing PSP and the firebreak within Woodvale Nature Reserve. This separation is likely a significant factor in the 'Poor' condition of this vegetation within the DE, as it is exposed to increased degradation through edge effects, including weeds, dumping of rubbish and use of herbicide within the existing maintenance zone to control weeds. Patch TP12 has a large size and large area to boundary ratio, however the DE coincides with only the western side with this area separated from the larger extent of TP1 by the existing PSP and firebreak. Given the linear extent of patch TP20, it presents with a small total area and small area to boundary ratio and the proposed action will not result in a significant change to the side or the area to boundary ratio. Patch TP20 exists as a separated isolated patch, mostly in 'Poor' condition and is approximately 40 m in width and 2.1 km in length. This patch is considered to have a small area to boundary ratio, subjecting the patch to potential edge effects.	Not Significant
Evidence of recruitment of key native plant species or the presence of a range of age cohorts	No evidence of Tuart recruitment was observed in the DE, indicating the patches within the DE may not be viable long term. Within the DE, vegetation comprises almost entirely 'Degraded' to 'Completely Degraded' vegetation, the majority of which is planted vegetation. Where remnant Tuart TEC vegetation does occur in the DE, the majority consists of remnant trees over an understorey of weeds and planted species. The significant weed infestation is considered a barrier to successful recruitment of key native species and would likely suppress the development of saplings.	Not Significant
Good faunal habitat	The DE contains foraging and potential breeding habitat for Black Cockatoos. Astron (2020) identified that the natural flora assemblage in the DE has been altered to an extent that there is a reduced number and quality of foraging species for Black Cockatoos. Therefore, vegetation in the DE is not considered to be quality foraging habitat under the DSEWPaC (2012a) referral guidelines. There is no confirmed current or historic breeding within the DE and better quality foraging and potential breeding habitat exists in adjacent and nearby reserves. The only other significant fauna species considered likely to be present in the DE, is the Quenda, as the Woodvale Nature Reserve has a known Quenda population (Astron 2020). Quenda may transit	Not Significant

TSSC (2019) Significance Indicator	Assessment	Outcome
	the vegetation in the DE, but are unlikely to reside there, given the degraded and narrow extent of vegetation in the DE.	
Patches that contain a unique combination of species and/or rare or important species in the context of the particular ecological community or local region	The patches of Tuart TEC in the DE do not contain a combination of unique species and/or rare or important species in the context of the Tuart TEC or native vegetation on the Swan Coastal Plain. No Threatened or Priority flora species are located within the understorey. Nor is any unique fauna species. The significant fauna species that are present are widespread at a local and regional scale and habitat is considered low value (Astron 2020). Therefore, the vegetation in the DE representing the TEC is not considered to contain a unique combination of species.	Not Significant
High native species richness	The condition of TP12 ranges from 'Very High' within Woodvale Nature Reserve to 'Poor' within the DE (Astron 2020). TSSC (2019) defines a 'Poor' condition rating as having minimal or no native cover and low species richness. Clearing as a result of the Proposed Action will remove the western edge of TP12, that is mostly devoid of any species richness and subject to ongoing edge effects that reduces its long term viability. TP20 has low native species diversity and is mostly in 'Poor' condition and planted. TP20 has high levels of weeds and has been subject to high levels of modification (Astron 2020). Fauna species richness is also low in the DE, with only three native fauna species recorded in the Astron (2020) survey. Given the above, none of the Tuart TEC in the DE contains high levels of native species richness.	Not Significant
Presence of threatened species	No Threatened flora species listed under State or Commonwealth legislation were recorded in vegetation considered to represent the Tuart TEC. Whilst Black Cockatoos may forage in the area, the natural flora assemblage in the DE has been altered to an extent that there is a reduced number and quality of foraging species for Black Cockatoos. Higher quality foraging habitat occurs in reserves adjacent to and within the local area of the DE.	Not Significant
Presence of cryptogams, soil crust and leaf litter or intact proteaceous root mats on or close to the soil surface where this is indicative of low disturbance.	Almost all of the Tuart TEC vegetation to be cleared is planted, in 'Poor' condition and is subject to high levels of disturbance. Parts of TP12 are 'Very High' quality in Woodvale Nature Reserve; however, the Proposed Action will not result in any further disturbance in this part of the patch as an existing PSP and firebreak exist as a buffer from Woodvale Nature Reserve.	Not Significant

11 INFORMATION SOURCES

The reliability and uncertainties in the technical studies undertaken in preparation of the Proposed Action have been outlined in Table 11-1.

Table 11-1 Reliability and uncertainties in technical studies used in preparing the referral

REFERENCE SOURCE	RELIABILITY	UNCERTAINTIES
Astron. (2020). Mitchell Freeway Widening Biological Survey. Unpublished report by Astron Environmental Pty Ltd for Main Roads Western Australia.	Information is reliable	There are no uncertainties
Kirby, T. (2020). Black Cockatoo Breeding, Feeding and Roosting Habitat Assessment, Mitchell Freeway. Prepared for Main Roads Western Australia.	Information is reliable	There are no uncertainties
Terratree. (2020). Phytophthora Dieback Assessment of Mitchell Freeway, Western Australia. Unpublished report prepared for Main Roads Western Australia.	Information is reliable	There are no uncertainties

12 REFERENCES

Astron. (2020). Mitchell Freeway Widening Biological Survey. Unpublished report by Astron Environmental Pty Ltd for Main Roads Western Australia.

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13 APPENDICES

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