MEMORANDUM

TO:	Andrea Zambolt	**FUNCTION:**	Planning & Approvals Team Leader
FROM:	Mark Stables	**FUNCTION:**	Senior Ecologist
CC:	Georgia Harmey	**DATE:**	30/06/2017
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SUBJECT:	**Moonimba Quarry, Bungawalbin – Biodiversity Review**		

1. INTRODUCTION AND BACKGROUND

It is understood that RMS has leased the Moonimba Quarry at Bungawalbin (West of Woodburn) to be used as a borrow site to supply material to the Woolgoolga to Ballina Pacific Highway Upgrade Project. This memo will form part of a modification to the Woolgoolga to Ballina Pacific Highway Upgrade Environmental Impact Statement (EIS), hence forth referred to as the W2B EIS, for the temporary intensification of operations at the site.

The Moonimba Borrow Site is located on Lot 193 DP755603 Boggy Creek Road, Bungawalbin (Figure 1.1). There are two existing council Development Applications associated with the existing quarry at the site. The current DA127/95 was executed in 1997. A new development application (DA2015/0069) was provided consent in 2015 for the expansion of the Moonimba Quarry, however this consent has not yet been activated.

As part of DA2015/0069 an Environmental Impact Statement (EIS), hence forth referred to as the Moonimba Quarry EIS, was prepared to support the development application for the expansion of the Moonimba Quarry. A Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014), hence forth referred to as the Moonimba Quarry Flora and Fauna Assessment, formed Appendix B4 of the Moonimba Quarry EIS and assessed the flora and fauna impacts from the proposed quarry expansion.

This memo provides updated ecological advice and significance assessments on threatened biodiversity matters relating to the proposed temporary intensification of operations at the Moonimba Borrow Site and should be read in conjunction with the Moonimba Quarry Flora and Fauna Assessment.

FIGURE 1.1 PROPOSAL LOCALITY

The proposal

The current proposal for Moonimba Borrow Site will include the following:

- Extraction of 1 million tonnes of material per annum for 2 years (this is equivalent to 400,000 m^3 per year)
- Utilisation of the two extraction areas described within the Moonimba Quarry EIS and granted consent under DA2015/0069
- Clearing of 9.5 ha of vegetation (the extent of clearing is consistent with what was approved under DA2015/0069, however the clearing will now be completed in a single stage event)
- Storage of fuel on site (up to 10,000L of diesel) and other chemicals within a small site office
- Transportation of the material from the site to the project alignment (via the local road network).

2. METHODS

2.1 Database searches

A desktop investigation was undertaken in February 2017 to examine new database records and legislative changes since the 2014 Moonimba Quarry Flora and Fauna Assessment was produced. Searches of the following databases were undertaken on the 3rd February 2017 (specifically searching for any new records since 2014 when the previous searches were completed);

- NSW Office of Environment and Heritage BioNet Atlas of NSW Wildlife.
- Department of the Environment's Protected Matters Search Tool.
- Department of Primary Industries Threatened and Protected Species Record Viewer

Results from database searches and any new or updated listings of threatened species or communities are discussed in Section 3.

2.2 Site inspection

A site inspection was conducted on 28 February 2017 to confirm the findings of the Moonimba Quarry Flora and Fauna Assessment and to examine the existing site attributes and condition. Weather conditions were overcast and heavy rain had been recorded prior to the inspection (108 mm recorded at Evans Head RAAF Bombing Range AWS – Station 058212 on 27 February 2017).

The site inspection was focused around the two approved quarry pits areas, being the 'eastern pit' and the 'western pit'.

The site inspection was limited to rapid assessment surveys that were designed to validate the existing biodiversity attributes to determine the validity of the previous detailed ecological survey findings.

Specifically the site inspection was designed to field validate the finding of the following detailed ecological surveys;

- Conacher Travers (2007) *Flora and Fauna Survey report Proposed Quarry Lot 193 DP755603 Bungawalbin-Whiporie Road Bungawalbin*. Report by Conacher Travers Pty Ltd.
- Australian Wetlands Consulting (2014) *Flora and Fauna Assessment Moonimba Quarry Lot 193 DP755603 Bungawalbin-Whiporie Road Bungawalbin*. Report by Australian Wetlands Consulting Pty Ltd, September 2014.

2.3 Existing environment

During the recent site inspection, soil water management within both the 'eastern pit' and 'western pit' appeared lacking and uncontrolled water with high sediment content was observed flowing off the sites and into adjacent bushland areas. In the 'eastern pit' an artificial channel (which was not previously identified in the 2014 Moonimba Quarry Flora and Fauna Assessment) was draining high sediment content water from the main pit directly into native vegetated areas (see Photo 5). This artificial draining channel has seemed to be purposely cut into the native landscape to drain water from the 'eastern pit' into the surrounding native bushland.

Uncontrolled high sediment content water flows were also observed leaving the 'West Cell' pit into adjacent native vegetated areas (see Photo 6).

Photo 5: Uncontrolled water flows from the eastern pit into adjacent area of native vegetation and drainage channel

Photo 6: Uncontrolled water flows from the eastern pit into adjacent area of native vegetation

3. RESULTS

3.1 Database results

Threatened flora searches

Database searches identified records of 9 species within the locality of the study area, including 3 listed under the EPBC Act. Since the Moonimba Quarry Flora and Fauna Assessment, only one additional threatened species was identified in the locality of the study area (Table 3.1). Since the Moonimba Quarry Flora and Fauna Assessment, no threatened species that have been previously recorded in the locality have changed threat-listed status.

Table 3.1 Additional threatened flora species identified in the region

SPECIES	LISTING		LIKELIHOOD OF OCCURRENCE
	TSC ACT	EPBC ACT	
Paspalidium grandispiculatum	V	V	**Low likelihood** – records of individuals were found 10km (Doubleduke vicinity) to the south of the study area. Habitat in study area is marginal. In addition, previous ecological surveys within study area unsuccessful to record any individuals

Threatened fauna searches

Database searches and a review of species considered likely to occur within the locality have identified a total of 13 threatened and/or migratory fauna species that have had a change in threat status since the preparation of the Moonimba Quarry Flora and Fauna Assessment. These changes include the listing of two previously unlisted threatened species along with changes to the threat status of 11 previously listed species. An overview of the listing changes are outlined in Table 3.2 below.

Of the 13 threat status changes to threatened and/or migratory fauna species, only two are considered to have a moderate or higher likelihood of occurrence within the study area. These species are the Greater Glider that has been listed as Vulnerable under the EPBC Act and the Dusky Woodswallow that has been listed as Vulnerable under the TSC Act. Consequently assessment of significances have been completed for these species (Appendix A).

Table 3.2 Changes in threatened fauna listings and species in the study area and region

SPECIES	LISTING		CHANGES SINCE 2014 REPORT	LIKELIHOOD OF OCCURRENCE IN STUDY AREA
	TSC ACT	EPBC ACT		
Greater Glider	-	V	Recently been listed as Vulnerable under EPBC Act (Threatened Species Scientific Committee 2016)	This species has records outside the study area to the west within Yarringully State Conservation Area and adjoining vegetation. However, records are >20 years old and previous ecological surveys for arboreal mammals within the study area have not recorded the species. Despite this, the species is known to occur within the greater region and to utilise moist eucalypt forests with abundance hollows which is present within the study area. Due to potential habitat within the study area and connectivity to extensive native vegetation patches there is a **moderate likelihood** for the Greater Glider to occur within the study area.
White-bellied Sea-eagle	V	M	Listed as Vulnerable under the TSC Act (NSW Scientific Committee 2016) and has records within the locality outside the study area.	A review of the species habitat preference and the available habitat onsite identified there is a **low likelihood of occurrence** within the study area due to limited available habitat.
Dusky Woodswallow	V	-	Listed as Vulnerable under the TSC Act (NSW Scientific Committee 2016).	Despite no records within the study area, the species is known to occur along the coast of NSW and to utilise woodland habitat. There is a **moderate likelihood of occurrence** within the study area due to available habitat.
Regent Honeyeater	CE	CE	Changed listing from Endangered to Critically Endangered under the EPBC Act (Threatened Species Scientific Committee 2015).	There is a **low likelihood of occurrence** within the study area due to no recent (>10 years) records with in the locality of the study area. Although opportunistic foraging by vagrant individuals cannot be discounted.
Swift Parrot	E	CE	Changed listing from Endangered to Critically Endangered under the EPBC Act (Threatened Species Scientific Committee 2015).	There is a **low likelihood of occurrence** within the study area due to no recent (>10 years) records with in the locality of the study area. Although opportunistic foraging by vagrant individuals cannot be discounted.
Eastern Curlew	-	CE; M	Listed as Critically Endangered under the EPBC Act (Threatened Species Scientific Committee 2015)	**Low likelihood of occurrence** within the study area due to no available habitat.

SPECIES	LISTING		CHANGES SINCE 2014 REPORT	LIKELIHOOD OF OCCURRENCE IN STUDY AREA
	TSC ACT	EPBC ACT		
Curlew Sandpiper	E	CE; M	Now listed as Critically Endangered under the EPBC Act (Threatened Species Scientific Committee 2015)	**Low likelihood of occurrence** within the study area due to no available habitat.
Painted Honeyeater	V	V	Now listed as Vulnerable under the EPBC Act (Threatened Species Scientific Committee 2015)	**Low likelihood of occurrence** within the study area due to no available habitat.
Bar-tailed Godwit	-	V; M	Now listed as Vulnerable under the EPBC Act (Threatened Species Scientific Committee 2015)	**Low likelihood of occurrence** within the study area due to no available habitat.
Lesser Sand Plover	V	E; M	Now listed as Endangered under the EPBC Act (Threatened Species Scientific Committee 2016)	**Low likelihood of occurrence** within the study area due to no available habitat.
Greater Sand Plover	V	V; M	Now listed as Vulnerable under the EPBC Act (Threatened Species Scientific Committee 2016)	**Low likelihood of occurrence** within the study area due to no available habitat.
Great Knot	-	CE; M	Now listed as Critically Endangered under the EPBC Act (Threatened Species Scientific Committee 2016)	**Low likelihood of occurrence** within the study area due to no available habitat.
Red Knot	-	E; M	Now listed as Endangered under the EPBC Act (Threatened Species Scientific Committee 2016)	**Low likelihood of occurrence** within the study area due to no available habitat.

3.2 Native vegetation

The vegetation within and surrounding the 'eastern pit' was confirmed as Open forest (Blackbutt, Pink Bloodwood) (see Photo 1 & 2). This community corresponds to the Woolgoolga to Ballina Project equivalent vegetation type Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast. The vegetation extent of this community was confirmed to be consistent with the area documented in the Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014).

Photo 1 & 2: East Cell - Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast

In respect to the 'western pit', the vegetation within and surrounding the approved cell extension was confirmed as Open Forest (Blackbutt, Pink Bloodwood) and Open Forest (Smudgy Apple) (see Photo 3 & 4). In terms of W2B project equivalent vegetation community types Open Forest (Blackbutt, Pink Bloodwood) corresponds to Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast whilst Open Forest (Smudgy Apple) does not correspond to a vegetation type identified within the project boundary. Open Forest (Smudgy Apple) is consistent the NSW VIS Classification vegetation type Pink Bloodwood - Red Mahogany - Smudgy Apple shrubby open forest on sandstone of northern NSW North Coast Bioregion.

Of the vegetation types impacted by the approved quarry expansion under DA2015/0069, neither form part of any threatened ecological community under the TSC Act or EPBC Act. The project approved conditions of consent require native vegetation offsetting prior to any vegetation clearing (see Condition 11 and 12 as reproduced below).

Overall the observed native vegetation and subsequent species habitats were considered to be consistent with those documented in the 2014 Moonimba Quarry Flora and Fauna Assessment report.

Photo 3: West Cell - Blackbutt - bloodwood dry heathy open forest on sandstones of the northern North Coast

Photo 4: West Cell - Pink Bloodwood - Red Mahogany - Smudgy Apple shrubby open forest on sandstone of northern NSW North Coast Bioregion

4. IMPACTS

4.1 Threatened species, populations and ecological communities

The Moonimba Quarry Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) confirmed the presence of the following threatened species and ecological communities from the study area;

- Two threatened flora species (Arrowhead Vine and Slender Milkvine) listed under the TSC Act were recorded within the study area. Habitat and specimens of these species were not recorded within the approved expansion areas.
- The endangered ecological community, Lowland Rainforest, was recorded from within the study area. This community was not recorded from within the approved quarry expansion areas.
- Thirteen threatened fauna species listed under the TSC Act were recorded from the study area. No additional threatened species were observed during the recent site inspection.

Project impacts were assessed for these threatened entities as part of DA2015/0069 approval. The project was considered unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats. However, since the 2014 Moonimba Quarry Flora and Fauna Assessment report a number of species threat listing under both TSC Act and EPBC have been updated and as a result assessments of significance for all relevant species have been undertaken below (refer to Section 4.4 and Appendix A).

4.2 Migratory species

Database results identified 35 migratory species that have potential to occur within the locality of the study area. Of these, 6 species have records on Bionet Atlas within the locality and 3 species were recorded within the study area by Australian Wetland Consulting in 2014. The habitats within the study area are unlikely to constitute important habitat for any of the listed migratory species, due to the habitat present is unlikely to support significant proportions of the population of any migratory species nor are the habitats critical to any life stage of these species. Due to their mobile nature, the identified species are likely to utilise a number of habitat types within the locality and are known to be relatively common in associated coastal forest environments. The proposed temporary intensification of operations would not significantly impact any listed migratory species.

4.3 Hollow trees

Based on the 2014 Moonimba Quarry Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) the density of habitat trees within the study area is relatively high – on average 10 hollow bearing trees per hectare and an approximate of 4445 hollow bearing trees occur within the study area. The removal of approximately 103 hollow bearing trees within the approved expansion area would only constitute a loss of 2.3% of hollow bearing trees available to hollow-dependent fauna (i.e. arboreal mammals and large forest owls). It is unlikely that the removal of 103 hollow bearing trees within the proposed expansion area would be a significant impact to threatened hollow-dependent species.

In terms of the existing hollow tree density, the study area estimate of 10 hollow bearing trees per hectare falls within the necessary hollow density required (6-13 hollows per hectare) to support hollow dependent fauna in NE NSW forests (Lindenmayer and Gibbons 2002).

With this understanding, the implementation and replacement of hollow bearing trees with nest boxes would be considered generally unnecessary and may lead to further disturbance and ongoing maintenance issues.

4.4 Assessments of Significance

This memo provides revised TSC Act and EPBC Act significance assessments based on the following changes since the 2014 report;

- Recent threatened species listings and threat status changes to recorded or moderate to higher likelihood of occurrence species
- Changes in vegetation clearing to comprise a single stage clearing event, as opposed to staged clearing as assessed and approved under the Moonimba Quarry EIS.

Significance assessments have been conducted for all recorded threatened species, populations, ecological communities and those species considered to have a moderate or higher likelihood of occurrence within the study area (Appendix A). Combined significance assessments have been conducted for groups of species that have similar life history and habitat requirements; e.g. threatened woodland birds, hollow-dependent microbats.

The significance assessments have been undertaken in accordance with the following published guidelines:

- Threatened species assessment guidelines – assessment of significance for TSC Act listed biodiversity (Department of Environment and Climate Change 2007)
- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance for EPBC Act listed biodiversity (Department of the Environment 2013)
- Referral guidelines for species listed under the EPBC Act (Department of the Environment and Energy 2017).

The finding of the significance assessments (Appendix A) have drawn the following conclusions;

- The proposal is unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitat listed under the TSC Act.
- A Species Impact Statement is not required for this proposal.
- The proposal is unlikely to have a significant impact on matters of national environmental significance
- An EPBC Act referral of this proposal for consideration of a controlled action is not required.

5. RECOMMENDATIONS

The Moonimba Borrow Site are to be managed in accordance with the Approved *Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11) Construction Environmental Management*

(CEMP) (Approved Project CEMP) and the associated Approved *Woolgoolga to Ballina Pacific Highway Upgrade Construction Flora and Fauna Management Plan (CFFMP), Appendix B2 of the CEMP* (Approved Project CFFMP). The contractor will refer and implement all relevant mitigation measures outlined in the Approved Project CEMP and CFFMP.

The mitigation measures outlined in Table 5.1 are from the Approved Project CFFMP and are highlighted key measures that should be applied the Moonimba Borrow Site.

In addition the mitigation measures within the CFFMP the following measures are recommended to be implemented at the Moonimba Borrow Site:

- To reduce the potential for injury to resident fauna (especially macropods), speed limits along access roads and tracks should be limited to 40-50km/hr to reduce likelihood of road collision and road mortality. Warning signs along regularly used roads should be erected to warn road users of potential wildlife within the vicinity along road verges.
- While targeted surveys did not record nesting or roosting sites of the Powerful and Masked Owl within the proposed clearing footprint, pre-clearing surveys will help determine whether nesting is occurring within or near the proposed clearing footprint. In the event that a nest tree or roost tree is located and an active breeding pair are utilising the hollow, it must be clearly marked and a buffer of a minimum 50 m radius must be applied and clearly delineated. Clearing of identified roosting tree is recommended to be removed outside breeding season (March – September) and when individuals have vacated the nest.
- Revegetation areas required under DA2015/0069 are further examined to ensure compliance with conditions of approval and ensure DA operation is possible in a timely manner.
- Biodiversity offsets as outlined under DA2015/0069 should be undertaken and implemented as part of any modification approval

Table 5.1 Key mitigation measures outlined in the Approved CFFMP

IMPACT	APPROVED CFFMP ID	MITIGATION MEASURES
Removal of native vegetation	FF3	In the event that threatened species or threatened ecological communities are unexpectedly identified during construction the Unexpected Threatened Species/ TECs Finds Procedure (Appendix O) will be followed.
	FF6	The pre-clearing process will be consistent with Roads and Maritime Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA projects (RTA, 2011a) and include: • Pre-clearing surveys by an experienced ecologist for large bird nests, particularly for listed species such as the Black-necked Stork, Eastern Osprey, Square-tailed Kite and Little Eagle during the nesting and breeding season (July to December) and tree roosting (e.g. Southern Myotis)or cave dwelling bats in trees or existing culvert/bridge structures. If the species is present in or directly adjacent to the project footprint (including ancillary facilities), measures to manage any species be considered, if required. • Mapping the location of any threatened flora and/or fauna species, Threatened Ecological Communities and habitat. • Construction traffic will be restricted to defined access tracks, fenced prior to the start of construction and maintained until construction is complete.
	FF7	To prevent injury and mortality of fauna during the clearing of vegetation and drainage of farm dams, an experienced and licensed wildlife carer and/or ecologist will be present to capture and relocate fauna where required. Further details regarding fauna handling and vegetation clearing procedures are provided in the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).
	FF8	Protective fencing to mark the limits of clearing (i.e. 'no-go' areas) surrounding the construction footprint will be installed and routinely inspected. The limits of clearing will be consistent with those verified in accordance with G40 2.4. The limits of clearing will be marked in accordance with the RMS Biodiversity Guidelines.
	FF17	Prior to construction, pre clearing surveys and inspections for endangered and threatened species shall be undertaken. The surveys and inspections, and any subsequent relocation of species, shall be undertaken under the guidance of a qualified ecologist. If incidental or unanticipated threatened flora and fauna finds are identified, work shall cease in the vicinity of the find to allow for an evaluation of an appropriate response (refer Appendix O in the CFFMP)
	FF35	A staged habitat removal process will be implemented consistent with the RMS Biodiversity Guidelines (RTA, 2011a).

IMPACT	APPROVED CFFMP ID	MITIGATION MEASURES
Aquatic impacts	FF46	All sediment and erosion control measures will be put in place during the construction process and may include sediment and erosion control curtains in the waterways to control turbidity generated during the construction and restoration process.
	FF47	No turbid water generated from the construction corridor or construction area is to be discharged to any waterway unless in accordance with relevant Environment Protection Licence conditions and developed in consultation with Environment Protection Agency and Department of Primary Industries (Fisheries).
Weed invasion	FF14	A weed management plan will be developed as part of the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004).
Invasion and spread of pathogens and disease	FF50	Measures to prevent the introduction and/or spread of pests and disease causing agents such as bacteria and fungi will be incorporated into the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).

6. CONCLUSION

The following threatened species and ecological communities occur within the study area;

- Two threatened flora species (Arrowhead Vine and Slender Milkvine) listed under the TSC Act were recorded within the study area. Habitat and specimens of these species were not recorded within the approved expansion areas.
- The endangered ecological community, Lowland Rainforest, was recorded from within the study area. This community was not recorded from within the approved quarry expansion areas.
- Thirteen threatened fauna species listed under the TSC Act were recorded from the study area. No additional threatened species were observed during the recent site inspection.

Project impacts were assessed for these threatened entities along with additional threatened species that were considered to have a moderate or higher likelihood of occurrence as part of DA2015/0069 approval. The project was considered unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats.

Since the 2014 Moonimba Quarry Flora and Fauna Assessment report, a number of species threat listing under both TSC Act and EPBC have been updated and as a result these species have been given further consideration in terms of their likelihood of occurrence within the study area.

Given the current proposal will result in a single stage clearing event, revised TSC Act and EPBC Act significance assessments have been undertaken (Appendix A). These assessments have concluded that;

- In terms of TSC Act matters, the action proposed is considered unlikely to lead to a significant impact on threatened species, populations, ecological communities or their habitats. Given this, a Species Impact Statement is not required for this proposal (Appendix A).
- In terms of EPBC Act matters, the action proposed is unlikely to pose a significant effect on Matters on National Environmental Significance and as such a referral of this proposal for consideration as a controlled action is not required (Appendix A).

The Moonimba Borrow Site is to be managed in accordance with the Approved *Woolgoolga to Ballina Pacific Highway Upgrade (Sections 3 to 11) Construction Environmental Management (CEMP)* and the associated Approved *Woolgoolga to Ballina Pacific Highway Upgrade Construction Flora and Fauna Management Plan (CFFMP), Appendix B2 of the CEMP*. The contractor will refer and implement all relevant mitigation measures outlined in the Approved Project CEMP and CFFMP.

Whilst the proposal is considered unlikely to cause a significant impact on threatened biodiversity the additional recommendations outlined in section 5 should be implemented to minimise any residual biodiversity impact.

Regards,

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Appendix A Significance Assessments

APPENDIX A – SIGNIFICANCE ASSESSMENTS

1. VEGETATION COMMUNTIES

1.1 Lowland Rainforest

Status

Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion is listed as an Endangered Ecological Community under the TSC Act.

This community is within the definition of Lowland Rainforest of Subtropical Australia and is listed as Critically Endangered Ecological Community listed under the EPBC Act.

Description

Lowland Rainforest on Floodplain is a rainforest community which now occurs only as small remnants in scattered localities on the NSW north coast, with less than 1000ha in total thought to remain. Larger stands of the community typically have a dense canopy, which blocks most light from reaching the ground, creating cool, moist conditions within. Lowland Rainforest on Floodplain supports a rich diversity of plants and animals. Typical tree species in the community include figs *(Ficus macrophylla, F. obliqua* and *F. watkinsiana),* palms *(Archontophoenix cunninghamiana* and *Livistona australis),* Silky Oak *(Grevillea robusta)*, Black Bean *(Castanospermum australe)* and Brush Cherry *(Syzygium australe).* Animals present include fruit-eating rainforest pigeons, Noisy Pitta, Brush-turkey, pademelons, flying foxes, the Land Mullet skink and rainforest snails.

Distribution

Lowland Rainforest on Floodplain generally occupies riverine corridors and alluvial flats with rich, moist silts often in subcatchments dominated by basic volcanic substrates. Major examples once occurred, and remnants remain, on the floodplains of the Tweed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. Other minor river systems also support the community.

Threats

- Clearing and fragmentation of habitat for development and agriculture.
- Invasion of community by introduced weeds, particularly exotic vines and lantana.
- Degradation of habitat by fire.
- Degradation of habitat by grazing stock.
- Dumping of rubbish within rainforest remnants.

Specific impacts

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, with the closest quarry excavation works occurring approximately 1km from the community.

1.1.1 TSC Act assessment

In the case of a Threatened species, whether the action proposed 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

Not applicable

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

The action proposed will not directly remove any existing extent of Lowland Rainforest threatened ecological community, with the closest quarry excavation works occurring approximately 1km from the community. Ameliorative measures have been recommended to mitigate any indirect impacts to this community. Given this, the action proposed is unlikely to adversely affect the extent or substantially adversely modify the composition of Lowland Rainforest such that the local occurrence would be placed at risk of extinction.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed is unlikely to directly remove any existing extent of Lowland Rainforest threatened ecological community, with the closest quarry excavation works occurring approximately 1km from the community.

The action proposed is unlikely result in an area of habitat for Lowland Rainforest to become fragment or isolated from other areas of habitat.

Important habitat is unlikely be removed, modified, fragmented or isolated as a result of the proposed action that would result in the long-term survival of this community in the locality to be affected.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No listed critical habitats under the TSC Act occur within the Richmond Valley LGA.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

No recovery plan has been prepared for Lowland Rainforest threatened ecological community under the TSC Act. In addition no threat abatement plans have relevance to the Lowland Rainforest threatened ecological community.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Clearing of native vegetation is listed as a key threatened process under the Threatened Species Conservation Act 1995. Clearing is defined as the destruction of a sufficient proportion of one or more

strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification, of the structure, composition and ecological function of stand or stands. The proposed action will result in the clearing of native vegetation however given the nearest clearing with be approximately 1 km form this community it is unlikely that it will result in increased impacts of this key threatening process on Lowland Rainforest. Given this, the action proposed is unlikely to constitute or likely to result in the operation or increase a key threatened process on Lowland Rainforest or its habitat.

Conclusion

The action proposed will not result in the direct removal of Lowland Rainforest and is considered unlikely to adversely affect occurrence and composition of this community such that it would be lead to the local occurrence becoming extinct. Further, given there the avoidance of direct impacts and that indirect impact will be managed through the implementation of mitigation measures, the action proposed is unlikely to result in a long-term adverse effect on fragmentation, isolation, and modification of the community within the locality.

In light of the above assessment the action proposed is considered unlikely to lead to a significant impact on Lowland Rainforest or its habitat.

1.1.2 EPBC Act Significance Assessment

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**

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, therefore the action proposed will not reduce the extent of this community.

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

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, therefore the action proposed will not fragment or increase fragmentation of this community.

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

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, therefore the action proposed would not adversely affect habitat critical to the survival of this 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.**

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, with the closest quarry excavation works occurring approximately 1km from the community. The action proposed will unlikely lead to a significant impact to abiotic factors associated with this threatened ecological community.

- **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.**

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, with the closest quarry excavation works occurring approximately 1km from the community.

Therefore it is unlikely that the action proposed will cause a substantial change in species composition leading to a decline or loss of functionally of important species.

Will the action 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**
- **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.**

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, with the closest quarry excavation works occurring approximately 1km from the community. Therefore it is unlikely that the action proposed will cause substantial reduction in the quality of this ecological community.

Interfere with the recovery of an ecological community

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed and therefore will not interfere with the recovery of this community.

Conclusion

No impacts to Lowland Rainforest threatened ecological community would occur due to the action proposed, with the closest quarry excavation works occurring approximately 1km from the community. Therefore it is unlikely that the action proposed will cause significant impacts to this threatened ecological community.

2. FLORA

2.1 Threatened Rainforest Flora

Tinospora tinosporoides (Arrowhead Vine) is listed as Vulnerable under the TSC Act. Whereas, *Belvisia mucronata* (Needle-leaf Fern) and *Marsdenia longiloba* (Slender Marsdenia) is listed as Endangered species under the TSC Act. *Marsdenia longiloba* (Slender Marsdenia) is also listed as Vulnerable under the EPBC Act. These species have been assessed together as they share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the action proposed. The habitat and ecology of the threatened rainforest flora is summarised in the below table (Table 2.1).

Table 2.1 Threatened rainforest flora

SCIENTIFIC NAME	TSC ACT	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Tinospora tinosporoides	V		North from the Richmond River in north-east NSW, where it is locally common in some parts of its range. Also recorded from a single location in south-east Queensland. Found in wetter subtropical rainforest, including littoral rainforest, on fertile, basalt-derived soils.	• Clearing and fragmentation of habitat for development, agriculture, and roads. • 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.
Belvisia mucronata	E		In Australia, this species is restricted to Queensland and NSW. In NSW, it is known from only five locations on the far north coast, north from Evans Head. Forms small clumps on trees or rocks in dry rainforest or along creeks in moist open forest. Occurs in low numbers at all sites.	• Fire. • Forestry activities. • Risk of local extinction due to low numbers. • Weed invasion, particularly Lantana.

SCIENTIFIC NAME	TSC ACT	EPBC ACT	HABITAT AND DISTRIBUTION	THREATS
Marsdenia longiloba	E	V	Scattered sites on the north coast of NSW north from Barrington Tops. Also occurs in south-east Queensland. Subtropical and warm temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	• Loss and fragmentation of habitat through land clearing for agriculture. • Loss and fragmentation of habitat through land clearing for urban development. • Invasion of habitat by introduced weeds. • Grazing and trampling of plants by cattle. • Disturbance of habitat and loss of individuals as a result of forestry activities. • Risk of local extirpation because populations are small. • At risk from the use of herbicides in weed control activities. • Roadside populations are at risk from road works.

Specific impacts

The action proposed will not result in any disturbance or loss of any rainforest habitat or riparian areas associated with the occurrence of *Tinospora tinosporoides, Belvisia mucronata* or *Marsdenia longiloba*.

2.1.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The proposed action will not result in any direct disturbance or loss of any rainforest or riparian habitat associated with the occurrence of *Tinospora tinosporoides, Belvisia mucronata* or *Marsdenia longiloba*. Therefore it is unlikely that the action proposed will have an adverse effect on the life cycle of any of the mentioned species to the point that a local population would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No threatened flora populations occur within the Richmond Valley LGA.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will not result in any direct disturbance or loss of any rainforest or riparian habitat associated with the occurrence of *Tinospora tinosporoides, Belvisia mucronata* or *Marsdenia longiloba*. Therefore the action proposed is unlikely to remove, modify, fragment or isolate important habitat for these species in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No listed critical habitats under the TSC Act occur within the Richmond Valley LGA.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for any of the mentioned threatened flora species under the TSC Act. The action proposed is unlikely to result in disturbance or loss of any rainforest or riparian habitat associated with the mentioned species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The action proposed would be consistent with one key threatening processes under the TSC Act, being clearing of native vegetation. The action proposed would impact 9.5ha of open sclerophyll forest however in regards to the mentioned threatened flora species, the action proposed is unlikely to result in disturbance or loss of any rainforest or riparian habitat associated with the occurrence of *Tinospora tinosporoides, Belvisia mucronata* or *Marsdenia longiloba*. Given this, the action proposed is unlikely to constitute or result in the operation or increase a key threatened process on Lowland Rainforest or its habitat.

Conclusion

The action proposed is unlikely to result in disturbance or loss of any rainforest or riparian habitat associated with the occurrence of *Tinospora tinosporoides, Belvisia mucronata* or *Marsdenia longiloba*. Therefore it is unlikely that the action proposed will have a significant impact of these species or their habitat.

3. FAUNA

3.1 Giant Barred Frog

Status

The Giant Barred Frog (*Mixophyes iteratus*) is listed as Endangered under both the TSC Act and EPBC Act.

Habitat and Distribution

Terrestrial species which occurs in rainforests, Antarctic beech or wet sclerophyll forests. Feeds on insects and smaller frogs (Cogger, 2000). The species is associated with permanent flowing drainages, from shallow rocky rainforest streams to slow-moving rivers in lowland open forest. It is not known to utilise still water areas (NSW Scientific Committee, 1999). More prevalent at lower altitudes and in larger streams than its congeners, although has been recorded up to 1000 metres asl. (NSW National Parks and Wildlife Service, 1999c).

Distributed along the coast and ranges from Eumundi in south-east Queensland to Warrimoo in the Blue Mountains. Declines appear to have occurred at the margins of the species' range. Northern NSW, particularly the Coffs Harbour-Dorrigo area, is a stronghold.

Threats

- Clearance of riparian vegetation
- Degradation of habitat due to exotic weeds.
- Reduction in water quality or alterations to flow patterns.
- Inadequate protection of riparian habitat during forestry activities.
- Infections of the fungal pathogen *Batrachochytrium dendrobatidis* that causes chytridiomycosis.
- 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 and loss of genetic variation.

Specific impacts

The Giant Barred Frog is likely to be found within rainforest communities and associated streams within the study area. The action proposed would unlikely disturb any potential habitat for the Giant Barred Frog.

3.1.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

Potential habitat associated with Giant Barred Frog (lowland rainforest) will unlikely be impacted by the action proposed. Implementation of water and sediment mitigation measures associated with the quarry will reduce any indirect impacts associated with runoff from operations. It is unlikely that the action proposed will have an adverse effect on the life cycle of Giant Barred Frog in that the local population would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

Within the study area, the action proposed is unlikely to disturb or impact areas of potential breeding habitat associated with rainforest and riparian areas. The action proposed will result in the removal of 9.5 ha of open forest vegetation that is considered to provide marginal foraging habitat for the Giant Barred Frog. This marginal habitat is unlikely to provide important habitat to the long-term survival of the species in the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of the Office of Environment and Heritage. No critical habitat has been listed for this species. No areas within the study area are considered critical to the survival of the Giant Barred Frog.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A national recovery plan for Stream Frogs of South-east Queensland, in which Giant Barred Frog is included, has identified a number of recovery actions for the species. The Office of Environment and Heritage has assigned the Giant Barred Frog species as Landscape management species under the *Saving our Species* program. The Office of Environment and Heritage has identified a number of management actions for the recovery for this species (Table 3.1).

Table 3.1 Recovery actions for Giant Barred Frog

Action*	Relevance to project
Protection and rehabilitation of the riparian habitat of the Giant Barred frog: weed removal, planting of overstorey species and the removal (or reduced density) of stock if necessary. Education of land owners and managers of the importance of maintaining riparian habitat and the integration of habitat protection into land management regulations.	Riparian areas within the study area will be retained and mitigation measures will be implemented to reduce any potential indirect impacts associated with the action proposed.

*The above recovery actions do not include actions which are related to state or regional wide actions.

The proposed action is unlikely to substantially contribute to or interfere with the implementation of these recovery strategies.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Giant Barred Frog, the following two key threatening processes under the TSC Act are considered unlikely to result in the operation of, or increase the impact of;

- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish)
- The propose action will be subject to ameliorative measures that will mitigation any potential impacts of these key threatening processes on potential habitat for the Giant Barred Frog.

Conclusion

The action proposed would unlikely impact any potential habitat (Lowland Rainforest and riparian habitat) associated with the Giant Barred Frog. With the implementation of water management mitigation measures any potential indirect impacts associated with runoff and sedimentation from the action proposed is unlikely to lead to a significant impact to the Giant Barred Frog. The action proposed is unlikely lead to a significant impact on the Giant Barred Frog or its habitat.

3.1.2 EPBC Act significance assessment

The Giant Barred Frog is listed as Endangered under the EPBC Act and it can be considered to be declining within the study area and the wider locality. This species is therefore assessed using the threatened species criteria of the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment, 2013). Under the EPBC Act, population of a species is defined as:

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

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will result in one or more of the following:

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

Potential habitat associated with Giant Barred Frog (lowland rainforest) will not be directly impacted or disturbed due to the action proposed and therefore it is unlikely that the action proposed will lead to a long-term decrease in the size of the local population.

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

The action proposed will not directly impact or disturb habitat associated with the Giant Barred Frog, therefore the action proposed will unlikely reduce the area of occupancy of the species.

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

The action proposed will not directly impact or disturb habitat associated with the Giant Barred Frog, therefore the action proposed will unlikely fragment any existing population into two or more.

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

No critical habitat has been listed for this species. No areas within the study area are considered critical to the survival of the Giant Barred Frog. The action proposed will unlikely adversely affect habitat critical to the survival of the Giant Barred Frog.

Will the action disrupt the breeding cycle of a population?

The action proposed will not directly impact or disturb breeding habitat associated with the Giant Barred Frog, therefore the action proposed will unlikely disrupt the breeding cycle of the local population.

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

The action proposed will not directly impact or disturb habitat associated with the Giant Barred Frog, therefore the action proposed will unlikely reduce the quality of habitat of the species in which it is likely to decline.

Will the action result in invasive species that are harmful to an Endangered species becoming established in the Endangered species´ habitat?

It is unlikely that invasive species (such as introduced predators) that are potentially harmful to the Giant Barred Frog would become further established as a result of the project.

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

No. It is unlikely that disease would be increased by the action.

Will the action interfere with the recovery of the species?

Due to the action proposed not directly impacting or disturbing habitat associated with the Giant Barred Frog it will not significantly interfere with the recovery of the species.

Conclusion

The action proposed will not directly impact or disturb habitat associated with the Giant Barred Frog, it is unlikely that the action proposed would significantly impact this species.

3.2 Spotted-tailed Quoll

Status

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as Vulnerable under the TSC Act and Endangered under the EPBC Act.

Habitat and Distribution

Spotted-tailed Quoll occur in a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline (Belcher, 2003). Preferred habitat for Spotted-tailed Quoll includes dry and moist sclerophyll forests where they nest in include hollow-bearing trees, fallen logs, burrows, small caves, rock crevices, boulder-fields and rocky-cliff faces and will feed in nearby cleared areas (Edgar and Belcher, 1998).

The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common (NSW National Parks and Wildlife Service, 1999a).

Threats

- 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.

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest for Spotted-tail Quoll. Habitat removal will occur around the edges of the two existing quarry pits.

3.2.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat for the Spotted-tail Quoll. Approximately 468ha of potential habitat is available within the study area, the removal of 9.5ha of potential habitat represents about 2% of potential habitat within the study area. This species is highly mobile utilising a large home range of between 350-3,500ha and as such it is considered unlikely that the impact of 9.5ha (loss of 2% of potential habitat) will have a significantly adverse effect upon a local population of Spotted-tailed Quoll such that it is likely to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**

- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat for the Spotted-tailed Quoll. The removal of 9.5ha of potential habitat is unlikely to significantly increase fragmentation or isolation for this species within the locality. The majority of the study area would still provide sufficient potential habitat for the species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would represent a loss of 2% within the study area although the majority of potential habitat would still remain (approximately 468ha). Given this, the proposed action is unlikely to remove, modify, fragment or isolate important habitat for the Spotted-tailed Quoll such that the long-term survival of the species within the locality is adversely affected.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of the Office of Environment and Heritage. No critical habitat has been listed for this species. No areas within the study area are considered critical to the survival of the Spotted-tailed Quoll.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for Spotted-tailed Quoll under the TSC Act. The Office of Environment and Heritage has assigned the Spotted-tailed Quoll species as Landscape management species under the *Saving our Species* program. The Office of Environment and Heritage has identified a number of management actions for the recovery for this species (Table 3.2). The action proposed will not significantly interfere with any of the recovery actions for this species.

Table 3.2 Recovery actions for Spotted-tailed Quoll

Action*	Relevance to project
Conserve old-growth forest stands and other areas of known habitat under perpetual, funded conservation agreements such as BioBanking agreements, conservation property vegetation plans or inclusion in the conservation reserve system.	Relevant. Biobanking and offsetting of habitat will be undertaken.
Monitor significant spotted-tailed quoll populations to investigate the impact of fox and wild dog baiting.	Not relevant.
Modify poultry runs and aviaries based on best-practice guidelines.	Not relevant.
Incorporate methods to reduce the numbers of spotted-tailed quolls killed at sections of roads where road kills are frequently reported. Assess the effectiveness of different mitigation methods.	Not relevant.

*The above recovery actions do not include actions which are related to state or regional wide actions.

The proposed action is unlikely to substantially contribute to or interfere with the implementation of these recovery strategies.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Clearing of native vegetation is listed as a key threatened process under the Threatened Species Conservation Act 1995. Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification, of the structure, composition and ecological function of stand or stands. The proposed action will result in the clearing of native vegetation however it is unlikely that will result in increased impacts of this key threatening process on potential habitat for the Spotted-tailed Quoll. The action proposed is unlikely to give rise to other listed key threatened processes.

In addition and specific to the Spotted-tailed Quoll, the following two key threatening processes have the potential to adversely impact on this species;

- Predation by the European Red Fox *Vulpes vulpes*
- Predation by the Feral Cat *Felis catus*

The propose action will be subject to ameliorative measures that will assist in the mitigation any potential impacts of these key threatening processes on potential habitat for the Spotted-tailed Quoll. Given this the proposed action is unlikely to result in the operation of or increase the impact of these key threatening process to the Spotted-tailed Quoll or its habitat.

Conclusion

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. Majority of habitat to be impacted occurs around the existing two quarry pits within the study area. The removal of 9.5ha of potential habitat will represent a 2% loss of potential habitat within the study area (approximately 468ha of potential habitat in the study area). The removal of this potential habitat is unlikely to significantly increase fragmentation or isolate any patches of important habitat for this species. In light of the above is unlikely that the action proposed will significantly impact the Spotted-tailed Quoll or its habitat.

3.2.2 EPBC Act significance assessment

The Spotted-tailed Quoll is listed as Endangered under the EPBC Act and it can be considered to be declining within the study area and the wider locality. This species is therefore assessed using the threatened species criteria of the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment, 2013). Under the EPBC Act, population of a species is defined as:

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

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will result in one or more of the following:

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

The action proposed will impact 9.5ha of potential habitat for the Spotted-tailed Quoll. While habitat in the study area has the potential to be used by this species, majority of habitat to be impacted will consist of habitat surrounding the current two disturbed quarry pits. The removal of this habitat will not significantly increase fragmentation or isolate any existing habitat patches. The action proposed impact area represents a relatively small area (approx. 2%) of potential habitat of locally occurring resources (approximately 468ha within the study area) that would be accessible to this species. Any

identified population of Spotted-tailed Quoll in the area would not be restricted to habitat contained within the impact area or the study area, as this species has a large home range. As there is similar foraging and breeding habitat that occurs within the locality, it is therefore unlikely that the action proposed will result in a long-term decline in the size of the population.

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

The action proposed will impact 9.5ha of potential habitat within the study area. Due to the project's relatively small disturbance area (approximately 2% of available habitat) surrounding the two existing quarry pits, the proposed action would disturb relative small areas of marginal habitat. The relatively small areas of potential habitat represent a small component of locally occurring resources that would be accessible to this species (approximately 468ha within study area), as this species has a large home range (350–3,500 ha) and is mobile. Therefore, the removal of about 9.5ha of potential habitat is unlikely to reduce the area of occupancy for the Spotted-tailed Quoll.

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

Habitat connectivity is unlikely to be affected by the project. The majority of the impact area occurs around the current two open quarry pits. Approximately 9.5ha of potential habitat is likely to be affected by the action proposed which represent 2% of available habitat in the study area. As the impact area is largely confined to areas surrounding the existing quarries it would not further fragment or isolate any existing population into two or more.

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

No critical habitat has been listed for the Spotted-tailed Quoll to date. The relatively small area of potential habitat likely to be affected represents a small component (approximately 2%) of locally occurring resources that would be accessible to this species. Therefore, the removal of about 9.5ha of potential habitat would not be considered critical to the survival of this species.

Will the action disrupt the breeding cycle of a population?

It is estimated that approximately 9.5ha of potential habitat would be affected by the action proposed. The study area has the potential contain den sites for this species in the form of rock crevices, small rock caves and large fallen timber. However, the field investigations did not find any breeding habitat within the impact area and therefore it is unlikely that the action proposed will remove or impact upon any den or sheltering habitat for this species. In addition, approximately 468ha of potential habitat and breeding habitat would still be accessible for individuals within the study area. Therefore, the removal of about 9.5ha of potential habitat is unlikely to disrupt the breeding cycle of a population.

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

The action proposed would remove approximately 9.5ha of potential habitat for this species. The study area has approximately 468ha of potential habitat for this species which would still be accessible. This species is known to have a large home range in which to hunt its prey species and the impact area would represent a small portion (approximately 2%) of this accessible habitat. Therefore, the proposed action is unlikely to cause the Spotted-tailed Quoll to decline.

Will the action result in invasive species that are harmful to an Endangered species becoming established in the Endangered species´ habitat?

It is unlikely that invasive species (such as introduced predators) that are potentially harmful to the Spotted-tailed Quoll would become further established as a result of the project.

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

No. It is unlikely that disease would be increased by the action.

Will the action interfere with the recovery of the species?

A recovery plan has not been prepared for the Spotted-tailed Quoll. Due to the small extent of habitat (9.5ha) likely to be affect by the proposed action, the action proposed is unlikely to interfere with the recovery of this species.

Conclusion

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. Majority of habitat to be impacted occurs around the existing two quarry pits within the study area. The removal of 9.5ha of potential habitat will represent a 2% loss of accessible habitat within the study area (approximately 468ha of potential habitat in the study area). It is unlikely that the action proposed will significantly impact the Spotted-tailed Quoll.

3.3 Pale-headed Snake

Status

The Pale-headed Snake (*Hoplocephalus bitorquatus*) is listed as Vulnerable under the TSC Act.

Habitat and Distribution

A partly arboreal, nocturnal species found in a range of habitats from rainforest and wet sclerophyll forest to the drier eucalypt forests of the western slopes. Feeds largely on frogs and lizards. A patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north-west slopes, and from the north coast from Queensland to Sydney. A small number of historical records are known for the New England Tablelands from Glenn Innes and Tenterfield; however, the majority of records appear to be from sites of relatively lower elevation (Cogger, 2000).

Threats

- 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.
- Disturbance to riparian habitat from the installation and maintenance of easements.

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest, including 103 hollow-bearing trees. Habitat removal will occur around the edges of the two existing quarry pits.

3.3.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat and 103 hollow-bearing trees for Pale-headed Snake. Approximately 449ha of potential habitat occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for this species. Based on the 2014 Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) the density of hollow bearing trees within the study area is relatively high – on average 10 hollow trees per hectare and an approximate of 4445 hollow bearing trees occur within the study area. The removal of approximately 103 habitat trees within the approved expansion area would only constitute a loss of 2.3% of hollow trees available to this species. It is therefore unlikely that the action proposed would have an adverse effect on the life cycle of this species in which the local population would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. In addition, 103 hollow-bearing trees will be impact by the action proposed. The removal of 9.5ha of habitat and 103 hollow-bearing trees is unlikely to significantly increase fragmentation or isolation for this species. The majority of the study area would still provide sufficient habitat (including approximately 4445 hollow-bearing trees) for the species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 449ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of the species within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of the Office of Environment and Heritage. No critical habitat has been listed for this species. No areas within the study area are considered critical to the survival of the Pale-headed Snake.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for Pale-headed Snake under the TSC Act. The Office of Environment and Heritage has assigned the Pale-headed Snake as Landscape management species under the *Saving our Species* program. The Office of Environment and Heritage has identified a number of management actions for the recovery for this species (Table 3.3). The action proposed is unlikely to significantly interfere with any of the recovery actions for this species.

Table 3.3 Recovery actions for Pale-headed Snake

Action*	Relevance to project
Undertake plantings of suitable hollow-bearing trees (e.g. red gum, coolabah, black box) in riparian and floodplain areas where habitat has been lost or fragmented. Target planting to increase connectivity and buffer areas of existing old-growth woodland habitat.	Relevant. Habitat restoration and replanting will take place in rehab areas in which suitable hollow-bearing species will be planted.

Action*	Relevance to project
Erect suitably designed nest-boxes (microbat/glider style) in locations lacking tree hollows (e.g. young stands), and in areas in or close to known riparian habitat, to provide shelter for the species. Ensure that nest boxes are monitored regularly to evaluate their uptake and effectiveness.	Not relevant. Due to the high density of hollow-bearing trees within the study area it would not be considered 'lacking in tree hollows'.
Raise awareness in and work with utility companies and their contractors to ensure that any disturbance due to easements (e.g. power lines) such as clearing or pruning trees or removing burls is done sensitively, to minimise the loss of tree hollows and maintain connectivity between known habitat patches.	Not relevant.

*The above recovery actions do not include actions which are related to state or regional wide actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to Pale-headed Snake, the action proposed is consistent with three key threatening processes under the TSC Act:

- clearing of native vegetation
- loss of hollow-bearing trees
- removal of dead wood and trees.

The extent of native vegetation clearing and habitat removal associated with the action proposed is considered relatively small 9.5ha of habitat. Although the project will represent the loss of potential foraging and nesting habitat, such habitat would only be a small component of locally occurring resources (approximately 2%) accessible to these species.

Removal of 103 hollow-bearing trees will represent approximately a loss of 2% of available hollow-bearing trees within the study area and slightly increase the impact of this key threatening process.

Conclusion

The action proposed would impact 9.5ha of potential habitat and 103 hollow-bearing trees for the Pale-headed Snake. Due to the proposed impact occurring around the margins of the existing quarries it is unlikely that existing habitat would be significantly fragmented or isolated. In addition the impact of 9.5ha of potential habitat and 103 hollow-bearing trees would represent a relatively small area (approximately 2%) of accessible local resources. It is therefore unlikely that the action proposed would significantly impact this species or its habitat.

3.4 Black-necked Stork

Status

The Black-necked Stork (*Ephippiorhynchus asiaticus*) is listed as Endangered under the TSC Act.

Habitat and Distribution

Widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Bulahdelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Usually forage in water 5-30cm deep for vertebrate and invertebrate prey. Eels regularly contribute the greatest biomass to their diet, but they feed on a wide variety of animals, including other fish, frogs and invertebrates (such as beetles, grasshoppers, crickets and crayfish). (Office of Environment & Heritage, 2014).

Threats

- Powerlines, especially close to wetlands or over floodplains
- Modification or degradation of wetlands through changes in natural water flows
- Loss of wetland habitat through clearing and draining for development.
- Loss of key habitat as a result of wetland drainage for flood mitigation and agricultural development.
- Degradation of wetland habitats through pollution.
- Loss of paddock trees used for nesting.
- Degradation of wetlands as a result of salinity.

Specific impacts

The action proposed would not significantly disturb or impact habitat for the Black-necked Stork. Opportunistic foraging habitat in the form of dams and small water bodies would still be retained within the study area.

3.4.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

Floodplain wetlands (i.e. swamps, billabongs, watercourses large dams) provide key habitat for the Black-necked Stork in NSW. Within the study area available habitat (i.e. small dams and water bodies) would unlikely act as important foraging habitat but likely be opportunistically used for foraging within the locality. The action proposed will not directly disturbed or significantly impact habitat for the Black-necked Stork. Therefore the action proposed is unlikely to have an adverse effect of the life cycle of the Black-necked Stork in which the local population would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed would not significantly disturb or impact habitat for the Black-necked Stork. The habitat within the study area provides opportunistic foraging habitat for the Black-necked Stork and is not considered to be significant for the long-term survival of Black-necked Stork as it is not used for breeding. Furthermore the Black-necked Stork is a highly mobile species and would be able to access other areas of suitable habitat within the study area and greater locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of the Office of Environment and Heritage. No critical habitat has been listed for this species. No areas within the study area are considered critical to the survival of the Black-necked Stork.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for Black-necked Stork under the TSC Act. The Office of Environment and Heritage has assigned the Black-necked Stork species as Partnership management species under the *Saving our Species* program. The Office of Environment and Heritage has identified a number of management actions for the recovery for this species. The action proposed will not significantly interfere with any of the recovery actions for this species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Black-necked Stork, the project is not consistent with any key threatening processes under the TSC Act.

Conclusion

The action proposed would not significantly disturb or impact habitat for the Black-necked Stork. The habitat within the study area provides opportunistic foraging habitat and is not considered to be significant for the long-term survival of Black-necked Stork as it is not used for breeding. The action proposed is unlikely to significantly impact this species or its habitat.

3.5 Arboreal Mammals

Brush-tailed Phascogale (*Phascogale tapoatafa)*, Squirrel Glider (*Petaurus norfolcensis*), Koala (*Phascolarctos cinereus)* and Yellow-bellied Glider (*Petaurus australis)* are listed as a Vulnerable species under the *Threatened Species Conservation Act 1995*. The Koala and Greater Glider (*Petauroides volans*) is also listed as Vulnerable under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These species have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the action proposed. The habitat and ecology of the threatened arboreal mammals is summarised in the below table (Table 3.4).

Table 3.4 Habitat and distribution of arboreal mammals

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Brush-tailed Phascogale	V		Largely arboreal it occurs in a range of habitats which have reliable rainfall (500-2000mm), but has preference for open dry sclerophyll forest on ridges (up to 600 m alt) with little/sparse ground cover. It nests in tree hollows and feeds at dusk on arthropods and small vertebrates (Strahan, 1995).	• Loss and fragmentation of habitat. • Loss of hollow-bearing trees. • Predation by foxes and cats. • Competition for nesting hollows with the introduced honeybee.
Squirrel Glider	V		The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. In NSW it is found in dry sclerophyll forest and woodland but not found in dense coastal ranges, 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. It is associated with mixed tree species stands with a shrub or Acacia midstorey. It requires abundant tree hollows for refuge and nest sites and feeds on gum of acacias, eucalypt sap and invertebrates (NSW National Parks and Wildlife Service, 1999b).	• 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

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Koala	V	V	The Koala occurs along the east coast of Australia and extends into Woodland, Mulga and River Red Gum forests west of the Great Dividing Range The range of the Koala covers all such suitable areas of NSW. The Koala inhabits eucalypt woodlands and forests. The diet is generally restricted to Eucalypt leaves, although on occasion, non-Eucalypt foliage is eaten. The foliage of *Eucalyptus haemastoma, Eucalyptus tereticornis*, *E. robusta, E. punctata, E. moluccana,* and *E. resinifera* are some of the primary and secondary food tree species for Koalas occurring in the Central Coast Koala management area. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted or nutrient deprived. Individual home ranges range from one to two ha in high quality habitat, to around 100 ha in more arid country where territories are usually discrete (Strahan and Van Dyck 2008) (Department of Environment and Climate Change, 2008a).	• human-induced climate change, especially drought • loss, modification and fragmentation of habitat • predation by feral and domestic dogs • intense fires that scorch or kill the tree canopy • road kills.
Yellow-bellied Glider	V		The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources (Office of Environment and Heritage, 2016).	• Loss and fragmentation of habitat. • Loss of hollow-bearing trees. • Loss of feed trees.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Greater Glider		V	The Greater Glider has a restricted distribution in eastern Australia, from the Windsor Tableland in north Queensland to central Victoria, with an elevated range from sea level to 1200m above sea level. The species is largely restricted to eucalypt forests and woodlands, with a diet comprising of eucalypt leaves and occasional flowers. It is found in abundance in montane eucalypt forest with relatively old trees and an abundance of hollows. It also favours forests with a diversity of eucalypts to cater for seasonal variation in food abundance (Department of the Environment, 2015).	— Habitat loss (through clearing, clear-fell logging and the destruction of senescent trees due to prescribed burning) and fragmentation — Inappropriate fire regimes — Forestry practices and logging — Loss of hollow-bearing trees

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest and remove 103 hollow-bearing trees. Habitat removal will occur around the edges of the two existing quarry pits.

3.5.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat for arboreal mammals, including 103 hollow-bearing trees. Approximately 468ha of potential habitat for arboreal mammals occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Based on the 2014 Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) the density of habitat trees within the study area is relatively high – on average 10 habitat trees per hectare and an approximate of 4445 habitat trees occur within the study area. The removal of approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to these species.

In regards to Koala, the action proposed would impact 9.5ha of low quality koala habitat where primary feed trees were found to be in irregular occurrence. The study area would still retain links to approximately 468ha of potential habitat in good quality condition. The loss of 9.5ha of potential habitat represents a loss of 2% of available habitat for Koala.

It is therefore unlikely that the action proposed would have an adverse effect on the life cycle of these species in which the local populations would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. In addition, 103 hollow-bearing trees will be impact by the action proposed. The removal of 9.5ha of habitat and 103 hollow-bearing trees would not significantly increase fragmentation or isolation for the mentioned species. The majority of the study area would still provide sufficient habitat (including hollow-bearing trees) for these species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 449ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of the species within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of Department of Environment & Heritage. There are currently four listed critical habitats in NSW. No critical habitat has been listed for any of the mentioned species. Given this, the action proposed is unlikely to have an adverse effect on critical habitat for the mentioned species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for Brush-tailed Phascogale, Squirrel Glider or Greater Glider to-date under the TSC Act. In the interim, the Office of Environment and Heritage has assigned these species as Landscape management species under the *Saving our Species* program. However, with the implementation of habitat restoration the action proposed would not significantly interfere with the site management actions outlined for these species.

A recovery plan has been prepared for the Koala under the TSC Act (Department of Environment and Climate Change, 2008b). The Department of Environment and Climate Change have established seven recovery objectives to help recover this species, which include:

- To conserve koalas in their existing habitat;
- To rehabilitate and restore koala habitat and populations;
- To develop a better understanding of the conservation biology of koalas;
- To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale;
- To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care;

- To manage over-browsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat;
- To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

Within each objective a number of recovery actions have been established. Based on the action proposed it is likely that the project would be in inconsistent with the second objective as it will add incrementally to the loss of potential Koala habitat. Due to the impact area displaying relatively low quality habitat likely to be affected by the action proposed and the abundance of potential habitat within the study area and locality, the action proposed is not likely to interfere with the objectives or actions for recovery for the Koala.

A recovery plan has been prepared for Yellow-bellied Glider under the TSC Act. National Parks and Wildlife have identified five objectives with 13 priority action statements to help recover this species (NSW National Parks and Wildlife Service, 2003).

- Co-ordinate the recovery of the Yellow-bellied Glider in NSW;
- Encourage and assist in improving the protection and management of the Yellow-bellied Glider and its habitat;
- Identify and monitor significant populations of the species;
- To facilitate strategic research into the ecology of the Yellow-bellied Glider that is relevant to its conservation;
- To increase community awareness of the Yellow-bellied Glider and encourage community involvement in its conservation.

The action proposed is unlikely to adversely affect any of these recovery objectives or actions for Yellow-bellied Gliders.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to arboreal mammals, the action proposed is consistent with two key threatening processes under the TSC Act:

- clearing of native vegetation
- loss of hollow-bearing trees (excluding Koala)

The extent of native vegetation clearing and habitat removal associated with the action proposed is considered relatively small (9.5ha of habitat). Although the project will represent the loss of potential foraging and nesting habitat, such habitat would only be a small component of locally occurring resources (approximately 2%) accessible to these species.

Removal of 103 hollow-bearing trees will represent approximately a loss of 2% of available hollow-bearing trees within the study area. Due to the high density of hollow-bearing trees within the study area it is unlikely that the removal of 103 hollow-bearing trees would be significant.

Conclusion

The action proposed will impact 9.5ha of potential habitat for arboreal mammals, including 103 hollow-bearing trees. Approximately 468ha of potential habitat for arboreal mammals occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Similarly approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to hollow dependent species. Based on the relative small extent of habitat to be impacted and the retention and accessible habitat within the study area is it unlikely that the action proposed would have a significant impact on arboreal mammals or their habitats.

3.5.2 EPBC Act significance assessment

The Koala and Greater Glider is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

Is this part of an important population?

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

In regards to the Greater Glider, any individuals found within the study area would unlikely be considered as an 'important population' as they are unlikely act as a key source population for breeding or maintain genetic diversity and are not near the limit of the species range. In addition, based on extensive field surveys and limited recent historical records have been found in the greater locality, suggesting the habitat within the impact area is unlikely important for any local population.

In regards to the Koala and based on findings by Australian Wetland Consulting, the proposed action would not remove a large area (>20ha) of critical habitat for Koala, the density of Koala is likely to be low as dominated preferred tree species do not occur within impact area and as a result any potential individuals found within the study area would not be considered part of an important population.

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

N/A both Koala and Greater Glider not considered part of important population.

Reduce the area of occupancy of an important population of the species

N/A both Koala and Greater Glider not considered part of important population.

Fragment an existing important population into two or more populations

N/A both Koala and Greater Glider not considered part of important population.

Adversely affect habitat critical to the survival of a species

No critical habitat is listed for both species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment, 2013).

Due to the low density of both Greater Glider and Koala activity with the locality and within the study area, it is unlikely that the action proposed will effect habitat critical to the survival of both species.

Disrupt the breeding cycle of an important population

N/A both Koala and Greater Glider not considered part of important population.

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

The action proposed will impact 9.5ha of potential habitat for these species. Approximately 468ha of potential habitat for both species occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Therefore, the proposed action is unlikely to cause a decrease in the availability of habitat in which would cause a decline in both species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Koala would become further established as a result of the project.

Introduce disease that may cause the species to decline

No. It is not likely that disease would be increased by the action.

Will the action interfere with the recovery of the species?

No recovery plan has been produced for Greater Glider, due to the relative small extent of habitat to be impact (9.5ha) and the extensive available habitat within the study area (468ha) it is unlikely that the proposed action will interfere with the recovery of the species.

The National Koala Conservation and Management Strategy (Department of the Environment, 2009) identifies a number of recovery actions for Koala's, the project will not interfere significantly with any of the identified recovery actions.

The NSW Recovery plan for the Koala (Garnett and Crowley, 2000) addresses the need for further ecological research on the species and the conservation and protection of habitat and identification of specific breeding requirements.

Specific objectives of the Koala recovery plan (Menkhorst et al., 1999) include:

- conserving koalas in their existing environment;
- rehabilitating and restoring koala habitat and populations;
- developing a better understanding of the conservation biology of koalas;
- ensuring the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale;
- managing captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care;
- managing over browsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat; and
- coordinating, promoting of implementation, and monitoring of the effectiveness of the NSW Koala Recovery Strategy across NSW.

Based on the removal of potential habitat, as discussed above, it is likely that the project would be in conflict with the second objective above to a small extent, by not improving habitat for the Koala. However, the habitat to be removed is low quality with irregular scattered feed tree species in the

study area. Due to the limited and largely low quality habitat likely to be affected by the action proposed (9.5ha of potential habitat) and the abundance of similar, and potential habitat in the study area (468ha), the action proposed is not likely to interfere with the recovery of the this species.

Conclusion

The proposed action will impact 9.5ha of potential habitat for both Koala and Greater Glider. Approximately 468ha of potential habitat for both species occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Based on the low density of primary Koala feed trees in the study area and the limited records for both Koala and Greater Glider it is unlikely that the impact area acts as important habitat. It is unlikely that the proposed action would have a significant impact on these species.

3.6 Woodland Birds

Little Lorikeet (*Glossopsitta pusilla)*, Grey-crowned Babbler (*Pomatostomus temporalis temporalis*), Brown Treecreeper (*Climacteris picumnus victoriae)*, Glossy Black-cockatoo (*Calyptorhynchus lathami)* and Dusky Woodswallow (*Artamus cyanopterus)* are listed as a Vulnerable species under the *Threatened Species Conservation Act 1995*. These species have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the action proposed. The habitat and ecology of the threatened forest birds is summarised in the below table (Table 3.5).

Table 3.5 Habitat and distribution of forest birds

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Little Lorikeet	V		The Little Lorikeet is a small green lorikeet with black bill and red patch on forehead and throat. The underside is yellow-green. Immatures are duller with less red on face and brown bill. Found in forests, woodland, treed areas along watercourses and roads. Forages mainly on flowers, nectar and fruit. Found along coastal east Australia from Cape York in Queensland down east coast and round to South Australia. Uncommon in southern Victoria (Higgins, 1999).	• Extensive clearing of woodlands for agriculture has significantly decreased food for the lorikeet. • Small scale clearing, destroys habitat and foraging sites. • Loss of hollow bearing trees has reduced nest sites, and increased competition with other native and exotic species for nest sites. • Competition with the introduced Honeybee for both nectar and hollows.
Grey-crowned Babbler	V		The Grey-crowned Babbler is found mainly in rural districts where it predominantly lives in roadsides and private land (Schulz 1991). Suitable habitats are usually abundant with leaf litter and debris; often dominated by eucalypts including box and ironbark species, partly-cleared woodland, acacia shrubland and adjoining farmland (Higgins, 1999).	• Loss, degradation and fragmentation of woodland habitat • degradation and loss of important habitat components (woody debris) • Invasion of weeds, including exotic perennial grasses. • Inappropriate fire regimes • Aggressive exclusion from Noisy Miner • Nest predation

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Brown Treecreeper	V		Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts. Nesting occurs in tree hollows (Office of Environment and Heritage, 2011).	• Historical loss of woodland, forest and mallee habitats as a result of agriculture, forestry, mining and residential development. • Fragmentation of woodland and forest remnants. • Ongoing degradation of habitat, particularly the loss of tree hollows and fallen timber from firewood collection and overgrazing. • Loss of ground litter from compaction and overgrazing. • Inappropriate forestry management practices. • Loss of understorey habitat. • Competition from invasive weeds. • Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Glossy Black-cockatoo	V		The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits 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. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites (Office of Environment & Heritage, 2015).	• Reduction of suitable habitat through clearing for development. • Decline of hollow bearing trees over time due to land management activities. • Excessively frequent fire • Decline in extent and productivity of sheoak foraging habitat due to feral herbivores. • Decline in extent and productivity of sheoak foraging habitat caused by moisture stress due to climate change. • Degradation of foraging habitat and reduced regeneration of sheoak stands due to grazing by domestic stock. • Loss of foraging habitat due to slashing/underscrubbing. • Habitat infestation by weeds
Dusky Woodswallow	V		The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In NSW, it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. Often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. Also recorded in shrublands and heathlands and various modified habitat, including regenerating forest; very occasionally in moist forest or rainforests(Higgins and Peter, 2002).	• Apparent decline has been attributed to declining habitat • Poor regeneration of open forest and woodland habitats due to habitat removal and modification • Aggressive exclusion by Noisy Miner • Inappropriate fire regimes.

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest and remove 103 hollow-bearing trees (associated with Glossy Black-cockatoo and Brown Treecreeper). Habitat removal will occur around the edges of the two existing quarry pits.

3.6.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat for forest birds, including 103 hollow-bearing trees. Approximately 449ha of potential habitat for forest birds occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Based on the 2014 Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) the density of habitat trees within the study area is relatively high – on average 10 habitat trees per hectare and an approximate of 4445 habitat trees occur within the study area. The removal of approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to hollow-dependent species (i.e. Glossy Black-cockatoo and Brown Treecreeper). It is therefore unlikely that the action proposed would have an adverse effect on the life cycle of these species in which the local populations would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. In addition, 103 hollow-bearing trees will be impact by the action proposed. The removal of 9.5ha of habitat and 103 hollow-bearing trees would not significantly increase fragmentation or isolation for the mentioned species due to their ability to be highly mobile. The majority of the study area would still provide sufficient habitat (including hollow-bearing trees) for these species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 449ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of these species within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of Department of Environment & Heritage. There are currently four listed critical habitats in NSW. No critical habitat has been listed for any of the mentioned species. Given this, the action proposed is unlikely to have an adverse effect on critical habitat for the mentioned species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been developed for the mentioned species, as produced under the TSC Act. In the interim however, the Office of Environment and Heritage has identified landscape management actions to help recover forest birds. The project is unlikely to cause significant impacts with any management actions, however, removal of vegetation will breach some recovery actions including: retention of existing vegetation and retention of dead timber on the ground and retention of protected woodland from habitat clearing. However, as part of the mitigation measures, recommended actions will be put in place to alleviate the breaches of recovery actions, these will include:

- retention of existing vegetation where possible;
- salvage of dead timber from project area into adjacent habitat to provide ground habitat;
- control of weeds and exotic flora within retained vegetation;
- implement buffer zones around vegetation stands where possible; and
- revegetation and habitat restoration in disturbed areas

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to forest birds, the action proposed is consistent with three key threatening processes under the TSC Act:

- clearing of native vegetation
- removal of dead wood and dead trees
- loss of hollow-bearing trees (associated with Glossy Black-cockatoo and Brown Treecreeper)

The extent of native vegetation clearing and habitat removal associated with the action proposed is considered relatively small (9.5ha of habitat). Although the project will represent the loss of potential foraging and nesting habitat, such habitat would only be a small component of locally occurring resources (approximately 2%) accessible to these species.

Removal of 103 hollow-bearing trees will represent approximately a loss of 2% of available hollow-bearing trees within the study area. Due to the high density of hollow-bearing trees within the study area it is unlikely that the removal of 103 hollow-bearing trees would be significant.

Conclusion

The action proposed will impact 9.5ha of potential habitat for forest birds, including 103 hollow-bearing trees. Approximately 449ha of potential habitat for forest birds occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Similarly approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to hollow dependent species. Based on the relative small extent of habitat to be impacted and the retention and accessible habitat within the study area is it unlikely that the action proposed would have a significant impact on forest birds.

3.7 Large Forest Owls

Powerful Owl (*Ninox strenua)*, Masked Owl (*Tyto novaehollandiae*) and Barking Owl (*Ninox connivens*) are listed as a Vulnerable species under the *Threatened Species Conservation Act 1995*. These species have been assessed together as they share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the action proposed. The habitat and ecology of the large forest owls is summarised in the below table (Table 3.6).

Table 3.6 Habitat and Distribution of large forest owls

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Powerful Owl	V		The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with staring yellow eyes and no facial-disc (Garnett and Crowley, 2000). It is a sedentary species with a home range of approximately 1000 hectares it occurs within open eucalypt, Casuarina or Callitris pine forest and woodland. It often roosts in denser vegetation including rainforest of exotic pine plantations. Generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling and require a shrub layer and owls are more often found in areas with more old trees and hollows than average stands (Garnett and Crowley, 2000).	• Fragmentation and loss of suitable woodland habitat. • Loss of hollow-bearing trees and changes in forest structure. • Disturbance during the breeding period. • High fire frequency. • Road kills. • Secondary poisoning • Predation of fledglings by foxes, dogs and cats
Masked Owl	V		Occurs within a diverse range of wooded habitats including forests, remnants and almost treeless inland plains. This species requires large-hollow bearing trees for roosting and nesting and nearby open areas for foraging. They typically prey on terrestrial mammals including rodents and marsupials but will also take other species opportunistically. Also known to occasionally roost and nest in caves (Garnett and Crowley, 2000).	• Loss of mature hollow-bearing trees • 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.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Barking Owl	V		The Barking Owl occurs in dry sclerophyll woodland. In the south-west it is often associated with riparian vegetation while in the south-east it generally occurs on forest edges. It nests in large hollows in live eucalypts, often near open country. It feeds on insects in the non-breeding season and on birds and mammals in the breeding season (Garnett and Crowley, 2000).	• Clearing and degradation of habitat • Inappropriate forest harvesting practices that remove old, hollow-bearing trees • Firewood harvesting resulting in the removal of fallen logs and felling of large dead trees. • Too-frequent fire leading to degradation of understorey vegetation • Disturbance of nesting and excessive disturbance of foraging by inappropriate use of call-playback surveys

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest and remove 103 hollow-bearing trees. Habitat removal will occur around the edges of the two existing quarry pits.

3.7.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat for large forest owls, including 103 hollow-bearing trees. Approximately 449ha of potential habitat for forest birds occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Based on the 2014 Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) the density of habitat trees within the study area is relatively high – on average 10 habitat trees per hectare and an approximate of 4445 habitat trees occur within the study area. The removal of approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to large forest owls. It is therefore unlikely that the action proposed would have an adverse effect on the life cycle of these species in which the local populations would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. In addition, 103 hollow-bearing trees will be impact by the action proposed. The removal of 9.5ha of habitat and 103 hollow-bearing trees would not significantly increase fragmentation or isolation for the mentioned species due to their ability to be highly mobile. The majority of the study area would still provide sufficient habitat (including hollow-bearing trees) for these species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 449ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of these species within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of Department of Environment & Heritage. There are currently four listed critical habitats in NSW. No critical habitat has been listed for any of the mentioned species. Given this, the action proposed is unlikely to have an adverse effect on critical habitat for the mentioned species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan listing a number of recovery actions has been prepared for Large Forest Owls (Department of Environment and Conservation, 2006), in which Barking Owl is not include, however it shares similar ecological characteristics to the species listed. The overall objective of the NSW Large Forest Owl Recovery Plan is to ensure that the large forest owl species persist in the wild in NSW in each region where they presently occur. No threat abatement plans have been prepared for these threatened species. The Office of Environment and Heritage has assigned this species as Landscape management species under the *Saving our Species* program with a number of recovery actions for these species. The action proposed will not interfere significantly with any of the management actions within the Large Forest Owl Recovery Plan and is consistent with the recovery actions under *Saving our Species* program.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to large forest owls, the action proposed is consistent with two key threatening processes under the TSC Act:

- clearing of native vegetation

- loss of hollow-bearing trees

The extent of native vegetation clearing and habitat removal associated with the action proposed is considered relatively small (9.5ha of habitat). Although the project will represent the loss of potential foraging and nesting habitat, such habitat would only be a small component of locally occurring resources (approximately 2%) accessible to these species.

Removal of 103 hollow-bearing trees will represent approximately a loss of 2% of available hollow-bearing trees within the study area. Due to the high density of hollow-bearing trees within the study area it is unlikely that the removal of 103 hollow-bearing trees would be significant. The impacts to large forest owls and nesting will be managed by undertaking pre-clearing surveys.

Conclusion

The action proposed will impact 9.5ha of potential habitat for large forest owls, including 103 hollow-bearing trees. Approximately 449ha of potential habitat for owls occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Similarly approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to owls. Based on the relative small extent of habitat to be impacted and the retention and accessible habitat within the study area is it unlikely that the action proposed would have a significant impact on large forest owls.

3.8 Macropods

Rufous Bettong (*Aepyprymnus rufescens)* and Red-legged Pademelon (*Thylogale stigmatica)* are listed as a Vulnerable species under the *Threatened Species Conservation Act 1995*. These species have been assessed together as they share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the action proposed. The habitat and ecology of macropods is summarised in the below table (Table 3.7).

Table 3.7 Habitat and Distribution of threatened macropods

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Rufous Bettong	V		From Cooktown in north Queensland, to north-east NSW, where it occurs east of the Dividing Range. In Queensland, it still occurs on both sides of the Great Divide. Found in a variety of forest types from wet sclerophyll to dry open woodland, where grass tussocks or fallen timber are present. Also known to occupy a mosaic of open forest and grasslands. It appears to prefer a more open forest structure, with a sparse shrub layer and a diverse ground cover. Builds nests in grass tussocks and under logs. Strongly associated with dry sclerophyll forest particularly those dominated by Spotted Gum (NSW National Parks and Wildlife Service, 1999c).	• 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.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Red-legged Pademelon	V		Restricted to the coastal and subcoastal strip of eastern Australia, from the tip of Cape York in north Queensland, south to the Hunter Valley, just north of Newcastle in NSW. Populations are confined mainly to areas of high rainfall. Macrohabitat is coastal and sub-coastal rainforests and wet sclerophyll forest. Dense understorey and ground cover is important. Ecotones between open and closed forest are favoured. Open areas are used for foraging while areas of dense ground cover / understorey provide areas for shelter and protection from predators (NSW National Parks and Wildlife Service, 1999c).	• Damage to habitat by feral pigs and domestic stock. • Loss of habitat through land clearing. • Predation by feral cats and foxes. • Frequent burning of understorey reducing shrub layer, particularly at forest margins. • Feral dogs and dingos. • Clearing and degradation of habitat providing cover; generally occurs on private properties adjacent to reserves. • Removal of wild dogs and dingoes potentially exposes pademelons to other threats (competition from other macropod species / fox predation) due to removal of top order predator.

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest for Rufous Bettong. Habitat removal will occur around the edges of the two existing quarry pits. In regards to Red-legged Pademelon, the action proposed will not impact any potential habitat (i.e. lowland rainforest) associated with the species.

3.8.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat for the Rufous Bettong. Approximately 449ha of potential habitat is available within the study area, the removal of 9.5ha of potential habitat represents only 2% of habitat to be impacted. This species is highly mobile and would still be able to utilise the remaining habitat in the study area, it is considered unlikely that the impact of 9.5ha (loss of 2% of potential habitat) will have a significantly adverse effect upon local Rufous Bettong populations that it is likely to be placed at risk of extinction.

In regards to the Red-legged Pademelon, the action proposed will not impact any potential habitat associated with this species (i.e. Lowland Rainforest) or surrounding this habitat. Therefore it is unlikely that the action proposed will have a significantly adverse effect upon local populations that it is likely to be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest for Rufous Bettong. Habitat removal will occur around the edges of the two existing quarry pits. In regards to Red-legged Pademelon, the action proposed will not impact any potential habitat (i.e. lowland rainforest) associated with the species.

The removal of 9.5ha of habitat would not significantly increase fragmentation or isolation for this species. The majority of the study area would still provide sufficient habitat for the species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of 2% of habitat and extensive accessible habitat would still remain (approximately 449ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of the Rufous Bettong within the locality.

In regards to the Red-legged Pademelon, the action proposed will not impact any potential habitat associated with this species (i.e. Lowland Rainforest) or surrounding this habitat. Therefore it is unlikely that the action proposed will reduce the long-term survival of the Red-legged Pademelon within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of the Office of Environment and Heritage. No critical habitat has been listed for both species. No areas within the study area are considered critical to the survival of the either Rufous Bettong or Red-legged Pademelon.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for either the Rufous Bettong or Red-legged Pademelon under the TSC Act. The Office of Environment and Heritage has assigned the Red-legged Pademelon as Landscape management species under the *Saving our Species* program. The Office of Environment

and Heritage has identified a number of management actions for the recovery for this species (Table 3.2).

The Department of Environment and Conservation has assigned 17 priority actions to help in the recovery of the Rufous Bettong within NSW. The action proposed is unlikely to have an adverse effect any of these recovery actions. This action proposed is unlikely to significantly affect the recovery of any local population of the species.

The action proposed will not significantly interfere with any of the recovery actions for either the Rufous Bettong or Red-legged Pademelon.

Table 3.8 Recovery actions for Red-legged Pademelon

Action*	Relevance to project
Conduct bush regeneration in degraded habitat to progressively replace lantana understorey with native rainforest vegetation.	Not relevant.
Implement monitoring of wallabies as well as fox activity at a selection of sites where wild dog control is known to occur / not occur. Monitor activity using motion-sensor cameras and sand-pads to evaluate impacts of predator control on populations.	Not relevant.

*The above recovery actions do not include actions which are related to state or regional wide actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

Threatening process means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. Key threatening processes are listed under the TSC Act.

With respect to Rufous Bettong and Red-legged Pademelon, the project is consistent with one KTP:

- clearing of native vegetation.

None of these KTPs are likely to significantly affect either species in the locality, as the action proposed will not impact any potential habitat associated with Red-legged Pademelon and the action proposed would only impact 2% of available potential habitat for Rufous Bettong.

Conclusion

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest for Rufous Bettong. Habitat removal will occur around the edges of the two existing quarry pits. In regards to Red-legged Pademelon, the action proposed will not impact any potential habitat (i.e. lowland rainforest) associated with the species. The removal of 9.5ha of potential habitat will represent a 2% loss of accessible habitat within the study area (approximately 449ha of potential habitat in the study area). The removal of habitat will not significantly increase fragmentation or isolate any patches of habitat. It is unlikely that the action proposed will significantly impact the either Rufous Bettong or Red-legged Pademelon.

3.9 Microbats

Threatened microchiropteran bats have been assessed together as they generally share similar habitat requirements, threats that affect their recovery, and potential impacts as result of the project. Threatened microchiropteran bats considered for this impact assessment are:

- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern Freetail Bat (*Micronomus norfolkensis* (syn. *Mormopterus norfolkensis*))
- Little Bentwing Bat (*Miniopterus australis*)
- Hoary Wattled Bat (*Chalinolobus nigrogriseus*).

These species have been assessed as a guild because of their similarity in habitat usage and habits, which are described in

Table 3.9 Habitat and Distribution of threatened microbats

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Eastern False Pipistrelle	V		Usually roosts in tree hollows in higher rainfall forests. Sometimes found in caves (Jenolan area) and abandoned buildings (Churchill, 2008).	• 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.
Yellow-bellied Sheathtail Bat	V		The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. 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.	• 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.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Greater Broad-nosed Bat	V		The preferred hunting areas of this species include tree-lined creeks and the ecotone of woodlands and cleared paddocks but it may also forage in rainforest. Typically it forages at a height of 3-6 metres but may fly as low as one metre above the surface of a creek. It feeds on beetles, other large, slow-flying insects and small vertebrates. It generally roosts in tree hollows but has also been found in the roof spaces of old buildings (Churchill, 2008).	• 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. • Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores. • Changes to water regimes are likely to impact food resources, as is the use of pesticides and herbicides near waterways.
Eastern Freetail Bat	V		Thought to live in Sclerophyll forest and woodland. Small colonies have been found in tree hollows or under loose bark. It feeds on insects above the forest canopy or in clearings at the forest edge (Churchill, 2008).	• 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.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Little Bentwing Bat	V		Feeds on small insects beneath the canopy of well timbered habitats including rainforest, Melaleuca swamps and dry Sclerophyll forests. Roosts in caves and tunnels and has specific requirements for nursery sites. Distribution becomes coastal towards the southern limit of its range in NSW. Nesting sites are in areas where limestone mining is preferred (Strahan, 1995).	• Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic. • Destruction of caves that provide seasonal or potential roosting sites. • 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 • Hazard reduction and wildfire fires during the breeding season. • Large scale wildfire or hazard reduction can impact on foraging resources.

Common Name	TSC Act	EPBC Act	Habitat and distribution	Threats
Hoary Wattled Bat	V		Widely distributed across northern Australia although absent from the arid centre. In north east NSW it extends from Port Macquarie in the south, north to the Queensland border. The species has been recorded as far west as Armidale and Ashford. In NSW the Hoary Wattled Bat occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Because it flies fast below the canopy level, forests with naturally sparse understorey layers may provide the best habitat. Roosts in hollows and rock crevices.	• Clearing and fragmentation of dry forest and woodland habitat through clearing for agriculture and development. • Loss of tree hollows for roosting and maternity sites from forest management favouring younger stands of trees. • Loss of hollow-bearing trees used for roosting and maternity sites as a result of too-frequent burning for grazing and forestry management activities. • Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals. The use of pesticides also reduces available insect food sources.

Specific impacts

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest, including 103 hollow-bearing trees. Habitat removal will occur around the edges of the two existing quarry pits. The action proposed would not impact any caves or potential cave roosting sites.

3.9.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential habitat and 103 hollow-bearing trees for hollow-dependent bats. The action proposed would not impact any caves or potential cave roosting sites for cave-dwelling bats (i.e. Little Bentwing). Approximately 468ha of potential habitat occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for this species. Based on the 2014 Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd, 2014) the density of habitat trees within the study area is relatively high – on average 10 habitat trees per hectare and an approximate of 4445 habitat trees occur within the study area. The removal of approximately 103 habitat trees within the approved expansion area would only constitute a loss of 2.3% of habitat trees available to this species. It is therefore unlikely that the action proposed would have an adverse effect on the life cycle of this species in which the local population of any of the mentioned threatened microbats would be placed at risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential habitat in the form of open sclerophyll forest. In addition, 103 hollow-bearing trees will be impact by the action proposed. The action proposed would not impact any caves or potential cave roosting sites for cave-dwelling bats (i.e. Little Bentwing). The removal of 9.5ha of habitat and 103 hollow-bearing trees would not significantly increase fragmentation or isolation for this species. The majority of the study area would still provide sufficient habitat (including hollow-bearing trees) for the species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 468ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of the any of the mentioned species within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of Department of Environment & Heritage. There are currently four listed critical habitats in NSW. No critical habitat has been listed for any of the mentioned species. Given this, the action proposed is unlikely to have an adverse effect on critical habitat for the mentioned species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The Office of Environment and Heritage has assigned these species to the Landscape or Partnership species management stream under the *Saving our Species* program (Office of Environment and Heritage, 2017). No priority sites have been identified within the study area or within the locality for any of the mentioned species. The Office of Environment and Heritage has identified a number of management actions for the recovery of these species.

The action proposed is unlikely to have an adverse effect on any of these recovery actions with the exception of vegetation removal around possible roost sites (approximately 103 hollows-bearing trees). Based on the 2014 Flora and Fauna Assessment (Australian Wetlands Consulting Pty Ltd,

2014) the density of habitat trees within the study area is relatively high – on average 10 habitat trees per hectare and an approximate of 4445 habitat trees occur within the study area. The removal of approximately 103 habitat trees within the approved expansion area would only constitute a loss of 2.3% of habitat trees available to hollow-dependent microbats. It is unlikely that the removal of 103 habitat trees within the proposed expansion area would be a significant impact to threatened hollow-dependent species and to the recovery of these species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to threatened microbats, the action proposed is consistent with three key threatening processes under the TSC Act:

- clearing of native vegetation
- removal of dead wood and dead trees
- loss of hollow-bearing trees

The extent of native vegetation clearing and habitat removal associated with the action proposed is considered relatively small (9.5ha of habitat). Although the project will represent the loss of potential foraging and roosting habitat, such habitat would only be a small component of locally occurring resources (approximately 2%) accessible to these species.

Removal of 103 hollow-bearing trees will represent approximately a loss of 2.3% of available hollow-bearing trees within the study area. Due to the high density of hollow-bearing trees within the study area it is unlikely that the removal of 103 hollow-bearing trees would be significant.

Conclusion

The action proposed will impact 9.5ha of potential habitat for microbats, including 103 hollow-bearing trees. Approximately 468ha of potential habitat for microbats occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Similarly approximately 103 habitat trees within the impact area would only constitute a loss of 2.3% of habitat trees available to hollow dependent species. Based on the relative small extent of habitat to be impacted and the retention and accessible habitat within the study area is it unlikely that the action proposed would have a significant impact on forest birds.

3.10 Grey-headed Flying-fox

Status

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under both the TSC Act and EPBC Act.

Habitat and Distribution

The Grey-headed Flying is endemic to Australia and presently occurs along the east coast from Maryborough in Queensland to Melbourne, Victoria (Department of the Environment and Heritage, 2003). This species is also occasionally found west of the Great Dividing Range to the western slopes of NSW and QLD. At any one time, the majority of animals only occupy a small proportion of this entire range (NSW National Parks and Wildlife Service, 2001). The Grey-headed Flying-fox utilises subtropical and temperate rainforests, tall sclerophyll forests, woodlands, heaths, swamps and mangroves, as well as urban gardens and fruit crops for foraging (Churchill, 2008, NSW National Parks and Wildlife Service, 2001).

This species is considered an important pollinator and seed disperser of native trees, as they forage on the nectar and pollen of eucalypts, angophoras, melaleucas and banksias, as well as fruit of rainforest trees and vines (NSW National Parks and Wildlife Service, 2001, Van Dyck and Strahan, 2008). While the majority of foraging events occur within 20 km of their day roost, some individuals will disperse and commute up to 50 km (Van Dyck and Strahan, 2008).

Grey-headed Flying-foxes are highly mobile and as the availability of native fruits, nectar and pollen varies over time and throughout their range, they respond to this by migrating between camps up and down the east coast, sometimes travelling hundreds of kilometres (NSW National Parks and Wildlife Service, 2001). When migration occurs they do not move as a colony, but as individuals or small groups resulting in the intermixing of sub-populations (Churchill, 2008). The population concentrates in May and June in northern NSW and Queensland where animals exploit winter-flowering trees such as Swamp Mahogany, Forest Red Gum and Paperbark, dispersing south during the summer (Department of the Environment and Heritage, 2003).

Grey-headed Flying-fox roost in large colonies of up to tens of thousands and may be shared with Little Red Flying-fox and Black Flying-fox(Churchill, 2008). Camps are generally located in gullies with dense vegetation (such as mangrove, rainforest, Melaleuca and Casuarina), close to water and generally located within 20 km of a regular food source (NSW National Parks and Wildlife Service, 2001). Site fidelity to camps is high with some camps in NSW used for over a century (NSW National Parks and Wildlife Service, 2001).These bats usually return annually to particular camps for rearing young (NSW National Parks and Wildlife Service, 2001).

Threats

- loss of foraging habitat
- disturbance of roosting sites
- unregulated shooting
- electrocution on powerlines.

Specific impacts

The action proposed will impact 9.5ha of potential foraging habitat in the form of open sclerophyll forest. Habitat removal will occur around the edges of the two existing quarry pits. No roost camps or potential roost camps will be impacted by the action proposed.

3.10.1 TSC Act significance assessment

In the case of a threatened species, whether the action proposed 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.

The action proposed will impact 9.5ha of potential foraging habitat in the form of open sclerophyll forest. The habitat to be impact would act as foraging habitat in the form of blossoming eucalypts and native fruiting trees. Although the action proposed will represent the loss of potential foraging habitat, the action proposed area would only be a small component of locally occurring resources that would be accessible to these species (approximately 468ha of potential habitat will be retained in the study area). No roost camps or potential roost camps will be impacted by the action proposed. Thus, the action proposed is not considered likely to impact the Grey-headed Flying-fox such that a viable local population would be placed at a significant risk of extinction.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the specie s that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **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**
- **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**

Not applicable.

In relation to the habitat of a Threatened species, population or ecological community:

- **the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality**

The action proposed will impact 9.5ha of potential foraging habitat in the form of open sclerophyll forest. Habitat removal will occur around the edges of the two existing quarry pits. No roost camps or potential roost camps will be impacted by the action proposed. The removal of 9.5ha of foraging habitat would not significantly increase fragmentation or isolation for the Grey-headed Flying-fox species due to their ability to be highly mobile. The majority of the study area would still provide sufficient habitat for the species including connectivity to large extents of native vegetation to the south and west. The removal of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 468ha). It is unlikely that the impact of 9.5ha of potential habitat would reduce the long-term survival of the species within the locality.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Critical habitat refers to those areas of land listed in the Register of Critical Habitat kept by the Chief Executive Officer of Department of Environment & Heritage. There are currently four listed critical habitats in NSW. No critical habitat has been listed for the Grey-headed Flying-fox. Given this, the action proposed is unlikely to have an adverse effect on critical habitat for this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plan has been prepared for Grey-headed Flying-fox under the TSC Act. The Office of Environment and Heritage has identified a number of management actions for the recovery for this species (Table 3.10). The action proposed will has relevance to one recovery action, being increasing the extent and viability of foraging habitat that is productive during winter and spring, by removing potential foraging habitat. However mitigation measures regarding habitat restoration will be undertaken in areas where foraging habitat it impacted. Despite this, the impact of 9.5ha of potential habitat would only represent a loss of approximately 2% of habitat and extensive accessible habitat would still remain (approximately 468ha). Therefore the action proposed is unlikely to significantly interfere with any of the recovery actions for this species.

Table 3.10 Recovery actions for Grey-headed Flying-fox

Action*	Relevance to project
Increase the extent and viability of foraging habitat for the Grey-headed Flying-fox that is productive during winter and spring through dedicated habitat creation and restoration using guides published by OEH (in preparation).	Some relevance. Removal of potential foraging habitat, however habitat restoration will be undertaken.
Negotiate agreements with landholders, particularly in-perpetuity covenants or stewardship agreements that promote the protection and retention of high quality foraging habitat and roost sites for grey-headed flying-foxes.	Not relevant. Action proposed doesn't contain vital foraging habitat or any roosts
Rehabilitate degraded flying-fox roost sites through weed management, planting new roost trees, managing understorey vegetation to maintain suitable microclimate conditions, establishing buffers between roost camps and nearby human settlements to minimise conflict.	Not relevant.
Conduct dedicated engagement programs in communities affected by flying-fox roost sites, building the capacity of all stakeholders to engage in the process of decision-making and developing camp management plans. Provide information about mitigating the impacts of flying-foxes on nearby residences and businesses such as strategic vegetation management, and structural modifications like double-glazing, air conditioning and shade cloths.	Not relevant.
Distribute public education materials to land managers and local community groups working with contentious flying-fox roost sites highlighting species status, reasons for being in urban areas, reasons for decline etc.	Not relevant.
Develop site-based heat stress response protocols for camps likely to be affected by heat stress events. Protocols should be based on best practice guidelines (http://www.environment.nsw.gov.au/animals/flying-fox-heat.htm), and should be implemented by licensed fauna rehabilitators. Data should be recorded to inform future management of heat stress events (http://www.environment.nsw.gov.au/resources/animals/150725-flying-fox-heat-data.docx).	Not relevant.

*The above recovery actions do not include actions which are related to state or regional wide actions.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to Grey-headed Flying-fox, the action proposed is consistent with three key threatening processes under the TSC Act:

- clearing of native vegetation

The extent of native vegetation clearing and habitat removal associated with the action proposed is considered relatively small in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally.

Conclusion

The action proposed will impact 9.5ha of potential habitat for Grey-headed Flying-fox. Approximately 468ha of potential habitat for Grey-headed Flying-fox occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Based on the relative small extent of habitat to be impacted and the retention and accessible habitat within the study area is it unlikely that the action proposed would have a significant impact on Grey-headed Flying-fox.

3.10.2 EPBC Act significance assessment for Grey-headed Flying-fox

The Grey-headed Flying-fox is listed as Vulnerable under the EPBC Act. The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity
- at or near the limit of the species range.

Is this part of an important population?

Grey-headed Flying-foxes occur across a range of wooded habitats where their favoured food, eucalypt blossom occurs. They set up roosting camps in association with blossom availability, which are usually situated in dense vegetation and associated with water. Grey-headed Flying-foxes can migrate up to 75 km north during the winter and during this time young flying-foxes establish camps.

A small roosting camp was observed 6.5km from the study area along the Richmond River near Woodburn, individuals from this camp would be expected to foraging within the study area. The study area does not contain suitable habitat for roosting camps and such habitat does not occur within its close vicinity. Therefore, a population of Grey-headed Flying-fox in the study area is not considered to be important, as no roost sites would be affected by the project.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

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

Not applicable. Grey-headed Flying-fox occurring in the in the study area is not part of an important population.

Reduce the area of occupancy of an important population of the species

Not applicable. Grey-headed Flying-fox occurring in the in the study area is not part of an important population.

Fragment an existing important population into two or more populations

Not applicable. Grey-headed Flying-fox occurring in the in the study area is not part of an important population.

Adversely affect habitat critical to the survival of a species

No critical habitat is listed for this species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment and Heritage 2006a).

The action proposed would impact 9.5ha of suitable foraging habitat for this species. As this species is highly mobile, with individuals foraging up to 50 km from roost sites, suitable foraging resources would be accessed in the locality. In addition, approximately 468ha of potential habitat for Grey-headed Flying-fox occurs within the study area, the removal of 9.5ha of potential habitat would represent only a loss of approximately 2% of habitat for these species. Therefore, this would not meet the above criteria.

Disrupt the breeding cycle of an important population

Not applicable. Grey-headed Flying-fox occurring in the in the study area is not part of an important population.

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

No. The project would only affect 9.5 ha of suitable foraging habitat for this species. As this species is known to forage up to 50 km from roost sites, the action proposed is not likely to significantly affect the availability of quality habitat for this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species´ habitat

It is not likely that invasive species (such as introduced predators) that are harmful to the Grey-headed Flying-fox would become further established as a result of the action proposed.

Introduce disease that may cause the species to decline

No. There are no known diseases that are likely to increase in the area as a result of the action proposed.

Interfere with the recovery of the species

Based on the relative small extent of habitat to be impacted, the retention and accessible habitat within the study area and no roost camps are located in the vicinity of the study area is it unlikely that the action proposed would interfere with the recovery of this species.

Conclusion

The Grey-headed Flying-fox frequents habitats that contain eucalypt blossom and native fruits such as figs, which are their favoured foods. The study area contains a number of eucalypt dominated

communities, these include those that are utilised by this species. A small amount of potentially suitable foraging habitat (9.5ha) will be affected by the action proposed, although this is unlikely to be significant to local populations, due to the abundance of similar and greater quality foraging habitat elsewhere within the study area (469ha) and in the wider locality. There were no Grey-headed Flying-fox camps within the study area or its vicinity, but there are camps in the wider region. Therefore habitat attributes occurring within the study area are not considered important to the long-term survival of the Grey-headed Flying-fox.

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Appendix B EPBC Search

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

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

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

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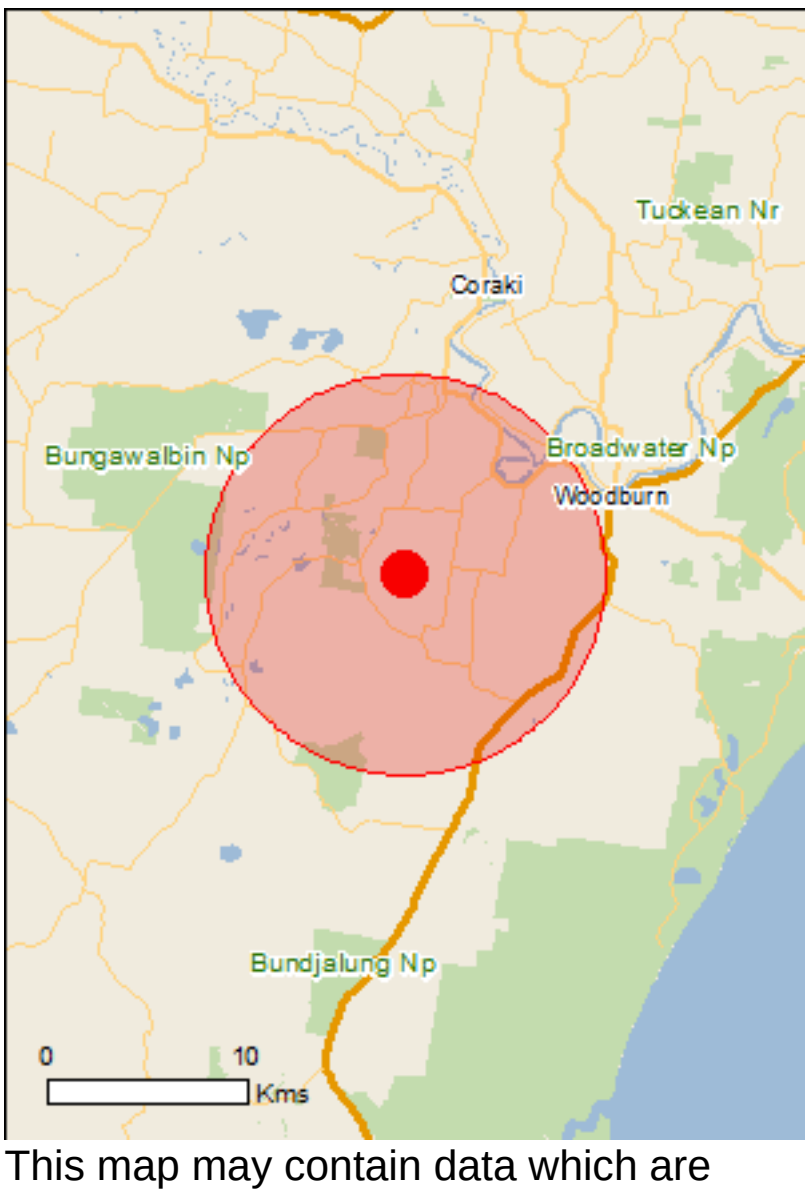

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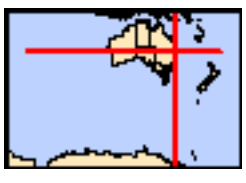

Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	60
Listed Migratory Species:	35

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	40
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	8
Regional Forest Agreements:	1
Invasive Species:	37
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

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

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat likely to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Nannoperca oxleyana Oxleyan Pygmy Perch [64468]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria olongburensis Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat may occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur within area
Insects		

Name	Status	Type of Presence
Phyllodes imperialis smithersi		
Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Plants		
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat may occur within area
Arthraxon hispidus		
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Cryptocarya foetida		
Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Desmodium acanthocladum		
Thorny Pea [17972]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus glaucina		
Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Gossia fragrantissima		
Sweet Myrtle, Small-leaved Myrtle [78867]	Endangered	Species or species habitat likely to occur within area
Hibbertia marginata		
[21970]	Vulnerable	Species or species habitat likely to occur within area
Macadamia integrifolia		
Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat known to occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat may occur within area
Ochrosia moorei Southern Ochrosia [11350]	Endangered	Species or species habitat likely to occur within area
Owenia cepiodora Onionwood, Bog Onion, Onion Cedar [11344]	Vulnerable	Species or species habitat likely to occur within area
Paspalidium grandispiculatum a grass [10838]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Prostanthera palustris Swamp Mint-bush [66703]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
Saiphos reticulatus Three-toed Snake-tooth Skink [88328]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
[Tringa nebularia](#)		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		
[Caretta caretta](#)		
Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
[Chelonia mydas](#)		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
[Dermochelys coriacea](#)		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Eretmochelys imbricata](#)		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Natator depressus](#)		
Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
[Sousa chinensis](#)		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bungawalbin	NSW
FMAs in CASINO	NSW
Jackywalbin	NSW
Pyrocarpa	NSW
Tabbimoble Swamp	NSW
UNE Special Management Zone No1	NSW
Yarringully	NSW
Yarringully	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
[North East NSW RFA](#)	New South Wales

Invasive Species	[Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Lower Bungawalbin Catchment Wetland Complex	NSW

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-29.10358 153.24819

Acknowledgements

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

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

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

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

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