We're working for Western Australia.

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

EPBC Act Referral

Contents

SECTION 1 – Summary of your proposed action

Title: Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

1.1 Project Industry Type

Transport – Land

1.2 Provide a detailed description of the proposed action, including all proposed activities

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

The Action includes the installation of a new PSP along the Mitchell Freeway, and the upgrading of existing PSPs to current design standards. The Action also includes the construction of noise walls to meet the state planning policy noise requirements for the upgrades of the freeway and nearby residential areas, stretching from Hepburn Avenue to Ocean Reef Road, verge side emergency stopping bays and the modification of on-ramps, Intelligent Transport Systems (ITS) works and drainage on the Mitchell Freeway to accommodate the works. These works are required to improve the safe and efficient use of this route. The Action will be implemented in a Development Envelope (DE) of 13.74 hectares (ha) and extends for more than four kilometres (km).

1.3 What is the extent and location of your proposed action?

1.31 Upload a spatial file

To be completed online.

1.4 Upload images of the proposed action area (including disturbance footprint, avoidance footprint (if relevant) and MNES habitat area/s) and if available, a compliant GIS file. The accepted file types are: zip, .kml, .kmz, .shp or .pdf.

To be completed online.

1.5 Provide a brief physical description of the property on which the proposed action will take place and the location of the proposed action (e.g. proximity to major towns, or for off-shore actions, shortest distance to mainland)

The Action is situated approximately 20 km north west of Perth within the Local Government Area of the City of Joondalup, within the Perth Metropolitan Region of Western Australia (WA). Attachment 1 - Figure 1 shows the regional location of the action.

1.6 What is the size of the proposed action area development footprint (or work area) including disturbance footprint and avoidance footprint (if relevant)?

The Action requires up to 13.74 ha of disturbance, to be undertaken within a DE of 13.74 ha. The area of disturbance is based on the current design of the action works, incorporating buffers to allow for construction. The DE represents the maximum area within which the works will be located; however, important environmental values have been removed from the envelope where possible. The final footprint is likely to be less than the DE, with project design further refining the area to be cleared, along with the environmental impact of the Action.

1.7 Proposed action location

1.7.3 Describe the location

Mitchell Freeway Southbound, between Ocean Reef Road to Hepburn Avenue, in the City of Joondalup, WA.

1.8 Primary Jurisdiction

Western Australia

1.9 Has the person proposing to take the action received any Australian Government grant funding to undertake this project?

Yes - Main Roads will receive Australian Government funding to undertake the work.

1.10 Is the proposed action subject to local government planning approval?

No

1.11 Provide an estimated start and estimated end date for the proposed action

Start Date: 01/07/2021

End Date: 31/12/2022

1.12 Provide details of the context, planning framework and state and/or local government requirements

Context and Project Justification

The DE is adjacent to the Mitchell Freeway, which is the primary distributor for the northern suburbs and is approximately 36 km in length.

The 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 and the construction of new emergency stopping bays, which is required to improve the safe and efficient use of this route.

Regulatory approvals required

- ***Environmental Protection Act 1986*, Part V Environmental Regulation Division 2, Clearing of Native Vegetation**

A native vegetation clearing permit will be required under the *Environmental Protection Act 1986* (EP Act) prior to clearing native vegetation. Granting and administration of clearing permits is regulated under the *Environmental Protection Act (Clearing of Native Vegetation) Regulations 2004*. Main Roads will submit an application for a clearing permit to the Department of Water and Environmental Regulation (DWER) to undertake native vegetation clearing for the action.

1.13 Describe any public consultation that has been, is being or will be undertaken, including with Indigenous stakeholders

Stakeholder consultation has been undertaken to date with local government and state government agencies, letter drops and discussions with key stakeholders. The Project is also on the Main Roads project updates webpage. As the Action develops further, Main Roads will continue liaising with the relevant stakeholder, landholders and the public.

1.13.1 Attach report(s) on any public consultations undertaken, including with Indigenous stakeholders

To be completed online if information available.

1.14 Describe any environmental impact assessment that have been or will be carried out under Commonwealth, State or Territory legislation including relevant impacts on the project

In accordance with Main Roads Environmental Assessment, Approvals and Compliance process (EAAC), an Environmental Impact Assessment (EIA) has been undertaken to investigate the key environmental aspects of the action and identify any potential significant impacts. The outcome of the EIA was to refer the action to the Department of Agriculture, Water and the Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), given the impacts on Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Tuart TEC) and Black Cockatoo habitat.

The EIA determined the Action was unlikely to have a significant impact on state environmental factors, therefore the Action has not been referred to the Environmental Protection Authority (EPA) under Part IV of the EP Act. Impacts relating to the clearing of native vegetation will be managed under Part V of the EP Act.

1.15 Is this action part of a staged development (or a component of a larger project)?

Yes

1.15.1 Provide information about the larger action and details of any interdependency between the stages/components and the larger action

The project works described in this 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 are generally into the median and involve no impacts to MNES. The packages of works (PSP, widening and ITS works) have been rolled into a single contract to simplify construction.

1.16 Is the proposed action related to other actions or proposals in the region?

No

SECTION 2 – Matters of national environmental significance

2.1 Is the proposed action likely to have any direct or indirect impact on the values of any World Heritage properties?

No

2.2 Is the proposed action likely to have any direct or indirect impact on the values of any National Heritage places?

No

2.3 Is the proposed action likely to have any direct or indirect on the ecological character of a RAMSAR wetland?

No

2.4 Is the proposed action likely to have any direct or indirect impact on the members of any listed species or any threatened ecological community, or their habitat?

Yes

2.4.1 Impact table

SPECIES	IMPACT
Tuart Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered)	The DE contains 8.75 ha of degraded Tuart TEC, of which the majority was planted by Main Roads. A survey conducted by Astron (2020) mapped a number of patches of Tuart TEC within and adjacent to the DE, with two distinct patches occurring in the DE (Shown in Attachment 1 – Figure 2). The Action will remove up to 8.75 ha of Tuart Woodlands and Forests TEC, from two patches (TP12 and TP20) along the Mitchell Freeway, comprising 5.81 ha (66%) planted vegetation in 'Completely Degraded' condition and 2.93 ha (34%) of remnant native vegetation, 98% of which is in 'Degraded' to 'Completely Degraded' condition. The Tuart TEC patches are described in Section 3.3 'Vegetation'. Main Roads has conducted an assessment of the impacts against the Commonwealth MNES Significant Impact Guideline 1.1 (DotE 2013). The outcome of the assessment was that, given the degraded nature of the community, the action will not have a significant impact on the Tuart TEC. This is outlined further in Attachment 2.
Calyptorhynchus latirostris (Carnaby's Cockatoo) (Endangered)	The DE falls within the known distribution range of the *Calyptorhynchus latirostris* (Carnaby's Cockatoo), but outside of the species known modelled breeding range. However, a known breeding site is located 1 km from the DE. Individuals of Carnaby's Cockatoo were recorded in the DE (Astron 2020), along with foraging evidence from *Corymbia calophylla* (Marri) and *Banksia* spp.

SPECIES	IMPACT
	The action will require the clearing of up to 3.01 ha of potential foraging habitat for Carnaby's Cockatoo from vegetation units Banksia Woodland, Jarrah Woodland and Tuart Woodland. The Action will also require the removal of up to 177 suitable diameter at breast height (DBH) trees (Suitable DBH Trees), with two trees containing suitable hollows (Astron 2020, Kirkby 2020). All of the 177 Suitable DBH Trees are also potential roosting sites. However none of these trees showed signs of current or historic use as breeding or roost sites. All of the vegetation in the DE (10 ha) forms potential future breeding and roosting habitat for Carnaby's Cockatoo. Carnaby's Cockatoo habitat within the DE is shown in Attachment 1 – Figure 3. Main Roads has conducted an assessment of the impacts on Carnaby's Cockatoo against the Commonwealth MNES Significant Impact Guidelines 1.1 (DotE 2013). The outcome of the assessment was that the Action is unlikely to have a significant impact on Carnaby's Cockatoo. This is outlined further in Attachment 2.
Calyptorhynchus banksii naso (Forest Red-Tailed Black Cockatoo) (Vulnerable)	The DE falls within the known distribution range of the *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo [FRTBC]). Individuals of FRTBC were recorded in the DE (Astron 2020), along with foraging evidence from Marri and *Allocasuarina* spp. (Sheoak). The action will require the clearing of up to 0.62 ha of 'low' quality foraging habitat for FRTBC in vegetation units Banksia Woodland and Jarrah Woodland, along with 177 Suitable DBH Trees, with two trees containing potentially suitable hollows (Astron 2020, Kirkby 2020). All of the 177 Suitable DBH Trees are also potential roosting sites. However none of these trees showed signs of current or historic use as breeding or roost sites. All of the vegetation in the DE (10 ha) forms potential future breeding and roosting habitat for FRTBC. FRTBC habitat within the DE is shown in Attachment 1 – Figure 3. Main Roads has conducted an assessment of the impacts on FRTBC against the Commonwealth MNES Significant Impact Guidelines 1.1 (DotE 2013). The outcome of the assessment was that the Action is unlikely to have a significant impact to FRTBC. This is outlined further in Attachment 2.

2.4.2 Do you consider this impact to be significant?

No

2.5 Is the proposed action likely to have any direct or indirect impact on the members of any listed migratory species, or their habitat

No

2.6 Is the proposed action to be undertaken in a marine environment (outside Commonwealth marine areas)?

No

2.7 Is the proposed action to be taken on or near Commonwealth land?

No

2.8 Is the proposed action taking place in the Great Barrier Reef Marine Park?

No

2.9 Is the proposed action likely to have any direct or indirect impact on a water resource from coal seam gas or large coal mining development?

No

2.10 Is the proposed action a nuclear action?

No

2.11 Is the proposed action to be taken by the Commonwealth agency?

No

2.12 Is the proposed action to be undertaken in a Commonwealth Heritage place overseas?

No

2.13 Is the proposed action likely to have any direct or indirect impact on any part of the environment in the Commonwealth marine area?

No

2.14 Upload any technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral

To be completed online.

- Astron (2020). Mitchell Freeway Widening Biological Survey. Unpublished report for Main Roads Western Australia.
- Kirkby, T (2020). Black Cockatoo Breeding, Feeding and Roosting Habitat Assessment, Mitchell Freeway. Unpublished report prepared for Main Roads Western Australia.

SECTION 3 – Description of the project area

3.1 Describe the flora and fauna relevant to the project area

Flora

As part of the Biological Survey, 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 Attachment 3.

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 likelihood of occurrence assessment and concluded that no Threatened species are considered likely to occur in the DE.

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

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

Two species listed as Weeds of National Significance (WoNs), **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. This level of weed incursion is expected considering the high levels of disturbance within the DE.

Fauna

A fauna survey, including a desktop assessment and targeted Black Cockatoo survey was conducted by Astron (2020) along the Mitchell Freeway in 49.6 ha survey area, including the area of the DE (Attachment 3). The targeted Black Cockatoo survey assessed the presence of Black Cockatoo foraging, roosting and breeding habitat. Tony Kirkby conducted a follow up assessment of Black Cockatoo habitat in the DE (Kirkby 2020). The follow up Black Cockatoo assessment is presented in Attachment 4.

Desktop searches of EPBC PMST, NatureMap and DBCA Threatened and Priority fauna spatial datasets identified the potential occurrence of 24 Threatened or Priority fauna species.

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)
- *Isoodon fusciventer* (Quenda), Priority 4 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.

The Black Cockatoo habitat assessment recorded 3.01 ha and 0.62 ha of potential foraging habitat for Carnaby's Cockatoo and FRTBC respectively and 177 Suitable DBH Trees, containing two 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).

All of the vegetation in the DE (10 ha) forms potential breeding and roosting habitat. As the DE is mostly comprised of the Mitchell Freeway road reserve, the vegetation has been impacted through historical clearing 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 is therefore not considered to be quality foraging habitat under the referral guidelines (DSEWPaC 2012).

3.1.1 Attach copies of any flora and fauna investigations and surveys (if applicable)

Upload the below listed reports online.

- Astron (2020). Mitchell Freeway Widening Biological Survey. Unpublished report for Main Roads Western Australia.
- Kirkby, T (2020). Black Cockatoo Breeding, Feeding and Roosting Habitat Assessment, Mitchell Freeway. Unpublished report prepared for Main Roads Western Australia.

3.2 Describe the hydrology relevant to the project area (including water flows)

The 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 groundwater and there are very few channelized 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).

No Surface Water Areas, Irrigation Districts, Rivers or Waterway Management Areas protected under the *Rights in Water and Irrigation Action 1914* (RIWI Act) are present within the DE. The DE is located within the Perth Coastal and Gwelup Underground Pollution Control Area, which is a Priority 3 Protection Zone.

The Action does not intersect any wetlands or watercourses. No Wetlands of International Importance will be impacted by the action. The closest Wetland of National Importance and geomorphic wetland, 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 Action. There is no risk of indirect impacts, such as changes to hydrology and changes to surface water flows, as Lake Joondalup lies in a different watershed and the groundwater flows are in the opposite direction. The hydrology will be maintained in its current regime with appropriate drainage design.

3.3 Describe the soil and vegetation characteristics relevant to the project area.

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]), which is described as:

- Spearwood System: Sand dunes and plains. Yellow deep sands, pale deep sands and yellow/brown shallow sands (DAFWA 2001)

Natural Resource Management Soil Systems and CSIRO 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 indicates that the majority of the DE has a low to extremely low probability of ASS occurring.

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 dunes of various ages, Marri on colluvial and alluvials. Includes a complex series of seasonal wetlands.

There is 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:

- Karrrakatta Complex – Central and South: Predominantly open forest of Tuart, Jarrah, Marri and woodland of Jarrah.

Astron (2020) identified that the DE contains 3.01 ha of native vegetation comprising vegetation units 'Tuart Forest 2' and 'Jarrah Woodland 2'. The remainder of the DE comprises 6.99 ha of planted vegetation and 3.74 ha of cleared areas (Attachment 1 – Figure 4). A number of Tuart TEC patches were mapped within the wider Astron (2020) survey area, with two patches occurring in the DE. A total of 8.75 ha of Tuart TEC occurs within the DE. The extent of the Tuart TEC in the DE, comprises 5.81 ha (66%) of planted vegetation in 'Completely Degraded' condition and 2.93 ha of native vegetation, (98%) in 'Degraded' to 'Completely Degraded' condition. This community also aligns with the equivalent state Priority Ecological Community (PEC) 'Tuart (Eucalyptus gomphocephala) woodlands of the Swan Coastal Plain'.

The two distinct Tuart TEC patches 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 2.76 ha of vegetation associated with this patch, representing 7.24% 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 92.39% planted vegetation and 7.97% native vegetation.
- Patch TP20 – Located between Whitsford Avenue and Hepburn Avenue, TP20 has a total patch size of 9.4 ha, of which 5.97 ha 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 61% planted vegetation and 39%

native vegetation.

Vegetation in the DE associated with patch TP12 is separated from the larger 'high quality' extent of this patch of Tuart TEC by an existing PSP and firebreak along the Woodvale Nature Reserve boundary. This separation is likely a significant factor in the condition of this area of vegetation, as both edges are exposed to increased degradation through edge effects and the majority of the patch within the DE was cleared as part of the Mitchell Freeway construction in the 1980's. Patch TP20 exists as a separate isolated patch with a small area to boundary ratio, subjecting the patch to potential edge effects. Patch TP20 within the DE was also largely cleared as part of the Mitchell Freeway construction in the 1980's.

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 (Attachment 1 – Figure 5) Astron (2020) noted high levels of disturbance to vegetation in the DE. The following vegetation conditions apply to the vegetation in the DE:

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

3.4 Describe any outstanding natural features and/or any other important or unique values relevant to the project area

No other outstanding natural features or important values are relevant to the DE.

3.5 Describe the status of native vegetation relevant to the project area.

Astron (2020) identified that the DE comprises 3.01 ha of native vegetation. Where remnant vegetation does occur, the majority consists of remnant trees over an understorey of weeds and planted species. The two native vegetation units in the DE (Attachment 1 – Figure 4), mapped by Astron (2020) are described below:

- 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 (2.4 ha)
- 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 (0.62 ha).

The DE contains 3.01 ha of the Karrakatta Complex. This vegetation complex has 23% of its pre-European extent remaining (EPA, 2015) and as such is above the minimum threshold of 10% for retention of vegetation complexes in constrained areas (EPA 2000). The removal of 3.01 ha of native vegetation in the DE will not cause the remaining vegetation in the Karrakatta Complex to fall below the 10% threshold.

3.6 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area

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.

3.7 Describe the current condition of the environment relevant to the project area

The current condition of the environment relevant to the DE can be described as degraded due to heavy disturbance from road construction and residential development. The Action is located in the Metropolitan Region which has undergone extensive native vegetation clearing for urbanisation. Where remnant vegetation does occur in the DE, the majority is considered to be in 'Completely Degraded' condition, consisting mostly of remnant trees or scattered remnant trees over an understorey of weeds and planted species. Astron (2020) identified that the vegetation in the DE has declined over time due to significant edge effects, as the remnant patches are very narrow and linear in nature.

Two significant weeds species listed as WoNs, **Asparagus asparagoides* (Bridal Creeper) and **Lantana camara* (Lantana) were recorded in the DE. Due to the high levels of disturbance within and adjacent to the DE, several common grass weed species such as **Ehrharta calycina* and **Eragrostis curvula* occur along the Mitchell Freeway in the DE.

3.8 Describe any Commonwealth Heritage Places or other places recognised as having heritage values to the project area.

No Commonwealth Heritage Places will be impacted from the Action.

The Department of Planning, Lands and Heritage Aboriginal Heritage database did not identify any Aboriginal Heritage sites within or adjacent to the DE.

The State Heritage Register (inherit database) and the City of Joondalup Municipal Inventory identified no State or Municipal Registered Places within the DE. The Pinnaroo Valley Memorial Park cemetery is located adjacent to the west of the Mitchell Freeway bound by Whitfords Avenue. This site is not expected to be impacted by the Action.

It is not expected that the Action will have any impacts to any heritage values.

3.9 Describe any Indigenous heritage values relevant to the project area

A database search did not identify any known Aboriginal heritage sites registered under the *Aboriginal Heritage Act 1972* (WA) (DPLH 2020).

A number of Aboriginal heritage surveys have been undertaken over the DE (DPLH 2020). The surveys did not identify any Aboriginal heritage sites across the DE.

3.10 Describe the tenure of the action area (eg. freehold, leasehold relevant to the project area

The DE intersects Crown land (road reserve) associated with the Mitchell Freeway. No land will be acquired for the Project.

3.11 Describe any existing or any proposed uses relevant to the project area

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 reserve for the Mitchell Freeway.

No other land uses are proposed.

SECTION 4 – Measure to avoid or reduce impacts

4.1 Describe the measures you will undertake to avoid or reduce impact from your proposed action

The development of the action has sought to reduce the disturbance footprint where practicable. The action has avoided Tuart TEC in good condition and suitable DBH Trees where possible. The Action is confined to the road reserve and will not intercept adjacent nature reserves containing higher quality vegetation and habitat. As the design continues to be refined, other opportunities will be explored to reduce the disturbance footprint of the Action.

During construction, temporary construction activities such as site offices, storage areas, laydown areas and stockpiles will be restricted to previously cleared areas. The disturbance footprint will be demarcated prior to clearing commencing to ensure clearing is contained within the approved boundary. Important environmental values, such as Tuart TEC and Suitable DBH Trees, will be demarcated as exclusion areas to ensure there is no disturbance beyond what has been approved.

A Construction Environmental Management Plan (CEMP) will be prepared to minimise the environmental impacts associated with the proposed action as well as identifying areas of responsibilities required for the implementation of management strategies. The CEMP will be implemented prior to construction, during construction and post construction works.

4.2 For matters protected by the EPBC Act that may be affected by the proposed action, describe the proposed environmental outcomes to be achieved

The proposal will result in the following impacts to matters protected by the EPBC Act:

<u>Tuart TEC</u>

- Clearing no more than 8.75 ha of vegetation representing this community.

<u>Carnaby's Cockatoo</u>

- Clearing no more than 3.01 ha of potential foraging habitat and up to 177 Suitable DBH Trees containing two potentially suitable breeding hollows.

FRTBC

- Clearing no more than 0.62 ha of potential foraging habitat and up to 177 Suitable DBH Trees containing two potentially suitable breeding hollows.

SECTION 5 - Conclusions on the likelihood of significant impacts

5.1 In Section 2 you indicate the below checked boxes to be of significant impact and therefore you consider the action to be a controlled action

N/A

5.2 If no significant matters are identified, provide the key reasons why you think the proposed action is not likely to have a significant impact on a matter protected under the EPBC Act and therefore not a controlled action.

Tuart TEC

The Action will necessitate the clearing of 8.75 ha of Tuart TEC, of which 5.81 ha (66%) is planted vegetation in 'Completely Degraded' condition and 2.93 ha is remnant vegetation, 98% of which is in 'Degraded' to 'Completely Degraded' condition. Almost all areas of the TEC in the DE are in 'Poor' condition in accordance with the condition categories for the TEC (DotEE 2019).

It is estimated that at the regional level, approximately 20,796 ha of the Tuart TEC remains, while at the local level 733 ha is remaining (Attachment 1 – Figure 6). 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 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 roadside and planted, is not expected to result in a significant impact to the Tuart TEC at a regional or local scale. This is detailed further in Attachment 2.

Carnaby's Cockatoo

Astron (2020) identified that there is a reduced number and quality of foraging species for Carnaby's Cockatoo and the vegetation in the DE and as such, would not be considered quality foraging habitat under the DSEWPaC (2012) referral guidelines. Higher quality foraging habitat extends into reserves adjacent to the DE (Woodvale Nature Reserve and Craigie Bushland). While the DE comprises suitable foraging species and potential breeding habitat, the habitat is highly fragmented and outside of the modelled breeding range for Carnaby's Cockatoo (EPA 2019), with no evidence of current or historic breeding observed.

Kirkby (2020) noted that Carnaby's Cockatoo are known to breed at the Edith Cowan University Campus, approximately 1 km 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. 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

(Attachment 4). 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 indicates a preference for higher quality foraging habitat north of the DE, which is more likely to support the Carnaby's Cockatoo breeding individuals at Edith University Campus.

The potential loss of 3.01 ha of potential 'low' quality foraging habitat and 10 ha of potential breeding and roosting habitat (representing a 0.19% reduction in potential foraging and 0.65 % of potential breeding and roosting habitat within the local area [6 km]) is not considered a significant impact to the species. Taking into consideration the lack of Carnaby's Cockatoo breeding and roosting records within the DE, the lack of high quality foraging resources and extent of higher quality habitat in the local area, the removal of 3.02 ha of potential foraging habitat, 177 Suitable DBH Trees with two potentially suitable hollows and 10 ha of potential breeding and roosting habitat is not expected to have a significant impact on Carnaby's Cockatoo. This is detailed further in Attachment 2.

FRTBC

Astron (2020) identified that the vegetation in the DE would not be considered quality foraging habitat for FRTBC under the DSEWPaC (2012) referral guidelines. Higher quality foraging habitat extends into reserves adjacent to the DE.

The Action is not expected to have a significant impact to FRTBC, given the clearing of 0.62 ha of potential foraging habitat and 10 ha of potential breeding and roosting habitat for FRTBC, representing 0.04% of the total available foraging habitat and 0.65% of the potential breeding and roosting available within 6 km of the DE. Additionally, FRTBCs are unlikely to breed in the DE due to a preference for larger stands of woodland or forest (Johnstone et al. 2010). While the DE comprises suitable foraging species and potential breeding habitat, the quality of this habitat is 'low' (Astron 2020) with no evidence of current or historic breeding observed.

Taking into consideration the lack of FRTBC breeding and roosting records within the DE, the lack of high quality foraging resources and extent of higher quality habitat in the local area, the removal of 0.62 ha of potential foraging habitat, 177 Suitable DBH Trees, with two potentially suitable hollows and 10 ha of potential breeding and roosting habitat, is not expected to have a significant impact on FRTBC. This is detailed further in Attachment 2.

Other MNES

The action is unlikely to have a significant impact on other MNES that potentially occur within or near the DE.

SECTION 6 – Environmental record of person proposing to take the action

6.1 Does the person taking the action have a satisfactory record of responsible environmental management? Please explain in further detail

Main Roads is a State Government agency with an assured record of responsible environmental management and performance.

Main Roads has a strong environmental compliance record, with Main Roads remaining in compliance with all conditions of environmental approvals granted under the EPBC Act and the *Environmental Protection Act 1986*.

Main Roads operations are undertaken in accordance with an Environmental Policy (https://www.mainroads.wa.gov.au/globalassets/community-environment/environment/environmental-policy.pdf), which outlines Main Roads overarching objectives for environmental protection, sustainability and continual improvement in environmental performance.

The Environmental Policy is implemented through Main Roads international standard AS/NZS ISO 14001:2015-certified Environmental Management System (EMS). Main Roads EMS provides a formalised systematic approach to environmental management for all aspects of the operations (road planning, construction and maintenance).

6.2 Provide details of any past or present proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against either (a) the person proposing to take the action or, (b) if a permit has been applied for in relation to the action – the person making the application

Not relevant.

6.3 Will the action be taken in accordance with the corporation's environmental policy and planning framework?

Yes

6.3.1 If yes, if the person taking the action is a proportion, please provide details of the corporation's environmental policy and planning framework

Main Roads operations are undertaken in accordance with an Environmental Policy, which outlines Main Roads overarching objectives for environmental protection, sustainability and continual improvement in environmental performance.

The Environmental Policy is implemented through Main Roads international standard AS/NZS ISO 14001:2015-certified Environmental Management System (EMS). Main Roads EMS provides a formalised systematic approach to environmental management for all aspects of the operations

(road planning, construction and maintenance).

Main Roads EMS is independently certified and covers the processes and activities that have the potential to impact the environment. 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 action, therefore, will be undertaken, monitored and measured in accordance with the Main Roads EMS.

Main Roads Environmental Policy commits to protecting and enhancing the natural environmental and social values in all Main Roads activities.

Main Roads Environment Policy and EMS certificate is publicly accessible from:

Environmental Policy - https://www.mainroads.wa.gov.au/globalassets/community-environment/environment/environmental-policy.pdf

EMS - https://www.mainroads.wa.gov.au/globalassets/community-environment/environment/mrwq51-ccee06-certificate-of-confidence-final-iso-14001-2015.pdf

6.3.2 Attach copies of any environmental policy and planning framework (if applicable)

N/A

6.4 Has the person taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?

Yes

6.4.1 EPBC Act No. and/or name of proposal

Main Roads has referred numerous projects under the EPBC Act. A list of some of the recent projects (2016-2020) referred to DAWE by Main Roads under the EPBC Act is provided in Table 6-1.

Table 6-1 Select List of Main Roads EPBC Referrals 2016 to 2020

EPBC REFERENCE	PROJECT	DECISION
EPBC 2020/8769	Albany Ring Road Stage 2 and 3b	Controlled action
EPBC 2020/8725	Karratha - Tom Price Road Stage 4	Controlled action
EPBC 2019/8545	Tonkin Highway Upgrade (Guildford Road to Great Eastern Highway)	Not controlled action
EPBC 2019/8471	Bunbury Outer Ring Road Northern and Central Section Project	Controlled action
EPBC 2018/8367	Mitchell Freeway Extension and Wanneroo Road Upgrade	Controlled action

EPBC REFERENCE	PROJECT	DECISION
EPBC 2018/8346	Indian Ocean Drive Widening, Gingin Shire	Not controlled action
EPBC 2018/8316	Roe Highway and Kalamunda Road Interchange Upgrade	Controlled action
EPBC 2018/8315	High Street Upgrade, Fremantle	Not controlled action
EPBC 2018/8284	Armadale Road to North Lake Road Bridge Development, Jandakot	Not controlled action
EPBC 2018/8279	South Coast Highway Road Widening SLK 14.1 to 18.3, Albany	Not controlled action
EPBC 2018/8238	Northam Cranbrook Road Widening, Katanning	Not controlled action
EPBC 2017/8110	Wanneroo Road / Ocean Reef Road Grade Separation, Pearsall	Not controlled action
EPBC 2017/8035	Great Northern Highway-Bindoon Bypass	Controlled action
EPBC 2017/8015	Upgrading Pinjarra Williams Road (M053) 24 -40 SLK	Not controlled action
EPBC 2017/8009	South Coast Highway Widening 8.2-14.16 SLK, Albany	Not controlled action
EPBC 2017/7972	Armadale Road Duplication - Tapper to Anstey Road	Not controlled action
EPBC 2017/7934	Road widening Kojonup South SLK 254.9 to SLK 266	Controlled action
EPBC 2017/7907	Albany Highway Crossman Intersection Improvements	Not controlled action
EPBC 2017/7884	Indian Ocean Drive Passing Lanes and Widening Works, 52-258 SLK	Not controlled action
EPBC 2017/7864	Brand Highway Widening and Passing Lanes Project 34.83-164.3 SLK	Controlled action
EPBC 2016/7811	South Western Highway Upgrade, Padbury Hill Stage 2 SLK 219.45-221.00, Balingup	Not controlled action

EPBC REFERENCE	PROJECT	DECISION
EPBC 2016/7777	South Coast Highway Cheynes East Intersection Upgrade and Realignment	Not controlled action
EPBC 2016/7762	Upgrade a section of Albany Highway, Harold Road passing lane	Not controlled action
EPBC 2016/7761	Great Northern Highway Muchea to Wubin Upgrade Stage 2, Walebing to Wubin	Controlled action
EPBC 2016/7757	Bowelling curves realignment- Collie Lake King Road 64.76-69.84 SLK	Controlled action
EPBC 2016/7743	Arthur River Road Upgrade	Not controlled action
EPBC 2016/7740	Brand Highway road formation and seal widening 51.2-77.5 SLK	Not controlled action
EPBC 2016/7732	Ellenbrook Bus Rapid Transit Project	Not controlled action
EPBC 2016/7714	Northam to Cranbrook Road Widening 325.9 - 347.4 SLK	Controlled action
EPBC 2016/7698	Maintenance Zone Establishment - Toodyay Goomalling Road, Williams Narrogin Highway and Pinjarra Williams Road, Wheatbelt Region	Controlled action
EPBC 2016/7665	Toodyay Road Widening and Upgrade Project	Controlled action
EPBC 2016/7664	Narrogin Link Road Stage 3 - North Extension	Not controlled action
EPBC 2016/7656	Great Northern Highway Muchea to Wubin Upgrade Stage 2 - Muchea North	Controlled action

SECTION 7 – References

7.1 References list

Table 7-1 References list and reliability

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
Department of Agriculture and Food Western Australia (DAFWA). 2001. Soil-landscape Systems of Western Australia digital datasetID - 3004.	Information is reliable	There are no uncertainties
Department of Agriculture, Water and the Environment (DAWE). (2020). Calyptorphynchus latirostris – Carnaby's Cockatoo, Short-billed Black Cockatoo: SPRAT profile. Available from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59523.	Information is reliable	There are no uncertainties
Department of Biodiversity, Conservation and Attractions (DBCA) (2020) NatureMap: Mapping Western Australia's Biodiversity. Department of Parks and Wildlife. https://naturemap.dpaw.wa.gov.au/.	Information is reliable	There are no uncertainties
Department of the Environment and Energy (DotEE) (2019). Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community. Canberra: Department of the Environment and Energy. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/153-conservation-advice.pdf.	Information is reliable	There are no uncertainties
DotEE (2017). Revised draft referral guideline for three threatened black	Information is reliable.	There are no uncertainties.

cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris* Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii* Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso*. Available from: https://www.environment.gov.au/epbc/comment/draft-revised-referral-guideline-black-cockatoo		
Department of the Environment and Energy (2020). *Calyptorhynchus latirostris* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat	Information is reliable	There are no uncertainties
Department of the Environment (DotE) (2013) Matters of National Environmental Significance, Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Canberra: Department of the Environment and Energy.	Information is reliable	There are no uncertainties
Department of Conservation and Land Management (CALM) (2003). An Atlas of Tuart Woodlands on the Swan Coastal Plain in Western Australia. Government of Western Australia. Available from: https://www.dpaw.wa.gov.au/images/documents/conservation-management/forests/tuart_atlas/tuart_atlas_full300.pdf	Information is reliable	There are no uncertainties
Department of Environment and Conservation (DEC) (2008). Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan. Available from http://www.environment.gov.au/system/files/resources/48e4fc8c-9cb7-4c85-bc9f-6b847cf4c017/files/wa-	Information is reliable	There are no uncertainties

forest-black-cockatoos-recovery-plan.pdf.		
Department of Parks and Wildlife (DPaW) (2013) *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan*. Perth: Government of Western Australia.	Information is reliable	There are no uncertainties
Department of Planning, Lands and Heritage (DPLH) (2020) Aboriginal Heritage Inquiry System. Available online from: http://maps.dia.wa.gov.au/AHIS2/default.aspx.	Information is reliable	There are no uncertainties
Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012) EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, FRTBC (vulnerable) *Calyptorhynchus banksii naso,* accessed: *https://www.environment.gov.au/system/files/resources/895d4094-af63-4dd3-8dff-ad2b9b943312/files/referral-guidelines-wa-black-cockatoo.pdf*	Information is reliable	There are no uncertainties
Department of Water and Environmental Regulation (DWER) (2020). Perth Groundwater Atlas Perth, Western Australia. Available online from: https://www.water.wa.gov.au/maps-and-data/maps/perth-groundwater-atlas.	Information is reliable	There are no uncertainties
Environmental Protection Authority (EPA) (2000). Environmental Protection of Native Vegetation in Western Australia: Clearing of native vegetation, with particular reference to the agricultural area. Position Statement No. 2. Perth, Western Australia. Available from: https://library.dbca.wa.gov.au/static/FullTextFiles/019983.pdf.	Information is reliable	There are no uncertainties

Environmental Protection Authority (EPA) (2019) EPA Technical Report: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region – Advice of the Environmental Protection Authority under Section 16(j) of the *Environmental Protection Act 1986*. EPA, Perth.	Information is reliable	There are no uncertainties
Garnett, S., Szabo, J., & Dutson, G. (2011). The Action Plan for Australian Birds 2010. CSIRO Publishing. Available from http://birdsindanger.net/taxatable.	Information is reliable	There are no uncertainties
Government of Western Australia (2019) 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019. WA Department of Biodiversity, Conservation and Attractions, Perth. Available online from: https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics.	Information is reliable	There are no uncertainties
Heddle, E. M., Loneragan, O. W., and Havel, J. J (1980). Atlas of Natural Resources Darling System, Western Australia. Department of Conservation and Environment.	Information is reliable	There are no uncertainties
IUCN Standards and Petitions Committee. 2019. Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. Downloadable from http://www.iucnredlist.org/documents/RedListGuidelines.pdf.	Information is reliable	There are no uncertainties
Johnstone, R. E., Johnstone, C., & Kirkby, T. (2010) Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed black cockatoo (*Calyptorhynchus banksii naso)* on the Swan Coastal Plain (Lancelin – Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements	Information is reliable	There are no uncertainties

and historical changes. Report to the Department of Planning, Perth.		
Johnstone, R.E., Kirkby, T. and Sarti, K. (2013). The breeding biology of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. I. Characteristics of nest trees and nest hollows. Pacific Conservation Biology 19 (3): 121–142.	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
Mitchell, D., K. Williams, and A. Desmond. 2002. Swan Coastal Plain 2 (SWA2 - Swan Coastal Plain Subregion). Department of Conservation and Land Management, Perth WA.	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

SECTION 8 – Proposed alternatives

8.1 Do you have any feasible alternatives to taking the proposed action?

No.

Section 9 – Contacts, signatures and declarations

Person proposing the action

9.1.1 Is the person proposing the action a member of an organisation?

Organisation

Organisation name
Main Roads Western Australia

Organisation type
Australian

ABN
50860676021

Primary Address
Don Aitken Centre, East Perth, Western Australia

Main phone number
138 138

Primary email address
enquiries@mainroads.wa.gov.au

9.1.2 I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

Not applicable

9.1.2.2 I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations
No

9.1.3 Contact

First name
Martine

Last name
Scheltema

Job title
Manager Environment

Email

martine.scheltema@mainroads.wa.gov.au

Address
PO Box 6202, East Perth, 6892, Western Australia

Proposed designated proponent

9.2.1 Is the proposed designated proponent a member of an organisation?

Yes

Organisation name
Main Roads Western Australia

Organisation type
Australian

ABN
50860676021

Primary Address
Don Aiken Centre, East Perth, Western Australia

Main phone number
138 138

Primary email address
enquiries@mainroads.wa.gov.au

9.2.2 Contact

First name
Martine

Last name
Scheltema

Job title
Manager Environment

Email
martine.scheltema@mainroads.wa.gov.au

Address
PO Box 6202, East Perth, 6892, Western Australia

Referring Party

9.3.1 Is the referring party a member of an organisation?

Organisation name
Main Roads Western Australia

Organisation type
Australian

ABN
50860676021

Primary Address
Don Aiken Centre, East Perth, Western Australia

Main phone number
138 138

Primary email address
enquiries@mainroads.wa.gov.au

9.3.2 Contact

First name
Amy

Last name
Dalton

Job title
Environment Officer

Email
amy.dalton@mainroads.wa.gov.au

Address
PO Box 6202, East Perth, 6892, Western Australia

Attachments

Attachment 1 – Figures

Figure 1. Proposed Action Location


OCEAN REEF RD
MONTEREY DR
MITCHELL FWY (NORTHBOUND) OFF TO OCEAN REEF RD
MITCHELL FWY
MITCHELL FWY PSP
PARKWOOD AV
CAMARINO DR
OVERVIEW MAP
Legend:
Development envelope
Woodvale Nature Reserve
EPBC Tuart woodlands and forests of the Swan Coastal Plain
Native vegetation
Planted vegetation
Local and regional roads
Scale 1:5,000 at A4
0 25 50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
THREATENED ECOLOGICAL COMMUNITIES
FIGURE 2
PAGE 1
strategen JBS&G


LEOPOLD CT
RICHARDSON CT
BENN COVE
MITCHELL FWY P SP
MITCHELL FWY
CAMARINO DR
WESTHAVEN DR
OVERVIEW MAP
Legend:
Development envelope
Woodvale Nature Reserve
EPBC Tuart woodlands and forests of the Swan Coastal Plain
Native vegetation
Planted vegetation
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
THREATENED ECOLOGICAL COMMUNITIES
FIGURE 2
PAGE 2
strategen JBS&G

Legend:

- Development envelope
- Woodvale Nature Reserve
- EPBC Tuart woodlands and forests of the Swan Coastal Plain
- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	THREATENED ECOLOGICAL COMMUNITIES
Job No: 58540	
Client: Main Roads	FIGURE 2 PAGE 3
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

File Name: W:\Projects\[JOpen\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Refernal\58540_02_TEC.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:
- Development envelope
- Woodvale Nature Reserve

EPBC Tuart woodlands and forests of the Swan Coastal Plain
- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

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Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

THREATENED ECOLOGICAL COMMUNITIES

FIGURE 2 PAGE 4

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Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:

- Development envelope
- Woodvale Nature Reserve
- EPBC Tuart woodlands and forests of the Swan Coastal Plain
- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	THREATENED ECOLOGICAL COMMUNITIES
Job No: 58540	
Client: Main Roads	FIGURE 2 PAGE 5
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

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Image Reference: www.nearmap.com® - Imagery Date: 30 August 2020

Legend:
- Development envelope
- Woodvale Nature Reserve
- EPBC Tuart woodlands and forests of the Swan Coastal Plain
- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

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Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

THREATENED ECOLOGICAL COMMUNITIES

FIGURE 2 PAGE 6

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Image Reference: www.nearmap.com® - Imagery Date: 30 August 2020

Legend:
- Development envelope
- Woodvale Nature Reserve
- EPBC Tuart woodlands and forests of the Swan Coastal Plain
- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

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Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

THREATENED ECOLOGICAL COMMUNITIES

FIGURE 2 PAGE 7

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Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020.

Legend:
- Development envelope
- Woodvale Nature Reserve
- EPBC Tuart woodlands and forests of the Swan Coastal Plain
- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

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Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

THREATENED ECOLOGICAL COMMUNITIES

FIGURE 2 PAGE 8

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Image Reference: www.nearmap.com® - Imagery Date: 30 August 2020.

Legend:

- Development envelope
- Woodvale Nature Reserve

EPBC Tuart woodlands and forests of the Swan Coastal Plain

- Native vegetation
- Planted vegetation
- Local and regional roads

Scale 1:2,000 at A4 — 0 25 50 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

THREATENED ECOLOGICAL COMMUNITIES

FIGURE 2 PAGE 9

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Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Figure 2. Threatened Ecological Communities


OVERVIEW MAP
OCEAN REEF RD
OCEAN REEF RD ON TO MITCHELL FWY (SOUTHBOUND)
MITCHELL FWY (NORTHBOUND) OFF TO OCEAN REEF RD
MITCHELL FWY
MITCHELL FWY
Legend:
Development envelope
Forest Red-tailed Black Cockatoo foraging habitat
Carnaby's Black Cockatoo foraging habitat
Black Cockatoo suitable DBH trees
Eucalyptus gomphocephala
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
BLACK COCKATOO HABITAT
FIGURE 3
PAGE 1
strategen JBS&G


OVERVIEW MAP
MITCHELL FWY
MITCHELL FWY SB
Legend:
Development envelope
Forest Red-tailed Black Cockatoo foraging habitat
Carnaby's Black Cockatoo foraging habitat
Black Cockatoo suitable DBH trees
Corymbia calophylla
Eucalyptus gomphocephala
Eucalyptus marginata
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
BLACK COCKATOO HABITAT
FIGURE 3
PAGE 2
strategen JBS&G


OVERVIEW MAP
MITCHELL FWY
MITCHELL FWY PSP
CAMMIRING DR
Legend:
Development envelope
Forest Red-tailed Black Cockatoo foraging habitat
Carnaby's Black Cockatoo foraging habitat
Black Cockatoo suitable DBH trees
Dead Stag
Eucalyptus gomphocephala
Habitat tree with potentially suitable hollow
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
BLACK COCKATOO HABITAT
FIGURE 3
PAGE 3
strategen JBS&G

Legend:
- Development envelope
- Forest Red-tailed Black Cockatoo foraging habitat
- Carnaby's Black Cockatoo foraging habitat

Black Cockatoo suitable DBH trees
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	BLACK COCKATOO HABITAT
Job No: 58540	
Client: Main Roads	FIGURE 3 PAGE 4
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

File Name: W:\Projects\[Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPS\C\Referral\58540_03_BCHabitat.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:
Development envelope
Local and regional roads

Scale 1:2,000 at A4 0 25 50 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

BLACK COCKATOO HABITAT

FIGURE 3 PAGE 5

strategen JBS&G

File Name: W:\Projects\1 Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Referral\58540_03_BCHabitat.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:

- Development envelope
- Carnaby's Black Cockatoo foraging habitat
- Black Cockatoo suitable DBH trees
  - *Eucalyptus gomphocephala*
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	BLACK COCKATOO HABITAT
Job No: 58540	
Client: Main Roads	FIGURE 3 PAGE 6
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

File Name: W:\Projects\1 (Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Referral\58540_03_BCHabitat.mxd
Image Reference: www.nearmap.com® - Imagery Date: 30 August 2020


OVERVIEW MAP
WHITFORDS AV
MITCHELL FWY PSP
WHITFORDS STN NORTH CARPARK ACCESS
MITCHELL FWY
WHITFORDS BUS STN & STH CARPARK ACCESS
WHITFORDS AV ON TO MITCHELL FWY (SOUTHBOUND)
THICKENHAM DR
HARROW WEALD WY
STOCKWELL WY
CHELSEA CT
Legend:
Development envelope
Carnaby's Black Cockatoo foraging habitat
Black Cockatoo suitable DBH trees
Dead Stag
Eucalyptus gomphocephala
Eucalyptus marginata
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 56540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
BLACK COCKATOO HABITAT
FIGURE 3
PAGE 7
strategen JBS&G

Legend:

- Development envelope
- Carnaby's Black Cockatoo foraging habitat

Black Cockatoo suitable DBH trees

- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)		Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50		BLACK COCKATOO HABITAT
Job No: 58540		
Client: Main Roads		FIGURE 3 PAGE 8
Version: A	Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan	Checked By: CT	

File Name: W:\Projects\JOpen\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_ETSC\Referral\58540_03_BCHabitat.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:
- Development envelope
- Carnaby's Black Cockatoo foraging habitat

Black Cockatoo suitable DBH trees
- *Eucalyptus gomphocephala*

Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

BLACK COCKATOO HABITAT

FIGURE 3 PAGE 9

strategen JBS&G

File Name: W:\Projects\[Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPSC\Refere\58540_03_BCHabitat.mxd
Image Reference: www.nearmap.com/8 - Imagery Date: 30 August 2020


OVERVIEW MAP
MITCHELL FWY
TWICKENHAM DR
ST JOHNS CT
MITCHELL FWY PSP
ROMFORD PL
Legend:
Development envelope
Carnaby's Black Cockatoo foraging habitat
Black Cockatoo suitable DBH trees
Dead Stag
Eucalyptus gomphocephala
Eucalyptus marginata
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
BLACK COCKATOO HABITAT
FIGURE 3
PAGE 10
strategen JBS&G

Legend:
- Development envelope
- Carnaby's Black Cockatoo foraging habitat

Black Cockatoo suitable DBH trees
- Dead Stag
- *Eucalyptus gomphocephala*
- *Eucalyptus marginata*
- Habitat tree with potentially suitable hollow
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

BLACK COCKATOO HABITAT

FIGURE 3 PAGE 11

strategen JBS&G

File Name: W:\Projects\...\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Refere\58540_03_BCHabitat.mxd
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Figure 3. Black Cockatoo Habitat


OVERVIEW MAP
OCEAN REEF RD
OCEAN REEF RD ON TO MITCHELL FWY (SOUTHBOUND)
MITCHELL FWY (NORTHBOUND) OFF TO OCEAN REEF RD
MITCHELL FWY
MITCHELL FWY PSP
Legend:
Development envelope
Vegetation types
Jarrah Woodland 2
Planted
Completely Cleared
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION TYPES
FIGURE 5
PAGE 1
strategen JBS&G


OVERVIEW MAP
MITCHELL FWY
Shared Path
Legend:
Development envelope
Vegetation types
Jarrah Woodland 2
Planted
Completely Cleared
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION TYPES
FIGURE 5
PAGE 2
strategen JBS&G

Legend:
- Development envelope

Vegetation types
- Jarrah Woodland 2
- Planted
- Completely Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION TYPES

FIGURE 5 PAGE 3

strategen JBS&G

File Name: W:\Projects\[Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPS\C\Referral\58540_05_VegTypes.mxd
Image Reference: www.nearmap.com\ - Imagery Date: 30 August 2020

Legend:
- Development envelope

Vegetation types
- Jarrah Woodland 2
- Planted
- Completely Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	VEGETATION TYPES
Job No: 58540	
Client: Main Roads	FIGURE 5 PAGE 4
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

File Name: W:\Projects\[Client\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 8_EPBC\Referral\58540_05_VegTypes.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020.

Legend:
- Development envelope

Vegetation types
- Planted
- Completely Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION TYPES

FIGURE 5 PAGE 5

strategen JBS&G

File Name: W:\Projects\Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPS\Refined\58540_05_VegTypes.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020.

Legend:
- Development envelope

Vegetation types
- Tuart Forest 2
- Planted
- Completely Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION TYPES

FIGURE 5 PAGE 6

strategen JBS&G

File Name: W:\Projects_Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 8_EPBC\Referral\58540_05_VegTypes.mxd
Image Reference: www.nearmap.com/8 - Imagery Date: 30 August 2020.


OVERVIEW MAP
WHITFORDS AV
MITCHELL FWY
MITCHELL FWY
WHITFORDS STH NORTH CARPARK ACCESS
WHITFORDS STH SOUTH CARPARK ACCESS
WHITFORDS AV ON TO MITCHELL FWY (SOUTHBOUND)
TWICKENHAM DR
HARROW MEWS WAY
STOCKWELL WY
CHELSEA CT
Legend:
Development envelope
Vegetation types
Tuart Forest 2
Planted
Completely Cleared
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION TYPES
FIGURE 5
PAGE 7
strategen JBS&G


OVERVIEW MAP
WHITFORDS AV ON TO MITCHELL FWY (SOUTHBOUND)
MITCHELL FWY
MITCHELL FWY SB
BRONTE WYND PL
ALPERTON CT
ARMADALE DR
Legend:
Development envelope
Vegetation types
Tuart Forest 2
Planted
Completely Cleared
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION TYPES
FIGURE 5
PAGE 8
strategen JBS&G


OVERVIEW MAP
MITCHELL FWY PSP
MITCHELL FWY
TWICKENHAM DR
DRAYTON GREEN WY
LEYTON CT
EDMONTON PL
Legend:
Development envelope
Vegetation types
Tuart Forest 2
Planted
Completely Cleared
Local and regional roads
Scale 1:2,000 at A4
0 25 50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION TYPES
FIGURE 5
PAGE 9
strategen JBS&G

Figure 4. Vegetation Types

File Name: W:\Projects\[Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC Referral\58540_06_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020.


OVERVIEW MAP
MITCHELL FWY
MITCHELL FWY
Legend:
Development envelope
Vegetation condition
Degraded
Degraded to completely degraded
Completely degraded
Completely degraded (planted)
Cleared
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION CONDITION
FIGURE 6
PAGE 2
strategen JBS&G

Legend:
- Development envelope
- Vegetation condition
  - Degraded
  - Degraded to completely degraded
  - Completely degraded
  - Completely degraded (planted)
  - Cleared
- Local and regional roads

Scale 1:2,000 at A4 — 0, 25, 50 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION CONDITION

FIGURE 6 PAGE 3

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File Name: W:\Projects\1 (Open)\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Referral\58540_06_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:
- Development envelope

Vegetation condition
- Completely degraded
- Completely degraded (planted)
- Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	VEGETATION CONDITION
Job No: 58540	
Client: Main Roads	FIGURE 6 PAGE 4
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

File Name: W:\Projects\OpenMain Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Refers\58540_06_VegCond.mxd
Image Reference: www.nearmap.com/8 - Imagery Date: 30 August 2020.

Legend:
- Development envelope

Vegetation condition
- Completely degraded (planted)
- Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION CONDITION

FIGURE 6 PAGE 5

strategen JBS&G

File Name: W:\Projects\J_Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPS\C\Refere\58540_06_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020

Legend:
- Development envelope

Vegetation condition
- Completely degraded
- Completely degraded (planted)
- Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	VEGETATION CONDITION
Job No: 58540	
Client: Main Roads	FIGURE 6 PAGE 6
Version: A Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan Checked By: CT	

File Name: W:\Projects\1 (Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC\Referral\58540_06_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020


OVERVIEW MAP
WHITFORDS AV
MITCHELL FWY
WHITFORDS STH NORTH CARPARK ACCESS
WHITFORDS STH SOUTH CARPARK ACCESS
WHITFORDS AV ON TO MITCHELL FWY (SOUTHBOUND)
TWICKENHAM DR
HARROW HEAD WY
STOCKWELL WY
CHELSEA CT
Legend:
Development envelope
Vegetation condition
Good
Degraded
Degraded to completely degraded
Completely degraded
Completely degraded (planted)
Cleared
Local and regional roads
Scale 1:2,000 at A4
0 25 50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION CONDITION
FIGURE 6
PAGE 7
strategen JBS&G

Legend:
- Development envelope

Vegetation condition
- Degraded to completely degraded
- Completely degraded
- Completely degraded (planted)
- Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)	Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
Coord. Sys. GDA 1994 MGA Zone 50	VEGETATION CONDITION
Job No: 58540	
Client: Main Roads	FIGURE 6 PAGE 8
Version: A / Date: 09-Oct-2020	strategen JBS&G
Drawn By: hsullivan / Checked By: CT	

File Name: W:\Projects\[Open\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPBC Referral\58540_06_VegCond.mxd
Image Reference: www.nearmap.com/© - Imagery Date: 30 August 2020.

Legend:
- Development envelope

Vegetation condition
- Degraded to completely degraded
- Completely degraded
- Completely degraded (planted)
- Cleared
- Local and regional roads

Scale 1:2,000 at A4 (0, 25, 50 metres)

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 58540

Client: Main Roads

Version: A | Date: 09-Oct-2020

Drawn By: hsullivan | Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION CONDITION

FIGURE 6 PAGE 9

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File Name: W:\Projects\Clients\Main Roads\58540 Mitchell Freeway Widening\GIS\Maps\Task 6_EPSC\Reforms\58540_06_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 30 August 2020.


OVERVIEW MAP
MITCHELL FWY
TAMPA PARK DR
ST JOHNS CT
MITCHELL FWY PSP
ROWFORD PL
Legend:
Development envelope
Vegetation condition
Degraded to completely degraded
Completely degraded
Completely degraded (planted)
Cleared
Local and regional roads
Scale 1:2,000 at A4
0
25
50
metres
Coord. Sys. GDA 1994 MGA Zone 50
Job No: 58540
Client: Main Roads
Version: A
Date: 09-Oct-2020
Drawn By: hsullivan
Checked By: CT
Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)
VEGETATION CONDITION
FIGURE 6
PAGE 10
strategen JBS&G

Legend:
Development envelope
Vegetation condition
Degraded to completely degraded
Completely degraded
Completely degraded (planted)
Cleared
Local and regional roads

Scale 1:2,000 at A4	
Coord. Sys. GDA 1994 MGA Zone 50	
Job No: 58540	
Client: Main Roads	
Version: A	Date: 09-Oct-2020
Drawn By: hsullivan	Checked By: CT

Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue)

VEGETATION CONDITION

FIGURE 6 PAGE 11

strategen JBS&G

Figure 5. Vegetation Condition

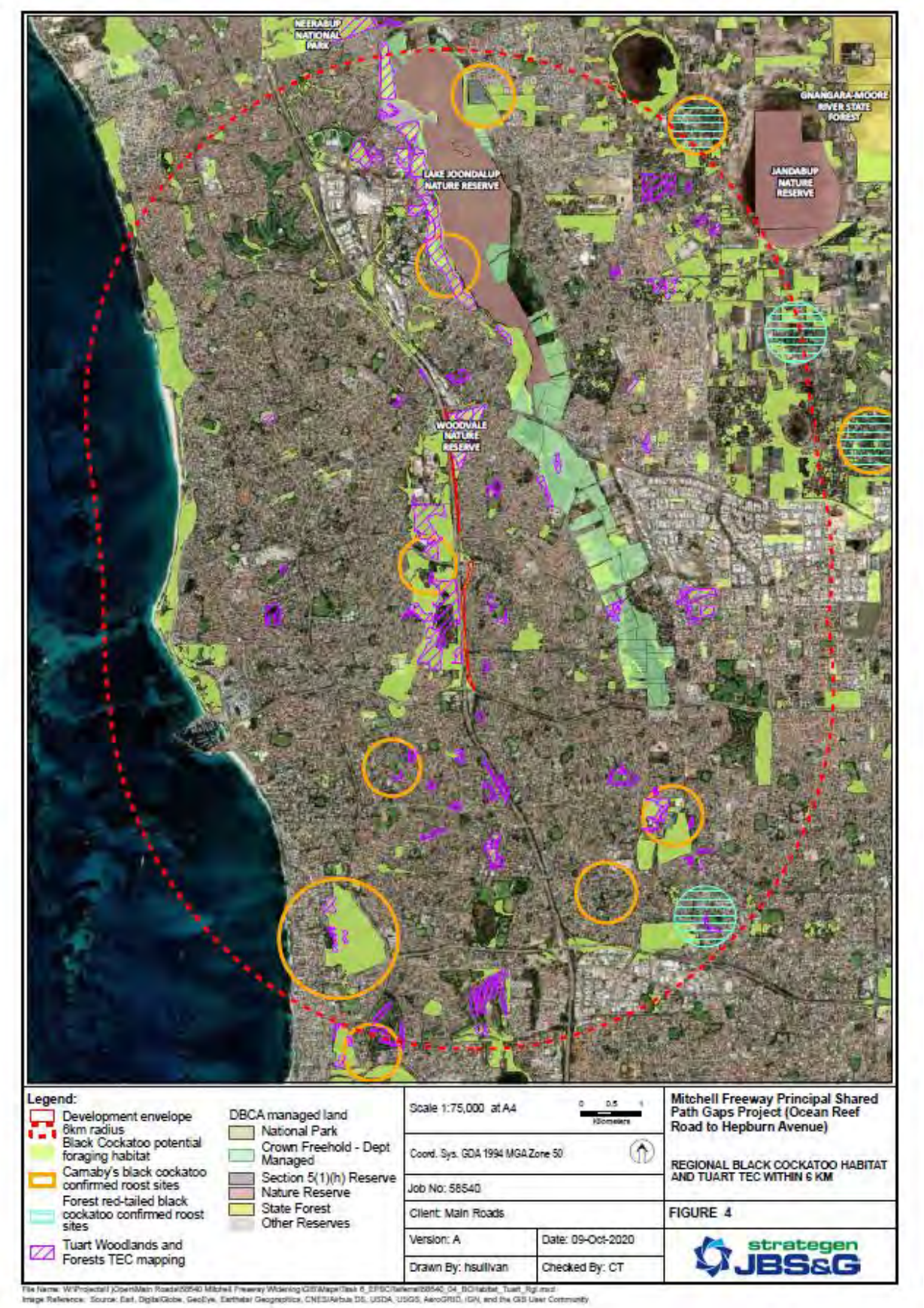

Figure 6. Regional Black Cockatoo Habitat and Regional Tuart TEC

Attachment 2 – Assessment of Impacts on MNES against Commonwealth Significant Impact Guidelines

Assessment of Impacts against the Commonwealth Significant Impact Guidelines

Purpose

The purpose of this document is to provide an assessment of impacts on Matters of National Environmental Significance (MNES) against the Commonwealth Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, to support the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral of the Mitchell Freeway Principal Shared Path Gaps Project (Ocean Reef Road to Hepburn Avenue) to the Department of Agriculture Water and Environment (DAWE).

Background

Main Roads Western Australia (Main Roads) proposes to install a pedestrian and cycle shared path (or Principal Shared Path (PSP)) and noise walls along the Mitchell Freeway at various sections between Ocean Reef Road and Hepburn Avenue, in the northern suburbs of Perth, Western Australia within a 13.74 ha Development Envelope (DE) (the Action).

Matters of National Environmental Significance

The EPBC Act protects and manages MNES which includes 'Threatened' ecological communities and species.

The following Threatened ecological communities and species have been identified in the Action area:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered)
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (Endangered)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) (Vulnerable).

Assessment of Matters of National Environmental Significance

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

The Action will necessitate the clearing of 8.75 ha of the Tuart (*Eucalyptus gomphocephala*) Woodland and Forests of the Swan Coastal Plain Ecological Community (Tuart TEC), of which 5.81 ha (66%) is planted vegetation in 'Completely Degraded' condition and 2.93 ha is remnant vegetation, 98% of which is in 'Degraded' to 'Completely Degraded' condition. Almost all areas of the TEC in the DE are in 'Poor' condition in accordance with the approved conservation advice condition categories for the Tuart TEC. Approximately 0.05 ha of the Tuart TEC is considered to be in 'moderate' condition (Astron 2020).

Regional (Perth subregion) and local (10 km radius) extents of the Tuart TEC, have been based on the methodology used in the approved conservation advice, utilising current native vegetation extent

data (GoWA 2019) and data from the Atlas of Tuart Woodlands on the Swan Coastal Plain (CALM 2003). It is estimated that at the regional level, approximately 20,796 ha of the Tuart TEC remains, while at the local level 733 ha is remaining. Noting this, 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 Action, leaving approximately 99.96% (regional scale) and 98.8% (local scale) of the current Tuart TEC extent remaining.

The Action will not significantly reduce the total extent of the Tuart TEC. The TEC mapped within the DE represents only 0.04% of that within the regional area and 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 unlikely that the area to be cleared exhibits higher diversity than other examples of the TEC within the region. Additionally, discussions between Main Roads and Professor Kingsley Dixon, a member of the Commonwealth Threatened Species and Communities Committee, have indicated that it was not intended for planted Tuarts within the road verges to meet the definition of the Tuart TEC in the approved conservation advice (Kingsley Dixon per comms). 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.

The clearing of 8.75 ha of the Tuart TEC mainly in poor condition, which is a loss of <1% of the Tuart TEC within 10 km and <0.05% at a regional scale will not adversely affect the area of occupancy of the Tuart TEC. Nor will the clearing involve the loss of the Tuart TEC at the extent of its range. The relatively small area of clearing of the Tuart TEC, which is mostly roadside and planted, is not expected to result in a significant impact to the Tuart TEC at a regional or local scale.

An assessment of the impacts against the Commonwealth Significant Impact Guidelines 1.1 was conducted for the Tuart TEC and is presented in Appendix A. The outcome of the assessment was that the Action will not have a significant impact on the Tuart TEC.

Carnaby's Cockatoo (*Calyptorhynchus latirostris*)

The Action will require the clearing of up to 3.01 ha of potential foraging habitat, 177 suitable diameter at breast height (DBH) tree (Suitable DBH Trees), with two containing suitable hollows for Carnaby's Cockatoo (Astron 2020, Kirkby 2020). All of the 177 Suitable DBH Trees are also potential roosting sites. However none of these trees showed signs of current or historic use as breeding or roost sites. All of the vegetation in the DE (10 ha) forms potential future breeding and roosting habitat for Carnaby's Cockatoo.

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 Carnaby's Cockatoo and the vegetation in the DE would not be considered quality foraging habitat under the DSEWPaC (2012) referral guidelines. Higher quality foraging habitat extends into reserves adjacent to the DE (Woodvale Nature Reserve and Craigie Bushland). Additionally, the Astron (2020) survey did not record any evidence of breeding or roosting within or directly adjacent to the DE. While the DE comprises suitable foraging species and potential breeding habitat, the quality of this habitat is 'low' (Astron 2020) and is outside of the modelled breeding range for Carnaby's Cockatoo, with no evidence of current or historic breeding observed.

Kirkby (2020) noted that Carnaby's Cockatoo are known to breed at the Edith Cowan University Campus, which is approximately 1 km from the DE. While foraging habitat in the DE may be utilised by individuals from either 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. Additionally, research obtained from Murdoch University of Black Cockatoo satellite-tracking data indicates that the general area surrounding the DE is an occasional transit corridor for Carnaby's Cockatoo. However, the data suggests that individuals are frequently utilising habitat north of the DE within Neerabup National Park where higher quality foraging habitat exists, with occasional trips transiting the area surrounding the DE. This indicates a preference for higher quality foraging habitat north of the DE, which is more likely to support the Carnaby's Cockatoo breeding individuals at Edith University Campus.

When considered in the context of habitat availability within the local area (based on suitable remnant vegetation within a 12 km radius), the potential loss of 3.01 ha of potential 'low' quality foraging habitat and 10 ha of potential breeding and roosting habitat (representing a 0.19% reduction in potential foraging and 0.65 % of potential breeding and roosting habitat within the local area [6 km]) is not considered a significant impact to the species.

Taking into consideration the lack of Carnaby's Cockatoo breeding and roosting records within the DE, the lack of high quality foraging resources and extent of higher quality habitat in the local area, the removal of 3.02 ha of potential foraging habitat, 177 Suitable DBH Trees, with two potentially suitable hollows and 10 ha of potential breeding and roosting habitat is not expected to have a significant impact on Carnaby's Cockatoo.

An assessment of the impacts against the Commonwealth Significant Impact Guidelines 1.1 was conducted for Carnaby's Cockatoo and is presented in Appendix B. The outcome of the assessment was that the Action is unlikely to have a significant impact on Carnaby's Cockatoo.

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)

The Action will require the clearing of up to 0.62 ha of 'low' quality foraging habitat for Forest Red-tailed Black Cockatoo (FRTBC), along with 177 Suitable DBH Trees, two with potentially suitable hollows (Astron 2020, Kirkby 2020). All of the 177 Suitable DBH Trees are also potential roosting sites. However none of these trees showed signs of current or historic use as breeding or roost sites. All of the vegetation in the DE (10 ha) forms potential future breeding and roosting habitat for FRTBC.

Astron (2020) identified that the natural flora assemblage has been altered to an extent that there is a reduced number and quality of foraging species for FRTBC and the vegetation in the DE would not be considered quality foraging habitat under the DSEWPaC (2012) referral guidelines. Higher quality foraging habitat extends into reserves adjacent to the DE. Additionally, the Astron (2020) survey did not record any evidence of breeding or roosting within or adjacent to the DE and no nearby roosting or breeding sites for FRTBC.

The Action is not expected to have a significant impact to FRTBC, given the clearing of 0.62 ha of potential foraging habitat and 10 ha of potential breeding and roosting habitat for FRTBC, representing 0.04% of the total available foraging habitat and 0.65% of the potential breeding and roosting available within 6 km of the DE. Additionally, FRTBCs are unlikely to breed in the DE due to

a preference for larger stands of woodland or forest (Johnstone et al. 2010). While the DE comprises suitable foraging species and potential breeding habitat, the quality of this habitat is 'low' (Astron 2020) with no evidence of current or historic breeding observed.

Taking into consideration the lack of FRTBC breeding and roosting records within the DE, the lack of high quality foraging resources and extent of higher quality habitat in the local area, the removal of 0.62 ha of potential foraging habitat, 177 Suitable DBH Trees, with two potentially suitable hollows and 10 ha of potential breeding and roosting habitat, is not expected to have a significant impact on FRTBC.

An assessment of the impacts against the Commonwealth Significant Impact Guidelines 1.1 was conducted for FRTBC and is presented in Appendix B. The outcome of the assessment was that the Action will not have a significant impact on FRTBC.

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Appendix A. Assessment of Significant Impact Criteria for Tuart Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Critically Endangered)

SIGNIFICANT IMPACT CRITERIA	IMPACT
Reduce the extent of an ecological community	The action will not significantly reduce the total extent of the Tuart TEC. It is estimated that at the regional level (Perth subregion), approximately 20,796.5 ha of the Tuart TEC remains, while at the local level (10 km) 733.4 ha remains. When considered at the regional and local level approximately 0.042% and 1.19% respectively of vegetation considered to represent the Tuart TEC is proposed to be cleared for the 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 (DoEE 2019). This 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. This 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 Action location, the Action will not affect the geographic extent of the Tuart TEC within the west to east zone parallel to the coast. Almost two thirds of the vegetation mapped as Tuart TEC was planted by Main Roads in the 1980s.
Fragment or increase fragmentation of an ecological community	The Action will not significantly fragment or increase fragmentation of the Tuart TEC within the local area. Vegetation associated with the TEC, within the DE, is currently fragmented and exists as two distinct patches (TP12 and TP20) which in themselves provide no direct linkage to other areas of significant remnant vegetation or Tuart TEC. The Action will not result in the splitting of the occurrence of TP12 as it will remove only the western edge, nor significantly increase the separation between it and other patches of the TEC that currently exist, given the narrow extent of clearing. Patch TP20 exists as an isolated patch that provides no direct connection to other significant occurrences of remnant vegetation. While the clearing will remove the majority of this patch, it already isolated in nature and as such clearing of patch TP20 will not significantly increase the fragmentation of an occurrence of the TEC overall.
Adversely affect the habitat critical to the survival of an ecological community	The Action is unlikely to affect habitat critical to the survival of the TEC. The Tuart TEC Conservation Advice (DotEE 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

SIGNIFICANT IMPACT CRITERIA	IMPACT
	• Areas maintaining ecological connectivity between significant patches None of the vegetation to be cleared by the Action is considered to meet the areas listed above. The Action will not result in any direct impacts to the occurrence of the TEC within conservation reserves. Of the 8.75 ha to be cleared, 5.81 ha (66%) consists of planted vegetation in 'Completely Degraded' condition The TEC within the DE comprises narrow strips of vegetation in land designated for road reserve. 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, locally within conservation reserves, there is approximately 139.2 ha of the TEC present. The vegetation within these reserves is likely to be in a 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.
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 pattern	The 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 Action will not require dewatering or encounter groundwater. There are no surface water features in the DE. The Construction Environmental Management Plan (CEMP) will include measures to manage the risk of impact to abiotic factors. As such, it is unlikely that there will be indirect impacts on abiotic factors from the Action on the Woodvale Nature Reserve.
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	The 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' condition (Astron 2020). The extent of the TEC within the DE is mostly planted and has been subject to high levels of disturbance from weeds and extensive edge effects resulting in low native species richness. 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.
Cause a substantial reduction in the quality or integrity of an	The Action will not result in a substantial reduction in the quality or integrity of the Tuart TEC outside of the DE. The 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. The potential for the

SIGNIFICANT IMPACT CRITERIA	IMPACT
occurrence of an ecological community	introduction and/or spread of invasive species and the mobilisation of fertilisers, herbicides or other chemicals or pollutants will be managed through standard hygiene management practices outlined in the project specific Construction Environmental Management Plan (CEMP).
Interfere with the recovery of an ecological community	Currently there is no recovery plan in place for this TEC. However, given that the present vegetation is mostly planted in 'Poor' condition and that it is does not provide a significant overall ecological function in the landscape, it is considered unlikely that the Action will interfere with the recovery of the TEC.

Appendix B. Assessment of Significant Impact Criteria for *Calyptorhynchus latirostris* (Carnaby's Cockatoo) (Endangered)

SIGNIFICANT IMPACT CRITERIA	IMPACT
Lead to a long-term decrease in the size of a population	The Action will not lead to a long term decrease in the size of the population of Carnaby's Cockatoo as the Action will require the clearing of 3.01 ha of low quality 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. It is expected that higher quality foraging habitat occurs in reserves adjacent to and within the local area of the DE. Regional data indicates that nearest roosting site is 4.8 km north east of the DE. A known breeding site is approximately 1 km to the north of the DE, within the Edith Cowan University 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. No known breeding or roosting habitat will be removed for the Action.
Reduce the area of occupancy of the species	The Action will not significantly reduce the area of occupancy of Carnaby's Cockatoo. 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 is between 34,500 km2 and 86,800 km2 (DotEE 2020). Clearing as a result of the Action represents between 0.0003% and 0.0008% of the estimated post-2003 area of occupancy (DPaW 2013). Considering the above and noting the degraded nature of the vegetation present, the lack of quality foraging habitat and no evidence of breeding, the Action will not reduce the area of occupancy of this species.
Fragment an existing population into two or more populations	The 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. 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 Action area amongst large patches of higher quality foraging habitat within 6 km of the DE. The Action will not create a gap greater than 4 km between patches of habitat and is unlikely to fragment an existing population in two or more populations.
Adversely affect habitat critical to the survival of a species	The Action may affect habitat critical to the survival of the species, however it is unlikely that this impact will be significant. 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

SIGNIFICANT IMPACT CRITERIA	IMPACT
	• 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. The heavily altered state of the vegetation, particularly in comparison to higher quality habitat in nearby reserves, 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. Noting this, the Action is not expected to significantly impact habitat critical to the survival of Carnaby's Cockatoo.
Disrupt the breeding cycle of a population	The 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, indicates that the recorded foraging habitat may support local breeding and roosting. The DE contains up to 177 suitable DBH trees (those greater than 500mm DBH). Two of those trees were identified as containing potentially suitable hollows for use by Black Cockatoos (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 (Kirkby 2020). In personal communication, Kirkby stated that the hollows are likely to be occupied by either Galah (*Cacatua roseicapilla*) or Little Corella (*Cacatua sanguinea*). However, 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 not considered significant.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The 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 3.01 ha of low quality Carnaby's Cockatoo foraging habitat represents a reduction in potential foraging by 0.2% and reduction of potential breeding and roosting habitat by 0.65% in the local area (6km).
Introduce disease that may cause the species to decline	The Action will not involve any actions that could potentially introduce infectious disease that could cause Carnaby's Cockatoo to decline. Terratree (2020) determined that while the majority of the DE was uninterpretable/excluded assessment due its degraded nature, there was one section assessed to be infested with *Phytophthora cinnamomi*. Given the highly disturbed nature of the DE and the actual presence of dieback, it is likely that *Phytophthora cinnamomi* is present throughout the site, but has not expressed in areas where there are few indicator species. The potential for the introduction and/or spread of *P. cinnamomi* can be appropriately managed through standard hygiene procedures in the CEMP 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

SIGNIFICANT IMPACT CRITERIA	IMPACT
	the 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.
Interfere with the recovery of the species	The Action will not interfere with the recovery of the species. The Carnaby's Cockatoo recovery plan (DBCA 2013) provide 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.

Appendix C. Assessment of Significant Impact Criteria for *Calyptorhynchus Banksii naso* (Forest Red-tailed Black Cockatoo) (Vulnerable)

SIGNIFICANT IMPACT CRITERIA	IMPACT
Lead to a long-term decrease in the size of an important population	The Action will not lead to a long term decrease in the size of an important population of FRTBC as the Action will require the clearing of 0.62 ha of potential foraging habitat, representing 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 and within the local area of the DE. No breeding or roosting by FRTBC in the DE has been observed and Kirkby (2020) notes that the closest known breeding site for FRTBC is approximately 230 km north east in the Darling Range.
Reduce the area occupancy of an important population	The 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 km2 (Garnett et al. 2011). While the Action is located within the mapped distribution of FRTBC, (DSEWPaC 2012; DotEE 2017) clearing as a result of the Action represents 0.0002% of the estimated area of occupancy (Garnett et al., 2011) Considering the above and noting the degraded nature of the habitat present, the lack of quality foraging and evidence of breeding, the Action will not reduce the area of occupancy of this species.
Fragment an existing important population into two or more populations	The 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. 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. The Action will not create a gap greater than 4 km between patches of habitat and is unlikely to fragment an existing population in two or more populations.
Adversely affect habitat critical to the survival of a species	The Action will not affect habitat critical to the survival of the species. The FRTBC 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, 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. The EPA (2019) identifies the importance of retaining foraging habitat which occurs in proximity to identified roosting habitat. Given there are no known FRTBC roosting or breeding sites within 12 km of the DE, the removal of 0.62 ha of potential foraging habitat for FRTBC is not expected to form part of critical habitat for the species.
Disrupt the breeding cycle of an important population	The Action will not disrupt the breeding cycle of an important population of FRTBC. No known breeding habitat was identified in the DE. 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 within the DE or within close proximity.

SIGNIFICANT IMPACT CRITERIA	IMPACT
	The Action will not disrupt the breeding cycle of an important population of FRTBC's as no known breeding occurs within the DE. 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, 2012). The most important breeding 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 survey did not record any evidence of current or historic breeding (Astron, 2020).
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Action will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that FRTBC 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 0.62 ha of 'low' quality FRTBC foraging habitat represents a reduction in potential foraging by 0.04% and reduction of potential breeding and roosting habitat by 0.65% in the local area (6km).
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Action will not introduce harmful or invasive species to the DE. The CEMP will include measures to manage the potential spread of weeds, dieback and feral animals into adjacent retained vegetation that could comprise habitat for the species.
Introduce disease that may cause the species to decline	The Action will not involve any actions that could potentially introduce infectious disease that could cause FRTBC to decline. Terratree (2020) determined that while the majority of the DE was uninterpretable/excluded assessment due its degraded nature, there was one section assessed to be infested with *Phytophthora cinnamomi*. The potential for the introduction and/or spread of *P. cinnamomi* can be appropriately managed through standard hygiene procedures in the CEMP 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 *P. cinnamomi* and therefore FRTBC will be not be impacted by dieback. The implementation of standard hygiene procedures will ensure the 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	The 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.

Attachment 3 – Astron (2020) Biological Survey Report

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway Biological Survey September/October 2019 and March/April 2020

Prepared for
Main Roads Western Australia

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Report Reference: 8612-19-BISR-1Rev1_200812

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Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway Biological Survey

Prepared for
Main Roads Western Australia

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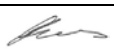
A	02/04/20	J. Braid	B. Lucas	
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Abbreviations

Abbreviation	Definition
Astron	Astron Environmental Services
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
cm	Centimetre
DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
FCT	Floristic Community Type
GDA	Geocentric Data of Australia
GPS	Global Positioning System
ha	Hectare
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
m	Metre
Main Roads	Main Roads Western Australia
mm	Millimetre
MGA	Map Grid of Australia
MNES	Matters of National Environmental Significance
NVIS	National Vegetation Information System
P	Priority flora species
PEC	Priority ecological community
PSP	Principal Shared Pathway
SCP	Swan Coastal Plain
T	Threatened flora species under the BC Act and/or EPBC Act
TEC	Threatened ecological community
WAHerb	Western Australian Herbarium
WoNS	Weeds of National Significance

Executive Summary

Astron Environmental Services was engaged by Main Roads Western Australia to undertake a biological survey for the widening of Mitchell Freeway southbound between Hodges Drive and Hepburn Avenue and for construction within three gaps in the Mitchell Freeway Principal Shared Pathway between Hodges Drive and Reid Highway (49.6 ha in total). The biological survey involved a desktop assessment, detailed single-phase flora and vegetation field survey and targeted black cockatoo assessment. The field survey was conducted in September/October 2019, with an additional area between Hepburn Avenue and Warwick Train Station surveyed in March/April 2020.

A total of 217 vascular flora species were recorded within the survey area. No *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or State-listed threatened flora was recorded. One priority flora species was recorded: *Jacksonia sericea* P4. Three of the 72 weed species recorded are listed as Weeds of National Significance (Australian Weeds Committee 2012) (**Asparagus asparagoides, *Lantana camara* and **Genista linifolia*) and three of the recorded weed species are listed as declared pest plants in Western Australia under the *Biosecurity and Agricultural Management Act 2007* (Department of Agriculture and Food Western Australia 2007)**Asparagus asparagoides, *Lantana camara* and **Moraea flaccida*).

Five remnant vegetation types were identified in the survey area: one Banksia Woodland, two Jarrah Woodlands and two Tuart Forests. Remnant vegetation types were recorded within 10.6 ha (21%) of the total survey area. The remaining area is either cleared (15%) or planted vegetation (64%). Vegetation condition of remnant vegetation ranged from Good to Completely Degraded with the majority in Completely Degraded condition due to consisting of scattered individual remnant species only.

Two EPBC Act listed threatened ecological communities (TECs) were inferred as occurring in the survey area: 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC recorded across 11.7 ha (including both remnant and planted vegetation types, as per the Approved Conservation Advice (Department of the Environment and Energy 2019a), and 'Banksia Woodlands of the Swan Coastal Plain' TEC recorded across 0.29 ha as a result of connectivity to adjacent remnant vegetation inferred to represent the TEC. Two State listed priority ecological communities were inferred as occurring in the survey area: 'Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain' and 'Banksia dominated woodlands of the Swan Coastal Plain IBRA Region' across 8.8 ha and 1.3 ha respectively; both are listed as priority 3 ecological communities by the Department of Biodiversity, Conservation and Attractions.

Of the 24 conservation significant vertebrate species identified in the desktop assessment, three species, quenda (*Isoodon fusciventer*), Carnaby's cockatoo (*Calyptorhynchus latirostris*) and forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) were recorded within the survey area, one species (peregrine falcon) was considered to have a 'moderate' likelihood and 20 species were considered to have a 'low' likelihood of occurrence.

The survey area is outside the current suggested distribution of Baudin's cockatoo (*Calyptorhynchus baudinii*). Carnaby's cockatoo individuals and foraging evidence were recorded at five separate locations during the current surveys within the survey area. Forest red-tailed black cockatoo

individuals and foraging evidence were recorded at five locations within the survey area during previous (Astron Environmental Services 2019a) and current surveys.

Twenty-nine known foraging resource species for the Carnaby's cockatoo and seven known foraging resource species for the forest red-tailed black cockatoo were recorded within the survey area. Remnant vegetation of the survey area, 10.6 ha for Carnaby's cockatoo and 1.7 ha for forest red-tailed black cockatoo, was classified as providing potential foraging habitat. However, it is not considered quality foraging habitat for black cockatoos due to the altered state of vegetation and sporadic and isolated distribution of these known foraging flora species.

Breeding for the forest red-tailed black cockatoo is unlikely within the survey area due to a preference for intact woodland or forest. Five hundred and thirty-three black cockatoo potential breeding trees (409 tuarts, 78 jarrah, 23 dead stags and 23 marri) with a diameter at breast height of over 50 cm were recorded within the survey area including 22 trees considered to have suitable hollows for Carnaby's cockatoos to breed in. Preliminary inspection of the hollows did not show signs of recent or historic use as nest sites and no confirmed breeding records are known from the survey area.

One individual quenda roadkill was recorded within the survey area, 228 m south of the Woodvale Nature Reserve. It is likely that this individual was part of a population within Woodvale Nature Reserve. Multiple diggings in the same area as the roadkill as well as at two other locations within the survey area were also recorded. The survey area contains habitat for the species; however, there is more suitable habitat within larger areas of remnant vegetation adjacent to the survey area, such as Woodvale Nature Reserve, which are known, or likely to, support populations of quenda.

The peregrine falcon was considered to have a moderate likelihood of occurring in the survey area due to previous records in the vicinity of the survey area. The survey area is considered potential foraging habitat for this species; however, this species is a cosmopolitan species that forages widely in all habitats.

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1 Introduction

1.1 Project Background

Main Roads Western Australia (Main Roads) is widening the Mitchell Freeway southbound between Hodges Drive and Hepburn Avenue and will be constructing within three gaps in the Mitchell Freeway Principal Shared Pathway (PSP) between Hodges Drive and Reid Highway.

Astron Environmental Services (Astron) was engaged by Main Roads to undertake a biological survey for the 49.6 ha survey area in the City of Joondalup and City of Stirling (Figure 1).

1.2 Scope and Objectives

The objective of the biological survey was to provide an assessment of the flora, vegetation, fauna (black cockatoo), soil, groundwater and surface water (wetlands) values within the survey area and to determine potential sensitivity to impact of black cockatoo habitat and remnant native vegetation. The outcome of the survey and information supplied in this report will be used to inform the environmental assessment and approvals process. The results of the biological survey may also assist in the preparation of a Clearing Impact Assessment and Vegetation Management Plan and may be used in State or Commonwealth referral documentation.

The scope of works included the following:

- Complete a desktop assessment of the survey area to identify:
    - all biological features and constraints which may be in or near to, the survey area
    - significant flora, vegetation/ecological communities, soil/land system, groundwater and surface water values and potential sensitivity to impact
    - a likelihood of occurrence assessment for threatened/priority flora and fauna species that potentially occur
    - broad pre-European vegetation type(s), including Beard (1979), Heddle et al. (1980) and Webb et al. (2016)
    - patch assessment for the 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' threatened ecological community (TEC) using existing mapping, aerial imagery and shapefiles provided by Main Roads to map potential tuart canopies and patches within the survey area.
- Conduct a detailed single-phase survey to:
    - verify and ground truth the desktop assessment findings
    - undertake vegetation association and condition mapping, including defining patches of planted and remnant native vegetation
    - identify and map the presence of any threatened or priority ecological communities (TECs or PECs)

  - patch assessment for vegetation types which may potentially align with the 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC against the key diagnostic characteristics as per the Approved Conservation Advice (Department of the Environment and Energy 2019a)
  - assessment of vegetation types which may potentially align with the Commonwealth listed TEC 'Banksia Woodlands of the Swan Coastal Plain ecological community' against the key diagnostic characteristics as per the Approved Conservation Advice (Department of the Environment and Energy 2016a)
  - targeted searches to record the presence of any threatened (Declared Rare) and priority flora, Weeds of National Significance (WoNS) or declared pests, and map the extent of populations if encountered. Any threatened flora to be mapped with a differential GPS
  - assess the flora species diversity, density, composition, structure and weed cover within marked quadrats
  - map wetland habitat and riparian habitat if present.
- Identification and mapping of black cockatoo foraging habitat, roosting, potential breeding and actual breeding trees as per Commonwealth guidelines (Department of Sustainability Environment Water Population and Communities 2012).
- Provide a combined flora, vegetation and black cockatoo assessment report.
- Provide a stand-alone memo providing any recommendations or advice on whether the project should be referred and any relevant management actions required to mitigate potential environmental impacts.

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure 1: Survey area location

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Author: A. Sleep	Date: 08-01-2020
Drawn: C. Dyde	Figure Ref: 8612-19-BIDR-1RevA_200108_Fig01_Locn

Datum: GDA 1994 - Projection: MGA Zone 50

0 2 4 6 8 10 Km

N

2 Environmental Context

2.1 Physical Environment

2.1.1 Geology, Landform and Soils

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). Soils consist of colluvial and aeolian sands, alluvial river flats and coastal limestone (Mitchell et al. 2002). The surface geology of the survey area is comprised of two geological units (Stewart et al. 2008) (Table 1). The survey area lies within the Karrakatta soil association on the Spearwood Dune System. The Karrakatta soil association is described as an undulating landscape with deep yellow sands over limestone (Department of Agriculture and Food 2003).

Table 1: Geological units in the survey area (Stewart et al. 2008).

Geological name	Label	Description	Extent within the survey area (ha)
Coastal dunes 38488	Qdc	Beach sand, sand dunes, coastal dunes, beaches, and beach ridges; calcareous and siliceous, locally shelly and/or cemented (beach rock); locally reworked.	31.6
Tamala Limestone	Qdct	Unconsolidated to strongly lithified calcarenite with calcrete/kankar soils; aeolian. Locally quartzose, feldspathic, or heavy-mineral-bearing.	18.0

2.1.2 Surface Water and Hydrology

The survey area is located within the Coastal Catchment of the Swan Coastal Basin (Department of Water and Environmental Regulation 2018). No Wetlands of International Importance (i.e. Ramsar wetlands) occur within the vicinity of the survey area (Department of the Environment and Energy 2019b). The nearest significant wetland, as listed by the Department of the Environment and Energy (2019c), is Lake Joondalup located 1.1 km east of the survey area within the Yellagonga Regional Park.

2.2 Biological Environment

2.2.1 Interim Biogeographic Regionalisation of Australia

The Interim Biogeographic Regionalisation for Australia (IBRA version 7) divides the Australian continent into 89 bioregions and 419 subregions (Department of the Environment and Energy 2019d). The IBRA regions represent a landscape-based approach to classifying the land surface, including attributes of climate, geomorphology, landform, lithology, and characteristic flora and fauna. The survey area is located within the Swan Coastal Plain bioregion of which 10.9% is represented in the national reserve system (Department of the Environment and Energy 2016b).

The biodiversity of the 53 subregions recognised in Western Australia was documented as part of a national audit to provide priorities for conservation action (Department of Conservation and Land

Management 2002). The survey area occurs within the Perth (SWA02) subregion of the Swan Coastal Plain bioregion and is described in the audit as:

- **Perth (SWA02)**: composed of colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, Banksia and Jarrah-Banksia woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials. Includes a complex series of seasonal wetlands and also includes Rottnest, Carnac and Garden Islands etc. Rainfall ranges between 600 and 1,000 mm annually and the climate is Mediterranean. The subregional area is 1,333,901 ha (Mitchell et al. 2002).

2.2.2 Land Systems

The survey area occurs within a single land system:

- **Spearwood System:** Sand dunes and plains. Yellow deep sands, pale deep sands and yellow/brown shallow sands (Department of Agriculture and Food Western Australia 2001).

The total area of this land system within the survey area and the Swan Coastal Plain bioregion is presented in Table 2.

Table 2: Distribution of land systems within the survey area and Swan Coastal Plain bioregion (Department of Agriculture and Food Western Australia 2001).

Land system	Total area within bioregion (ha)	Total area within the survey area (ha)	Proportion within the survey area (%)
Spearwood System	277,427.2	49.6	0.02%

2.2.3 Pre-European Vegetation

The pre-European vegetation mapping of Western Australia dataset maps original natural vegetation presumed to have existed prior to European settlement. It is based predominantly on the published and unpublished mapping of J.S. Beard at a 1:250,000 scale.

Three pre-European vegetation units are mapped within the survey area:

- **Guilderton 1007**: Mosaic: Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* heath / Shrublands; *Acacia rostellifera* and *Acacia cyclops* thicket (Shepherd et al. 2002).
- **Spearwood 6**: Medium woodland; Tuart and Jarrah (Shepherd et al. 2002).
- **Spearwood 998**: Medium woodland; Tuart (Shepherd et al. 2002).

Table 3 summarises the current and pre-European extent of these three vegetation units in the Swan Coastal Plain bioregion and the survey area.

Table 3: Current and pre-European vegetation extent in the survey area and Swan Coastal Plain bioregion (Government of Western Australia 2018).

Beard Vegetation Association	Extent in survey area (ha)	Current extent in bioregion (ha)	Pre-European extent in bioregion (ha)	Proportion of pre-European extent remaining (%)
6	31.8	13,304.1	56,343.0	23.6
998	15.6	18,411.7	50,867.9	36.2
1007	2.2	20,679.6	30,109.8	68.6

The pre-1750 distribution of vegetation complexes characteristic of various combinations of landforms, soils and rainfall along the Swan Coastal Plain (south of Lancelin) has been mapped at a scale of 1:250,000 and compiled into a dataset (Department of Biodiversity, Conservation and Attractions 2018). The majority of the Swan Coastal Plain was described by Heddle et al. (1980) with the far southern section completed by Webb et al. (2016).

The survey area is located within remnants of two vegetation complexes:

- **Karrakatta Complex** – Central and South: predominantly open forest of *Eucalyptus gomphocephala* (Tuart), *E. marginata* (Jarrah), *Corymbia calophylla* (Marri) and woodland of *E. marginata* and *Banksia* species.
- **Cottesloe Complex** – Central and South: mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri); closed heath on the Limestone outcrops.

Table 4 summarises the most recent and pre-European extents of these vegetation complexes.

Table 4: Current and pre-European vegetation extent of vegetation complexes within the survey area (Government of Western Australia 2019).

Vegetation Complex	Extent in survey area (ha)	Current extent (ha)	Pre-European extent (ha)	Proportion of pre-European extent remaining (%)
Karrakatta Complex - Central and South	36.9	12,467.2	53,081.0	23.5
Cottesloe Complex – Central and South	12.7	14,567.9	45,299.6	32.2

2.2.4 Conservation Reserves in the Region

The Yellagonga Regional Park is located approximately 940 m east of the northern end of the survey area. It contains a series of interconnected natural wetlands including Lake Joondalup, Beenyup Swamp, Walluburnup Swamp and Lake Goollelal. There are two Nature Reserves within 3 km of the survey area: Woodvale Nature Reserve (WA30809) is directly adjacent to the survey area near Ocean Reef Road and intersects the survey area near Camarino Drive, and Lake Joondalup Nature Reserve (WA31048) is 1.3 km east of the northern end of the survey area. In addition, four unnamed

Conservation and Recreation Reserves are located 1.9 km east (WA46926), 2.4 km north-east (WA43290) and 2.8 km east (WA46756 and WA50514) from the survey area, respectively.

2.3 State and Commonwealth Conservation Categories and Management for Native Flora and Ecological Communities

Commonwealth and State regulatory authorities maintain databases of the locations and conservation status of significant flora and ecological communities in Western Australia.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage Matters of National Environmental Significance (MNES) including listed flora and ecological communities. These listed flora, fauna and ecological communities are allocated a conservation category, which are outlined in Tables A.1 and A.2 (Appendix A).

Ecological communities may be subject to processes that threaten to destroy or significantly modify it across much of its range. These communities are identified as TECs and are listed at both Commonwealth level under the EPBC Act and State level under the *Biodiversity Conservation Act 2016* (BC Act) (Table A.3, Appendix A). The Department of Biodiversity, Conservation and Attractions (DBCA) maintains a list of PECs, which may also be under threat and are assigned one of four priority rankings according to the criteria outlined in Table A.5 (Appendix A).

Under Western Australian legislation, all native flora and fauna are protected and it is an offence to 'take' protected species. The BC Act also provides for native species to be gazetted as threatened, extinct or specially protected (specific to fauna) (Table A.5; Appendix A). Under the BC Act threatened species may be listed as one of three categories: critically endangered, endangered or vulnerable. In addition, due to the diversity of Western Australia's flora and fauna, many species are known from only a few collections or locations, but have not been adequately surveyed, with these flora and fauna species included on supplementary conservation lists managed by DBCA called the *Priority Flora List* and *Priority Fauna List* (Table A.6, Appendix A).

2.4 Introduced Flora Categories and Management

Significant weed species are identified at both the Commonwealth and State levels. The Australian Weeds Strategy (Australian Weeds Committee 2012) identifies WoNS which have the potential to impact primary industry and/or environmental and social values. The management of weeds in Western Australia is primarily regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act) with some provision under the BC Act. Species listed under this act are allocated one of three declared pest categories which define the required level of management (Department of Primary Industries and Regional Development 2018). Declared pest categories are presented in Table A.8 (Appendix A).

3 Methods

3.1 Desktop Assessment

3.1.1 Database Searches

State and Commonwealth database searches were conducted to identify listed significant flora, fauna and ecological communities within, or in close proximity to, the survey area. The DBCA database search results dated August 2019 were provided by Main Roads within a 10 km radius to the survey area, however only those results within 5 km were considered, as per the Consultant Brief dated 7 August 2019. Database search details are summarised in Table 5 and results are presented in Appendix B. Conservation categories for ecological communities, flora and fauna are presented in Appendix A. Introduced flora species were compared to the Department of Primary Industries and Regional Development Western Australian Organism List, to determine if any have been listed as declared pests (Department of Primary Industries and Regional Development 2018), and the WoNS list (Australian Weeds Committee 2012). Introduced flora categories are presented in Appendix A.

Table 5: Summary of database searches undertaken.

Database	Date search results received	Search focus	Search result
Department of Environment and Energy Protected Matters Search Tool (Department of the Environment and Energy 2019e)	27/08/2019	MNES	5 km buffer around a line defined by the coordinates: 31° 45' 10" S, 115° 45' 45" E 31° 46' 11" S, 115° 46' 40" E 31° 46' 30" S, 115° 46' 49" E 31° 48' 54" S, 115° 47' 01" E 31° 49' 25" S, 115° 47' 05" E 31° 49' 39" S, 115° 47' 13" E 31° 50' 18" S, 115° 47' 37" E 31° 50' 60" S, 115° 47' 52" E
NatureMap (Department of Biodiversity, Conservation and Attractions 2019a)	27/08/2019	Flora and fauna of conservation significance	5 km buffer around a line defined by the coordinates: 31° 45' 10" S, 115° 45' 45" E 31° 46' 11" S, 115° 46' 40" E 31° 46' 30" S, 115° 46' 49" E 31° 48' 54" S, 115° 47' 01" E 31° 49' 25" S, 115° 47' 05" E 31° 49' 39" S, 115° 47' 13" E 31° 50' 18" S, 115° 47' 37" E 31° 51' 00" S, 115° 47' 52" E 31° 49’ 03” S, 115° 46’ 31” E

Database	Date search results received	Search focus	Search result
Threatened and Priority Ecological Communities Database (Department of Biodiversity, Conservation and Attractions 2019b)	27/08/2019	Listed threatened and priority ecological communities	10 km radius around survey area shapefiles provided by Main Roads
Threatened and Priority Flora Database (TPFL) (Department of Biodiversity, Conservation and Attractions 2019c)	27/08/2019	Listed threatened and priority flora	5 km radius around survey area shapefiles provided by Main Roads
Western Australian Herbarium Flora (Department of Biodiversity, Conservation and Attractions 2019d)			
Threatened and Priority Fauna Database (Department of Biodiversity, Conservation and Attractions 2019e)	27/08/2019	Listed threatened and priority fauna Information on black cockatoo roosting and breeding occurrences	5 km radius around survey area shapefiles provided by Main Roads
Western Australian government datasets (Department of the Environment and Energy 2019b, 2019c, 2019d) and the Register of the National Estate dataset (Department of the Environment and Energy 2008)	27/08/2019	Environmentally Sensitive Areas (ESAs)	5 km radius from the survey area boundary

3.1.2 Likelihood of Occurrence Assessment

3.1.2.1 Significant Vegetation - Threatened Ecological Communities

Prior to undertaking the flora and vegetation field survey, a desktop assessment for potential patch occurrences of the 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC (Tuart TEC) was undertaken as per the Consultant Brief. Aerial imagery overlain with potential tuart woodland mapping (provided by Main Roads) and locations of tuart trees recorded during Astron's black cockatoo habitat assessment survey (conducted within the survey area 24 to 25 September 2019 as part of the current survey – see Section 3.2.2) was assessed against the diagnostics of the Approved Conservation Advice (Department of the Environment and Energy 2019a) and Main Roads Technical Guidance Factsheet (Main Roads Western Australia 2020), taking into account approximate canopy extent and associated buffer, potential number of tuart trees present

and possible size of patches, to identify preliminary patches of the Tuart TEC for formal assessment in the field.

3.1.2.2 *Significant Flora*

Prior to conducting the field survey, aerial imagery was interpreted to identify potential vegetation types. The significant flora species returned from the database searches were then categorised according to the criteria in Table 6 to determine potential occurrence within the survey area.

Table 6: Criteria used to assess the likely presence of significant flora in the survey area.

Likelihood of occurrence	Criteria
Recorded	Species previously recorded within the survey area and likely to still occur (records from literature review or recent database records, in areas where no clearing has been undertaken).
Likely	Species previously recorded within the survey area (older records from database searches) or within 2 km of the survey area and suitable habitat appears to be present in the survey area.
Potential	Species previously recorded within 2 km to 5 km of the survey area and/or suitable habitat appears to be present in the survey area.
Unlikely	No suitable habitat appears to be present in the survey area.
Unknown	No information available to assess likelihood.

Following the field survey, the significant flora species identified during the desktop assessment were again assessed to determine their likelihood of occurrence within the survey area. Post-field survey likelihood was primarily based on validating the presence (and thorough inspection) of suitable habitats within the survey area, combined with life form, habitat and flowering information (i.e. visibility) for each flora species.

3.1.2.3 *Significant Fauna*

Conservation listed vertebrate fauna returned from the database searches were also categorised for likelihood of occurrence within the survey area according to the criteria listed in Table 7. Following the field survey, the conservation significant fauna species identified during the desktop assessment were again assessed to determine their likelihood of occurrence within the survey area. Post-field survey likelihood was primarily based on validating the presence (and thorough inspection) of suitable habitats within the survey area.

Table 7: Criteria used to define likelihood of occurrence of conservation significant fauna species.

Likelihood of occurrence	Pre-survey	Post-survey
Recorded	N/A	Species or evidence of species recorded during survey.
High	Species has been recorded within the survey area or within 1 km of the survey area and preferred habitat appears to be present.	Core or preferred habitats present in the survey area which are abundant and/or high quality condition. OR Species is known to be cryptic and may not have been detected despite adequate survey effort and suitable habitat present within the survey area. OR Species or evidence of species recorded within the survey area however doubt remains over the taxonomic identification, validity of record.
Moderate	Species has been recorded within the prescribed database search area and suitable habitat appears to be present. OR Species has been recorded within 1 km of the survey area but preferred habitat does not appear to be present.	Core or highly suitable habitats present in the survey area, however species was not detected despite adequate survey effort. OR Core or preferred habitats present in the survey area are mainly in poor or modified condition but species has previously been recorded within 1 km of the survey area.
Low	Species recorded from within the prescribed database search area, but suitable habitat does not appear to be present.	Species has not been recorded in the survey area despite adequate survey effort. OR Species dependent on specific habitats that do not occur in the survey area. OR Species considered locally extinct.

3.2 Field Survey

3.2.1 Flora and Vegetation Survey

The biological survey from Hodges Drive to Hepburn Avenue was conducted by Astron Senior Environmental Scientist Bethea Loudon (Botanist; Flora Permit FB62000049) and Environmental Scientist Alexandra Sleep (Botanist; Flora Permit SL012530) on 26 to 27 September and 2 to 3 October 2019. The biological survey from Hepburn Avenue to Warwick Train Station was conducted by Alexandra Sleep on 26 March and 1 to 2 April 2020. A previous survey had been undertaken by Dr Markus Mikli (Botanist; Flora Permit SL012330) on 11 April 2019 in a small section of the survey area (0.9 ha adjacent to Twickenham Drive) with results provided in Astron (2019b). The survey was

undertaken in accordance with the requirements outlined in the Consultant Brief, dated 7 August 2019. A map depicting GPS track logs to attest to time and effort expended is included (Figure C.1, Appendix C). Bethea Loudon has over 20 years and Alexandra Sleep has over nine years of experience in undertaking flora and vegetation surveys throughout Western Australia, including the Swan Coastal Plain. Both team members are considered experienced and capable in field survey and are trained in plant identification.

The methods adopted for the flora and vegetation survey were formulated in accordance with the following regulatory guidance:

- Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority 2016a).
- Environmental Factor Guideline – Flora and Vegetation (Environmental Protection Authority 2016b).
- Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (Department of the Environment and Energy 2016a)
- Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community (Department of the Environment and Energy 2019a).

Information acquired during the desktop assessment assisted in the design of the field survey. Pre-survey planning involved the examination of satellite imagery to identify potentially different landforms, habitat and vegetation types.

Sampling was undertaken using a combination of quadrats of dimensions 10 m by 10 m as per regulatory expectations for Swan Coastal Plain floristic quadrats (Environmental Protection Authority 2016b) and relevés. As the vegetation of the survey area occurs along highly disturbed freeway edges, quadrats (11 in total) were only used to sample areas of intact remnant vegetation. Relevés (41 in total) were used to capture vegetation which has been planted, or areas which contained remnant vegetation which were too small to install a quadrat within. Three vegetation types had less than three quadrats recorded due to either restricted or fragmented occurrence within the survey area. The following was recorded from each quadrat and relevé:

- Location – coordinates measured using a handheld Global Position Systems (GPS) (MGA50, GDA94). One set of coordinates was taken from the north-west corner of each quadrat.
- Recorder and date – personnel involved in sampling that location and the survey date.
- Species – vascular plant species present, including weed species. Species that were not confidently identified during the field survey were collected for later identification.
- Foliar cover – the estimated percentage cover for each flora species.
- Vegetation description – vegetation types were described according to level 5 of the National Vegetation Information System (NVIS) using NVIS sub-association level for structural descriptions (Department of the Environment and Energy 2017).

- Vegetation condition – assessed according to the vegetation condition classification of Keighery (1994) as adapted in Environmental Protection Authority (2016a) (Table D.2, Appendix D).
- Habitat – a broad description of the surrounding landscape based on landform, topography and soil.
- Disturbance – records of any obvious disturbances such as fire, tracks, weed infestation, or grazing.
- Photographs – a photograph was taken of each quadrat.

Thirty-eight mapping notes were used to supplement quadrat and relevé data and included vegetation descriptions for mapping purposes. Vegetation types were described and mapped using data collected from quadrats, relevés and mapping notes. Vegetation condition was mapped using a combination of quadrat/relevé data, opportunistic observations and the mean condition rating for each vegetation type.

Habitats and vegetation types in the survey area considered to have the potential to support significant flora (based on previously recorded significant flora records and associated habitat preference information) were targeted in the field to record the presence or absence of significant flora.

3.2.1.1 Significant Vegetation Survey

Additional information was captured to assess the potential occurrence of the Tuart TEC and 'Banksia Woodlands of the Swan Coastal Plain ecological community' TEC (Banksia Woodlands TEC) as per the criteria outlined in the two Approved Conservation Advice documents (Department of the Environment and Energy 2016a, 2019a)and Main Roads Technical Guidance factsheets (Main Roads Western Australia 2017, 2020)

'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC

Potential patches identified in the desktop assessment were visited to ground truth the accuracy. To assist with the interpretation of the TEC and delineation of the patches, the location of all *Eucalyptus gomphocephala* (tuart) individuals observed during the field survey were recorded. The canopy boundary of each tree was mapped on field maps, including where these canopies extended beyond the edge of the survey area. Patch assessments were also undertaken in vegetation adjacent to the survey area to assist with interpretation of potential Tuart TEC within the survey area.

At least one patch assessment was carried out within each patch which was estimated to be >0.5 ha in the field (patches <0.5 ha are not considered to form part of the TEC (Department of the Environment and Energy 2019a)). The information recorded was used to define each patch as per the key diagnostic characteristics, condition categories and thresholds in the Approved Conservation Advice (Department of the Environment and Energy 2019a), to determine whether it is inferred to represent the TEC.

A total of 52 patch assessments were conducted on customised electronic forms. The following information was recorded at each patch assessment:

- name of patch assessment – each individual patch was given a unique identifier
- location – coordinates measured using a handheld GPS (MGA50, GDA94)
- recorder and date – personnel involved in sampling that location and the survey date
- habitat – a broad description of the surrounding landscape based on landform, topography and soil
- dominant weed species and total weed cover
- vegetation description – a broad field description to assist in defining the patch
- vegetation structure (woodland/open woodland/open forest/forest/scattered trees)
- approximate number of tuarts in the location of the patch assessment (it is difficult to determine the exact number of trees in some locations, however the main criteria is the presence of at least two living, established tuarts in the uppermost canopy layer as per the Approved Conservation Advice (Department of the Environment and Energy 2019a))
- other tree canopy species
- an inventory of understorey flora species
- evidence of regeneration of tuart trees and if so number of juveniles
- presence of large tuart trees (any tuart with a diameter at breast height (DBH) of 50 cm or greater)
- condition scale rating as per Table 2 of the Approved Conservation Advice (Department of the Environment and Energy 2019a)
- evidence of significant fauna.

Following the field survey, tuart canopy boundaries were digitised and buffered by 30 m using a geospatial program, and excluded areas, such as large roads, existing buildings and gardens, were removed (Department of the Environment and Energy 2019a, Main Roads Western Australia 2020). The freeway lanes and freeway on-ramps were considered to separate a patch based on their size (typically two lanes merging into one with cleared shoulder on each side). Separation of patches was determined using the 30 m buffering of tuart trees; where tree buffers overlapped, the polygon boundaries were dissolved to be one inclusive patch. However, if there was no overlap this indicated a distance of 60 m or greater between tuart canopies and therefore separate patches (Department of the Environment and Energy 2019a). Due to the post-survey buffering of tuart trees, some patches had multiple patch assessments undertaken. This ensured that smaller patches which may have been individually assessed in the field were assessed for prospective representation as the Tuart TEC due to their size and/or condition.

Some of the areas assessed are considered to be planted (based on examination of historical aerial imagery and species composition). The Approved Conservation Advice notes that revegetated areas and areas of regrowth can be part of the nationally protected ecological community if they meet key diagnostics and minimum condition thresholds (Department of the Environment and Energy 2019a). As such vegetation mapped as Planted Vegetation was included in the Tuart TEC assessment of the

survey area, however planted gardens and parks are considered to be excluded from the TEC (Main Roads Western Australia 2020).

'Banksia Woodlands of the Swan Coastal Plain' TEC

Data captured in quadrats and relevés was utilised to determine the presence of the Banksia Woodlands TEC based on the key diagnostic characteristics and condition thresholds listed within the Approved Conservation Advice (Department of the Environment and Energy 2016a) and Main Roads factsheet (Main Roads Western Australia 2017). Patch assessments were conducted to supplement quadrat data in areas dominated or co-dominated by *Banksia attenuata* and/or *Banksia menziesii*. Patch assessments were also undertaken in vegetation adjacent to the survey area, to assist with interpretation of sections within the survey area. A total of 13 Banksia Woodland patch assessments were conducted on customised electronic forms. The following information was recorded at each patch assessment (if applicable):

- location – coordinates measured using a handheld GPS (MGA50, GDA94)
- recorder and date – personnel involved in sampling that location and the survey date
- habitat – a broad description of the surrounding landscape based on landform, topography and soil
- dominant weed species and total weed cover
- vegetation description – a broad field description to assist in defining the patch
- vegetation structure (woodland/open woodland/open forest/forest/scattered trees)
- dominant low tree species
- low tree canopy cover
- tall overstorey species
- tall overstorey cover
- an inventory of understorey flora species
- condition scale rating as per Table 3 of the Approved Conservation Advice (Department of the Environment and Energy 2016a).

3.2.2 Targeted Black Cockatoo Assessment

The black cockatoo habitat assessment survey was undertaken by Astron Principal Scientist Dr Jessica Johnston and Senior Environmental Scientist John Trainer on 24 to 25 September 2019 and Senior Environmental Scientist David Keirle on 26 to 27 March 2020. Part of the survey area (8.6 ha) was previously surveyed by John Trainer on 10 April 2019 (Astron Environmental Services 2019a). Dr Jessica Johnston, David Keirle and John Trainer each have over 10 years of experience in conducting fauna assessments within the survey area's bioregion. The field team has previous experience in conducting surveys and specifically black cockatoo assessments on the Swan Coastal Plain. Survey effort is shown in Figure C.2 (Appendix C). The survey was completed in accordance with the requirements outlined in the Consultant Brief, dated 7 August 2019 as well as the EPA Technical

Guidance – Terrestrial Fauna Surveys (Environmental Protection Authority 2016c), EPA Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (Environmental Protection Authority 2016d) and the referral guidelines for three threatened black cockatoo species (Department of Sustainability Environment Water Population and Communities 2012).

Based upon the current distributions for the three threatened species of black cockatoo, only the Carnaby's cockatoo (*Calyptorhynchus latirostris*) (listed as both endangered under both the EPBC Act and BC Act) and forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) (listed as vulnerable under both the EPBC Act and the BC Act) are likely to occur within the vicinity of the survey area (Department of Sustainability Environment Water Population and Communities 2012). The current distribution for the Baudin's cockatoo (*Calyptorhynchus baudinii*) (listed as endangered under both the EPBC Act and the BC Act) does not occur on the northern Swan Coastal Plain (Department of Sustainability Environment Water Population and Communities 2012).

3.2.2.1 Foraging Habitat

To determine if the vegetation within the survey area constitutes foraging habitat for black cockatoos as specified under the referral guidelines, the flora were identified and compared with a list of known foraging species (Chapman 2007, Valentine and Stock 2008, Groom 2011) In addition, the ground was searched for any evidence of black cockatoo foraging, for example the chewed fruits of the marri (*Corymbia calophylla*).

3.2.2.2 Roosting Habitat

Based on the referral guidelines, night roosts for Carnaby's cockatoo typically occur in the tallest trees of an area, and usually close to an important water source and quality foraging habitat (Department of Sustainability Environment Water Population and Communities 2012). Forest red-tailed black cockatoos typically roost in tall trees within or at the edges of forests (Department of Sustainability Environment Water Population and Communities 2012). The survey area was surveyed for trees or stands of trees that matched these descriptions, and for any evidence of recent use as a roost site (feathers and droppings).

3.2.2.3 Breeding Habitat

To determine the breeding habitat classification of the site in accordance with the referral guidelines (Department of Sustainability Environment Water Population and Communities 2012), a habitat assessment of each tree was undertaken. Any tree species with a DBH of 50 cm or greater, or 30 cm or greater if salmon gum (*Eucalyptus salmonophloia*) or wandoo (*E. wandoo*), is classified as a mature tree with the potential for breeding hollows or to develop them in time (Department of Sustainability Environment Water Population and Communities 2012). Each mature tree was assessed for its breeding potential and the following data were recorded: location (using a differential GPS), tree species, DBH, overall height, presence of hollows and a photograph. Fifteen potential breeding trees identified during the survey were unable to be safely accessed. An approximate GPS location was taken at the time of survey and then the point was manually moved to the identified tree using aerial imagery in ArcGIS. An estimate of DBH and overall height was recorded and the tree was searched for hollows using binoculars. Hollows were assessed from ground level by an experienced observer and

classified according to guidance criteria. To determine if trees had suitable breeding hollows, the following criteria were used and recorded for each mature tree (based on Gibbons and Lindenmayer (2002)):

- height of the hollow in the tree
- minimum entrance width of a hollow
- diameter of the branch on which the hollow occurred
- whether the branch was living, part dead or dead
- whether the tree had multiple hollows
- evidence of any past or current breeding activity (observation of individuals, chewing around entrance of hollows, presence of feathers)
- evidence of current occupancy (observation of individuals, presence of feathers, feeding debris).

3.2.3 Taxonomy and Nomenclature

Plant specimens that were not identified in the field were identified and verified at the Western Australian Herbarium (WAHerb) by Bethea Loudon and Alexandra Sleep. The assigned nomenclature is consistent with the current listing of scientific names recognised by the WAHerb and was used for the species list and associated species information collected.

3.2.4 Floristic Analysis

Classification analysis of quadrat floristic data from the survey area was conducted to examine the relationship of the survey area quadrats with quadrats from the Swan Coastal Plain (SCP) dataset, and therefore SCP Floristic Community Types (FCTs). A number of TECs and PECs were defined by DBCA's Swan Coastal Plain floristic survey based on the resultant FCTs. (Gibson et al. 1994). Only quadrat data from the survey area was classified. Classification was not conducted on the relevé data which was sampled from planted vegetation.

The SCP dataset utilised comprises quadrat data from the original SCP survey (Gibson et al. 1994) and sites (quadrats and relevés) established subsequent to that survey (Keighery et al. 2012). The SCP dataset was accessed from *NatureMap*. Taxon nomenclature was updated where possible, including name changes based on recent taxonomic publications. Where taxa with informally-assigned names (e.g. potentially novel taxa, taxa with incomplete identification) had been vouchered at the WAHerb, these were updated with the current identification (Western Australian Herbarium 2019). Those taxa that are no longer considered to occur in Western Australia or the South-West by the WAHerb (Western Australian Herbarium 2019), or those where the recorded name is not listed on the census of Western Australian flora (and a current name could not be determined) were retained in the dataset.

The classification analysis method generally followed those presented in Gibson et al. (1994) to replicate the 1994 analysis. Annual and introduced (weed) taxa were included in the analysis, while

singletons (taxa recorded only once in the quadrat dataset) were removed prior to analysis. Taxa and infra-taxa were amalgamated as outlined in Appendix 3 of Gibson et al. (1994).

A number of taxa from the survey area data were amalgamated with entities from the SCP dataset to align to infra-taxa level. Taxa where identification was unclear due to poor available material and opportunistic taxa (those recorded outside and within the vicinity of a quadrat) were removed from the dataset prior to analysis. All taxa removed from and grouped in the classification analysis (excluding singletons) are presented in Appendix E, Table E1.

An initial analysis incorporating all 11 survey area quadrats was undertaken, followed by a single site insertion approach whereby each quadrat was analysed individually with the SCP dataset to further define their relationship to the SCP FCTs. Quadrats from the April 2019 survey (Astron Environmental Services 2019b) were not included in the FCT analysis as these were not considered to represent intact remnant vegetation.

A single-layer matrix containing presence/absence data was processed utilising PATN (V4) (Belbin and Collins 2019) to perform the classification and ordination analysis of the floristics. The parameters as used in the classification analysis of the SCP floristic survey (Gibson et al. 1994) were applied:

- Bray-Curtis coefficient (to generate an association matrix, consisting of pairwise coefficients of similarities between quadrats based on floristic data).
- Agglomerative hierarchical clustering using flexible Unweighted Pair Group Method with Arithmetic Mean (UPGMA) (ß=-0.1) (to generate a quadrat classification dendrogram) (Sneath and Sokal 1973).

The resulting dendrograms of the classification analyses were then reviewed to determine which SCP quadrats and therefore FCTs the survey area quadrats were mostly closely related to.

3.2.5 Determination of Planted and Remnant Native Vegetation

Much of the survey area has been previously disturbed and subject to landscaping or revegetation with infill planting of a range of different species, including locally native species (for example *Acacia rostellifera*), native species occurring outside of the their native range (for example *Melaleuca nesophila*), non-native species and commercially available cultivars (for example *Eucalyptus sideroxylon* (red ironbark), a species native to eastern Australia). Although significant ground disturbance would have occurred with the original construction of the freeway, there are small areas of remnant vegetation that persist. It was difficult to determine these areas in some instances as the planted vegetation contained species that would occur naturally in the area, and previously disturbed areas may have had a retained seedbank from the original disturbance.

In order to map out areas of remnant vegetation, aerial imagery from immediately post freeway construction were examined (1989 and 1985 for the southern section and 2000 for the northern section) and combined with on-ground observations looking for: evidence of vegetation clearing, indicators of original vegetation types such as *Xanthorrhoea preissii* and small sedge species such as *Mesomelaena* and *Lepidosperma*, as well as visual examination of adjacent areas of vegetation for structural formation.

To determine whether individual flora species occurred naturally in the area, distribution information was obtained from FloraBase (Western Australian Herbarium 2019). Where a species naturally occurred in the area (according to FloraBase) but was recorded in planted vegetation (for example in areas previously cleared and not adjacent to any remnant vegetation), or growing as part of a structural formation not considered to be consistent with local remnant vegetation it was considered to be planted, but also potentially native to the area.

3.3 Limitations

Following completion of the desktop assessment and field surveys, a review of any limitations that may have affected a complete assessment of the data collected was conducted. The limitations listed in Table 8 are based on those suggested as considerations in Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority 2016a).

Table 8: Statement of limitations.

Potential limitation	Limitation (None/minor/requires consideration)	Statement regarding potential limitations
i) Availability of contextual information at a regional and local scale	None	The vegetation types of the Swan Coastal Plain (north of Pinjarra) were mapped by Beard at a scale of 1:250,000 in the 1960s and 1970s (later digitised) with the entire area later mapped at a scale of 1:1,000,000 (Beard 1979). Vegetation complexes of the Swan Coastal Plain (south of Lancelin) have been mapped at a scale of 1:250,000 and compiled into a dataset (Department of Biodiversity, Conservation and Attractions 2018). The majority of the Swan Coastal Plain was described by Heddle, Loneragan and Havell (1980) with the far southern section completed by Webb et al (2016). Contextual information is therefore not a limiting factor for this survey. The movements and habitat requirements of the black cockatoo species are well documented, in particular their presence on the Swan Coastal Plain. Therefore, contextual information is not a limiting factor for this survey.
ii) Competency/ experience of the team carrying out the survey, including experience in the bioregion surveyed	None	Bethea Loudon has over 20 years of experience and Alexandra Sleep has over nine years of experience in undertaking flora and vegetation surveys throughout Western Australia, including the Swan Coastal Plain. Both team members are considered experienced and capable in field survey and are trained in plant identification. Dr Jessica Johnston, David Keirle and John Trainer have over 10 years of experience in conducting fauna assessments within the survey area's bioregion. The field team has previous experience in conducting surveys and specifically black cockatoo assessments on the Swan Coastal Plain.
iii) Proportion of flora/fauna recorded and/or collected, any identification issues	None	A total of 217 flora species were recorded from the survey area, seven specimens were unable to be identified to species level, however none are considered to be significant species. The proportion of flora recorded was not considered to be a limiting factor for this survey. The fauna survey considered black cockatoos only rather than a census of all fauna present and hence no taxonomic groups were considered to be under-represented during the survey.
iv) Was the appropriate area fully surveyed (effort and extent)	None	The survey area was considered adequately surveyed to compile a representative list of species, (including significant flora and introduced flora), as well as describe and map vegetation at a level appropriate for management decisions. The survey was considered complete and adequate for a targeted black cockatoo assessment of this survey area. Tree hollows were assessed only from ground level.

Potential limitation	Limitation (None/minor/requires consideration)	Statement regarding potential limitations
v) Access restrictions within the survey area	Minor	The majority of the survey area was able to be accessed by vehicle and traversed by foot. Sections of the survey area in the middle of the freeway were unable to be accessed on foot; where possible these were observed from vantage points on overpass bridges. This is not considered to be a significant limitation to the survey as visual inspection of these areas from vantage points indicated that the floristic values of the central freeway areas are not significant and inspection of aerial imagery confirmed that the majority of these areas have been previously cleared. Fifteen potential black cockatoo breeding trees were unable to be safely accessed and a Differential GPS point was not obtained. An approximate GPS location was taken at the time of survey and then the point was manually moved to the identified tree using aerial imagery in ArcGIS. These trees were observed from vantage points and the DBH was estimated to determine if the trees were classified as potential habitat trees. Trees were examined using binoculars to search for possible hollows.
vi) Survey timing, rainfall, season of survey	Minor	The primary flora and vegetation survey was conducted in late September to early October. This is within the recommended survey timing for flora and vegetation surveys within the South-West botanical province (Environmental Protection Authority 2016a). Rainfall in the five months prior to survey was approximately 126.6 mm below average (Bureau of Meteorology 2019), however this is not considered to be a limiting factor for this survey. An additional area was surveyed in April 2020, this was outside the recommended survey timing for flora and vegetation surveys within the South-West botanical province (Environmental Protection Authority 2016a) and may represent a minor limitation for this portion of the survey area due to some annual and tuberous/cormous perennial species not being visible. The black cockatoo field survey was conducted during April 2019 (Astron Environmental Services 2019a), September 2019 and March 2020 which is considered an appropriate survey time for black cockatoos on the Swan Coastal Plain (Johnstone, Johnstone, and Kirkby 2010).
vii) Disturbance that may have affected the results of survey such as fire, flood or clearing.	Minor	Much of the survey area has been previously disturbed and subject to landscaping or revegetation with infill planting of a range of different species, including locally native species, native species occurring outside of their native range, non-native species and commercially available cultivars. This represents a limitation to the accuracy of the vegetation mapping, as there are some areas where overlap of remnant species with planted assemblages occurred. This also represents a limitation to the statistical analysis and determination of Swan Coastal Plain FCTs due to high levels of disturbance and low levels of floristic diversity in remnant vegetation. These disturbances did not affect the outcomes of the fauna survey.

4 Results and Discussion

4.1 Desktop Assessment

4.1.1 Significant Vegetation and Flora

A review of DBCA's TEC and PEC database and the EPBC Protected Matters Search Tool identified the presence of nine listed communities within 5 km of the survey area (Table 9). The survey area intersects the mapped buffer of the 'Banksia dominated woodlands of the Swan Coastal Plain IBRA region' DBCA priority 3 PEC, which is also listed as an EPBC Act TEC 'Banksia Woodlands of the Swan Coastal Plain'. The locations of the TECs and PECs in the vicinity of the survey area are mapped in Figure F.1 (Appendix F).

Table 9: Threatened and priority ecological communities previously recorded within 5 km of the survey area.

Ecological community description	State conservation status (BC Act or DBCA listing)	EPBC Act conservation status	Distance from survey area (km)
Banksia dominated woodlands of the Swan Coastal Plain IBRA region	PEC (priority 3)	TEC (endangered)	Survey area is within TEC buffer[1]
Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')	PEC (priority 3)	-	0.3 km from PEC buffer[1]
Northern Spearwood shrublands and woodlands ('floristic community type 24'). (Can be a component of the endangered Banksia Woodlands of the Swan Coastal Plain EPBC Act listed TEC)	PEC (priority 3)	-	0.7 km from PEC buffer[1]
Callitris preissii (or *Melaleuca lanceolata)* forests and woodlands, Swan Coastal Plain ('floristic community type 30a')	TEC (vulnerable)	-	0.4 km from TEC buffer[1]
Banksia attenuata woodlands over species rich dense shrublands ('floristic community type 20a')	TEC (endangered)	TEC (endangered)	3.2 km from TEC buffer[1]
Southern *Eucalyptus gomphocephala – Agonis flexuosa* woodlands ('floristic community type 25') (can be a component of the endangered *Banksia* Woodlands of the Swan Coastal Plain or Tuart Woodlands of the Swan Coastal Plain EPBC listed TECs)	PEC (priority 3)	-	1.2 km from PEC buffer[1]
Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')	PEC (priority 3)	-	3.9 km from PEC buffer[1]
Banksia Woodlands of the Swan Coastal Plain	-	TEC (endangered)	Community likely to occur within area[2]

Ecological community description	State conservation status (BC Act or DBCA listing)	EPBC Act conservation status	Distance from survey area (km)
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain	-	TEC (critically endangered)	Community likely to occur within area[2]

Source: [1] DBCA TEC and PEC database; [2] EPBC Protected Matters Search Tool

The desktop assessment for the presence of the Tuart TEC identified 16 potential patches, ranging in size from 0.1 ha to 4.9 ha, of which six patches were estimated to be < 0.5 ha in area.

Database search results identified 14 significant flora species within a 5 km radius of the survey area. This included one threatened (T), three priority (P) 1, two P2, seven P3 and one P4 species. *Jacksonia sericea* P4 has been previously recorded within the survey area, no threatened or other priority flora have been previously recorded within the survey area. The locations of significant flora listed in the database search results are mapped in Figure F.1 (Appendix F).

Of the remaining 13 P flora species listed in the database search results, five were considered likely to occur, three had the potential to occur and the remaining five were considered unlikely to occur in the survey area based on pre-survey assessment of previous location and preferred habitat information (Table G.1 Appendix G).

4.1.2 Environmentally Sensitive Areas

No Environmentally Sensitive Areas (ESAs) intersect the survey area. The survey area is located within the buffer of the Banksia Woodlands TEC (which is also listed as a P3 PEC). While this TEC is federally listed under the EPBC Act, it is not listed as a TEC under State legislation and is therefore not included as an ESA. The Woodvale Nature Reserve (incorporating the Wanneroo Research Station) occurs adjacent to the survey area and there are a further 37 ESAs located within a 5 km radius of the survey area (Table 10).

Table 10: Environmentally Sensitive Areas located within 5 km of the survey area.

Name	ESA criteria	Distance from survey area (km)
Callitris preissii (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain ('floristic community type 30a')	Threatened ecological community (State listed)	0.4
Banksia attenuata woodlands over species rich dense shrublands ('floristic community type 20a')		3.4
Marianthus paralius	Threatened flora (State listed)	4.3 and 0.5
Joondalup Lake	Defined wetland: nationally important wetland	1.1

Name	ESA criteria	Distance from survey area (km)
Little Carine Swamp	Defined wetland: conservation category wetland	0.2
Big Carine Swamp		0.8
Lake Joondalup		1.1
Beenyup Swamp		1.4
Wallubuenup Swamp		1.8
Lake Goolelal		2.1
Lake Gwelup		2.8
Unnamed		3.3
Star Swamp		3.6
Pauls Swamp		4.1
407 – Woodvale Nature Reserve, Woodvale	Bush Forever sites	0
303 – Whitfords Avenue Bushland, Craigie/Padbury		0.03
203 – Carine Swamps, Carine		0.1
39 – Shepherds Bush Reserve, Kingsley		0.6
299 – Yellagonga Regional Park, Wanneroo/Woodvale/Kingsley		0.9
202 – Warwick Open Space Conservation Area		1.5
Site numbers 212, 204, 325, 383, 164, 308, 328, 469, 471, 327 and 322		2 to 5
Wanneroo Research Station	Register of the National Estate	0
Lake Joondalup Reserves		1.2
Star Swamp Area		2.8
Reserve 20091 (1978 Boundary)		3.1
Neerabup National Park		3.6
Trigg -Karrinyup Reserve and Dune System		3.6

4.1.3 Conservation Significant Vertebrate Fauna

Results of the database searches indicate that 37 vertebrate species of conservation significance, including four reptile species, 25 bird species and eight mammal species potentially occur within the vicinity of the survey area and are mapped in Figure F.2 (Appendix F). However, 13 of these were marine/pelagic species that are not relevant to the habitats present. As such, their records were omitted from the desktop assessment. Of the remaining 24 species, four species were considered to have a 'high' pre-survey likelihood of occurrence, two species were considered to have a 'moderate' likelihood and 18 species were considered to have a 'low' likelihood of occurrence (Table F.2, Appendix F).

4.1.3.1 Black Cockatoos

Foraging Habitat

The threatened and priority fauna database search returned a total of 618 records for Carnaby's cockatoo and six records for the forest red-tailed black cockatoo within 5 km of the survey area (Department of Biodiversity, Conservation, and Attractions 2019b) (Figure F.1, Appendix F).

Results from the NatureMap database search provided five records of forest red-tailed black cockatoos, three records of Baudin's Cockatoos and 950 records of Carnaby's cockatoos within a 5 km radius of the survey area (Department of Biodiversity, Conservation, and Attractions 2019a) (Appendix F).

The records of Baudin's cockatoo although relatively recent, are outside the current suggested distribution of this species (Department of Sustainability Environment Water Population and Communities 2012) and may represent misidentifications. As such, this species was classified as having a 'low' likelihood of occurrence in the survey area. Forest red-tailed black cockatoo and Carnaby's cockatoo have been identified as occurring in, or within proximity to the survey area and both species were classified as having a 'high' likelihood of occurrence in the survey area (inclusive of species recorded during the current survey).

Roosting Habitat

No black cockatoo roost sites are known within the survey area, with the closest confirmed roost site occurring in Warwick, approximately 2.3 km east of the southern portion of the survey area (Department of Biodiversity, Conservation, and Attractions 2019b). An additional two confirmed roost sites (at North Beach and Joondalup) and two unconfirmed roost sites have been recorded within 6 km of the survey area (Department of Biodiversity, Conservation, and Attractions 2019b). An extended search radius of 6 km was used for roosting habitat because black cockatoos usually forage within 6 km of a night roost (Department of Sustainability Environment Water Population and Communities 2012).

Breeding Habitat

According to the referral guidelines the survey area occurs outside of the current breeding range for all three black cockatoo species (Department of Sustainability Environment Water Population and Communities 2012). One possible breeding area for Carnaby's cockatoo overlapped the southern portion of the 5 km desktop study area (Department of Biodiversity, Conservation, and Attractions 2019b).

4.2 Flora and Vegetation Survey

4.2.1 Seasonal Conditions

Rainfall and temperature observations recorded from Perth Airport weather station (Bureau of Meteorology station number 009021) were used to describe local rainfall and temperatures in the 12 months preceding the September/October 2019 survey (Figure 2). A total of 533.0 mm of rainfall was received in this period; 228.2 mm below the long-term mean of 761.2 mm (1944 to 2019) (Bureau of Meteorology 2019). Winter rainfall in 2019 was approximately 36.8 mm below the long-term

average for the same period, and rainfall in the five months prior to the 2019 survey was approximately 36.8 mm below average. The mean maximum temperature for the month preceding the 2019 survey (August 2019) was 1.6°C above the long-term average for this month (29.7°C) (1944 to 2019) (Bureau of Meteorology 2019). Rainfall during the five months prior to the March/April 2020 survey was 12.6 mm below average. The mean maximum temperature for the month preceding the 2020 survey (March 2020) was 0.6°C above the long-term average for this month (39.7°C) (1944 to 2019) (Bureau of Meteorology 2019).

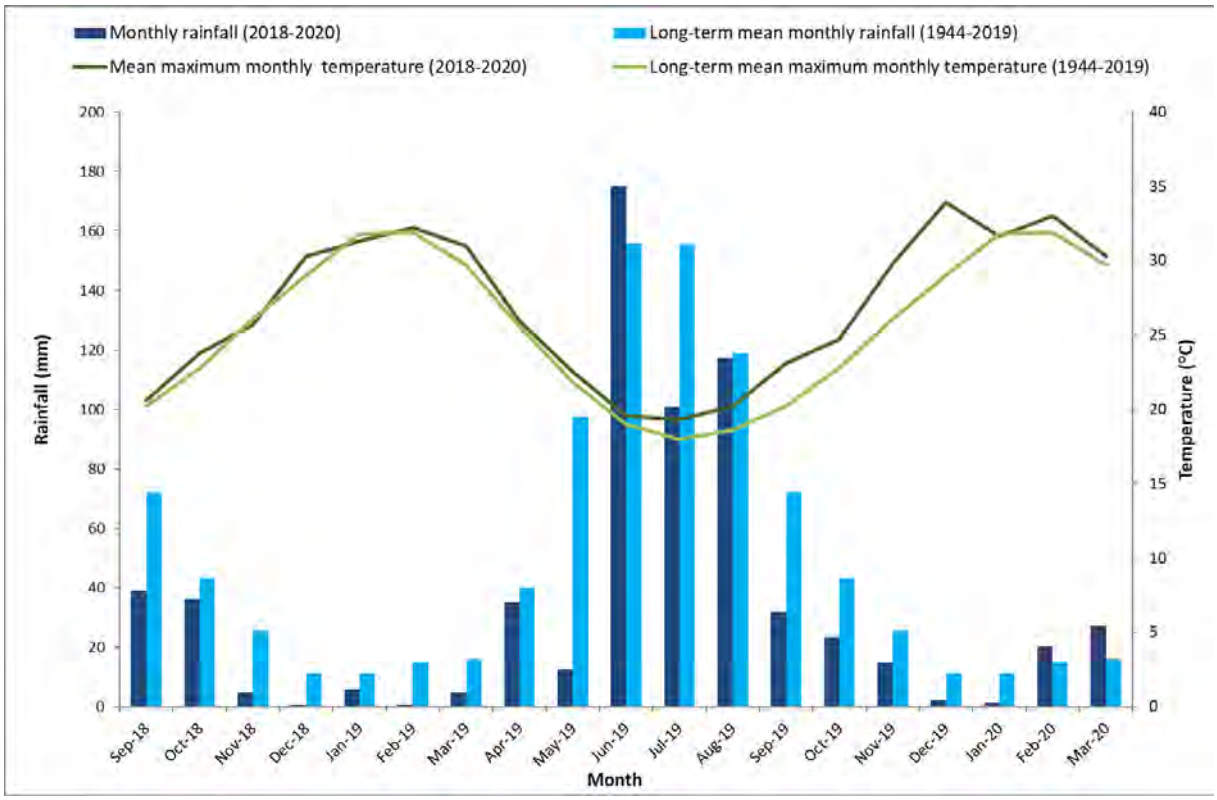


Figure 2: Long-term mean monthly rainfall (mm) (1944 to 2019) and total recorded monthly rainfall (mm) September 2018 to March 2020 at Perth Airport weather station (009021); and long-term mean monthly maximum temperatures (°C) (1944 to 2019) and monthly maximum temperatures (°C) (September 2018 to March 2020) at Perth Airport weather station (009021) (Bureau of Meteorology 2020).

4.2.2 Vegetation

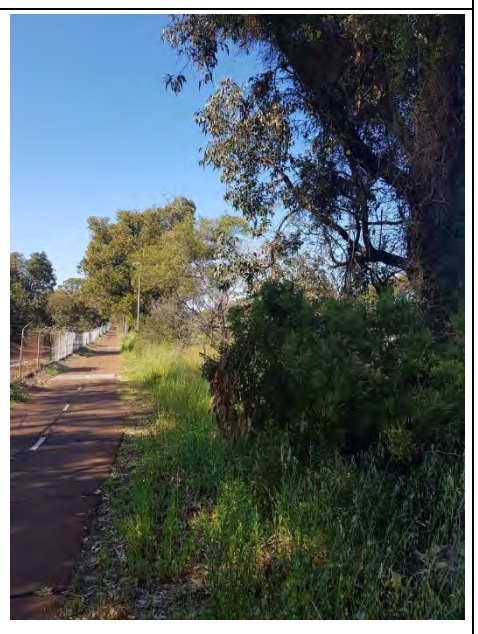
4.2.2.1 Vegetation Types

Based on the structural and floristic characteristics observed in the field, five remnant vegetation types were recorded in the survey area. This included one *Banksia* woodland, two *Eucalyptus marginata* (jarrah) woodlands and two *Eucalyptus gomphocephala* (tuart) forests. Remnant vegetation types were mapped across 10.6 ha (21%) of the survey area. The remaining 39 ha of the survey area was either cleared (7.2 ha, 15%) or planted vegetation (31.8 ha, 64%). Descriptions and representative photographs for vegetation types are presented in Table 11. Vegetation type mapping is provided in Figure H.1, Appendix H and quadrat/relevé data is presented in Appendix I.

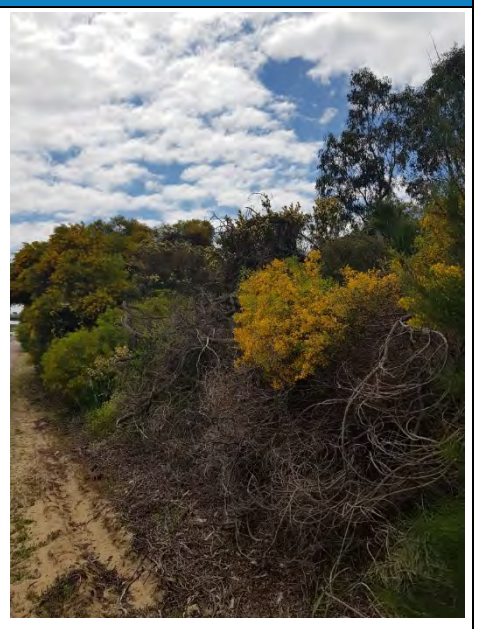
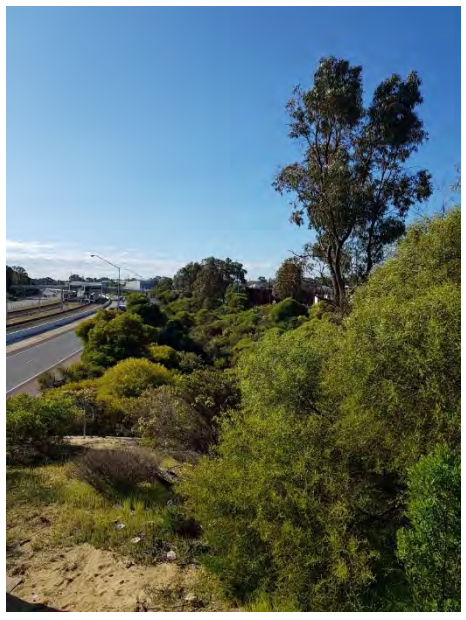
The vegetation types, Jarrah Woodland 2, and Tuart Forest 1 and Tuart Forest 2 are analogous with the pre-European vegetation associations Spearwood 6 and Spearwood 998 respectively, as identified

in Section 2.2.3. No extant areas of the Guilderton 1007 vegetation association were recorded within the survey area.

Table 11: Vegetation types described for the survey area.

Vegetation units and description	Site(s)	Range of vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Banksia Woodland *Allocasuarina fraseriana* and *Banksia attenuata* low open woodland over *Banksia sessilis* and *Jacksonia sternbergiana* tall open shrubland over *Xanthorrhoea preissii* and *Olearia axillaris* sparse mid shrubland over *Hibbertia hypericoides*, *Synaphea spinulosa* and *Tricoryne elatior* low shrubland over *Mesomelaena pseudostygia*, *Conostylis aculeata* subsp. *aculeata* and *Alexgeorgea nitens* sparse sedgeland over *Ehrharta calycina* and *Avena fatua* sparse tussock grassland.	MFQ-06	Good to Completely Degraded	0.28 (1%)	 **Plate 1: Banksia Woodland**
Jarrah Woodland 1 *Eucalyptus marginata, Allocasuarina fraseriana* and *Banksia attenuata* mid open forest to low woodland over *Xanthorrhoea preissii* (+/- *Jacksonia sternbergiana/Allocasuarina humilis*) mid open shrubland over *Hibbertia hypericoides* low open shrubland over *Mesomelaena pseudostygia* and/or *Lepidosperma calcicola* and/or *Desmocladus flexuosus* sparse sedgeland over a tussock grassland of introduced grasses.	MFQ-02 MFQ-07 MFQ-08 MFR-04 MFR-42	Good to Completely Degraded	0.80 (2%)	 **Plate 2: Jarrah Woodland 1**
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.	MFR-06 MFR-08 MFR-10	Degraded to Completely Degraded	0.63 (1%)	 **Plate 3: Jarrah Woodland 2**

Vegetation units and description	Site(s)	Range of vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Tuart Forest 1 *Eucalyptus gomphocephala* mid open forest over *Acacia cochlearis* and *Acacia xanthina* tall open shrubland over *Xanthorrhoea preissii* and *Templetonia retusa* mid open shrubland over *Oxalis pes-caprae*, *Pelargonium capitatum* and *Gazania linearis* forbland over *Ehrharta calycina, Avena fatua* and *Ehrharta longiflora* open tussock grassland.	MFQ-01 MFR-01 MFR02	Degraded to Completely Degraded	0.42 (1%)	 Plate 4: Tuart Forest 1
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.	MFQ-03 MFQ-04 MFQ-05 MFR-16 MFR-18 MFR-20 MFR-22 MFR-24 MFR-26 MFR-28 MFR-36 MF5Q-01 MF5Q-02 MF5Q-03 MF5R-02 MF5R-03 MF5R-04 MF5R-05 MF5R-06 MF5R-08 MF5R-09 MF5R-10 MF5R-11 MF5R-13 MF5R-14	Good to Completely Degraded	8.43 (17%)	 Plate 5: Tuart Forest 2

Vegetation units and description	Site(s)	Range of vegetation condition	Total area (ha) (proportion of survey area (%))	Representative photograph
Planted Vegetation	MFR-02 MFR-03 MFR-12 MFR-14 MFR-30 MFR-32 MFR-34 MFR-38 MFR-40 MFRAS-05 MF5R-01 MF5R-07 MF5R-12 MF5R-15 MF5R-16	Completely Degraded - Planted	31.80 (64%)	 **Plate 6: Planted Vegetation**  **Plate 7: Planted Vegetation**
Completely Cleared	NA	Cleared	7.22 (15%)	NA

4.2.2.2 Vegetation Condition

Remnant vegetation in the survey area was in Good to Completely Degraded condition. Planted vegetation is mapped separately as Completely Degraded – Planted (Table 12, Figure J.1, Appendix J). More than 60% of the vegetation in the survey area is considered to be planted. Where remnant vegetation did occur, the majority was considered to be Completely Degraded, consisting only of remnant trees or scattered remnant trees over an understorey of weeds and planted species. It is expected that the quality of these remnants has declined over time as they are subject to significant edge effects being very narrow and linear in nature. Degrading factors noted within the survey area included:

- 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 species richness and loss of 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.

Table 12: Vegetation condition recorded for the survey area.

Vegetation condition	Total mapped area within the survey area (ha)	Proportion of survey area (%)
Good	0.4	<1
Good to Degraded	0.5	<1
Degraded	1.3	3
Degraded to Completely Degraded	2.5	5
Completely Degraded	5.9	12
Completely Degraded – Planted	31.8	64
Completely Cleared (e.g. firebreaks, footpaths, roads)	7.2	15
Total	**49.6**	**100**

4.2.2.3 Floristic Analysis

The 11 quadrats sampled from the survey area had greatest similarity to SCP FCTs S11, 24 and 28 (Table 13). A dendrogram for the analysis containing all 11 quadrats, and individual dendrograms for each quadrat (single insertion method) are presented in Appendix K. All areas of native vegetation captured by the quadrats are small patches which are degraded to some degree with high levels of weeds, subject to extensive edge effects and modification, and low native species richness, therefore statistical results are not conclusive.

Table 13: Results of FCT analysis.

Quadrat	All survey area quadrats	Single site insertion	Final determination	Description
MFQ-01	S11	S11	S11	Northern *Acacia rostellifera* – *Melaleuca acerosa* shrublands
MFQ-02	28	28	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MFQ-03	24	24	24	Northern Spearwood shrublands and woodlands (PEC)
MFQ-04	28 [weak association]	S15 (S11, 24)	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MFQ-05	28 [weak association]	28	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MFQ-06	24	24	24	Northern Spearwood shrublands and woodlands (PEC)
MFQ-07	28 [weak association]	28	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MFQ-08	28	28	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MF5Q-01	28 [weak association]	28	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MF5Q-02	28 [weak association]	25, S15	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands
MF5Q-03	28 [weak association]	28, S09	28	Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands

Northern Spearwood Shrublands and Woodlands (FCT 24) PEC

Quadrats MFQ-03 (vegetation type Tuart Forest 2) and MFQ-06 (vegetation type Banksia woodland) showed greatest similarity to FCT 24 Northern Spearwood shrublands and woodlands based on species composition (Table 13). This priority 3 PEC which can also be a component of the endangered Banksia Woodlands TEC (Department of Biodiversity, Conservation and Attractions 2019f) is described as:

> 'Heaths with scattered *Eucalyptus gomphocephala* occurring on deeper soils north from Woodman Point. The heathlands in this group typically include *Banksia sessilis, Calothamnus quadrifidus* and *Schoenus grandiflorus*' (Department of Biodiversity, Conservation and Attractions 2019f).

Both MFQ-03 and MFQ-06 were recorded as having significantly different structural composition to FCT 24 and were not characterised by heathland (summarised in Table 14). In the field the vegetation of MFQ-06 visually represents a *Banksia attenuata/Allocasuarina fraseriana* open woodland, with plants of *Banksia sessilis* and *Olearia axillaris* infiltrating the vegetation from adjacent plantings. When these two taxa are removed from the single insertion analysis of MFQ-06, the vegetation has an

association with FCT 28 (Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands), indicating that their presence influences the grouping of this quadrat. As such these two sites are not considered to represent the P3 Northern Spearwood shrublands and woodlands PEC.

Table 14: Comparison of structural formations with FCT 24.

Structural formation class	FCT 24	MFQ-03	MFQ-06
Overstorey	Scattered *Eucalyptus gomphocephala*	*Eucalyptus gomphocephala* and *Eucalyptus marginata* mid open forest	*Allocasuarina fraseriana* and *Banksia attenuata* low open woodland
Mid-layer	*Banksia sessilis, Calothamnus quadrifidus* heathland	*Xanthorrhoea preissii*, *Acacia rostellifera* and *Jacksonia sternbergiana* mid open shrubland.	*Banksia sessilis* and *Jacksonia sternbergiana* tall open shrubland over *Xanthorrhoea preissii* and *Olearia axillaris* sparse mid shrubland

Spearwood *B. attenuata* or *B. attenuata* – *Eucalyptus* woodlands (FCT 28)

All eight quadrats determined by the results of the analyses as representing FCT 28, were considered to represent FCT 28 based on the presence of key native taxa such as *Eucalyptus marginata*, *Banksia attenuata*, *Allocasuaring fraseriana*, *Desmocladus flexuosus*, *Hibbertia hypericoides*, *Xanthorrhoea preissii*, *Gompholobium tomentosum*, *Mesomelaena pseudostygia*, *Lepidosperma calcicola*, *Burchardia congesta* and *Lomandra hermaphrodita*. Similarly, the land system of the survey area correlates with that on which FCT 28 occurs, the Spearwood system.

In most instances, the results of the single insertion analyses showed the survey area quadrats aligned with groups of SCP FCT 28 quadrats (compared to single quadrats), indicating a higher level of confidence in relationship. The single insertion method showed affiliations with other FCTs for MFQ-04 and MF5Q-02, reflecting the degree of degradation and low native taxa composition of these two sites. A review of the remnant native taxa recorded within these quadrats was undertaken and the vegetation determined as aligning with FCT 28.

Northern *Acacia rostellifera* – *Melaleuca acerosa* shrublands (FCT S11)

FCT S11 occurs on upland areas centred on the Spearwood and Quindalup dunes with an average species richness of 21 taxa (Department of Environmental Protection 2000).

The vegetation represented by MFQ-01 is highly disturbed (Degraded-Completely Degraded condition), consisting mainly of introduced species (Appendix I). The low diversity of native taxa would have affected the grouping of this quadrat within the broader SCP dataset. In both analyses, MFQ-01 grouped with SCP quadrats m4601 and m4602 (Appendix K) both of which also have low native taxa presence and neither of which contain *Melaleuca acerosa* (now *M. systena*). All 14 SCP quadrats representing S11 occur close to the coast (Gibson et al. 1994).

The absence of *Acacia rostellifera* and *M. systena* in addition to the presence of *A. cochlearis* and *A. xanthina*, and its position low in the landscape, would likely exclude MFQ-01 from representing FCT

S11 (in the absence of any detailed information). However, it is difficult to ascertain with any level of certainty which other FCT MFQ-01 would better represent due to its degraded condition.

4.2.2.4 Significant Vegetation

Two State listed PECS and two Commonwealth listed TECs occur within the survey area as detailed in the following sections.

Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain PEC

The defining characteristics of the Tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain PEC (Tuart PEC) are that it primarily occurs on the Spearwood or Quindalup dunes between Jurien Bay and Sabina River, with tuart the key dominant canopy species, but it may comprise a variety of flora and fauna assemblages (Department of Biodiversity, Conservation and Attractions 2019f). Based on this information, vegetation types Tuart Forest 1 and Tuart Forest 2 are inferred to represent this PEC having tuart present as a dominant canopy species and occurring on the Spearwood dunes. An area of 8.8 ha has been mapped in the survey area as this PEC, ranging in condition from Good to Completely Degraded (Figure L.1.1 to L.1.13, Appendix L). A Threatened and Priority ecological community report form for the Tuart PEC occurrences is presented in Appendix L.

Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC

A total of 33 tuart patches were mapped within the survey area (Table 15 and Figure L.2.1 to L.2.16, Appendix L). In all, a total of 44.6 ha was mapped as the Tuart TEC, of which 11.7 ha was recorded within the survey area. Two patches (TP05 and TP20) were inferred to represent the EPBC Act listed Tuart TEC as they are >5 ha in size irrespective of understorey condition. As patch boundaries are considered to be 30 m from the outer canopy, the areas mapped as TEC incorporate non-vegetated and narrow paved areas such as footpaths in some places. Where hardscapes such as the Mitchell Freeway (including on-ramps), gardens or extensive cleared areas were present that were considered to significantly alter the overall function of the ecological community, such areas have been excluded from patches (Main Roads Western Australia 2020).

Patch assessments and photographs are presented in Table L.3 (Appendix L). Locations of patch assessments are mapped in Figure L.2.1 to L.2.16 (Appendix L). A Threatened and Priority ecological community report form for the Tuart TEC occurrences is presented in Appendix L.

Table 15: Tuart woodlands and forests of the Swan Coastal Plain TEC patch assessment.

Patch number	Patch assessments	Patch size (ha)	TEC condition category[1]	Part of TEC	Criteria/comments
TP01	Not assessed	0.3	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP02	Not assessed	0.3	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP03	Not assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP04	MFT-01	1.6	Poor	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered Moderate to Poor
TP05	Not assessed	0.47	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP06	MFT-02	1.7	Poor to Moderate	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered Moderate to Poor
TP07	Not assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP08	Not assessed	0.1	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP09	Not assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP10	Not assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP11	Not assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP12	MFT-03, MFT-40, MFT-41, MFT-42, MFT-04, MFT-06, MFT-05, MFT-07, MFT-08, MFT-09, MFT-10, MFT-11, MFT-12, MFT-13	35.2 (3.3 ha within survey area)	Poor to Very High	Yes	All patches of 5 ha or greater that meet the key diagnostic characteristics (Table L.1, Appendix L) are part of the TEC.

Patch number	Patch assessments	Patch size (ha)	TEC condition category[1]	Part of TEC	Criteria/comments
TP15	Not assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP16	Not assessed	0.1	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP17	Not assessed	0.6	Poor	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (TableL.1, Appendix L), this patch is considered to be in Poor condition. No patch assessment was undertaken here due to the location in the middle of the freeway, however it was observed to be tuart trees with no understorey.
TP18	Not assessed	0.1	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP19	MFT-18, MFT-20	1.8	Poor	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.
TP20	MFT-19, MFT-21, MFT-22, MFT-23, MFT-24, MFT-25, MFT-26, MFT-27, MFT-28, MFT-29, MFT-30, MF5T-02	9.4 (8.4 ha within survey area)	Poor to Moderate	Yes	All patches of 5 ha or greater that meet the key diagnostic characteristics (TableL.1, Appendix L) are part of the TEC.
TP21	MFT-31, MFT-32, MF5T-03	2.3	Poor	No	A patch of this size needs to be at least Moderate condition with either an important landscape role, habitat role or show regeneration as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.

Patch number	Patch assessments	Patch size (ha)	TEC condition category[1]	Part of TEC	Criteria/comments
TP22	MFT-33	0.8	Poor	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.
TP23	Not assessed	0.1	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP24	MFT-35, MFT-36	0.4	Poor	No	Less than 0.5 ha, therefore not representative of the TEC
TP25	MFT-37, MF5T-06 MF5T-05 MF5T-04	3.2	Poor to Moderate	No	A patch of this size needs to be at least Moderate condition with either an important landscape role, habitat role or show regeneration as per the condition categories and thresholds (Table L.1, Appendix L). 1.3 ha of this patch is in poor condition and is therefore not considered in the assessment (Main Roads Western Australia 2020). The remaining 1.9 ha is considered to be in Moderate condition; when considered separately (Main Roads Western Australia 2020) a patch of this size (< 2 ha) needs to have an understorey in high condition.
TP26	MFT-38	0.1	Poor	No	Less than 0.5 ha, therefore not representative of the TEC
TP27	None assessed	0.2	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP28	None assessed	0.4	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP29	None assessed	0.8	NA	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.

Patch number	Patch assessments	Patch size (ha)	TEC condition category[1]	Part of TEC	Criteria/comments
TP30	MFT-15, MFT-16, MFT-17	1.5	Poor	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.
TP31	MFT-34	0.6	Poor	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.
TP32	None assessed	0.1	NA	No	Less than 0.5 ha, therefore not representative of the TEC
TP33	MF5T-07 MF5T-08 MF5T-09	0.9	NA	No	A patch of this size needs to be High or Very High condition as per the condition categories and thresholds (Table L.1, Appendix L), this patch is considered to be in Poor condition.
TP34	None assessed	0.48	Poor	No	Less than 0.5 ha, therefore not representative of the TEC
TP35	None assessed	0.14	Poor	No	Less than 0.5 ha, therefore not representative of the TEC

1 – Department of Environment and Energy (2019a)

Banksia dominated woodlands of the Swan Coastal Plain IBRA region PEC

The Banksia dominated woodlands of the Swan Coastal Plain IBRA region PEC (Banksia Woodlands PEC) is mostly dominated or co-dominated by *Banksia attenuata* and/or *Banksia menziesii* and occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally Quindalup sands (Department of Biodiversity, Conservation and Attractions 2019f). Vegetation type Banksia Woodland is inferred as representing this PEC, along with sections of vegetation types Jarrah Woodland 1 and Jarrah Woodland 2 where *B. attenuata* and/or *B. menziesii* is dominant or co-dominant or inferred to have been dominant prior to disturbance. An area of 1.3 ha of Banksia Woodlands PEC has been mapped within the survey area, ranging in condition from Good to Completely Degraded (Figure L.1.1 to L.1.13, Appendix L). A Threatened and Priority ecological community report form for the Banksia Woodlands PEC is presented in Appendix L.

Banksia Woodlands of the Swan Coastal Plain TEC

Vegetation types Banksia Woodland, Jarrah Woodland 1 and Jarrah Woodland 2 have affinities to the Banksia Woodlands TEC; quadrats within these vegetation types are most closely related to FCTs 28 and 24, which are considered to represent the Banksia Woodlands TEC (Department of the Environment and Energy 2016a). In some places within these vegetation types, the cover of *Eucalyptus marginata* may be too high to be considered emergent trees[1] over a dominant layer of *Banksia* species, as stated in the Approved Conservation Advice (Department of the Environment and Energy 2016a). The poor condition and fragmented nature of the remnant vegetation within the survey area contributes to difficulty in clearly defining the TEC in these areas.

To be considered as part of the EPBC Act ecological community a patch is required to meet at least the Good condition category, and where a patch is in Good condition it must be a minimum of 2 ha in area. Smaller patch sizes (0.5 ha to 1 ha) may represent the TEC however the condition must be in Very Good or Excellent condition (Table L.2, Appendix L) (Department of the Environment and Energy 2016a). Table 16 presents the outcomes of the patch assessments undertaken for the presence of the Banksia Woodlands TEC within the survey area.

None of the Banksia Woodland vegetation type mapped within the survey area meets the minimum size requirements or separation distance to be considered part of the EPBC Act Banksia Woodlands TEC, despite being in Good condition in part. Two areas of Jarrah Woodland 1 and Jarrah Woodland 2 were assessed for their potential to represent the Banksia Woodlands TEC through the presence of vegetation inferred to represent the TEC, occurring adjacent to the survey area. These areas and their relation to the survey area are discussed below.

Vegetation within the Woodvale Nature Reserve was considered in the assessment, as some remnant vegetation within the survey area occurs adjacent to it (Jarrah Woodland 2) (Figure L.3.3 – L.3.4, Appendix L). In general, the presence of *Eucalyptus marginata* or *Eucalyptus gomphocephala* at

[1] Emergent trees were considered those species, such as *Eucalyptus marginata* and *E. gomphocephala*, that typically grow taller than the lower tree layer containing the Banksia, and where the foliage cover of these taxa was less than the cover of the Banksia species. Where the cover exceeded that of the Banksia, the vegetation was no longer considered to represent a Banksia low woodland but rather a Eucalyptus mid woodland.

greater cover than what could be considered to be emergent trees indicates that the vegetation within the northern part of the nature reserve is not likely to be Banksia Woodlands TEC. A section of vegetation within the southern part of the reserve (MFB-11) (BP06, Table 16; Figure L.3.4, Appendix L) does meet the criteria to be considered representative of the Banksia Woodlands TEC, however does not extend into the survey area due to the greater dominance of *Eucalyptus marginata.* In addition, the area of remnant vegetation in this section of the survey area is in Degraded to Completely Degraded condition and when considered in isolation does not meet the minimum condition threshold of Good.

An area consisting of vegetation type Jarrah Woodland 1 (BP02, Table 16 and Figure L.3.1, Appendix L) was inferred to represent the Banksia Woodlands TEC due to connectivity to a larger patch, despite its condition. Of this patch, approximately 0.29 ha intersects the survey area. All patch assessment sites are shown in Figure L.3.1 to L.3.4 and Table L.4 (Appendix L). The results of patch assessments are shown in Table 16.

In total, 0.29 ha of the Banksia Woodlands TEC was mapped in the survey area (Degraded to Completely Degraded and Completely Degraded condition), with 7.5 ha mapped adjacent to the survey area (Figure L.3.1 to L.3.4, Appendix L).

A Threatened and Priority ecological community report form for the Banksia Woodlands TEC is presented in Appendix L.

Table 16: Banksia Woodlands of the Swan Coastal Plain patch assessments.

Patch number	Sites[1]	Vegetation type	Total patch size (ha)	TEC condition category[2]	Part of TEC	Criteria/comments
BP01	MFQ-06 MFB-01	Banksia Woodland	0.3	Good	No	A patch in this condition (Good) needs to be at least 2 ha in size as per minimum patch sizes outlined in Table L.2, Appendix L.
BP02	MFQ-07	Jarrah Woodland 1[3]	6.0 (0.29 ha in survey area)	Degraded-Completely Degraded to Completely Degraded	Yes	This section of vegetation within the survey area adjoins vegetation inferred to be the EPBC Act ecological community and represents a minor variation of the larger patch.
	MFB-02 MFB-05 (adjoining remnant vegetation)	Not mapped (outside survey area)		Good		This section of vegetation adjacent to the survey area meets the criteria for the EPBC Act ecological community as per Appendix L, Section L2.
BP03	MFB-BL1 MFQ-08	Jarrah Woodland 1	0.2	Good to Completely Degraded	No	To be considered as part of the EPBC Act ecological community a patch should meet at least the Good condition category. Only 0.01 ha of this patch is mapped as Good.
BP04	MFQ-02 MFR-04	Jarrah Woodland 1	0.1	Good to Degraded	No	This patch is in Good to Degraded condition, a patch in Good condition needs to be at least 2 ha in size.
	MFB-06 MFB-07 (adjoining remnant vegetation)	Not mapped (outside survey area)		Good to Degraded	No	This patch is in Good to Degraded condition, a patch in Good condition needs to be at least 2 ha in size as per minimum patch sizes outlined in Table L.2, Appendix L.

Patch number	Sites[1]	Vegetation type	Total patch size (ha)	TEC condition category[2]	Part of TEC	Criteria/comments
BP05	MFR-06 MFR-08 MFR-10	Jarrah Woodland 2	10.0	Degraded-Completely Degraded to Completely Degraded	No	Does not meet the criteria for the EPBC Act ecological community as per Table L.2, Appendix L due to the presence of *Eucalyptus marginata* and/or *E. gomphocephala* at equal or greater cover than the Banksia (MFB-12, MFB-13); or patch suitable but less than 2 ha (Good condition) (MFB-14).
	MFB-12 MFB-13 MFB-14 (adjoining remnant vegetation[2])	Not mapped		Very Good		
BP06	MFB-11	Not mapped	1.8 (0 ha in survey area)	Very Good	Yes	This section of vegetation meets the criteria for the EPBC Act ecological community as per Table L.2, Appendix L, however does not intersect the survey area.
BP07	Not assessed	Not mapped	0.1	Completely Degraded	No	To be considered as part of the EPBC Act ecological community a patch should meet at least the Good condition category. This patch is Completely Degraded.

1 – Sites MFB-08, MFB-09 and MFB-10 were assessed as having *Eucalyptus marginata* and/or *E. gomphocephala* at greater percentage covers than what could be considered emergent trees (thus dominating the vegetation community), these sites are not within the survey area and were not mapped as a patch for assessment, therefore are not included in Table 16.

2 -Department of the Environment and Energy (2016a)

3 – This section of the survey area was considered to be Jarrah Woodland due to the presence of a large, isolated Jarrah tree within a narrow and limited sampling area. The vegetation adjacent to the survey area has emergent medium to tall trees above the Banksia canopy.

Other Significant Vegetation

The Guilderton 1007 pre-European vegetation association, which has less than 30% of its pre-European extent remaining, was identified during the desktop assessment as occurring in the north of the survey area. The field survey did not locate any vegetation corresponding to this association, with the pre-European mapped extent identified as planted vegetation.

Riparian Vegetation

No remnant vegetation considered to represent riparian vegetation was recorded from the survey area. There are a number of wetlands that occur in close proximity to the survey area, however remnant indicator species were not recorded (for example *Melaleuca rhaphiophylla, M. preissiana, Baumea* sp. (Gibson et al. 1994) Additionally, statistical analysis of remnant vegetation quadrats showed no similarity with any wetland or dampland community types in Gibson et al (1994) (Table 13).

4.2.3 Flora

A total of 217 vascular flora species, from 51 families and 138 genera, were recorded in the survey area. Seven specimens were unable to be identified to species level due to insufficient material for identification, none of these are considered to represent species of significance. An indeterminate *Lepidosperma* species was recorded during the April survey (Astron Environmental Services 2019b); subsequent collections of *Lepidosperma* across the survey area in September/October found only *Lepidosperma leptostachyum* and *Lepidosperma calcicola,* both of which are locally common species. The dominant plant families were Fabaceae, with 34 species represented, Myrtaceae (33) and Proteaceae (21) (Table 17). *Eucalyptus* was the most frequently recorded genera (Table 17). Approximately 37% to 56% of the flora recorded was native taxa; a range is given here as some native taxa recorded are expected to have been planted and not necessarily naturally occurring. A species list and species by site matrix are presented in Table M.1 and M.2 respectively (Appendix M).

Table 17: Taxa most frequently recorded in the survey area.

Family	Number of species
Fabaceae	34
Myrtaceae	33
Proteaceae	21
Genus	**Number of species**
Eucalyptus	14
Acacia	12
Melaleuca	8

4.2.3.1 Significant Flora

No EPBC Act or State-listed threatened flora were recorded within the survey area. Three priority flora species were recorded within the survey area:

- *Ricinocarpos tuberculatus* P2
- *Grevillea olivacea* P4
- *Jacksonia sericea* P4.

Although *Ricinocarpos tuberculatus* P2 and *Grevillea olivacea* P4 are listed as priority flora by DBCA they are considered to be planted within the survey area and well outside of their natural range; both

occurred in vegetation mapped as Planted Vegetation. *Ricinocarpos tuberculatus* P2 has a natural range east of the survey area in the Avon Wheatbelt IBRA region, it is also commonly planted in the Perth metropolitan area, with two cultivars available from local nurseries (Benara Nurseries 2019). The natural range of *G. olivacea* P4 is approximately 120 km north of the survey area in the Geraldton Sandplains and northern part of the Swan Coastal Plain (Dandaragan Plateau) IBRA regions (Western Australian Herbarium 2019), however it is commonly used around the Perth metropolitan area as a horticultural species.

A total of 17 *Jacksonia sericea* P4 were recorded within the survey area (Figure N.1, Appendix N), mostly from the northern end of the survey area, with one record in the centre of the survey area, adjacent to Camarino Drive. This species has been previously recorded within the survey area and surrounds and is known to occur in sandy soils and limestone (Focused Vision Consulting 2018, Department of Biodiversity, Conservation and Attractions 2019g). This species appeared to persist in disturbed areas which had a significant cover of weedy grasses. It was also recorded from two areas of previously cleared, planted vegetation indicating that it may have established from retained seedbank or rootstock. The inconspicuous diffuse greyish green phylloclades and a sprawling habit (Plate 8 and Plate 9) of *J. sericea* P4 as well as similarity to the common *Jacksonia calcicola* (which is differentiated by pungent phylloclades) (Barrett and Pin Tay 2005) may indicate that it is more widespread in the local area than records indicate. Locations of *J. sericea* are shown in Table N.1 and Figure N.1 (Appendix N) and Threatened and Priority Flora report forms in Appendix N.

Plate 8: *Jacksonia sericea* P4 habit.

Plate 9: *Jacksonia sericea* P4 non-pungent phylloclades.

Of the eight taxa listed in the DBCA database search results that were considered likely to occur or having the potential to occur in the desktop assessment, all are considered unlikely to occur post survey. This is either because the habitats within the survey area are not considered to be suitable, or

the taxa are perennial species which would have been easily observed during the survey if they were present.

4.2.3.2 Introduced Flora

Seventy-two weed species were recorded within the survey area, representing approximately 31% of the total flora species recorded. Of the 72 weed species, 40 taxa[2] have an ecological impact rating of High for the Swan Region (Table M.1, Appendix M) (Department of Parks and Wildlife 2013), including the four weed species that are listed as WoNS (Australian Weeds Committee 2012) and/or listed as declared pest plants in Western Australia under the BAM Act (Department of Agriculture and Food Western Australia 2016):

- **Asparagus asparagoides* (bridal creeper) – declared pest and WoNS
- **Lantana camara* (lantana) – declared pest and WoNS
- **Genista linifolia* (flax-leaf broom) – WoNS
- **Moraea flaccida* (one-leaf cape tulip) – declared pest.

**Moraea flaccida* was recorded throughout the survey area with eight occurrences within all mapped vegetation types, it is likely that this species is more widespread, with some areas surveyed out of season in May/April when this cormous perennial species would not have been visible. **Lantana camara* was recorded at two locations (both within the Tuart Forest 2 vegetation type), **Asparagus asparagoides* was recorded from one location within the Tuart Forest 2 vegetation type and **Genista linifolia* was recorded from one location in planted vegetation. The locations of significant weeds within the survey area are presented in Figure N.1 and Table N.2 (Appendix N).

4.2.3.3 Planted Flora

Sixty-four flora species are considered to be planted within the survey area (or at least in some parts of the survey area). This represents 30% of the total flora species recorded. Of these 64 species:

- 11 (5%) are native to Western Australia but occur outside of their natural range
- six (3%) are not native to Western Australia (but not considered to be weeds) or are commercially available cultivars
- 34 (16%) are locally native species which are also considered to be planted in all or some parts of the survey area.
- Six (3%) are native to Western Australia but occur outside of their natural range and are also known to be naturalized within their recorded range

[2] The impact and invasiveness ratings for weeds in the Swan Region (Department of Parks and Wildlife 2013) also includes a number of native species which are naturalised in part of their range

- Seven (3%) are locally native species which are considered to be planted in all or some part of the survey area and are also known to be naturalized within their recorded range.

4.3 Conservation Significant Vertebrate Species

Of the 24 species identified in the desktop assessment, three species: quenda (*Isoodon fusciventer*), Carnaby's cockatoo and forest red-tailed black cockatoo, were recorded within the survey area, one species was considered to have a 'moderate' likelihood and 20 species were considered to have a 'low' likelihood of occurrence (Table G.2, Appendix G). The two black cockatoo species are discussed in more detail in Section 4.3.1.

The quenda is listed as P4 by DBCA. The quenda is widely distributed near the south-west coast of Western Australia from Guilderton north of Perth to east of Esperance (Department of Environment and Conservation 2012). They have a patchy distribution through the jarrah and karri forest, the Swan Coastal Plain, and inland as far as Hyden. This species prefers scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeding in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Department of Environment and Conservation 2012). On the Swan Coastal Plain, quenda are often associated with wetlands (Department of Environment and Conservation 2012).

There were 100 previous records of the quenda within 5 km of the survey area including one recorded within the survey area at the Whitfords Avenue Mitchell Freeway northbound on-ramp (Department of Biodiversity, Conservation, and Attractions 2019b). One individual quenda roadkill was recorded within the survey area (Figure O.1 and Table O.2, Appendix O). The sighting was recorded 228 m south of the Woodvale Nature Reserve (Department of Biodiversity, Conservation, and Attractions 2019b), that is likely to support a quenda population. Multiple diggings of this species were also recorded in the vicinity of the dead individual. Two additional digging locations were observed in a small area of remnant vegetation approximately 138 m and 775 m north of Warwick Road (Figure O.1 and Table O.2, Appendix O), suggesting that they can exist in small areas of remnant vegetation within urban areas.

The peregrine falcon (*Falco peregrinus*) is listed as Other Specially Protected Fauna under the BC Act and was considered to have a moderate likelihood of occurrence. It is uncommon, although widespread throughout much of Australia excluding the extremely dry areas and has a wide and patchy distribution. It shows habitat preference for areas near cliffs along coastlines, rivers and ranges and within woodlands along watercourses and around lakes (Johnstone and Storr 1998). It is cosmopolitan and will hunt in any habitat, soaring at height or from a perch. There are 13 records of the peregrine falcon within 5 km of the survey area, with the closest recorded in 2001 within 314 m of the survey area at Pinnaroo Valley Memorial Park (Department of Biodiversity, Conservation, and Attractions 2019b). The survey area is considered potential foraging habitat for this species.

4.3.1 Black Cockatoos

4.3.1.1 Foraging Habitat

The survey area contained 29 known foraging resource species for the Carnaby's cockatoo (including three weed species) and seven known foraging resource species for the forest red-tailed black

cockatoo (including one weed species) (Valentine and Stock 2008; Groom 2011; Chapman 2007) (Table 18). Although Carnaby's cockatoos forage on a number of species in the survey area, only the marri, jarrah, tuart and proteaceous species are considered a staple part of their diet.

During the botanical surveys in September/October 2019; two individual Carnaby's cockatoos were recorded: one individual was observed foraging on *Banksia prionotes* (Plate 10) and one individual was observed on a concrete wall before foraging on a jarrah tree (Plate 11) (Table O.2, Appendix O). Seven individual Carnaby's cockatoos as well as foraging evidence by this species on marri fruit was recorded at three locations during the March 2020 survey (Figure O.1 and Table O.2, Appendix O).

Previous foraging evidence from forest red-tailed black cockatoos on marri fruit was recorded under a single tree during the April 2019 survey (Astron Environmental Services 2019a) (Figure O.1 and Table O.1, Appendix O). Two individual forest red-tailed black cockatoos were observed feeding on a cape lilac tree in March 2020. In addition, foraging evidence from the forest red-tailed black cockatoo on marri (Plate 12) and sheoak fruit (Plate 13) were recorded at three locations during the March 2020 survey (Figure O.1 and Table O.2, Appendix O). Threatened Species Report Forms for the sightings are provided in Appendix P.

Plate 10: Carnaby's cockatoo individual foraging on *Banksia prionotes*.

Plate 11: Carnaby's cockatoo individual sitting on concrete wall.

Plate 12: Foraging evidence of forest red-tailed black cockatoos on marri (*Corymbia calophylla*) nuts.

Plate 13: Foraging evidence of forest red-tailed black cockatoos on sheoak (*Allocasuarina fraseriana*) seeds.

Small areas of remnant vegetation mapped within the survey area contain suitable foraging species and are therefore considered potential foraging habitat for black cockatoos (Figure O.1, Appendix O). A total of 10.6 ha (21%) of the survey area (Banksia woodland, Jarrah woodland and Tuart forest) is considered potential foraging habitat for Carnaby's cockatoo and 1.7 ha (3%) of the survey area (Banksia and Jarrah woodland) is considered potential foraging habitat for forest red-tailed black cockatoo. However, as the survey area is comprised of the Mitchell Freeway road reserves, the vegetation of the survey area has been impacted through historical clearing 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, so it would not be considered quality foraging habitat under the referral guidelines (Department of Sustainability Environment Water Population and Communities 2012).

Table 18: Black cockatoo foraging resource species recorded within the survey area.

Foraging resource species	Carnaby's cockatoo	Forest red-tailed black cockatoo
Acacia saligna	X	
Agonis flexuosa	X	
Allocasuarina fraseriana	X	X
Banksia attenuata	X	
Banksia grandis	X	
Banksia menziesii	X	
Banksia nivea	X	
Banksia prionotes	X	
Banksia sessilis	X	
Callistemon viminalis 'Kings Parks Special'	X	
Callitris preissii	X	
Corymbia calophylla (marri)	X	X
**Erodium botrys*	X	
Eucalyptus caesia (silver princess)	X	
Eucalyptus camaldulensis (river red gum)	X	
Eucalyptus gomphocephala (tuart)	X	
Eucalyptus marginata (jarrah)	X	X
Eucalyptus rudis (flooded gum)	X	
Eucalyptus todtiana (coastal blackbutt)	X	
Grevillea robusta	X	
Hakea lissocarpha	X	X
Hakea prostrata	X	X
Hakea trifurcata	X	X
Jacksonia furcellata	X	
**Lupinus angustifolius*	X	
**Lupinus cosentinii*	X	
Melia azedarach (cape lilac)	X	X
Mesomelaena pseudostygia	X	
Xanthorrhoea preissii	X	

4.3.1.2 Breeding Habitat

The survey area contained 533 trees (409 tuarts, 78 jarrah, 23 dead stags and 23 marri) of sufficient DBH to be classified in the referral guidelines as potential breeding trees (Department of Sustainability Environment Water Population and Communities 2012) (Figure O.1 and Table O.1; Appendix O). The survey area also contained a number of planted eucalypt species that are not native to the Swan

Coastal Plain. As such these trees are not considered potential breeding trees and are not part of this assessment.

Forest red-tailed cockatoos are considered unlikely to breed in the survey area due to a preference for larger stands of woodland or forest, whereas Carnaby's cockatoos will also utilise isolated remnant trees if suitable (Johnstone, Johnstone, and Kirkby 2010).

Twenty-two of the potential breeding trees (12 tuarts, two jarrah and eight dead stags) contained hollows which were considered suitable for use by black cockatoos as potential breeding sites (Table O.1, Appendix O). For hollows to be of use to black cockatoos they should have an entrance at least 12 cm wide (Groom 2010; Johnstone, Johnstone, and Kirkby 2010). Preliminary inspection of the hollows did not show signs of recent or historic use as nest sites (i.e. chew marks and droppings).

4.3.1.3 Roosting Habitat

Based on the referral guidelines, night roosts for Carnaby's cockatoo occur in the tallest trees of an area, usually close to an important water source and quality foraging habitat (Department of Sustainability Environment Water Population and Communities 2012). All 533 potential breeding trees mentioned in Section 4.3.1.2 are of sufficient height to be classified as potential roost sites and occur within 400 m of standing water in the south of the survey area, but none of the trees showed signs of current or historic use as roost sites. However, the survey area occurs within 2.3 km of a confirmed roost site and 1.3 km of an unconfirmed roost site for Carnaby's cockatoo (Department of Biodiversity, Conservation, and Attractions 2019b).

5 Conclusions

5.1 Vegetation

The survey area consisted of a linear corridor running along the edge of the Mitchell Freeway southbound freeway lanes and central areas from Hodges Drive to Warwick Train Station, with a small section adjacent to the northbound lanes south of Beach Road. Most of the survey area has been previously disturbed, but retains small patches of modified remnant vegetation.

Five remnant vegetation types were identified within the survey area, this included one Banksia Woodland, two *Eucalyptus marginata* (jarrah) woodlands and two *Eucalyptus gomphocephala* (tuart) forests. Remnant vegetation types were mapped across 10.6 ha (21%) of the survey area. The remaining 39 ha of the survey area was either cleared (7.2 ha, 15%) or planted vegetation (31.8 ha, 64%).

Remnant vegetation in the survey area was in Good to Completely Degraded condition, with the majority considered Completely Degraded as it consisted of scattered remnant species only. It is expected that quality of these remnants has been declining over time due to significant edge effects.

The desktop assessment identified the pre-European vegetation association, Guilderton 1007 (Mosaic: Shrublands; *Acacia lasiocarpa* and *Melaleuca acerosa* (now *M. systena*) heath / Shrublands; *Acacia rostellifera* and *Acacia cyclops* thicket (Shepherd et al. 2002)), as being in the survey area. This association has less than the 30% threshold of its pre-European extent remaining, as outlined by Environmental Protection Authority (2000). The pre-European mapping of Guilderton 1007 intersects the most northern section of the survey area, however none of the remnant vegetation recorded is considered to be representative of that vegetation.

Vegetation inferred to represent the EPBC Act listed Tuart TEC was recorded within the survey area, across 11.7 ha in much of the survey area south of the northern edge of the Woodvale Nature Reserve. Vegetation inferred to represent the EPBC Act listed Banksia Woodlands TEC was recorded at the northern end of the survey area, across 0.29 ha near Hodges Drive.

Vegetation considered to represent the State listed Tuart and Banksia Woodlands PECs were recorded within the survey area across 8.8 ha and 1.3 ha respectively.

5.2 Flora

A total of 217 vascular flora species, from 47 families and 127 genera, were recorded in the survey area. No EPBC Act listed flora were recorded, but one priority flora species was recorded: *Jacksonia sericea* P4.

Eight priority flora species (all perennial) have been previously recorded within 5 km of the survey area and based on pre-survey assessment of previous location and preferred habitat information were considered likely or having the potential to occur. These species were not located during the targeted survey and are considered to have been observable, should they have been present. The survey area has considerable disturbance and limited floristic diversity which further limits the potential for any threatened or priority flora species to occur. All eight species are considered unlikely to occur in the survey area post survey.

Seventy-two weed species were recorded within the survey area, accounting for 31% of the species recorded. Forty taxa have an ecological impact rating of High for the Swan Region (Department of Parks and Wildlife 2013), including three listed as WoNS (Australian Weeds Committee 2012) (**Asparagus asparagoides, *Lantana camara* and **Genista linifolia*) and three listed as declared pest plants in Western Australia (**Asparagus asparagoides, *Moraea flaccida* and **Lantana camara*) under the BAM Act (Department of Agriculture and Food Western Australia 2016).

**Asparagus asparagoides* and **Lantana camara* were recorded from within the remnant vegetation type Tuart Forest 2, while **Genista linifolia* was recorded from planted vegetation. **Moraea flaccida* was recorded from throughout the survey area across all vegetation types. **Asparagus asparagoides* has s22(2) legal status and 'exempt' keeping category in Western Australia. It is a highly invasive environmental weed and occurs in a variety of disturbed and natural habitats (Department of Primary Industries and Regional Development 2019). **Moraea flaccida* has s22(2) legal status and 'exempt' keeping category in Western Australia and is a serious pasture weed, spread by seed and corms (Department of Primary Industries and Regional Development 2019). **Lantana camara* has s22(2) legal status and C3 – Management keeping category. It is an environmental weed that typically invades areas along rivers and near wetlands (Department of Primary Industries and Regional Development 2019). **Genista linifolia* is an environmental weed which invades disturbed roadsides, it forms dense clumps and hedges which exclude native vegetation (Department of the Environment and Energy 2019f). Sixty-four (29%) flora species are considered to be planted within the survey area (or in part of the survey area).

5.3 Conservation Significant Vertebrate Fauna

Of the 24 conservation significant vertebrate species identified in the desktop assessment, three species (quenda, Carnaby's cockatoo and forest red-tailed black cockatoo) were recorded within the survey area, one species (peregrine falcon) was considered to have a 'moderate' likelihood and 20 species were considered to have a 'low' likelihood of occurrence.

Based upon the current distributions for the three threatened species of black cockatoo, only the Carnaby's cockatoo and forest red-tailed black cockatoo are likely to occur in the vicinity of the survey area. Carnaby's cockatoo individuals and foraging evidence on marri nuts were recorded at five locations within the survey area. Forest red-tailed black cockatoo individuals and foraging evidence on marri nuts and sheoak seeds was recorded during both the April 2019 (Astron Environmental Services 2019a) and current surveys at five locations; however, breeding for this species in the area is unlikely due to a preference for intact woodland or forest (Department of Sustainability Environment Water Population and Communities 2012).

Twenty-nine known foraging resource species, including three weed species, for the Carnaby's cockatoo and seven known foraging resource species, including one weed species, for the forest red-tailed black cockatoo were recorded within the survey area; however, only the marri, jarrah, tuart and *Banksia* species are considered key species for foraging Carnaby's cockatoos. Nine individual Carnaby's cockatoos were observed within the survey area, including foraging on *Banksia prionotes* and jarrah and two individual forest red-tailed black cockatoos were observed feeding on a cape lilac tree within the survey area. Remnant vegetation of the survey area, comprising 10.6 ha for Carnaby's cockatoo and 1.7 ha for forest red-tailed black cockatoo, was classified as providing potential foraging

habitat. However, it is not considered high quality foraging habitat as defined in the referral guidelines (Department of Sustainability Environment Water Population and Communities 2012) due to the altered state of vegetation and the sporadic and isolated distribution of known foraging flora species.

Five hundred and thirty-three black cockatoo potential breeding trees (409 tuarts, 78 jarrah, 23 dead stags and 23 marri) with a DBH of over 50 cm were recorded within the survey area including 22 trees (12 tuarts, two jarrah and eight dead stags) considered to have suitable hollows for Carnaby's cockatoos to breed in. Preliminary inspection of the hollows did not show signs of recent or historic use as nest sites and no confirmed breeding records are known from the survey area.

One individual quenda roadkill was recorded 228 m south of the Woodvale Nature Reserve (Department of Biodiversity, Conservation, and Attractions 2019b), and it is likely that this individual was from of a larger quenda population within Woodvale Nature Reserve. Multiple diggings in the same area as the roadkill as well as diggings from two other locations in a small area of remnant vegetation were recorded within the survey area. The survey area contains habitat for the species; however, there is more suitable habitat within larger areas of remnant vegetation adjacent to the survey area, such as Woodvale Nature Reserve, which are known, or likely to, support populations of quenda.

The peregrine falcon was considered to have a moderate likelihood of occurring in the survey area as there were 13 previous records within 5 km of the survey area, with the closest record in 2001 within 314 m of the survey area at Pinnaroo Valley Memorial Park (Department of Biodiversity, Conservation, and Attractions 2019b). The survey area is considered potential foraging habitat for this species; however, this species is a cosmopolitan species that forages widely in all habitats.

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Appendix A: Conservation Categories for Flora, Fauna and Ecological Communities, and Categories for Introduced Flora

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Table A.1: Categories and definitions for threatened flora and fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999.*

Conservation category	Definition
Extinct	Taxa with no reasonable doubt that the last member of the species has died.
Extinct in the wild	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriated seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (E)	Taxa are not critically endangered; and are facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (V)	Taxa are not critically endangered or endangered; and are facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Conservation dependent (CD)	Taxa are the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or the following subparagraphs are satisfied: i) the taxa is a species of fish; ii) the taxa is the focus of a management plan that provides management actions necessary to stop the decline of, and support the recovery of, the taxa so that its chances of long term survival in nature are maximised; iii) the management plan is in force under a law of the Commonwealth or of a State or Territory; iv) cessation of the management plan would adversely affect the conservation status of the taxa Fish includes all taxa of bony fish, sharks, rays, crustaceans, molluscs and other marine organisms, but does not include marine mammals/reptiles.
Migratory (Mi)	Taxa are considered migratory species; i) if they are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II); ii) all migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA); and iii) Are native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Note: CD and Mi are only related to conservation significant fauna

Table A.2: Definitions and criteria for threatened ecological communities under the *Environment Protection and Biodiversity Conservation Act 1999.*

Categories of ecological communities	
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

Table A.3: Categories of threatened ecological communities (Department of Environment and Conservation 2013).

PD: Presumed Totally Destroyed
An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B): A) Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats **or** B) All occurrences recorded within the last 50 years have since been destroyed.
CR : Critically Endangered
An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more of** the following criteria (A, B or C): A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% **and either or both** of the following apply (i or ii): i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii) modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii): i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

En: Endangered

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting **any one or more** of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement **and either or both** of the following apply (i or ii):

i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);

ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, **and one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);

ii) there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;

iii) there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.

C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

VU: Vulnerable

An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting **any one or more of** the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.

B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Possible Threatened Ecological Communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5 (Table A.4).

Table A.4: Definitions and criteria for priority ecological communities (Department of Environment and Conservation 2013).

P1: Priority One – Poorly-known ecological communities
Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two – Poorly-known ecological communities
Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three – Poorly-known ecological communities
(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four
Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five – Conservation dependent ecological communities
Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table A.5: Conservation codes for threatened Western Australian flora and fauna under the *Biodiversity Conservation Act 2016* (Department of Biodiversity, Conservation and Attractions 2019).

Code	Conservation category	Definition
Critically endangered (CR)	Listing in accordance with Ministerial Guidelines (Section 20 of the BC Act).	Taxa "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines."
Endangered (EN)	Listing in accordance with Ministerial Guidelines (Section 21 of the BC Act)	Taxa "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines."
Vulnerable (VU)	Listing in accordance with Ministerial Guidelines (Section 22 of the BC Act)	Taxa "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines."
Extinct (EX)	Listing in accordance with Ministerial Guidelines (Section 24 of the BC Act)	"there is no reasonable doubt that the last member of the species has died."
Extinct in the wild (EW)	Listing in accordance with Ministerial Guidelines (Section 25 of the BC Act)	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form". Currently there are no threatened flora species listed as EW. If listing of a species as EW occurs, then a schedule will be added to the applicable notice.
Migratory species (MI)	Listed as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation*	"Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth."
Species of special conservation interest (conservation dependent fauna) (CD)	Listed as conservation dependent fauna under schedule 6 of the *Wildlife Conservation*	"Species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened."
Other specially protected species (OS)	Listed as other specially protected fauna under schedule 7 of the *Wildlife Conservation*	"Fauna otherwise in need of special protection to ensure their conservation."

Note: MI, CD and OS are only related to conservation significant fauna

Taxa that have not yet been adequately surveyed to be listed under Schedule 1 or 2 are added to the Priority Flora and Priority Fauna Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as Threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring.

Table A.6: Priority species codes for Western Australian flora and fauna (Department of Biodiversity, Conservation and Attractions 2019).

P1: Priority One – Poorly known taxa
Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2: Priority Two – Poorly known taxa
Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3: Priority Three – Poorly known taxa
Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4: Priority Four: Rare, near threatened and other taxa in need of monitoring
(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

The management of introduced flora species in Western Australia is now regulated through the *Biosecurity and Agriculture Management Act 2007* (BAM Act). A list of declared pests, including 'pest' plants is provided under the BAM Act, which has been updated to incorporate a number of other Acts that are administered by Department of Agriculture and Food Western Australia (Department of Agriculture and Food Western Australia 2016). Declared pests can fall into two categories: one that relates to the prevention of introducing the species or eradicating it; and the other relates to managing the species and whether it can be kept (i.e. for scientific purposes, education or other purpose).

The threat and risk posed to site-specific biodiversity values, influences to rehabilitation success, primary production, infrastructure assets or human health will differ depending on the unique characteristics of each site and the associated land management practice or operation. Therefore site or project specific weed assessments and priorities should be reviewed for each project.

As per introduced flora species, the BAM Act seeks to establish a modern biosecurity regulatory scheme to prevent serious animal pests from entering the State and becoming established, and to minimise the spread and impact of any that are already present within the State. Declared animal pests fall into three categories as Gazetted under the *Biosecurity and Agriculture Management Regulations 2013*. These categories are outlined in Table A.7.

Table A.7: Declared pests control categories as gazetted under the *Biosecurity and Agriculture Management Regulations 2013*.

Category	Description
C1 (Exclusion)	Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 (Eradication)	Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 (Management)	Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

References

Department of Agriculture and Food Western Australia. 2016. Western Australian Organisms List. https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol.

Department of Biodiversity, Conservation and Attractions. 2019. Conservation Codes for Western Australian flora and fauna. Perth WA.

Department of Environment and Conservation. 2013. Definitions, categories and criteria for threatened and priority ecological communities. Guidance Document, Department of Biodiversity, Conservation and Attractions, Perth WA.

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Appendix B: Database Search Results

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Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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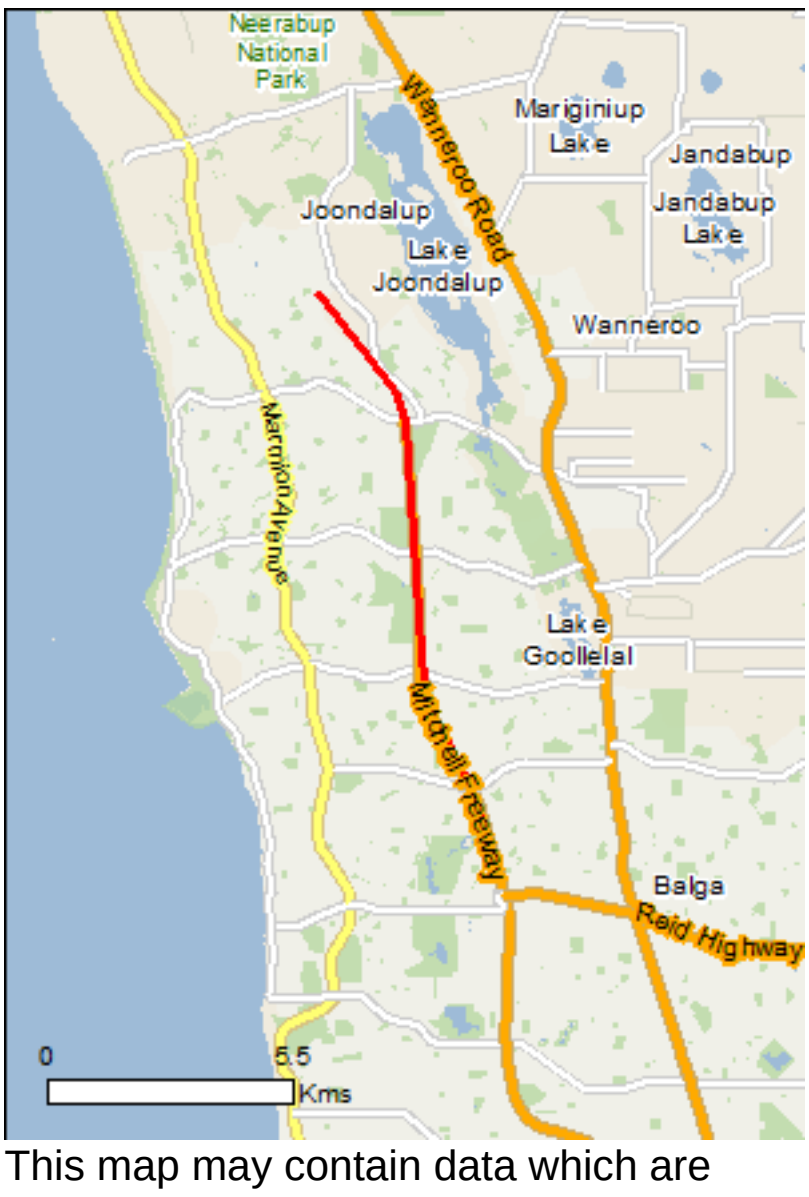

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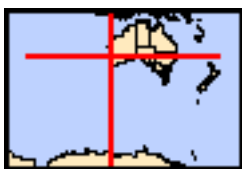

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	49
Listed Migratory Species:	43

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	69
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	8
Regional Forest Agreements:	None
Invasive Species:	38
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Insects		
Hesperocolletes douglasi Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Breeding known to occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Plants		
[Andersonia gracilis](#) Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
[Anigozanthos viridis subsp. terraspectans](#) Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
[Diuris purdiei](#) Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
[Drakaea elastica](#) Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
[Drakaea micrantha](#) Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
[Eleocharis keigheryi](#) Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
[Eucalyptus argutifolia](#) Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat likely to occur within area
[Lepidosperma rostratum](#) Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
[Marianthus paralius](#) [83925]	Endangered	Species or species habitat known to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia		
Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus		
Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Species or species habitat known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel	Endangered	Species or species

Name	Threatened	Type of Presence
[1060]		habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna anaethetus Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Stigmatopora nigra		
Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus		
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris		
Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer		
Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri		
Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Aipysurus pooleorum		
Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii		
Spectacled Seasnake [1123]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Pelamis platurus		
Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Lake Joondalup	WA
Neerabup	WA
Unnamed WA21176	WA
Unnamed WA43290	WA
Unnamed WA46756	WA
Unnamed WA46926	WA
Unnamed WA50514	WA
Woodvale	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]

Name	State
Joondalup Lake	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.75268 115.7624,-31.76967 115.77767,-31.77488 115.78026,-31.81492 115.78351,-31.82369 115.78459,-31.82757 115.78696,-31.83846 115.7936,-31.84989 115.79779

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 22/11/2019

Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Line'
Vertices	31° 45' 10" S,115° 45' 45" E 31° 46' 11" S,115° 46' 40" E 31° 46' 30" S,115° 46' 49" E 31° 48' 54" S,115° 47' 01" E 31° 49' 25" S,115° 47' 05" E 31° 49' 39" S,115° 47' 13" E 31° 50' 18" S,115° 47' 37" E 31° 50' 60" S,115° 47' 52" E
Group By	Kingdom

Kingdom	Species	Records
Animalia	548	40040
Chromista	38	80
Fungi	52	66
Plantae	868	2645
Protozoa	18	25
TOTAL	**1524**	**42856**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Animalia					
1.		*? ?*			
2.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
3.		*Acanthaluteres vittiger*			
4.		*Acanthistius pardalotus*			
5.		*Acanthistius serratus*			
6.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
7.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
8.	24262	*Acanthiza inornata (Western Thornbill)*			
9.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
10.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
11.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
12.	25536	*Accipiter fasciatus (Brown Goshawk)*			
13.	42368	*Acritoscincus trilineatus (Western Three-lined Skink)*			
14.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
15.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
16.		*Aetapcus maculatus*			
17.		*Amblyomma triguttatum*			
18.		*Aname mainae*			
19.		*Aname tepperi*			
20.	24310	*Anas castanea (Chestnut Teal)*			
21.	24312	*Anas gracilis (Grey Teal)*			
22.	24313	*Anas platyrhynchos (Mallard)*			
23.		*Anas platyrhynchos subsp. domesticus*			
24.	24315	*Anas rhynchotis (Australasian Shoveler)*			
25.	24316	*Anas superciliosa (Pacific Black Duck)*			
26.	47414	*Anhinga novaehollandiae (Australasian Darter)*			
27.	24506	*Anous tenuirostris subsp. melanops (Australian Lesser Noddy)*		T	
28.		*Anser anser*			
29.	24561	*Anthochaera carunculata (Red Wattlebird)*			
30.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
31.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
32.	25554	*Apus pacificus (Fork-tailed Swift, Pacific Swift)*		IA	
33.	24285	*Aquila audax (Wedge-tailed Eagle)*			
34.		*Aracana aurita*			
35.		*Arachnura higginsi*			
36.		*Araneus cyphoxis*			
37.		*Araneus eburneiventris*			
38.		*Araneus eburnus*			
39.		*Araneus senicaudatus*			
40.	24209	*Arctocephalus tropicalis (Subantarctic fur-seal)*		T	
41.	25558	*Ardea ibis (Cattle Egret)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
42.	24338	*Ardea ibis subsp. coromanda (Cattle Egret)*			
43.	25559	*Ardea intermedia (Intermediate Egret)*			
44.	41324	*Ardea modesta (great egret, white egret)*			
45.	24340	*Ardea novaehollandiae (White-faced Heron)*			
46.	24341	*Ardea pacifica (White-necked Heron)*			
47.		*Argiope protensa*			
48.		*Argiope trifasciata*			
49.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
50.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
51.		*Artoria linnaei*			
52.		*Artoriopsis expolita*			
53.		*Aulohalaelurus labiosus*			
54.		*Aulohalaelurus labiosus?*			
55.		*Aulostomus chinensis*			
56.		*Austracantha minax*			
57.		*Australomimetus aurioculatus*			
58.		*Austrammo harveyi*			
59.		*Austrolabrus maculatus*			
60.	24318	*Aythya australis (Hardhead)*			
61.		*Backobourkia brounii*			
62.		*Badumna insignis*			
63.	24044	*Balaenoptera acutorostrata (Dwarf Minke Whale)*			
64.		*Ballarra longipalpus*			
65.		*Barnardius zonarius*			
66.		*Batrachomoeus rubricephalus*			
67.		*Bianor maculatus*			
68.	24319	*Biziura lobata (Musk Duck)*			
69.	24345	*Botaurus poiciloptilus (Australasian Bittern)*		T	
70.		*Brachaluteres jacksonianus*			
71.	42380	*Brachyurophis fasciolatus subsp. fasciolatus (Narrow-banded Shovel-nosed Snake)*			
72.	42381	*Brachyurophis semifasciatus (Southern Shovel-nosed Snake)*			
73.	24359	*Burhinus grallarius (Bush Stone-curlew)*			
74.	25713	*Cacatua galerita (Sulphur-crested Cockatoo)*			
75.	24721	*Cacatua galerita subsp. galerita (Sulphur-crested Cockatoo)*	Y		
76.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
77.	25715	*Cacatua roseicapilla (Galah)*			
78.	25716	*Cacatua sanguinea (Little Corella)*			
79.	24729	*Cacatua tenuirostris (Eastern Long-billed Corella)*	Y		
80.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
81.	24427	*Cacomantis flabelliformis subsp. flabelliformis (Fan-tailed Cuckoo)*			
82.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
83.		*Caesioscorpis theagenes*			
84.	24779	*Calidris acuminata (Sharp-tailed Sandpiper)*		IA	
85.	25738	*Calidris canutus (Red Knot, knot)*		IA	
86.	24784	*Calidris ferruginea (Curlew Sandpiper)*		T	
87.	24788	*Calidris ruficollis (Red-necked Stint)*		IA	
88.	24789	*Calidris subminuta (Long-toed Stint)*		IA	
89.		*Callogobius depressus*			
90.		*Callogobius mucosus*			
91.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
92.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black Cockatoo)*		T	
93.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)*		T	
94.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)*		T	
95.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
96.		*Capropygia unistriata*			
97.		*Carassius auratus*			
98.		*Carcharhinus brachyurus*			
99.		*Carcharhinus sp.*			
100.	25625	*Carduelis carduelis (Goldfinch, European Goldfinch)*	Y		
101.	25335	*Caretta caretta (Loggerhead Turtle)*		T	
102.		*Centroberyx australis*			
103.	24086	*Cercartetus concinnus (Western Pygmy-possum, Mundarda)*			
104.		*Cercophonius granulosus*			
105.		*Cercophonius sulcatus*			
106.		*Chaetodermis penicilligera*			
107.		*Chaetodon assarius*			
108.	24186	*Chalinolobus gouldii (Gould's Wattled Bat)*			
109.	25575	*Charadrius leschenaultii (Greater Sand Plover)*		T	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
110.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
111.		*Cheilodactylus gibbosus*			
112.		*Cheilodactylus rubrolabiatus*			
113.		*Chelidonichthys kumu*			
114.		*Chelmonops curiosus*			
115.	43380	*Chelodina colliei (South-western Snake-necked Turtle)*			
116.	25336	*Chelonia mydas (Green Turtle)*		T	
117.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
118.	47909	*Cheramoeca leucosterna (White-backed Swallow)*			
119.	41332	*Chlidonias leucopterus (White-winged Black Tern, white-winged tern)*		IA	
120.	24980	*Christinus marmoratus (Marbled Gecko)*			
121.		*Chroicocephalus novaehollandiae*			
122.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
123.	24432	*Chrysococcyx lucidus subsp. plagosus (Shining Bronze Cuckoo)*			
124.	24288	*Circus approximans (Swamp Harrier)*			
125.	24774	*Cladorhynchus leucocephalus (Banded Stilt)*			
126.		*Cleidopus gloriamaris*			
127.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
128.	24613	*Colluricincla harmonica subsp. rufiventris (Grey Shrike-thrush)*			
129.	24399	*Columba livia (Domestic Pigeon)*	Y		
130.		*Conger wilsoni*			
131.		*Cookeolus japonicus*			
132.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
133.		*Coris auricularis*			
134.		*Cormocephalus aurantiipes*			
135.		*Cormocephalus novaehollandiae*			
136.		*Cormocephalus strigosus*			
137.	24416	*Corvus bennetti (Little Crow)*			
138.	25592	*Corvus coronoides (Australian Raven)*			
139.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
140.	25701	*Coturnix ypsilophora (Brown Quail)*			
141.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
142.	25595	*Cracticus tibicen (Australian Magpie)*			
143.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
144.	25596	*Cracticus torquatus (Grey Butcherbird)*			
145.		*Crapatalus arenarius*			
146.	25399	*Crinia glauerti (Clicking Frog)*			
147.	25400	*Crinia insignifera (Squelching Froglet)*			
148.		*Cristiceps aurantiacus*			
149.		*Crustulina bicruciata*			
150.	30893	*Cryptoblepharus buchananii*			
151.	25020	*Cryptoblepharus plagiocephalus*			
152.		*Cryptoerithus quobba*			
153.	30899	*Ctenophorus adelaidensis (Southern Heath Dragon, Western Heath Dragon)*			
154.	25027	*Ctenotus australis*			
155.	25039	*Ctenotus fallens*			
156.		*Cybiosarda elegans*			
157.	25087	*Cyclodomorphus celatus (Western Slender Blue-tongue)*			
158.	24322	*Cygnus atratus (Black Swan)*			
159.	24323	*Cygnus olor (Mute Swan)*	Y		
160.		*Cynoglossus broadhursti*			
161.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
162.		*Dactylopus dactylopus*			
163.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
164.	24687	*Daption capense (Cape Petrel)*			
165.		*Delena cancerides*			
166.	30905	*Delma concinna subsp. concinna (Javelin Legless Lizard)*			
167.	25766	*Delma fraseri (Fraser's Legless Lizard)*			
168.	24999	*Delma grayii*			
169.	25296	*Demansia psammophis subsp. reticulata (Yellow-faced Whipsnake)*			
170.	24325	*Dendrocygna eytoni (Plumed Whistling Duck)*			
171.	25346	*Dermochelys coriacea (Leatherback Turtle)*		T	
172.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
173.		*Dingosa serrata*			
174.		*Diodon nicthemerus*			
175.	24929	*Diplodactylus granariensis subsp. granariensis*			
176.	24939	*Diplodactylus polyophthalmus*			
177.		*Dipulus caecus*			
178.		*Echeneis naucrates*			
179.	25251	*Echiopsis curta (Bardick)*			

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180.	25096	*Egernia kingii (King's Skink)*			
181.	25100	*Egernia napoleonis*			
182.		*Egretta garzetta*			
183.		*Egretta novaehollandiae*			
184.		*Elanus axillaris*			
185.	24290	*Elanus caeruleus subsp. axillaris (Australian Black-shouldered Kite)*			
186.	25250	*Elapognathus coronatus (Crowned Snake)*			
187.	47937	*Elseyornis melanops (Black-fronted Dotterel)*			
188.		*Engraulis australis*			
189.		*Eodelena convexa*			
190.		*Eolophus roseicapillus*			
191.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
192.	24567	*Epthianura albifrons (White-fronted Chat)*			
193.		*Eriophora biapicata*			
194.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
195.		*Ethmostigmus rubripes*			
196.		*Euleptorhamphus viridis*			
197.	25621	*Falco berigora (Brown Falcon)*			
198.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
199.	24472	*Falco cenchroides subsp. cenchroides (Australian Kestrel, Nankeen Kestrel)*			
200.	25623	*Falco longipennis (Australian Hobby)*			
201.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
202.	24475	*Falco peregrinus subsp. macropus (Australian Peregrine Falcon)*		S	
203.	24616	*Falcunculus frontatus subsp. leucogaster (Western Shrike-tit, Crested Shrike-tit)*			
204.	24041	*Felis catus (Cat)*	Y		
205.		*Filicampus tigris*			
206.		*Fistularia petimba*			
207.	25727	*Fulica atra (Eurasian Coot)*			
208.	24761	*Fulica atra subsp. australis (Eurasian Coot)*			
209.	25729	*Gallinula tenebrosa (Dusky Moorhen)*			
210.	24763	*Gallinula tenebrosa subsp. tenebrosa (Dusky Moorhen)*			
211.	25730	*Gallirallus philippensis (Buff-banded Rail)*			
212.		*Gambusia affinis*			
213.	42314	*Gavicalis virescens (Singing Honeyeater)*			
214.		*Gea theridioides*			
215.		*Geogarypus taylori*			
216.	25530	*Gerygone fusca (Western Gerygone)*			
217.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
218.	47962	*Glyciphila melanops (Tawny-crowned Honeyeater)*			
219.		*Gnathanacanthus goetzeei*			
220.		*Gnathophis longicaudatus*			
221.	24443	*Grallina cyanoleuca (Magpie-lark)*			
222.		*Gymnothorax prasinus*			
223.		*Gymnothorax woodwardi*			
224.	25627	*Haematopus fuliginosus (Sooty Oystercatcher)*			
225.	24293	*Haliaeetus leucogaster (White-bellied Sea-Eagle)*			
226.	24295	*Haliastur sphenurus (Whistling Kite)*			
227.	24689	*Halobaena caerulea (Blue Petrel)*			
228.	24296	*Hamirostra isura (Square-tailed Kite)*			
229.		*Helcogramma decurrens*			
230.	25410	*Heleioporus eyrei (Moaning Frog)*			
231.	25475	*Hemiergis peronii*			
232.	25119	*Hemiergis quadrilineata*			
233.		*Hemiramphus robustus*			
234.		*Henicops dentatus*			
235.		*Heteroclinus heptaeolus*			
236.		*Heteroclinus milwardi (ms)*			
237.		*Heteroclinus perspicillatus*			
238.		*Heteroclinus sp.*			
239.		*Heterodontus portusjacksoni*			
240.	47965	*Hieraaetus morphnoides (Little Eagle)*			
241.	25734	*Himantopus himantopus (Black-winged Stilt)*			
242.	24491	*Hirundo neoxena (Welcome Swallow)*			
243.		*Hogna crispipes*			
244.		*Hogna immansueta*			
245.	24215	*Hydromys chrysogaster (Water-rat, Rakali)*		P4	
246.	25366	*Hydrophis elegans (Elegant Seasnake, Bar-bellied Seasnake)*			
247.	43384	*Hydrophis platurus (Yellow-bellied Seasnake)*			
248.	48587	*Hydroprogne caspia (Caspian Tern)*		IA	
249.	24211	*Hydrurga leptonyx (Leopard Seal)*			

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250.		*Hyporhamphus melanochir*			
251.		*Idiommata blackwalli*			
252.	48935	*Idiosoma sigillatum (Swan Coastal Plain shield-backed trapdoor spider)*		P3	
253.		*Isometroides vescus*			
254.	48588	*Isoodon fusciventer (Quenda, southwestern brown bandicoot)*		P4	
255.		*Isopeda leishmanni*			
256.	47975	*Ixobrychus dubius (Australian Little Bittern)*		P4	
257.		*Karaops jarrit*			
258.	24070	*Kogia breviceps (Pygmy Sperm Whale)*			
259.		*Kyphosus cornelii*			
260.		*Lagocephalus sceleratus*			
261.	24367	*Lalage tricolor (White-winged Triller)*			
262.		*Lampona brevipes*			
263.		*Lampona cylindrata*			
264.		*Lamponella kimba*			
265.		*Lamponina elongata*			
266.		*Lampris guttatus*			
267.	25637	*Larus novaehollandiae (Silver Gull)*			
268.	24511	*Larus novaehollandiae subsp. novaehollandiae (Silver Gull)*			
269.	25638	*Larus pacificus (Pacific Gull)*			
270.		*Latrodectus hasseltii*			
271.	25133	*Lerista elegans*			
272.	25148	*Lerista lineopunctulata*			
273.	25165	*Lerista praepedita*			
274.	25005	*Lialis burtonis*			
275.	25661	*Lichmera indistincta (Brown Honeyeater)*			
276.	25415	*Limnodynastes dorsalis (Western Banjo Frog)*			
277.	42461	*Limosa haemastica (Hudsonian Godwit)*	Y		Y
278.	30932	*Limosa lapponica (Bar-tailed Godwit)*		IA	
279.	25741	*Limosa limosa (Black-tailed Godwit)*		IA	
280.	25378	*Litoria adelaidensis (Slender Tree Frog)*			
281.	25388	*Litoria moorei (Motorbike Frog)*			
282.	25683	*Lonchura castaneothorax (Chestnut-breasted Mannikin)*			
283.		*Longepi woodman*			
284.		*Lophoictinia isura*			
285.		*Lotella rhacinus*			
286.		*Lycosa austicola*			Y
287.		*Lycosa australicola*			
288.		*Lycosa gilberta*			
289.		*Lycosa godeffroyi*			
290.	24690	*Macronectes giganteus (Southern Giant Petrel)*		IA	
291.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
292.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
293.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
294.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
295.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
296.	25654	*Malurus splendens (Splendid Fairy-wren)*			
297.	24583	*Manorina flavigula (Yellow-throated Miner)*			
298.		*Maratus chrysomelas*			
299.		*Maratus pavonis*			
300.		*Maratus speciosus*			
301.		*Maratus spicatus*			
302.		*Masasteron sampeyae*			
303.		*Masasteron tuart*			
304.	25758	*Megalurus gramineus (Little Grassbird)*			
305.	24051	*Megaptera novaeangliae (Humpback Whale)*		S	
306.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
307.	25184	*Menetia greyii*			
308.	24598	*Merops ornatus (Rainbow Bee-eater)*			
309.	24077	*Mesoplodon densirostris (Blainville's Beaked Whale)*			
310.		*Metavelifer multiradiatus*			
311.		*Meuschenia freycineti*			
312.		*Microcarbo melanoleucos*			
313.	25693	*Microeca fascinans (Jacky Winter)*			
314.	24213	*Mirounga leonina (Southern Elephant Seal)*			
315.		*Missulena granulosa*			
316.		*Missulena occatoria*			
317.		*Mituliodon tarantulinus*			
318.		*Mitzoruga insularis*			
319.		*Molycria vokes*			

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320.	25240	*Morelia spilota subsp. imbricata (Carpet Python)*			
321.	25191	*Morethia lineoocellata*			
322.	25192	*Morethia obscura*			
323.	48008	*Morus serrator (Australasian Gannet)*			
324.	25671	*Motacilla alba (White Wagtail)*			
325.		*Muraenichthys australis*			
326.		*Muraenichthys tasmaniensis*			
327.	24223	*Mus musculus (House Mouse)*	Y		
328.		*Mustelus antarcticus*			
329.		*Myandra bicincta*			
330.		*Myandra cambridgei*			
331.	25610	*Myiagra inquieta (Restless Flycatcher)*			
332.		*Myialges ancistronae*			
333.		*Myliobatis australis*			
334.	25420	*Myobatrachus gouldii (Turtle Frog)*			
335.	25344	*Natator depressus (Flatback Turtle)*		T	
336.		*Neatypus obliquus*			
337.	25248	*Neelaps bimaculatus (Black-naped Snake)*			
338.	25249	*Neelaps calonotos (Black-striped Snake, black-striped burrowing snake)*		P3	
339.		*Neopataecus waterhousii*			
340.	24738	*Neophema elegans (Elegant Parrot)*			
341.	24210	*Neophoca cinerea (Australian Sea-lion)*		T	
342.		*Nephila edulis*			
343.		*Nicodamus mainae*			
344.	25252	*Notechis scutatus (Tiger Snake)*			
345.		*Notiasemus glauerti*			
346.		*Notolabrus parilus*			
347.	25564	*Nycticorax caledonicus (Rufous Night Heron)*			
348.	24742	*Nymphicus hollandicus (Cockatiel)*			
349.	24497	*Oceanites oceanicus (Wilson's Storm-petrel)*		IA	
350.		*Ocrisiona leucocomis*			
351.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
352.		*Odax acroptilus*			
353.		*Odax cyanomelas*			
354.		*Oecobius navus*			
355.		*Ommatoiulus moreletii*			
356.		*Ophichthus melanochir*			
357.		*Ophisurus serpens*			
358.		*Orectolobus n.sp*			Y
359.		*Ornithonyssus bacoti*			
360.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
361.	24328	*Oxyura australis (Blue-billed Duck)*		P4	
362.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
363.	24624	*Pachycephala rufiventris subsp. rufiventris (Rufous Whistler)*			
364.	24692	*Pachyptila belcheri (Slender-billed Prion)*			
365.	24693	*Pachyptila desolata (Antarctic Prion)*			
366.	25707	*Pachyptila salvini (Salvin's Prion)*			
367.	48591	*Pandion cristatus (Osprey, Eastern Osprey)*		IA	
368.		*Parablennius postoculomaculatus*			
369.		*Paralampona marangaroo*			
370.		*Parapallene haddoni*			
371.		*Parapercis ramsayi*			
372.		*Parascyllium variolatum*			
373.	25253	*Parasuta gouldii*			
374.	25255	*Parasuta nigriceps*			
375.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
376.	25682	*Pardalotus striatus (Striated Pardalote)*			
377.		*Parma victoriae*			
378.		*Parupeneus chrysopleuron*			
379.	25687	*Passer domesticus (House Sparrow)*	Y		
380.	24641	*Passer domesticus subsp. domesticus (House Sparrow)*	Y		Y
381.		*Pediana occidentalis*			
382.	24648	*Pelecanus conspicillatus (Australian Pelican)*			
383.		*Pempheris klunzingeri*			
384.	48060	*Petrochelidon ariel (Fairy Martin)*			
385.	48061	*Petrochelidon nigricans (Tree Martin)*			
386.	48066	*Petroica boodang (Scarlet Robin)*			
387.	24659	*Petroica goodenovii (Red-capped Robin)*			
388.	25697	*Phalacrocorax carbo (Great Cormorant)*			
389.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			

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390.	24667	*Phalacrocorax sulcirostris (Little Black Cormorant)*			
391.	25699	*Phalacrocorax varius (Pied Cormorant)*			
392.	24409	*Phaps chalcoptera (Common Bronzewing)*			
393.		*Phenasteron machinosum*			
394.		*Phoebetria sp.*			Y
395.		*Pholcus phalangioides*			
396.	34039	*Phycodurus eques (Leafy Sea Dragon)*		P2	
397.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
398.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
399.		*Phyllophichthus xenodontus*			
400.		*Phyllopteryx taeniolatus*			
401.	24841	*Platalea flavipes (Yellow-billed Spoonbill)*			
402.	24842	*Platalea regia (Royal Spoonbill)*			
403.		*Platax teira*			
404.		*Platycephalus chauliodous*			
405.		*Platycephalus endrachtensis*			
406.		*Platycephalus sp.*			
407.	25720	*Platycercus icterotis (Western Rosella)*			
408.	24747	*Platycercus spurius (Red-capped Parrot)*			
409.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
410.	24750	*Platycercus zonarius subsp. semitorquatus (Twenty-eight Parrot)*			
411.	24843	*Plegadis falcinellus (Glossy Ibis)*		IA	
412.	25007	*Pletholax gracilis subsp. gracilis (Keeled Legless Lizard)*			
413.	24382	*Pluvialis fulva (Pacific Golden Plover)*		IA	
414.	24383	*Pluvialis squatarola (Grey Plover)*		IA	
415.	25703	*Podargus strigoides (Tawny Frogmouth)*			
416.	24679	*Podargus strigoides subsp. brachypterus (Tawny Frogmouth)*			
417.	25704	*Podiceps cristatus (Great Crested Grebe)*			
418.	24680	*Podiceps cristatus subsp. australis (Great Crested Grebe)*			
419.	25510	*Pogona minor (Dwarf Bearded Dragon)*			
420.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
421.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
422.	25722	*Polytelis anthopeplus (Regent Parrot)*			
423.		*Polytelis swainsonii*			Y
424.	25731	*Porphyrio porphyrio (Purple Swamphen)*			
425.	24767	*Porphyrio porphyrio subsp. bellus (Purple Swamphen)*			
426.	24769	*Porzana fluminea (Australian Spotted Crake)*			
427.	25732	*Porzana pusilla (Baillon's Crake)*			
428.	24770	*Porzana pusilla subsp. palustris (Baillon's Crake)*			
429.	24771	*Porzana tabuensis (Spotless Crake)*			
430.		*Prionosternum nitidiceps*			
431.		*Prionosternum scutatum*			
432.	25708	*Procellaria aequinoctialis (White-chinned Petrel)*		T	
433.	25261	*Pseudechis australis (Mulga Snake)*			
434.		*Pseudogobius olorum*			
435.		*Pseudolampona woodman*			
436.	24230	*Pseudomys albocinereus (Ash-grey Mouse)*			
437.	25511	*Pseudonaja affinis (Dugite)*			
438.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
439.	42416	*Pseudonaja mengdeni (Western Brown Snake)*			
440.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
441.		*Pseudorhombus jenynsii*			
442.	24702	*Pterodroma brevirostris (Kerguelen Petrel)*			
443.	24703	*Pterodroma lessonii (White-headed Petrel)*			
444.	25710	*Pterodroma macroptera (Great-winged Petrel)*			
445.		*Pterygotrigla polyommata*			
446.	24711	*Puffinus assimilis subsp. assimilis (Little Shearwater)*			
447.		*Purpureicephalus spurius*			
448.		*Pycnothea flynni*			
449.	25008	*Pygopus lepidopodus (Common Scaly Foot)*			
450.	24243	*Rattus fuscipes (Western Bush Rat)*			
451.	24245	*Rattus rattus (Black Rat)*	Y		
452.		*Raveniella cirrata*			
453.		*Raveniella peckorum*			
454.	24776	*Recurvirostra novaehollandiae (Red-necked Avocet)*			
455.		*Regalecus glesne*			
456.	48096	*Rhipidura albiscapa (Grey Fantail)*			
457.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
458.	24454	*Rhipidura leucophrys subsp. leucophrys (Willie Wagtail)*			
459.		*Rhycherus gloveri*			

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460.		*Saurida grandisquamis*			
461.		*Scobinichthys granulatus*			
462.		*Scomber australasicus*			
463.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
464.	24279	*Sericornis frontalis subsp. maculatus (White-browed Scrubwren)*			
465.		*Seriola lalandi*			
466.		*Servaea melaina*			
467.		*Sillago schomburgkii*			
468.		*Simonus lineatus*			Y
469.	25266	*Simoselaps bertholdi (Jan's Banded Snake)*			
470.		*Siphonognathus argyrophanes*			
471.	30948	*Smicrornis brevirostris (Weebill)*			
472.		*Solaenodolichopus pruvoti*			
473.		*Sphyraena obtusata*			
474.		*Sphyrna zygaena*			
475.		*Steatoda capensis*			
476.	48116	*Stercorarius antarcticus (Brown Skua)*		P4	
477.	24522	*Sterna bergii (Crested Tern)*			
478.	24525	*Sterna fuscata subsp. nubilosa (Sooty Tern)*			
479.	25643	*Sterna hybrida (Whiskered Tern)*			
480.	24533	*Sterna paradisaea (Arctic Tern)*			
481.	48594	*Sternula nereis (Fairy Tern)*			
482.	24329	*Stictonetta naevosa (Freckled Duck)*			
483.		*Stigmatopora argus*			
484.	25597	*Strepera versicolor (Grey Currawong)*			
485.	25589	*Streptopelia chinensis (Spotted Turtle-Dove)*	Y		
486.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
487.		*Strongylura leiura*			
488.	24936	*Strophurus michaelseni*			
489.	25518	*Strophurus spinigerus*			
490.	24943	*Strophurus spinigerus subsp. inornatus*			
491.	24942	*Strophurus spinigerus subsp. spinigerus*			
492.		*Supunna funerea*			
493.		*Supunna picta*			
494.		*Sutorectus tentaculatus*			
495.	33992	*Synemon gratiosa (Graceful Sunmoth)*		P4	
496.		*Synothele durokoppin*			
497.		*Synothele michaelseni*			
498.		*Synothele mullaloo*			
499.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
500.	24682	*Tachybaptus novaehollandiae subsp. novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
501.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
502.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
503.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
504.		*Tasmanicosa leuckartii*			
505.		*Tetralycosa oraria*			
506.	48597	*Thalasseus bergii (Crested Tern)*		IA	
507.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
508.		*Thysanophrys cirronasus*			
509.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
510.	25519	*Tiliqua rugosa*			
511.	25204	*Tiliqua rugosa subsp. aspera*			
512.	25207	*Tiliqua rugosa subsp. rugosa*			
513.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
514.	24309	*Todiramphus sanctus subsp. sanctus (Sacred Kingfisher)*			
515.		*Torquigener pleurogramma*			
516.		*Torquigener vicinus*			
517.		*Trachichthys australis*			
518.		*Trachinocephalus myops*			
519.		*Trachurus declivis*			
520.	48141	*Tribonyx ventralis (Black-tailed Native-hen)*			
521.	25723	*Trichoglossus haematodus (Rainbow Lorikeet)*			
522.	24755	*Trichoglossus haematodus subsp. moluccanus (Rainbow Lorikeet)*	Y		
523.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
524.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
525.	24806	*Tringa glareola (Wood Sandpiper)*		IA	
526.	24808	*Tringa nebularia (Common Greenshank, greenshank)*		IA	
527.	24809	*Tringa stagnatilis (Marsh Sandpiper, little greenshank)*		IA	
528.		*Trygonorrhina sp.*			Y

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529.	24069	*Tursiops truncatus (Bottlenose Dolphin)*			
530.		*Tylosurus crocodilus*			
531.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
532.	24983	*Underwoodisaurus milii (Barking Gecko)*			
533.		*Urodacus hartmeyeri*			
534.		*Urodacus novaehollandiae*			
535.		*Urodacus planimanus*			
536.		*Urodacus woodwardii*			
537.	25577	*Vanellus miles (Masked Lapwing)*			
538.	24386	*Vanellus tricolor (Banded Lapwing)*			
539.	25218	*Varanus gouldii (Bungarra or Sand Monitor)*			
540.	25526	*Varanus tristis (Racehorse Monitor)*			
541.		*Venator immansueta*			
542.		*Venatrix pullastra*			
543.	24040	*Vulpes vulpes (Red Fox)*	Y		
544.		*Westrarchaea pusilla*			
545.		*Westrarchaea sinuosa*			
546.	41351	*Xenus cinereus (Terek Sandpiper)*		IA	
547.		*Zachria flavicoma*			
548.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			
Chromista					
549.	26444	*Acrosorium ciliolatum*			
550.	26487	*Asperococcus bullosus*			
551.	26586	*Caulocystis uvifera*			
552.	26662	*Cladostephus spongiosus*			
553.	26694	*Colpomenia sinuosa*			
554.	26720	*Cystophora grevillei*			
555.	26724	*Cystophora pectinata*			
556.	26766	*Dictyopteris muelleri*			
557.	26767	*Dictyopteris plagiogramma*			
558.	26775	*Dictyota ciliolata*			
559.	29537	*Dictyota fastigiata*			
560.	26805	*Ecklonia radiata*			
561.	26810	*Encyothalia cliftonii*			
562.	48244	*Feldmannia mitchelliae*			
563.	26946	*Hormophysa cuneiformis*			
564.	27043	*Lobophora variegata*			
565.	27044	*Lobospira bicuspidata*			
566.	27090	*Myriodesma quercifolium*			
567.	27117	*Padina gymnospora*			
568.	48303	*Petalonia binghamiae*	Y		
569.	27152	*Platythalia quercifolia*			
570.	35222	*Rugulopteryx radicans*			
571.	44573	*Sargassopsis decurrens*			
572.	27238	*Sargassum distichum*			
573.	27239	*Sargassum fallax*			
574.	27246	*Sargassum lacerifolium*			
575.	27249	*Sargassum linearifolium*			
576.	29956	*Sargassum paradoxum*			
577.	27253	*Sargassum peronii*			
578.	27254	*Sargassum podacanthum*			
579.	27260	*Sargassum tristichum*			
580.	29957	*Sargassum vestitum*			
581.	27264	*Scaberia agardhii*			
582.	27273	*Scytothalia dorycarpa*			
583.	42785	*Sirophysalis trinodis*			
584.	27306	*Sporochnus scoparius*			
585.	27345	*Turbinaria gracilis*			
586.	27373	*Zonaria turneriana*			
Fungi					
587.	48599	*Amanita arenaria*			
588.	48332	*Amanita preissii (Cinnamon-ring Lepidella)*		P3	
589.	46626	*Anthracocystis destruens*			Y
590.		*Asterostroma persimile*			
591.	38765	*Battarrea stevenii*			
592.		*Boletus prolinius*			
593.		*Boletus sp.*			
594.		*Calocera guepinioides*			
595.	38771	*Coltriciella dependens*			

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596.	38780	*Crepidotus eucalyptorum*			
597.		*Dermocybe clelandii*			
598.	47215	*Entoloma byssisedum*			
599.		*Gymnopilus allantopus*			
600.		*Gymnopilus purpuratus*			
601.	38790	*Gyrodontium sacchari*			
602.	38791	*Hebeloma crustuliniforme*			
603.		*Hydnangium carneum*			
604.	40869	*Inocybe curvipes*	Y		
605.	48529	*Inocybe isabellina*			
606.	48535	*Inocybe memorialis*			
607.	48545	*Inocybe sabulosa*			
608.		*Laccaria canaliculata*			
609.		*Leucoagaricus barssii*			
610.	46454	*Leucoagaricus leucothites*			
611.		*Leucocoprinus birnbaumii*			
612.		*Melanoleuca fusca*			
613.	38811	*Mycena clarkeana*			
614.	38817	*Panaeolus papilionaceus*			
615.		*Panus fasciatus*			
616.		*Peziza repanda*			
617.	38820	*Phallus hadriani*			
618.		*Phellinus gilvus*			
619.		*Phlebia subceracea*			
620.		*Pholiota communis*			
621.	49071	*Picipes badius*			
622.	48976	*Pisolithus hypogaeus*			Y
623.		*Pluteus romellii*			
624.	38830	*Psilocybe coprophila*			
625.	48835	*Pycnoporus coccineus*			
626.	49072	*Ramaria gracilis*			
627.		*Resupinatus trichotis*			Y
628.	48906	*Russula delica*			
629.		*Schizophyllum commune*			
630.	38839	*Schizopora paradoxa*			
631.		*Sphaerobolus stellatus*			
632.	38840	*Stereum hirsutum*			
633.		*Tomentella pilosa*			
634.		*Tremella mesenterica*			
635.	38846	*Tubaria serrulata*			
636.		*Uromycladium tepperianum*			
637.	45907	*Ustilago trichophora*			Y
638.	38847	*Xerula mundroola*			
Plantae					
639.	15466	*Acacia applanata*			
640.	3237	*Acacia benthamii*		P2	
641.	3262	*Acacia cochlearis (Rigid Wattle)*			
642.	3282	*Acacia cyclops (Coastal Wattle)*			
643.	3374	*Acacia huegelii*			
644.	3409	*Acacia lasiocarpa (Panjang)*			
645.	11611	*Acacia lasiocarpa var. lasiocarpa*			
646.	15721	*Acacia lasiocarpa var. sedifolia*			
647.	17861	*Acacia longifolia*	Y		
648.	17464	*Acacia longifolia subsp. longifolia*	Y		
649.	3502	*Acacia pulchella (Prickly Moses)*			
650.	15481	*Acacia pulchella var. glaberrima*			
651.	3525	*Acacia rostellifera (Summer-scented Wattle)*			
652.	3527	*Acacia saligna (Orange Wattle, Kudjong)*			
653.	30032	*Acacia saligna subsp. saligna*			
654.	3541	*Acacia sessilis*			
655.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
656.	3584	*Acacia truncata*			
657.	3602	*Acacia willdenowiana (Grass Wattle)*			
658.	3604	*Acacia xanthina (White-stemmed Wattle)*			
659.	1208	*Acanthocarpus preissii*			
660.	26447	*Acrothamnion preissii*			
661.	7818	*Actites megalocarpus (Dune Thistle)*			
662.	11837	*Adenanthos cygnorum subsp. cygnorum (Common Woollybush)*			
663.	4582	*Adriana quadripartita (Bitter Bush)*			
664.	1505	*Agave americana (Century Plant)*			

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			Y		
665.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
666.	48513	*Aizoon pubescens*	Y		
667.	1056	*Alexgeorgea nitens*			
668.	1377	*Allium porrum (Leek)*	Y		
669.	1378	*Allium triquetrum (Three-cornered Garlic)*	Y		
670.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
671.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
672.	13908	*Allocasuarina lehmanniana subsp. lehmanniana*			
673.	2652	*Alternanthera nodiflora (Common Joyweed)*			
674.	2653	*Alternanthera pungens (Khaki Weed)*	Y		
675.	6565	*Alyxia buxifolia (Dysentery Bush)*			
676.	26454	*Amansia serrata*			
677.	25840	*Amaranthus blitum*	Y		
678.	2662	*Amaranthus hybridus (Slim Amaranth)*	Y		
679.	126	*Amphibolis antarctica (Sea Nymph)*			
680.	127	*Amphibolis griffithii*			
681.	20184	*Amphipogon laguroides subsp. laguroides*			
682.	200	*Amphipogon turbinatus*			
683.	26458	*Amphiroa anceps*			
684.	26463	*Amphiroa gracilis*			
685.	6311	*Andersonia heterophylla*			
686.	7827	*Angianthus cunninghamii (Coast Angianthus)*			
687.	1409	*Anigozanthos humilis (Catspaw)*			
688.	11434	*Anigozanthos humilis subsp. humilis*			
689.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
690.	11261	*Anigozanthos manglesii subsp. manglesii*			
691.		*Anotrichium crinitum*			
692.	17455	*Anredera cordifolia*	Y		
693.	6947	*Anthocercis ilicifolia*			
694.	6949	*Anthocercis littorea (Yellow Tailflower)*			
695.	26471	*Antithamnion armatum*			
696.	26475	*Antithamnion hanovioides*			
697.	3186	*Aphanes arvensis (Parsley Piert)*	Y		
698.	6210	*Apium annuum*			
699.	8595	*Apium graveolens (Wild Celery)*	Y		
700.	26481	*Apjohnia laetevirens*			
701.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
702.	7839	*Arctotheca populifolia (Dune Arctotheca, Beach Pumpkin, Coast Capeweed, Beach Daisy)*	Y		
703.	7840	*Arctotis stoechadifolia (White Arctotis, Silver Arctotis)*	Y		
704.	26484	*Areschougia ligulata*			
705.	1264	*Arnocrinum preissii*			
706.	6580	*Asclepias curassavica (Redhead Cottonbush)*	Y		
707.	20752	*Asparagus aethiopicus*	Y		
708.	8779	*Asparagus asparagoides (Bridal Creeper)*	Y		
709.	1364	*Asphodelus fistulosus (Onion Weed)*	Y		
710.	20283	*Astartea scoparia (Common Astartea)*			
711.	7851	*Asteridea pulverulenta (Common Bristle Daisy)*			
712.	6323	*Astroloma ciliatum (Candle Cranberry)*			
713.	6331	*Astroloma microcalyx (Native Cranberry)*			
714.	6334	*Astroloma pallidum (Kick Bush)*			
715.	6339	*Astroloma xerophyllum*			
716.	2452	*Atriplex cinerea (Grey Saltbush)*			
717.	17234	*Austrostipa compressa*			
718.	17238	*Austrostipa eremophila*			
719.	17240	*Austrostipa flavescens*			
720.	35317	*Austrostipa mundula*		P3	
721.	17246	*Austrostipa nitida*			
722.		*Austrostipa sp.*			
723.	37421	*Austrostipa sp. Marchagee (B.R. Maslin 1407)*			
724.	231	*Avellinia michelii*	Y		
725.	234	*Avena fatua (Wild Oat)*	Y		
726.	16346	*Bacopa monnieri*	Y		
727.	34161	*Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)*		P1	
728.	1800	*Banksia attenuata (Slender Banksia, Piara)*			
729.	1819	*Banksia grandis (Bull Banksia, Pulgarla)*			
730.	1821	*Banksia hookeriana (Hooker's Banksia)*			
731.	1822	*Banksia ilicifolia (Holly-leaved Banksia)*			
732.	1830	*Banksia littoralis (Swamp Banksia, Pungura)*			

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733.	1834	*Banksia menziesii (Firewood Banksia)*			
734.	32202	*Banksia nivea (Honeypot Dryandra, Pudjarn)*			
735.	1842	*Banksia prionotes (Acorn Banksia)*			
736.	32077	*Banksia sessilis var. cygnorum*			
737.	32315	*Barbula calycina*			
738.	741	*Baumea articulata (Jointed Rush)*			
739.	743	*Baumea juncea (Bare Twigrush)*			
740.	745	*Baumea preissii*			
741.	5382	*Beaufortia elegans (Elegant Beaufortia)*			
742.	7046	*Bellardia trixago (Bellardia)*	Y		
743.	48503	*Betaphycus speciosus*			
744.	25788	*Billardiera fraseri (Elegant Pronaya)*			
745.	749	*Bolboschoenus caldwellii (Marsh Club-rush)*			
746.	26511	*Bornetia binderiana*			
747.	17665	*Boronia purdieana subsp. purdieana*			
748.	11381	*Boronia ramosa subsp. anethifolia*			
749.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
750.	7867	*Brachyscome bellidioides*			
751.	7878	*Brachyscome iberidifolia*			
752.	11187	*Brassica barrelieri subsp. oxyrrhina (Smooth-stem Turnip)*	Y		
753.	2999	*Brassica rapa*	Y		
754.	3000	*Brassica tournefortii (Mediterranean Turnip)*	Y		
755.	2995	*Brassica x napus*	Y		
756.	244	*Briza maxima (Blowfly Grass)*	Y		
757.	245	*Briza minor (Shivery Grass)*	Y		
758.	247	*Bromus arenarius (Sand Brome)*			
759.	249	*Bromus diandrus (Great Brome)*	Y		
760.	26521	*Bryopsis australis*			
761.	26522	*Bryopsis foliosa*			
762.	32331	*Bryum lanatum*			
763.	12770	*Burchardia congesta*			
764.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
765.	1276	*Caesia micrantha (Pale Grass Lily)*			
766.	1277	*Caesia occidentalis*			
767.	3002	*Cakile maritima (Sea Rocket)*	Y		
768.	15330	*Caladenia arenicola*			
769.	1586	*Caladenia discoidea (Dancing Orchid)*			
770.	1592	*Caladenia flava (Cowslip Orchid)*			
771.	15348	*Caladenia flava subsp. flava*			
772.	15352	*Caladenia georgei*			
773.	1599	*Caladenia latifolia (Pink Fairy Orchid)*			
774.	15360	*Caladenia longicauda subsp. borealis*			
775.	15361	*Caladenia longicauda subsp. calcigena*			
776.	15365	*Caladenia longicauda subsp. longicauda*			
777.	15377	*Caladenia reptans subsp. reptans*			
778.	2845	*Calandrinia brevipedata (Short-stalked Purslane)*			
779.	2848	*Calandrinia corrigioloides (Strap Purslane)*			
780.	2854	*Calandrinia granulifera (Pygmy Purslane)*			
781.	2856	*Calandrinia liniflora (Parakeelya)*			
782.	19309	*Calectasia narragara*			
783.	10861	*Callistachys lanceolata (Wonnich)*			
784.	96	*Callitris preissii (Rottnest Island Pine, Maro)*			
785.	26533	*Callophycus costatus*			
786.	26534	*Callophycus dorsifer*			
787.	26536	*Callophycus oppositifolius*			
788.	5415	*Calothamnus lateralis*			
789.	5426	*Calothamnus quadrifidus (One-sided Bottlebrush, Kwowdjard)*			
790.	35816	*Calothamnus quadrifidus subsp. quadrifidus*			
791.	5429	*Calothamnus sanguineus (Silky-leaved Blood flower, Pindak)*			
792.	5439	*Calytrix angulata (Yellow Starflower)*			
793.	5460	*Calytrix fraseri (Pink Summer Calytrix)*			
794.	5476	*Calytrix sapphirina*			
795.	32338	*Campylopus introflexus*	Y		
796.	8521	*Canna indica (Indian Shot)*	Y		
797.	13488	*Canna x generalis*	Y		
798.	3005	*Cardamine hirsuta (Common Bittercress)*	Y		
799.	49010	*Cardamine occulta*	Y		
800.	753	*Carex appressa (Tall Sedge)*			
801.	754	*Carex divisa (Divided Sedge)*	Y		
802.	755	*Carex fascicularis (Tassel Sedge)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
803.	43241	*Carex thecata*			
804.	2795	*Carpobrotus edulis (Hottentot Fig)*	Y		
805.	2798	*Carpobrotus virescens (Coastal Pigface, Kolboko, Bain)*			
806.	1162	*Cartonema philydroides*			
807.	2951	*Cassytha flava (Dodder Laurel)*			
808.	2957	*Cassytha racemosa (Dodder Laurel)*			
809.	18314	*Casuarina cunninghamiana subsp. cunninghamiana*	Y		
810.	13685	*Catapodium rigidum (Rigid Fescue)*	Y		
811.	26556	*Caulerpa cactoides*			
812.	44539	*Caulerpa cylindracea*			
813.	26563	*Caulerpa flexilis*			
814.	48455	*Caulerpa geminata*			
815.	27382	*Caulerpa longifolia forma crispata*			
816.	26570	*Caulerpa obscura*			
817.	26574	*Caulerpa scalpelliformis*			
818.	46993	*Caulerpa taxifolia var. distichophylla*			
819.	26580	*Caulerpa trifaria*			
820.	258	*Cenchrus ciliaris (Buffel Grass)*	Y		
821.	259	*Cenchrus echinatus (Burrgrass)*	Y		
822.	6214	*Centella asiatica*			
823.	26587	*Centroceras clavulatum*			
824.	1125	*Centrolepis drummondiana*			
825.	26593	*Ceramium filicula*			
826.	26595	*Ceramium isogonum*			
827.	26601	*Ceramium rubrum*			
828.	2889	*Cerastium glomeratum (Mouse Ear Chickweed)*	Y		
829.	32462	*Ceratodon purpureus subsp. convolutus*			
830.	18156	*Chamaecytisus palmensis (Tagasaste)*	Y		
831.	1280	*Chamaescilla corymbosa (Blue Squill)*			
832.	5498	*Chamelaucium uncinatum (Geraldton Wax)*			
833.	26616	*Champia affinis*			
834.	26621	*Champia zostericola*			
835.	1513	*Chasmanthe floribunda (African Cornflag)*	Y		
836.	26622	*Chauviniella coriifolia*			
837.	2483	*Chenopodium album (Fat Hen)*	Y		
838.	2490	*Chenopodium glaucum (Glaucous Goosefoot)*	Y		
839.	2491	*Chenopodium macrospermum*	Y		
840.	26632	*Chondria curdieana*			
841.	7925	*Chondrilla juncea (Skeleton Weed)*	Y		
842.	17833	*Chordifex microcodon*			
843.	7935	*Cichorium intybus (Chicory)*	Y		
844.	26649	*Cladophora albida*			
845.	26659	*Cladophora valonioides*			
846.	26663	*Cladurus elatus*			
847.	26665	*Claviclonium ovatum*			
848.	10804	*Clematis linearifolia*			
849.	2929	*Clematis pubescens (Common Clematis)*			
850.	26671	*Codium duthieae*			
851.	26672	*Codium galeatum*			
852.	26675	*Codium laminarioides*			
853.	26678	*Codium muelleri*			
854.	26682	*Codium spinescens*			
855.	26688	*Coeloclonium tasmanicum*			
856.	26690	*Coeloclonium verticillatum*			
857.	4550	*Comesperma calymega (Blue-spike Milkwort)*			
858.	15607	*Conospermum acerosum subsp. acerosum*			
859.	15516	*Conospermum canaliculatum subsp. canaliculatum*			
860.	1876	*Conospermum incurvum (Plume Smokebush)*			
861.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
862.	6347	*Conostephium minus (Pink-tipped Pearl flower)*			
863.	6348	*Conostephium pendulum (Pearl Flower)*			
864.	6349	*Conostephium preissii*			
865.	1418	*Conostylis aculeata (Prickly Conostylis)*			
866.	11826	*Conostylis aculeata subsp. aculeata*			
867.	11513	*Conostylis aculeata subsp. cygnorum*			
868.	1425	*Conostylis bracteata*		P3	
869.	1427	*Conostylis candicans (Grey Cottonhead)*			
870.	11438	*Conostylis candicans subsp. candicans*			
871.	1436	*Conostylis juncea*			
872.	1454	*Conostylis setigera (Bristly Cottonhead)*			

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873.	11597	*Conostylis setigera subsp. setigera*			
874.	7939	*Conyza bonariensis (Flaxleaf Fleabane)*	Y		
875.	7941	*Conyza parva*	Y		
876.		*Conyza sp.*			
877.	20074	*Conyza sumatrensis*	Y		
878.	29283	*Coprosma repens*	Y		
879.	48259	*Cortaderia selloana subsp. selloana*	Y		
880.	17104	*Corymbia calophylla (Marri)*			
881.	1285	*Corynotheca micrantha (Sand Lily)*			
882.	11283	*Corynotheca micrantha var. micrantha*			
883.	7945	*Cotula coronopifolia (Waterbuttons)*	Y		
884.	7947	*Cotula turbinata (Funnel Weed)*	Y		
885.	3136	*Crassula alata*	Y		
886.	3137	*Crassula colorata (Dense Stonecrop)*			
887.	11709	*Crassula colorata var. acuminata*			
888.	3139	*Crassula exserta*			
889.	3140	*Crassula glomerata*	Y		
890.	3146	*Crassula thunbergiana*	Y		
891.	11345	*Crassula thunbergiana subsp. thunbergiana*	Y		
892.	7953	*Crepis foetida (Foetid Hawksbeard)*	Y		
893.	4810	*Cryptandra scoparia*			
894.	26708	*Cryptonemia kallymenioides*			
895.	26712	*Curdiea obesa*			
896.	1487	*Cyanella hyacinthoides*	Y		
897.	15114	*Cyanicula gemmata*			
898.	283	*Cynodon dactylon (Couch)*	Y		
899.	18318	*Cyperus involucratus*	Y		
900.	810	*Cyperus rotundus (Nut Grass)*	Y		
901.	816	*Cyperus tenuiflorus (Scaly Sedge)*	Y		
902.	10916	*Cyrtostylis huegelii*			
903.	7454	*Dampiera linearis (Common Dampiera)*			
904.	26738	*Dasya elongata*			
905.	26751	*Dasyclonium flaccidum*			
906.	26752	*Dasyclonium incisum*			
907.	26753	*Dasyphila preissii*			
908.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
909.	10823	*Datura inoxia*	Y		
910.	6218	*Daucus glochidiatus (Australian Carrot)*			
911.	3807	*Daviesia divaricata (Marno)*			
912.	18560	*Daviesia divaricata subsp. divaricata*			
913.	3824	*Daviesia nudiflora*			
914.	16585	*Daviesia nudiflora subsp. nudiflora*			
915.	3831	*Daviesia pedunculata*			
916.	3832	*Daviesia physodes*			
917.	3845	*Daviesia triflora*			
918.	17663	*Desmocladus asper*			
919.	16595	*Desmocladus flexuosus*			
920.	1259	*Dianella revoluta (Blueberry Lily)*			
921.	11636	*Dianella revoluta var. divaricata*			
922.	306	*Dichelachne crinita (Longhair Plumegrass)*			
923.	31597	*Dichondra micrantha*	Y		Y
924.	1287	*Dichopogon capillipes*			
925.	29615	*Dichotomaria obtusata*			
926.	26758	*Dicranema revolutum*			
927.	26762	*Dictyomenia sonderi*			
928.	26763	*Dictyomenia tridens*			
929.	320	*Digitaria sanguinalis (Crab Grass)*	Y		
930.	4453	*Diplolaena angustifolia (Yanchep Rose)*			
931.	4454	*Diplolaena dampieri (Southern Diplolaena)*			
932.	4748	*Diplopeltis petiolaris*			
933.	3011	*Diplotaxis muralis (Wall Rocket)*	Y		
934.	19649	*Disa bracteata*	Y		
935.	7054	*Dischisma arenarium*	Y		
936.	7055	*Dischisma capitatum (Woolly-headed Dischisma)*	Y		
937.	7961	*Dittrichia graveolens (Stinkwort)*	Y		
938.	7962	*Dittrichia viscosa*	Y		
939.	11049	*Diuris corymbosa*			
940.	12939	*Diuris magnifica*			
941.	48751	*Drosera drummondii*			
942.	3095	*Drosera erythrorhiza (Red Ink Sundew)*			

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943.	3106	*Drosera macrantha (Bridal Rainbow)*			
944.	3109	*Drosera menziesii (Pink Rainbow)*			
945.	48710	*Drosera micrantha*			
946.	3116	*Drosera omissa (Bright Sundew)*			
947.	3118	*Drosera pallida (Pale Rainbow)*			
948.	49090	*Drosera sp. Branched styles (S.C. Coffey 193)*			
949.	32351	*Eccremidium pulchellum*			
950.	328	*Echinochloa colona (Awnless Barnyard Grass)*	Y		
951.	329	*Echinochloa crus-pavonis (South American Barnyard Grass)*	Y		
952.	26803	*Echinothamnion hystrix*			
953.	11485	*Ehrharta brevifolia var. cuspidata*	Y		
954.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
955.	349	*Ehrharta longiflora (Annual Veldt Grass)*	Y		
956.	353	*Eleusine indica (Crowsfoot Grass)*	Y		
957.	1643	*Elythranthera brunonis (Purple Enamel Orchid)*			
958.	6132	*Epilobium ciliatum*	Y		
959.	6133	*Epilobium hirtigerum (Hairy Willow Herb)*			
960.	14289	*Epilobium tetragonum subsp. tetragonum*	Y		
961.	376	*Eragrostis curvula (African Lovegrass)*	Y		
962.	14104	*Eremaea pauciflora var. pauciflora*			
963.	5542	*Eremaea purpurea*			
964.	7215	*Eremophila glabra (Tar Bush)*			
965.	17175	*Eremophila glabra subsp. albicans*			
966.	15410	*Eriochilus dilatatus subsp. dilatatus*			
967.	15414	*Eriochilus helonomos*			
968.	4332	*Erodium botrys (Long Storksbill)*	Y		
969.	4333	*Erodium cicutarium (Common Storksbill)*	Y		
970.	4336	*Erodium moschatum (Musky Crowfoot)*	Y		
971.	6219	*Eryngium pinnatifidum (Blue Devils)*			
972.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
973.	26821	*Erythroclonium muelleri*			
974.	26823	*Erythroclonium sonderi*			
975.	5615	*Eucalyptus decipiens (Limestone Marlock, Moit)*			
976.	5649	*Eucalyptus foecunda (Narrow-leaved Red Mallee)*			
977.	5659	*Eucalyptus gomphocephala (Tuart, Duart)*			
978.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
979.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
980.	13541	*Eucalyptus petrensis*			
981.	5763	*Eucalyptus rudis (Flooded Gum, Kulurda)*			
982.	5790	*Eucalyptus todtiana (Coastal Blackbutt)*			
983.	18085	*Eucalyptus utilis*			
984.	3872	*Euchilopsis linearis (Swamp Pea)*			
985.	4627	*Euphorbia helioscopia (Sun Spurge)*	Y		
986.	4638	*Euphorbia peplus (Petty Spurge)*	Y		
987.	4648	*Euphorbia terracina (Geraldton Carnation Weed)*	Y		
988.	26830	*Euptilota articulata*			
989.	10765	*Exocarpos sparteus (Broom Ballart, Djuk)*			
990.	20162	*Fabronia hampeana*		P2	
991.	1515	*Ferraria crispa (Black Flag)*	Y		
992.	20216	*Ficinia nodosa (Knotted Club Rush)*			
993.	32369	*Fissidens tenellus*			
994.	6221	*Foeniculum vulgare (Fennel)*	Y		
995.	5209	*Frankenia pauciflora (Seaheath)*			
996.	2971	*Fumaria muralis (Wall Fumitory)*	Y		
997.	7976	*Galinsoga parviflora (Potato Weed)*	Y		
998.	7323	*Galium murale (Small Goosegrass)*	Y		
999.	20346	*Gamochaeta coarctata*	Y		
1000.	20475	*Gastrolobium capitatum*			
1001.	20483	*Gastrolobium linearifolium*			
1002.	20482	*Gastrolobium nervosum*			
1003.	16311	*Gazania linearis*	Y		
1004.	26848	*Gelidium crinale*			
1005.	26850	*Gelinaria ulvoidea*			
1006.	32380	*Gemmabryum pachythecum*			
1007.	32381	*Gemmabryum preissianum*			
1008.	4339	*Geranium molle (Dove's Foot Cranesbill)*	Y		
1009.	4341	*Geranium solanderi (Native Geranium)*			
1010.	26854	*Gigartina disticha*			
1011.	1520	*Gladiolus caryophyllaceus (Wild Gladiolus)*	Y		
1012.	26858	*Glaphyrymenia pustulosa*			

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1013.	26859	*Gloiocladia australe*			
1014.	26864	*Gloiosaccion brownii*			
1015.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
1016.	11051	*Gomphocarpus physocarpus*	Y		
1017.	11083	*Gompholobium scabrum*			
1018.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
1019.	6161	*Gonocarpus pithyoides*			
1020.	26868	*Gracilaria cliftonii*			
1021.	26871	*Gracilaria flagelliformis*			
1022.	1982	*Grevillea crithmifolia*			
1023.	15839	*Grevillea preissii subsp. preissii*			
1024.	33737	*Grevillea sp. Ocean Reef (D. Pike Joon 4)*		P1	Y
1025.	2119	*Grevillea vestita*			
1026.	12824	*Grevillea vestita subsp. vestita*			
1027.	26883	*Griffithsia monilis*			
1028.	26886	*Griffithsia teges*			
1029.	5011	*Guichenotia ledifolia*			
1030.	2784	*Gyrostemon ramulosus (Corkybark)*			
1031.	1468	*Haemodorum laxum*			
1032.	1470	*Haemodorum paniculatum (Mardja)*			
1033.	1475	*Haemodorum spicatum (Mardja)*			
1034.	2146	*Hakea costata (Ribbed Hakea)*			
1035.	2175	*Hakea lissocarpha (Honey Bush)*			
1036.	2197	*Hakea prostrata (Harsh Hakea)*			
1037.	2203	*Hakea ruscifolia (Candle Hakea)*			
1038.	31793	*Hakea sp. Eastern coastal plain (G.J. Keighery 8014)*			
1039.	2214	*Hakea trifurcata (Two-leaf Hakea)*			
1040.	47213	*Halimeda versatilis*			
1041.	48568	*Halopeltis australis*			
1042.	164	*Halophila ovalis (Sea Wrack)*			
1043.	26900	*Haloplegma preissii*			
1044.	26911	*Haraldiophyllum erosum*			
1045.	3961	*Hardenbergia comptoniana (Native Wisteria)*			
1046.	3016	*Heliophila pusilla*	Y		
1047.	8084	*Helminthotheca echioides (Ox-tongue, Prickly Ox-tongue)*	Y		
1048.	439	*Hemarthria uncinata (Matgrass)*			
1049.	16933	*Hemiandra glabra*			
1050.	6836	*Hemiandra incana*			
1051.	6838	*Hemiandra linearis (Speckled Snakebush)*			
1052.	6839	*Hemiandra pungens (Snakebush)*			
1053.	38320	*Hemiandra sp. Jurien (B.J. Conn & M.E. Tozer BJC 3885)*			
1054.	26915	*Hennedya crispa*			
1055.	1293	*Hensmania turbinata*			
1056.	26919	*Herposiphonia rostrata*			
1057.	1526	*Hesperantha falcata*	Y		
1058.	26925	*Heterocladia caudata*			
1059.	26927	*Heterodoxia denticulata*			
1060.	443	*Heteropogon contortus (Bunch Speargrass)*			
1061.	26930	*Heterosiphonia crassipes*			
1062.	26936	*Heterosiphonia muelleri*			
1063.	31114	*Heterozostera nigricaulis*			
1064.	5112	*Hibbertia aurea*			
1065.	5116	*Hibbertia crassifolia*			
1066.	5117	*Hibbertia cuneiformis (Cutleaf Hibbertia)*			
1067.	5134	*Hibbertia huegelii*			
1068.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
1069.	45534	*Hibbertia hypericoides subsp. hypericoides*			
1070.	5154	*Hibbertia perfoliata*			
1071.	5162	*Hibbertia racemosa (Stalked Guinea Flower)*			
1072.	43280	*Hibbertia sericosepala*			
1073.	11461	*Hibbertia spicata subsp. leptotheca*		P3	
1074.	5173	*Hibbertia subvaginata*			
1075.	444	*Holcus lanatus (Yorkshire Fog)*	Y		
1076.	445	*Holcus setiger (Annual Fog)*	Y		
1077.	6222	*Homalosciadium homalocarpum*			
1078.	449	*Hordeum leporinum (Barley Grass)*	Y		
1079.	3966	*Hovea pungens (Devil's Pins, Puyenak)*			
1080.	3968	*Hovea trisperma (Common Hovea)*			
1081.	12859	*Hovea trisperma var. trisperma*			
1082.	5216	*Hybanthus calycinus (Wild Violet)*			

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1083.	6225	*Hydrocotyle bonariensis*	Y		
1084.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
1085.	6229	*Hydrocotyle diantha*			
1086.	26960	*Hymenocladia chondricola*			
1087.	26962	*Hymenocladia dactyloides*			
1088.	35922	*Hypnea cornuta*			
1089.	26968	*Hypnea filiformis*			
1090.	35898	*Hypnea musciformis*			
1091.	26973	*Hypnea valentiae*			
1092.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
1093.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
1094.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
1095.	9352	*Hypochaeris radicata (Flat Weed, Cats-ear)*	Y		
1096.	1070	*Hypolaena exsulca*			
1097.	6620	*Ipomoea cairica (Coast Morning Glory)*	Y		
1098.	20200	*Isolepis cernua var. setiformis*			
1099.	917	*Isolepis marginata (Coarse Club-rush)*			
1100.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
1101.	3992	*Isotropis cuneifolia (Granny Bonnets)*			
1102.	14783	*Jacksonia calcicola*			
1103.	4010	*Jacksonia floribunda (Holly Pea)*			
1104.	4012	*Jacksonia furcellata (Grey Stinkwood)*			
1105.	4027	*Jacksonia sericea (Waldjumi)*		P4	
1106.	4029	*Jacksonia sternbergiana (Stinkwood, Kapur)*			
1107.	26988	*Jania verrucosa*			
1108.	1188	*Juncus pallidus (Pale Rush)*			
1109.	4037	*Kennedia coccinea (Coral Vine)*			
1110.	4044	*Kennedia prostrata (Scarlet Runner)*			
1111.	26995	*Kuetzingia canaliculata*			
1112.	15498	*Kunzea glabrescens (Spearwood)*			
1113.	1370	*Lachenalia reflexa*	Y		
1114.	20019	*Lachnagrostis filiformis*			
1115.	8096	*Lactuca serriola (Prickly Lettuce)*	Y		
1116.	29046	*Lactuca serriola forma serriola*	Y		
1117.	18585	*Lagenophora huegelii*			
1118.	467	*Lagurus ovatus (Hare's Tail Grass)*	Y		
1119.	4052	*Latrobea tenella*			
1120.	27000	*Laurencia elata*			
1121.	27001	*Laurencia filiformis*			
1122.	27007	*Laurencia obtusa*			
1123.	11911	*Laxmannia ramosa subsp. ramosa*			
1124.	1309	*Laxmannia squarrosa*			
1125.	7574	*Lechenaultia floribunda (Free-flowering Leschenaultia)*			
1126.	7580	*Lechenaultia linarioides (Yellow Leschenaultia)*			
1127.	27011	*Lenormandia latifolia*			
1128.	27012	*Lenormandia pardalis*			
1129.	27013	*Lenormandia spectabilis*			
1130.	6880	*Leonotis leonurus (Lion's Ear)*	Y		
1131.	925	*Lepidosperma angustatum*			
1132.	42742	*Lepidosperma calcicola*			
1133.	937	*Lepidosperma longitudinale (Pithy Sword-sedge)*			
1134.	940	*Lepidosperma pubisquameum*			
1135.	944	*Lepidosperma scabrum*			
1136.		*Lepidosperma sp.*			
1137.	945	*Lepidosperma squamatum*			
1138.	15418	*Leptoceras menziesii*			
1139.	2350	*Leptomeria pauciflora (Sparse-flowered Currant Bush)*			
1140.	27015	*Leptosomia rosea*			
1141.	5850	*Leptospermum laevigatum (Coast Teatree)*	Y		
1142.	19821	*Lessertia frutescens*	Y		
1143.	28292	*Leucanthemum x superbum (Shasta Daisy)*	Y		
1144.	16449	*Leucophyta brownii*			
1145.	6360	*Leucopogon australis (Spiked Beard-heath)*			
1146.	6374	*Leucopogon conostephioides*			
1147.	6405	*Leucopogon insularis*			
1148.	40801	*Leucopogon maritimus*		P1	
1149.	6425	*Leucopogon oxycedrus*			
1150.	6427	*Leucopogon parviflorus (Coast Beard-heath)*			
1151.	6434	*Leucopogon polymorphus*			
1152.	6436	*Leucopogon propinquus*			

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1153.	40803	*Leucopogon squarrosus subsp. squarrosus*			
1154.	6489	*Limonium sinuatum (Perennial Sea Lavender)*	Y		
1155.	4364	*Linum usitatissimum (Flax)*	Y		
1156.	36160	*Liparophyllum capitatum*			
1157.	9289	*Lobelia anceps (Angled Lobelia)*			
1158.	7402	*Lobelia gibbosa (Tall Lobelia)*			
1159.	7408	*Lobelia tenuior (Slender Lobelia)*			
1160.	36860	*Lobelia tenuior subsp. dictyosperma*			Y
1161.	3048	*Lobularia maritima (Sweet Alyssum)*	Y		
1162.	6515	*Logania vaginalis (White Spray)*			
1163.	475	*Lolium multiflorum (Italian Ryegrass)*	Y		
1164.	478	*Lolium rigidum (Wimmera Ryegrass)*	Y		
1165.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
1166.	1228	*Lomandra hermaphrodita*			
1167.	1231	*Lomandra maritima*			
1168.	1232	*Lomandra micrantha (Small-flower Mat-rush)*			
1169.	1234	*Lomandra nigricans*			
1170.	1239	*Lomandra preissii*			
1171.	1243	*Lomandra sericea (Silky Mat Rush)*			
1172.		*Lomandra sp.*			
1173.	1246	*Lomandra suaveolens*			
1174.	8564	*Lotus subbiflorus*	Y		
1175.	4066	*Lupinus cosentinii*	Y		
1176.	1198	*Luzula meridionalis (Field Woodrush)*			
1177.	1097	*Lyginia barbata*			
1178.	18049	*Lyginia imberbis*			
1179.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
1180.	6456	*Lysinema ciliatum (Curry Flower)*			
1181.	34736	*Lysinema pentapetalum*			
1182.	5281	*Lythrum hyssopifolia (Lesser Loosestrife)*	Y		
1183.	2838	*Macarthuria apetala*			
1184.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
1185.	25819	*Marianthus paralius*		T	
1186.	3049	*Matthiola incana (Common Stock)*	Y		
1187.	4079	*Medicago polymorpha (Burr Medic)*	Y		
1188.	4080	*Medicago sativa (Alfalfa)*	Y		
1189.	34676	*Meionectes brownii (Swamp Raspwort)*			
1190.	5887	*Melaleuca cardiophylla (Tangling Melaleuca)*			
1191.	5920	*Melaleuca huegelii (Chenille Honeymyrtle)*			
1192.	13271	*Melaleuca huegelii subsp. huegelii*			
1193.	5952	*Melaleuca preissiana (Moonah)*			
1194.	5959	*Melaleuca rhaphiophylla (Swamp Paperbark)*			
1195.	5964	*Melaleuca seriata*			
1196.	18598	*Melaleuca systena*			
1197.	5983	*Melaleuca trichophylla*			
1198.	4516	*Melia azedarach (White Cedar)*			
1199.	4085	*Melilotus indicus*	Y		
1200.	6884	*Mentha spicata (Spearmint)*	Y		
1201.	6885	*Mentha suaveolens (Apple Mint)*	Y		
1202.	15994	*Mentha x piperita var. citrata*	Y		
1203.	953	*Mesomelaena graciliceps*			
1204.	955	*Mesomelaena pseudostygia*			
1205.	27067	*Metagoniolithon chara*			
1206.	27069	*Metagoniolithon stelliferum*			
1207.	27070	*Metamastophora flabellata*			
1208.	485	*Microlaena stipoides (Weeping Grass)*			
1209.	15419	*Microtis media subsp. media*			
1210.	8105	*Millotia myosotidifolia*			
1211.	8106	*Millotia tenuifolia (Soft Millotia)*			
1212.	4100	*Mirbelia spinosa*			
1213.	29418	*Monoculus monstrosus*	Y		
1214.	4662	*Monotaxis grandiflora (Diamond of the Desert)*			
1215.	19585	*Monotaxis grandiflora var. grandiflora*			
1216.	19179	*Moraea flaccida (One-leaf Cape Tulip)*	Y		
1217.	2415	*Muehlenbeckia polybotrya*			
1218.	27077	*Mychodea aciculare*			
1219.	7289	*Myoporum caprarioides (Slender Myoporum)*			
1220.	7291	*Myoporum insulare (Blueberry Tree, boobialla)*			
1221.	6199	*Myriophyllum tillaeoides*			
1222.	138	*Najas marina (Prickly Water Nymph)*			

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1223.	19161	*Nemesia strumosa*	Y		
1224.	27100	*Neurymenia fraxinifolia*			
1225.	4366	*Nitraria billardierei (Nitre Bush)*			
1226.	27103	*Nizymenia conferta*			
1227.	2401	*Nuytsia floribunda (Christmas Tree, Mudja)*			
1228.	6138	*Oenothera drummondii (Beach Evening Primrose)*	Y		
1229.	16390	*Oenothera drummondii subsp. drummondii*	Y		
1230.	14293	*Oenothera indecora subsp. bonariensis*	Y		
1231.	6142	*Oenothera stricta (Common Evening Primrose)*	Y		
1232.	2365	*Olax benthamiana*			
1233.	6503	*Olea europaea (Olive)*	Y		
1234.	8127	*Olearia axillaris (Coastal Daisybush)*			
1235.	8149	*Olearia rudis (Rough Daisybush)*			
1236.	7348	*Opercularia hispidula (Hispid Stinkweed)*			
1237.	18255	*Opercularia vaginata (Dog Weed)*			
1238.	7122	*Orobanche minor (Lesser Broomrape)*	Y		
1239.	1537	*Orthrosanthus laxus (Morning Iris)*			
1240.	11749	*Orthrosanthus laxus var. laxus (Morning Iris)*			
1241.	27107	*Osmundaria prolifera*			
1242.	17756	*Osteospermum ecklonis*	Y		
1243.	4356	*Oxalis pes-caprae (Soursob)*	Y		
1244.	27112	*Pachymenia orbicularis*			Y
1245.	1762	*Parietaria debilis (Pellitory)*			
1246.	532	*Paspalum urvillei (Vasey Grass)*	Y		
1247.	533	*Paspalum vaginatum (Salt Water Couch)*			
1248.	1550	*Patersonia occidentalis (Purple Flag, Koma)*			
1249.	30472	*Patersonia occidentalis var. occidentalis*			
1250.	4343	*Pelargonium capitatum (Rose Pelargonium)*	Y		
1251.	40423	*Pentameris airoides (False Hairgrass)*	Y		
1252.	48805	*Pentameris patula*	Y		
1253.	16477	*Pericalymma ellipticum var. ellipticum*			
1254.	13911	*Persicaria decipiens*			
1255.	11020	*Persicaria hydropiper*			
1256.	16984	*Persicaria lapathifolia*	Y		
1257.	2273	*Persoonia saccata (Snottygobble)*			
1258.	20368	*Petrophile axillaris*			
1259.	2286	*Petrophile brevifolia*			
1260.	48781	*Petrophile brevifolia subsp. brevifolia*			
1261.	2299	*Petrophile linearis (Pixie Mops)*			
1262.	2301	*Petrophile macrostachya*			
1263.	19825	*Petrorhagia dubia*	Y		
1264.	27133	*Phacelocarpus labillardieri*			
1265.	27134	*Phacelocarpus peperocarpos*			
1266.	27135	*Phacelocarpus sessilis*			
1267.	18529	*Philotheca spicata (Pepper and Salt)*			
1268.	1478	*Phlebocarya ciliata*			
1269.	6734	*Phyla nodiflora var. nodiflora*	Y		
1270.	4675	*Phyllanthus calycinus (False Boronia)*			
1271.	17794	*Phyllanthus tenellus*	Y		
1272.	2793	*Phytolacca octandra (Red Ink Plant)*	Y		
1273.	5232	*Pimelea argentea (Silvery Leaved Pimelea)*			
1274.	5237	*Pimelea calcicola*		P3	
1275.	5243	*Pimelea ferruginea*			
1276.	5244	*Pimelea floribunda*			
1277.	5254	*Pimelea leucantha*			
1278.	5261	*Pimelea rosea (Rose Banjine)*			
1279.	18117	*Pimelea rosea subsp. rosea*			
1280.	5268	*Pimelea sulphurea (Yellow Banjine)*			
1281.	42281	*Pithocarpa cordata*			
1282.	18352	*Pithocarpa pulchella var. melanostigma*			
1283.	18353	*Pithocarpa pulchella var. pulchella*			
1284.	19744	*Pittosporum angustifolium*			
1285.	19745	*Pittosporum ligustrifolium*			
1286.	7304	*Plantago major (Greater Plantain)*	Y		
1287.	27144	*Platoma cyclocolpum*			
1288.	27155	*Plocamium cartilagineum*			
1289.	27156	*Plocamium mertensii*			
1290.	571	*Poa annua (Winter Grass)*	Y		
1291.	577	*Poa poiformis (Coastal Poa)*			
1292.	578	*Poa porphyroclados*			

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1293.	8175	*Podolepis gracilis (Slender Podolepis)*			
1294.	8179	*Podolepis nutans (Nodding Podolepis)*			
1295.	8182	*Podotheca angustifolia (Sticky Longheads)*			
1296.	8183	*Podotheca chrysantha (Yellow Podotheca)*			
1297.	8184	*Podotheca gnaphalioides (Golden Long-heads)*			
1298.	27161	*Pollexfenia lobata*			
1299.	27162	*Pollexfenia pedicellata*			
1300.	582	*Polypogon monspeliensis (Annual Beardgrass)*	Y		
1301.	27173	*Polysiphonia decipiens*			
1302.	29621	*Polysiphonia forfex*			
1303.	27175	*Polysiphonia infestans*			
1304.	4689	*Poranthera ericoides (Heath Poranthera)*			
1305.	4691	*Poranthera microphylla (Small Poranthera)*			
1306.	27184	*Porphyra lucasii*			
1307.	122	*Posidonia angustifolia*			
1308.	105	*Posidonia coriacea*			
1309.	124	*Posidonia ostenfeldii*			
1310.	125	*Posidonia sinuosa*			
1311.	109	*Potamogeton crispus (Curly Pondweed)*			
1312.	110	*Potamogeton drummondii*			
1313.	111	*Potamogeton ochreatus (Blunt Pondweed)*			
1314.	1672	*Prasophyllum fimbria (Fringed Leek Orchid)*			
1315.	27190	*Protokuetzingia australasica*			
1316.	8189	*Pseudognaphalium luteoalbum (Jersey Cudweed)*			
1317.	41651	*Pteridium esculentum subsp. esculentum*			
1318.	27195	*Pterocladia lucida*			
1319.	27198	*Pterocladiella capillacea*			
1320.		*Pterostylis aff. nana*			
1321.	15426	*Pterostylis aspera*			
1322.	12217	*Pterostylis sanguinea*			
1323.	1698	*Pterostylis vittata (Banded Greenhood)*			
1324.	27206	*Ptilophora prolifera*			
1325.	2718	*Ptilotus drummondii (Narrowleaf Mulla Mulla)*			
1326.	11260	*Ptilotus drummondii var. drummondii (Pussytail)*			
1327.	2742	*Ptilotus manglesii (Pom Poms, Mulamula)*			
1328.	2751	*Ptilotus polystachyus (Prince of Wales Feather)*			
1329.	15856	*Ptilotus sericostachyus subsp. sericostachyus*			
1330.	40841	*Ptilotus stirlingii subsp. stirlingii*			
1331.	4181	*Pultenaea reticulata*			
1332.	16367	*Pyrorchis nigricans (Red beaks, Elephants ears)*			
1333.	8195	*Quinetia urvillei*			
1334.	32480	*Racopilum cuspidigerum var. convolutaceum*			
1335.	3061	*Raphanus raphanistrum (Wild Radish)*	Y		
1336.	6014	*Regelia inops*			
1337.	19183	*Retama raetam*	Y		
1338.	18547	*Rhadinothamnus anceps*			
1339.	2578	*Rhagodia baccata (Berry Saltbush)*			
1340.	11341	*Rhagodia baccata subsp. baccata*			
1341.	11930	*Rhagodia baccata subsp. dioica (Sea Berry Saltbush)*			
1342.	15035	*Rhodanthe corymbosa*			
1343.	13234	*Rhodanthe manglesii*			
1344.	27220	*Rhodopeltis australis*			
1345.	27222	*Rhodophyllis volans*			
1346.	19942	*Ricinocarpos undulatus*			
1347.	14485	*Romulea flava var. minor*	Y		
1348.	1556	*Romulea rosea (Guildford Grass)*	Y		
1349.	3066	*Rorippa nasturtium-aquaticum (Watercress)*	Y		
1350.	44608	*Rosulabryum billarderii*			
1351.	20496	*Rubus laudatus*	Y		
1352.	2429	*Rumex acetosella (Sorrel)*	Y		
1353.	2433	*Rumex crispus (Curled Dock)*	Y		
1354.	40426	*Rytidosperma occidentale*			
1355.	2906	*Sagina apetala (Annual Pearlwort)*	Y		
1356.	48433	*Salicornia blackiana*			
1357.	44534	*Salix humboldtiana*	Y		
1358.	6987	*Salpichroa origanifolia (Pampas Lily of the Valley)*	Y		
1359.	30434	*Salsola australis*			
1360.	6484	*Samolus repens (Creeping Brookweed)*			
1361.	2356	*Santalum acuminatum (Quandong, Warnga)*			
1362.	27229	*Sarcomenia delesserioides*			

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1363.	17543	*Sarcozona bicarinata*		P3	
1364.	7595	*Scaevola anchusifolia*			
1365.	7603	*Scaevola canescens (Grey Scaevola)*			
1366.	7606	*Scaevola crassifolia (Thick-leaved Fan-flower)*			
1367.	7614	*Scaevola globulifera*			
1368.	7626	*Scaevola nitida (Shining Fanflower)*			
1369.	13181	*Scaevola repens var. angustifolia*			
1370.	13182	*Scaevola repens var. repens*			
1371.	13152	*Scaevola thesioides subsp. thesioides*			
1372.	48834	*Schinus terebinthifolia*	Y		
1373.	27268	*Schizymenia dubyi*			
1374.	48356	*Schoenoplectus tabernaemontani*			
1375.	982	*Schoenus clandestinus*			
1376.	984	*Schoenus curvifolius*			
1377.	992	*Schoenus grandiflorus (Large Flowered Bogrush)*			
1378.	27274	*Sebdenia flabellata*			
1379.	20665	*Senecio angulatus*	Y		
1380.	25884	*Senecio pinnatifolius var. latilobus*			
1381.	8220	*Senecio vulgaris (Common Groundsel)*	Y		
1382.	2909	*Silene gallica (French Catchfly)*	Y		
1383.	2910	*Silene nocturna (Mediterranean Catchfly)*	Y		
1384.	8227	*Silybum marianum (Variegated Thistle)*	Y		
1385.	7020	*Solanum linnaeanum (Apple of Sodom)*	Y		
1386.	47173	*Solanum lycopersicum (Tomato)*	Y		
1387.	7022	*Solanum nigrum (Black Berry Nightshade)*	Y		
1388.	48866	*Solanum nitidibaccatum*	Y		
1389.	7037	*Solanum symonii*			
1390.	27281	*Solieria robusta*			
1391.	9367	*Sonchus hydrophilus (Native Sowthistle)*			
1392.	8231	*Sonchus oleraceus (Common Sowthistle)*	Y		
1393.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
1394.	1558	*Sparaxis bulbifera*	Y		
1395.	1560	*Sparaxis pillansii (Harlequin Flower)*	Y		
1396.	4207	*Sphaerolobium medium*			
1397.	624	*Spinifex hirsutus (Hairy Spinifex)*			
1398.	625	*Spinifex longifolius (Beach Spinifex)*			
1399.	27301	*Spongoclonium conspicuum*			
1400.	635	*Sporobolus virginicus (Marine Couch)*			
1401.	27310	*Spyridia filamentosa*			
1402.	4828	*Spyridium globulosum (Basket Bush)*			
1403.	9069	*Stackhousia huegelii*			
1404.	2918	*Stellaria media (Chickweed)*	Y		
1405.	15066	*Stenanthemum notiale subsp. chamelum*			
1406.	19403	*Stenopetalum gracile*			
1407.	636	*Stenotaphrum secundatum (Buffalo Grass)*	Y		
1408.	27314	*Stictosporum nitophylloides*			
1409.	2316	*Stirlingia latifolia (Blueboy)*			
1410.	7679	*Stylidium adpressum (Trigger-on-stilts)*			
1411.	30278	*Stylidium androsaceum*			
1412.	25831	*Stylidium araeophyllum (Stilt Walker)*			
1413.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
1414.	7694	*Stylidium bulbiferum (Circus Triggerplant)*			
1415.	7696	*Stylidium calcaratum (Book Triggerplant)*			
1416.	7709	*Stylidium crossocephalum (Posy Triggerplant)*			
1417.	7710	*Stylidium cygnorum*			
1418.	11808	*Stylidium diuroides subsp. diuroides*			
1419.	25801	*Stylidium hesperium*			
1420.	25829	*Stylidium neurophyllum (Coastal Plain Triggerplant)*			
1421.	25800	*Stylidium paludicola*		P3	
1422.	7774	*Stylidium piliferum (Common Butterfly Triggerplant)*			
1423.	7785	*Stylidium repens (Matted Triggerplant)*			
1424.	7798	*Stylidium schoenoides (Cow Kicks)*			
1425.	48297	*Styphelia filifolia*		P3	
1426.	2329	*Synaphea spinulosa*			
1427.	15532	*Synaphea spinulosa subsp. spinulosa*			
1428.	32437	*Syntrichia antarctica*			
1429.	32438	*Syntrichia pagorum*			
1430.	15741	*Tamarix aphylla (Athel Tree)*	Y		
1431.	45613	*Taraxacum khatoonae*	Y		
1432.	4256	*Templetonia retusa (Cockies Tongues)*			

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1433.	2791	*Tersonia cyathiflora (Button Creeper)*			
1434.	2820	*Tetragonia decumbens (Sea Spinach)*	Y		
1435.	2824	*Tetragonia tetragonoides (New Zealand Spinach)*			
1436.	20649	*Tetrapanax papyrifer*	Y		Y
1437.	1036	*Tetraria octandra*			
1438.	35582	*Tetraria sp. Mt Madden (C.D. Turley 40 BP/897)*			
1439.	134	*Thalassodendron pachyrhizum*			
1440.	43554	*Thalia dealbata*	Y		Y
1441.	1708	*Thelymitra fuscolutea (Chestnut Sun Orchid)*			
1442.	1717	*Thelymitra variegata (Queen of Sheba)*		P2	
1443.	10874	*Thinopyrum distichum*	Y		
1444.	5105	*Thomasia triphylla*			
1445.	2644	*Threlkeldia diffusa (Coast Bonefruit)*			
1446.	27331	*Thuretia quercifolia*			
1447.	1318	*Thysanotus arbuscula*			
1448.	1319	*Thysanotus arenarius*			
1449.	1343	*Thysanotus patersonii*			
1450.	46055	*Thysanotus sp. Coastal plain (N.H. Brittan 66/63)*			
1451.	1351	*Thysanotus sparteus*			
1452.	1357	*Thysanotus thyrsoideus*			
1453.	1358	*Thysanotus triandrus*			
1454.	6280	*Trachymene pilosa (Native Parsnip)*			
1455.	32450	*Trichostomum eckelianum*			
1456.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
1457.	4289	*Trifolium angustifolium (Narrowleaf Clover)*	Y		
1458.	4291	*Trifolium arvense (Hare's Foot Clover)*	Y		
1459.	4292	*Trifolium campestre (Hop Clover)*	Y		
1460.	17763	*Trifolium campestre var. campestre (Hop Clover)*	Y		
1461.	4295	*Trifolium dubium (Suckling Clover)*	Y		
1462.	4298	*Trifolium hirtum (Rose Clover)*	Y		
1463.	14738	*Trifolium resupinatum var. resupinatum*	Y		
1464.		*Trifolium sp.*			
1465.	4360	*Tropaeolum majus (Garden Nasturtium)*	Y		
1466.	11665	*Trymalium ledifolium var. ledifolium*			
1467.	27347	*Tylotus obtusatus*			
1468.	27351	*Ulva fasciata*			
1469.	35263	*Ulva flexuosa*			
1470.	27352	*Ulva lactuca*			
1471.	49097	*Ulva stenophylloides*			Y
1472.	29112	*Urochloa panicoides var. panicoides*	Y		Y
1473.	8254	*Urospermum picroides (False Hawkbit)*	Y		
1474.	8255	*Ursinia anthemoides (Ursinia)*	Y		
1475.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
1476.	7125	*Utricularia australis*			
1477.	7131	*Utricularia dichotoma (Fairy Aprons)*			
1478.	8257	*Vellereophyton dealbatum (White Cudweed)*	Y		
1479.	15432	*Verticordia densiflora var. densiflora*			
1480.	6077	*Verticordia drummondii (Drummond's Featherflower)*			
1481.	6101	*Verticordia nitens (Morrison Featherflower, Kodjeningara)*			
1482.	6103	*Verticordia ovalifolia*			
1483.	4322	*Vicia sativa (Common Vetch)*	Y		
1484.	11474	*Vicia sativa subsp. nigra*	Y		
1485.	27360	*Vidalia spiralis*			
1486.	4325	*Viminaria juncea (Swishbush, Koweda)*			
1487.	722	*Vulpia bromoides (Squirrel Tail Fescue)*	Y		
1488.	11137	*Vulpia fasciculata*	Y		
1489.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
1490.	7384	*Wahlenbergia capensis (Cape Bluebell)*	Y		
1491.	7386	*Wahlenbergia gracilenta (Annual Bluebell)*			
1492.	7388	*Wahlenbergia multicaulis*			
1493.	7389	*Wahlenbergia preissii*			
1494.	8282	*Waitzia suaveolens (Fragrant Waitzia)*			
1495.	13332	*Waitzia suaveolens var. flava*			
1496.	17910	*Washingtonia filifera*	Y		
1497.	27362	*Webervanbossea splachnoides*			
1498.	27368	*Wrangelia plumosa*			
1499.	1398	*Wurmbea monantha*			
1500.	1401	*Wurmbea pygmaea*			
1501.	8286	*Xanthium occidentale (Noogoora Burr)*	Y		
1502.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1503.	6289	*Xanthosia huegelii*			
1504.	44861	*Xerochrysum macranthum*			
1505.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
1506.	36218	*Zygodon menziesii*			

Protozoa

1507.	38967	*Arcyria incarnata*			
1508.	38969	*Arcyria minuta*			
1509.	38970	*Arcyria obvelata*			
1510.	38971	*Arcyria occidentalis*			Y
1511.	38978	*Badhamia panicea*			
1512.	38998	*Craterium minutum*			
1513.	38999	*Cribraria argillacea*			Y
1514.	39008	*Diachea leucopodia*			
1515.	39018	*Didymium bahiense*			
1516.	39020	*Didymium difforme*			
1517.	39057	*Perichaena corticalis*			
1518.	39058	*Perichaena depressa*			
1519.	39059	*Perichaena vermicularis*			
1520.	39074	*Physarum pusillum*			
1521.	39077	*Physarum straminipes*			Y
1522.	39079	*Physarum viride*			
1523.	39094	*Trichia affinis*			
1524.	39098	*Trichia favoginea*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

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Appendix C: Survey Effort

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GPS Tracklogs
Survey Area

Main Roads Western Australia
Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure C.1: Survey effort

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Author: C. Dyde	Date: 08-05-2020	Scale: 1:10,000 at A3 Coordinate System: GDA 1994 MGA Zone 50
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200508_Effort_FigC	Metres 0 100 200 300 400 500 N

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GPS Tracklogs

Survey Area

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure C.2: Survey effort

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Author: C. Dyde	Date: 08-05-2020	Scale: 1:10,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 Metres 0 100 200 300 400 500 N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200508_Effort_FigC	

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GPS Tracklogs
Survey Area

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure C.3: Survey effort

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Author: C. Dyde	Date: 08-05-2020	Scale: 1:10,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 Metres 0 100 200 300 400 500 N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200508_Effort_FigC	

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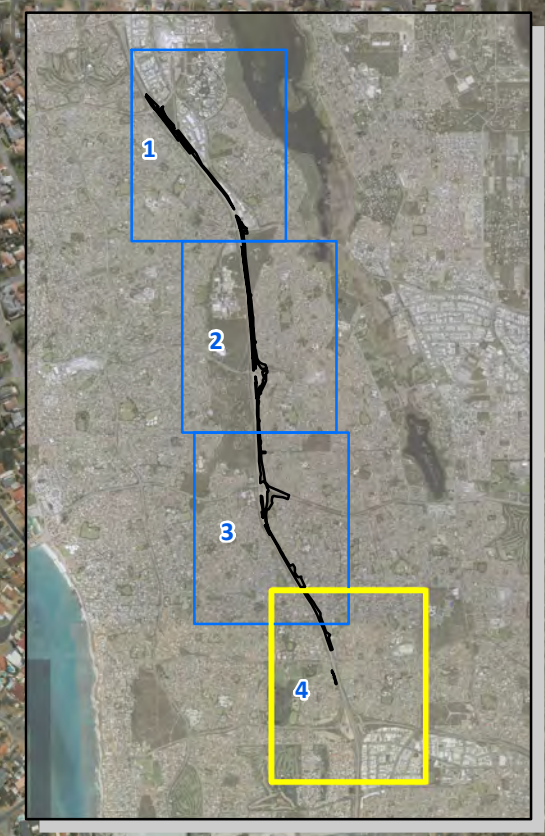

GPS Tracklogs

Survey Area

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure C.4: Survey effort

astron

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Author: C. Dyde	Date: 08-05-2020
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200508_Effort_FigC

Scale: 1:10,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 100 200 300 400 500 Metres

N

Appendix D: Vegetation Classification and Condition Scales

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Table D.1: Classification system used to describe vegetation structure (Keighery 1994) as adapted from Muir (1977) and Aplin (1979).

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover
Trees > 30 m	Tall closed forest	Tall open Forest	Tall woodland	Tall open woodland
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland
Trees < 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland
Tree Mallee	Closed tree mallee	Tree mallee	Open tree mallee	Very open tree mallee
Shrub Mallee	Closed shrub mallee	Shrub mallee	Open shrub mallee	Very open shrub mallee
Shrubs > 2 m	Closed scrub	Open scrub	Tall shrubland	Tall open shrubland
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland
Shrubs < 1 m	Closed low heath	Open low heath	Low shrubland	Low open shrubland
Grasses	Closed grassland	Grassland	Open grassland	Very open grassland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open grassland

Table D.1: Vegetation condition scale as adapted from Keighery (1994) (Environmental Protection Authority 2016a).

Vegetation condition	Condition description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Appendix E: Vascular Plant Taxa Amalgamated and Omitted During Statistical Analysis

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Table E1: Vascular plant taxa amalgamated and omitted during statistical analysis.

Taxon	Amalgamation/deletion
Acacia applanata *Acacia willdenowiana*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Acacia lasiocarpa *Acacia lasiocarpa* var. *lasiocarpa*	Amalgamated (only var. *lasiocarpa* and var. *bracteata* in original dataset)
Acacia pulchella *Acacia pulchella* var. *glaberrima* *Acacia pulchella* var. *pulchella* *Acacia pulchella* var. *reflexa*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
**Aira caryophyllea* **Aira cupaniana*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Austrostipa campylachne *Austrostipa ?campylachne* *Austrostipa semibarbata* *Austrostipa semibarbata* group (Gibson *et al.* 1994)	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
**Avena barbata* **Avena fatua*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Boronia denticulata *Boronia spathulata*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Bossiaea angustifolia *Bossiaea eriocarpa*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Caladenia flava *Caladenia flava* subsp. *flava*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Caladenia longicauda *Caladenia longicauda* subsp. *longicauda*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Conostylis pauciflora subsp. *euryrhipis* (P4) *Conostylis pauciflora* subsp. *pauciflora* (P4)	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Drosera erythrorhiza *Drosera magna* *Drosera squamosa*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Drosera geniculata *Drosera gigantea*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Drosera humilis *Drosera porrecta* *Drosera stolonifera*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Epilobium billardiereanum *Epilobium billardiereanum* subsp. *billardiereanum* *Epilobium billardiereanum* subsp. *intermedium*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994); subsp. *billardiereanum* not in original SCP dataset
Eriochilus dilatatus *Eriochilus dilatatus* subsp. *dilatatus* *Eriochilus dilatatus* subsp. *multiflorus*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)

Taxon	Amalgamation/deletion
Hovea trisperma var. *trisperma* *Hovea trisperma*	Amalgamated (no infra-taxa for MR data, best match based on location/habitat)
**Iridaceae* sp.	Omitted - Indeterminate identification
Lepidosperma calcicola *Lepidosperma squamatum* (group)	Amalgamated (is a more recent name, not in original SCP dataset, most likely match/part of this complex which has now been split)
Lepidosperma leptostachyum *Lepidosperma* aff. *scabrum*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Melaleuca sp.	Omitted - Indeterminate identification
Patersonia occidentalis var. *angustifolia* *Patersonia occidentalis* var. *occidentalis* *Patersonia occidentalis* (Swamp form) (N Gibson and MN Lyons 554)	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Pericalymma ellipticum *Pericalymma ellipticum* var. *floridum*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Poa poiformis *Poa porphyroclados*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Pterostylis brevisepala *Pterostylis pyramidalis* *Pterostylis* sp. crinkled leaf (G.J. Keighery 13426) *Pterostylis* sp. limestone (B.J. Keighery & G.J. Keighery 65)	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Rhagodia baccata subsp. *baccata* *Rhagodia baccata* subsp. *dioica*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Scaevola repens *Scaevola repens* var. *repens*	Amalgamated (wider leaves, most likely match)
Thelymitra sp.	Omitted - Indeterminate identification
Thysanotus manglesianus *Thysanotus* ?*manglesianus* *Thysanotus manglesianus/patersonii* complex *Thysanotus patersonii*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Tricostularia exsul *Tricostularia neesii*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
Verticordia plumosa *Verticordia plumosa* var. *brachyphylla*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)
**Watsonia meriana* var. *bulbillifera* **Watsonia meriana* var. *meriana*	Amalgamated (as per Appendix 3 of Gibson *et al.* 1994)

Appendix F: Environmental Constraints Mapping

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Survey Area

Environmentally Sensitive Areas (ESAs)

TEC/PEC Areas

Community Name

Acacia shrublands on taller dunes

Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region

Banksia attenuata woodlands over species rich dense shrublands

Callitris preissii (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain

Coastal shrublands on shallow sands

Northern Spearwood shrublands and woodlands

Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands

Previous Significant Flora Records

Conservation Code

Threatened (T)

Priority 1 (P1)

Priority 2 (P2)

Priority 3 (P3)

Priority 4 (P4)

Previous Significant Fauna Records

Conservation Code

CD

CR & IA

EN

IA

OS

P2

P3

P4

VU

VU & IA

Black Cockatoo Spatial Data

Black Cockatoo Locations

Carnaby's Roost Point

Breeding Areas

Breeding Area - Possible

Roost Areas Confirmed - Buffered 6kms

Roost Areas Unconfirmed - Buffered 6kms

Dept of Biodiversity, Conservation and Attractions

Legislated Lands and Waters

Nature Reserve

Conservation Park

Marine Park

Crown Freehold - Dept Managed

Section 5(1)(h) Reserve

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure F.1: Environmental constraints

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Author: C. Dyde	Date: 18-05-2020	Scale: 1:50,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 0 1 2 3 Kilometres N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_FigF1_EnvCon	

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Appendix G: Threatened and Priority Flora and Fauna Species Likelihood of Occurrence within the Survey Area

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Table G.1: Likelihood of occurrence of threatened and priority flora previously recorded within 5 km of the survey area (Department of Biodiversity, Conservation and Attractions 2019a, Department of the Environment and Energy 2019).

Species	Habit and flowering information*	Life form*	Habitat*	Likelihood of occurrence	
				Pre-survey	Post-survey
Threatened					
Marianthus paralius	Woody, almost prostrate shrub approximately 50 cm wide with red-orange flowers and white stamens (Department of Environment and Conservation 2009). The leaves are thick and ovate (Department of Environment and Conservation 2009).	Perennial	Amongst coastal heath in areas of white sand and brown loam on coastal limestone cliffs (Department of Environment and Conservation 2009).	Unlikely	Unlikely
Priority 1					
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425)	Erect shrub ca 2 m high. Petals white, pink-tinged underneath, with a deep pink band across the base; sepals pink; centre green or yellow.	Perennial	Sand with limestone outcropping.	Likely	Unlikely
Grevillea sp. Ocean Reef (D. Pike Joon 4)	Shrub 1 m to 2 m high. Leaves tripartitely divided, deeply divided with lobes 8 mm to 11 mm long and margins revolute. White or cream flowers in terminal inflorescences.	Perennial	Broad dune swales, shallow grey sand with limestone outcropping and dunes of yellow-brown sand.	Unlikely	Unlikely
Leucopogon maritimus	Low spreading shrub to c. 40 cm high and 60 cm wide, often multi-stemmed close to the base , but single-stemmed at ground level (Hislop 2011). Leaves spirally arranged and narrowly elliptic, white flowers arranged into compact terminal and upper axillary conflorescences (Hislop 2011). Peak flowering likely between April and June, fruit is likely to be present between June and September (Hislop 2011).	Perennial	Restricted to near coastal Quindalup dunes (Hislop 2011). Occurs in deep calcareous sands on the mid to upper slopes of dunes or in shallow sand over limestone, but avoiding the thicker vegetation in the swales (Hislop 2011).	Unlikely	Unlikely
Priority 2					
Acacia benthamii	Shrub, ca 1 m high. New shoots minutely woolly. Phyllodes linear, pungent, attenuate at both ends (Maslin 2018). Flowers yellow, August to September.	Perennial	Sand. Limestone breakaways	Likely	Unlikely

Species	Habit and flowering information*	Life form*	Habitat*	Likelihood of occurrence	
				Pre-survey	Post-survey
Thelymitra variegata	Leaf curved to slightly spiralled, dark green with a purplish base (Jeanes 2009). Inflorescence 15 cm to 35 cm tall bearing 1 to 6 flowers usually predominantly reddish, purplish or violet, variegated, mostly with darker spots or blotches, often with yellow margins and an overall glossy iridescent sheen (Jeanes 2009). Flowers June to September.	Tuberous Perennial	Open sandy clearings amongst grass tussocks or rushes in shrubby vegetation, mostly on well-drained deep sandy soils (Jeanes 2009).	Potential	Unlikely
Priority 3					
Austrostipa mundula	Fine, clumping grass to 0.4 m, flowers recorded October to November.	Perennial	Grey sand with outcropping limestone.	Likely	Unlikely
Conostylis bracteata	Rhizomatous, tufted or shortly proliferous perennial, grass-like or herb, 0.2 m to 0.45 m high. Flowers yellow, August to September.	Perennial	Sand, limestone. Consolidated sand dunes.	Likely	Unlikely
Hibbertia spicata subsp. *leptotheca*	Low growing, erect to spreading shrub to 50 cm. Glossy leaves with involute margins. Flowers somewhat pendulous with 10 to 15 stamens per flower.	Perennial	Near coastal limestone ridges, outcrops and cliffs	Unlikely	Unlikely
Pimelea calcicola	Erect to spreading shrub, 0.2 m to 1 m high. Flowers pink, September to November.	Perennial	Grey, brown or yellow sand with limestone outcropping, shallow soils on limestone ridges and hills. *Eucalyptus gomphocephala* woodland, *Melaleuca/Acacia rostellifera* scrub, *Banksia sessilis* scrub.	Potential	Unlikely

Species	Habit and flowering information*	Life form*	Habitat*	Likelihood of occurrence	
				Pre-survey	Post-survey
Sarcozona bicarinata	Herbaceous succulent to 0.1 m. Leaves dull green, the margins tinged pink, adaxial surface flat, lateral surfaces convex (Prescott and Venning 1984). Flowers sessile or very shortly pedicellate (Prescott and Venning 1984) large, white and daisy-like with flowering between August and September (Seeds of South Australia 2019).	Perennial	*Banksia sessilis* closed shrubland, white sand	Unlikely	Unlikely
Stylidium paludicola	Reed-like herb to 1 m (Wege 2014). Leaves in a basal rosette or tuft (Wege 2014). Inflorescence a dense head-like or shortly elongate raceme 7 to 40 flowered (Wege 2014). Flowers medium to dark pink with dark reddish to purplish pink throat markings (Wege 2014).	Perennial	Seasonally wet localities in grey to black peaty sand over clay in dense *Melaleuca* shrubland, *Corymbia calophylla* and *M. preissiana* woodland or low shrubland with emergent *Melaleuca* (Wege 2014).	Likely	Unlikely
Styphelia filifolia	Erect shrub to 0.9 m. Leaves linear to very narrowly ovate with strongly recurved to revolute margins, apex mucronate, the mucro innocuous (Hislop and Puente-Lelievre 2017). Inflorescence axillary, pendulous bearing 1 to 4 pendulous flowers in March to May (Hislop and Puente-Lelievre 2017).	Perennial	Sandy soils usually in *Banksia* or Jarrah woodland and in low-lying situations (Hislop and Puente-Lelievre 2017).	Potential	Unlikely
Priority 4					
Jacksonia sericea	Low spreading shrub, to 0.6 m high. Flowers orange, usually December or January to February.	Perennial	Calcareous and sandy soils.	Recorded	Recorded

*Information derived from Florabase (Western Australian Herbarium 2019) unless specified.

Table G.2: Likelihood of occurrence of conservation significant vertebrate fauna species previously recorded in the vicinity of the survey area (Department of Biodiversity, Conservation and Attractions 2019b, Department of the Environment and Energy 2019).

Scientific name (common name)	Conservation codes			Preferred habitat and context	Pre-survey likelihood	Post-survey likelihood
	EPBC Act	WC Act	DBCA			
Reptiles						
Neelaps calonotos (Black-striped snake)	-	-	P3	Favours sandy soils supporting heath and banksia/eucalypt woodland. All recent records of this species have been recorded in coastal habitats. There are 25 previous records within 5 km of the survey area, however, these were all made in 1986 or earlier with the exception of two records in 1995. Suitable habitat within the survey area is considered to be in too poor condition to support this species.	Moderate	Low
Birds						
Oxyura australis (Blue-billed duck)	-	-	P4	Mainly the deeper freshwater lakes and swamps, occasionally salt lakes and estuaries freshened by floodwaters. The survey area lacks the deep wetlands required by this species.	Low	Low
Botaurus poiciloptilus (Australasian bittern)	EN	EN		Found in beds of tall rush mixed with or near short fine sedge and open pools. Also occurs around swamps, lakes, pools, rivers and channels fringed with lignum, canegrass or other dense vegetation.	Low	Low
Ixobrychus flavicollis australis (Australian black bittern (south western subpop.)	-	-	P2	Freshwater pools, swamps and lagoons, well screened with trees.	Low	Low
Plegadis falcinellus (Glossy ibis)	IA	IA	-	Wetland habitats such as fresh water marshes at the edges of lakes, rivers and wet swamp areas. This species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons.	Low	Low
Limosa lapponica (Bar-tailed godwit)	IA	IA	-	Mainly in coastal habitats e.g. large intertidal sandflats, banks, mudflats, estuaries and bays. Found often around beds of seagrass and sometimes, in nearby saltmarsh.	Low	Low

Scientific name (common name)	Conservation codes			Preferred habitat and context	Pre-survey likelihood	Post-survey likelihood
	EPBC Act	WC Act	DBCA			
Limosa limosa (Black-tailed godwit)	IA	IA		The shallows of fresh water lakes, swamps, river pools. Also found on estuarine flats, rocky and muddy coasts and near-coastal salt lakes.	Low	Low
Charadrius leschenaultii (Greater sand plover)	IA	VU, IA		Mainly sandy beaches and tidal mud, reef and sand flats. Vagrant to Australia.	Low	Low
Tringa glareola (Wood Sandpiper)	IA	IA		Generally open areas such as the margins of inland freshwater lakes and reservoirs. This species rarely occurs in coastal habitats but may be found along the creeks of saltmarshes and mangrove swamps.	Low	Low
Tringa stagnatilis (Marsh sandpiper)	IA	IA	-	Found at the margins of inland freshwater and brackish wetlands such as rice paddy-fields, swamps, salt-pans, salt-marshes, sewage works and marshy lake-edges, and although it is rare on open coastlines it can occasionally be found on estuaries, lagoons and intertidal mudflats.	Low	Low
Tringa nebularia (Common greenshank)	IA	IA	-	A variety of freshwater, marine and artificial wetlands, including swamps, open muddy or rocky shores of lakes and large rivers, sewage farms, saltworks, muddy coastal flats, mangroves and estuaries.	Low	Low
Calidris ruficollis (Red-necked stint)	IA	IA	-	The edge of sheltered waters including estuaries, beaches, near-coastal salt lakes, swamps, lakes, sewerage ponds and bore overflows.	Low	Low
Calidris acuminata (Sharp-tailed sandpiper)	IA	IA	-	Muddy edges of shallow fresh/brackish wetlands with emergent sedges, saltmarsh, grass and low vegetation.	Low	Low
Calidris ferruginea (Curlew sandpiper)	CR; IA	VU; IA	-	Mainly occur on intertidal mudflats in sheltered coastal Areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast.	Low	Low

Scientific name (common name)	Conservation codes			Preferred habitat and context	Pre-survey likelihood	Post-survey likelihood
	EPBC Act	WC Act	DBCA			
Apus pacifus (Fork-tailed swift)	IA	IA	-	Summer migrant to Australia and occurs in low to very high airspace, largely independent of terrestrial habitats and landforms.	Low	Low
Falco peregrinus (Peregrine falcon)	-	OS	-	Cosmopolitan, will hunt in any habitat, soaring at height or from a perch; often near cliffs. Nests on rocky ledges in tall, vertical cliff faces and tall trees associated with drainage lines. There are 13 records of the Peregrine Falcon within 5 km of the survey area, with the closest recorded in 2001 within 314 m of the survey area at Pinnaroo Valley Memorial Park. The survey area is considered potential foraging habitat for this species.	High	Moderate
Calyptorhynchus latirostris (Carnaby's cockatoo)	EN	EN	-	Eucalypt woodland, principally wandoo or salmon gum, and shrubland or kwongan heath dominated by *Hakea* and *Banksia* species. Numerous previous records exist for this species and suitable habitat is present within the survey area.	High	Recorded
Calyptorhynchus banksii naso (Forest red-tailed black cockatoo)	VU	VU		Eucalypt forest where it feeds primarily on marri and jarrah fruit. Recent records exist for this species and suitable habitat is present within the survey area.	High	Recorded
Calyptorhynchus baudinii (Baudin's cockatoo)	VU	VU	-	Eucalypt forest, where it feeds on mainly marri seeds, flowers, nectar and buds. Also feed on seeds of eucalyptus, hakea, banksia and pine species. The records of Baudin's cockatoo although relatively recent, are outside the current suggested distribution of this species (Department of Sustainability Environment Water Population and Communities 2012) and may represent misidentifications.	Low	Low

Scientific name (common name)	Conservation codes			Preferred habitat and context	Pre-survey likelihood	Post-survey likelihood
	EPBC Act	WC Act	DBCA			
Mammals						
Dasyurus geoffroii (Western quoll, chuditch)	VU	VU	-	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. In Western Australia, wandoo and salmon gum woodland, mallee, jarrah forest and mixed marri/jarrah forest. The previous records for this species are over 3 km from the survey area and were recorded in 1974.	Low	Low
Isoodon fusciventer (Quenda)	-	-	P4	Scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeds in adjacent forest and woodland that is burnt regularly and in areas of pasture and cropland lying close to dense cover. There are numerous records of this species within 5 km of the survey area, including one record within the survey area in 2014 (based on secondary evidence).	High	Recorded
Myrmecobius fasciatus (Numbat)	EN	EN	-	Jarrah forests and Wandoo woodlands that contain hollow logs and branches. One previous record of this species was made in 1974. This species is now considered locally extinct.	Low	Low
Notamacropus Irma (Western brush wallaby)	-	-	P4	Open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. Three previous records of this species from 1972 and suitable habitat is not present within the survey area.	Moderate	Low
Hydromys chrysogaster (Water-rat)	-	-	P4	Usually found near permanent bodies of fresh or brackish water along river and lake banks. They prefer areas with riparian vegetation and a degree of habitat complexity.	Low	Low

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Appendix H: Vegetation Type Mapping

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382800

383000

6486400

6486200

6486000

1
2
3
4
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6
7
8
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12
13
14
15
16
17

MFQ-06

Survey Area

Sampling Sites

Quadrat

Vegetation Type

Banksia Woodland

Planted Vegetation

Completely Cleared

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.1: Vegetation type mapping with quadrat and relevé locations

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delivering environmental intelligence™

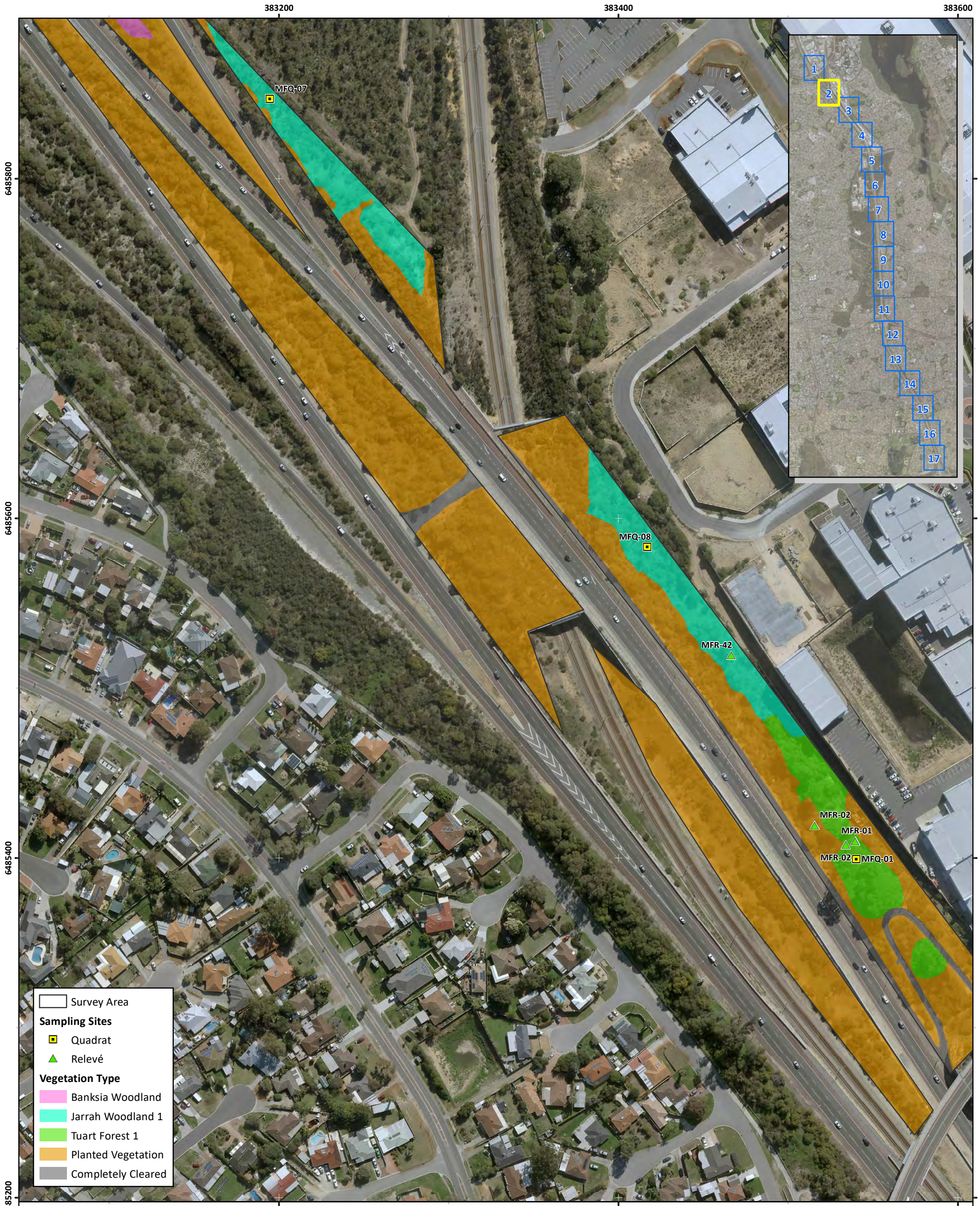
Author: C. Dyde	Date: 18-05-2020
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH

Scale: 1:2,000 at A3

Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80 100 Metres

N



Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.2: Vegetation type mapping with quadrat and relevé locations

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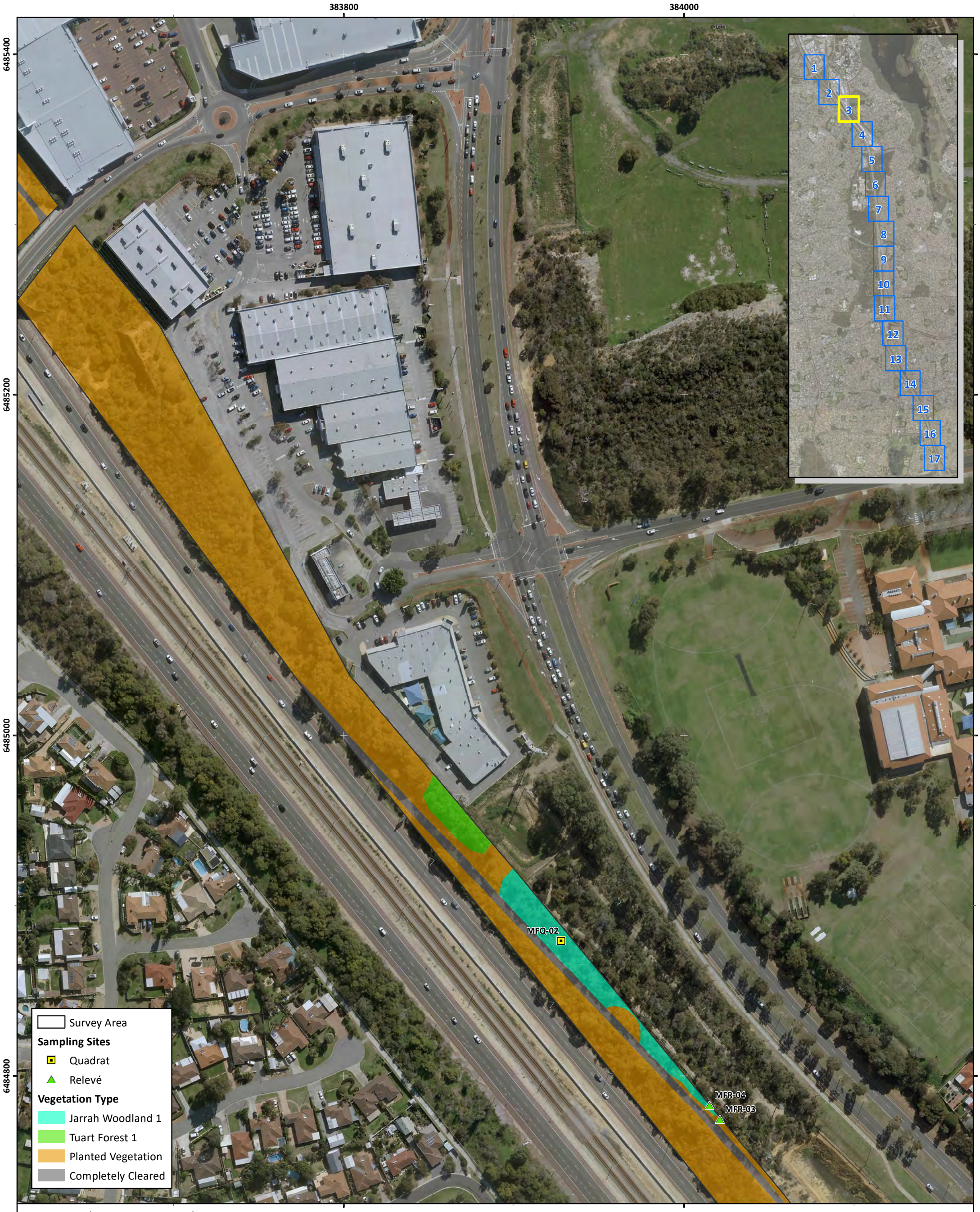
Author: C. Dyde	Date: 18-05-2020	Scale: 1:2,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 Metres 0 20 40 60 80 100 N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH	



Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.3: Vegetation type mapping with quadrat and relevé locations

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Author: C. Dyde	Date: 18-05-2020	Scale: 1:2,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 Metres 0 20 40 60 80 100 N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH	

384000 384200 384400

6484600 6484400 6484200

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Survey Area

Vegetation Type

Tuart Forest 1

Planted Vegetation

Completely Cleared

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.4: Vegetation type mapping with quadrat and relevé locations

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Author: C. Dyde	Date: 18-05-2020	Scale: 1:2,000 at A3 Coordinate System: GDA 1994 MGA Zone 50
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH	Metres 0 20 40 60 80 100 N

384400 384600 384800

6484000 6483800 6483600 6483400

MFRAS-05

MFR-06

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Survey Area

Sampling Sites

Relevé

Vegetation Type

Jarrah Woodland 2

Tuart Forest 1

Planted Vegetation

Completely Cleared

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.5: Vegetation type mapping with quadrat and relevé locations

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Author: C. Dyde	Date: 18-05-2020	Scale: 1:2,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 Metres 0 20 40 60 80 100 N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH	

384400 384600 384800

6483200 6483000 6482800

MFR-08 MFR-10 MFR-12

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Survey Area

Sampling Sites

Relevé

Vegetation Type

Jarrah Woodland 2

Planted Vegetation

Completely Cleared

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.6: Vegetation type mapping with quadrat and relevé locations

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Author: C. Dyde	Date: 18-05-2020	Scale: 1:2,000 at A3
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH	Coordinate System: GDA 1994 MGA Zone 50

0 20 40 60 80 100 Metres

N

Main Roads Western Australia

Mitchell Freeway Widening Southbound and PSP Mitchell Freeway Gaps Hodges Drive to Reid Highway - Biological Survey

Figure H.7: Vegetation type mapping with quadrat and relevé locations

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delivering environmental intelligence™

Author: C. Dyde	Date: 18-05-2020	Scale: 1:2,000 at A3 Coordinate System: GDA 1994 MGA Zone 50 Metres 0 20 40 60 80 100 N
Drawn: A. Sleep	Figure Ref: 8612-19-BIDR-1RevB_200518_VegMap_FigH	