

G Appendix

Significance assessments – flora and fauna

**EPBC Act Species
THREATENED FLORA**

***Quassia* sp. Moonee Creek (Moonee Quassia)**

Will the action lead to a long-term decrease in the size of a population?

The Moonee Quassia is generally uncommon and widely scattered in coastal foothill and range country north of Coffs Harbour. It has been recorded from Pine Brush State Forest, McCraes Knob (via Tucabia), Flaggy Creek (near Glenreagh), Timbertop (Kangaroo River State Forest), Wedding Bells State Forest, Conglomerate State Forest and Orara East State Forest (Quinn *et al.* 1995).

In the vicinity of the Proposal approximately 70 individuals of this species were recorded on the western side of the proposed alignment extending over approximately 150 metres away from the existing highway. Four individuals are located in close proximity to the road reserve and will need to be protected during construction to ensure they are not impacted. These plants are located approximately 15 metres from the footprint of the Proposal. The majority of the plants are well outside the area to be impacted by construction. As no individuals of this species will be required to be removed, the Proposal will not lead to a long-term decrease in the size of the population.

Will the action reduce the area of occupancy of the species?

The area of occupancy of Moonee Quassia would not be reduced as a result of the Proposal.

Will the action fragment an existing population into two or more populations?

The Proposal would not result in the fragmentation of the existing population of Moonee Quassia.

Will the action adversely affect habitat critical to the survival of a species?

No areas of critical habitat in relation to the Moonee Quassia are listed under the EPBC Act. The area of habitat occupied by Moonee Quassia would not be impacted by the Proposal.

Will the action disrupt the breeding cycle of a population?

The Proposal is not likely to disrupt the breeding cycle of the population of Moonee Quassia, as there is no evidence that the existing highway has had any impact on the population.

Will the action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Moonee Quassia habitat is wet sclerophyll forest and heathy dry sclerophyll forest on sandstone and metasediment. The majority of locations appear to be in the ecotone between wet and dry sclerophyll forest. Within the proposal footprint, only one location of Moonee Quassia was identified during the flora surveys within suitable habitat. The impact to this area will be minimal and unlikely to affect habitat to the extent that the species is likely to decline.

Will the action result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?

The Flora and Fauna Management Sub-Plan to be developed for the Proposal will incorporate measures to minimise the risk of weed invasion during construction. In operation, vehicles traveling on the new highway would potentially be a source of weed species through dispersal of weed seeds, however this risk is no greater than the current situation.

Will the action introduce disease that may cause the species to decline?

No, there are no known diseases associated with the Moonee Quassia.

Will the action interfere with the recovery of the species?

A recovery plan has not been prepared for the Moonee Quassia. The Proposal would not impact this species and will therefore not interfere with the recovery of the species.

Slender Marsdenia (*Marsdenia longiloba*)

Will the action lead to a long-term decrease in the size of an important population of a species?

A population consisting of 20 to 30 plants was identified on the eastern side of the existing highway north of Gaundrons Road at Mid Sapphire. The Proposal would not directly impact the population of Slender Marsdenia which is located to the east of the existing highway. At this location the Proposal consists of two new carriageways to the west of the existing highway with the latter to become a south-bound off ramp. There are no proposed works in the immediate vicinity of the population. As such, there would be no long-term decrease in the size of the present population at Mid Sapphire.

Will the action reduce the area of occupancy of an important population?

The area of occupancy of Slender Marsdenia would not be reduced as a result of the Proposal.

Will the action fragment an existing important population into two or more populations?

The existing population of Slender Marsdenia would not be fragmented as a result of the Proposal.

Will the action adversely affect habitat critical to the survival of a species?

No areas of critical habitat in relation to Slender Marsdenia are listed under the EPBC Act. The area of habitat occupied by Slender Marsdenia at Mid Sapphire would not be impacted by the Proposal.

Will the action disrupt the breeding cycle of an important population?

The Proposal is not likely to disrupt the breeding cycle of the population of Slender Marsdenia, as there is no evidence that the existing highway has had any impact on the population.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

Slender Marsdenia was found in one location within the vicinity of the Proposal. This area of habitat will not be directly impacted by the Proposal and would be protected during construction from works to the south associated with the Sapphire interchange.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The Proposal would not impact on the area of Slender Marsdenia habitat. Measures to prevent weed invasion from construction activities associated with the Sapphire interchange to the south of the Slender Marsdenia habitat would be outlined in the Flora and Fauna Management Sub-Plan to be developed for the Proposal.

Will the action introduce disease that may cause the species to decline?

No, there are no known diseases associated with Slender Marsdenia

Will the action interfere substantially with the recovery of the species?

A recovery plan has not been prepared for the Slender Marsdenia. The Proposal would not impact this species and will therefore not interfere with the recovery of the species.

THREATENED FAUNA

The following assessments have been undertaken for those threatened and migratory species recorded during the field survey periods. Other threatened or migratory species that were considered to have the potential to occur but were not recorded during the field surveys are not assessed.

Grey-headed Flying-Fox (*Pteropus poliocephalus*)

Will the action lead to a long-term decrease in the size of an important population of a species?

The Proposal would result in a very minor reduction in the extent of available foraging habitat for the Grey-headed Flying-fox. The minor reduction in area of potential foraging habitat would not result in the decrease in size of the population within the local area.

Will the action reduce the area of occupancy of an important population?

Potential foraging habitat is present adjacent to the Proposal and extensively within the local area. The area of occupancy of the local population would not be reduced by the Proposal.

Will the action fragment an existing important population into two or more populations?

The local population would not be fragmented by the Proposal due to the highly mobile nature of this species and the area that can be covered by individuals while foraging.

Will the action adversely affect habitat critical to the survival of a species?

No areas of critical habitat in relation to the Grey-headed Flying-fox are listed under the EPBC Act. The area of habitat potentially impacted by the Proposal is not considered to be critical to the long-term maintenance and survival of the species.

Will the action disrupt the breeding cycle of an important population?

The Proposal will impact on potential foraging habitat for this species but would not impact on the breeding cycle. No camps or roost sites were identified in the vicinity of the Proposal.

Will the action modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?

The Grey-headed Flying-fox feeds on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. The open forest and rainforest communities found within the Proposal area form foraging habitat for these species. The Proposal would require the clearing of approximately 76 hectares of these vegetation communities. Extensive areas of similar habitat are present within the local area in Moonee Beach and Sherwood Nature Reserves and Wedding Bells and Orara East State Forests.

In the bypass section the Proposal would traverse an area of currently connected habitat through Wedding Bells State Forest. However, due to the highly mobile nature of this species this would not result in any area of habitat being isolated or unavailable to this species. The Proposal would result in some edge effects, possibly up to 50 metres from the new road edge which would potentially affect the quality of habitat in this localised area. The extent of the changes as a result of the Proposal would not cause the species to decline.

Will the action result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?

The Proposal would not result in the introduction of species harmful to the Grey-headed Flying-fox. Numerous roads already exist throughout the potential foraging habitat within the local area.

Will the action introduce disease that may cause the species to decline?

There are no known diseases associated with the Grey-headed Flying-fox.

Will the action interfere substantially with the recovery of the species?

The Proposal will not interfere substantially with the recovery of the species due to the potential impact being restricted to a very small reduction in available foraging habitat.

MIGRATORY SPECIES

According to the assessment guidelines, an area of 'important habitat' for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or

- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilised by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?

The Proposal area does not constitute 'important habitat' for the White-bellied Sea Eagle. The White-bellied Sea-Eagle was observed in the northern section of the proposed road corridor within Wedding Bells State Forest. This species inhabits large rivers, fresh and saline lakes, reservoirs, estuaries and coastal seas. The White-bellied Sea-Eagle feeds mainly off fish, but it takes other aquatic animals, birds and mammals as well. The Proposal would temporarily impact a very small area of potential hunting habitat along watercourses during the construction and demolition of bridges.

Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?

The Proposal area does not form 'important habitat' for the White-bellied Sea Eagle, and it would not result in the introduction of species harmful to the White-bellied Sea Eagle. Numerous roads already exist throughout the local area in the vicinity of the potential hunting habitat for this species.

Will the action seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?

The Proposal would not disrupt the lifecycle of an ecologically significant proportion of the population. The White-bellied Sea Eagle observed within the Proposal area does not represent a significant proportion of the population of this migratory species. Notwithstanding this, a nest possibly belonging to a White-bellied Sea Eagle was observed during surveys in the Proposal area. This nest is located approximately 100 metres south of Wedding Bells State Forest and is located within the Proposal footprint. The nest would need to be removed for construction and would be re-located to a location determined by a wildlife specialist.

White-throated Needletail (*Hirundapus caudacutus*)

Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?

The Proposal area does not constitute 'important habitat' for the White-throated Needletail. The White-throated Needletail was observed overhead at several locations along the proposed road corridor. This species is an aerial bird that will occasionally roost in trees and feeds on flying insects, such as termites, ants, beetles and flies which it catches in flight. The Proposal would not impact on foraging areas for this species and would have a negligible impact on roosting sites.

Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?

The Proposal area does not form 'important habitat' for the White-throated Needletail, and it would not result in the introduction of species harmful to the White-throated Needletail. Numerous roads already exist throughout the local area and the Proposal would not result in any additional risk of invasive species being introduced to the local area.

Will the action seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?

The Proposal would not disrupt the lifecycle of an ecologically significant proportion of the population. The observations of the White-throated Needletail within the Proposal area do not represent a significant proportion of the population of this migratory species. The removal of native vegetation within

the Proposal area is not considered likely to seriously disrupt breeding, feeding, migration or resting behaviour within the local area.

Black-faced Monarch (*Monarcha melanopsis*)

Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?

The Proposal area does not constitute 'important habitat' for the Black-faced Monarch. The Black-faced Monarch was identified from the central and northern sections of the proposed road corridor. This species occupies tangled understoreys of rainforest and eucalypt forest. The Proposed action would require the removal of approximately 2 hectares of rainforest and 68 hectares of eucalypt forest communities, some of which would contain tangled understoreys.

Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?

The Proposal area does not form 'important habitat' for the Black-faced Monarch, and it would not result in the introduction of species harmful to the Black-faced Monarch. Numerous roads already exist throughout the local area and the Proposal would not result in any additional risk of invasive species being introduced to the local area.

Will the action seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?

The Proposal would not disrupt the lifecycle of an ecologically significant proportion of the population. The observations of the Black-faced Monarch within the Proposal area do not represent a significant proportion of the population of this migratory species. The removal of native vegetation within the Proposal area is not considered likely to seriously disrupt breeding, feeding, migration or resting behaviour of this species in the local area.

Rufous Fantail (*Rhipidura rufifrons*)

Will the action substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species?

The Proposal area does not constitute 'important habitat' for the Rufous Fantail. The Rufous Fantail was recorded from the northern section of the proposed road corridor. This species occupies wet forests and less often open forests. The Proposed action would require the removal of approximately 2 hectares of the preferred rainforest habitat, and approximately 73 hectares of open forest communities.

Will the action result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species?

The Proposal area does not form 'important habitat' for the Rufous Fantail, and it would not result in the introduction of species harmful to the Rufous Fantail. Numerous roads already exist throughout the local area and the Proposal would not result in any additional risk of invasive species being introduced to the local area.

Will the action seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species?

The Proposal would not disrupt the lifecycle of an ecologically significant proportion of the population. The observations of the Black-faced Monarch within the Proposal area do not represent a significant proportion of the population of this migratory species. The removal of native vegetation within the Proposal area is not considered likely to seriously disrupt breeding, feeding, migration or resting behaviour of this species in the local area.

Significance Assessments

The following significance assessments have been undertaken in accordance with the draft *Guidelines for Threatened Species Assessments* (Department of Environment and Conservation / Department of Primary Industries 2005) for threatened species and communities listed under the NSW *Threatened Species Conservation Act 1995*. Species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* have been assessed under the *Significant Impact Guidelines – Matters of National Environmental Significance* (Department of Environment and Heritage 2006).

| Scientific name | Common name | TSC Act ¹ | EPBC Act ¹ |
|---------------------------------------|--------------------------------|----------------------|-----------------------|
| REPTILES | | | |
| <i>Coeranoscincus reticulatus</i> | Three-toed Snake-tooth Skink | V | V |
| AMPHIBIANS | | | |
| <i>Litoria brevipalmata</i> | Green-thighed Frog | V | - |
| <i>Crinia tinnula</i> | Wallum Froglet | V | - |
| <i>Mixophyes iteratus</i> | Giant Barred Frog | E | E |
| <i>Litoria aurea</i> | Green and Golden Bell Frog | E | V |
| <i>Litoria olongburensis</i> | Wallum Sedge Frog | V | V |
| BIRDS | | | |
| <i>Calyptorhynchus lathami</i> | Glossy Black-Cockatoo | V | - |
| <i>Coracina lineata</i> | Barred-Cuckoo-shrike | V | - |
| <i>Pandion heliaetus</i> | Osprey | V | - |
| <i>Ninox strenua</i> | Powerful Owl | V | - |
| <i>Cyclopsitta diophthalma coxeni</i> | Coxen's Double-eyed Fig-Parrot | E | E |
| <i>Monarcha leucotis</i> | White-eared Monarch | V | - |
| <i>Ptilinopus regina</i> | Rose-crowned Fruit-Dove | V | - |
| <i>Ptilinopus superbus</i> | Superb Fruit-Dove | V | - |
| <i>Turnix melanogaster</i> | Black-breasted Button-quail | E | V |
| <i>Erythrotriorchis radiatus</i> | Red Goshawk | E | V |
| <i>Lathamus discolor</i> | Swift Parrot | E | E |
| <i>Lophoictinia isura</i> | Square-tailed Kite | V | - |
| <i>Melanodryas cucullata</i> | Hooded Robin | V | - |
| <i>Xanthomyza phrygia</i> | Regent Honeyeater | E | E |
| <i>Tyto novaehollandiae</i> | Masked Owl | V | - |
| <i>Dromaius novaehollandiae</i> | Emu | E2 | - |
| <i>Ephippiorhynchus asiaticus</i> | Black-necked Stork | E | - |
| <i>Irediparra gallinacea</i> | Comb-crested Jacana | V | - |
| <i>Stictonetta naevosa</i> | Freckled Duck | V | - |
| <i>Climacteris picumnus</i> | Brown Treecreeper | V | - |
| MAMMALS | | | |
| <i>Cercartetus nanus</i> | Eastern Pygmy-possum | V | - |
| <i>Petaurus norfolcensis</i> | Squirrel Glider | V | - |
| <i>Petaurus australis</i> | Yellow-bellied Glider | V | - |
| <i>Pteropus poliocephalus</i> | Grey-headed Flying-Fox | V | V |
| <i>Myotis adversus</i> | Large-footed Myotis | V | - |
| <i>Miniopterus australis</i> | Little Bent-wing Bat | V | - |
| <i>Miniopterus schreibersii</i> | East Bent-wing Bat | V | - |
| <i>Scoteanax rueppellii</i> | Greater Broad-nosed Bat | V | - |
| <i>Syconycteris australis</i> | Eastern Blossom Bat | V | - |
| <i>Mormopterus norfolkensis</i> | East Coast Freetail Bat | V | - |
| <i>Aepyprymnus rufescens</i> | Rufous Bettong | V | - |

| Scientific name | Common name | TSC Act ¹ | EPBC Act ¹ |
|---|--------------------------------|----------------------|-----------------------|
| <i>Dasyurus maculatus</i> | Spotted-tailed Quoll | V | E |
| <i>Phascogale tapoatafa</i> | Brush-tailed Phascogale | V | - |
| <i>Phascolarctos cinereus</i> | Koala | V | - |
| <i>Potorous tridactylus</i> | Long-nosed Potoroo | V | V |
| <i>Planigale maculata</i> | Common Planigale | V | - |
| <i>Pseudomys oralis</i> | Hastings River Mouse | E | E |
| <i>Chalinolobus dwyeri</i> | Large-eared Pied Bat | V | V |
| <i>Chalinolobus nigrogriseus</i> | Hoary Wattled Bat | V | - |
| <i>Falsistrellus tasmaniensis</i> | Eastern False Pipistrelle | V | - |
| <i>Kerivoula papuensis</i> | Golden-tipped Bat | V | - |
| <i>Nyctophilus bifax</i> | Eastern Long-eared Bat | V | - |
| <i>Pteropus alecto</i> | Black Flying-Fox | V | - |
| <i>Saccolaimus flaviventris</i> | Yellow-bellied Sheath-tail-bat | V | - |
| <i>Vespadelus troughtoni</i> | Eastern Cave Bat | V | - |
| FLORA | | | |
| <i>Marsdenia longiloba</i> | Slender Marsdenia | E | V |
| <i>Lindsaea incisa</i> | Slender Screw Fern | E | - |
| <i>Amorphospermum whitei</i> | Rusty Plum | V | - |
| <i>Quassia</i> sp. Moonee Creek | Moonee Quassia | E | E |
| ENDANGERED ECOLOGICAL COMMUNITIES | | | |
| Littoral Rainforest | - | E | - |
| Lowland Rainforest on Floodplain | - | E | - |
| Swamp Sclerophyll Forest on Coastal Floodplains | - | E | - |
| Swamp Oak Floodplain Forest | - | E | - |
| Coastal Saltmarsh | - | E | - |

¹ E = endangered; E2 = endangered population; V = vulnerable

Three-toed Snake-tooth Skink

The Three-toed Snake-tooth Skink was not recorded during the surveys but suitable habitat exists within the Proposal area and there are database records for this species within the locality. The Three-toed Snake-tooth Skink occurs in rainforest and occasionally moist eucalypt forest, on loamy or sandy soils.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would impact on potential shelter and food resources for the Three-toed Snake-tooth Skink. This species lives in loose soil, rotting logs and leaf litter of rainforests and less often moist forest. It feeds on earthworms and beetle grubs.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of approximately two hectares of rainforest providing potential habitat for the Three-toed Snake-tooth Skink. An additional 65 hectares of moist open forest would be cleared, some parts of which may provide suitable habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Three-toed Snake-tooth Skink is near the southern limit of its distribution in the Sapphire to Woolgoolga area. This species occurs in the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. It is noted as being very uncommon south of Grafton.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

An area of rainforest forming potential habitat for this species that is currently connected would be impacted by the Proposal. This area of rainforest is located approximately 100 metres south of Newmans Road in the bypass section of the Proposal. This area of rainforest would be split into two areas east and west of the Proposal which are likely to be of sufficient size to support a population of the Three-toed Snake-tooth Skink if it was present within these areas. These areas would be joined by fauna friendly culverts to assist fauna crossing but these structure are unlikely to be used by the Three-toed Snake-tooth Skink.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Green-thighed Frog

Found in wet sclerophyll forest along the northern coast of NSW to Ourimbah. Also in a variety of habitats including dry to wet sclerophyll forest, rainforests and shrubland with a healthy understorey. Breeding aggregations occur in still water habitats such as grassy temporary to semi-permanent ponds and flooded ditches in late spring and summer.

The Green-thighed Frog was recorded at Skinners Creek in Orara East State Forest approximately one kilometre west of the Proposal. Three males were heard calling from a flooded oxbow lagoon within Skinners Creek in moist open forest. While this area of Skinners Creek is well outside the Proposal, there are other areas of potential habitat closer to the proposed route. These are on the western side of the existing highway south of Bucca Road, and drainage lines and depressions in the northern two kilometres of the Proposal in Wedding Bells State Forest. The Green-thighed Frog was not recorded at these locations despite suitable weather conditions during the survey period.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal is unlikely to affect the lifecycle of the Green-thighed Frog. Breeding occurs following heavy rainfall in late spring and summer, with frogs aggregating around grassy semi-permanent ponds and flood-prone grassy areas. The Proposal would not impact on this process with impacts to these types of areas limited to a relatively small area within parts of Wedding Bells State Forest.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Green-thighed Frogs are found in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain (NPWS 2005). The Proposal would result in the clearing during construction of a relatively small area of potential habitat consisting of drainage lines and depressions within the northern parts of Wedding Bells State Forest. The hydrology of the local area would not be significantly altered by the Proposal and soil and water quality controls to be implemented during construction and operation would protect aquatic habitats.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Green-thighed Frog is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found along the coast and ranges from the NSW central coast to south-east Queensland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the upgrade section the Proposal would not affect habitat connectivity. In the bypass section of the Proposal, within Wedding Bells State Forest, the Proposal would traverse drainage lines and depressions which form potential habitat for this species. The inclusion of fauna friendly culverts to facilitate movement between habitat areas within this section of the Proposal would minimise this potential impact. As such, the Proposal is not likely to significantly affect habitat connectivity for the Green-thighed Frog.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Wallum Froglet

The Wallum Froglet is associated with wallum swamps and low land meandering watercourses on coastal plains. Found most commonly in wallum wetlands characterised by low nutrients, highly acidic, tanin-stained waters that are typically dominated by paperbarks and tea-trees. Also found in sedgeland and wet heathland.

The Wallum Froglet was recorded approximately 50 metres to the west of the existing highway, 800 metres north of the proposed Arrawarra interchange. This location is north of where the Project ties into the existing single carriageway and is outside the Project footprint. Potential habitat for the Wallum Froglet also occurs in heathland on the eastern side of the existing highway north of Emerald Beach and on the western verge of the existing highway just south of the proposed Arrawarra interchange.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would impact a small area of potential Wallum Froglet habitat. This species is generally restricted to wallum swamps where breeding would take place in late winter. Due to the relatively small area of disturbance to potential habitat, it is unlikely that the lifecycle of this species would be affected within the local area. Soil and water quality management measures would protect aquatic habitats during both construction and operation of the Proposal.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The heathland north of Emerald Beach would not be disturbed by the Proposal. South of the proposed Arrawarra interchange, the new carriageway would be within the existing road reserve but would impact on potential Wallum Froglet habitat. This area of potential habitat extends to the west beyond the road reserve into Wedding Bells State Forest.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Wallum Froglet is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found along the coast from the NSW central coast to south-east Queensland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would not affect habitat connectivity for this species as no areas of currently connected potential habitat would be bisected by the Proposal and habitat and potential habitat was found to be west and east of the Proposal area respectively.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Giant Barred Frog

The Giant Barred Frog was not recorded during the surveys but suitable habitat exists within the Proposal area and there are database records for this species within the locality. The Giant Barred Frog is found in rainforests, moist eucalypt forests and dry eucalypt forests with riparian vegetation, steep sided stream banks and pool-riffles.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would impact on three sites (Woolgoolga Creek, Arrawarra Creek, and a tributary of Halls Creek) considered to be sub optimal habitat for the Giant Barred Frog. This species breeds from late spring to summer with eggs laid onto moist creek banks or rocks above water level. While this species was not recorded during optimal weather conditions during the survey period, the Proposal would impact these stream sites which are potential habitat. The construction of bridges at Woolgoolga Creek and Arrawarra Creek, and culverts at the tributary of Halls Creek would be a relatively minor potential impact on the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The sites of sub optimal habitat (Woolgoolga Creek, Arrawarra Creek, and a tributary of Halls Creek) would be impacted by the Proposal. Potential foraging areas consisting of deep, damp leaf litter in rainforest and moist open forest would also be impacted.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Giant Barred Frog is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found on the coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Areas of potential habitat (Woolgoolga Creek, Arrawarra Creek, and a tributary of Halls Creek) are currently connected. The Proposal design incorporates bridges allowing fauna passage at Woolgoolga Creek and Arrawarra Creek and fauna friendly culverts at the tributary of Halls Creek which will minimise impacts on fauna passage within these areas.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Green and Golden Bell Frog

The Green and Golden Bell Frog was not recorded during the surveys but suitable habitat exists within proximity to the Proposal area. There are no database records for this species within the locality. Optimum habitat for this species includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Lake Russell, the area of potential habitat for this species, is located approximately 50 metres to the west of the closest edge of the Proposal. The Proposal would not impact on the lifecycle of this species as the body of Lake Russell and surrounding areas would not be impacted. This species usually breeds in summer when conditions are warm and wet, with females producing a raft of eggs that initially float on the surface of the water before settling to the bottom, often amongst vegetation.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would not impact on Lake Russell, the area of potential habitat for this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Green and Golden Bell Frog is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

There are no areas of habitat that are currently connected that would be impacted by the Proposal.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Wallum Sedge Frog

The Wallum Sedge Frog was not recorded during the surveys but potential habitat exists within the Proposal and nearby areas. The Wallum Sedge Frog is associated with paperbark swamps and sedge swamps of the coastal "wallum" country. Wallum is a Banksia dominated lowland heath ecosystem characterised by acidic waterbodies. This species is usually found amongst sedges and rushes in coastal wetlands.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would impact a small area of potential Wallum Sedge Frog habitat. Due to the relatively small area of disturbance to potential habitat, it is unlikely that the lifecycle of this species would be affected within the local area. Soil and water quality management measures would protect aquatic habitats during both construction and operation of the Proposal.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would impact a relatively small area of potential Wallum Sedge Frog habitat in the vicinity of the Arrawarra interchange area. This area of potential habitat extends beyond the road reserve into Wedding Bells State Forest.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Wallum Sedge Frog is found in coastal areas from Fraser Island in south-east Queensland to Yuraygir National Park south of Grafton in northern NSW. The Sapphire to Woolgoolga area represents the southern limit of this species distribution.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the upgrade section the Proposal would not affect habitat connectivity. In the bypass section of the Proposal, in the vicinity of the Arrawarra interchange area, the Proposal would impact Swamp Sclerophyll Forest forming potential habitat for this species. The inclusion of fauna friendly culverts to facilitate movement between habitat areas within this section of the Proposal would minimise this potential impact. As such, the Proposal is not likely to significantly affect habitat connectivity for the Wallum Sedge Frog.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Glossy Black-Cockatoo

The Glossy Black-Cockatoo is associated with a variety of forest types containing *Allocasuarina* species, with intact drier forest types with less rugged landscapes being preferred. This species nests in large trees with large hollows. The Glossy Black-Cockatoo was recorded at several locations along the road corridor during field surveys and several DECC Wildlife Atlas records exist for the study area and adjacent bushland. The Glossy Black-Cockatoo was generally recorded within larger tracts of open forest and floodplain forest communities along the length of the Proposal.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Glossy Black-Cockatoo is dependent on large hollow-bearing eucalypts for nest sites. Approximately 154 hollow bearing trees would be removed for construction of the Proposal. Approximately one third of the hollow-bearing trees surveyed contained large hollows which are likely to be of sufficient size to be potential roosting sites for this species. Investigations have identified that a similar density of hollow-bearing trees occurs within Wedding Bells State Forest, indicating that this habitat resource is not rare within the local area.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would result in the loss of approximately 81 hectares of moist open forest and floodplain forest which provides potential foraging habitat for the Glossy Black-Cockatoo.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Glossy Black-Cockatoo is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species occurs from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would traverse areas of currently connected habitat for the Glossy Black-Cockatoo, however, given the highly mobile nature of this species it would not form a barrier to movement within the local area.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Osprey

The Osprey was observed at several locations along the proposed road corridor, with sightings most common in proximity to larger watercourses. There are also numerous Department of Environment and Climate Change Wildlife Atlas records of the species within the locality. The Osprey is associated with waterbodies including coastal waters, inlets, lakes, estuaries, beaches, offshore islands and sometimes along inland rivers. The Osprey feeds on fish over clear open water. This species may nest on the ground, on sea cliffs or in trees. For nesting, Ospreys generally prefer emergent trees, often dead or partly dead with a broken off crown.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Any potential impacts on the lifecycle of the Osprey would occur as a result of disturbance to nesting sites. Approximately 100 m south of Wedding Bells State Forest, a large nest possibly belonging to an Osprey was observed on the eastern side of the proposed alignment. This nest tree may need to be removed during construction and if so, would be relocated to a location determined by a wildlife specialist. Ospreys have been known to nest in close proximity to highways, therefore if the nest tree is not required to be removed during construction and is used by an osprey, then this is not considered to be a significant impact on the lifecycle of this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would have little impact on foraging habitat for this species as the area of watercourses disturbed would be negligible in relation to those present in the local area.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Osprey is not at the limit of its distribution in the Sapphire to Woolgoolga area. Ospreys are found right around the Australian coast line, except for Victoria and Tasmania (NPWS 2005).

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Due to the highly mobile nature of this species and the negligible area of habitat within the Proposal area, habitat connectivity would not be affected by the Proposal.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Powerful Owl

A Powerful Owl was recorded in the northern section of the Proposal within Wedding Bells State Forest. The Powerful Owl is associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes. Large trees with hollows at least 0.5 m deep are required for shelter and breeding.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts that are at least 150 years old. In north-eastern NSW nesting occurs from late summer to mid autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400-1450 ha (NPWS 2005). The Proposal would require the clearing of

approximately 154 hollow bearing trees, of which only a small proportion would potentially be suitable for nesting for Powerful Owls. It is not known if the Power Owl detected during the surveys is utilising any of the tree hollows that would be required to be removed for the Proposal. Prior to clearing for construction, inspections of large hollows will be undertaken by a wildlife specialist to determine whether the hollow is being used by a Powerful Owl. If there is evidence that a tree hollow is being used by a Powerful Owl, relocation would be undertaken in accordance with RTA and Department of Environment and Climate Change protocols.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of approximately 81 hectares of forest vegetation forming hunting grounds for the Powerful Owl. This represents a relatively small area in relation to similar habitat available in the local area. Wedding Bells and Orara East State Forests contain extensive areas of similar habitat. As most prey species require hollows and a shrub layer, these are important habitat components for the Powerful Owl.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Powerful Owl is not at the limit of its distribution in the Sapphire to Woolgoolga area. Powerful Owls are found mainly on the coastal side of the Great Dividing Range from Mackay in Queensland to south-western Victoria (NPWS 2005).

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The bypass section of the Proposal within Wedding Bells State Forest would impact on currently connected habitat for the Powerful Owl. However, given the highly mobile nature of this species the Proposal would not form a barrier resulting in areas of habitat being unavailable.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Barred Cuckoo-Shrike

The Barred-Cuckoo-shrike was recorded at one location north of Sapphire in moist open forest adjacent to the existing highway. The Barred-Cuckoo-shrike is associated with rainforests, eucalypt forests and timbered watercourses.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The potential impact on the lifecycle of the Barred-Cuckoo-shrike as a result of the Proposal is generally restricted to a minor reduction in available foraging habitat.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The main impact on this species would be the clearing of approximately two hectares of rainforest containing fruit trees and approximately 81 hectares of open forest vegetation used for foraging. In relation to the available habitat in adjacent and surrounding areas, the Proposal is not considered likely to significantly affect this species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Barred-Cuckoo-shrike is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found in eastern Australia from Cape York to the Manning River.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The bypass section of the Proposal within Wedding Bells State Forest would impact on currently connected habitat for the Barred-Cuckoo-shrike. However, given the highly mobile nature of this species the Proposal would not form a barrier resulting in areas of habitat being unavailable.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Squirrel Glider

The Squirrel Glider was recorded during surveys on the eastern side of the existing highway south of the Coffs Harbour Clay Target Club in Broad-leaved Paperbark Forest and in the northern section of Moonee Beach Nature Reserve close to the boundary with the road reserve. The Squirrel Glider is associated with dry hardwood forest and woodlands. Habitats typically include gum bark and high nectar producing species, including winter flower species. The presence of hollow bearing eucalypts is a critical habitat feature.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would result in the removal of approximately 154 hollow bearing trees, many of which would contain potential shelter and nest sites for the Squirrel Glider. The greatest loss of hollow bearing trees would be within Wedding Bells State Forest. Investigations in areas adjacent to the Proposal in Wedding Bells State Forest have identified a similar frequency of hollow bearing trees indicating that this important habitat feature is not uncommon in the local area. Prior to clearing for construction, inspections of tree hollows will be undertaken by a wildlife specialist to determine if they are being used by a Squirrel Gliders. If there is evidence that a tree hollow is being used by a Squirrel Glider, relocation would be undertaken in accordance with RTA and Department of Environment and Climate Change protocols.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

In addition to the loss of hollow bearing trees discussed above, impacts on habitat include the loss of food resources through clearing of open forest communities including flowering understorey and shrub layers. The Proposal would result in the loss of approximately 50 hectares of forest communities dominated by either Blackbutt or Paperbark which provide suitable shelter and foraging habitats respectively.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Squirrel Glider is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria (NPWS 2005).

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential glider habitat that are currently connected would be bisected by the Proposal. To facilitate glider movement in this area the Proposal will incorporate purpose built glider crossings. The location of the crossings will be determined in consultation with Department of Environment and Climate Change and State Forests.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Yellow-bellied Glider

The Yellow-bellied Glider was recorded during surveys in proximity to the proposed route in moist open forest in Wedding Bells State Forest. The species is restricted to tall mature forests, preferring productive tall open sclerophyll forests with a mosaic of tree species including some that flower in winter. Large hollows within mature trees are required for shelter, nesting and breeding.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would result in the removal of approximately 154 hollow bearing trees, some of which would contain potential shelter and nest sites for the Yellow-bellied Glider. The greatest loss of hollow bearing trees would be within Wedding Bells State Forest. Investigations in areas adjacent to the Proposal in Wedding Bells State Forest have identified a similar frequency of hollow bearing trees indicating that this important habitat feature is not uncommon in the local area. Prior to clearing for construction, inspections of tree hollows will be undertaken by a wildlife specialist to determine if they are being used by a Yellow-bellied Gliders. If there is evidence that a tree hollow is being used by a Squirrel Glider, relocation would be undertaken in accordance with RTA and Department of Environment and Climate Change protocols.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

In addition to the loss of hollow bearing trees, the Proposal would result in the clearing of approximately 76 hectares of open forest communities incorporating food resources such as winter flowering species (Broad-leaved Paperbark). Extensive areas of habitat similar to those to be removed by the Proposal are present in adjacent areas such as Moonee Beach Nature Reserve, Wedding Bells State Forest and Orara East State Forest.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Yellow-bellied Glider is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential glider habitat that are currently connected would be bisected by the Proposal. To facilitate glider movement in this area the Proposal will incorporate purpose built glider crossings. The location of the crossings will be determined in consultation with Department of Environment and Climate Change and State Forests.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Flying Foxes

Threatened flying foxes have been assessed together as they have similar habitat requirements and potential impacts as a result of the Proposal. The species assessed here are the Grey-headed Flying Fox and the Black Flying Fox.

The Grey-headed Flying Fox was recorded at five locations in the vicinity of the proposed route during surveys. The Grey-headed Flying Fox inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy.

The Black Flying Fox has database records within the locality (10 kilometre radius of the Proposal) but was not recorded during surveys. The Black Flying Fox has large communal day-time camps in remnants of coastal subtropical rainforest or swamp forest, often with Grey-headed Flying-foxes.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The potential impact on the lifecycle of the flying fox species as a result of the Proposal is generally restricted to a very minor reduction in available foraging habitat. No camps were identified in the vicinity of the Proposal during surveys indicating that there would be no disturbance to roost sites.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Grey-headed and Black Flying Foxes feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. The open forest and rainforest communities found within the Proposal area form foraging habitat for these species. The Proposal would require the clearing of approximately 83 hectares of these vegetation communities. Extensive areas of similar habitat are present within the local area in Moonee Beach and Sherwood Nature Reserves and Wedding Bells and Orara East State Forests.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Grey-headed Flying Fox and Black Flying Fox are not at the limit of their distribution in the Sapphire to Woolgoolga area. Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. The Black Flying Fox occurs in coastal and near-coastal areas across northern Australia through eastern Queensland to the Bellinger River in northern NSW.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Due to the already fragmented nature of the landscape and the presence of the existing highway within the upgrade section, the Proposal would not cause additional isolation or fragmentation of habitat. In the bypass section, within Wedding Bells State Forest, the Proposal would pass through currently connected areas of habitat for the Grey-headed and Black Flying Foxes. However, given the highly mobile nature of these species the loss of connectivity in this area would not greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Large-footed Myotis

The Large-footed Myotis was recorded at Cunninghams Creek and Skinners Creek during field surveys. The watercourses and adjacent vegetation traversed by the Proposal provide suitable habitat for this species. The Large-footed Myotis occupies most habitat types including mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland; as long as they are close to water. While roosting is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, under bridges, in mines, tunnels and stormwater drains. This species forages over streams and pools catching insects and small fish.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Large-footed Myotis breeds in November or December having one young each year. The existing bridges within the Proposal area are potential roost sites for this species and may be used for breeding. The Proposal would require the demolition of existing bridges at Double Crossing, Skinners and Cunninghams Creeks. Prior to the demolition of the existing bridges an inspection will be undertaken by a qualified ecologist to identify any roosting bats. If found, any bats would be moved and relocated in accordance with a protocol to be developed in conjunction with DECC. The Proposal will involve the construction of several new bridges which, during the operation phase, may become potential roost sites for this species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Large-footed Myotis forages over streams and pools catching insects and small fish by raking its feet across the water surface. The Proposal would not affect foraging habitat for the Large-footed Myotis, with the exception of disturbance to relatively small areas during the construction phase for the demolition and construction of bridges.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Large-footed Myotis is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would have a minor temporary impact on habitat connectivity along streams and watercourses during construction and demolition of bridges.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Eastern Pygmy-possum

The Eastern Pygmy-Possum was recorded during surveys from one location in moist open forest in the vicinity of the proposed road corridor, west of Woolgoolga. This area of forest adjoins the extensive areas of forest within Wedding Bells State Forest to the west. The species is found in wet and dry eucalypt forest, subalpine woodland, coastal banksia woodland and wet heath. Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat

insects, seeds and fruit. The presence of *Banksia sp.* and *Leptospermum sp.* are an important habitat feature for this species. Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old bird's nests and in the branch forks of tea-trees.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would result in the removal of approximately 154 hollow bearing trees, some of which would contain potential shelter and nest sites for the Eastern Pygmy-Possum. The greatest loss of hollow bearing trees would be within Wedding Bells State Forest. Investigations in areas adjacent to the Proposal in Wedding Bells State Forest have identified a similar frequency of hollow bearing trees indicating that this important habitat feature is not uncommon in the local area. Prior to clearing for construction, inspections of tree hollows will be undertaken by a wildlife specialist to determine if they are being used by a Eastern Pygmy-Possum. If there is evidence that a tree hollow is being used by a Eastern Pygmy-Possum, relocation would be undertaken in accordance with RTA and Department of Environment and Climate Change protocols.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would impact this species through the clearing of foraging resources and the loss of small tree hollows. The loss of approximately 81 hectares of potential foraging habitat and 154 hollow bearing trees, the majority containing at least one small hollow, would impact this species in the immediate vicinity of the Proposal. However, the preferred habitat resources of this species are widespread in the local area with the extensive forested land including Sherwood and Moonee Beach Nature Reserves and Wedding Bells and Orara East State Forest.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Eastern Pygmy-possum is not at the limit of its distribution in the Sapphire to Woolgoolga area. The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential habitat that are currently connected would be bisected by the Proposal. While the connectivity of habitat would be broken, the areas of habitat available in this area would still be extensive compared to the home-ranges of this species. To the west of the Proposal is the majority of the extensive forested areas of Wedding Bells State Forest, while to the east is approximately 56 hectares of forested area. Male Eastern Pygmy-possums have non-exclusive home-ranges of about 0.68 hectares and females about 0.35 hectares.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Spotted-tailed Quoll

The Spotted-tailed Quoll was not recorded during the surveys but suitable habitat exists within the Proposal area and there are database records for this species within the locality. The Spotted-tailed Quoll utilises a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Individual Spotted-tailed Quolls use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Within the Proposal area there are likely to be fallen logs and hollow-bearing trees that would be suitable for den sites, particularly within the Wedding Bells State Forest section. The potential for impact on the lifecycle of this species would occur during the construction phase. Immediately prior to clearing activities specific searches by an ecologist for threatened fauna including the Spotted-tailed Quoll would be undertaken. If found, any individuals would be re-located into suitable habitat as close as possible to the area in which they were found.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Spotted-tailed Quolls consume a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects. The Proposal would impact on a relatively small area of potential hunting grounds for this species. The 83 hectares of vegetation providing potential habitat for this species is considered small in relation to the home ranges of up to 750 hectares for females and 3,500 for males.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Spotted-tailed Quoll is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species is found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential habitat that are currently connected would be bisected by the Proposal. This section of the Proposal has the potential to act as a barrier to ground dwelling and arboreal fauna movement within the local area. The Proposal design includes facilities for fauna crossing within these areas with fauna underpasses and fauna friendly culverts. Fauna exclusion fencing would be used to direct fauna towards crossing structures.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Brush-tailed Phascogale

The Brush-tailed Phascogale was not recorded during the surveys but suitable habitat exists within the Proposal area and there are database records for this species within the locality. The Brush-tailed Phascogale prefers dry sclerophyll open forest with a sparse groundcover of herbs, grasses, shrubs or leaf litter but also inhabit heath, swamps, rainforest and wet sclerophyll forest.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Brush-tailed Phascogale nests and shelters in small tree hollows and use many different hollows over a short time span. The potential impact on the life-cycle of this species relates to the loss of tree hollows which form potential nest sites for this species. Investigations in areas adjacent to the Proposal in Wedding Bells State Forest have identified a similar frequency of hollow bearing trees indicating that this habitat feature is not uncommon in the local area. Prior to clearing for construction, inspections of tree hollows will be undertaken by a wildlife specialist to determine if they are being used by a Brush-tailed Phascogale. If there is evidence that a tree hollow is being used by a Brush-tailed Phascogale, relocation would be undertaken in accordance with RTA and Department of Environment and Climate Change protocols.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Brush-tailed Phascogale feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Approximately 83 hectares of potential foraging habitat for this species would be removed as a result of the Proposal.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Brush-tailed Phascogale is not at the limit of its distribution in the Sapphire to Woolgoolga area. The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is found on the Great Dividing Range and in the north-east and south-east of the State.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential habitat that are currently connected would be bisected by the Proposal. This section of the Proposal has the potential to act as a barrier to ground dwelling and arboreal fauna movement within the local area. The Proposal design includes facilities for fauna crossing within these areas with fauna underpasses and fauna friendly culverts. Fauna exclusion fencing would be used to direct fauna towards crossing structures.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Koala

The Koala was not recorded during the surveys but suitable habitat exists within the Proposal area and there are database records for this species within the locality. Koalas inhabit eucalypt woodlands and forests.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal is unlikely to significantly impact any lifecycle processes for any koalas that may utilise the Proposal area. The potential impact on this species would be the removal of foraging habitat.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Approximately 76 hectares of eucalypt forest forming potential foraging habitat would be required to be cleared for the Proposal. Extensive areas of similar habitats are present in the local area including Wedding Bells State Forest and Moonee Nature Reserve.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Koala is not at the limit of its distribution in the Sapphire to Woolgoolga area. The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential habitat that are currently connected would be bisected by the Proposal. This section of the Proposal has the potential to act as a barrier to ground dwelling and arboreal fauna movement within the local area. The Proposal design includes facilities for fauna crossing within these areas with fauna underpasses and fauna friendly culverts. Fauna exclusion fencing would be used to direct fauna towards crossing structures.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Ground Dwelling Mammals

The threatened ground dwelling mammals Rufous Bettong, Long-nosed Potoroo, Common Planigale, and Hastings River Mouse have been assessed together as they occur in similar habitats and would potentially be subject to similar impacts as a result of the Proposal. These mammals were not recorded during the surveys but suitable habitat exists within the Proposal area.

Rufous Bettongs inhabit a variety of forests from tall, moist eucalypt forest to open woodland. A dense cover of tall native grasses is their preferred shelter. The Long-nosed Potoroo inhabits coastal heaths and dry and wet sclerophyll forests with dense understorey with occasional open areas an essential part of their habitat. The Common Planigale inhabits rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover. The Hastings River Mouse inhabits a variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The potential impact on the lifecycle of these threatened species would be the loss of foraging habitat and nest sites through clearing of open forest communities. The Rufous Bettong, Long-nosed Potoroo, Common Planigale and Hastings River Mouse all utilise dense groundcover, usually grassy, and have a variety of food sources such as seeds, leaves, grasses, herbs, roots, tubers, fungi and insects.

For the Hastings River Mouse permanent shelter such as rocky outcrops is important. This habitat feature is relatively rare within the Proposal area.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the removal of approximately 81 hectares of open forest communities providing habitat for these species. The food and shelter resources within these communities are generally present in areas adjacent to the proposal such as Wedding Bells State Forest and Moonee Nature Reserve.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Rufous Bettong, Long-nosed Potoroo, Common Planigale and Hastings River Mouse are not at the limit of their distribution in the Sapphire to Woolgoolga area. The Rufous Bettong occurs from Cooktown, Queensland, to north-eastern NSW. The Long-nosed Potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania. The Common Planigale occurs in Arnhem Land and along the east coast from northern Queensland to the NSW lower north coast. The Hastings River Mouse is found from south-east Queensland to north-east NSW.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The upgrade section of the Proposal passes through a mosaic of urban land, agricultural land and remnant bushland. Due to this fragmented landscape and the existing highway the Proposal would not impact on habitat connectivity. In the bypass section where the Proposal passes through Wedding Bells State Forest areas of potential habitat that are currently connected would be bisected by the Proposal. This section of the Proposal has the potential to act as a barrier to ground dwelling fauna movement within the local area. The Proposal design includes facilities for fauna crossing within these areas with fauna underpasses and fauna friendly culverts. Fauna exclusion fencing would be used to direct fauna towards crossing structures.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Bats (cave roosting)

Threatened cave roosting bats have been assessed together as they have similar habitat requirements and potential impacts as a result of the Proposal. The species assessed here are:

- Little Bent Wing Bat
- Eastern Bent Wing
- Eastern Cave Bat
- Large-eared Pied Bat

These threatened bats are generally found in forested areas including dry open forest and moist open forest, with the Little Bent Wing Bat also utilising rainforest. They are insectivorous bats, although little is understood about the feeding and breeding behaviour of the Eastern Cave Bat. All species roost in caves although mines, tunnels, bridges, culverts and other man-made structures may be used.

The Little Bent-wing and Eastern Bent-wing Bats were recorded at several locations along the length of the Proposal, often in proximity to culverts within moist open forest and swamp sclerophyll forest. The Eastern Cave Bat and Large-eared Pied Bat were not recorded during surveys but have suitable habitat present within the Proposal area.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would affect a relatively small area of foraging habitat for these species which is unlikely to affect their lifecycle. The existing bridges and culverts within the Proposal area are potential roost sites for these species, however, breeding is likely to take place in maternity caves with specific temperature and humidity conditions. As such, it is considered unlikely that the lifecycle of these species would be impacted by the Proposal.

The majority of culverts and bridges of the existing highway would not be altered by the Proposal with the impact on these areas restricted to disturbance such as noise during the construction period. The Proposal would require the demolition of existing bridges at Double Crossing, Skinners and Cunninghams Creeks. Prior to the demolition of the existing bridges an inspection will be undertaken by a qualified ecologist to identify any roosting bats. If found, any bats would be relocated in accordance with a protocol to be developed in conjunction with DECC. The Proposal will involve the construction of several new bridges which, during the operation phase, may become potential roost sites for these species.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of approximately 83 hectares of forest communities which may form potential foraging habitat for these species. This represents a relatively small area in relation to the availability of similar habitats in the locality such as Wedding Bells State Forest, Orara East State Forest and Moonee Beach Nature Reserve.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Little Bent Wing Bat, Eastern Bent Wing, Eastern Cave Bat and Large-eared Pied Bat are not at the limit of their distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Due to the already fragmented nature of the landscape and the presence of the existing highway within the upgrade section, the Proposal would not cause additional fragmentation of habitat. In the bypass section, within Wedding Bells State Forest, the Proposal would pass through currently connected areas of habitat for the Little Bent Wing Bat, Eastern Bent Wing, Eastern Cave Bat and Large-eared Pied Bat. However, given the highly mobile nature of these species the loss of connectivity in this area would not greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Bats (hollow roosting)

Threatened hollow roosting bats have been assessed together as they have similar habitat requirements and potential impacts as a result of the Proposal. The species assessed here are:

- Greater Broad-nosed Bat
- East Coast Freetail Bat
- Hoary Wattled Bat
- Eastern False Pipistrelle
- Eastern Long-eared Bat
- Yellow-bellied Sheathtailed Bat

These threatened bats are generally found in forested areas including dry open forest and moist open forest, swamp forest and rainforest. They are insectivorous bats and generally roost in tree hollows with some species also roosting under bark and occasionally utilising man-made structures such as buildings.

During surveys the Greater Broad-nosed Bat was recorded at Cunninghams Creek and the East Coast Freetail Bat north of the Arrawarra interchange. The Hoary Wattled Bat, Eastern False Pipistrelle, Eastern Long-eared Bat and Yellow-bellied Sheathtailed Bat were not recorded during surveys but have suitable habitat and/or database records within the locality.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would affect a relatively small area of foraging habitat for these species which is unlikely to affect their lifecycle. The more notable impact for these species would be the loss of potential roosting sites with 154 hollow bearing trees to be removed as a result of the Proposal. The majority of these hollow bearing trees are located within the Wedding Bells State Forest section of the Proposal. Investigations have identified that a similar density of hollow-bearing trees occurs within adjacent areas

of Wedding Bells State Forest indicating that this habitat resource is not rare within the local area. Due to the presence of suitable foraging and roosting habitat in the vicinity of the Proposal and the local area generally, it is considered unlikely that the lifecycle of these species would be impacted by the Proposal.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of approximately 83 hectares of forest communities which may form potential foraging habitat for these species. This represents a relatively small area in relation to the availability of similar habitats in the locality such as Wedding Bells State Forest, Orara East State Forest and Moonee Beach Nature Reserve.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Greater Broad-nosed Bat, East Coast Freetail Bat, Eastern False Pipistrelle and Yellow-bellied Sheath-tailed Bat are not at the limit of their distribution in the Sapphire to Woolgoolga area. The Coffs Harbour area represents the southern limit of distribution for the Hoary Wattled Bat and Eastern Long-eared Bat.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Due to the already fragmented nature of the landscape and the presence of the existing highway within the upgrade section, the Proposal would not cause any additional fragmentation of habitat. In the bypass section, within Wedding Bells State Forest, the Proposal would pass through currently connected areas of habitat for these species. However, given the highly mobile nature of these species the loss of connectivity in this area would not greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Bats (rainforest roosting)

Threatened bats that roost within rainforest have been assessed together as they have similar habitat requirements and potential impacts as a result of the Proposal. The species assessed here are the Eastern Blossom Bat and Golden-tipped Bat. The Eastern Blossom Bat was recorded during surveys in Wedding Bells State Forest south of Arrawarra Creek. The Golden-tipped Bat was not recorded during surveys but has suitable habitat present within the locality.

Both species roost in rainforests and feed in adjacent swamps and forests.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would require the removal of potential roosting and foraging habitat for these species. Eastern Blossom Bats roost individually in foliage of the sub-canopy of rainforests and forages on a diverse range of nectar producing plants in adjacent heathlands and paperbark swamps. Flowering plants are required year round. Golden-tipped Bats roost in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first and second-order streams. Golden-tipped Bats forage in rainforest and sclerophyll forest and are specialist feeders on small web-building spiders.

Foraging resources within the local area are not in short supply, with the greatest potential impact on the lifecycle of these species relating to the loss of potential roosting sites within rainforest vegetation. For the Golden-tipped Bat there is potential roosting habitat in the rainforest gully area just south of

Newmans Road. Approximately one hectare of this vegetation would be required to be removed for the Proposal. This rainforest extends to the east and west of the Proposal area.

For the Eastern Blossum Bat approximately two hectares of rainforest containing potential roost sites would be removed for the Proposal.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Eastern Blossum Bat and Golden-tipped Bat forage in swamps and forests adjacent to roost sites in rainforest areas. The Golden-tipped Bat will fly up to two kilometres from roost sites to forage. The extent of clearing as a result of the Proposal within two kilometres of the rainforest gully south of Newmans Road is minimal compared to that available within this distance.

The Eastern Blossum Bat forages in forests and swamps with year round flowering species required. The forests communities containing the winter flowering species of Broad-leaved Paperbark and Swamp Mahogany are a valuable foraging resource for this species. Nine hectares of these communities would be removed as a result of the Proposal. This is a small amount in relation to the area of available habitat in the local area.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Eastern Blossum Bat and Golden-tipped Bat are not at the limit of their distribution in the Sapphire to Woolgoolga area. The Golden-tipped Bat is distributed along the east coast of Australia from Cape York Peninsula in Queensland to Bega in southern NSW. The Eastern Blossum Bat is found in coastal areas of north-east NSW and eastern Queensland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Within the bypass section, the Proposal would pass through currently connected areas of habitat for the Eastern Blossum Bat and Golden-tipped Bat. However, given the highly mobile nature of these species the loss of connectivity in this area is not likely to greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Rainforest Birds

Threatened birds whose primary habitat is rainforest have been assessed together as they occupy similar habitats and would potentially be similarly impacted as a result of the Proposal. The species assessed here are:

- Rose-crowned Fruit-dove
- Superb Fruit-dove
- Coxen's Double-eyed Fig-parrot
- Black-breasted Button-quail
- White-eared Monarch

None of these species were recorded during surveys, however, there is suitable habitat within the Proposal area and/or database records within the locality.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would require the removal of approximately two hectares of rainforest providing potential habitat for these species. The rainforest habitat provides areas of shelter suitable for roosting and nesting for these species. The clearing of the rainforest would result in the removal of potential nest sites for these species which would potentially impact on their lifecycle. The areas of rainforest to be removed around Sapphire in the upgrade section of the Proposal are generally small and exist within a generally developed landscape. The area of rainforest in the bypass section of the Proposal south of Newmans Road, extends to the east and west of the proposed carriageways with a relatively small area to be removed in relation to that which will remain in adjacent areas.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the removal of approximately two hectares of rainforest providing potential habitat for these species. The rainforest would provide foraging resources such as fruit for the Rose-crowned Fruit-dove, Superb Fruit-dove and Coxen's Double-eyed Fig-parrot, and a source of insects for the White-eared Monarch and Black-breasted Button-quail.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Rose-crowned Fruit-dove, Superb Fruit-dove and Coxen's Double-eyed Fig-parrot are not at the limit of their distribution in the Sapphire to Woolgoolga area. The Sapphire to Woolgoolga area would represent the southernmost limit of distribution for the Black-breasted Button-quail and White-eared Monarch.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Within the bypass section, the Proposal would pass through a currently connected area of rainforest south of Newmans Road. However, given the highly mobile nature of these species the loss of connectivity in this area is not likely to greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Open Forest Birds

Threatened birds whose primary habitat is open forest, or in north eastern NSW is open forest have been assessed together as they occupy similar habitats and would potentially be similarly impacted as a result of the Proposal. The species assessed here are:

- Swift Parrot
- Regent Honeyeater
- Brown Treecreeper
- Hooded Robin
- Masked Owl
- Emu (population in the NSW North Coast Bioregion)

None of these species were recorded during surveys, however, there is suitable habitat within the Proposal area and/or database records within the locality.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would require the clearing of approximately 81 hectares of open forest communities, including approximately 66 hectares of eucalypt dominated open forest. These areas would contain potential nesting sites for these species including hollow bearing trees which are required for the Masked Owl and Brown Treecreeper. One hundred and fifty four hollow bearing trees would be removed as a result of the Proposal. In relation to the area of open forest habitat present in the local area, the potential impact on the lifecycle of these species would only be minor.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of approximately 81 hectares of open forest communities containing potential foraging resources for these species. This represents a relatively small area in relation to the availability of similar habitats in the locality such as Wedding Bells State Forest, Orara East State Forest and Moonee Beach Nature Reserve.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Swift Parrot, Regent Honeyeater, Brown Treecreeper, Hooded Robin, Masked Owl and Emu are not at the limit of their distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Due to the already fragmented nature of the landscape and the presence of the existing highway within the upgrade section, the Proposal would not cause any additional fragmentation of habitat. In the bypass section, within Wedding Bells State Forest, the Proposal would pass through currently connected areas of habitat for these species. However, given the highly mobile nature of these species the loss of connectivity in this area would not greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Aquatic Birds

Threatened aquatic birds have been assessed together as they have similar habitat requirements and potential impacts as a result of the Proposal. The species assessed here are:

- Black-necked Stork
- Comb-crested Jacana
- Freckled Duck

None of these species were recorded during surveys, however, there is suitable habitat within the Proposal area and/or database records within the locality. These species inhabit wetlands, swamps, billabongs, creeks, lakes and farm dams. The Comb-crested Jacana prefers wetlands with a good cover of floating vegetation, especially water-lilies.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal would have a very limited impact on aquatic habitats. The Proposal would cross a number of creeks providing potential habitat for the Freckled Duck. There would be temporary disturbance to creek areas during the construction phase, however, these habitats would be protected through soil and water quality management measures. The Proposal would impact, at least partially, on three farm dams providing potential habitat for these species. The area of potential habitat impacted by the Proposal is

small in consideration of available habitat in areas in close proximity to the Proposal such as Hearnese Lake, Lake Russell, and the estuarine areas associated with the numerous waterways crossed by the Proposal to the east. Given the extent of habitat in the local area compared to that to be impacted for these species, it is considered unlikely that the lifecycle of these species would be affected.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The impact on aquatic habitats will be relatively limited within the Proposal area. Three farm dams would be at least partially impacted. Waterways would be protected during the construction phase. The extent of impact is small in relation to the available habitat in the local area.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Black-necked Stork, Comb-crested Jacana and Freckled Duck are not at the limit of their distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would not impact on habitat connectivity for these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Threatened Raptors

Threatened raptors have been assessed together as they have similar habitat requirements and potential impacts as a result of the Proposal. The species assessed here are the Square-tailed Kite and Red Goshawk. Neither of these species were recorded during surveys, however, there is suitable habitat within the Proposal area and/or database records within the locality.

These species are found in timbered habitats such as woodlands and open forests and show a preference for watercourses.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The open forests within the Proposal area provide potential habitat for the Square-tailed Kite and Red Goshawk. There is likely to be suitable nest sites for these species within the Proposal area which would be removed by the Proposal. Due to the large ranges of these species the potential impact of the Proposal is considered to be localised and relatively minor. Particularly as these species were not observed during field surveys.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the removal of approximately 81 hectares of open forest habitats that are potential foraging grounds for these species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Square-tailed Kite is not at the limit of its distribution in the Sapphire to Woolgoolga area. The Proposal would represent the southern limit of distribution for the Red Goshawk.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

Due to the already fragmented nature of the landscape and the presence of the existing highway within the upgrade section, the Proposal would not cause any additional fragmentation of habitat. In the bypass section, within Wedding Bells State Forest, the Proposal would pass through currently connected areas of habitat for these species. However, given the highly mobile nature of these species the loss of connectivity in this area would not greatly impact these species.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Flora

Slender Marsdenia

Slender Marsdenia (*Marsdenia longiloba*) is a slender vine, growing to five metres in height in moist open forest. A population consisting of 20 to 30 plants was identified on the eastern side of the existing highway north of Gaundrons Road at Mid Sapphire. This population extends over a distance of approximately 50 metres within Grey Gum-Grey Ironbark Forest which is in good condition with few weeds. The Proposal would not directly impact the population of Slender Marsdenia which is located to the east of the existing highway. At this location the Proposal consists of two new carriageways to the west of the existing highway with the latter to become a south-bound off ramp.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal is not considered likely to impact on the lifecycle of this species as there will be no direct impact on the area of habitat and given the existing level of development and roads in proximity to the population.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

There are no proposed works in the immediate vicinity of the population. However, construction of the Gaudrons/Split solitary interchange to the south would require measures to ensure that construction machinery and personnel are excluded from the area containing the threatened species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Slender Marsdenia is not at the limit of its distribution in the Sapphire to Woolgoolga area. This species occurs in scattered sites on the north coast of NSW north from Barrington Tops into south-east Queensland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would not impact on any areas of currently connected known habitat for Slender Marsdenia.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Slender Screw Fern

Lindsaea incisa (Slender Screw Fern) is a small ground fern with slender erect fronds 10 to 20 cm long which arise from a rhizomatous root system. This species grows in heathy open forest grading into swamp sclerophyll forest on seasonally waterlogged or poorly drained sites. Slender Screw Fern was identified at a single location on the western side of the existing highway in Orara East State Forest south of Bucca Road. The plants occur as a single patch approximately 30 metres west of the existing highway, occupying an area of approximately 8 m by 2 m and consisting of 200 to 300 stems.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal is not considered likely to impact on the lifecycle of this species as there will be no direct impact on the area of habitat and given the existing level of development and roads in proximity to the population.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

In the vicinity of the population a proposed service road would be located on the western side of the existing highway. The toe of the batter slope would be located approximately 10 metres from the area of Slender Screw Fern. Construction of the proposed service road to the east of the patch of Slender Screw Fern would require measures to ensure that construction machinery and personnel are excluded from the area containing the threatened species.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Slender Screw Fern is not at the limit of its distribution in the Sapphire to Woolgoolga area. It is found from south-east Queensland to just south of Coffs Harbour.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would not impact on any areas of currently connected known habitat for Slender Screw Fern.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Rusty Plum

Rusty Plum (*Amorphospermum whitei*) is a medium-sized tree with typical habitat consisting of gully rainforest or wet sclerophyll forest with a well developed rainforest understorey. Four individuals are present at mid-Sapphire, eight individuals in the vicinity of Woolgoolga Creek, and one individual approximately 400 m north of Woolgoolga Creek.

Rusty Plum was recorded at several locations during the route options development phase of the Proposal. A large number of trees were recorded in the upper catchment of Woolgoolga Creek with other populations identified at Slaters Crossing Road, Bark Hut Creek and Moonee Creek. Survey work indicated that Rusty Plum is fairly widespread in rainforest and wet sclerophyll forests surrounding the Proposal area. While this species is rare close to the coast due to clearing and development, it is reasonably common in the hinterland.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal is not considered likely to impact the lifecycle of this species due to the minor impact and the other known populations in the local area.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

A relatively small area of habitat consisting of moist gully vegetation would be impacted as a result of the Proposal. Eight of the 13 individuals identified during surveys would be impacted by the Proposal. Three individuals at mid-Sapphire, located on the western side of the existing highway would require removal for the proposed northbound carriageway, and five of the eight individuals located at Woolgoolga Creek would be impacted by the dual carriageways and associated embankments.

To minimise the impact on this species, an investigation into the feasibility of relocating the species to suitable habitat on nearby land in secure tenure (in accordance with the ANPC 2004 guidelines) would be undertaken.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Rusty Plum is not at the limit of its distribution in the Sapphire to Woolgoolga area. Rusty Plum occurs in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would have a very minor impact on habitat connectivity in the vicinity of Woolgoolga Creek. Suitable habitat for this species extends to the east and west of the Proposal at Woolgoolga Creek.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Moonee Quassia

Moonee Quassia (*Quassia* sp. Moonee Creek) is a shrub to two metres high which grows in wet sclerophyll forest and heathy open forest on sandstone and metasediment. Moonee Quassia was identified from one location in the vicinity of the road corridor, on the western side of the existing highway north of Wakelands Road. This population extended west from the road reserve for approximately 150 m and contained approximately 70 plants, four of which are located within proximity of the road corridor.

This population is outside the footprint of the Proposal and is not expected to be directly impacted. Environmental protection measures such as erosion and sediment controls would be required to protect the adjacent areas of habitat of Moonee Quassia from indirect impacts arising from construction activities.

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

The Proposal is not considered likely to impact on the lifecycle of this species as there will be no direct impact on the area of habitat and given the existing level of development and roads in proximity to the population.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

A very small area of habitat within the road reserve would be impacted by the Proposal. However, no individuals would be required to be removed.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The Sapphire to Woolgoolga area represents the southern limit of distribution of this species. While this species has a relatively restricted distribution, from the Moonee Creek area to north east of Grafton, a number of populations occur in State Forests in the hinterland ranges including Wedding Bells, Orara East and Conglomerate State Forests.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would not impact on any areas of currently connected known habitat for Moonee Quassia.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Endangered Ecological Communities

Littoral Rainforest

Small areas of Littoral Rainforest occur on the eastern and western side of the existing highway in the upgrade section of the Proposal at Sapphire Beach. Some areas of this community are degraded due to the adjacent cleared land and surrounding residential areas. This community would be affected by the Proposal (on the western side of the existing highway) at Sapphire Beach.

Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. In total, it comprises less than one percent of the total area of rainforest in NSW. The largest known stand occurs in Iluka Nature Reserve, which is about 136 hectares in size (NPWS 2007).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Approximately 1.1 hectares of Littoral Rainforest would be removed by the Proposal.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Littoral Rainforest is not at the limit of its known distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would not result in any currently connected areas of habitat becoming isolated.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Lowland Rainforest on Floodplain

Lowland Rainforest on Floodplain occurs in two areas within the bypass section of the Proposal. A small area on the floodplain of Woolgoolga Creek would not be affected by the Proposal. Approximately one hectare would be removed from a larger area of the community where the Proposal crosses Newmans Road.

On the NSW north coast Lowland Rainforest on Floodplain occurs only as small remnants in scattered localities, with less than 1000ha in total thought to remain (NPWS 2007).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Approximately 1.0 hectare of Lowland Rainforest on Floodplain would be removed by the Proposal.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Lowland Rainforest on Floodplain is not at the limit of its known distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The area of currently connected Lowland Rainforest on Floodplain south of Newmans Road would be impacted by the Proposal. The Proposal would pass roughly through the middle of this area.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Swamp Sclerophyll Forest on Coastal Floodplains

Swamp Sclerophyll Forest is fairly common in the central sections of the Proposal between Sandy Beach and Moonee Beach. Within this section, the Proposal is largely contained within the existing road reserve extending slightly into adjoining properties at various locations. Much of the Swamp Sclerophyll Forest within the road reserve is young regrowth with moderate to high levels of common exotic species in the understorey.

Both the Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest are fairly widespread on the coastal floodplain adjacent to the Proposal, although their extent has been greatly reduced by land clearing. The impact on these endangered ecological communities has been minimised by containing the development footprint predominantly within the current road reserve at the central and upgrade sections of the Proposal. Occurrences of these communities within the road reserve generally consist of regrowth in poorer condition than examples found on adjacent land including private land, Coffs Harbour City Council land and State Forests land.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of 10.8 hectares of Swamp Sclerophyll Forest.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Swamp Sclerophyll Forest is not at the limit of its known distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would impact on a relatively small area of currently connected habitat for this endangered ecological community.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Swamp Oak Floodplain Forest

Both the Swamp Oak Floodplain Forest and Swamp Sclerophyll Forest are fairly widespread on the coastal floodplain adjacent to the Proposal, although their extent has been greatly reduced by land clearing. The impact on these endangered ecological communities has been minimised by containing the development footprint predominantly within the current road reserve at the central and upgrade sections of the Proposal. Occurrences of these communities within the road reserve generally consist of regrowth in poorer condition than examples found on adjacent land including private land, Coffs Harbour City Council land and State Forests land.

Regrowth in the road reserve is often dominated by Swamp Oak, even though the adjacent swamp forest outside the road reserve is dominated by Broad-leaved Paperbark of Swamp Sclerophyll Forest. This phenomenon is commonly seen along roadsides where these species co-occur and may be the result of Swamp Oak colonising disturbed ground more readily. This change in species composition can create problems in determining the vegetation type; however, as both Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest are endangered ecological communities, it does not affect the determination of the conservation status of the vegetation.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

The Proposal would require the clearing of 5.3 hectares of Swamp Oak Floodplain Forest.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Swamp Oak Floodplain Forest is not at the limit of its known distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

The Proposal would impact on a relatively small area of currently connected habitat for this endangered ecological community.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.

Coastal Saltmarsh

A very small area of Coastal Saltmarsh is present on the eastern side of the existing highway at Double Crossing Creek south of Woolgoolga. There would be no direct impact on this community. However, environmental measures to protect soil and water quality would be implemented to ensure no indirect impacts on this community as a result of construction activities.

In 1985 it was estimated that the total area of coastal saltmarsh in NSW was approximately 5700 hectares distributed in fragmented patches mostly less than 100 hectares. Since this estimate, further reduction and fragmentation has occurred (NSW Scientific Committee 2004).

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

This community would not be directly impacted by the Proposal.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Coastal Saltmarsh is not at the limit of its known distribution in the Sapphire to Woolgoolga area.

How is the proposal likely to affect current disturbance regimes?

The Proposal is not likely to appreciably affect current disturbance regimes such as intensity and frequency of fires or floods.

How is the proposal likely to affect habitat connectivity?

No areas of currently connecting habitat would be impacted by the Proposal.

How is the proposal likely to affect critical habitat?

The Department of Environment and Climate Change maintains a register of critical habitat. The Proposal area does not form part of any declared critical habitat area.