Appendix A

Tests of Significance (BC Act)

Tests of significance ('five-part tests') under Section 7.3 of the BC Act have been completed for the following threatened species and communities:

Flora:

- Arrow-head Vine
- Corokia
- Green-leaved Rose Walnut
- Narrow-leaf Finger Fern
- Onion Cedar
- Peach Myrtle
- Rainforest Senna
- Red Boppel Nut
- Red Lilly Pilly
- Rough-shelled Bush Nut
- Rusty Plum
- Rusty Rose Walnut
- Scrub Turpentine
- Small-leaved Hazelwood
- Tree Guinea Flower

TECs:

- Lowland rainforest

Fauna:

Highly Mobile Birds

- Barred Cuckoo-shrike
- Glossy Black-Cockatoo
- Little Lorikeet
- Marbled Frogmouth
- Varied Sittella
- White-eared Monarch
- Rose-crowned Fruit-dove
- Superb Fruit-dove
- Wompoo Fruit-dove

Less Mobile Birds

- Albert's Lyrebird
- Pale-vented Bush-hen

Owls

- Masked Owl
- Powerful Owl
- Sooty Owl

Ground-dwelling Mammals

- Long-nosed Potoroo
- Spotted-tailed Quoll

Macropods

- Parma Wallaby
- Red-legged Pademelon

- Rufous Bettong

Arboreal mammals

- Koala
- Squirrel Glider
- Southern Greater Glider
- Yellow-bellied Glider

Flying-foxes

- Eastern Tube-nosed Bat
- Grey-headed Flying-fox

Microbats

- Eastern Cave Bat
- Eastern Coastal Free-tailed Bat
- Eastern False Pipistrelle
- Eastern Long-eared Bat
- Golden-tipped Bat
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Bent-winged Bat
- Yellow-bellied Sheathtail-bat

Reptiles

- Stephens Banded Snake

Amphibians

- Fleay's Barred Frog
- Giant Barred Frog
- Green-thighed Frog
- Loveridge's Frog
- Pouched Frog

FLORA & TECs

Arrow-head Vine

Arrow-head Vine is a tall woody climber associated with wetter subtropical rainforest, including littoral rainforest, on fertile, basalt-derived soils.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for development, agriculture, and roading.
- Risk of local extinction because populations are small at some locations.
- Grazing and trampling by domestic stock.
- Fire.
- Invasion of habitat by introduced weeds.
- Accidental damage to plants when cutting introduced vines during bush regeneration.

Corokia

Corokia is a shrub or small tree to 4 m tall, with a highly restricted distribution. Flowering occurs spring–summer, with red drupes following shortly after. Typically found at the boundaries between wet eucalypt forest and warm temperate rainforest, at altitudes up to 800 m.

Threatening processes for this species include:

- Loss of habitat from clearing for urban expansion.
- Risk of extinction because populations are small and distribution is highly restricted.
- Timber harvesting activities.
- Fire, as hot fires will kill the plants.
- Invasion of habitat by weeds.

Green-leaved Rose Walnut

The Green-leaved Rose Walnut is a tree up to 30 m tall with brown bark, often in loose round plates. Twigs and branchlets are covered in hairs. The moderately glossy leaves are oval or drawn out towards the tips, and measure 6 – 12 cm long and 3 – 5 cm wide, with three to five pairs of side veins. Flushes of new growth are pinkish-green. Flowers are small, yellowish and hairless, and are held in small clusters. The fleshy fruits are egg-shaped, 2.5 – 3 cm long and black when ripe.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for coastal development.
- Clearing and fragmentation of habitat for agriculture.
- Infestation of habitat by weeds.
- Clearing and fragmentation of habitat for road-works.
- Frequent fire.
- Disturbance from recreational users in reserve areas.
- Forestry related activities within wet sclerophyll forest habitat.
- Damage from domestic stock.
- Habitat loss and fragmentation as a result of infrastructure development including powerline construction.

Narrow-leaf Finger Fern

The Narrow-leaf Finger Fern is a small fern, growing in small colonies, with hanging or erect fronds, which occurs in moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.

Threatening processes for this species include:

- Loss of habitat through clearing, especially along streamsides.
- Damage to habitat by human visitation.
- Illegal collection by fern enthusiasts.

Onion Cedar

Onion Cedar is a tall evergreen tree, up to 30 m, with a dense glossy dark-green crown which occurs in subtropical and dry rainforest from Bangalow to the McPherson Range.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for development, agriculture, and road-works.
- Climate change
- Weed invasion, primarily *Lantana camara*.
- Activation of acid sulfate soils
- Grazing by domestic stock.
- Fire.
- Current or potential future land management practices do not support species conservation

Peach Myrtle

Peach Myrtle is a shrub or small tree growing up to 12 m tall, the trunk often crooked and covered in brown scaly or flaky bark. It often forms clumps of plants as it grows from root suckers and coppice shoots. Found only in the far north-east of NSW in Nightcap and Mount Jerusalem National Parks and Whian Whian State Conservation Area, west of Mullumbimby. Occurs in Warm temperate rainforest on less fertile soils derived from rhyolite rock; often associated with Coachwood (*Ceratopetalum apetalum*).

Threatening processes for this species include:

- Fire.
- Risk of local extinction because distribution is restricted.
- Susceptible to Myrtle Rust.
- Risk of local extinction because numbers are low.
- Road maintenance.
- Possible mining activities.
- Low recruitment.

Rainforest Senna

Rainforest Senna grows on the margins of subtropical, littoral and dry rainforests and is often found as a gap phase shrub. Flowering occurs in spring and summer and the fruit is ripe in summer and autumn. Primarily pollinated by a variety of bees.

Threatening processes for this species include:

- Clearing of habitat for agriculture.
- Clearing of habitat for development.
- Invasion by introduced weeds, particularly lantana, bitou bush and exotic and native vines.
- Accidental removal during weed-control programs.
- Disturbance and habitat damage from domestic stock.
- Timber harvesting activities.
- Disturbance during road/track maintenance activities.

- Inappropriate fire regime, either too intense/frequent or too infrequent, preventing growth and recruitment.
- Potential for disturbance or degradation of habitat close to walking tracks.
- Poor knowledge of the species distribution and population dynamics.

Red Boppel Nut

Red Boppel Nut is a small tree to 10 m tall, often with several unbranched stems rising from the rootstock. Flowering is mostly winter; fruits appear in spring and summer. Occurs in subtropical rainforest, moist eucalypt forest and Brush Box forest.

Threatening processes for this species include:

- Clearing of rainforest habitat for development or agriculture.
- Invasion of habitat by introduced weeds, particularly Lantana and exotic vines.
- Fire.
- Collection of seed for horticulture.
- Disturbance by domestic stock.
- Disturbance during roadworks.

Red Lilly Pilly

Small tree to about 11 m tall, with a restricted range from the Richmond River in north-east NSW to Gympie in Queensland. Usually found in riverine and subtropical rainforest on rich alluvial or basaltic soils. Flowering occurs February–March.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for development, agriculture, road-works and powerlines.
- Weed infestation and general degradation of rainforest habitat.
- Grazing and trampling of seedlings and saplings by domestic stock.
- Roadside slashing and mowing.
- Illegal collection for horticulture.
- Large scale, high intensity fire is likely to cause significant damage to the population.

Rough-shelled Bush Nut

The Rough-shelled Bush Nut is a small to medium-sized, usually densely bushy, tree growing up to 18m tall. The species is confined chiefly to the north of the Richmond River in north-east NSW, extending just across the border into Queensland; occurs in subtropical rainforest, usually near the coast. Flowering occurs August–October, fruit ripe January.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks.
- Risk of local extinction due to low numbers.
- Grazing and trampling by domestic stock.
- Fire.
- Invasion of habitat by weeds.
- Loss of local genetic strains through hybridisation with commercial varieties.
- Reduction of genetic diversity as a result of fragmentation.

Rusty Plum

Rusty Plum is a small to medium-sized tree to 20 m high with a very fluted or irregular trunk, occurring in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland. Typically found in gully, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest; occurs on poorer soils in areas below 600 metres above sea level.

Threatening processes for this species include:

- Clearing of habitat for development.
- Timber harvesting activities.
- Clearing for agriculture.
- Invasion of habitat by introduced weeds, particularly Lantana.
- Inappropriate fire regime altering habitat and resulting in direct loss of individuals.
- Road work and track maintenance.
- Trampling by domestic stock.

Rusty Rose Walnut

Often a small crooked tree but can grow to 35 m tall; has a restricted distribution from Burleigh Heads in Queensland to the Richmond River in north-east NSW. It is locally abundant in some parts of its range in NSW. Occurs in sheltered moist gullies in lowland subtropical and warm temperate rainforest on alluvium or basaltic soils. The species occurs in regrowth and highly modified forms of these habitats. Flowers have been recorded in spring and in March, October and November, with fruits recorded in March and May.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for coastal development and agriculture.
- Infestation of habitat by weeds.
- Clearing and fragmentation of habitat for road-works.
- Frequent fire.
- Disturbance from recreational users in reserve areas.
- Forestry related activities within wet sclerophyll forest habitat.
- Damage from domestic stock.
- Habitat loss and fragmentation as a result of infrastructure development including powerline construction.

Scrub Turpentine

Scrub Turpentine is a shrub or small tree to 25 m high which occurs in a range of forest communicates including Subtropical Rainforests, Northern Warm Temperate Rainforests, Littoral Rainforest and Wet Sclerophyll Forests. Populations and individuals of Scrub Turpentine are often found in wet sclerophyll associations in rainforest transition zones and creekside riparian vegetation. The species may also occur as a pioneer in adjacent areas of dry sclerophyll and grassy woodland associations Flowering occurs in late winter through to spring, with a peak in October, and fruits typically begin to appear in December.

The key threat to Scrub Turpentine is mortality caused by infection by Myrtle Rust (*Austropuccinia psidii*).

Small-leaved Hazelwood

The Small-leaved Hazelwood is a tall shrub or small tree that grows to 7 m tall and is restricted to the Mount Warning caldera from Springbrook in Queensland, to the Nightcap Range in north-east New South Wales and within 40 km of the coast. This species grows in subtropical and warm temperate rainforests on less fertile soils derived from rhyolite and occasionally in wet sclerophyll forest adjacent to rainforest. The altitude of known sites ranges from 140 m to 1000 m above sea level. Flowering has been recorded from August to September and fruiting has been recorded in December and February

Threatening processes for this species include:

- Clearing of habitat for agriculture.
- Fire destroying individuals and their habitat.
- Private native forestry.
- Clearing of habitat for development.
- Disturbance from road maintenance and construction.
- Risk of local extinction because populations are small.
- Risk of local extinction because of limited distribution.
- Climate changed induced habitat modifications.
- Weed invasion.

Tree Guinea Flower

Tree Guinea Flower grows as a tall shrub to small tree with star-shaped hair-clusters on the branches. Showy yellow flowers with 5 petals are produced in spring. The fruit is a dry pod, splitting at the top to expose the seeds. The species is associated with heath, open forest or rainforest and is restricted to the coastal ranges of the Mount Warning area of north-east NSW including Mt Warning and Nightcap National Parks; with a separate population in the Wauchope–Kendall area.

Based on recent field assessment (GeoLINK, in prep.), a population of up to 1000 mature plants may occur within the Nightcap range. Fire affected populations of the species were killed outright, with substantial post-fire seedling germination observed.

Threatening processes for this species include:

- Isolation of populations.
- Trampling by tourist activities.
- Timber harvesting activities.
- Inappropriate fire regimes, which do not encourage regeneration of the species.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Works required for the TBHT will traverse threatened flora habitat at numerous locations, however based on the construction methodology (ecologist present to guide works in sensitive locations) it would be unlikely that any threatened flora would be directly physically impacted by the construction works given that avoidance of impacts is both an aim of the proposal and is able to be practically achieved by micro-siting of the track and/or any facilities.

Tree Guinea Flower will be directly affected where 86 seedlings will be impacted in section 3 of the track. While efforts to avoid these plants were implemented, germination in this area is prolific and the track siting opportunities highly constrained. Following survey of other populations of Tree Guinea Flower within Nightcap NP/Whian Whian SCA (GeoLINK, in prep.), it was determined that a

reasonably robust population of the species occurs (despite some small populations being affected by the 2019 fires) and that the loss of approximately 86 seedlings of the species would not significantly affect the viability of the local population, where the greatest threat is posed by future wildfires or too frequent fires. Micro-siting of the trail and facilities would still be undertaken where possible to avoid direct impact of individuals, however, some minor impact is expected.

Once operational, there is increased potential for disturbance to threatened flora by accidental damage or disturbance, creation of informal tracks or side tracks / shortcuts or by patrons actively picking or collecting fruit or flowers (e.g. Red Boppel Nut). While the incidence of these impacts cannot be quantified, it is expected that they would be very low. The persistence of numerous stems of threatened flora along existing tracks and trails and low levels of impact (including the highly trafficked Minyon Loop) is an encouraging baseline by which to measure potential impacts of the TBHT.

Transmission of Myrtle Rust is a key threat to stems of Scrub Turpentine and Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

On this basis, the construction and operation of the TBHT would be unlikely to have an adverse effect on the life cycle of any of the subject species such that a viable local population would be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Lowland rainforest: the TBHT will impact on areas of lowland rainforest < 600 m ASL from track construction and formation at several locations. An estimated 2.37 km of walking track will be constructed within undisturbed lowland rainforest whereby removal of shrubs, saplings, vines and groundcovers will be removed/disturbed by staff completing works by hand with mattocks and crowbars. This sensitive approach without using machinery will minimise disturbance to both vegetation and the ground layer and no canopy trees or mature trees will require removal. Allowing for a maximum of 2 m of disturbance, approximately 0.474 ha of lowland rainforest may be disturbed. This disturbance is negligible in the context of substantial areas of lowland rainforest within the three reserves, where an estimated 3179 ha of lowland rainforest occurs (refer to **Table 5.2**). On this basis the works may result in physical disturbance (via track construction) of approximately 0.015% of lowland rainforest within the three reserves. On this basis, the localised nature and low impacts of the works would not place lowland rainforest at increased risk of extinction and would not substantially and adversely modify the composition of lowland rainforest in the locality.

Other impacts within lowland rainforest where existing trails and tracks occur (and where minor refinements are required) would be negligible.

c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

Threatened flora: as noted, 86 seedlings of Tree Guinea Flower will require removal for track construction in Section 3 of the TBHT. The loss of these plants represents a very small population of the established population in the locality with large numbers of adult plants occurring (est. ~ 1000) and substantial evidence of post fire germination being evident (GeoLINK, in prep.). Micro-siting of the trail and facilities would still be undertaken where possible to avoid direct impact of individuals, however, some minor impact is expected.

No other threatened flora will be directly removed for the construction of the TBHT. Where habitat for more sensitive species occurs (e.g. *Grammitis stenophylla*) the TBHT and camp facilities will be micro-sited to avoid these areas and maintain separation from the walking track.

Lowland rainforest: an estimated 0.474 ha of lowland rainforest will be disturbed by construction and subjected to selective removal of shrubs, vines and groundcovers. This forms a negligible portion of the ~3179 ha of lowland rainforest within the three conservation reserves in which the works would occur. Other impacts within lowland rainforest where existing trails and tracks occur (and where minor refinements are required) would be negligible.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Threatened flora: the construction and operation of the TBHT would not result in the fragmentation of habitat for any of the subject threatened flora such that any population would be isolated or that key life cycle functions (flowering, pollination, genetic exchange, propagule dissemination) would be negatively impacted by the construction or operation of the TBHT. The TBHT will partially fragment Tree Guinea Flower seedlings within an area of post fire regeneration, however the track would not contribute to any genetic isolation or limit reproductive success of the species.

Lowland rainforest: a total of 9.7 km of the TBHT will occur within rainforest, of which 2.37 km requires track construction within undisturbed areas. Tracks within undisturbed areas will be narrow (600 mm in width, with a potential disturbance footprint of 2 m width) and would not result in fragmentation of any vegetation, create canopy disruption or exacerbate any edge effects within closed forest environments.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Threatened flora: Tree Guinea Flower - the habitat to be removed represents a small portion of available habitat for the species in the context of numerous adult and regenerating populations within the two southern reserves.

For other species, no habitat of any threatened flora will be removed as a result of the proposed construction methodology. Ongoing walking along the constructed track would be unlikely to significantly impact on threatened flora habitat.

Lowland rainforest: an estimated 0.015% of lowland rainforest will be disturbed from construction within undisturbed vegetation within the context of the three conservation reserves. These impacts are very low and are limited to select removal of shrubs, vines and groundcovers. This habitat is of low importance to the structural complexity and long term survival of lowland rainforest in the locality. Use of existing tracks and trails within/abutting rainforest is unlikely to result in any significant impacts to existing rainforest communities.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No areas of outstanding biodiversity value listed in the BC Act occur at or in proximity to the site.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A key threatening process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species or ecological communities. The current list of KTP under the BC Act, and whether the Proposal is recognised as a KTP is shown in **Table G.1**.

Table G.1 Key Threatening Processes

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic climate change			✓
Bushrock removal	✓		
Clearing of native vegetation	✓		
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition and habitat degradation by feral goats (*Capra hircus*)			✓
Competition from feral honeybees (*Apis mellifera*)			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest eucalypt dieback associated with over-abundant psyllids and bell miners			✓
Habitat degradation by Feral Horses, *Equus caballus*			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of red imported fire ants (*Solenopsis invicta*)			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of Lantana (*Lantana camara*)			✓
Invasion of native plant communities by African Olive (*Olea europaea L. subsp. cuspidata*)			✓
Invasion of native plant communities by *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*) into NSW		✓	
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees		✓	
Loss or degradation (or both) of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)		✓	
Predation by the European Red Fox (*Vulpes vulpes*)		✓	
Predation by the feral cat (*Felis catus*)			✓
Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish)			✓

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)			✓
Removal of dead wood and dead trees	✓		

Several KTPs may apply to the construction and operation of the TBHT:

- *Bushrock removal*: Bush rock will be removed or relocated at strategic locations where rock is already disturbed or will be unearthed from excavation or has fallen from the cliff face at Minyon Falls (refer to **Section 3.2.3**). The extent of bush rock removal will be negligible in the context of the overall TBHT. This KTP is not relevant to the subject threatened flora; nor would it substantially affect the structure and integrity of lowland rainforest.
- *Clearing of Native Vegetation:* refers to the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. Construction works would require clearing of shrubs, vines and groundcovers over a distance of approximately 14.39 km (estimated area of ~ 2.88 ha), with nominal vegetation disturbance required to adapt existing tracks and trails and install facilities at the three camps (estimated area of ~ 0.7 ha). Contributions to this KTP are therefore very minor in the context of three large conservation reserves.
- *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*: not relevant to threatened flora and communities; addressed by adoption and implementation of standard hygiene protocols during construction.
- *Infection of native plants by Phytophthora cinnamomic*: Phytophthora is already present within all reserves. The operation and construction of the TBHT would be unlikely to increase the incidence of Phytophthora such that any of the subject species (or lowland rainforest) would be significantly affected.
- *Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae*: introduction and transmission of Myrtle Rust is a concern for the project but can be managed by standard control and minimisation measures during construction and addressed by education on best practice management during operations.
- *Invasion, establishment and spread of Lantana (Lantana camara)*: Lantana already occurs at low densities in select areas of the TBHT. The construction and operation of the project would be unlikely to significantly increase the incidence of Lantana such that it would significantly affect threatened flora or communities.
- *Invasion of native plant communities by exotic perennial grasses*: Exotic grasses (mostly Broad-leaved paspalum) are common along track verges in some disturbed areas. There is potential that patrons may spread grass seed along the track and into areas of native vegetation. There is little risk of native grass invasion affecting any of the subject threatened flora or rainforest TEC due to low light conditions being unfavourable to exotic grasses.
- *Invasion of the Yellow Crazy Ant (Anoplolepis gracilipes) into NSW*: Yellow Crazy Ants have been recorded in the Lismore region and have potential to be transported to the site by machinery during the construction phase. Adoption and maintenance of appropriate hygiene procedures would address this issue.
- *Loss of hollow-bearing trees*: no standing hollow-bearing trees would require removed for the construction works. Timber 'deadfalls' require clearing across old snig tracks along parts of the TBHT and some fallen trees may contain small hollows; the importance of these habitats at ground level (ie. accessed by predators) is likely to be very low.
- *Predation and hybridisation by feral dogs (Canis lupus familiaris)/Predation by the European Red Fox (Vulpes vulpes)*: The TBHT will improve opportunities for dispersal by feral animals such as wild dogs and foxes. However, the majority of the TBHT already occurs and there is a large

network of roads and informal pathways throughout all three reserves from historic operations. As such, contributions to this KTP are expected to be minor.

- *Removal of dead wood and dead trees*: Fallen timber is common along less well maintained tracks and will require removal and relocation. The impacts of these works are unlikely to be significant.

Conclusion

It is considered unlikely that the local population of any of the subject species or communities would be placed at significant risk of extinction as a result of the proposal.

FAUNA

Highly Mobile Birds

Barred Cuckoo-shrike

The Barred Cuckoo-shrike occurs within rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. They are usually seen in pairs or small flocks foraging among foliage of trees for insects and fruit. They are active birds, frequently moving from tree to tree.

Threatening processes for this species include:

- Reduction of habitat, particularly rainforest, due to clearing for agriculture, development and timber harvesting.

Glossy Black-Cockatoo

Glossy Black-Cockatoo inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak (*Allocasuarina diminuta*) and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. Glossy Black-Cockatoo are dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

Threatening processes for this species include:

- Reduction of suitable habitat through clearing for development.
- Decline of hollow-bearing trees over time due to land management activities.
- Excessively frequent fire which eliminates sheoaks from areas, prevents the development of mature sheoak stands, and destroys nest trees.
- Firewood collection resulting in loss of hollow-bearing trees, reduced recruitment of hollow-bearing trees, and disturbance of breeding attempts.
- Decline in extent and productivity of sheoak foraging habitat due to feral herbivores.
- Reduced access to surface water in close proximity to foraging and nesting habitat.
- Limited information on the location of nesting aggregations and the distribution of high quality breeding habitat.
- Disturbance from coal seam gas and open cut coal mining causing loss of foraging and breeding habitat as well as disturbing reproductive attempts.
- Decline in extent and productivity of sheoak foraging habitat caused by moisture stress due to climate change.
- Forestry activity resulting in loss of hollow-bearing trees, reduced recruitment of hollow-bearing trees, degradation of foraging habitat, and disturbance of breeding attempts.
- Degradation of foraging habitat and reduced regeneration of sheoak stands due to grazing by domestic stock.
- Loss of foraging habitat due to slashing/ under scrubbing.
- Change in the spatial and temporal distribution of resources due to global warming.
- Illegal bird smuggling and egg-collecting.
- Habitat infestation by weeds such as African Boxthorn, Gazania, Buffel Grass and other invasive grasses.

Little Lorikeet

The Little Lorikeet mostly forages in the canopy of open eucalypt forest and woodland, utilising *Eucalyptus*, *Angophora, Melaleuca* and other tree species. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. The species feeds mostly on nectar and pollen, but occasionally also on native fruits such as mistletoe. Nests are generally located in proximity to feeding areas if possible and entrances are small (3 cm) and usually high above the ground (2-15 m). Nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees are often chosen, including species like *Allocasuarina*. The nesting season extends from May to September.

Threatening processes for this species include:

- Clearing of woodlands for agriculture.
- Loss of old hollow-bearing trees.
- Competition with the introduced Honeybee.
- Infestation of habitat by invasive weeds.
- Inappropriate fire regimes.
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.
- Climate change impacts including reduction in resources due to drought.
- Degradation of woodland habitat and vegetation structure due to overgrazing.

Marbled Frogmouth

Marbled Frogmouths inhabit subtropical rainforest, particularly in deep, wet, sheltered gullies along creek lines and often containing stands of Bangalow Palms or ferns. In NSW, the species is most often found in moist, lowland, mesophyll vine forest. Less often, Marbled Frogmouths are found in the ecotone between rainforest and wet Eucalyptus forests, or occasionally in cool rainforest and higher elevation temperate rainforests. The Marbled Frogmouth is, like other frogmouths, nocturnal, hunting at night and roosting by day. The diet consists mainly of large nocturnal insects. Birds breed from about August to December. The usual clutch is one but is sometimes two eggs.

Threatening processes for this species include:

- Clearing, fragmentation and isolation of rainforest and associated wet eucalypt forests for agriculture and forestry has been the main cause of past declines and continue to operate as a threat for the species.
- Opening of the canopy and promotion of dense understorey growth caused by timber harvesting.
- Invasion of habitat by weeds following disturbance.
- Isolation of patches of habitat owing to frequent burning of connecting forest.

Varied Sittella

The Varied Sittella is distributed widely in NSW, extending from the coast to the far west. The NSW population has undergone a moderate reduction over the past several decades. Habitat includes eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella forages for arthropods on bark, dead branches and small branches and twigs; the nest is cup-shaped and built of plant fibres and cobwebs in an upright tree fork high in the living tree canopy.

Threatening processes for this species include:

- Habitat decline.
- Dominance of Noisy Miners in woodland patches.
- Threats include habitat degradation through small-scale clearing for fence lines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection.
- Infestation of habitat by invasive weeds.
- Inappropriate fire regimes.
- Climate change impacts including reduction in resources due to drought.
- Overgrazing by stock impacting on leaf litter and shrub layer.

White-eared Monarch

In NSW, White-eared Monarchs occurs in rainforest, especially drier types, such as littoral rainforest, as well as wet and dry sclerophyll forests, swamp forest and regrowth forest. They appear to prefer the ecotone between rainforest and other open vegetation types or the edges of rainforest, such as along roads. The White-eared Monarch eats insects, but their diet is not well studied. They breed from about September to March, usually nesting high in the canopy, and often at the edge of patches of rainforest.

Threatening processes for this species include:

- Clearing and increasing fragmentation and isolation of habitat, especially low-elevation subtropical rainforest, littoral rainforest and wet sclerophyll forest, through agricultural, tourist and residential development or forestry activities.
- Forest management that results in conversion of multi-aged forests to young, even-aged stands.
- Invasion of forests by weeds.
- Inappropriate fire regimes that degrade habitat or allow invasion by weeds.
- Degradation or loss of habitat through grazing of stock.
- Changes to rainforest habitat with climate change including drying and increased fire frequency.
- Lack of information on the species habitat requirements in NSW, particularly breeding habitat.
- Easily disturbed by the presence of people

Wompoo/ Rose-crowned/ Superb Fruit-dove

Fruit-doves occupy similar habitat niches in moist sclerophyll and rainforests, predominantly along the east coast of NSW. They feed on ripe fruits from a diverse range of fruit bearing species including figs, palms, trees, shrubs and vines. These birds are thought to be effective medium to long distance vectors for seed dispersal due their locally nomadic behaviour. Breeding takes place from spring to summer within a stick nest where typically a single egg is laid. Both parent birds take turns to incubate the egg.

Threatening processes for these species include:

- Clearing and fragmentation of low to mid-elevation rainforest due to coastal development and grazing.
- Logging and roading in moist eucalypt forest with well-developed rainforest understorey.
- Burning, which reduces remnant rainforest habitat patches.
- Infestation of rainforest habitat by invasive weeds.
- Removal of Camphor Laurel food source without appropriate mitigation measures.

Less Mobile Birds

Albert's Lyrebird

Albert's Lyrebird mainly occurs in the wettest rainforests or wet sclerophyll forests with a wet understorey, often of rainforest plants. Higher densities of Albert's Lyrebirds occur in association with a canopy of eucalypts compared with rainforest lacking eucalypts (for equivalent climate), and in wet sclerophyll forest with greater weights of litter and logs and slower rates of litter decomposition.

Threatening processes for this species include:

- Clearing of rainforest and wet eucalypt forest habitat, and subsequent, fragmentation and isolation of remnant patches, for forestry and agriculture is thought to be the main reason for the decline of the species and continued clearing through forestry activities or for agricultural and residential development remains a threat to the species.
- Intensive management of forests, especially loss of optimal wet sclerophyll forest habitat to plantations of eucalypts or Hoop Pines (*Araucaria cunninghamii*), but also including damage to the canopy, understorey and ground layers of rainforest and wet sclerophyll forest habitats through forestry practices.
- Invasion of logged or otherwise damaged habitat by weeds, especially Lantana (*Lantana camara*), which reduces suitability of the habitat.
- Damage to habitat by grazing stock.
- Encroachment of urban or rural development close to habitat of Albert's Lyrebirds, as densities of Lyrebirds are lower close to such developments than would be expected.
- The isolated population in the Blackwall Range is under threat because it is so small, with possibly as few as ten or fewer birds, and isolated from other populations.
- Fire may be a threat in exceptionally dry years, particularly isolated outlying populations.
- Predation by Red Foxes (*Vulpes vulpes*), and feral or, close to settlements, domestic Dogs and Cats may pose some threat, though this is thought to be of minor significance.
- Anthropogenic climate change, and potential changes to habitat and further restrictions of range linked to such change.

Pale-vented Bush-hen

The Pale-vented Bush-hen inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. Bush-hens also occur in secondary forest growth, rank grass or reeds, thickets of weeds, such as Lantana and pastures, crops or other farmland, such as crops of sugar cane, and grassy or weedy fields, or urban gardens where they border forest and streams or wetlands, such as farm dams. Key elements of their habitat are dense undergrowth 2 to 4 m tall and within 300 m of water.

The diet consists of seeds, plant matter, earthworms, insects and some frogs, taken from ground cover or by wading at edges of streams or wetlands. The breeding season is from spring to early autumn, October to April. The nest is a shallow bowl or cup of grass stems, often partly hooded, built close to water in thick ground vegetation such as dense Blady Grass (*Imperata cylindrica*), Mat Rush (*Lomandra* spp.) or reeds, often under or growing through shrubs or vine or beneath a tree.

Birds lay 4 to 7 eggs in a clutch and will re-lay after a successful breeding attempt and make multiple attempts after nesting failures. The incubation period is about 3 weeks. The hatchlings are precocial and can run soon after hatching; they are probably dependent on their parents for 4 to 5 weeks after hatching.

Threatening processes for this species include:

- Clearing, filling and draining of wetlands for agricultural, residential and industrial development.
- Pollution of wetlands from agricultural, urban and industrial run-off, including herbicides and pesticides.
- Changes to wetlands caused by weed invasion, often associated with sedimentation or grazing.
- Predation by introduced, feral and domestic predators, particularly Red Foxes (*Vulpes vulpes*) and Cats (*Felis catus*).
- Destruction of habitat and predation by feral Pigs (*Sus scrofa*).
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Loss of dense and rank understorey vegetation near streams and wetlands with clearing associated with urban and semi-rural developments.

Owls

Masked Owl

Masked Owls live in dry eucalypt forests and woodlands from sea level to 1ten0 m and often hunt along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to ten00 ha. Masked Owls roost and breed in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.

Threatening processes for this species include:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future.
- Clearing of habitat for grazing, agriculture, forestry or other development.
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests.
- Secondary poisoning from rodenticides.
- Being hit by vehicles.

Powerful Owl

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (*Syncarpia glomulifera)*, Black She-oak (*Allocasuarina littoralis)*, Blackwood (*Acacia melanoxylon)*, Rough-barked Apple (*Angophora floribunda)*, Cherry Ballart (*Exocarpos cupressiformis)* and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Flying-foxes are important prey in some areas; birds comprise about ten-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

Threatening processes for this species include:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl.
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat.
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success.
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability.
- Road kills.
- Secondary poisoning.
- Predation of fledglings by foxes, dogs and cats.

Sooty Owl

Sooty Owls occur in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*). Nests in very large tree-hollows.

Threatening processes for this species include:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future.
- Clearing of habitat for grazing, agriculture, forestry or other development.
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests.
- Secondary poisoning from rodenticides.

Ground-dwelling Mammals

Long-nosed Potoroo

Long-nosed Potoroo inhabit coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.

Threatening processes for this species include:

- Habitat loss and fragmentation from land clearing for residential and agricultural development.
- Predation from foxes, wild dogs and cats.
- Too frequent fires or grazing by stock that reduce the density and floristic diversity of understorey vegetation.
- Logging or other disturbances that reduce the availability and abundance food resources, particularly hypogeous fungi, and ground cover.
- Unplanned clearing in areas where the species occurs on private property is likely to degrade the species' habitat.

- Removal of wild dogs and dingoes potentially exposes potoroos to other threats (competition from other species of wallaby / fox predation) due to removal of top order predator.

Spotted-tailed Quoll

The Spotted-tailed Quoll is recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Quolls are mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.

A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creek lines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

Threatening processes for this species include:

- Loss, fragmentation and degradation of habitat.
- Competition with introduced predators such as cats and foxes.
- Deliberate poisoning, shooting and trapping, primarily in response to chicken predation.
- Roadkill
- Poisoning from eating cane toads in the wild.

Macropods

Parma Wallaby

Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.

Threatening processes for this species include:

- Predation by foxes.
- Predation by domestic and wild dogs/dingos.
- Loss and fragmentation of habitat through clearing and under scrubbing.
- Inappropriate fire regime reducing or degrading habitat, especially as a result of overly frequent or intense fires and regular burning of forest margins.
- Climate change altering habitat and increasing risks associated with fire.
- Removal of the understorey and shrub layer by grazing stock.
- Predation by feral cats.
- Habitat degradation and grazing competition by feral horses, cattle, pigs and rabbits.
- Intensive forestry practices resulting in, or exacerbating, habitat loss and fragmentation.
- Habitat degradation and grazing competition by domestic stock.
- Vehicle strike.
- Lack of information about disease prevalence and susceptibility.

Red-legged Pademelon

Red-legged Pademelons inhabit forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub. Wet gullies with dense, shrubby ground cover provide shelter from predators. Animals disperse from dense shelter areas to feed from late afternoon to early morning, favouring native grasses and herbs on the edge of the forest. Also known to feed on fruits, young seedling leaves and stems, fungi and ferns.

Threatening processes for this species include:

- Loss or fragmentation of habitat due to land clearing and under scrubbing.
- Predation by domestic and wild dogs/dingos.
- Predation by foxes.
- Inappropriate fire regime reducing or degrading habitat, especially as a result of overly frequent or intense fires and regular burning of forest margins.
- Habitat degradation and grazing competition by feral horses, cattle, pigs, and rabbits.
- Predation by feral cats.
- Habitat degradation and grazing competition by domestic stock.
- Climate change altering habitat and increasing risks associated with fire.
- Intensive forestry practices resulting in, or exacerbating, habitat loss and fragmentation.
- Broad scale lantana removal resulting in habitat loss.
- Lack of information about disease prevalence and susceptibility.

Rufous Bettong

Rufous Bettongs inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter. They sleep during the day in cone-shaped nests constructed of grass in a shallow depression at the base of a tussock or fallen log. At night they feed on grasses, herbs, seeds, flowers, roots, tubers, fungi and occasionally insects.

Threatening processes for this species include:

- Changes to the grassy understorey by inappropriate burning and grazing.
- Competition from rabbits.
- Predation by feral cats and foxes, whose numbers appear to increase when dingoes are reduced through baiting.
- Loss of habitat through clearing, logging and collection of fallen timber.
- Poor knowledge of the species' abundance and distribution in the western parts of its range.

Arboreal mammals

Koala

In NSW, Koalas mainly occur on the central and north coasts, with populations on the western side of the Great Dividing Range. Habitat consists of eucalypt woodlands and forests, in which the Koala feeds on more than 70 eucalypt species and 30 non-eucalypt species. Preferred browse species differ across regions. In Lismore, Byron and Tweed LGAs, preferred food trees include Forest Red Gum (*Eucalyptus tereticornis*), Tallowwood (*E. microcorys*), Swamp Mahogany (*E. robusta*) and Small-fruited Grey Gum (*E. propinqua*), with several other species recognised as secondary feed trees.

Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size. Generally solitary, the Koala has complex social hierarchies based on a dominant

male with a territory that overlaps that of several females, with sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.

Threatening processes for this species include:

- Loss, modification and fragmentation of habitat.
- Predation by feral and domestic dogs.
- Intense fires that scorch or kill the tree canopy.
- Road-kills.
- Human-induced climate change, especially drought.

Squirrel Glider

Squirrel Gliders inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. They prefer mixed species stands with a shrub or Acacia mid-storey. Squirrel Gliders live in family groups of a single adult male one or more adult females and offspring and require abundant tree hollows for refuge and nest sites. The diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.

Threatening processes for this species include:

- Habitat loss and degradation.
- Fragmentation of habitat.
- Loss of hollow-bearing trees.
- Loss of understorey food resources.
- Inappropriate fire regimes.
- Reduction in food resources due to drought.
- Mortality due to entanglement on barbed wire.
- Occupation of hollows by exotic species.
- Mortality due to collision with vehicles.
- Predation by exotic predators.
- Changes in spatial and temporal distribution of habitat due to climate changes.

Yellow-bellied Glider

Yellow Bellied Gliders predominantly occur in tall mature Eucalypt Forest in areas typically with high rainfall and nutrient rich soils. Forest type preferences include tall montane, mixed coastal and dry escarpment forests, moist gullies and creek flats and tend to vary depending on latitude and elevation. Yellow-bellied Gliders feed primarily on plant and insect exudates including nectar from flowers, sap, honeydew and manna. Protein is acquired from pollen and insects. Distinctive V shaped scars indicate Yellow-bellied Glider feed trees where the animal bites or incises the trunk or limbs of preferred trees to encourage the edible sap to flow. This highly mobile species occupies a large home range between 20 to 85 hectares dispersing to find seasonally variable food resources. They depend on large hollow bearing trees for denning and breeding where family groups of two to six individuals have been recorded.

Threatening processes for this species include:

- Loss and fragmentation of habitat.
- Loss of hollow-bearing trees.
- Loss of feed trees
- Climate change and reduction in resources due to drought.

Southern Greater Glider

The Greater Glider is Australia's largest gliding marsupial, weighing approximately 900–1700 g and is distributed throughout forests and woodlands of eastern Australia from temperate eastern Victoria to tropical northeast Queensland (Taylor & Goldingay 2009). Greater Gliders feed almost exclusively on the foliage of eucalypts and use gliding locomotion to move between trees. Home ranges are commonly between 1 - 3 ha but may reach up to 11 ha in environments where hollow-bearing trees are limited (Smith et al. 2007, cited in Taylor & Goldingay 2009). Density estimates range from 0.1 to 3.8 individuals/ha (Henry 1984, Kehl and Borsboom 1984, Comport et al. 1996, Smith et al. 2007; cited in Taylor & Goldingay 2009).

Threats to the species include (refer Threatened Species Scientific Committee 2016):

- Habitat loss (through clearing, clearfell logging and the destruction of senescent trees due to prescribed burning) and fragmentation
- Too intense or frequent fires
- Timber production
- Climate change
- Barbed wire fencing (entanglement)
- Hyper-predation by owls
- Competition from sulphur-crested cockatoos

Flying-foxes

Eastern Tube-nosed Bat

Eastern Tube-nosed Bats favour streamside habitats within coastal subtropical rainforest and moist eucalypt forests with a well-developed rainforest understorey. They feed mainly on fruit and nectar from trees in the rainforest canopy and sometimes come close to human settlement to visit flowering or fruiting trees.

Threatening processes for this species include:

- Clearing and fragmentation of rainforest and wet eucalypt forest for agriculture and residential development.
- Habitat fragmentation and degradation from past land clearing for agriculture, forestry, and urban development reducing habitat availability and condition and food and water availability
- Degradation from weeds including lantana and vines suppressing regeneration of food trees.
- Destruction of Black Bean, an important food tree, because the seeds are toxic to cattle.
- Predation by cats particularly while foraging on low hanging fruit and flowers.
- Disturbance due to agricultural development, individuals getting caught on barbed wire fences near feeding and drinking areas (e.g. near orchards and dams).
- Alteration of habitat from climate change including structure, floristic composition, resource availability (water and food trees and palms), rainforest drying including gullies and streams.
- Monitoring is required to assess the species population trends over time
- Monitoring is required to assess the severity of threats.

Grey-headed Flying-fox (GHFF)

Grey-headed Flying-foxes (GHFF) forage within subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. GHFF feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines, as well as from cultivated gardens and orchards. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies,

close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. GHFF may travel up to 50 km from the camp to forage; commuting distances are more often <20 km.

Threatening processes for this species include:

- Clearing of woodlands for agriculture.
- Loss of roosting and foraging sites.
- Electrocution on powerlines, entanglement in netting and on barbed-wire.
- Heat stress.
- Conflict with humans.
- Incomplete knowledge of abundance and distribution across the species' range.

Microbats

Eastern Cave Bat

A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.

Threatening processes for this species include:

- Clearing and isolation of dry eucalypt forest and woodland, particularly about cliffs and other areas containing suitable roosting and maternity sites, mainly as a result of agricultural and residential development.
- Loss of suitable feeding habitat near roosting and maternity sites as a result of modifications from timber harvesting and inappropriate fire regimes usually associated with grazing.
- Pesticides and herbicides may reduce the availability of invertebrates, or result in the accumulation of toxic residues in individuals' fat stores.
- Damage to roosting and maternity sites from mining operations, and recreational activities such as caving.
- There is a strong likelihood that unrecorded populations could be unintentionally affected by land management actions.
- Probable predation by cats and foxes.
- Very little is known about the ecology, behaviour and habitat requirements.

Eastern Coastal Free-tailed Bat

Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

Threatening processes for this species include:

- Loss of hollow-bearing trees.
- Loss of foraging habitat.
- Application of pesticides in or adjacent to foraging areas.
- Artificial light sources spilling onto foraging and/or roosting habitat
- Large scale wildfire or hazard reduction burns on foraging and/or roosting habitat.

Eastern False Pipistrelle

The Eastern False Pipistrelle prefers moist habitats, with trees taller than 20 m. It generally roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Females are pregnant in late spring to early summer.

Threatening processes for this species include:

- Disturbance to winter roosting and breeding sites.
- Loss of roosting habitat, primarily hollow-bearing eucalypts.
- Loss and fragmentation of foraging habitat, particularly extensive areas of continuous forest and areas of high productivity.

Eastern Long-eared Bat

Occurs in lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest. Coastal rainforest and patches of coastal scrub are particularly favoured. Roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings.

Threatening processes for this species include:

- Development pressures in or near swamp, wet sclerophyll and rainforests resulting in habitat degradation, alterations to moisture regimes, and edge effects, and loss of connectivity
- Loss of hollow-bearing trees and stands of palms and rainforest trees used for roosting and maternity sites.
- Invasion of habitat by weeds, particularly by Bitou Bush on the coast.
- High frequency fire.
- Climate change resulting in degradation of habitat from forest drying and increasing likelihood of fire.
- Limited known sites for the species reducing NSW population viability.
- Predation from cats.
- Vehicle strike.
- Light pollution in and near habitat areas impacting species behaviour.

Golden-tipped Bat

The Golden-tipped Bat occurs in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. It is also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Roosting sites are mainly in rainforest gullies on small first- and second-order streams in usually abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified with an access hole on the underside. Bats may also roost under thick moss on tree trunks, in tree hollows, dense foliage and epiphytes.

Threatening processes for this species include:

- Loss of riparian rainforest for roosting and foraging habitat.
- Loss of understorey habitat on upper-slopes for foraging.
- Forestry operations that fragment habitat or result in loss of roosting habitat.
- Habitat fragmentation.
- Lack of knowledge of the threats to the species.
- Burning rainforest habitat.
- Loss of hollow bearing trees.
- Pesticides and other chemicals used in or adjacent to habitat areas.

- Exotic weeds, particularly lantana and vines, that degrade habitat and alter the structure of rainforest and adjacent wet and dry sclerophyll forest vegetation communities.

Greater Broad-nosed Bat

Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.

Threatening processes for this species include:

- Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.
- Although this species usually roosts in tree hollows, it has also been found in buildings.
- Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m.
- Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.
- Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.

Large and Little Bent-winged Bat

Bent-winged bats occur in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Roosting occurs in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Little Bentwinged-bats often share roosting sites with the Large Bent-winged Bat and, in winter, the two species may form mixed clusters.

In NSW, the largest maternity colony is in close association with a large maternity colony of Large Bent-winged Bats and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites/ maternity colonies are known in Australia.

Threatening processes for these species include:

- Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic.
- Destruction of caves that provide seasonal or potential roosting sites.
- Changes to habitat, especially surrounding maternity/ nursery caves and winter roosts.
- Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals.
- Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges.
- Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges.

- Introduction of exotic pathogens such as the White-nosed fungus.
- Hazard reduction and wildfire fires during the breeding season.
- Large scale wildfire or hazard reduction can impact on foraging resources.
- Poor knowledge of reproductive success and population dynamics.

Large-eared Pied Bat

Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.

Threatening processes for this species include:

- Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development.
- Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing.
- Damage to roosting and maternity sites from mining operations, and recreational caving activities.
- Use of pesticides.
- Disturbance to roosting areas by goats.

Yellow-bellied Sheathtail-bat

Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

Threatening processes for this species include:

- Disturbance to roosting and summer breeding sites.
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.
- Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.
- Pesticides and herbicides may reduce the availability of insects or result in the accumulation of toxic residues in individuals' fat stores.

Reptiles

Stephen’s Banded Snake

Stephens’ Banded Snake occupies rainforest and eucalypt forests and rocky areas up to 950 m in altitude on the coast and ranges. Stephens' Banded Snake is nocturnal, and shelters during the day between loose bark and tree trunks, amongst vines, or in hollow trunks and limbs, or in rock crevices and under rock slabs. Common prey includes frogs, lizards, birds and small mammals.

Threatening processes for this species include:

- Clearing and fragmentation of habitat.
- Forestry practices which result in loss of old or dead trees.

- Too frequent burning for fuel reduction or grazing management which destroys old and dead trees and removes understorey vegetation.
- Illegal collection of snakes from the wild.
- Poor knowledge of the species' habitat preferences

Amphibians

Fleay's Barred Frog

Occurs in rainforest and wet eucalypt forest of the escarpment and foothills, usually close to gravely streams. The species occurs along stream habitats from first to third order streams (i.e. small streams close to their origin through to permanent streams with grades of 1 in 50) but is not found in ponds or ephemeral pools. A nest is constructed in the shallow running water that occurs between pools in relatively wide, flat sections of the stream. Eggs are deposited in a shallow excavation in the stream bed or pasted directly onto bed rock.

Threatening processes for this species include:

- Clearing and fragmentation of areas of habitat for agriculture or development.
- Sedimentation of creeks resulting from upstream activities and cattle access.
- Changes in water flow patterns, either increased or decreased flows.
- Chytrid fungal disease.
- Timber harvesting and other forestry practices.
- Use of herbicides and chemicals (including sunscreen and soaps) near streams.
- Regular roadside slashing damaging critical breeding habitat and refugia.
- Reduction of leaf-litter and fallen log cover through burning.
- Cane toads use the same niche, competing for food and habitat; they may be a vector for disease and possibility predate on juveniles.
- Mistflower; causing changes in breeding habitat structure - clogging up gravel beds and constraining available space.
- Habitat disturbance and direct mortality from feral pigs.
- Habitat disturbance and trampling resulting from human visitation
- Trampling by domestic stock, particularly of oviposition sites.

Giant Barred Frog

Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, Giant Barred Frogs will also sometimes occur in other riparian habitats, such as those in drier forest or degraded riparian remnants, and even occasionally around dams. Breeding takes place from late spring to summer. Once eggs are laid and fertilised in the water, the female kicks them out of the water where they stick onto a suitable bank (e.g. overhanging or steeply sloped). Hatchlings drop or wriggle into the water. Tadpoles grow to about 11cm and it may take up to 14 months between egg laying and the completion of metamorphosis.

Although generally found within about 20m of the stream, outside the breeding season, the Giant Barred Frog may disperse away from the stream (e.g. 50m or further). It is a generalist feeder, with large insects, snails, spiders and frogs included in its diet.

Threatening processes for this species include:

- Much of the habitat of the Giant Barred Frog occurs in the lower reaches of streams that are also the focus of agricultural and rural residential activities. Clearance of riparian vegetation is a major threat in these environments.
- Tall, dense weed infestations can decrease the quality and amount of habitat available, particularly where there are canopy gaps in the riparian vegetation. Lantana and exotic grasses decrease habitat suitability.
- Reduction in water quality or alterations to flow patterns. Embryos and tadpoles can be vulnerable to siltation.
- Inadequate protection of riparian habitat during forestry activities.
- In some locations, the Giant Barred Frog is known to carry chronic infections of the fungal pathogen *Batrachochytrium dendrobatidis* that causes chytridiomycosis. This pathogen is a threat as it is a known cause of decline in frog species, however it is unclear whether the Giant Barred Frog is currently declining from this cause.
- Predation of individuals and disturbance of habitat or destruction of eggs by feral pigs.
- Damage to riparian habitats from grazing and physical disturbance by domestic stock.
- Small population sizes particularly within the south of the species range may make it susceptible to stochastic events and loss of genetic variation.

Green-thighed Frog

Green-thighed Frogs occur 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. It prefers wetter forests in the south of its range but extends into drier forests in northern NSW and southern Queensland. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among water plants, including water weeds. The larvae are free swimming**.**

Threatening processes for this species include:

- Changes to drainage patterns which reduce periodic local flooding.
- Damage to semi-permanent and ephemeral ponds and flood-prone vegetation.
- Clearing of habitat for development.
- Clearing of habitat for agriculture
- Habitat disturbance through timber harvesting.
- Reduction in water quality through pasture fertilisation.
- Reduction in habitat and water quality as a result of grazing
- Reduction of leaf-litter and cover of fallen logs through burning for agricultural purposes.

Loveridge's Frog

Loveridge's Frog favours subtropical and warm temperate rainforest and wet eucalypt forest, but also occurs in moist eucalypt forest where rocky outcropping creates surface water. The species is dependent on high moisture levels, occurring in the headwaters of small streams and about soaks where ground-water is continually present and close to the surface.

Threatening processes for this species include:

- Risk of local extinction due to small, scattered populations.
- Isolation of populations through clearing and forest fragmentation associated with agricultural and forestry practices.
- Infection by amphibian chytrid fungus.
- Reduction of moisture levels and reduced water quality from road-works, forestry activities, frequent burning associated with grazing management and trampling by domestic stock.

- Reduction of moisture levels caused by logging opening up the forest and drying out the ground litter, and forest management which changes old-growth forest to young even-aged stands, causing substantial water loss.
- Anthropogenic climate change altering microhabitat.
- Competition for habitat and other resources by the cane toad.
- Disturbance and degradation (e.g. substrate damage, turbidity) of habitat due to road/track maintenance.

Pouched Frog

Pouched frogs live in cool, moist rainforest, including Antarctic Beech, or moist eucalypt forest in mountainous areas, mostly above 800 m but have been found as low as 300m. They spend most of the time in damp leaf litter, or under rocks and rotten logs.

Threatening processes for this species include:

- Timber harvesting.
- Road construction and maintenance activities.
- Weed invasion in productive environments
- Removal of fallen logs and leaf litter through frequent fire, particularly fire associated with grazing management.
- Anthropogenic climate change
- Infection by amphibian chytrid fungus
- Drought and climate change leading to increased temperatures.
- Habitat damage from trampling by domestic stock.

a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Highly Mobile Birds

The TBHT would not involve removal of mature native vegetation and as such would not impact areas of nesting/ roosting habitat for any of the subject species. Vegetation removal required for the construction works would be minor in the context of the species home ranges or habitat requirements and no specific key resources (eg. figs) would require removal. Being highly mobile, none of the subject species would be likely to be impacted by the construction works (directly or indirectly). Human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Less Mobile Birds

Albert's Lyrebird would be impacted by disturbance and human presence during the construction period, with works unlikely to affect any key resources (foraging or breeding habitat) which do not occur widely within the project footprint. As for mobile birds, the effects of human impacts during operation of the TBHT are likely to be relatively low.

As such the proposal is unlikely to have an adverse effect on the life cycle of Albert's Lyrebird such that a viable local population would be placed at risk of extinction.

Habitat for the Pale-vented Bush-hen comprises streamside habitats and disturbed Lantana on adjacent private land. While minor Lantana removal would be required to upgrade the Nightcap Road, this would be negligible in a local context in regard to refuge habitat for the species. As for Albert's Lyrebird, the effects of human impacts during operation of the TBHT are likely to be relatively low. As such the proposal is unlikely to have an adverse effect on the life cycle of the Pale-vented Bush-hen such that a viable local population would be placed at risk of extinction.

Owls

The TBHT would not involve removal of mature native vegetation and as such would not impact areas of nesting/ roosting habitat for any of the subject species. Vegetation removal required for the construction works would be minor in the context of the species home ranges or habitat requirements and habitat for prey items would be unlikely to be significantly affected. Being highly mobile, none of the subject species would be likely to be impacted by the construction works (directly or indirectly). Human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Ground-dwelling Mammals

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. These impacts would form a negligible part of the foraging and sheltering requirements of any of the subject macropod species. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Arboreal mammals

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. No hollow-bearing trees which may be used for denning or breeding would be removed. These impacts would form a negligible part of the foraging and sheltering requirements of any of the subject arboreal species, and dispersal ability would not be impaired. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Flying-foxes

Disturbance for the TBHT would not affect resources (foraging, shelter/camps) for nectar-feeding bats. Night-time human disturbance (noise, light) would limited in range and expected to be at low levels; such disturbance would be unlikely to hinder foraging activity. As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Microbats

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. No hollow-bearing trees which may be used for roosting or breeding would be removed. These impacts would form a negligible part of the foraging and sheltering requirements of any of the subject microbats, and dispersal ability would not be impaired. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Reptiles

Impacts to rainforest and wet sclerophyll forest (habitat for Stephen's Banded Snake) will be minimised in a spatial sense (9.72 km of the TBHT occurs within undisturbed habitats with intact litter and ground layers) and result in negligible disturbance to areas of leaf litter which may harbour prey items. No hollow-bearing trees would be removed and any fallen timber will be removed and relocated (ie. there will be no net reduction of shelter sites). Disturbance within rocky areas would be minimal with regard to impacting potential shelter areas.

As such the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of Stephen's Banded Snake would be placed at risk of extinction.

Amphibians

Impacts to rainforest and wet sclerophyll forest will be minimised in a spatial sense (9.72 km of the TBHT occurs within undisturbed habitats with intact litter and ground layers) and result in discreet localised disturbance to watercourses (stepping stones) and areas of leaf litter. These impacts are negligible in the context of available habitats in the reserves. While there is potential for reductions in water quality during construction and operation of the TBHT this can be managed by standard erosion/sediment controls and promoting best practice to patrons of the track (to reduce any pollution entering streams) to minimise harm to sensitive environments.

As such the proposal is unlikely to have an adverse effect on the life cycle of amphibian species such that a viable local population would be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Refer previous assessment re: lowland rainforest.

c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

- Highly Mobile Birds: Habitat loss from within the greatest areas of impacts (~ 8km) would be very low in the context of reserved land in the locality and would not affect any core foraging, roosting, refuge or breeding habitat. Impacts from other aspects of the TBHT (construction in modified habitats), occupation would be unlikely to significantly affect habitat for any of the subject species.
- Less Mobile Birds: The minor works required for construction of the TBHT and camps would not disturb any significant foraging or nesting habitat for Albert's Lyrebird or the Pale-vented Bush-hen in the context of extensive areas of conservation reserved land.
- Owls: The minor works required for construction of the TBHT and camps would not significantly disturb foraging, roosting or nesting habitat for the subject owl species and would be unlikely to affect the prey base on which these species depend.
- Ground-dwelling mammals: The minor works required for construction of the TBHT and camps would not significantly disturb foraging or refuge habitat for the subject species in the context of extensive areas of conservation reserved land.
- Macropods: The minor works required for construction of the TBHT and camps would not significantly disturb foraging or refuge habitat for the subject species in the context of extensive areas of conservation reserved land.
- Arboreal mammals: No tree removal would be required, and no hollow-bearing trees would require removal. The TBHT would not significantly affect the subject species in the context of extensive areas of conservation reserved land.
- Flying-foxes: The TBHT would be unlikely to have any impact any foraging or roosting resources for nectar-feeding bats in the context of extensive areas of conservation reserved land.
- Microbats: Foraging habitat for all species would be unaffected, and key roost habitats such as hollow-bearing trees and rock areas/caves are avoided. The small scale loss of micro habitats (birds nest, vine thickets) which may be utilised as roost habitat would be negligible in the context of extensive areas of conservation reserved land.
- Reptiles: Disturbance to the litter layer, minor removal of shrubs and vine thickets and selective rock removal would be unlikely to affect habitat for Stephens Banded Snake in the context of extensive areas of conservation reserved land.
- Amphibians: Localised impacts to watercourses and adjacent environments during the construction phase would be very minor over the length of the TBHT and could be confidently managed via standard construction mitigation measures. Ongoing operational impacts from reduced water quality would be unlikely to affect habitat for the subject species in the context of extensive areas of conservation reserved land.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The TBHT (and camps) require small and/or lineal disturbance to habitat for the subject species, with the majority of the walking track already modified or fragmented by historic works. Additional works required for the TBHT are at a small scale and would not reduce the ability for dispersal, breeding or genetic exchange between any of the subject species.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

- Highly Mobile Birds: The habitat to be removed/modified is unlikely to be important for foraging, roosting, refuge or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Less Mobile Birds: The habitat to be removed/modified is unlikely to be important for foraging or breeding for Albert's Lyrebird or Pale-vented Bush-hen in the context of extensive areas of conservation reserved land.

- Owl: The habitat to be removed/modified is unlikely to be important for foraging, roosting or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Ground-dwelling mammals: The habitat to be removed/modified is unlikely to be important for foraging, refuge or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Macropods: The habitat to be removed/modified is unlikely to be important for foraging, refuge or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Arboreal mammals: The habitat to be removed/modified is unlikely to be important for foraging, refuge, denning or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Flying-foxes: The habitat to be removed/modified is unlikely to be important for foraging or roosting for either of the subject species in the context of extensive areas of conservation reserved land.
- Microbats: The habitat to be removed/modified is unlikely to be important for foraging, roosting or breeding for any microbat species in the context of extensive areas of conservation reserved land.
- Reptiles: The habitat to be removed/modified is unlikely to be important for foraging or breeding for Stephen's Banded Snake in the context of extensive areas of conservation reserved land.
- Amphibians: The habitat to be removed/modified is unlikely to be important for foraging, refuge or breeding for any of the subject amphibian species in the context of extensive areas of conservation reserved land.

d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No areas of outstanding biodiversity value listed in the BC Act occur at or in proximity to the site.

e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A key threatening process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species or ecological communities. The current list of KTP under the BC Act, and whether the Proposal is recognised as a KTP is shown in **Table G.2** (below).

Table G.2 Key Threatening Processes

Key Threatening Process (as per Schedule 4 of the BC Act)	***Is the activity characteristic of, or likely to increase the risk of a key threatening process?***		
	Likely	***Possible***	***Unlikely***
Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic climate change			✓
Bushrock removal	✓		
Clearing of native vegetation	✓		
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition and habitat degradation by feral goats (*Capra hircus*)			✓
Competition from feral honeybees (*Apis mellifera*)			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments			✓

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Forest eucalypt dieback associated with over-abundant psyllids and bell miners			✓
Habitat degradation by Feral Horses, *Equus caballus*			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of red imported fire ants (*Solenopsis invicta*)			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of Lantana (*Lantana camara*)			✓
Invasion of native plant communities by African Olive (*Olea europaea L. subsp. cuspidata*)			✓
Invasion of native plant communities by *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*) into NSW		✓	
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees		✓	
Loss or degradation (or both) of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)		✓	
Predation by the European Red Fox (*Vulpes vulpes*)		✓	
Predation by the feral cat (*Felis catus*)			✓
Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)			✓
Removal of dead wood and dead trees	✓		

Several KTPs may apply to the construction and operation of the TBHT:

- *Bushrock removal*: Bush rock will be removed or relocated at strategic locations where rock is already disturbed or will be unearthed from excavation or has fallen from the cliff face at Minyon Falls (refer to **Section 3.2.3**). The extent of bush rock removal will be negligible in the context of the overall TBHT and is unlikely to represent important refuge for any threatened species as these areas are already disturbed. The removal of bush rock is unlikely to substantially affect habitat for threatened amphibians or Stephen's Banded Snake in the context of the overall TBHT.
- *Clearing of Native Vegetation:* refers to the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. Construction works would require clearing of shrubs, vines and groundcovers at campgrounds of ~ 0.07ha and over a distance of approximately 14.39 km (estimated area of ~ 2.88 ha), with nominal vegetation disturbance required to adapt existing tracks and trails and install facilities at the three camps. Contributions to this KTP are therefore very minor in the context of three large conservation reserves.
- *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*: the existing levels of chytrid in the local amphibian population is not known. This threat would be addressed by adoption and implementation of standard hygiene protocols during construction.

- *Infection of native plants by Phytophthora cinnamomic*: Phytophthora is already present within all reserves. The operation and construction of the TBHT would be unlikely to increase the incidence of Phytophthora such that any of the subject species (or lowland rainforest) would be significantly affected.
- *Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae*: introduction and transmission of Myrtle Rust is a concern for the project but can be managed by standard control and minimisation measures during construction and addressed by education on best practice management during operations.
- *Invasion, establishment and spread of Lantana (Lantana camara)*: Lantana already occurs at low densities in select areas of the TBHT. The construction and operation of the project would be unlikely to significantly increase the incidence of Lantana such that it would significantly affect threatened flora or communities.
- *Invasion of native plant communities by exotic perennial grasses*: Exotic grasses (mostly Broad-leaved paspalum) are common along track verges in some disturbed areas. There is potential that patrons may spread grass seed along the track and into areas of native vegetation. There is little risk of native grass invasion affecting any of the subject threatened flora or rainforest TEC due to low light conditions being unfavourable to exotic grasses.
- *Invasion of the Yellow Crazy Ant (Anoplolepis gracilipes) into NSW*: Yellow Crazy Ants have been recorded in the Lismore region and have potential to be transported to the site by machinery during the construction phase. Adoption and maintenance of appropriate hygiene procedures would address this issue.
- *Loss of hollow-bearing trees*: no standing hollow-bearing trees would require removed for the construction works. Timber 'deadfalls' require clearing across old snig tracks along parts of the TBHT and some fallen trees may contain small hollows; the importance of these habitats at ground level (ie. accessed by predators) is likely to be very low.
- *Predation and hybridisation by feral dogs (Canis lupus familiaris)/Predation by the European Red Fox (Vulpes vulpes)*: The TBHT will improve opportunities for dispersal by feral animals such as wild dogs and foxes. However, the majority of the TBHT already occurs and there is a large network of roads and informal pathways throughout all three reserves from historic operations. As such, contributions to this KTP are expected to be minor.
- *Removal of dead wood and dead trees*: Fallen timber is common along less well maintained tracks and will require removal and relocation. The impacts of these works are unlikely to be significant to any of the subject species.

Conclusion

It is considered unlikely that the local population of any of the subject species would be placed at significant risk of extinction as a result of the proposal.

Appendix H

Significant Impact Assessment (EPBC Act)

Based on field results and the potential occurrence assessment (fauna only), this Significant Impact Assessment has been prepared in accordance with the *Matters of National Environmental Significance Significant impact guidelines* (v1.1; DoE 2013).

Several species/ communities listed in the EPBC Act have been recorded within or are considered as potentially occurring within the TBHT footprint (refer **Table H.1**).

In addition, approximately 5 km of the TBHT occurs within the 'Gondwana Rainforests of Australia' World Heritage Area (WHA) and assessment of the natural and cultural values of the WHA is required. The WHA is also a registered Natural Heritage Place.

Table H.1 EPBC Act listed species/communities recorded at or potentially occurring on the TBHT

Scientific name	*Common name*	*EPBC Act listing*
FLORA/TECs		
Corokia whiteana	Corokia	Vulnerable
Endiandra hayesii	Rusty Rose Walnut	Vulnerable
Hicksbeachia pinnatifolia	Red Boppel Nut	Vulnerable
Macadamia tetraphylla	Rough-shelled Bush Nut	Vulnerable
Owenia cepiodora	Onion Cedar	Vulnerable
Rhodamnia rubescens	Scrub Turpentine	Critically Endangered
Symplocos baeuerlenii	Small-leaved Hazelwood	Vulnerable
Syzygium hodgkinsoniae	Red Lilly Pilly	Vulnerable
Uromyrtus australis	Peach Myrtle	Endangered
n/a	Lowland Rainforest of Subtropical Australia	Critically Endangered
FAUNA		
Calyptorhynchus lathami lathami	Glossy Black Cockatoo	Vulnerable
Dasyurus maculatus	Spotted-tailed Quoll	Endangered
Mixophyes fleayi	Fleay's Barred Frog	Endangered
Mixophyes iteratus	Giant Barred Frog	Endangered
Petauroides volans	Southern Greater Glider	Endangered
Phascolarctos cinereus	Koala	Endangered
Potorous tridactylus	Long-nosed Potoroo	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable

The Significant Impact Guidelines (SIG) assess species and communities under their relevant listing criteria (i.e. vulnerable, endangered, critically endangered). Five-part tests have been completed for all these species as per BC Act requirements (refer **Appendix H**). However, significant impact criteria differ between the two Acts and endangered and critically endangered species/communities listed in the EPBC Act are subject to a more rigorous assessment than that required under the BC Act (which doesn't discriminate between listing status).

On this basis a Significant Impact Assessment has been completed for all endangered and critically endangered species/communities listed in **Table H.1** (i.e. Peach Myrtle, Scrub Turpentine, Lowland Rainforest of Subtropical Australia, Spotted-tailed Quoll, Fleay's Barred Frog, Giant Barred Frog, Greater Glider) and the 'Gondwana Rainforests of Australia' World Heritage Area (WHA) and Natural Heritage Place.

Significant Impact Assessment - World Heritage properties

World Heritage properties are places with natural or cultural heritage values which are recognised to have outstanding universal value. Approval under the EPBC Act is required for any action occurring within or outside a declared World Heritage property that has, will have, or is likely to have a significant impact on the World Heritage values of the World Heritage property.

An action is likely to have a significant impact on the World Heritage values of a declared World Heritage property if there is a real chance or possibility that it will cause:

- *one or more of the World Heritage values to be lost*
- *one or more of the World Heritage values to be degraded or damaged, or*
- *one or more of the World Heritage values to be notably altered, modified, obscured or diminished.*

World Heritage properties with natural heritage values

An action is likely to have a significant impact on natural heritage values of a World Heritage property if there is a real chance or possibility that the action will affect the following values:

Values associated with geology or landscape

- *damage, modify, alter or obscure important geological formations in a World Heritage property*
- *damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a World Heritage property*
- *modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes, in a World Heritage property*
- *divert, impound or channelise a river, wetland or other water body in a World Heritage property, and*
- *substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property.*

Biological and ecological values

- *reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property*
- *fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property*
- *cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property, and*
- *fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property.*

Wilderness, natural beauty or rare or unique environment values

- *involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values, and*
- *introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values.*

NOTE: the Gondwana Rainforests of Australia (GDA) World Heritage Area includes approximately 40 separate reserves located between Newcastle and Brisbane on the east coast of Australia and covers a total area of approximately 370,000 ha. Nightcap NP forms only a small portion of the total WHA, and GDA within the NP covering an area of approximately 4,900 ha. The 5 km of the TBHT within the WHA utilises the existing Historic Nightcap Track, an established walking track established decades previously.

An assessment of the potential impacts on the natural heritage values of the Gondwana Rainforests WHA within Nightcap NP is provided in **Table H.2**.

World Heritage properties with cultural heritage values

An action is likely to have a significant impact on cultural heritage values of a World Heritage property if there is a real chance or possibility that the action will affect the following values:

Historic heritage values

- *permanently remove, destroy, damage or substantially alter the fabric of a World Heritage property*
- *extend, renovate, refurbish or substantially alter a World Heritage property in a manner which is inconsistent with relevant values*
- *permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a World Heritage property*
- *involve activities in a World Heritage property with substantial and/or long-term impacts on its values*
- *involve construction of buildings or other structures within, adjacent to, or within important sight lines of, a World Heritage property which are inconsistent with relevant values, and*
- *make notable changes to the layout, spaces, form or species composition in a garden, landscape or setting of a World Heritage property which are inconsistent with relevant values.*

Other cultural heritage values including Indigenous heritage values

- *restrict or inhibit the existing use of a World Heritage property as a cultural or ceremonial site causing its values to notably diminish over time*
- *permanently diminish the cultural value of a World Heritage property for a community or group to which its values relate*
- *alter the setting of a World Heritage property in a manner which is inconsistent with relevant values*
- *remove, damage, or substantially disturb cultural artefacts, or ceremonial objects, in a World Heritage property, and*
- *permanently damage or obscure rock art or other cultural or ceremonial features with World Heritage values.*

An assessment of the potential impacts on the cultural heritage values of the Gondwana Rainforests WHA within Nightcap NP is provided in **Table H.3**.

Note: **Table H.3** was reviewed by Tim Hill (Everick Heritage) to ensure consistency with heritage matters.

Table H.2 Potential impacts of the Activity on the natural heritage values of the Gondwana Rainforests WHA

Values	*Potential impacts*
Geology or landscape values	
damage, modify, alter or obscure important geological formations in a World Heritage property	The Activity will not result in any damage, modify, alter or obscure important geological formations within the WHA in Nightcap NP.
damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a World Heritage property	No substantial works other than minor adjustments to the existing walking track (Historic Nightcap Track) will occur within the WHA. No camps are sited within the WHA and no earthworks, excavation or other substantial works will occur.
modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes, in a World Heritage property	The degree of works within the WHA will be very minor, as the TBHT utilises an existing walking track (Historic Nightcap Track). Any amendments to the track will be constructed sensitively (by hand) and erosion and sediment controls will be established and maintained for the duration of construction to ensure environmental impacts are minimised.
divert, impound or channelise a river, wetland or other water body in a World Heritage property	Nil
substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property	Nil. As noted, the impacts within WHA are at a very small scale and erosion and sediment controls will mitigate the potential for environmental impacts.
Biological and ecological values	
reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property	The relatively minor nature of the Activity would result in small scale disturbance within the context of a substantial area of NPWS conservation reserve. Within the WHA, works will be extremely minor due to utilisation of the existing Historic Nightcap Track and no works in undisturbed habitats will occur. As such, the Activity will not reduce the diversity or modify the composition of plant and animal species within the WHA.
fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property	Refer above. The TBHT utilises an existing walking track within the WHA, and no further fragmentation of habitat will occur.
cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property	Within the WHA, works will be extremely minor due to utilisation of the existing Historic Nightcap Track and no works in undisturbed habitats will occur. On this basis there is little potential for the Activity resulting in a long-term reduction in rare, endemic or unique plant or animal populations or species in the WHA.
fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property	Refer previous responses.
Wilderness, natural beauty or rare or unique environment values	
involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values	Works within the WHA will be completed sensitively and at a small scale, with minor works required to improve the existing Historic Nightcap Track walking track. Works required not significantly impact the values of the WHA.

Values	*Potential impacts*
introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values	Intrusive elements of the construction process within the WHA include short-term noise and odours (eg. vehicle emissions). These would have no lasting impacts on the values of the WHA. Once operational, the TBHT would have negligible intrusive impacts within the WHA environments apart from occasional noise associated with track maintenance.

Table H.3 Potential impacts of the Activity on the cultural heritage values of the Gondwana Rainforests WHA

Values	*Potential impacts*
Historic heritage values	
permanently remove, destroy, damage or substantially alter the fabric of a World Heritage property* ** physical material including structural elements and other components, fixtures, fittings, contents and items with historic value*	Nil
extend, renovate, refurbish or substantially alter a World Heritage property in a manner which is inconsistent with relevant values	Nil
permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a World Heritage property	As noted, works within the WHA will be completed sensitively and at a small scale, with minor works required to improve the existing Historic Nightcap Track walking track. While the 5 km of the TBHT within WHA occurs in proximity to Aboriginal heritage sites, no impacts to these sites would occur. NOTE: being a walking track the TBHT is consistent with the heritage values of the Historic Nightcap Track and will provide opportunities for interpretation of heritage values.
involve activities in a World Heritage property with substantial and/or long-term impacts on its values	The TBHT would not have substantial and/or long-term impacts on cultural values within the WHA/ Historic Nightcap Track as it utilises an existing walking track and impacts from construction and operation (intensification of use) would not affect cultural heritage values.
involve construction of buildings or other structures within, adjacent to, or within important sight lines of, a World Heritage property which are inconsistent with relevant values	Nil. No structures will be built within the WHA.
make notable changes to the layout, spaces, form or species composition in a garden, landscape or setting of a World Heritage property which are inconsistent with relevant values	Nil
Other cultural heritage values including Indigenous heritage values	
restrict or inhibit the existing use of a World Heritage property as a cultural or ceremonial site causing its values to notably diminish over time	The WHA is within land of the Widjabul Wia-bal People and is subject to a Native Title Claim. The TBHT will not restrict or inhibit the existing use of land within the WHA for the Widjabul Wia-bal.

Values	Potential impacts
permanently diminish the cultural value of a World Heritage property for a community or group to which its values relate	As noted, impacts to the WHA are negligible in the context of Nightcap NP and more broadly (within 39 other reserves in eastern Australia). No cultural heritage values will be permanently diminished. The track design has a minimal footprint and the construction method is considered to be reversible or consistent with the natural rocky landscape.
alter the setting of a World Heritage property in a manner which is inconsistent with relevant values	Nil. The TBHT is consistent with the existing landscape values of natural bushland and the existing walking track.
remove, damage, or substantially disturb cultural artefacts, or ceremonial objects, in a World Heritage property	Nil. No cultural artefacts or ceremonial objects will be removed as a result of the TBHT occurring within the WHA.
permanently damage or obscure rock art or other cultural or ceremonial features with World Heritage values	Works for the TBHT are minor in the context of the WHA and no rock art or other cultural or ceremonial features would be damaged or obscured by the minor improvements to the existing walking track.

Significant Impact Assessment - Natural Heritage places

The National Heritage List contains places or groups of places with outstanding heritage value to Australia - whether natural, Indigenous or historic or a combination of these. Approval under the EPBC Act is required for any action occurring within, or outside, a National Heritage place that has, will have, or is likely to have a significant impact on the National Heritage values of the National Heritage place.

An action is likely to have a significant impact on the National Heritage values of a National Heritage place if there is a real chance or possibility that it will cause:

- *one or more of the National Heritage values to be lost*
- *one or more of the National Heritage values to be degraded or damaged, or*
- *one or more of the National Heritage values to be notably altered, modified, obscured or diminished.*

The significant impact criteria for Natural Heritage places are identical for World Heritage properties (refer previous pages), with the exception of matters of Indigenous heritage values - these are addressed below.

National Heritage places with Indigenous heritage values

An action is likely to have a significant impact on Indigenous heritage values of a National Heritage place if there is a real chance or possibility that the action will:

- *restrict or inhibit the continuing use of a National Heritage place as a cultural or ceremonial site causing its values to notably diminish over time*
- *permanently diminish the cultural value of a National Heritage place for an Indigenous group to which its National Heritage values relate*
- *alter the setting of a National Heritage place in a manner which is inconsistent with relevant values*
- *remove, destroy, damage or substantially disturb archaeological deposits or cultural artefacts in a National Heritage place*
- *destroy, damage or permanently obscure rock art or other cultural or ceremonial, artefacts, features, or objects in a National Heritage place*
- *notably diminish the value of a National Heritage place in demonstrating creative or technical achievement*
- *permanently remove, destroy, damage or substantially alter Indigenous built structures in a National Heritage place, and*
- *involve activities in a National Heritage place with substantial and/or long-term impacts on the values of the place.*

An assessment of the potential impacts on the Indigenous heritage values of the Gondwana Rainforests National Heritage place within Nightcap NP is provided in **Table H4**.

Note: **Table H4** was reviewed by Tim Hill (Everick Heritage) to ensure consistency with heritage matters.

Table H.4 Potential impacts of the Activity on Indigenous heritage values of the Gondwana Rainforests National Heritage place

Values	*Potential impacts*
restrict or inhibit the existing use of a National Heritage place as a cultural or ceremonial site causing its values to notably diminish over time	The National Heritage place (NHP) is within land of the Widjabul Wia-bal People and is subject to a Native Title Claim. The TBHT will not restrict or inhibit the existing use of land within the NHP for the Widjabul Wia-bal.
permanently diminish the cultural value of a National Heritage place for a community or group to which its National Heritage values relate	As noted, impacts to the NHP are negligible in the context of Nightcap NP and more broadly (within 39 other reserves in eastern Australia). No Indigenous heritage values will be permanently diminished. The track design has a minimal footprint and the construction method is considered to be reversible or consistent with the natural rocky landscape.
alter the setting of a National Heritage place in a manner which is inconsistent with relevant values	Nil. The TBHT is consistent with the existing landscape values of natural bushland and the existing walking track.
remove, destroy, damage or substantially disturb archaeological deposits or cultural artefacts in a National Heritage place	Nil. No archaeological deposits or cultural artefacts will be removed, destroyed, damaged or substantially disturbed as a result of the NHP occurring within the TBHT.
destroy, damage or permanently obscure rock art or other cultural or ceremonial, artefacts, features, or objects in a National Heritage place	Works for the TBHT are minor in the context of the WHA and no rock art or other cultural or ceremonial features would be damaged or obscured by the minor improvements to the existing walking track.
notably diminish the value of a National Heritage place in demonstrating creative or technical achievement	N/A
permanently remove, destroy, damage or substantially alter Indigenous built structures in a National Heritage place	N/A. No Indigenous built structures occur in the National Heritage place.
involve activities in a National Heritage place with substantial and/or long-term impacts on the values of the place	Once constructed, the TBHT will operate as a 'low key' remote walking track which is unlikely to intrude upon the existing values of the NHP. This is particularly relevant in the context of utilising an existing public walking track and the minor intensification of existing usage.

Significant Impact Assessment - Critically endangered and endangered species listed in the EPBC Act

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

- *lead to a long-term decrease in the size of a population*
- *reduce the area of occupancy of the species*
- *fragment an existing population into two or more populations*
- *adversely affect habitat critical to the survival of a species*
- *disrupt the breeding cycle of a population*
- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
- *introduce disease that may cause the species to decline, or*
- *interfere with the recovery of the species.*

Definitions: A 'population of a species' is an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- geographically distinct regional population, or collection of local populations, or
- a population, or collection of local populations, that occurs within a particular bioregion.

Assessments have been completed for six endangered species (Peach Myrtle, Spotted-tailed Quoll, Fleay's Barred Frog, Giant Barred Frog, Grater Glider and Koala) and one critically endangered species (Scrub Turpentine) listed in the EPBC Act as follows. Species profiles are provided in **Appendix G** (five-part tests).

An assessment of the potential impact of the TBHT on the subject species (as above) with reference to the significant impact criteria follows.

Is there possibility that the activity will:

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

Peach Myrtle: the TBHT will pass through or proximate to small areas of known habitat for Peach Myrtle, however no plants will be directly impacted with the implementation of various mitigation strategies in the construction methodology (ecologist present to guide works in sensitive locations). Transmission of Myrtle Rust is a key threat to Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of Peach Myrtle.

Scrub Turpentine: the TBHT will pass through or proximate to small areas of known habitat for Scrub Turpentine, however no plants will be directly impacted with the implementation of various mitigation strategies in the construction methodology (ecologist present to guide works in sensitive locations). Transmission of Myrtle Rust is a key threat to Peach Myrtle, with the TBHT increasing the potential for

infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

No other sub-populations of Scrub Turpentine within the three reserves would be affected directly or indirectly. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of Scrub Turpentine.

Spotted-tailed Quoll: Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. No hollow-bearing trees which may be used for denning or breeding would be removed. These impacts would form a negligible part of the foraging and sheltering requirements of any of the Spotted-tailed Quoll and dispersal ability would not be impaired over the extensive home ranges occupied by the species. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of the Spotted-tailed Quoll.

Koala

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. Dispersal ability would not be impaired over the home ranges occupied by the species. The TBHT would not result in any loss of mature trees and human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of the Koala.

Southern Greater Glider

Greater Gliders reside within Nightcap NP, Mt Jerusalem NP and Whian Whian SCA. They occupy a small area of habitat in the context of the species extensive home range (northern Queensland to southern Victoria), where the species is estimated to occupy ~ 16,000 km² within an area of occurrence of ~ 1,500 000 km² (Threatened Species Scientific Committee 2016). The species is also considered widespread and common in north-eastern New South Wales (Kavanagh 2004). Gliders in the locality would be unlikely to represent a key source population for breeding or dispersal, would be unlikely to be necessary for maintaining genetic diversity and the TBHT and local area are not at the extent of the species' distributional limits. The TBHT would not result in any loss of mature trees (including hollow-bearing trees) and hence impacts on habitat of the local Greater Glider population are expected to be negligible.

Fleay's & Giant Barred Frog: the TBHT requires minor localised works within several watercourses and at bridge locations which may support Fleay's & Giant Barred Frog. Direct impacts to the species habitat would be negligible, and implementation and maintenance of erosion and sediment control would minimise potential for downstream water quality impacts during and post construction. Potential negative impacts to water quality from patrons of the track would be minimised by educational information and signage. On this basis the construction and operation of the TBHT would be unlikely to lead to a long-term decrease in the size of the local population of Fleay's & Giant Barred Frog within any of the affected catchments in the context of the three reserves.

- *reduce the area of occupancy of the species?*

Peach Myrtle: the minor works required for the TBHT would not result in any significant reduction of warm-temperate rainforest which would reduce the area of occupancy of the species.

Scrub Turpentine: the minor works required for the TBHT would not result in any significant reduction of sclerophyll forest or rainforest communities which would reduce the area of occupancy of the species.

Spotted-tailed Quoll, Koala, Southern Greater Glider: substantial areas of habitat of several thousand hectares occurs for the species within the three reserves. The TBHT would not reduce the area of occupancy of the species in this context.

Koala

The relatively minor works required for the TBHT would not result in any significant reduction of sclerophyll forest which would reduce the area of occupancy of the species.

Southern Greater Glider

The relatively minor works required for the TBHT would not result in any significant reduction of sclerophyll forest which would reduce the area of occupancy of the species.

Fleay's & Giant Barred Frog: the relatively minor works required for the TBHT would not result in any significant reduction of rainforest/watercourse habitats which would reduce the area of occupancy of either of the subject species.

- *fragment an existing population into two or more populations?*

Peach Myrtle: the TBHT would not result in any significant fragmentation of rainforest habitat for Peach Myrtle which would affect pollination, breeding or reproductive potential.

Scrub Turpentine: the TBHT would not result in any significant fragmentation of habitat for Scrub Turpentine which would affect pollination, breeding or reproductive potential.

Spotted-tailed Quoll: the TBHT would not result in any fragmentation of habitat for the Spotted-tailed Quoll in a local context and extensive areas of habitat within the three reserves would be unaffected.

Koala

The TBHT would not fragment habitat for the Koala; no canopy trees will require removal and no barriers to movement or dispersal would occur.

Southern Greater Glider

The TBHT would not fragment habitat for the Greater Glider; no canopy trees will require removal and no barriers to movement or dispersal would occur.

Fleay's & Giant Barred Frog: the TBHT would not result in any significant fragmentation of rainforest habitat for either of the subject species which would affect breeding or reproductive potential.

- *substantial adversely affect habitat critical to the survival of a species?*

Peach Myrtle: based on the low impacts of construction, the TBHT would not result in any significant impacts to rainforest habitat for Peach Myrtle which is critical to the survival of the species.

Scrub Turpentine: based on the low impacts of construction, the TBHT would not result in any significant impacts to habitat for Scrub Turpentine which is critical to the survival of the species.

Spotted-tailed Quoll: based on the likelihood of very low impacts to habitat for the Spotted-tailed Quoll, the TBHT would not result in any significant impacts to habitat which is critical to the survival of the species.

Koala: based on the low impacts of construction and no removal of canopy trees, the TBHT would not result in any significant impacts to habitat which is critical to the survival of the species.

Southern Greater Glider: Due to the extensive range occupied by the species, the low scale impacts of the TBHT would not adversely affect habitat critical to the survival of the Greater Glider.

Fleay's & Giant Barred Frog: the TBHT requires minor localised works within several watercourses and bridge locations which may provide habitat for Fleay's & Giant Barred Frog. Direct impacts to potential habitat would be negligible, and implementation and maintenance of erosion and sediment control would minimise potential for downstream water quality impacts during and post construction. On this basis the TBHT would be unlikely to substantially adversely affect habitat critical to the survival of either species in the context of the three reserves.

- *disrupt the breeding cycle of a population?*

Peach Myrtle: reproduction of Peach Myrtle is unlikely to be affected by the TBHT during either construction or operation as no individuals would be removed or disturbed. While infection by Myrtle Rust poses a significant risk of hampering reproductive success, prescribed mitigation measures will minimise the likelihood of Myrtle Rust infection. No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly.

Scrub Turpentine: reproduction of Scrub Turpentine is unlikely to be affected by the TBHT during either construction or operation as no individuals would be removed or disturbed. While infection by Myrtle Rust poses a significant risk of hampering reproductive success, prescribed mitigation measures will minimise the likelihood of Myrtle Rust infection. No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly. Scrub Turpentine

Spotted-tailed Quoll: based on the likelihood of very low impacts to habitat for the Spotted-tailed Quoll, the TBHT would be unlikely to disrupt the breeding cycle of a population of the species in a local context.

Koala: based on the likelihood of very low impacts to habitat for the Koala, the TBHT would be unlikely to disrupt the breeding cycle of a population of the species in a local context.

Southern Greater Glider: The TBHT construction process would be unlikely to disrupt breeding given the large areas of habitat available within the three reserves and where hollow-bearing trees are reasonably common.

Fleay's & Giant Barred Frog: the minor works to watercourse habitat would be completed during periods of low or no flow (autumn/winter/spring) and would be unlikely to disrupt breeding success (late spring to summer) of either species in the context of the three reserves.

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

Peach Myrtle: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Peach Myrtle is likely to decline. No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly.

Scrub Turpentine: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Scrub Turpentine is likely to decline. No other sub-populations of Scrub Turpentine within the three reserves would be affected directly or indirectly.

Spotted-tailed Quoll: based on the likelihood of very low impacts to habitat for the Spotted-tailed Quoll, the TBHT would be unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the Spotted-tailed Quoll is likely to decline.

Koala: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Koalas are likely to decline.

Southern Greater Glider: The negligible habitat loss that the TBHT would incur (regrowth, vines, shrubs and groundcovers) would not have an impact on the Greater Glider.

Fleay's & Giant Barred Frog: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that either of the subject species is likely to decline. No other sub-populations of the subject species within the three reserves would be affected directly or indirectly.

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

Peach Myrtle: the risk of any invasive species (weeds, pests or pathogens) affecting habitat for Peach Myrtle is relatively low and would be mitigated by the various biosecurity strategies prescribed.

Scrub Turpentine: the risk of any invasive species (weeds, pests or pathogens) affecting habitat for Scrub Turpentine is relatively low and would be mitigated by the various biosecurity strategies prescribed.

Spotted-tailed Quoll: the risk of any invasive species (weeds, pests or pathogens) significantly affecting the Spotted-tailed Quoll is very low and would be mitigated by the various biosecurity strategies prescribed.

Koala: the risk of any invasive species (weeds, pests or pathogens) significantly affecting the Koala is very low and would be mitigated by the various biosecurity strategies prescribed.

Southern Greater Glider: The TBHT would be unlikely to result in a significant increase in invasive species which may significantly affect the local population of the Greater Glider. Hygiene and monitoring protocols will manage invasive species with a high degree of confidence.

Fleay's & Giant Barred Frog: the risk of any invasive species (weeds, pests or pathogens) affecting habitat for the subject species is relatively low and would be mitigated by the various biosecurity strategies prescribed.

- *introduce disease that may cause the species to decline?*

Peach Myrtle: transmission of Myrtle Rust is a key threat to Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

Scrub Turpentine: transmission of Myrtle Rust is a key threat to Scrub Turpentine, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

Spotted-tailed Quoll: the construction or operation of the TBHT would be unlikely to introduce any disease that may cause the species to decline.

Koala: the construction or operation of the TBHT would be unlikely to introduce any disease that may cause the species to decline.

Southern Greater Glider: the potential for introduction of disease which may negatively affect the Greater Glider will be managed by implementation of appropriate hygiene and management protocols.

Fleay's & Giant Barred Frog: introduction and establishment of chytrid disease is a key threat to Fleay's & Giant Barred Frog. While the construction and operation of the TBHT may increase the potential for chytrid transmission this will be mitigated via standard minimisation measures.

- *interfere with the recovery of the species?*

Peach Myrtle: the construction or operation of the TBHT would be unlikely to interfere with the recovery of Peach Myrtle due to low impacts within small areas of habitat. Other sub-populations of Peach Myrtle within the three reserves would not be placed at any additional risk which might affect recovery of the species.

Scrub Turpentine: the construction or operation of the TBHT would be unlikely to interfere with the recovery of Scrub Turpentine due to low impacts within small areas of habitat. Other sub-populations of Scrub Turpentine within the three reserves would not be placed at any additional risk which might affect recovery of the species.

Spotted-tailed Quoll: the construction or operation of the TBHT would be unlikely to interfere with the recovery of the species due to low impacts within substantial areas of high quality habitat within the three reserves.

Koala: the construction or operation of the TBHT would be unlikely to interfere with the recovery of the species due to low impacts within substantial areas of high quality habitat within the three reserves.

Southern Greater Glider: The construction and operation of the TBHT is a low risk activity in the context of the life cycle requirements of the Greater Glider and within extensive areas of high quality habitat within conservation reserves. The recovery of the species would be unlikely to be impacted as a result of the TBHT.

Fleay's & Giant Barred Frog: the construction or operation of the TBHT would be unlikely to interfere with the recovery of either species due to low localised impacts within substantial areas of high quality habitat within the three reserves.

Significant Impact Assessment - Critically endangered and endangered ecological communities listed in the EPBC Act

Significant impact criteria: An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- *reduce the extent of an ecological community*
- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*
- *adversely affect habitat critical to the survival of an ecological community*
- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns*
- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting*
- *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
  - *assisting invasive species, that are harmful to the listed ecological community, to become established, or*
  - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or*
- *interfere with the recovery of an ecological community.*

An assessment has been completed for the critically endangered ecological community Lowland Rainforest of Subtropical Australia (LRSA) as follows. It is noted that the conservation advice for LRSA only considers this community as occurring up to elevations of 300 m ASL.

Is there possibility that the activity will:

- *reduce the extent of an ecological community?*

Approximately 5.8 km of the TBHT occurs within lowland rainforest ≤ 300 m ASL, with works in undisturbed vegetation accounting for only 0.52 km (~ 0.1 ha). This disturbance represents a fraction of the substantial areas of rainforest within the three reserves which comprise the site. The construction works required for the TBHT would not result in any significant structural modification to LRSA which would reduce the extent of this community in a local context.

- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?*

The TBHT will result in micro-impacts to rainforest by the hand clearing and disturbance for the walking track over a 2 metre width (~ 0.1 ha), whereby no canopy cover or larger trees or shrubs would be removed. These works would not fragment or increase fragmentation of LRSA.

- *adversely affect habitat critical to the survival of an ecological community?*

The minor impacts of the TBHT are negligible in a local context to the extent that they would not adversely affect habitat critical to the survival of LRSA.

- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?*

The construction and operation of the TBHT (as previously described) are of a small scale such that impacts on abiotic factors such as soil/nutrients would be minimal and would be managed carefully through erosion and sediment control. The minor nature of works would not have potential to impact on groundwater or surface water drainage patterns.

- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?*

Construction works would require the removal of groundcovers and vines only, and these impacts would be reduced wherever possible during the hand constriction process. The flora species impacted are all common within LRSA and their nominal loss would not substantially alter species composition or hasten the decline of these species within LRSA.

- *cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
  - *assisting invasive species, that are harmful to the listed ecological community, to become established, or*
  - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community*

While the TBHT may have minor potential for increasing the incidence of weeds, these risks are low in remote rainforest communities and can be capably managed by prescribed mitigation measures. It would be unlikely that any other invasive species harmful to LRSA may be introduced, or their influence increased by the construction or operation of the TBHT.

There is minor potential for an increase in nutrients within waterway from walkers using sunscreen or soaps. These risks can be minimised by appropriate educational material and promotion of best practice guidelines. Any risks of pollutants (eg. oils, fuel) entering waterways during the construction phase can be managed via standard environmental strategies (eg. refuelling policies, bunding, booms, spill kits etc).

- *interfere with the recovery of an ecological community?*

The construction or operation of the TBHT is of relatively low risk to LRSA and the low impacts would be unlikely to interfere with the recovery of this community in a local context.