

ATTACHMENT H

ETON RANGE REALIGNMENT PROJECT FAUNA ASSESSMENT REPORT

Department of Transport
and Main Roads

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1. Introduction

Ecological Survey & Management was engaged by the Department of Transport and Main Roads to undertake a fauna and habitat assessment of an area proposed for realignment of the Peak Downs Highway crossing of the Eton Range, approximately 40 km south-west of Mackay (Figure 1). This area of the Peak Downs Highway is known as Spencer Gap.

The objective of the fauna and habitat assessment was to identify key fauna constraints within the area of interest (the Study Area) to inform design and approvals required for the Project.

1.1. Background

A number of studies have been undertaken as part of the route selection and design of the Project, including:

- 2010 Ecological Assessment Report Peak Downs Highway Realignment Eton Range Crossing undertaken by Ecological Survey & Management
- 2013 Eton Range Upgrade Project – Options Q1a-W21 and X1A-X2A undertaken by Ecological Survey & Management.

These surveys largely focused on vegetation and flora assessment and mapping. This current assessment expands on the results of these previous surveys by assessing the fauna values of the Study Area.

Additionally, the Study Area has been altered since the 2010 and 2013 surveys were undertaken and this assessment addresses the vegetation mapping and threatened flora values of the expanded Study Area.

1.1.1. Scope of works

This assessment involved:

- Review of existing information such as existing field-validated regional ecosystem (RE) mapping and previous assessments, aerial photography and relevant database searches such as Queensland Museum, Wildlife Online and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool
- Undertake a four (4) day fauna assessment to assess quality of habitats and apply targeted survey techniques aimed at identifying significant fauna species
- Identify potential breeding places, such as bird nests, hollow-bearing trees and caves within the Study Area
- Prepare significance assessments for EPBC Act listed fauna species known or considered likely to occur in the Study Area
- Undertake a one (1) day vegetation mapping exercise to capture REs in the expanded Study Area and map additional locations of Significant species known to occur in the area.

2. Methods

2.1. Desktop Review

A number of database and mapping sources were reviewed as part of this assessment and were used to target field survey methods for the Study Area. Sources included:

- EPBC Act Protected Matters Search Tool (SEWPaC 2013b)
- Wildlife Online database (EHP 2013)
- Queensland Museum Database (Queensland Museum 2013)
- Vegetation Management Regional Ecosystem and Remnant Map (Version 8.0) (NRM 2013b) and Essential Habitat Map (Version 4.0) (NRM 2013a)
- Nearmap 2011 Aerial photography
- Atlas of Groundwater Dependent Ecosystems (National Water Commission 2013).

2.2. Field Survey

A total of 11 survey sites were established throughout the Study Area that combined a number of survey techniques in order to target the range of significant fauna species that potentially occur in the Study Area. A description of these techniques and survey effort is described in Sections 2.2.1 – 2.2.8. The distribution of survey techniques employed throughout the Study Area is shown on Figure 1.

2.2.1. Spotlighting

Spotlighting was undertaken on foot over three nights for a total of 18 person hours. The distinctive calls of some fauna were also used to identify their presence. All habitat types were spotlighted during the survey period.

2.2.2. Call playback

Call playback involved broadcasting a recorded call of an owl or arboreal mammals through a megaphone in an effort to elicit a territorial response from any animals that hear the call. Animals either call in response to the recording and/or move in to the location that the call was played from. The call is played and then approximately 2 to 3 minutes are spent listening for a response and looking for animals that have moved into the area without calling. Call playback was undertaken at six sites. Following the call playback session, spotlighting was conducted of the immediate area to locate any owls that had flown into the area without calling and had not been seen during the call playback. The calls of the following species were played:

- Barking Owl (*Ninox connivens*)
- Masked Owl (*Tyto novaehollandiae*)
- Southern Boobook (*Ninox novaeseelandiae*)

- Barn Owl (*Tyto alba*)
- Koala (*Phascolarctos cinereus*)

2.2.3. Active Searching

Active searching was conducted to detect reptiles, frogs and small ground dwelling mammals. It involved the searching of suitable microhabitat such as logs, bark, deep leaf litter, surface rocks and shedding bark. Active searching was undertaken at five sites for a total of 10 person hours across the Study Area.

2.2.4. Anabat

The Anabat surveys involved the use of an SD1 Anabat detector to record the echolocation calls of micro-bats as they forage. A sonogram was then produced using software that allows for comparison against reference calls for identified. Unfortunately, some species of bat have very similar and/or quiet calls and cannot be positively distinguished via Anabat (e.g. *Nyctophilus* species). Therefore, a probability rating is provided for calls identified. All Anabat calls were analysed by Greg Ford, a specialist in analysing Anabat recordings.

Anabat units were deployed for one night from dusk until dawn at 6 locations across the Study Area. Anabat survey sites were selected on the basis of having suitable flyways, flowering trees that attract insects or water that attracts insects and bats.

2.2.5. Koala Line Transects

The Wildlife Online search indicated that the Koala had been previously recorded from the search area. Therefore, targeted line transects were conducted in the Study Area to provide information in relation to the use of the Study Area by this species. In line with the Interim Koala Referral Advice for Proponents (SEWPaC 2012b), line transects were stratified across the Study Area to establish an estimate of population density, distribution and habitat preferences.

The methodology employed for the line transects involved two ecologists walking a distance of 25 m apart for a length of 500 m on one side of a centreline and then returning along the other side of the 500 m centreline also remaining a distance of 25 m apart, while inspecting each tree along this transect. This results in a search area of 5 ha (500 m x 100 m search area) for each transect. In total, five line transects were conducted, with 25 ha of potential habitat actively searched for this species in the Study Area.

For trees where a Koala or evidence of a Koala was identified, the type of observation, species of the tree and location were noted.

2.2.6. Infrared Cameras

Cameras were set on a bait station of a chicken frame, apple and sweet potato. Cameras were set at 5 sites across the Study Area for a duration of four nights each.

2.2.7. Bird Surveys

Bird surveys were conducted at each of the 11 survey sites, with all birds seen and heard recorded. Eleven person hours were spent conducting bird surveys throughout the Study Area. Opportunistic records of birds were also made while undertaking other activities throughout the Study Area. Approximately 60 person hours were spent undertaking opportunistic bird surveys during the field survey.

2.2.8. Opportunistic Observations

Records of fauna in the Study Area were also made opportunistically while undertaking other activities, such as moving between trap sites, throughout the survey periods.

2.3. Habitat Assessment

The BioCondition Assessment Methodology (Eyre et al. 2011) was developed by the former Queensland Environmental Protection Agency to provide a methodology for the rapid assessment of terrestrial ecosystem condition. The methodology is similar to the Habitat Hectare and BioMetric methodologies developed in Victoria and New South Wales respectively.

The BioCondition methodology provides a measure of the condition of a 'patch' of vegetation in comparison to the same vegetation in its 'undisturbed' or pre-European state. This involves the assessment of a patch of vegetation against a 'benchmark'. For example, the number of large trees in a patch is measured and compared against the number of benchmark large trees for that vegetation type, and scored accordingly. A BioCondition assessment provides a condition score for a patch of vegetation as a score out of 100.

To date a comprehensive set of benchmarks for REs has yet to be developed. In this case the user is required to identify and assess the best available patch of vegetation of the same type, in a similar landscape context within the region, to use as a benchmark.

Due to the practical limitations of identifying a suitable and accessible reference site to determine a benchmark for the relevant vegetation type, Ecological Survey & Management developed a simplified BioCondition methodology to enable a rapid assessment of vegetation condition that generally follows the BioCondition methodology without the requirement for a benchmark reference site. The modified methodology is based on judgement of the difference of the vegetation from undisturbed conditions. While this greatly increases the subjectivity of the assessment it still provides an objective assessment framework and is considered an improvement on purely subjective assessments of habitat and vegetation condition.

However, without a benchmark it is not possible to conduct some parts of the BioCondition assessment. Specifically, these are the assessment of native species richness within each life form and the detailed assessment of native grass cover, native herb and forb cover, and native annual species cover. This simplified methodology includes an assessment of the level of cover of native species in the understorey against what would be

expected in an undisturbed example of the vegetation type. Therefore, the modified assessment provides a score out of 85 that is then multiplied by 1.176 to obtain a score out of 100.

Once a score out of 100 is developed, this is then compared to Table 1, to rate the patch of vegetation on a scale of 1 to 4, whereby 1 represents vegetation of good biodiversity condition and 4 represents poor biodiversity condition.

Table 1: Categorisation of BioCondition Scores

Condition Class	BioCondition Score
1	>85 %
2	>or= 70 – 84 %
3	>or= 60 – 69 %
4	<6 %

This methodology was applied at 17 habitat assessment sites throughout the Study Area (Figure 1). Sites were chosen to represent each polygon or patch, as well as provide duplicates where possible for each RE occurring within the Study Area. A series of vegetation attributes were assessed at each site to establish using scores outlined in the BioCondition Assessment Methodology (Eyre et al. 2011), including:

- Canopy cover and health
- Canopy recruitment
- Canopy height
- Shrub layer
- Ground cover
- Large trees
- Fallen logs
- Weed cover
- Organic litter
- Size of patch
- Connectivity
- Context.

2.4. Significant Species Assessment

Database searches identified significant species that potentially occur within the Study Area. The likelihood of such species occurring was then assessed based on the results of the field assessment.

The likelihood of species occurring within the Study Area was classified using the criteria presented in Table 2. The assessment was based on the

species' known ranges and habitat preferences, which were evaluated based on characteristics of the Study Area observed during field surveys.

Table 2: Criteria to assess potential for species to occur in the Study Area

Likelihood to Occur	Definition
Present	The species was recorded within the Study Area during the field surveys.
High	The species was not recorded within the Study Area during field surveys, but is known to occur within the surrounding area, and habitat of suitable quality exists within the Study Area.
Moderate	The species was not recorded within the Study Area during field surveys, although it is known to occur in the wider region. Habitat was identified for the species in the Study Area during the field surveys, however, it is marginal, fragmented and/or small in size, or degraded.
Low	The species was not recorded within the Study Area during the field surveys. The species is either: <ul style="list-style-type: none"> a) Unlikely to occur in the wider region and due to the lack of, or extremely poor quality habitat in the Study Area, the species is not expected to occur within the Study Area b) May forage periodically in the wider region and may overfly the Study Area, but the habitat in the Study Area is generally not suitable.

2.4.1. Impact Assessments

For species listed under the EPBC Act that were recorded or considered to have a high likelihood of occurring in the Study Area, the significance of impacts was assessed in accordance with the Significant Impact Guidelines (DoE 2013c).

Species of a moderate or lower likelihood of occurring in the Study Area were not assessed against the Significant Impact Guidelines as the Study Area is not considered to provide good quality or important habitat for these species due to:

- the relatively small area of impact
- the highly disturbed nature of the Study Area as a result of the existence of the Peak Downs Highway
- extensive and more intact habitat to the east and west of the Study Area in the Eton and Connors Ranges.

Therefore, there is a high confidence that impacts to these species would not be significant.

There is no prescribed methodology for the assessment of potential impacts under the NC Act or the subordinate NC Regulation. Assessments of the potential impacts to species listed under the NC Act were undertaken on the basis of the species' known ecology, project design and potential mitigation measures.

2.5. Fauna Field Survey Standards

The Queensland Government has developed Terrestrial Vertebrate Fauna Survey Guidelines (DSITIA 2012) that outline recommended survey effort and techniques for survey of terrestrial vertebrate fauna in Queensland.

Similarly, the Commonwealth Government has developed a series of specific guidelines tailored to the threatened species being targeted e.g. threatened reptiles, bats, birds, fish and mammal species.

These guidelines have been considered in development of survey methods for this Project, particularly with regard to survey timing and techniques employed to target significant species most likely to occur in the Study Area.

2.6. Limitations

Ecological survey often fails to record all species of flora and fauna present on a site for a variety of reasons, such as seasonal absence or reduced activity during certain seasons. Furthermore, the ecology and nature of Significant and/or cryptic species means that such species are potentially not recorded during short survey periods.

Therefore, it is possible that some fauna species that have a larger home range may not have been detected in the Study Area during the fauna survey periods.

This assessment overcomes these limitations by assessing impacts not only on species recorded during the field survey, but on species that are potentially present (based on known distribution and habitat availability).

3. Results

3.1. Fauna

3.1.1. Habitat and Landscape Connectivity

The maintenance of landscape connectivity between patches of habitat is a fundamental aspect of conservation ecology (Endler 1977; Forman 1995). Habitat corridors are often recommended to maintain and/or enhance landscape connectivity (Bennett et al. 1999).

The Study Area lies within a large connected landscape of remnant vegetation associated with the Eton and Connors Ranges. This landscape corridor links important refuges of Spencer Gap State Forest and Ben Mohr State Forest in close proximity to the Study Area and Crediton State Forest, Homevale National Park and Eungella National Park further west and north-west of the Study Area.

A first order stream is located in the north of the Study Area and flows in a northerly direction towards Sandy Creek.

3.1.2. Habitat Assessment

Using the modified BioCondition methodology, habitat condition scores were established for 17 sites within the Study Area, representing each of the four REs occurring in the Study Area. These scores are presented in Table 3. The Study Area presented an average condition score of 68.9, which falls within the condition class of 3. However, patches within REs 8.12.3, 8.12.5 and 8.12.7 represented relatively good condition, with score categories of 1 and 2 (Table 3).

The relatively low average condition score for the Study Area is most likely a reflection of the existing disturbance within the Study Area, resulting from the existing Peak Downs Highway. The cleared corridor and associated edge effects degrade the overall quality of vegetation and habitat.

Table 3: Modified BioCondition Scores for each of the 17 habitat assessment sites within the Study Area

Site Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Regional Ecosystem	8.12.3	8.12.12	8.12.5	8.12.3	8.12.12	8.12.3	8.12.5	8.12.7	8.12.7	8.12.12	8.12.7	8.12.7	8.12.12	8.12.7	8.12.7	8.12.7	8.12.7
Canopy cover and Health	5	5	5	5	5	5	5	5	5	5	5	3	5	4	5	3	5
Canopy Recruitment	3	3	3	5	0	5	3	3	3	3	3	5	3	0	3	5	3
Canopy Height	5	3	3	3	5	5	5	3	3	3	5	3	3	3	5	3	3
Shrub Layer	5	3	5	5	3	5	5	5	5	5	5	3	5	3	5	3	5
Ground Cover	10	2	10	6	0	10	6	10	10	6	10	6	6	6	2	2	10
Large Trees	8	3	3	8	3	8	8	3	8	3	6	8	3	0	3	3	1
Fallen Logs	3	2	2	3	2	3	2	4	2	2	2	4	2	2	2	0	4
Weed cover	5	0	10	5	0	10	5	10	10	5	5	3	3	3	3	0	10
Organic Litter	5	3	5	5	3	5	5	5	5	5	5	5	3	3	3	3	5
Size of Patch	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Connectivity	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	4	5
Context	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	5

Site Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Total	69	44	66	65	41	76	64	68	71	57	66	60	53	44	47	40	66
Total /100	81	52	78	76	48	89	75	80	83	67	78	71	62	52	55	47	78
BioCondition Score Category (Eyre et al. 2011)	2	4	2	2	4	1	2	2	2	3	2	2	3	4	4	4	2

3.1.3. Fauna Diversity

The fauna survey resulted in records of 73 species in the Study Area, including 3 amphibians, 53 birds, 9 mammals and 8 reptiles.

Amphibians

Three amphibians were recorded during the survey, one of these being the introduced Cane Toad (**Rhinella marina*), which was recorded at most sites in most habitats (Appendix A). The two native species were recorded at one site only, Site 4 (Figures 1 and 2).

Birds

A total of 53 bird species were recorded during the survey with most species commonly recorded at Sites 7, 8, 9 10 and 11. The most commonly occurring species were Cicadabird (*Coracina tenuirostris*), Australian Brush-turkey (*Alectura lathamii*), Leaden Flycatcher (*Myiagra rubecula*), Rufous Whistler (*Pachycephala rufiventris*), Torresian Crow (*Corvus orru*). The dry rainforest along the creek lines was the most diverse habitat type (8.12.3).

One species, the Spectacled Monarch (*Monarcha trivirgatus*), recorded in the Study Area is listed as Migratory under the Migratory provisions of the Commonwealth EPBC Act. This species and the potential for other significant species to occur in the Study Area is discussed in Section 3.1.4.

Habitat for a range of bird species occurs throughout the Study Area and a number of potential habitat trees, suitable for nesting bird species have been recorded in the Study Area. These habitat trees are shown on Figure 3 and described in Appendix A.

Mammals

Field surveys recorded 28 mammal species in the Study Area, including at least 15 species of microchiropteran bat. Another 3 recorded bat calls could not be reliably identified due to poor call quality and/or known call similarities between sympatric species (Ford 2013). One exotic mammal, the Wild Dog/Dingo (**Canis lupus*) was recorded.

One species, the Koala (*Phascolarctos cinereus*), listed as Vulnerable under the Commonwealth EPBC Act was recorded at three locations and heard calling during spotlighting activities (Figure 3).

Further discussion about this species and the likelihood for other significant species to occurring the Study Area is provided in Section 3.1.4.

As discussed previously, a number of potential habitat trees, supporting hollows, were recorded in the Study Area. A total of 88 habitat trees were recorded, mainly comprises Pink Bloodwood (*Corymbia intermedia*). This is considered a high number of habitat trees given the relatively small area of the Study Area. These habitat trees are shown on Figure 3 and described in Appendix A.

Reptiles

Habitat quality for reptiles is strongly influenced by attributes such as leaf litter, fallen logs and debris. The loss of these habitat elements very often occurs in disturbed environments and often leads to reductions in both diversity and abundance of reptiles.

Most sites assessed had a good density and coverage of leaf litter, whilst fallen timber forming hollow logs and debris was not abundant across most areas of the Study Area (Table 3). Nonetheless a moderate number of reptiles species were recorded given the relatively small Study Area and extent of disturbance created by clearing for the Peak Downs Highway.

The Open-litter Rainbow-skink (*Carlia pectoralis*) and Lace Monitor (*Varanus varius*) were most commonly recorded and most species were identified in Sites 1 and 2 (Appendix A).

3.1.4. Significant Species

Database search results for a 20 km radial area surrounding the Study Area, indicates the potential for 27 fauna species listed under the Queensland NC Act and/or Commonwealth EPBC Act to occur in the search area (Table 4). This includes 1 amphibian, 15 birds, 7 mammals and 4 reptiles which are discussed further below.

EPBC Act-listed Species

Sixteen species listed under the EPBC Act were returned from database searches for the search area. Of these, one (the Koala) was recorded in the Study Area during field surveys and four are considered to have a moderate likelihood of occurring in the Study Area due to the availability of suitable habitat (Table 4).

The four species with a moderate likelihood of occurring in the Study Area include:

- Red Goshawk (*Erythrotriorchis radiatus*) - Vulnerable
- Squatter Pigeon (*Geophaps scripta scripta*) - Vulnerable
- Northern Quoll (*Dasyurus hallucatus*) - Endangered
- Masked Owl (*Tyto novaehollandiae kimberli*) - Vulnerable.

While habitat within the Study Area is considered potentially suitable for these species, and there are known records of the Squatter Pigeon and Northern Quoll in the search area, these species would occur throughout the Eton and Connors Ranges and extensive areas of more intact habitat are available for these species. The Study Area is unlikely to support breeding habitat for any of these species due to lack of specific habitat features, such as caves and watercourses. Therefore, the Study Area would not form unique or important habitat for these species.

Koala

The Koala was identified at three locations in the Study Area. Two females and one male animal were observed in two Lemon Scented Gums (*Corymbia citriodora* var. *citriodora*) and one in a Broad-leaved Stringybark

(*Eucalyptus portuensis*). All three animals observed were within 8.12.7 (Figures 2 and 3). Calls of this species were also heard in adjacent areas during spotlighting activities during the field survey.

Based on the number of records, in a relatively small area over a short timeframe, the Koala is considered to occur in high abundance within and surrounding the Study Area. Therefore, there is potential for the Koalas that were identified in the Study Area to form part of an important population in the region. All vegetation in the Study Area is expected to provide suitable habitat for this species, except for the vine thicket community represented by RE 8.12.3. This habitat area equates to 80.7 ha in the Study Area. The Study Area is not considered particularly unique or of good quality, and therefore, it is expected that the more intact and remote areas of the Eton and Connors Ranges provide more important habitat for this species.

The existing Peak Downs Highway, is likely to cause a barrier effect to movement of the Koala either side of the highway, and there would be a risk of injury or fatality for individuals crossing the highway. However, this highway probably doesn't form a complete barrier given the persistence of this species in the Study Area.

Migratory Species

Table 5 lists the migratory species returned from the EPBC Act Protected Matters Search Tool for the search area. Of the 16 species returned from this search, one, the Spectacled Monarch (*Monarch trivirgatus*), was identified in 8.12.3 in the Study Area and another two, Black-faced Monarch (*Monarcha melanopsis*) and Rufus Fantail (*Rhipidura rififrons*), are considered to have a moderate or higher likelihood of occurring in the Study Area.

All vegetated areas within the Study Area provide potential suitable habitat for these species.

NC Act-listed Species

In addition to the 16 EPBC Act listed species identified in database search results, 11 NC Act species are considered to potentially occur in the search area, based on previous records.

Of these, five have a moderate likelihood of occurring in the Study Area (Table 4):

- Grey Goshawk (*Accipiter novaehollandiae*) – Near Threatened
- Australian Swiftlet (*Aerodramus terraereginae*) – Near Threatened
- Square-tailed Kite (*Lophoictinia isura*) – Near Threatened
- Black-chinned Honeyeater (*Melithreptus gularis*) – Near Threatened
- Ghost Bat (*Macroderma gigas*) - Vulnerable.

All of these species have been recorded in the search area and all potential forage in suitable habitat throughout the Study Area. Most of these species are more likely to overfly the Study Area, although the Ghost Bat and Black-chinned Honeyeater may forage within vegetated

habitat. However, none of these species are likely to nest or roost in the Study Area due to lack of suitable habitat features, such as caves and cliffs and watercourses.

No species listed under the NC Act were identified in the Study Area during field surveys.

3.1.5. Pests

Two exotic species were identified in the Study Area. One of these, the Wild Dog/Dingo is listed as a Class 2 declared species under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002* (Appendix A).

Other declared species are likely to occur in the Study Area and broader landscape.

Table 4: Significant fauna returned from database searches for the search area

Scientific Name	Common Name	NC Reg'n 1	EPBC Act 2	Source 3	Preferred habitat	Potential to occur in the study area? 4
Amphibians						
<i>Taudactylus eungellensis</i>	Eungella Day Frog	E	E	DoE	Occurring in upland rainforest streams primarily within Eungella National Park, Cathu State Forest and Eungella State Forest (DEH 2005).	Low: This species is associated with wet tropical rainforest, which does not occur within the study area.
Birds						
<i>Accipiter novaehollandiae</i>	Grey Goshawk	NT	-	Wildlife Online	Occurs in a wide range of habitats including rainforest, gallery forest, dense or open forest, swamp forest, woodlands, plantations and mangroves but is most abundant where vegetation provides cover for hunting from perches (Marchant & Higgins 1994).	Moderate: Habitat in the Study Area is suitable for this species.
<i>Aerodramus terraereginae</i>	Australian Swiftlet	NT	-	Wildlife Online	This species flies over rainforest, cleared lands, beaches and gorges and breeds in isolated caves. It occurs in north eastern Queensland south to about Mackay (Pizzey et al. 2012).	Moderate: Habitat in the Study Area suitable for this species.
<i>Calyptorhynchus lathamii</i>	Glossy Black-cockatoo	V	-	Wildlife Online	This species occurs in eucalypt woodlands with an understorey or sub-canopy of Casuarina or Allocasuarina on the seeds of which its diet is based. It nests in tree hollows (Garnett & Crowley	Low: There are few Allocasuarina trees within the Study Area.

Scientific Name	Common Name	NC Reg'n 1	EPBC Act 2	Source 3	Preferred habitat	Potential to occur in the study area? 4
					2000).	
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	NT	-	Wildlife Online	The species forages mainly in open fresh waters such as flooded grassland or sedgelands, shallow swamps with abundant aquatic and short emergent vegetation and permanent pools on floodplains. It also uses freshwater meadows, wet heathland, semi-permanent swamps with tall emergent vegetation, paperbark swamps, watercourses and reservoirs (Marchant & Higgins 1994).	Low: Open wetland habitat does not occur in the Study Area.
<i>Erythrotriorchis radiatus</i>	Red Goshawk	E	V	DoE	The Red Goshawk is generally found in open woodland, the edges of rainforest, and in dense riverine vegetation of coastal and subcoastal forests (Marchant & Higgins 1993). This species is known to have a large home range but nest in tall trees usually within 1km of a waterway or wetland (Garnett and Crowley 2000).	Moderate: It is possible that the Red Goshawk could forage within the Study Area, although the lack of substantial waterways or wetlands make it unlikely to nest within the Study Area.
<i>Geophaps scripta scripta</i>	Squatter Pigeon	V	V	Wildlife Online, DoE	This species is known from tropical dry, open sclerophyll woodlands and sometimes savanna (Higgins and Peter 1996). It appears to favour sandy soil dissected with low gravelly ridges and is less common on heavier soils with	Moderate: Although this species is more common west of the range it is possible that it may occur within the woodland vegetation types

Scientific Name	Common Name	NC Reg'n 1	EPBC Act 2	Source 3	Preferred habitat	Potential to occur in the study area? 4
					dense grass cover. It is nearly always found in close association with permanent water. The southern sub-species of the Squatter Pigeon is described as occurring south of the Burdekin River (Higgins and Davies 1996).	within the Study Area.
<i>Lewinia pectoralis</i>	Lewin's Rail	NT	-	Wildlife Online	Densely vegetated, fresh, brackish or saline wetlands, usually with areas of standing water. Favours permanent wetlands but will use ephemeral wetlands. Wetland habitat may include swamps, marshes, lakes, inundated depressions, small pools, swampy or tidal creeks and streams, saltmarshes, coastal lagoons, estuaries and farm dams with dense fringing or emergent vegetation, such as reeds, grasses and sedges. Occurs between Julatten inland to Atherton Tablelands, south to Proserpine. Also likely in south-east Queensland from Fraser Island south and inland to Toowoomba (Marchant & Higgins 1993).	Low: Wetland habitat does not occur in the Study Area.
<i>Lophoictinia isura</i>	Square-tailed Kite	NT	-	Wildlife Online	This species hunts primarily over open forest, woodlands and mallee vegetation types that are rich in passerines, as well as adjacent low scrubby areas and wooded towns.	Moderate: This species could potentially occur within the Study Area.

Scientific Name	Common Name	NC Reg'n 1	EPBC Act 2	Source 3	Preferred habitat	Potential to occur in the study area? 4
					It appears to prefer a structurally diverse landscape (Garnett & Crowley 2000).	
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	NT	-	Wildlife Online	This species occurs in the dry eucalypt woodlands with an annual rainfall of 400 - 700mm usually on the inland slopes of the Great Divide but extending to the coast between Brisbane and Rockhampton. It appears to favour vegetation associations with box and ironbark (Garnett and Crowley 2000).	Moderate: This species could potentially occur within the woodland vegetation types within the Study Area.
<i>Neochmia ruficauda ruficauda</i>	Star Finch	E	E	DoE	The Star finch usually inhabits low dense damp grasslands bordering wetlands and waterways and also open savannah woodlands near water or subject to inundation (Higgins et. al. 2006). Absent from expanses of open country and uplands, usually occurring in valleys (Higgins et. al. 2006). In Queensland this species' range has largely contracted to the southern Cape York. There have not been any confirmed records from the Cairns to Townsville region for some time and none were recorded during the Birds Australia Atlas project (Higgins et. al. 2006). Recent records around Rockhampton are thought likely to	Low: This species is usually found in valleys and the Study Area lacks suitable habitat.

Scientific Name	Common Name	NC Reg'n ₁	EPBC Act ₂	Source ³	Preferred habitat	Potential to occur in the study area? ⁴
					be aviary escapees (Higgins et. al. 2006).	
<i>Nettapus coromandelianus</i>	Cotton Pygmy-goose	NT	-	Wildlife Online	This species is found on freshwater lakes, swamps and large water impoundments (Garnett and Crowley 2000).	Low: Suitable habitat not present within study area
<i>Poephila cincta cincta</i>	Black-throated Finch	E	E	DoE	This species is known from dry, open grassy woodlands and forests and grasslands of the sub-tropics and tropics with seeding grasses and ready access to water (Higgins et al 2006). Also thought to probably require a mosaic of different habitat in the wet season to find seed (Mitchell 1996 in Garnett and Crowley 2000). Mainly inhabit dry open to very open eucalypt woodlands with dense grassy ground cover and often along watercourses (Higgins et. al. 2006). This species has undergone a significant range contraction from the southern parts of its former distribution. It has not been recorded in south-east Queensland since the early 80s and is now thought to be extinct in NSW(Higgins et al. 2006). It is noted as being mostly absent from the coastal plain but occasionally recorded from the area around Townsville and Ingham (Higgins et	Low: The Study Area is represented by wet sclerophyll mid-dense to dense forests, which are unsuitable for this species.

Scientific Name	Common Name	NC Reg'n ₁	EPBC Act ₂	Source ³	Preferred habitat	Potential to occur in the study area? ⁴
					al. 2006).	
<i>Rostratula australis</i>	Australian Painted Snipe	V	E	Wildlife Online, DoE	This species occurs in shallow, vegetated temporary or infrequently filled wetlands, sometimes with trees or shrubs where it feeds at the water's edge on seeds and invertebrates (Garnett and Crowley 2000). Since 1990 there have been fewer than 100 records of this species throughout Australia (Garnett and Crowley 2000).	Low: Suitable wetland habitat is not present within the Study Area.
<i>Tadorna radjah</i>	Radjah Shelduck	NT	-	Wildlife Online	Tropical coast wetlands and rivers, mud-flats, salt-marsh, mangroves, paperbark swamps (Simpson & Day 1998).	Low: Suitable waterway and wetland habitat is not present within the Study Area.
<i>Tyto novaehollandiae kimberli</i>	Masked Owl	V	V	DoE	Forests, woodlands, caves along the entire east coast of Australia (Simpson et al. 2010).	Moderate: There are no known records of this species in the vicinity of the Study Area, and it is more likely to occur in more intact areas of the Eton and Connors Ranges, however, vegetation and terrain is potentially suitable.
Mammals						

Scientific Name	Common Name	NC Reg'n ¹	EPBC Act ²	Source ³	Preferred habitat	Potential to occur in the study area? ⁴
<i>Dasyurus hallucatus</i>	Northern Quoll	LC	E	Wildlife Online, DoE	The Northern Quoll was once widespread in Queensland but has undergone a severe range contraction and is now absent from much of its former range. It is usually associated with dissected rocky escarpments but also known from eucalypt forest and woodlands, around human settlement and occasionally rainforest. In the Northern Territory Northern Quoll populations are becoming extinct within one year of the arrival of the Cane Toad (<i>Rhinella marina</i>) although in Queensland some remnant quoll populations persist in areas where Cane Toads have long been present (Van Dyck & Strahan 2008). The areas where the quoll persist in Queensland tend to be steep, rocky areas close to water that have not been recently burnt and appear to have become extinct in many lowland habitats formerly occupied (Woinarski et. al. 2008).	Moderate: It is possible that this species occurs within the broader area but is considered more likely to be associated with the steeper and less accessible areas of the Eton/Connors Range.
<i>Macroderma gigas</i>	Ghost Bat	V	-	Wildlife Online	The Ghost Bats roosts in shallow caves along cliff lines, boulder pile and deep limestone caves. They occur in a broad range of habitats including arid spinifex hill sides,	Moderate: Suitable roosting habitat potentially exists for this species close to the Study Area but

Scientific Name	Common Name	NC Reg'n 1	EPBC Act 2	Source 3	Preferred habitat	Potential to occur in the study area? 4
					grasslands, monsoon forest, savannah woodlands, tall open forest, deciduous vine forest and tropical rainforest (Churchill 2008).	not within the Study Area. Therefore, it could potentially forage but is unlikely to roost within the Study Area.
<i>Nyctophilus timoriensis / corbeni</i>	South-eastern Long-eared Bat	V	V	DoE	Strahan (1995) notes that the eastern long-eared bat is distributed south of the Tropic of Capricorn but uncommon and localised. This species has undergone recent taxonomic review and is now considered to be <i>Nyctophilus</i> species 2 (Churchill 2008).	Low: This species is generally not considered to occur as far north as Mackay and is generally found further inland.
<i>Phascolarctos cinereus</i>	Koala	LC	V	Wildlife Online, DoE	This species is widespread in Sclerophyll forest and woodlands on foothills and plains on both sides of the Great Dividing Range from about Chillagoe, Queensland to Mt Lofty ranges in South Australia (Menkhorst & Knight 2011).	Present: This species was recorded at three locations in the Study Area in RE 8.12.7. All areas of the Study Area, except RE 8.12.3 are considered to provide habitat for this species.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	LC	V	DoE	It occurs in a coastal belt from Rockhampton to Melbourne roosting in camps commonly formed in gullies, typically not far from water and usually in vegetation with dense canopy. Various habitats that include	Low: This Study Area is beyond the northern range of this species.

Scientific Name	Common Name	NC Reg'n ₁	EPBC Act ₂	Source ³	Preferred habitat	Potential to occur in the study area? ⁴
					Eucalyptus, Angophoras, tea-trees and Banksias (van Dyck & Strahan 2008).	
<i>Rhinolophus philippinensis</i> (large form)	Greater Large-eared Horseshoe Bat	E	E	DoE	Restricted to a broad strip of coastal and near-coastal habitat in north-eastern Queensland from Iron Range on Cape York Peninsula south to Townsville. May occur inland where suitable cave habitat exists, in Broken River, Undara, Chillagoe. May also occur south of Townsville at Mt Elliot and Cape Cleveland. Habitat includes rainforest, riparian forest, open forest and woodland. Roosts in caves and possibly tree hollows, dense foliage and large bridge culverts (van Dyck & Strahan 2008).	Low: The Study Area is outside the known distribution of this species. There have been no records of this species in the vicinity of the Study Area.
<i>Xeromys myoides</i>	Water Mouse	V	V	DoE	The Water Mouse inhabits saline grassland, mangroves, margins of freshwater swamps and lakes close to fore dunes in coastal Northern Territory and Queensland coast from Cooloola to Proserpine as well as Bribie and Stradbroke Islands (Menkhorst & Knight 2011).	Low: There is not suitable habitat in the Study Area and the terrain is unsuitable.
Reptiles						
<i>Denisonia maculata</i>	Ornamental	V	V	DoE	The Ornamental Snake is found in close association with frogs which	Low: Preferred Brigalow and gilgai

Scientific Name	Common Name	NC Reg'n 1	EPBC Act 2	Source ³	Preferred habitat	Potential to occur in the study area? ⁴
	Snake				form the majority of its prey. It is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions with clay soils but is also known from lake margins, wetlands and waterways (SEWPaC 2013a).	habitat is not present in the Study Area.
<i>Egernia rugosa</i>	Yakka Skink	V	V	DoE	A ground dwelling reptile found in dry open forests, woodlands and rocky areas of the Brigalow Belt. It is often found under dead timber and in deep rock crevices (Wilson, 2005).	Low: This species is usually found further inland and from drier habitats.
<i>Eulamprus amplus</i>	Lemon-barred Forest Skink	NT	-	Qld Museum	Confined to rainforest in the Eungella National Park, Finch Hatton, Mt Blackwood and Conway State Forest areas where it is often seen basking on rocks along waterways (Wilson 2005).	Low: Appears to be restricted to wet rainforests, which do not occur in the Study Area.
<i>Rheodytes leukops</i>	Fitzroy River Turtle	V	V	DoE	Known from the Fitzroy River and its tributaries (Cogger 2000).	Low: There is not suitable habitat for this species within the Study Area.

Table 5: Migratory species returned from database searches for the search area

Species	Common Name	EPBC Act Status	Preferred Habitat	Potential to occur in the Study Area
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory & Marine: Species or species habitat likely to occur within area	Aerial over open habitat sometimes over forests and cities (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Hiaeetus leucogaster</i>	White-bellied Sea-eagle	Migratory & Marine: Species or species habitat likely to occur within area	Coasts, islands, estuaries, large rivers, lakes and reservoirs (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Hirundapus caudacutus</i>	White-throated Needletail	Migratory & Marine: Species or species habitat likely to occur within area	Aerial over forests, woodlands, farmlands, plains, lakes and towns (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory & Marine: Species or species habitat may occur within area	Woodlands, beaches, rainforest and mangroves (Pizzey et al. 2012).	Low: More likely to occur in lowland areas.
<i>Monarcha melanopsis</i>	Black-faced Monarch	Migratory & Marine: Species or species habitat likely to occur within area	Rainforest, eucalypt woodlands and forest, coastal scrubs, rainforest gullies (Pizzey et al. 2012).	High: Prefers similar habitat to Spectacled Monarch, which occurs throughout the Study Area.
<i>Monarcha trivirgatus</i>	Spectacled Monarch	Migratory & Marine: Species or species habitat may occur within area	Rainforest, thickly wooded gullies, waterside vegetation (Pizzey et al. 2012).	Present: This species was identified during a bird survey in 8.12.3 in the Study Area.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Migratory & Marine: Species or species habitat may occur within area	Heavily vegetated gullies in forests and taller woodlands and during migration coastal forests, woodlands,	Low: Prefers more coastal areas of habitat.

Species	Common Name	EPBC Act Status	Preferred Habitat	Potential to occur in the Study Area
			mangroves, gardens and open country (Pizzey et al. 2012).	
<i>Rhipidura rififrons</i>	Rufous Fantail	Migratory & Marine: Species or species habitat may occur within area	Rainforest, wet eucalypt forests, monsoon forests, paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks (Pizzey et al. 2012).	Moderate: All vegetated areas within the Study Area provide potential habitat for this species.
<i>Ardea alba</i>	Great Egret	Migratory & Marine: Species or species habitat known to occur within area	Shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, sewage ponds, larger dams (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Ardea ibis</i>	Cattle Egret	Migratory & Marine: Species or species habitat likely to occur within area	Stock paddocks, pastures, croplands, garbage dumps, wetlands, tidal mudflats and drains (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Gallinago hardwickii</i>	Latham's Snipe	Migratory & Marine: Species or species habitat may occur within area	Soft wet ground or shallow water with tussocks, wet paddocks, seepage below dams, irrigated areas, scrub or open woodland (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Hirundo rustica</i>	Barn Swallow	Migratory: Species or species habitat may occur within area	Open forests, woodlands, grasslands, caves, ledges, offshore rocky islands, farmlands, grain stubbles, rail	Low: Is more likely to occur in open communities.

Species	Common Name	EPBC Act Status	Preferred Habitat	Potential to occur in the Study Area
			yards, towns. Occasionally roosts in old buildings. Is widespread in Australia and coastal islands (Pizzey et al. 2012).	
<i>Rostratula benghalensis</i>	Australian Painted Snipe	Vulnerable, Migratory & Marine: Species or species habitat may occur within area	Refer Table 4	Low: Refer Table 4.
<i>Anseranas semipalmata</i>	Magpie Goose	Marine: Species or species habitat may	Large seasonal wetlands and well vegetated dams with rushes and sedges, wet grasslands and floodplains (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Pandion haliaetus</i>	Osprey	Marine: Species or species habitat likely to occur within area	Coasts, estuaries, bays, inlets, islands and surrounding waters, coral atolls, reefs and lagoons (Pizzey et al. 2012).	Low: Suitable habitat does not occur in the Study Area.
<i>Crocodylus porosus</i>	Salt-water Crocodile	Marine: Species or species habitat likely to occur within area	Occurs in coastal waters, estuaries, freshwater sections of lakes, inland swamps and marshes in all coastal areas north of Rockhampton, west to King Sound (near Broome) in Western Australia (DoE 2013a).	Low: Suitable estuarine habitat does not occur in the Study Area.

3.2. Vegetation

On-ground vegetation mapping was undertaken for the new expanded Study Area and is shown in Figure 2. Twenty-one vegetation assessment sites were performed as part of this mapping.

No new REs were identified to that mapped as part of the previous 2011 vegetation assessment undertaken by Ecological Survey & Management (reference 11027 Ltr01a). All vegetation is listed as Least Concern under the Queensland *Vegetation Management Act 1999*.

None of the vegetation assemblages identified in the Study Area are listed as Threatened Ecological Communities under the Commonwealth EPBC Act.

3.2.1. Significant Species

New locations of the NC Act listed Near Threatened Rough Malletwood (*Rhodamnia pauciovulata*) were identified, in addition to those recorded as part of the 2011 vegetation assessment undertaken for the Project. Approximately 18 individuals have now been identified in the Study Area. One additional NC Act-listed plant was recorded in the Study Area, Veiny Whitewood (*Atalaya rigida*) is listed as Near Threatened, and was recorded in RE 8.12.3 in the same location as the Rough Malletwood population. A full list of species recorded in the Study Area according to RE type is provided in Appendix B.

4. Impacts and Recommendations

4.1. Habitat Disturbance and Fragmentation

Up to 86 ha of potential habitat, in the form of remnant Least Concern vegetation may be removed within the Study Area. This will result in a reduction of the overall carrying capacity of the local area.

This disturbance has the potential to exacerbate barrier effects currently created by the Peak Downs Highway as a wider road corridor will be established. However, increased or new fragmentation is unlikely as impacts will largely involve expanding the existing cleared area, which have already fragmented habitat either side of the highway. No habitat areas will be isolated from other habitat areas as a result of vegetation clearing.

General habitat features, such as native feed trees, ground and hollow habitat are likely to be lost to some extent, however, no outstanding or unique habitat features will be lost as a result of the Project.

4.2. Edge Effects

Edge effects in the form of species and structure modification through increased light, wind shear, weed invasion or changed species composition, is unlikely to be significant as a result of this Project given these effects are already acting on habitat either side of the Peak Downs Highway.

The most likely outcome will be that edge effects will be increase the depth of edge effects to some extent, although new edges are unlikely to be created for this Project. The denser vine thicket community, represented by RE 8.12.3, will be most susceptible to edge effects although the dense nature of this community will limit the depth of edge effects into intact areas.

4.3. Indirect Impacts

Noise and vibration emissions will result from vegetation clearing, some blasting may also be required in the creation of expanded carriageways and steep batters. Temporary or intermittent noise and vibration emissions will be associated with machinery and activity associated with construction of the Project.

Most fauna species exhibit a high degree of adaptability to these noise impacts. Construction noise may cause some behavioural modification by birds, potentially altering feeding activity, and sudden loud noises may also startle bird and mammal species. Consequently, depending on the magnitude of construction noise, there may be some species that will be repulsed by noise and therefore, will forego utilisation of habitat within the noise disturbance zones. This zone will likely be different for individual species and depend on the intensity and nature of the noise sources. It is not possible to quantify the proportion of the local fauna community that will be adversely affected by this issue but it is expected to be a minority of species, and repulsion of fauna is unlikely to occur over a significant

distance from the noise source. In the case of temporary noise associated with construction or clearing activities, native fauna are likely to return to affected habitat areas within a short period of the noise emissions ceasing.

Impacts on fauna from ground vibration (e.g. from blasting and the operation of some equipment) will be similar to noise disturbance. It is possible that some species would forego the utilisation of areas close to the vibration source, where the intensity of the vibration exceeds the tolerance of the species. However, again this is likely to be temporary during the construction period.

Dust deposition will be greatest during vegetation clearing activities and blasting activities and the severity will depend on local weather conditions.

Potential impacts of light spill from lighting associated with construction will also be temporary and most types of common and adaptable species identified in the Study Area during the field survey, are generally able to adapt to environmental conditions over small areas.

The indirect and temporary impacts described above can be easily managed in most cases through standard mitigation measures and attenuation devices as well as sensitive site planning, i.e. minimising blasting activities or vegetation clearing in adverse weather conditions. Overall, indirect impacts will not have significant impacts on fauna.

With regard to indirect impacts as a result of operation of the realigned Peak Downs Highway, these types of impacts in the form of noise and light area already occurring in the Study Area and the magnitude of these is unlikely to change.

4.4. Pest Plants and Animals

The Project has the capacity to result in the introduction and spread of weed species and to facilitate the establishment and expansion of existing populations of pest animals and plants. The invasion of pest plants could degrade the quality of fauna habitats further, increase pest animals such as European Rabbits and Red Foxes and result in direct predation of native fauna species. However, the Peak Downs Highway already presents this risk and many of these types of pests already occur in the Study Area.

Evidence of pest animals, particularly Wild Dog/Dingo were common along the edges of the Peak Downs Highway. This pest species has the ability to move freely and in some cases long distances throughout the landscape and/or readily colonise new areas. Other species, which weren't detected are also likely to be present, particularly given the conduit effect of the Peak Downs Highway, which is a major transport route in Queensland. Therefore, it is unlikely this Project will introduce new species, but rather attract some feral animal species for periods, for example Wild Dogs/Dingos during vegetation clearing activities.

A Pest Animal and Weed Management Plan will be developed and implemented to manage pest animals as part of the Project.

4.5. EPBC Act-listed Species

An assessment of the significance of impacts using the DoE Significant Impact Guidelines (2013) has been undertaken for the EPBC Act listed species identified in the Study Area, i.e. the Koala. This significance assessment is provided in Appendix C.

The outcome of the Koala significance assessment indicates that although the individuals identified in the Study Area potentially form part of an important population, it is unlikely a significant impact will occur to this species as a result of the Project, due to there being no important habitat in the Study Area for any EPBC Act listed species and better quality intact habitat occurs extensively throughout the Eton and Connors Ranges.

Significance assessment for other EPBC Act-listed species potentially occurring in the Study Area were considered redundant given the relatively small and disturbed nature of the large sections of the Study Area, extensive more intact habitat elsewhere in the Eton and Connors Ranges and the lack of evidence from field survey suggesting an important population of any other EPBC Act-listed species occurs in the Study Area. Also, the Study Area is unlikely to support breeding habitat for any other potentially occurring EPBC Act-listed species. Therefore, the Project would not cause a Significant impact to any other EPBC Act-listed species.

4.5.1. *Migratory species*

A number of migratory birds are considered to potentially occur in the Study Area as listed in Table 5. Approximately 86 ha of habitat will be cleared as part of this Project.

In accordance with the Significant impact guidelines an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify, destroy or isolate an area of important habitat for a migratory species
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

It is considered unlikely the Study Area provides important habitat for any migratory species as the habitat is homogenous in the surrounding landscape and would be unlikely to form important breeding habitat for any migratory species. Additionally, the Study Area already suffers from edge effects from the existing Peak Downs Highway, including weed incursion and modified habitat. For these reasons, the Study Area is unlikely to support an ecologically significant proportion of the population of a migratory species.

Therefore, the Project is considered unlikely to result in a significant impact to a migratory species.

4.6. NC Act-listed Species

Up to 86 ha of potential habitat for a number of NC Act-listed species may be impacted in the Study Area.

These impacts will mainly occur in the form of habitat clearing, temporary increased risk of predation, temporary disturbance from construction activities and increased barrier effects and increased edge effects adjacent newly cleared areas.

The type of impact in the Study Area is not new as the Peak Downs Highway has already created many of these impacts, resulting in habitat that is modified and not optimal. More intact habitat areas occur in close proximity to the Study Area and extent more than 25 km in a south-east and north-west direction throughout the Eton and broader Connors Ranges.

Overall, the Project is unlikely to disturb large areas or important habitat for NC Act-listed species.

4.7. Impact Mitigation

Very steep terrain constrains the design of the realignment, which allows little opportunity to avoid important habitat features. Nonetheless, where an opportunity is identified to avoid specific habitat trees (outlined in Appendix A and shown on Figure 3) and significant plants in the Study Area, this should be undertaken.

All of the significant plants occur in the vine thicket community in the northern portion of the Study Area, therefore, this habitat should be avoided as far as possible. Options for relocation of the Rough Malletwood and Veiny Whitewood should be investigated to maintain their presence in this area.

A number of controls on clearing methods and construction of the realigned highway is proposed in order to minimise impacts to vegetation and habitat and should be included in the construction Environmental Management Plan (EMP) as well as other specific management plans. Proposed controls are:

- Work areas in the vicinity of remnant vegetation will be clearly delineated during construction to prevent unnecessary encroachment of disturbance into adjacent remnant vegetation
- A Species Management Program will be developed that includes spotter/catcher pre-clearing inspections and monitoring
- Clearing will be undertaken sequentially and in accordance with all necessary internal, Queensland and Commonwealth Government permits and approvals. This will restrict the area of remnant vegetation to be cleared to that required for the safe construction and operation of the Project
- Clearing is limited to only that necessary for the Project
- Vegetation clearing and construction activities should be avoided during wet seasons particularly in the vicinity of drainage channels

- A weed and pest animal management plan will be developed that includes measures such as weed audits and mapping, design of an appropriate treatment control program, wash-down procedures and passive monitoring and control of pest plants
- If blasting is required, it should be undertaken in favourable climatic conditions, i.e. not during wet or windy conditions
- Dust suppression techniques are employed where necessary
- Speed limits are enforced throughout the Project area during construction
- Runoff and siltation of the drainage channel in the northern portion of the Study Area is managed to avoid downstream impacts to water quality.

4.8. Permits and Approvals

A Species Management Program (SMP) will be required for significant species identified or considered likely to occur within the Study Area as outlined in this report in accordance with the NC Act. The SMP will outline actions to be undertaken to minimise impacts on animal breeding places and will be submitted to the EHP for approval prior to the commencement of construction activities. The SMP will include prescriptions on the nature and duration of clearing, translocation surveys where relevant, as well as measures to be employed during clearing activities, such as direction of clearing, leaving habitat trees and clearing surrounding vegetation, monitoring and managing water quality of downstream watercourses. The role of the spotter/catcher will be important as part of the SMP. Pre-clearance surveys will be undertaken by the spotter/catcher as part of the SMP. Where a significant species is identified, e.g. a Koala, an exclusion zone will be established around the animal and the individual allowed to move on of its own accord.

A Clearing Permit will be required to disturb plants listed under the NC Act. This will be relevant for the Veiny Whitewood and Rough Malletwood in the Study Area. Translocation or offsets may be required as part of this permit.

4.9. Residual impacts

4.9.1. EPBC Act Environmental Offsets Policy

Up to 80.7 ha of Koala habitat will be impacted as a result of the Project. The EPBC Act Environmental Offsets Policy (Offsets Policy) (SEWPaC 2012a) relates to all protected matters under the EPBC Act, including species and communities listed under Sections 18 and 18A, which includes the Koala.

Sections 4 and 5.2 of the Offsets Policy states that offsets under the EPBC Act are only required if residual impacts are 'significant'. 'Significant' impacts are defined under the Significant Impact Guidelines (DoE 2013c).

This assessment has found that significant impacts to species or communities listed under the EPBC Act as a result of the Project are unlikely as a result of the proportionally small area of habitat proposed to

be cleared compared with that surrounding the Study Area and the low potential for the Study Area to provide important habitat for an EPBC Act listed species.

4.9.2. Queensland Biodiversity Offsets Policy

The Queensland Government has previously committed, through the Six Month Action Plan – July to December 2013 to review the overarching framework for environmental offsets in Queensland in order to ‘implement a single environmental offsets policy for Queensland’.

To date a new environmental offset framework or policy has not been implemented and EHP has advised that until a new policy is in place the existing framework and policies remain in effect. Therefore, the Queensland Biodiversity Offset Policy (QBOP) (DERM 2011) is the primary mechanism requiring offsets for impacts to state significant biodiversity values, as a result of state controlled road activities, in Queensland.

Based on the descriptions provided in the QBOP, the state significant flora and fauna values that will be impacted by the Project include:

- Potential habitat for the Grey Goshawk, Squatter Pigeon, Square-tailed Kite, Black-chinned Honeyeater and Ghost Bat (86 ha)
- Known habitat for the Veiny Whitewood and Rough Malletwood (5.6 ha).

First order streams shown on the Vegetation management Supporting Map are also considered state significant biodiversity values and which do occur in the northern portion of the Study Area. Offsetting of these values may be required through determination by the Department of Environment and Heritage Protection (EHP) under the QBOP. However, with the recent reforms of the *Vegetation Management Act 1999* and repeal of the Regional Vegetation Management Codes, offsetting requirements regarding watercourses may no longer be required and would require negotiation with the EHP.

5. Conclusions

Approximately 86 ha of Least Concern remnant vegetation occurs in the Study Area and all vegetation provides potential habitat for a number of state and Commonwealth listed species, including:

- Northern Quoll – Endangered (EPBC Act)
- Red Goshawk – Endangered (NC Act); Vulnerable (EPBC Act)
- Squatter Pigeon – Vulnerable (NC Act and EPBC Act)
- Masked Owl – Vulnerable (NC Act and EPBC Act)
- Ghost Bat – Vulnerable (NC Act)
- Grey Goshawk – Near Threatened (NC Act)
- Australian Swiftlet – Near Threatened (NC Act)
- Black-chinned Honeyeater – Near Threatened (NC Act).

One EPBC Act listed Vulnerable species, the Koala, was identified in the Study Area and the population that occurs in this location is likely to form part of an important population as defined under the Significant Impact Guidelines, due to the abundance of individuals recorded in the Study Area. Approximately 80.7 ha of habitat for this species occurs in the Study Area.

One migratory, the Spectacled Monarch, was recorded in the Study Area and another two species are considered to have a moderate or higher likelihood of occurring in the Study Area. All vegetated areas of the Study Area, 86 ha, provides suitable habitat for these species.

Up to 86 ha of clearing may occur for the Project, however, this is unlikely to cause a significant impact to state or Commonwealth listed species, due to the extensive and more intact habitat available throughout the Eton and Connors Ranges and the relatively small area of habitat to be disturbed.

A number of measures have been recommended to minimise impacts to significant species, including retaining the identified habitat trees where possible, translocating significant plants and minimising vegetation clearing as far as possible.

A Species Management Plan for NC Act-listed fauna and a Clearing Permit for NC Act-listed flora is likely to be required for the Project. Offsets for these values may be required under the QBOP.

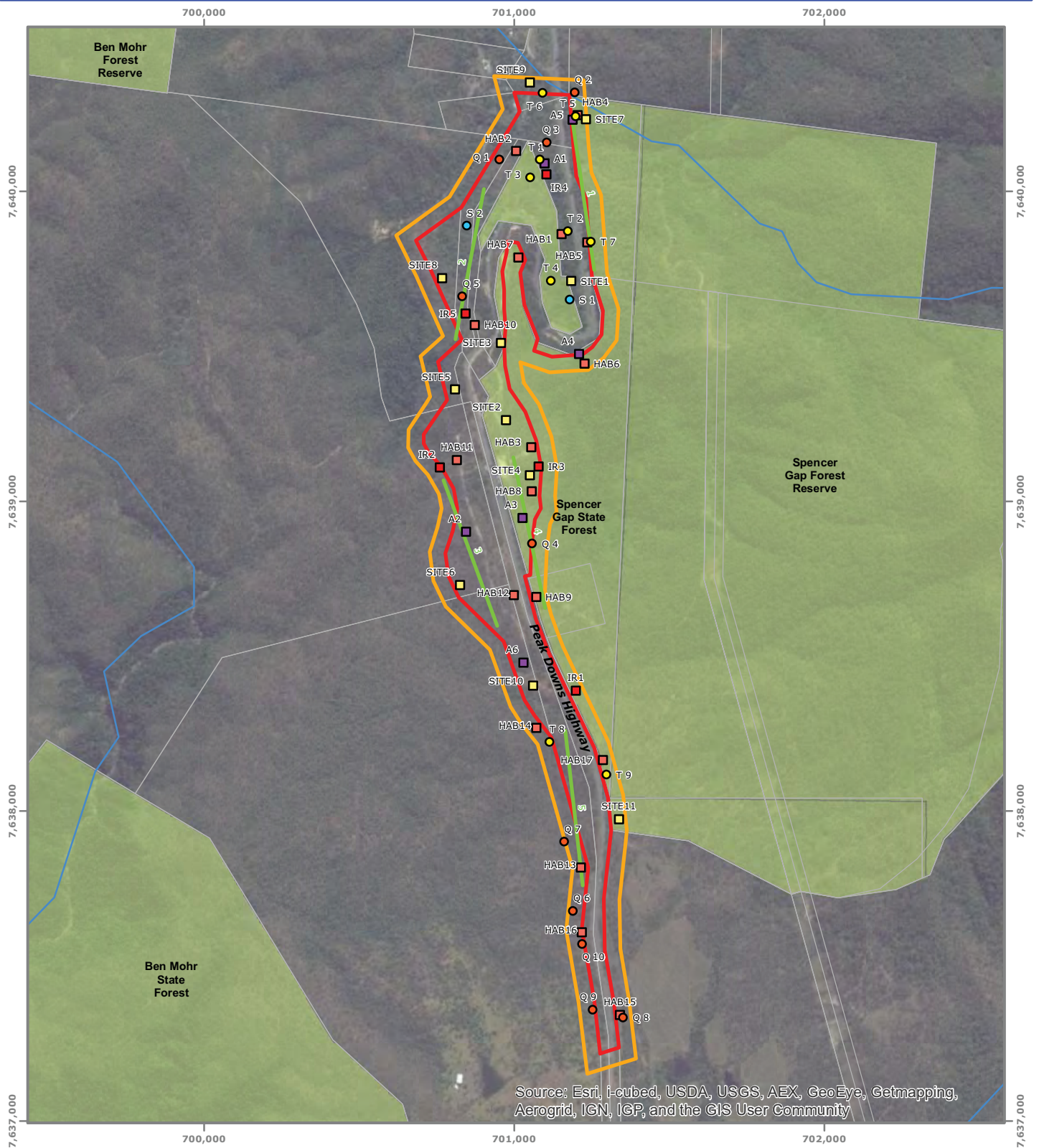
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FIGURES



Legend

- Study Area
- Buffer
- Watercourse
- Protected Areas
- Cadastral Boundaries
- Vegetation Assessment Site**
- Quaternary (Q1-Q10)
- Tertiary (T1-T9)
- Secondary (S1-S2)

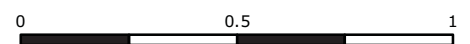
Fauna Survey Sites

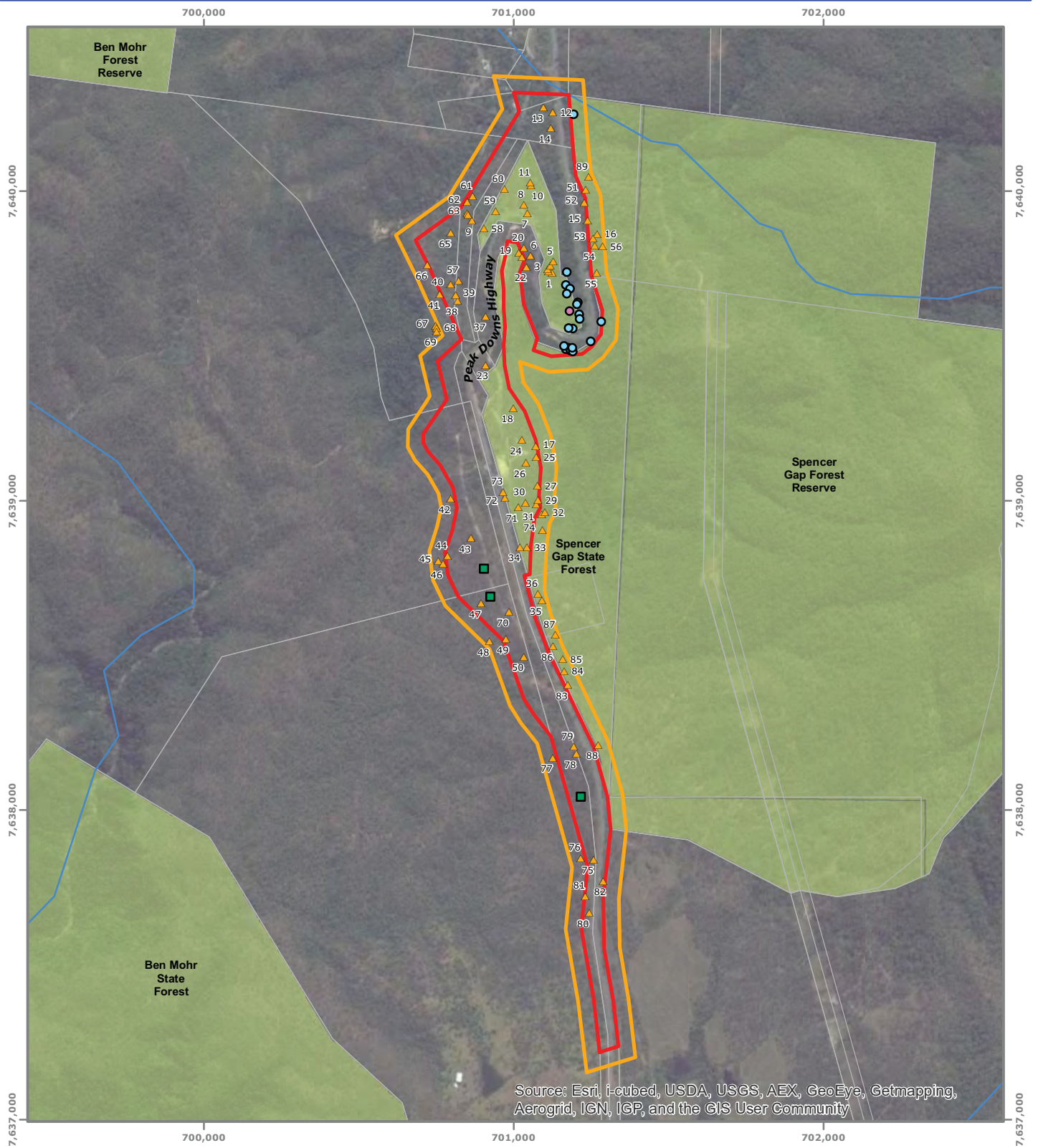
- Anabat Site (A1-A6)
- Habitat Assessment Site (HAB1-HAB17)
- Infrared Camera Site (IR1-IR5)
- Site (SITE1-SITE11)
- KoalaTransects

Figure 1 : Flora and fauna survey sites

Eton Range

Map Number: 13025_01_e
 Date: 23 December 2012
 Map Projection: MGA94 (Zone 55)





Legend

- Study Area
- Buffer
- Watercourse
- Protected Areas
- Cadastral Boundaries
- ▲ Habitat Tree (1-98)

Significant Fauna Species Records

- Koala (*Phascolarctos cinereus*) - Vulnerable (EPBC Act)

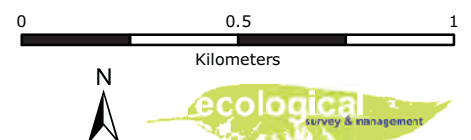
Significant Flora Species Records

- Veiny Whitewood (*Atalaya rigida*) - Near Threatened (NC Act)
- Rough Malletwood (*Rhodamnia pauciovulata*) - Near Threatened (NC Act)

Figure 3 : Significant species records

Eton Range

Map Number: 13025_03_d
 Date: 19 December 2012
 Map Projection: MGA94 (Zone 55)



APPENDIX A

FAUNA AND HABITAT TREE RECORDS FOR THE STUDY AREA

Table A1: Fauna inventory for the Study Area

Common Name	Species Name	NC Act Status	EPBC Act Status	Survey Sites											Anabat Sites						Incidental	
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	A1	A2	A3	A4	A5	A6		
Amphibians																						
Cane toad	<i>Rhinella marina</i>	*	*		Sp, AS	Sp	Sp	Sp	Sp	Sp	AS	Sp										
Eastern sedge frog	<i>Litoria fallax</i>	LC	NL				H															
Green tree frog	<i>Litoria caerulea</i>	LC	NL				Sp															
Birds																						
Australasian Figbird	<i>Sphecotheres vieilloti</i>	LC	NL																			X
Australian Brush-turkey	<i>Alectura lathamii</i>	LC	NL				Ir	Ir		X												X
Australian Magpie	<i>Cracticus tibicen</i>	LC	NL																			X
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	LC	NL				H					H										
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	LC	NL											X								
Brown Honeyeater	<i>Lichmera indistincta</i>	LC	NL																			X
Brush Cuckoo	<i>Cacomantis variolosus</i>	LC	NL										X									X
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	LC	NL																			X, X
Cicadabird	<i>Coracina tenuirostris</i>	LC	NL							X	X			X								X
Eastern Barn Owl	<i>Tyto javanica</i>	LC	NL						H													
Eastern Koel	<i>Eudynamys orientalis</i>	LC	NL																			X, X

Common Name	Species Name	NC Act Status	EPBC Act Status	Survey Sites											Anabat Sites						Incidental		
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	A1	A2	A3	A4	A5	A6			
Red-backed Fairy-wren	<i>Malurus melanocephalus</i>	LC	NL								X											X	
Red-browed Finch	<i>Neochmia temporalis</i>	LC	NL											X									X
Red-tailed Black-Cockatoo	<i>Calyptorhynchus banksii</i>	LC	NL									X											X
Red-winged Parrot	<i>Aprosmictus erythropterus</i>	LC	NL								X												
Restless Flycatcher	<i>Myiagra inquieta</i>	LC	NL																				X
Rufous Whistler	<i>Pachycephala rufiventris</i>	LC	NL								X	X		X	X								X
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	LC	NL																				X
Southern Boobook	<i>Ninox novaeseelandiae</i>	LC	NL										H										
Spangled Drongo	<i>Dicrurus bracteatus</i>	LC	NL								X												X
Spectacled Monarch	<i>Symposiachrus trivirgatus</i>	LC	M																				X
Spotted Nightjar	<i>Eurostopodus argus</i>	LC	NL																				X
Striated Pardalote	<i>Pardalotus striatus</i>	LC	NL																				X
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>	LC	NL																				X
Torresian Crow	<i>Corvus orru</i>	LC	NL			Ir					X			X	X								
Varied Triller	<i>Lalage leucomela</i>	LC	NL																				X
Weebill	<i>Smicronis brevirostris</i>	LC	NL																				X, X

Common Name	Species Name	NC Act Status	EPBC Act Status	Survey Sites											Anabat Sites						Incidental	
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	A1	A2	A3	A4	A5	A6		
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	LC	NL									X										X
White-browed Robin	<i>Poecilodryas superciliosa</i>	LC	NL																			X
White-browed Scrubwren	<i>Sericornis frontalis</i>	LC	NL								X											X, X
White-cheeked Honeyeater	<i>Phylidonyris niger</i>	LC	NL																			X, X
White-throated Gerygone	<i>Gerygone albogularis</i>	LC	NL		AS									X								
White-throated Honeyeater	<i>Melithreptus albogularis</i>	LC	NL								X											X
Willie Wagtail	<i>Rhipidura leucophrys</i>	LC	NL																			X
Wompoo Fruit-Dove	<i>Ptilinopus magnificus</i>	LC	NL																			X
Yellow Honeyeater	<i>Lichenostomus flavus</i>	LC	NL																			X
Mammals																						
Beccari's Free-tailed Bat	<i>Mormopterus beccarii</i>	LC	NL													A		A				A
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	LC	NL													Au						
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	LC	NL	Ir, Sp										Sp								
Common Dunnart	<i>Sminthopsis murina</i>	LC	NL		Sp																	
Dingo, Wild Dog	<i>Canis lupus</i>	*	*																			Tr, Sc

Common Name	Species Name	NC Act Status	EPBC Act Status	Survey Sites											Anabat Sites						Incidental	
				Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	A1	A2	A3	A4	A5	A6		
Red-necked Wallaby	<i>Macropus rufogriseus</i>	LC	NL														Ir					
Sugar Glider	<i>Petaurus breviceps</i>	LC	NL			Sp																
Troughton's Sheath-tail Bat	<i>Taphozous troughtoni</i>	LC	NL														Au	A		A		
Tube-nosed Bat	<i>Murina florium</i>	LC	NL	Sp																		
Whiptail Wallaby	<i>Macropus parryi</i>	LC	NL																			X
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>	LC	NL																		H	H
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>	LC	NL														A	A	A			A
	<i>Nyctophilus sp.</i>																	A		Au	Au	
Reptiles																						
Blue-throated Rainbow-skink	<i>Carlia rhomboidalis</i>	LC	NL	Sp																		
Bynoe's gecko	<i>Heteronotia binoei</i>	LC	NL		AS						X											
Chain-backed Dtella	<i>Gehyra catenata</i>	LC	NL		Sp								Sp									
Lace Monitor	<i>Varanus varius</i>	LC	NL	Ir	Ir	Ir																
Ocellated Velvet Gecko	<i>Oedura monillis</i>	LC	NL																			Spot
Open-litter Rainbow-skink	<i>Carlia pectoralis</i>	LC	NL	AS							Sp, AS			AS								X
Peron's snake-eyed skink	<i>Cryptoblepharus plagiocephalus</i>	LC	NL		AS										AS							
Yellow-faced Whipsnake	<i>Demansia psammophis</i>	LC	NL	AS																		

Notes

Heard	H
Active search	AS
Anabat recording	A
Anabat recording unconfirmed	AU
General observation	X
Infra-red camera	Ir
Scats	Sc
Spotlighting	Sp
Tracks	Tr

Table A2: Habitat trees in the Study Area

Tree No.	Latitude	Longitude	Species	Hollow Size	Location of Hollow	Number of Hollows	Nest Present?
1	-21.333218	148.939269	<i>Corymbia intermedia</i>	Small	Branch	Several	
2	-21.333172	148.939156	<i>Corymbia intermedia</i>	Medium	Branch	Several	
3	-21.333107	148.939133	<i>Corymbia intermedia</i>	Medium	Trunk	Several	
4	-21.333012	148.939216	<i>Corymbia intermedia</i>	Medium	Trunk	Several	
5	-21.332894	148.939292	<i>Corymbia intermedia</i>	Small	Branch	Several	
6	-21.332723	148.938601	<i>Corymbia intermedia</i>	Medium	Branch	Numerous	
7	-21.331482	148.938483	<i>Eucalyptus platyphylla</i>	Small	Branch	Several	
8	-21.331248	148.938367	<i>Corymbia intermedia</i>	Small	Branch	Several	
9	-21.33173	148.936755	<i>Corymbia intermedia</i>	Medium	Trunk	One	
10	-21.330672	148.938588	<i>Corymbia intermedia</i>	Small	Branch	One	
11	-21.330591	148.938553	<i>Eucalyptus platyphylla</i>	Small	Branch	Numerous	
12	-21.328542	148.939232	<i>Eucalyptus platyphylla</i>	Medium	Branch	Several	
13	-21.328401	148.938944	"Stag"	Small	Branch	Several	
14	-21.329	148.939176	<i>Corymbia intermedia</i>	Small	Branch	Several	
15	-21.331689	148.940358	<i>Corymbia intermedia</i>	Small	Branch	Several	Termitorium
16	-21.332069	148.940662	<i>Corymbia intermedia</i>	Small	Branch	Several	
17	-21.338293	148.938828	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
18	-21.337174	148.938114	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
19	-21.332652	148.938224	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
20	-21.332497	148.938375	<i>Eucalyptus portuensis</i>	Medium	Branch	Several	
21	-21.332771	148.938323	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
22	-21.333058	148.938477	<i>Corymbia intermedia</i>	Small	Branch	Several	
23	-21.335936	148.937238	<i>Eucalyptus portuensis</i>	Small	Branch	One	

Tree No.	Latitude	Longitude	Species	Hollow Size	Location of Hollow	Number of Hollows	Nest Present?
24	-21.338106	148.938397	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
25	-21.338606	148.938842	<i>Eucalyptus drepanophylla</i>	Small	Trunk	Several	
26	-21.338765	148.938528	<i>Eucalyptus drepanophylla</i>	Small	Branch	Several	
27	-21.339447	148.938895	"stag"	Small	Trunk	Several	
28	-21.339971	148.938868	"stag"	Medium	Trunk	Several	
29	-21.339849	148.938921	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
30	-21.339928	148.938527	<i>Eucalyptus portuensis</i>	Small	Trunk	Several	
31	-21.340253	148.939041	<i>Corymbia citriodora ssp. citriodora</i>	Medium	Branch	Several	
32	-21.340209	148.939135	<i>Corymbia citriodora ssp. citriodora</i>	Medium	Branch	Several	
33	-21.341232	148.938586	<i>Eucalyptus portuensis</i>	Small	Branch	Several	Termitorium
34	-21.341232	148.938377	"stag"	Medium	Branch	Several	
35	-21.342769	148.939078	<i>Eucalyptus exserta</i>	Medium	Branch	One	
36	-21.342588	148.93896	<i>Eucalyptus exserta</i>	Medium	Branch	Several	
37	-21.334512	148.937216	<i>Eucalyptus portuensis</i>	Medium	Trunk	Several	
38	-21.334066	148.936341	<i>Eucalyptus platyphylla</i>	Small	Branch	One	
39	-21.333907	148.936279	<i>Eucalyptus platyphylla</i>	Small	Branch	Several	
40	-21.333589	148.936123	<i>Eucalyptus platyphylla</i>	Medium	Trunk	One	
41	-21.333885	148.93579	<i>Corymbia intermedia</i>	Medium	Trunk	One	
42	-21.339854	148.936198	<i>Eucalyptus drepanophylla</i>	Medium	Branch	Several	
43	-21.340992	148.936844	"stag"	Medium	Trunk	Several	
44	-21.341515	148.936119	"stag"	nil	nil	nil	Termitorium
45	-21.341673	148.935841	<i>Eucalyptus exserta</i>	Medium	Trunk	Several	

Tree No.	Latitude	Longitude	Species	Hollow Size	Location of Hollow	Number of Hollows	Nest Present?
46	-21.341747	148.935979	<i>Eucalyptus exserta</i>	Small	Branch	Several	
47	-21.342888	148.937183	<i>Corymbia citriodora ssp. citriodora</i>	Small	Branch	Several	
48	-21.344	148.937457	<i>Corymbia citriodora ssp. citriodora</i>	Medium	Trunk	Several	
49	-21.343923	148.937967	<i>Lophostemon suaveolens</i>	Small	Trunk	Several	
50	-21.344426	148.938534	"stag"	Medium	Trunk	Several	
51	-21.330777	148.940277	<i>Eucalyptus platyphylla</i>	Medium	Trunk	Several	
52	-21.331156	148.94025	<i>Corymbia intermedia</i>	nil	nil	nil	Termitorium
53	-21.332207	148.940525	<i>Corymbia intermedia</i>	Small	Branch	Several	
54	-21.332406	148.940593	<i>Corymbia intermedia</i>	Medium	Branch	Several	
55	-21.333196	148.94066	<i>Corymbia intermedia</i>	Small	Branch	Several	
56	-21.33244	148.940839	<i>Corymbia intermedia</i>	Small	Branch	Several	
57	-21.333475	148.936367	<i>Corymbia intermedia</i>	Medium	Branch	Several	
58	-21.331942	148.937134	<i>Eucalyptus platyphylla</i>	Small	Branch	Several	
59	-21.33144	148.937499	<i>Eucalyptus platyphylla</i>	Medium	Branch	One	
60	-21.330795	148.93775	<i>Corymbia intermedia</i>	Small	Trunk	One	
61	-21.331012	148.936766	<i>Corymbia intermedia</i>	Small	Trunk	One	
62	-21.331168	148.936599	<i>Corymbia intermedia</i>	Medium	Branch	One	
63	-21.331514	148.936609	<i>Eucalyptus platyphylla</i>	Medium	Trunk	Several	
64	-21.33156	148.936641	<i>Corymbia intermedia</i>	Small	Trunk	One	
65	-21.332085	148.936103	<i>Corymbia tessellaris</i>	Small	Branch	Several	
66	-21.333028	148.935388	<i>Eucalyptus drepanophylla</i>	Small	Trunk	One	
67	-21.33481	148.935667	<i>Corymbia intermedia</i>	Medium	Trunk	Several	

Tree No.	Latitude	Longitude	Species	Hollow Size	Location of Hollow	Number of Hollows	Nest Present?
68	-21.334857	148.935697	<i>Corymbia intermedia</i>	Medium	Branch	Several	
69	-21.33497	148.935697	<i>Corymbia intermedia</i>	Small	Branch	Several	
70	-21.343121	148.938057	<i>Eucalyptus exserta</i>	<i>nil</i>	<i>nil</i>	<i>nil</i>	Termitorium
71	-21.34006	148.938301	<i>Corymbia citriodora ssp. citriodora</i>	Small	Branch	Several	
72	-21.339796	148.937882	<i>Corymbia citriodora ssp. citriodora</i>	Medium	Branch	Several	
73	-21.339624	148.937833	<i>Eucalyptus exserta</i>	Medium	Branch	Several	
74	-21.340729	148.939068	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
75	-21.350314	148.940786	<i>Eucalyptus portuensis</i>	Medium	Branch	Several	
76	-21.350277	148.940381	<i>Corymbia trachyphloia</i>	<i>nil</i>	<i>nil</i>	<i>nil</i>	Termitorium
77	-21.347365	148.939476	<i>Eucalyptus portuensis</i>	<i>nil</i>	<i>nil</i>	<i>nil</i>	Termitorium
78	-21.347248	148.940211	<i>Corymbia citriodora ssp. citriodora</i>	Medium	Trunk	Several	
79	-21.347022	148.94012	<i>Eucalyptus portuensis</i>	Medium	Branch	Several	
80	-21.351873	148.940671	<i>Eucalyptus drepanophylla</i>	<i>nil</i>	<i>nil</i>	<i>nil</i>	Termitorium
81	-21.351388	148.940546	<i>Corymbia citriodora ssp. citriodora</i>	Small	Branch	Several	
82	-21.350938	148.941089	<i>Eucalyptus portuensis</i>	Medium	Trunk	One	
83	-21.345244	148.939917	<i>Melaleuca fluviatilis</i>	Medium	Trunk	One	
84	-21.344837	148.939802	"stag"	Medium	Branch	Several	
85	-21.344494	148.939756	<i>Eucalyptus platyphylla</i>	Medium	Branch	Several	
86	-21.344106	148.939444	<i>Eucalyptus portuensis</i>	Small	Branch	Several	
87	-21.343766	148.93951	<i>Eucalyptus portuensis</i>	Large	Trunk	One	
88	-21.34697	148.940882	<i>Eucalyptus exserta</i>	Medium	Trunk	Several	

Tree No.	Latitude	Longitude	Species	Hollow Size	Location of Hollow	Number of Hollows	Nest Present?
89	-21.33041	148.940358	"stag"	Medium	Trunk	One	

APPENDIX B

FLORA RECORDS FOR THE STUDY AREA

Table B1: Flora inventory for the Study Area

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
CYPERACEAE	<i>Abildgaardia ovata</i>	<i>ncn</i>	LC	NL			+		
MIMOSACEAE	<i>Acacia bidwillii</i>	Corkwood Wattle	LC	NL			+ -2		
MIMOSACEAE	<i>Acacia disparrima ssp. disparrima</i>	Hickory Wattle	LC	NL	+ -2	2		1 -2	
MIMOSACEAE	<i>Acacia leiocalyx ssp. leiocalyx</i>	Black Wattle	LC	NL		+ -2	+ -3		
MIMOSACEAE	<i>Acacia leptocarpa</i>	<i>ncn</i>	LC	NL		+ -2	+ -2	+	
MYRTACEAE	<i>Acmena smithii</i>	Lilly Pilly	LC	NL	1				
RUTACEAE	<i>Acronychia laevis</i>	Glossy Acronychia	LC	NL	2 -3				
EUPHORBIACEAE	<i>Actephila latifolia</i>	<i>ncn</i>	LC	NL	1				
EUPHORBIACEAE	<i>Actephila lindleyi</i>	Actephila	LC	NL	1				
ADIANTACEAE	<i>Adiantum aethiopicum</i>	Maidenhair Fern	LC	NL	2 -3	1			
ADIANTACEAE	<i>Adiantum hispidulum var. hispidulum</i>	Rough Maidenhair Fern	LC	NL	2 -3				
FABACEAE	<i>Aeschynomene indica</i>	Buddha Pea	*	*					1
ASTERACEAE	<i>Ageratum conyzoides ssp. conyzoides</i>	Blue Top	LC	NL		+ -3 (e)	1		+ -3
RUBIACEAE	<i>Aidia racemosa</i>	Archer Cherry	LC	NL	1				
SIMAROUBACEAE	<i>Ailanthus triphysa</i>	White Bean	LC	NL	2	+			
MIMOSACEAE	<i>Albizia lebbeck</i>	Indian Siris	*	*				+	
MIMOSACEAE	<i>Albizia procera</i>	Native Siris	LC	NL	1 -2 (e)	+	+	+	
EUPHORBIACEAE	<i>Alchornea ilicifolia</i>	Native Holly	LC	NL	1				
EUPHORBIACEAE	<i>Alchornea thozetiana var. thozetiana</i>	Thozet's Holly	LC	NL	+				
SAPINDACEAE	<i>Alectryon subdentatus</i>	Hard Alectryon	LC	NL	+				
SAPINDACEAE	<i>Alectryon tomentosa</i>	Hairy Alectryon	LC	NL	+				
POACEAE	<i>Alloteropsis semialata</i>	Cockatoo Grass	LC	NL		1	1		
RHAMNACEAE	<i>Alphitonia excelsa</i>	Red Ash	LC	NL		2	+ -3	3	
APOCYNACEAE	<i>Alstonia constricta</i>	Milky Pine	LC	NL	2 -5				
APOCYNACEAE	<i>Alstonia scholaris</i>	Milky Pine	LC	NL	2				

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
AMARANTHACEAE	<i>Alternanthera dentata</i>	Purple Hedge	*	*		+			
FABACEAE	<i>Alysicarpus vaginalis</i>	Alyce Clover	*	*					+
APOCYNACEAE	<i>Alyxia ruscifolia</i>	Chain Fruit	LC	NL	2				
LORANTHACEAE	<i>Amyema biniflorum</i>	Bronze Mistletoe	LC	NL				1	
LORANTHACEAE	<i>Amyema congener ssp. rotundifolium</i>	Variable Mistletoe	LC	NL			+		
POACEAE	<i>Ancistrachne uncinulata</i>	Hooky Grass	LC	NL	+ -2				
ULMACEAE	<i>Aphananthe phillipinensis</i>	Rough-Leaved Elm	LC	NL	2				
ARAUCARIACEAE	<i>Araucaria cunninghamii</i>	Hoop Pine	LC	NL	+				
MIMOSACEAE	<i>Archidendropsis thozetiana</i>	Southern Siris	LC	NL	+				
STERCULIACEAE	<i>Argyrodendron polyandrum</i>	Brown Tulip Oak	LC	NL	2-5				
POACEAE	<i>Aristida calycina</i>	Dark Wiregrass	LC	NL			+ -3		
POACEAE	<i>Aristida gracilipes</i>	(a) Wiregrass	LC	NL	+				
POACEAE	<i>Aristida latifolia</i>	<i>ncn</i>	LC	NL					+
POACEAE	<i>Aristida ramosa</i>	Purple Wiregrass	LC	NL					1
SAPINDACEAE	<i>Arytera distylis</i>	Twin-leaved Coogera	LC	NL	+				
SAPINDACEAE	<i>Arytera divaricata</i>	Coogera	LC	NL	2				
POLYPODIACEAE	<i>Asplenium paleaceum</i>	Scaly Asplenium	LC	NL	+				
SAPINDACEAE	<i>Atalaya australiana</i>	<i>ncn</i>	LC	NL	+				
RUBIACEAE	<i>Atractocarpus fitzalanii</i>	Native Gardenia	LC	NL	+				
FABACEAE	<i>Austrosteenisia blackii</i>	Blood Vine	LC	NL	3				
SCROPHULARIACEAE	<i>Bacopa procumbens</i>	<i>ncn</i>	*	*					+
EUPHORBIACEAE	<i>Baloghia inophylla</i>	Scrub Bloodwood	LC	NL	2 (d/l)				
ASTERACEAE	<i>Bidens alba var. radicata</i>	Sheppard's Needles	*	*				1-3	1-3
POACEAE	<i>Bothriochloa bladhii</i>	Forest Bluegrass	LC	NL		1			

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
POACEAE	<i>Bothriochloa ewartiana</i>	Desert Bluegrass	LC	NL					+
POACEAE	<i>Brachiaria decumbens</i>	Signal Grass	*	*		+	+		+ -3
PHYLLANTHACEAE	<i>Breynia oblongifolia</i>	Coffee Bush	LC	NL	+	1		+	
EUPHORBIACEAE	<i>Bridelia leichhardtii</i>	Small-Leaved Scrub Ironbark	LC	NL	1				
BURSERACEAE	<i>Canarium australianum</i>	Mango Bark	LC	NL	1				
POACEAE	<i>Capillipedium spicigerum</i>	Scented Top	LC	NL		1-3	+ -1		
CAPPARACEAE	<i>Capparis arborea</i>	Native Pomegranate	LC	NL	2-3				
CAPPARACEAE	<i>Capparis ornans</i>	Showy Caper	LC	NL	+				
APOCYNACEAE	<i>Carissa ovata</i>	Klunkerberry	LC	NL	2				
LAURACEAE	<i>Cassytha filiformis</i>	Dodder Laurel	LC	NL	1			1	
VITACEAE	<i>Cayratia acris</i>	Soft Water Vine	LC	NL	+				
FABACEAE	<i>Centrosema molle</i>	Centro	*	*			+ -2		+ -2
CAESALPINIACEAE	<i>Chamaecrista bifida</i>	<i>ncn</i>	LC	NL			+		
CAESALPINIACEAE	<i>Chamaecrista nomame</i>	<i>ncn</i>	LC	NL			+		
CAESALPINIACEAE	<i>Chamaecrista rotundifolia</i>	Wynn's Cassia	*	*					+
ADIANTACEAE	<i>Cheilanthes sieberi ssp. sieberi</i>	Mulga Fern	LC	NL			1		
ADIANTACEAE	<i>Cheilanthes tenuifolia</i>	Rock Fern	LC	NL			1		
OLEACEAE	<i>Chionanthus ramiflora</i>	Native Olive	LC	NL	3-4			+	
POACEAE	<i>Chloris gayana cv.</i>	Rhodes Grass	*	*					+ -2
POACEAE	<i>Chloris inflata</i>	Purpletop Chloris	*	*					+ -2
POACEAE	<i>Chloris virgata</i>	Feathertop Rhodes Grass	*	*					+ -2
POACEAE	<i>Chrysopogon fallax</i>	Golden Beard Grass	LC	NL			+		
VITACEAE	<i>Cissus cardiophylla</i>	Heart-Leaved Water Vine	LC	NL	+ -2				
VITACEAE	<i>Cissus oblonga</i>	Smooth Water Vine	LC	NL	+ -3		+		

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
RUTACEAE	<i>Clausena brevistyla</i> var. <i>brevistyla</i>	Native Wampi	LC	NL	+				
EUPHORBIACEAE	<i>Cleistanthus dallachyanus</i>	<i>ncn</i>	LC	NL	+ -2				
POACEAE	<i>Cleistochloa subjuncea</i>	<i>ncn</i>	LC	NL			1		
RANUNCULACEAE	<i>Clematis glycinoides</i>	Clematis	LC	NL	1				
VITACEAE	<i>Clematocissus opaca</i>	Forest Grape	LC	NL	+	+			
VERBENACEAE	<i>Clerodendrum floribundum</i>	Smooth Lolly Bush	LC	NL	2 (e)				
RUTACEAE	<i>Coatesia paniculata</i>	Axebreaker	LC	NL	+				
BORAGINACEAE	<i>Cordia dichotoma</i>	Snotty Gobbles	LC	NL	2				
LAXMANNIACEAE	<i>Cordylina murchisoniae</i>	Small Palm Lily	LC	NL	-2				
MYRTACEAE	<i>Corymbia citrodora</i> ssp. <i>citriodora</i>	Lemon-Scented Gum	LC	NL		1	3-6	+ -2	
MYRTACEAE	<i>Corymbia dallachiana</i>	Dallachy's Gum	LC	NL			+		
MYRTACEAE	<i>Corymbia erythrophloia</i>	Variable-Barked Bloodwood	LC	NL				+	
MYRTACEAE	<i>Corymbia intermedia</i>	Pink Bloodwood	LC	NL	2 (e)	2-4		2	
MYRTACEAE	<i>Corymbia tessellaris</i>	Carbeen	LC	NL	+(e)	+ -2	+	2-3	
MYRTACEAE	<i>Corymbia torelliana</i>	Cadaghi	LC	NL				+	
MYRTACEAE	<i>Corymbia trachyphloia</i> ssp. <i>trachyphloia</i>	Brown Blood	LC	NL		+	+ -2		
ASTERACEAE	<i>Crassocephalum crepidioides</i>	Thickhead	*	*			+		+
FABACEAE	<i>Crotalaria goreensis</i>	Gambia Pea	*	*			+		+ -2
FABACEAE	<i>Crotalaria lanceolata</i> ssp. <i>lanceolata</i>	<i>ncn</i>	*	*					+ -1
LAURACEAE	<i>Cryptocarya bidwillii</i>	Yellow Laurel	LC	NL	1				
LAURACEAE	<i>Cryptocarya hypospodia</i>	Northern Laurel	LC	NL	1				
LAURACEAE	<i>Cryptocarya onoprienkoana</i>	Rose Maple	LC	NL	1				
LAURACEAE	<i>Cryptocarya triplinervis</i> var. <i>pubens</i>	Three-Veined Laurel	LC	NL	3	+			
SAPINDACEAE	<i>Cupaniopsis simulata</i>	Northern Tuckeroo	LC	NL	3-4		+		

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
ASTERACEAE	<i>Cyanthillium cinereum</i>	<i>ncn</i>	LC	NL		+	2		
ZAMIACEAE	<i>Cycas media</i>	<i>ncn</i>	LC	NL		3	1	+ -2	
RUBIACEAE	<i>Cyclophyllum coprosmoides</i>	Coast Canthium	LC	NL	+ -2				
ORCHIDACEAE	<i>Cymbidium canaliculatum</i>	Black Orchid	LC	NL			+		
CYPERACEAE	<i>Cyperus gracilis</i>	Whisker Grass	LC	NL	+	+	1	+	
CYPERACEAE	<i>Cyperus gunnii var. novae-hollandiae</i>	<i>ncn</i>	LC	NL	2				
CYPERACEAE	<i>Cyperus victoriensis</i>	<i>ncn</i>	LC	NL			+		
FABACEAE	<i>Dalbergia sissoo</i>	Himalayan Raintree	*	*		1		+ -1	1
AMARANTHACEAE	<i>Deeringia arborescens</i>	<i>ncn</i>	LC	NL	+				
FABACEAE	<i>Desmodium rhytidophyllum</i>	Hairy Tre-Foil	LC	NL			2		
FABACEAE	<i>Desmodium tortuosum</i>	<i>ncn</i>	*	*		+	+ -2	1	
FABACEAE	<i>Desmodium triflorum</i>	<i>ncn</i>	LC	NL		1	+ -2		
HEMEROCALLIDACEAE	<i>Dianella caerulea</i>	Blue Flax Lily	LC	NL	+		+		
POACEAE	<i>Dichanthium aristatum</i>	Angleton Grass	*	*					+
POACEAE	<i>Digitaria breviglumis</i>	<i>ncn</i>	LC	NL	+ -3 (e)		1-2		
POACEAE	<i>Digitaria eriantha</i>	Pangola Grass	*	*					
SAPINDACEAE	<i>Dioscorea transversa</i>	Native Yam	LC	NL	1				
EBENACEAE	<i>Diospyros australis</i>	Black Plum	LC	NL	1				
EBENACEAE	<i>Diospyros geminata</i>	Scaly Ebony	LC	NL	2				
EBENACEAE	<i>Diospyros hebecarpa</i>	(an) Ebony	LC	NL	1				
SAPINDACEAE	<i>Diploglottis obovata</i>	Native Tamarind	LC	NL	+ -3				
ORCHIDACEAE	<i>Dockrillia bowmanii</i>	<i>ncn</i>	LC	NL	+				
SINOPTERIDACEAE	<i>Doryopteris concolor</i>	<i>ncn</i>	LC	NL	3-4				
POLYPODIACEAE	<i>Drynaria sparsisora</i>	<i>ncn</i>	LC	NL	1	+ (e)			
EUPHORBIACEAE	<i>Drypetes deplanchei</i>	Yellow Tulip	LC	NL	3				
MELIACEAE	<i>Dysoxylum mollissimum ssp. molle</i>	Red Bean	LC	NL	1				
ELAEOCARPACEAE	<i>Elaeocarpus obovatus</i>	Hard Quandong	LC	NL	+ -4				

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
SAPINDACEAE	<i>Elattostachys xylocarpa</i>	White Tamarind	LC	NL	+				
POACEAE	<i>Eleusine indica</i>	Crows Foot Grass	LC	NL					2
ASTERACEAE	<i>Emilia sonchifolia</i>	Emilia	LC	NL			+		
LAURACEAE	<i>Endiandra compressa</i>	White Bark	LC	NL	1				
ASTERACEAE	<i>Epaltes australe</i>	<i>ncn</i>	LC	NL			+		2
POACEAE	<i>Eragrostis spartinooides</i>	<i>ncn</i>	LC	NL		2	+ -3		
POACEAE	<i>Eragrostis tenuiflora</i>	Elastic Grass	*	*					
MYRTACEAE	<i>Eucalyptus drepanophylla</i>	Northern Grey Ironbark	LC	NL		+ -3	+ -4	2-3	
MYRTACEAE	<i>Eucalyptus exserta</i>	Queensland Peppermint	LC	NL		2-4	+ -2		
MYRTACEAE	<i>Eucalyptus platyphylla</i>	Poplar Gum	LC	NL			+ -1		
MYRTACEAE	<i>Eucalyptus portuensis</i>	White Mahogany	LC	NL	1(e)	4-6	+ -4	1	
MYRTACEAE	<i>Eucalyptus tereticornis</i>	Queensland Blue Gum	LC	NL				3-4	
MYRTACEAE	<i>Eugenia reinwardtiana</i>	Beach Cherry	LC	NL	1				
ANACARDIACEAE	<i>Euroschinus falcata</i>	Ribbonwood	LC	NL	+ -3		+	2	
LAXMANNIACEAE	<i>Eustrephus latifolius</i>	Wombat Berry	LC	NL	+ -1	1		1	
CONVOLVULACEAE	<i>Evolvulus alsinoides</i>	Creeping Speedwell	LC	NL		+			
CYPERACEAE	<i>Exocarya scleroides</i>	<i>ncn</i>	LC	NL	+ -2				
MORACEAE	<i>Ficus hillii</i>	Sandpaper Fig	LC	NL	2				
MORACEAE	<i>Ficus opposita</i>	Sandpaper Fig	LC	NL	+		+	1	
MORACEAE	<i>Ficus racemosa</i>	Cluster Fig	LC	NL	2-3 (d/l)			+	
MORACEAE	<i>Ficus rubiginosa forma rubiginosa</i>	Rock Fig	LC	NL			+		
MORACEAE	<i>Ficus virens ssp. sublanceolata</i>	White Fig	LC	NL	+				
MORACEAE	<i>Ficus watkinsiana</i>	Strangler Fig	LC	NL	+				
CYPERACEAE	<i>Fimbristylis cinnamometorum</i>	<i>ncn</i>	LC	NL			+ -2		+ -3
FABACEAE	<i>Flemingia lineata</i>	<i>ncn</i>	LC	NL		1	+ -2	2	+ -2

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
RUTACEAE	<i>Flindersia australis</i>	Crows Ash	LC	NL		+			
RUTACEAE	<i>Flindersia schottiana</i>	Cudgerie	LC	NL	+ -3				
PHYLLANTHACEAE	<i>Flueggea leucopyrus</i>	Currant Bush	LC	NL		+			
CYPERACEAE	<i>Gahnia aspera</i>	Saw Sedge	LC	NL	+ -2				
SAPINDACEAE	<i>Ganophyllum falcatum</i>	<i>ncn</i>	LC	NL	2				
RUTACEAE	<i>Geijera salicifolia</i> var. <i>latifolia</i>	Broad-Leaved Wilga	LC	NL	2				
ORCHIDACEAE	<i>Geodorum densiflorum</i>	Pink Nodding Orchid	LC	NL		+	+		
PHYLLANTHACEAE	<i>Glochidion apodogynum</i>	Cheese Tree	LC	NL	2 (e)	+ -1	+ -2	+ -2	
ASTERACEAE	<i>Glossocardia bidens</i>	Native Cobblers Pegs	LC	NL			+		
VERBENACEAE	<i>Glossocarya hemiderma</i>	Glossocarya	LC	NL	+				
FABACEAE	<i>Glycine cyrtoloba</i>	<i>ncn</i>	LC	NL			+		
FABACEAE	<i>Glycine tabacina</i>	Glycine Pea	LC	NL			2		
APOCYNACEAE	<i>Gomphocarpus physocarpus</i>	Balloon Cotton	*	*					+
MYRTACEAE	<i>Gossia bidwillii</i>	Python Tree	LC	NL	3				
MYRTACEAE	<i>Gossia hillii</i>	Scaly Myrtle	LC	NL	+				
SAPINDACEAE	<i>Guioa acutifolia</i>	Northern Guioa	LC	NL	1				
HALORAGACEAE	<i>Haloragis aspera</i>	<i>ncn</i>	LC	NL				+	
ASTERACEAE	<i>Helichrysum boormanii</i>	<i>ncn</i>	LC	NL			+		
POACEAE	<i>Heteropogon contortus</i>	Bunched Speargrass	LC	NL		1-3	2-5		
POACEAE	<i>Heteropogon triticeus</i>	Giant Speargrass	LC	NL			2-4		
APOCYNACEAE	<i>Heterostemma acuminatum</i>	Blue Tiger Butterfly Vine	LC	NL					
MALVACEAE	<i>Hibiscus divaricatus</i>	<i>ncn</i>	LC	NL		2		1	
CELASTRACEAE	<i>Hippocratea obtusifolia</i> var. <i>barbata</i>	Knot Vine	LC	NL	2				
VIOLACEAE	<i>Hybanthus stellarioides</i>	Spade Flower	LC	NL			+		
POACEAE	<i>Hyparrhenia rufa</i> ssp. <i>altissima</i>	Thatch Grass	*	*		+ -2	+		2-5

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
LAMIACEAE	<i>Hyptis suaveolens</i>	Hyptis	*	*					+
MENISPERMACEAE	<i>Hypserpa decumbens</i>	Hypserpa	LC	NL	2				
POACEAE	<i>Imperata cylindrica</i>	Blady Grass	LC	NL		+		+-4	+-2
FABACEAE	<i>Indigofera brevidens</i> var. <i>brevidens</i>	(an) Indigo	LC	NL	+ (e)				
FABACEAE	<i>Indigofera hirsuta</i>	Hairy Indigo	LC	NL					+-2
CONVOLVULACEAE	<i>Ipomoea hederifolia</i>	Scarlet Creeper	*	*					2
CONVOLVULACEAE	<i>Ipomoea quamoclit</i>	Star Of Bethlehem	*	*					1
SAPINDACEAE	<i>Jagera pseudorhus</i> var. <i>pseudorhus</i>	Foam Bark	LC	NL	2-5	+-2	+	1	
OLEACEAE	<i>Jasminum didymum</i> ssp. <i>racemosum</i>	Slender Jasmine	LC	NL	2-5				
OLEACEAE	<i>Jasminum singuliflorum</i>	Soft Jasmine	LC	NL	2				
RUBIACEAE	<i>Kailarsenia ochreatea</i>	Native Gardenia	LC	NL	1		1-2	+-3	
VERBENACEAE	<i>Lantana camara</i> var. <i>camara</i>	Common Lantana	*	*	+-3 (e)		+-1	1-5	
DRYOPTERIDACEAE	<i>Lastreopsis microsora</i>	Creeping Shield Fern	LC	NL	-3				
CAESALPINIACEAE	<i>Leucaena leucocephala</i>	White Popinac	*	*					+-2
LAMIACEAE	<i>Leucas linifolia</i>	<i>ncn</i>	*	*					+
LAURACEAE	<i>Litsea leefeana</i>	Brown Bolly Gum	LC	NL	1				
LAURACEAE	<i>Litsea reticulata</i>	Bolly Gum	LC	NL	+				
CAMPANULACEAE	<i>Lobelia purpurascens</i>	White Root	LC	NL			+		
LAXMANNIACEAE	<i>Lomandra longifolia</i>	Spiny-Headed Mat-Rush	LC	NL			+		
LAXMANNIACEAE	<i>Lomandra multiflora</i> ssp. <i>multiflora</i>	Many-Headed Mat Rush	LC	NL		+	+		
MYRTACEAE	<i>Lophostemon confertus</i>	Brush Box	LC	NL	3		+-5		
MYRTACEAE	<i>Lophostemon grandiflorus</i>	Northern Swamp Box	LC	NL				2	
MYRTACEAE	<i>Lophostemon suaveolens</i>	Swamp Box	LC	NL			+-2	2-5	

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
EUPHORBIACEAE	<i>Macaranga tanarius</i>	Macaranga	LC	NL	+ (e)			+ -3	
MORACEAE	<i>Maclura cochinchinensis</i>	Cockspur Vine	LC	NL	1				
FABACEAE	<i>Macroptilium atropurpureum</i>	Sirartro	*	*				+ -2	1-5
EUPHORBIACEAE	<i>Mallotus philippensis</i>	Red Kamala	LC	NL	4		1	1	
CELASTRACEAE	<i>Maytenus disperma</i>	Orange Bush	LC	NL	+ (e)				
POACEAE	<i>Megathyrsus maximus var. maximus cv. Hamil</i>	Guinea Grass	*	*					1
POACEAE	<i>Megathyrsus maximus var. pubiglume</i>	Green Panic	*	*		+ -2	+	+ -4	1-5
MYRTACEAE	<i>Melaleuca fluviatilis</i>	Paper-Barked Tea Tree	LC	NL				1	
MYRTACEAE	<i>Melaleuca viridiflora</i>	Broad-Leaved Tea Tree	LC	NL			+ -4		
POACEAE	<i>Melinis minutiflora</i>	Molasses Grass	*	*			1	+ -4(e)	1-5
ANNONACEAE	<i>Melodorum leichhardtii</i>	Zig-Zag Vine	LC	NL	2				
MELASTOMATAACEAE	<i>Memecylon pauciflorum var. pauciflorum</i>	<i>ncn</i>	LC	NL	1				
RUTACEAE	<i>Micromelum minutum</i>	Micromelum	LC	NL	2-5				
POLYPODIACEAE	<i>Microsorium sp. (n-r)</i>	<i>ncn</i>	LC	NL	+ -3				
ANNONACEAE	<i>Miliusa brahei</i>	<i>ncn</i>	LC	NL	2-4				
FABACEAE	<i>Millettia pinnata</i>	Indian Beech	LC	NL	+ -4(g)				
MIMOSACEAE	<i>Mimosa pudica var. unijuga</i>	Common Sensitive Plant	*	*			1	+ -2	+ -3
SAPINDACEAE	<i>Mischocarpus anodontus</i>	Veiny Pear-Fruit	LC	NL	1				
POACEAE	<i>Mnesithea rottboellioides</i>	<i>ncn</i>	LC	NL		+	1	+ -4	+
COMMELINACEAE	<i>Murdannia graminea</i>	Slug Herb	LC	NL			+		
MYOPORACEAE	<i>Myoporum acuminatum</i>	Boobialla	LC	NL		1			
MYRSINACEAE	<i>Myrsine porosa</i>	(a) Muttonwood	LC	NL	+				
LAURACEAE	<i>Neolitsea brassii</i>	Northern Bolly Gum	LC	NL	+ -2				
OLEACEAE	<i>Notelaea microcarpa var. microcarpa</i>	Narrow-Leaved Mock Olive	LC	NL	+				

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
OLEACEAE	<i>Olea paniculata</i>	Native Olive	LC	NL	1				
POACEAE	<i>Oplismenus aemulus</i>	Paddymelon Grass	LC	NL	+				
POACEAE	<i>Oplismenus mollis</i>	Beard Grass	LC	NL	1-3	1			
POACEAE	<i>Ottochloa gracillima</i>	Graceful Grass	LC	NL	+				
BIGNONIACEAE	<i>Pandorea pandorana</i>	Wonga Vine	LC	NL	1-2				
POACEAE	<i>Panicum effusum</i>	Hairy Panic	LC	NL			+		
POACEAE	<i>Panicum simile</i>	Two-Coloured Panic	LC	NL		+	+ -2		+
MIMOSACEAE	<i>Paraserianthes toona</i>	Mackay Cedar	LC	NL	2				
APOCYNACEAE	<i>Parsonsia longipetiolata</i>	Green-Leaved Silkpod	LC	NL	+				
APOCYNACEAE	<i>Parsonsia paulforsteri</i>	Narrow-Leaved Silkpod	LC	NL	2				
POACEAE	<i>Paspalidium distans</i>	Shot Grass	LC	NL		+	1		
PASSIFLORACEAE	<i>Passiflora foetida</i>	Stinking Passionvine	*	*					+
PASSIFLORACEAE	<i>Passiflora suberosa</i>	Corky Passionvine	*	*	2-3	1-2		+ -2	
RUBIACEAE	<i>Pavetta australiensis</i>	Butterfly Bush	LC	NL	2-3				
ADIANTACEAE	<i>Pellaea nana</i>	Small-Leaved Sickle Fern	LC	NL	+ -3				
RUTACEAE	<i>Pentaceras australe</i>	Penta's Ash	LC	NL	1				
PIPERACEAE	<i>Peperomia blanda var. floribunda</i>	<i>ncn</i>	LC	NL	+ -3				
ASTERACEAE	<i>Peripleura hispidula</i>	<i>ncn</i>	LC	NL			1		
PROTEACEAE	<i>Persoonia falcata</i>	(a) Geebung	LC	NL			+ -1		
PHYLLANTHACEAE	<i>Phyllanthus gunnii</i>	Gunn's Phyllanthus	LC	NL	+	1			
PHYLLANTHACEAE	<i>Phyllanthus virgatus</i>	<i>ncn</i>	LC	NL			2		
URTICACEAE	<i>Pipturus argenteus</i>	Native Mulberry	LC	NL	+ (e)				
NYCTAGINACEAE	<i>Pisonia aculeata</i>	Pisonia	LC	NL	+				
PITTOSPORACEAE	<i>Pittosporum ferrugineum ssp. linifolium</i>	Rusty Pittosporum	LC	NL	+				

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
LECYTHIDACEAE	<i>Planchonia careya</i>	Cocky Apple	LC	NL		+	+ -2	+ -2	
PLANTAGINACEAE	<i>Plantago debilis</i>	<i>ncn</i>	LC	NL			+		+
ANACARDIACEAE	<i>Pleiogynium timorense</i>	Burdekin Plum	LC	NL	+ -2		+		
MENISPERMACEAE	<i>Pleogyne australe</i>	Wiry Grape	LC	NL	1				
RUBIACEAE	<i>Pogonolobus reticulatus</i>	<i>ncn</i>	LC	NL			+		
ANNONACEAE	<i>Polyalthia nitidissima</i>	Canary Beech	LC	NL	+ -3				
ARALIACEAE	<i>Polyscias elegans</i>	Celery Wood	LC	NL	2			+	
SAPOTACEAE	<i>Pouteria myrsinifolia</i>	Blunt-Leaved Coondoo	LC	NL	1				
SAPOTACEAE	<i>Pouteria pohlmaniana</i>	Yellow Boxwood	LC	NL	1				
RUBIACEAE	<i>Psychotria sp. (Shute Harbour L.J. Webb 7916)</i>	<i>ncn</i>	LC	NL	2		+ -2 (e)		
RUBIACEAE	<i>Psydrax odorata ssp. australiana</i>	Shiny Canthium	LC	NL		+			
ASTERACEAE	<i>Pterocaulon redolens</i>	<i>ncn</i>	LC	NL			1		
ASTERACEAE	<i>Pterocaulon sphacelatum</i>	Applebush	LC	NL					+
POLYPODIACEAE	<i>Pyrrosia confluens</i>	Robber Fern	LC	NL	+				
MYRTACEAE	<i>Rhodamnia pauciovulata</i>	Small-Leaved Malletwood	NT	NL	2				
POACEAE	<i>Rhynchelytrum repens</i>	Red Natal Grass	*	*			+		+ -3
PHYTOLACCACEAE	<i>Rivina humilis</i>	Baby Pepper	*	*	+ -4				
LAMIACEAE	<i>Salvia reflexa</i>	Mintweed	*	*		+		1	
RUTACEAE	<i>Sarcomelicope simplicifolia</i>	Bauer	LC	NL	1				
POACEAE	<i>Sarga nitida forma aristata</i>	<i>ncn</i>	LC	NL		+ -3	+ -3	+ -3	1
CYPERACEAE	<i>Scleria mackaviensis</i>	<i>ncn</i>	LC	NL	2-3	3	2		
FLACOURTIACEAE	<i>Scolopia braunii</i>	Flintwood	LC	NL	+				
APOCYNACEAE	<i>Secamone elliptica</i>	Corky Milk Vine	LC	NL	+				
CAESALPINIACEAE	<i>Senna obtusifolia</i>	Sicklepod	*	*					1
POACEAE	<i>Setaria oplismenioides</i>	<i>ncn</i>	LC	NL	1				
POACEAE	<i>Setaria surgens</i>	<i>ncn</i>	LC	NL					+ -2
MALVACEAE	<i>Sida cordifolia</i>	Flannel Weed	LC	NL			+		

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
ASTERACEAE	<i>Sigesbeckia orientalis</i>	Indian Weed	*	*	+ (e)				
SMILACACEAE	<i>Smilax australis</i>	Austral Sarsparilla	LC	NL	2-3				
SOLANACEAE	<i>Solanum nigrum</i>	Blackberry Nightshade	*	*					+
SOLANACEAE	<i>Solanum seaforthianum</i>	Brazilian Nightshade	*	*	+ -2				
SOLANACEAE	<i>Solanum torvum</i>	Devil's Fig	*	*			+		+
ASTERACEAE	<i>Sonchus oleraceus</i>	Milk Thistle	*	*					+
POACEAE	<i>Sorghum halepense</i>	Johnson Grass	*	*					+ -2
RUBIACEAE	<i>Spermacoce brachystema</i>	<i>ncn</i>	LC	NL			+ -2		
VERBENACEAE	<i>Stachytarpheta jamaicensis</i>	Blue Snakeweed	*	*			+		
MENISPERMACEAE	<i>Stephania japonica var. discolor</i>	Tape Vine	LC	NL		+			
STERCULIACEAE	<i>Sterculia quadrifida</i>	Peanut Tree	LC	NL	1				
MORACEAE	<i>Streblus pendulinus</i>	Whalebone Tree	LC	NL	+				
FABACEAE	<i>Stylosetanthes harmata</i>	Stylo	*	*		+	1		1
FABACEAE	<i>Stylosetanthes scabra</i>	Shrubby Stylo	*	*					1-3
MYRTACEAE	<i>Syzygium australe</i>	Brush Cherry	LC	NL	+ -3 (d/l)				
FABACEAE	<i>Tephrosia filipes</i>	<i>ncn</i>	LC	NL		+	1		+
COMBRETACEAE	<i>Terminalia porphyrocarpa</i>	(a) Damson Tree	LC	NL	2-3				
COMBRETACEAE	<i>Terminalia sericocarpa</i>	Brown Damson	LC	NL	1-4				
VITACEAE	<i>Tetragium nitens</i>	Native Grape	LC	NL	2				
POACEAE	<i>Themeda quadrivalvis</i>	Grader Grass	*	*					1-4
POACEAE	<i>Themeda triandra</i>	Kangaroo Grass	LC	NL			1-5	2	
RUBIACEAE	<i>Timonius timon</i>	Timon Tree	LC	NL	2				
MENISPERMACEAE	<i>Tinospora smilacina</i>	Arrow-Head Vine	LC	NL	+				
ULMACEAE	<i>Trema tomentosa var. tomentosa</i>	Poison Peach	LC	NL			1		
BORAGINACEAE	<i>Trichodesma zeylanica</i>	Rough Bluebell	LC	NL		2			

FAMILY	Botanical Name	Common Name	NC Act Status ¹	EPBC Act Status ²	8.12.3	8.12.5	8.12.7	8.12.12	Road Reserve
JOHNSONIACEAE	<i>Tricoryne elatior</i>	<i>ncn</i>	LC	NL				1	
ASTERACEAE	<i>Tridax procumbens</i>	Tridax Daisy	*	*					+ -2
RUBIACEAE	<i>Triflorensia ixoroides</i>	<i>ncn</i>	LC	NL	+				
ULMACEAE	<i>Triumfetta rhomboidea</i>	Chinese Burr	*	*				+ -3	+ -2
MORACEAE	<i>Trophis scandens var. scandens</i>	Burney Vine	LC	NL	+ -2				
FABACEAE	<i>Uraria lagopodioides</i>	<i>ncn</i>	LC	NL			+	1	
POACEAE	<i>Urochloa mosambicensis</i>	Sabi Grass	*	*					+
GOODENIACEAE	<i>Velleia pubescens</i>	<i>ncn</i>	LC	NL			+ -2		+ -2
ASTERACEAE	<i>Wedelia spilanthoides</i>	<i>ncn</i>	LC	NL				1	
LAXMANNIACEAE	<i>Xanthorrhoea latifolia ssp. latifolia</i>	Forest Grass Tree	LC	NL			+ -3		
FABACEAE	<i>Zornia muriculata</i>	<i>ncn</i>	LC	NL			2		

1. Queensland NC Ac Status: Least Common (LC), Near Threatened (NT), Naturalised Exotic (*) flora species.
2. Commonwealth EPBC Act Status: Not Listed (NL), Naturalised Exotic (*) flora species.
3. Relative abundance of species was based on the Braun-Blanquet technique cover-abundance scale (Mueller-Dombois & Ellenberg 1974, Whittaker 1975) as follows:
 - + = individual specimen recorded
 - 1 = sparse, <5%
 - 2 = any number, <5%
 - 3 = 5 – 24%
 - 4 = 25 – 49%
 - 5 = 50 – 74%
 - 6 = 75 – 100%.

APPENDIX C

KOALA SIGNIFICANCE ASSESSMENT

C1: Koala (*Phascolarctos cinereus*)

Description

The Koala is a tree-dwelling, medium-sized marsupial with a stocky body, large rounded ears, sharp claws and variable but predominantly grey-coloured fur. Males generally are larger than females and there is a gradient in body weight from north to south across their range, with larger individuals in the south and smaller individuals in the north. The average weight of males is 6.5 kg in Queensland, compared with 12 kg in Victoria. In the north of its range, the Koala tends to have shorter, silver-grey fur, whereas in the south it has longer, thicker, brown-grey fur (DoE 2013a, Date accessed 17 December 2013).

Distribution

The Koala is endemic to Australia, and is widespread in coastal and inland areas from north-east Queensland to Eyre Peninsula, South Australia. The range extends over 22° of latitude and 18° of longitude, or about one million square kilometres. The Koala's distribution is not continuous across this range and it occurs in a number of populations that are separated by cleared land or unsuitable habitat.

In Queensland the Koala has scattered populations throughout Queensland, in moist forests along the coast, sub-humid woodlands in southern and central Queensland, and in some eucalypt woodlands along watercourses in the semi-arid environments of the western part of the State. The Koala has also been found to occur in non-riverine communities in semi-arid areas.

The greatest density of the Koala in the State occurs in south-east Queensland, and lower densities occur through central and eastern areas. For example, population densities range from moderately high in south-east Queensland and some parts of central Queensland (e.g. 1–3 koalas/ha) to low in other parts of central Queensland (e.g. 0.01 koalas/ha) (DoE 2013b).

Habitat Preference

Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus *Eucalyptus*. The distribution of Koalas is also affected by altitude (limited to <800m ASL), temperature and, at the western and northern ends of the range, leaf moisture (DoE 2013b).

Threats

The main identified threats to the Koala are loss and fragmentation of habitat, vehicle strike, disease, and predation by the Dog (*Canis lupus familiaris*). Drought and incidences of extreme heat are also known to cause very significant mortality, and post-drought recovery may be substantially impaired by the range of other threatening factors (DoE 2013b).

Within the Study Area, primary threats are:

- Habitat loss
- Increased risk of predation, particularly just after clearing activities

- Vehicle strike, particularly by haul trucks, which cannot slow or break quickly.

However, given the Peak Downs Highway already exists at this location, these threats are already acting on the Koala at this location.

Table C1: Significance Assessment for the Koala

<p><i>Occurrence within the Project Area</i></p>
<p>Koalas were recorded at three locations in the Study Area as part of November 2013 field surveys. This species was recorded in RE 8.12.3, 'Lemon-scented Gum (<i>Corymbia citriodora</i>) +/- Broad-leaved Stringybark (<i>Eucalyptus portuensis</i>) +/- Grey Ironbark (<i>E. drepanophylla</i>) (or Narrow-leaved Ironbark (<i>E. crebra</i>)) open forest on hill slopes and undulating plateaus, on Mesozoic to Proterozoic igneous rocks' (Queensland Herbarium 2013). It was also recorded calling during spotlighting activities. All REs in the Study Area, except RE 8.12.3 provide suitable habitat for this species. This equates to 80.7 ha.</p>
<p><i>Important population</i></p>
<p>The concept of an 'important population' is central to assessing the potential for an action to have a significant impact on a species listed as Vulnerable under the EPBC Act. Each of the key 'important population' aspects is addressed below.</p> <p><i>a) Key Source population for breeding or dispersal</i></p> <p>The SPRAT profile cites research (Melzer et al. 2000) indicating that the Koala population density in Central Queensland varies from moderately high (e.g. 1-3 koalas/ha) in some parts of Central Queensland to low (e.g. 0.01 koalas/ha) in other parts of Central Queensland. 2010 population estimates for the Wet Tropics and Central Mackay Coast suggest 10 000 Koalas remain, however, the confidence in this population estimate is low (DoE 2013b)</p> <p>Eucalypt open forest throughout the Study Area provides suitable habitat for Koalas as they have been recorded in this location. Given this species was identified at three locations within a relatively small area of habitat (80.7 ha) and over a period of only five days, it is considered the species occurs in high abundance in this local area and disperses throughout the Eton and Connors Ranges. Therefore, the habitat in this area may support a key source population.</p> <p><i>b) Populations that are necessary for maintaining genetic diversity</i></p> <p>All Koala populations are necessary for maintaining genetic diversity. Although, this species is sufficiently widespread and mobile that risk of reduction in genetic diversity would be low.</p> <p><i>c) Populations that are near the limit of the species' range</i></p> <p>The Koala is known to occur from north-east Queensland to South Australia. Therefore, the Koalas that occur in the Study Area are not near the limit of the species' range.</p> <p><i>Conclusion:</i> The Koalas that have been recorded in the Study Area have</p>

potential to form part of a key source population for breeding or dispersal. Therefore, the animals that use habitat in the Study Area are potentially part of an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

a) Lead to a long-term decrease in the size of an important population of a species

Up to 80.7 ha of habitat for the Koala will potential be removed as part of the Project. While Koalas are known to occur in the Study Area, construction of the Project can be undertaken in a manner that avoids significant disturbance, injury or fatality of Koalas.

While there is a risk of vehicle strike of this species along the Peak Downs Highway, the Project is not introducing a new type of activity as the Peak Downs Highway already exists in this area. The Project is unlikely to increase the risk of vehicle strike to Koalas as this section of the highway will remain a low speed zone due to the steep and winding nature of the alignment.

Therefore, the Project is considered unlikely to lead to a long-term decrease in the size of the Koala population within the broader area.

b) Reduce the area of occupancy of an important population

Up to 80.7 ha of habitat for the Koala will potential be removed as part of the Project. However, this is comprised of Least Concern REs, which occur extensively throughout the Eton and Connors Ranges and which are connected to the north-west and south-east of the Study Area.

Therefore, the Project is considered unlikely to reduce the area of occupancy of the Koala in the broader area.

c) Fragment an existing important population into two or more populations

Clearing for the Project will involve 80.7 ha of suitable habitat either side of the existing Peak Downs Highway (Figure 3). Creation of this highway in the past has resulted in fragmenting habitat areas and creating a barrier to movement to some extent.

The Project will not create further fragmentation, but may increase the barrier effect of the existing highway.

Therefore, the Project is considered unlikely to fragment the Koala population in the area.

d) Adversely affect habitat critical to the survival of a species

The habitat in the Study Area comprises largely remnant open forest communities. These habitats are not unique in the local area or broader landscape and all are listed as Least Concern under the Queensland *Vegetation Management Act 1999*, indicating their extent of occurrence in the landscape. While the abundance of the Koala in the Study Area is considered to be high, it is expected this is not unique to the Study Area, but typical of the broader Eton and Connors Ranges. The removal of 80.7 ha of suitable habitat at this location, is considered unlikely to adversely affect habitat critical to the survival of the species as extensive areas of habitat will remain, and the habitat adjacent to the existing Peak

Downs Highway is not as intact as that occurring further away from the Highway in more remote areas of the ranges.

Therefore, the Project is considered unlikely to adversely affect habitat critical to the survival of the Koala..

e) Disrupt the breeding cycle of an important population

The breeding cycle of an important population is unlikely to be disrupted as the Project can be developed in a way that reduces direct and indirect impacts to individuals. For example, in the instance that Koalas are identified during pre-clearance surveys, an exclusion zone will be established to allow the animal to move from the area of their own accord, minimising disturbance and stress to this species.

Therefore, the Project is considered unlikely to disrupt the breeding cycle of the Koala population within the area.

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

The extent of potential habitat proposed to be cleared as part of this Project is 80.7 ha which is likely to account for only a small area of the suitable habitat in the broader landscape. The clearing will not cause isolation of any areas of suitable Koala habitat. This has already occurred with the construction of the existing Peak Downs Highway.

Consequently, disturbance of this relatively small area of habitat is not considered to modify, destroy, remove or isolate or decrease availability or quality of habitat to the extent that the Koala is likely to decline.

g) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Invasive species, including feral animals such as the fox (*Vulpes vulpes*) and Dog are likely to occur throughout the Eton and Connors Ranges, including within and adjacent the Study Area. These types of predatory species are drawn to areas of disturbance to prey upon mammals and reptiles that are moving away from the disturbance area, therefore, predation by feral animals is a risk to this species during and immediately after clearing activities. Predatory species are also attracted to the prey opportunities presented by cleared linear corridors, i.e. exposure of prey moving across easements, although this cleared linear corridor is already present in the form of the existing Peak Downs Highway.

This Project is considered unlikely to result in invasive species becoming established in potential habitat in the Study Area or adjacent areas, as these invasive and predatory species are already established throughout the wider landscape. Additionally, spotter/catchers will be present during all clearing activities to ensure animals move away from the disturbance area naturally or are safely relocated to suitable habitat nearby the disturbance area, minimising the risk of predation by feral animals to this species as a result of the Project.

Therefore, the Project is considered unlikely to result in an invasive species harmful to the Koala becoming established in the area.

h) Introduce disease that may cause the species to decline, or

Three viruses are known to affect Koalas in the wild, Chlamydia and Koala Retrovirus (KoRV-A and KoRV-B). It is known that Chlamydia is a sexually

transmitted disease in Koalas, however, how the Retrovirus is spread contagiously is unknown. Studies have shown that 100% of Koalas in the wild have the Retrovirus, and the majority of Queensland and New South Wales populations are infected with Chlamydia (Hanger & Loader 2009).

Stress has been suggested to exacerbate the effects of disease on Koala populations in more populated areas. However, the Project does not present a significant mechanism for the introduction or increase in the prevalence of these diseases in the local Koala population, due to the relatively small area of disturbance on wooded vegetation habitat types as a result of this Project.

Therefore, the Project is considered unlikely to result in the introduction of a disease that may cause the Koala to decline in the area.

i) Interfere substantially with the recovery of the species.

A total of 80.7 ha of habitat occurs in the Study Area, which is proposed to be cleared. This area is considered relatively small and therefore is unlikely to interfere substantially with the recovery of Koala in Queensland.

Therefore, the Project is considered unlikely to interfere substantially with the recovery of the Koala in the area.

Conclusion: Despite individuals of Koala occurring in the Study Area, potentially forming part of an important population, the Project is considered unlikely to result in a significant impact to the Koala. This is due to the relatively small size of habitat proposed to be impacted and the persistence of this population despite the existing Peak Downs Highway.