APPENDIX E

Biodiversity Values of Gulf Mountain

16 July 2012

Dorian Walsh
Hansen Bailey
PO Box 473
Singleton NSW 2330

Cumberland Ecology
PO Box 2474
Carlingford Court 2118
NSW Australia
Telephone (02) 9868 1933
Mobile 0425 333 466
Facsimile (02) 9868 1977
Web: www.cumberlandecology.com.au

RE: BIODIVERSITY VALUES OF GULF MOUNTAIN: A POTENTIAL OFFSET PROPERTY FOR THE COALPAC CONSOLIDATION PROJECT AMENDED BIODIVERSITY OFFSET STRATEGY

Dear Dorian

The purpose of this letter is to summarise the biodiversity values of the aforementioned property that is being considered for inclusion in the Coalpac Consolidation Project (the Project) Biodiversity Offset Strategy.

We have completed a two day site investigation of the Gulf Mountain property and this letter summarises our findings.

The primary aim of site investigations was to verify and quantify vegetation communities and flora and fauna habitat for, but not limited to, threatened species predicted to be impacted by the Project. We have concluded that the 1,277 ha Gulf Mountain property could add substantially to the current biodiversity offset package proposed for the Project.

Appendix A summarises the biodiversity values of Gulf Mountain property.

Yours sincerely

David Robertson

David Robertson
Director
david.robertson@cumberlandecology.com.au

Appendix A

Biodiversity Values of Gulf Mountain

A.1 Background

An Environmental Assessment was prepared and exhibited for the Project by Hansen Bailey (2012). The Project included an offset package to compensate for predicted impacts to flora and fauna and currently includes the features shown in the table below:

Table A.1 Pre-existing Offset Package

Vegetation Type	Project Disturbance Boundary (ha)	Proposed Offset (ha)	Proposed Offset Ratio
CEEC and EEC[1]	18.44	221.7	12.0
Non C/EEC (native only)	818.41	1,530	1.9
TOTAL	**836.85**	**1,752**	**2.1**

Notes: 1 includes the area of EPBC Act and TSC Act Box Gum Woodland and Derived Native Grassland.

Following exhibition, discussions were held with key Government agencies to progress work on preparation of a Response to Submissions report. One of the key concerns raised by government representatives was the size of pre-existing offsets. Consequently, the proponent has commissioned subsequent searches for offsets and has proposed additions to the proposed biodiversity offset package.

This report provides a summary of biodiversity values from preliminary site investigations of a potential offset property, Gulf Mountain.

A.2 Methods

Prior to the site inspection of the Gulf Mountain property, a database analysis of threatened species recorded in the area (10km radius) was undertaken. The species recorded in the area were among a suite of species considered during habitat assessment of the property. During the two day site inspection on 9-10 July 2012, existing vegetation mapping was ground-truthed by recording the changes in vegetation composition and structure during random meanders and using aerial photography, topographic maps, a hand-held GPS unit and photographs. Notes and photographs were recorded during habitat assessment. Incidental fauna sightings and scats were also recorded during the site inspection.

A.3 Key Findings – Gulf Mountain

The key features of this property for consideration as a biodiversity offset are as follows:

Lot & DP: Lot 56 DP 755791.

Size: 1,277 ha.

Bioregion: South Eastern Highlands Bioregion.

Location/Context: adjoins private forested land. It is not connected directly to OEH land, but links indirectly through to Winburndale Nature Reserve via a strip of uncleared forest and woodland to the south of the property. Winburndale Nature Reserve connects to Turon State Forest and Sunny Corner State Forest. The property has 5.4 kilometres of Turon River frontage.

Geology: A suite of conglomerate, sandstone, mudstone siltstone geological units, including similar geological formations to those that occur in parts of the Project Boundary.

Topography: The terrain of this property is very steep and rugged. The property drops from 1,100 m above sea level to approximately 700m above sea level where it meets the Turon River.

Vegetation & Habitat Condition: good condition with local impacts from pigs and goats.

A.3.1 Vegetation

Three vegetation types that occur in the Project Boundary (impact area) predominate across Gulf Mountain, including Sheltered Gully Forest, Broad-leaved Peppermint – Brittle Gum Woodland and Scribbly Gum Woodland.

Aspect and topography seem to dictate the distribution and occurrence of vegetation communities. Very steep, rocky and west facing slopes generally supported Scribbly Gum Woodland where Scribbly Gum (*Eucalyptus rossii*) and Red Stringybark (*Eucalyptus macrorhyncha*) were most common (**Photograph A.1** and **A.2**). The understorey varied in structure and composition depending on aspect. Exposed slopes were sparsely vegetated and species poor; some steep south facing slopes had a rich grassy ground layer. On less steep slopes, mountain saddles and in sheltered dry gullies, Broad-leaved Peppermint (*Eucalyptus dives)* and Brittle Gum (*Eucalyptus mannifera*) Woodland occurred with a grassy and herbaceous ground layer. At some gully heads on gentle slopes, Mountain Gum (*E. dalrympleana*) and Ribbon Gum (*E. viminalis*) were common and sometimes dominated the canopy (**Photograph A.7**). Riparian River Oak Forest dominated by River oak (*Casuarina cunninghamiana)* was confined to the Turon River (**Photograph A.5**) with creek flats and upland drainage lines supporting Sheltered Ribbon Gum (*Eucalyptus viminalis*) Open Forest with the understorey varying from shrubby to grassy (**Photograph A.6**). There is also potential for some small areas of Sheltered Ribbon Gum Open Forest along creek flats to resemble CEEC Box Gum Woodland.

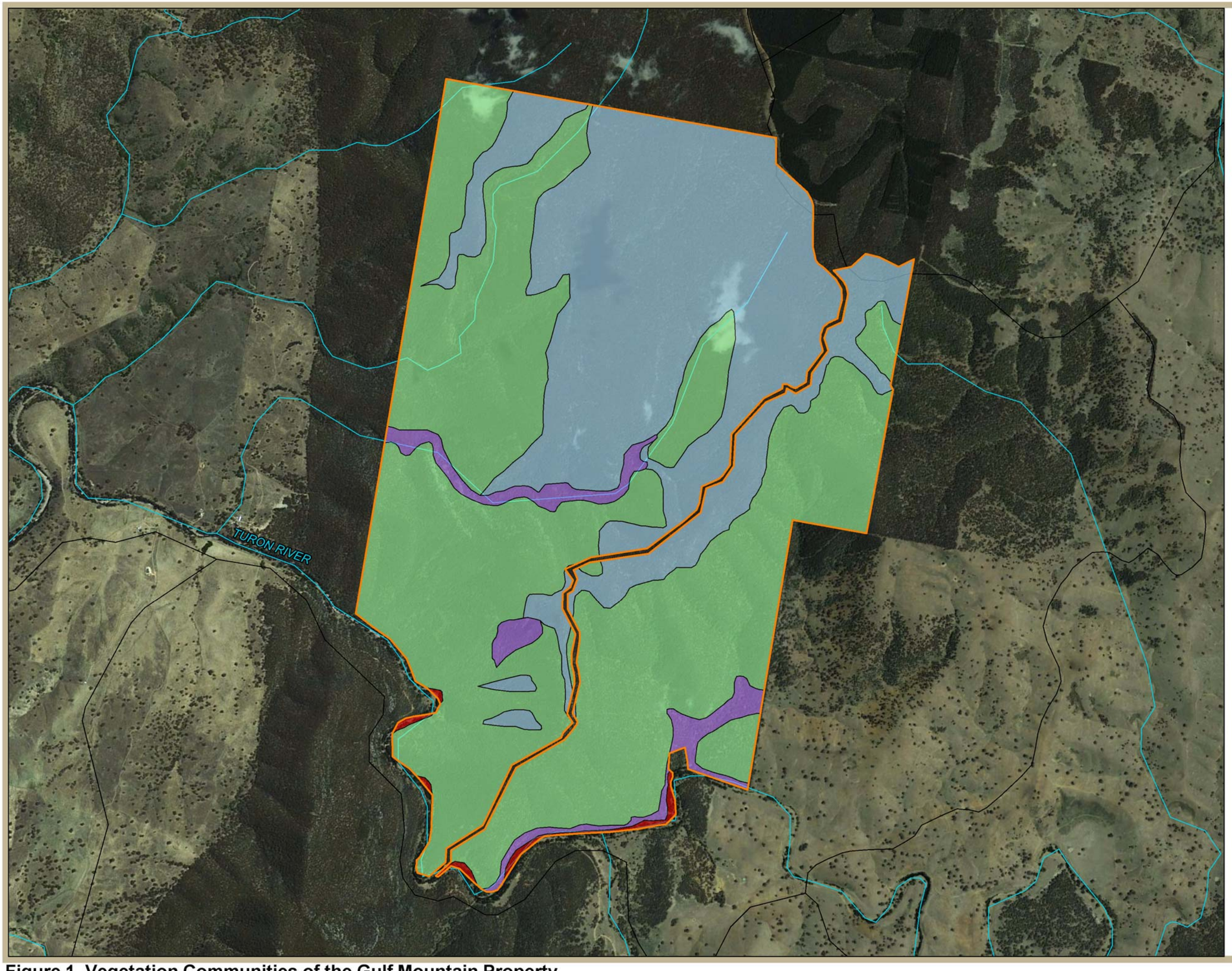
The extent of each vegetation community recorded on the property during the preliminary site investigation is estimated below in **Table A.2**.

Table A.2 Vegetation Communities in Gulf Mountain

Vegetation Community	Area (ha)
Riparian River Oak Forest	6.98
Sheltered Gully Ribbon Gum Open Forest*	44.96
Broad-leaved Peppermint -Brittle Gum Woodland*	478.25
Scribbly Gum Woodland*	747.55
TOTAL	**1,277.73**

*Notes * = plant communities found within the Project Disturbance Boundary* (impact area)

Coordinate System: MGA Zone 55 (GDA 94)



Legend

Gulf Mountain Property

Vegetation Community

- Scribbly Gum Woodland
- Broadleaved Peppermint -Brittle Gum Woodland
- Riparian River Oak Forest
- Sheltered Gully Ribbon Gum Open Forest

N

Grid North

Image Source:
© 2012 Cnes/Spot Image
Image © 2012 GeoEye

Data Source:
Geoscience Australia 2006

CUMBERLAND ECOLOGY

I:\...\9023\Figures\Letter 18\

Figure 1. Vegetation Communities of the Gulf Mountain Property

500 0 500 1000 1500 2000 m

A.3.2 Flora Values

No threatened flora species were recorded during the site investigation; though the property provides potential habitat in gullies and slopes for a number of threatened plants known in the area, including *Derwentia blakelyi* and *Eucalyptus cannonii.* The latter is a species that will be impacted by the Project.

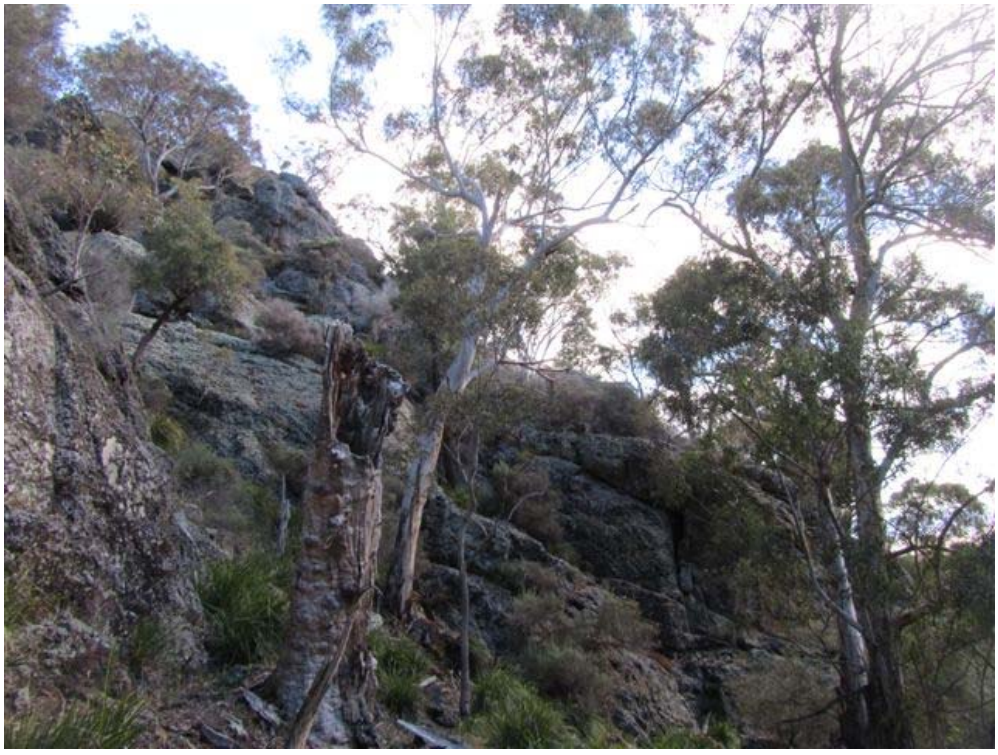
A.3.3 Fauna Values

The fauna habitats within the Gulf Mountain property occur within the woodland and open forest vegetation communities and within the permanent and ephemeral water resources. The majority of vegetation comprises low open forest and woodland with areas containing a tall canopy being restricted to drainage lines and gully heads. The canopy species present within the property include both smooth and rough-barked species. The plant diversity within the exposed Scribbly Gum Woodland was low, resulting from a sparse understorey. This community occupied extensive rocky outcrops. The upland drainage lines are lined with thick shrubs providing habitat for small woodland birds. Other key habitat features recorded within the property include an abundance of fallen logs and debris (**Photograph A.3** and **A.4**), permanent and ephemeral drainage lines (including the Turon River) (**Photograph A.5** and **A.6**), hollow-bearing trees (including hollows of various sizes), stags, extensive rocky outcrops (**Photograph A.2**), nectar-producing trees, mistletoes and Koala feed trees (including *Eucalyptus viminalis* and a variety of secondary feed species). These habitats occur at a range of altitudes including along ridgelines, steep and gently sloping topography and along the Turon River.

The habitats available within the property provide known and potential habitat for a suite of species listed under the TSC Act and/or EPBC Act. The Scarlet Robin (*Petroica boodang*), that is listed as Vulnerable under the TSC Act, was observed at numerous locations within the upper slopes and ridgelines. The Varied Sittella (*Daphoenositta chrysoptera*), that is listed as Vulnerable under the TSC Act was recorded in Scribbly Gum Woodland at one location within the property. Extensive areas of the property support suitable habitat features, such as an abundance of fallen logs and stags, for these species.

Good potential habitat exists for threatened microchiropteran bats, birds and amphibians. The tree hollows and stags within the property provide potential shelter, roosting and nesting habitat for threatened microchiropteran bats such as the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), which is known in the area. Although not recorded in the area, the rocky escarpments could provide potential habitat for the Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*). The property supports foraging habitat for owl species, such as the Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*), however there is limited roosting and nesting habitat for these species as the vegetation lacks a dense or multilayered understorey, and hollows of a suitable size were not observed. Foraging and nesting resources are also available for a range of other threatened bird species such as the Little Lorikeet (*Glossopsitta pusilla*) and Brown Treecreeper (*Climacteris picumnus victoriae*). Potential habitat for the Booroolong Frog (*Litoria booroolongensis*) was observed along the Turon River with known records occurring upstream and downstream of the property.

Photograph A.1 Overview of south-western hillside. River Oak in foreground and Scribbly Gum in background



Photograph A.2 Scribbly Gum Woodland on rocky outcrops

Photograph A.3 **Broad-leaved Peppermint – Brittle Gum Woodland with abundant fallen timber**

Photograph A.4 **Scribbly Gum Woodland with abundant fallen timber and hollows**

Photograph A.5 **Riparian River Oak Forest along the Turon River. Potential Booroolong Frog habitat**

Photograph A.6 **Ribbon Gum Open Forest in drainage line**

Photograph A.7 Ribbon Gum & Mountain Gum at gully head

The table below provides a summary of the revised biodiversity offset strategy for the Project if Gulf Mountain is included.

Table A.3 Proposed Offset Package including Gulf Mountain

Vegetation Type	Project Disturbance Boundary (ha)	Proposed Offset (ha)	Proposed Offset Ratio
CEEC & EEC[1]	18.44	221.7	12.0
Non C/EEC (native only)	818.41	2,808	3.4
TOTAL	**836.85**	**3,030**	**3.6**

Notes: 1 includes the area of EPBC Act and TSC Act Box Gum Woodland and Derived Native Grassland.

A.4 Conclusions and Recommendations

The Gulf Mountain property would contribute significantly if incorporated into the offset package that is proposed for the Project. Three vegetation types that occur in the Project Disturbance Boundary (impact area) predominate across Gulf Mountain, including Sheltered Ribbon Gum Open Forest, Broad-leaved Peppermint – Brittle Gum Woodland and Scribbly Gum Woodland. The property does not directly adjoin conservation reserves, but indirectly connects to Winburndale Nature Reserve via intact forest and woodland. Moreover, it is large enough to form a conservation area in its own right.

The terrain of Gulf Mountain is very steep and somewhat similar to parts of the Project Boundary. Rocky outcrops are extensive throughout the property. It is also an appropriate large size (1,277 ha) and provides habitat for a suite of threatened fauna, particularly woodland birds and micro bats. For example Scarlet Robin and Varied Sittella were detected during the site inspection and based upon habitat other species would almost certainly occur.

The acquisition Gulf Mountain for inclusion in the biodiversity offset package proposed for the Project will achieve a 3.6:1 ratio and the vegetation within the property has close affiliations (floristically and physically) with those in the Project Boundary.

APPENDIX F

Summary of Project Impacts and Compensation Measures for Threatened Biodiversity

16 July 2012

Dorian Walsh
Hansen Bailey
6/127-129 John Street
Singleton, NSW, 2330

Cumberland Ecology
PO Box 2474
Carlingford Court 2118
NSW Australia
Telephone (02) 9868 1933
Mobile 0425 333 466
Facsimile (02) 9868 1977
Web: www.cumberlandecology.com.au

SUMMARY OF COALPAC CONSOLIDATION PROJECT IMPACTS AND COMPENSATION MEASURES ON THREATENED BIODIVERSITY

Dear Dorian

The purpose of this letter is to form part of the proposed Coalpac Consolidation Project (the Project) response to submissions and to address a request from NSW and Commonwealth Government agencies to summarise the Project's biodiversity impacts and proposed offset strategy. A key concern made by government representatives was the inadequate size of the proposed offset property package. Consequently, the proponent has taken this into consideration and has made provisions to increase the size of the offset package by potentially adding the Gulf Mountain property. A summary of the biodiversity values of Gulf Mountain is provided in 9023 Letter 19.

The Project has the potential to have a substantial impact on the ecology of the local area if no mitigation and compensation measures were proposed, removing areas of endangered vegetation and habitat for a range of threatened species. In recognition of the potential ecological impacts of the Project, a substantial rehabilitation and offsetting package is proposed and will be implemented by Coalpac. All forest and woodland areas to be cleared by Project mining operations will be rehabilitated to forest and woodland, and in the long term extensive areas of forest, woodland, watercourses and grassland habitat within the offset lands will be permanently conserved.

Appendix A provides a summary of the Project's biodiversity impacts on species and communities listed under the EPBC Act and TSC Act and outlines the newly proposed offset strategy including an explanation of the rationale behind the calculations of habitat quantity and condition.

Appendix B provides two separate tables summarising the Project's biodiversity impacts on species and communities listed under the EPBC Act

and TSC Act and the amount of compensatory habitat being provided in the amended offset strategy.

Yours sincerely

David Robertson
Director
david.robertson@cumberlandecology.com.au

Appendix A

Project Impact and Proposed Offset Package Summary

A.1 Background

An Environmental Assessment has been prepared and exhibited for the Project by Hansen Bailey (2012). Following exhibition, numerous submissions have been received and discussions were held with key Government agencies to progress work on preparation of a response to submissions.

On 21st June 2012, Cumberland Ecology and Hansen Bailey staff met with representatives of the NSW Department of Planning and Infrastructure (DoPI), Office of Environment and Heritage (OEH) and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

Further clarification has been sought by OEH and SEWPaC on the Project's impacts upon biodiversity and the adequacy of proposed compensation measures (offsets) for flora and fauna. The offsets package has been designed particularly to compensate for predicted impacts to threatened biodiversity listed under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

SEWPaC also requested that Matters of National Environmental Significance (MNES) that were likely to be impacted by the Project should be summarised separately to other threatened biota that are solely listed by the NSW TSC Act. DoPI requested that information be provided about the way that the proposed offset package addresses the specific species requirements of threatened flora and fauna that are predicted to be impacted by the Project.

The proponent has commissioned additional searches for offsets and has proposed amendments to the proposed offset package. Additionally, Cumberland Ecology has reviewed recent analysis of biodiversity impacts by the NSW Land and Environment Court, particularly the Duralie Appeal (Ironstone Community action Group Inc v NSW Minister for Planning and Duralie Coal Pty. Ltd [2011/ NSWLEC 195]) and has presented the biodiversity impacts and proposed offsets in a manner that is consistent with how the Duralie case was considered.

This document presents the features of the amended offset package and responds to the following issues:

- The adequacy of habitats within the proposed offset package that was exhibited with the EA. Consequently, in response, the proponent has reviewed the proposed offset package and made provisions to increase the size of offsets with the Gulf Mountain property;
- The adequacy of the proposed offsets to meet the needs of specific threatened flora and fauna species; and
- Assessment of habitat condition for threatened species and communities.

To support the response to ecological issues raised, two summary tables have been prepared. **Appendix B** provides two separate summary tables that summarise statistics about the proposed offsets and pre-existing properties and Gulf Mountain.

Table B.1 provides a summary of threatened biodiversity listed under the EPBC Act.

Table B.2 provides a summary of threatened biodiversity listed under the TSC Act.

Each table identifies threatened biodiversity known or considered to have potential to occur in the Project Boundary and estimates the extent of preferred habitat within the Project Boundary and Project offsets. A detailed rationale is also provided on how species' habitats were defined or predicted for the assessment.

To respond to concerns about the adequacy of the offset package for selected threatened species, two further sets of information have been provided concerning eucalypts and flowering times, and the array of vegetation types within the proposed offsets. **Appendix C** provides a list of eucalypts recorded in the Project Boundary and their indicative flowering times for reference to blossom-feeding fauna. **Appendix D** provides a breakdown of each vegetation community recorded in the Project Boundary and offsets and their broad faunal habitat form.

A.1.1 Project Offset Strategy Summary

The exhibited EA included an offset package to compensate for predicted impacts to flora and fauna and currently includes the features shown in the table below:

Table A.1 Current Offset Strategy

Vegetation Type	Project Disturbance Boundary (ha)	Proposed Offset (ha)	Proposed Offset Ratio
CEEC and EEC[1]	18.44	221.7	12.0
Non C/EEC (native only)	818.41	1,530	1.9
TOTAL	**836.85**	**1,752**	**2.1**

Notes: 1 includes the area of EPBC Act and TSC Act Box Gum Woodland and Derived Native Grassland.

The exhibited offset strategy comprised four offset properties with a total area of over 1,752 ha, which included:

- Hillcroft Offset: property west of the Project Boundary supports 327 ha of known *Eucalyptus cannonii* habitat, 450 ha of suitable *E. cannonii* habitat requiring rehabilitation, 86 ha of *Persoonia marginata* habitat, adjoins a population of the Booroolong Frog (*Litoria booroolongensis*), suitable habitat for the Spotted-tailed Quoll and a suite of woodland birds and micro-bats. It contains similar vegetation and derived grasslands capable of being rehabilitated to vegetation communities

consistent with those occurring within the Project Disturbance Boundary. Ultimately, rehabilitation of this property will link Sunny Corner State Forest to Ben Bullen State Forest;

- Yarran View Offset: property in Bylong Valley supports CEEC Box Gum Woodland and Derived Native Grassland and contains suitable habitat for the Regent Honeyeater, Swift Parrot, Spotted-tailed Quoll and a suite of woodland birds;

- Hillview/Billabong Offset: property to the west of the Project Boundary supports CEEC Capertee Rough-barked Apple Red Gum Yellow Box Woodland and Derived Native Grassland, known *Eucalyptus cannonii* habitat and similar vegetation impacted by the Project; and

- Hyrock Hartley: property within Hartley Vale supporting similar sandstone habitats to that within the Project Boundary, particularly sandstone escarpment complexes, and with historical records of the Spotted-tailed Quoll, Giant Dragonfly and Blue Mountains Water Skink. The property also provides suitable habitat for the Brush-tailed Rock-wallaby, Large-eared Pied Bat, Broad-headed Snake and a suite of woodland birds. This property will complete a gap in the Blue Mountain National Park extension as part of the GOS2.

An additional offset property, Gulf Mountain, is proposed for inclusion in the offset strategy.

- Gulf Mountain: property within Running Stream supporting 1,277 ha of similar vegetation types to that within the Project Boundary. Property is good condition and provides known and potential habitat for woodland birds, such as Scarlet Robin, Varied Sittella, Brown Treecreeper and Little Lorikeet, potential habitat Booroolong Frog habitat along the Turon River.

The table below provides a summary of the revised biodiversity offset strategy for the Project if Gulf Mountain is included.

Table A.2 Proposed Offset Package including Gulf Mountain

Vegetation Type	Project Disturbance Boundary (ha)	Proposed Offset (ha)	Proposed Offset Ratio
CEEC & EEC[1]	18.44	221.7	12.0
Non C/EEC (native only)	818.41	2,808	3.4
TOTAL	**836.85**	**3,030**	**3.6**

Notes: 1 includes the area of EPBC Act and TSC Act Box Gum Woodland and Derived Native Grassland.

A.1.2 Structure of Report

Threatened species and communities that are listed by the EPBC Act (MNES) and species and communities listed under the TSC Act have been discussed separately in this letter.

Section A.2.1 - A.2.3 provides a discussion and summary of relevant MNES (alphabetically).

Section A.2.4 – A.2.6 provides a discussion and summary of threatened species and communities that are covered by the TSC Act (alphabetically).

Section A.3 provides an assessment of habitat condition for threatened species and community.

Where a species or community is listed under both the EPBC Act and the TSC Act, the information is presented twice in order to present a complete summary of matters covered by each Act in each section.

A.1.3 Issues not Addressed

It is important to note that the summary tables do not quantify species' or community's habitat that will be rehabilitated progressively during mine rehabilitation. Nor does it consider threatened biodiversity habitat or threatened ecological communities that are not impacted by the Project, but conserved in offsets (i.e. Booroolong Frog, Blue Mountains Water Skink, Giant Dragonfly and Blue Mountains Swamps). This information can be found in the Coalpac Consolidation Project Ecological Impact Assessment (the Report) (Cumberland Ecology, 2012). The summary tables do not compare population estimates of threatened plants to be removed and retained in the Project Boundary, conserved or replanted in offsets. This information has also been provided in the Report.

A.2 Rationale for Defining Habitat Extents in the Project Boundary and Offsets

This section provides a detailed rationale of how species' and community's habitats were defined and estimated within the Project Boundary and offsets. This utilises evidence recorded during surveys of the Project Boundary and offsets, scientific literature and other credible sources as well as database records (OEH 2012).

The predicted areas of habitat are precautionary and use vegetation formations or "macro" habitat to encapsulate the species' habitat (i.e. dry sclerophyll forest). These "macro" habitats are usually made up of "micro" habitat, which contain specific requirements (i.e. winter flowering eucalypts) that are more preferred, as well as supplementary habitat that the species may utilise stochastically or during natural disasters (drought, abnormal flowering seasons) or while travelling between areas of preferred habitat. This approach considers the full extent of habitat present. Where applicable, the same rationale used to define species' habitat in the Project Boundary has been used to define species' habitat in offsets.

Species and communities are addressed in two groups. First, habitat for threatened species and communities observed in the Project Boundary is discussed, followed by those threatened species that have not been recorded from the Project Boundary but are known to occur in the Lithgow LGA and have potential to occur in the Project Boundary.

A.2.1 Habitat for EPBC Threatened Species Observed in the Project Boundary to be Cleared and Habitat to be Conserved in Offsets

i. Eucalyptus cannonii

Eucalyptus cannonii (Capertee Stringybark) is listed as Vulnerable under both the EPBC Act and the TSC Act. It has been detected throughout the Project Boundary and 129 records of this species have been made in the Lithgow LGA.

From observations in the field, the species was found to occur sporadically over much of the Project Boundary. This is consistent with findings from Hunter & White (1999) and Hall & Brooker (1973). Where recorded in the Project Boundary, the density varied between vegetation communities and was generally more common on mid to lower slopes and valley floors, as found by Hall & Brooker (1973). Vegetation communities which recorded the highest densities were Tableland Gully Ribbon Gum Blackwood – Apple Box Forest and Cox's Permian Red Stringybark - Brittle Gum Woodland. Densities within Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland were variably different. The species was not recorded within Exposed Blue Mountains Sydney Peppermint – Silvertop Ash Shrubby Woodland and was rarely found in Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest (usually close to community transitional zones). Following the findings of surveys in the Project Boundary the species was presumed to occupy all habitats that it was recorded in, albeit in different densities.

Approximately 278 ha of habitat for this species will be removed from within the Project Boundary.

The species has been recorded in undisturbed habitat in offsets. Approximately 327 ha of potential habitat for this species is present in the proposed offset lands. In addition, 450 ha of derived grasslands of vegetation communities that this species has been recorded in will also be restored and the species will be planted as part of woodland restoration in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

ii. Large-eared Pied Bat

The Large-eared Pied Bat (*Chalinobus dwyeri*) is listed as Vulnerable under both the EPBC Act and the TSC Act. It was possibly detected within the Project Boundary (Cumberland Ecology 2012), and 71 records occur in the Lithgow LGA.

This species appears to roost in caves and overhangs in sandstone cliffs and forages in fertile woodland valley habitat within close proximity of each other as almost as records

occur within kilometres of rocky terrain (SEWPaC 2011). This species has been recorded foraging in a range of vegetation types, including dry and wet sclerophyll forest, grassy woodland, *Callitris* dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland and sandstone outcrop country (SEWPaC 2011).

The sandstone escarpments of the Project Boundary are likely to support roosting and breeding habitat while the forests and woodlands, particularly on valley floors would provide optimal forage for the Large-eared Pied Bat. No direct impacts are expected to occur to roosting/breeding habitat as all open cut operations will be set back 50m from all rocky escarpments. Surface subsidence from highwall mining is estimated to be minimal at less than 20 mm (GEONET 2011). Roosting and breeding habitat is available in the rocky escarpments of the Hyrock Hartley property and all forest and woodland in offsets would offer forage habitat for the species.

Approximately 1,622 ha of habitat for this species occurs in the Project Boundary, and a total of 835 ha of forage habitat will be cleared for the Project.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4.2 of the Report). Knowing the species does not travel too far from roost sites to forage on fertile valleys, it is likely that the species roosts in rocky escarpments in nearby offsets in Wollemi National Park, Ben Bullen State Forest and Blue Mountains National Park. Although not known in the locality of Hyrock Hartley, this property provides potential roost and foraging habitat as its position in the landscape is similar to the Project Boundary. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands on fertile slopes will also be restored as part of woodland restoration in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

iii. Persoonia marginata

Persoonia marginata (Clandulla Geebung) is listed as Vulnerable under both the EPBC Act and the TSC Act. A large population of this species has been recorded in the northern part of the Project Boundary, and 29 records occur in the Lithgow LGA.

Persoonia marginata was observed to occupy discrete habitat that could be mapped accurately by walking habitat boundaries using a GPS. Examination of the geological profile at each subpopulation in the Project Boundary suggests that this population may be closely associated with the Upper Irondale Seam (comprised of coal, oil shale, minor shale and sandstone) and the Irondale Seam (contains coal and minor shale), which belong to Shoalhaven Group (NSW National Parks and Wildlife Service 1999). The populations were rarely found above these seams within the skeletal sandstone soil along the plateaus or at lower landscape positions such as in gullies containing deeper wetter soils and denser groundcover (NSW National Parks and Wildlife Service 1999). The population may also be strongly influenced by aspect, with individuals in the Project Boundary subpopulations recorded exclusively on western slopes. All three subpopulations were also recorded on

sloping and relatively flat land facing west in dry sclerophyll forest or woodland with a sparse understorey (NSW National Parks and Wildlife Service 1999). The vegetation in which these subpopulations have been recorded has been classified as Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest.

Approximately 16.19 ha of habitat for this species that occurs in the Project Boundary will be conserved and rehabilitated, and 3.09 ha will be cleared. Another 33.58 ha occurs outside the Project Boundary in Ben Bullen State Forest.

The species has been recorded in undisturbed habitat in offsets (s.6.4.1 of the Report). Approximately 86 ha of potential habitat for this species is present in the proposed offset lands.

Table B.1 show the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

iv. Satin Fly-catcher

The Satin Fly-catcher (*Myiagra cyanoleuca*) is listed as Migratory under the EPBC Act. It has been detected within the Project Boundary (Cumberland Ecology 2012, AES 2003, Wildsearch 1997) and 74 records occur in the Lithgow LGA.

The Satin Flycatcher is a migratory species that has been recorded during current surveys and previous surveys (Wildsearch 1997). Satin Flycatchers have been recorded in wet sclerophyll forest and dry sclerophyll forest and woodland with varying understories (SEWPaC 2012). Tree species within these habitats recorded in the Project Boundary include *Eucalyptus dalrympleana*, *E. viminalis*, *E. blakelyi*, *E. melliodora* and *E. macrorhyncha.*

Approximately 1,589 ha of forest and woodland habitat for this species occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

All areas of forest and woodland in the Project Boundary have been considered to comprise habitat for this species. Wet and dry sclerophyll forest and woodland will be conserved within offsets. Approximately 2,302 ha of this kind of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

A.2.2 Habitat for EPBC Threatened Ecological Community Observed in the Project Boundary to be Cleared and Habitat to be Conserved in Offsets

i. Box Gum Grassy Woodland

Box Gum Grassy Woodland is listed as an EEC under the TSC Act and as a CEEC under the EPBC Act. The rationale for determining the extent of Box Gum Grassy Woodland has been explained within the Report. For more information please refer to s.2.3., s.3.2 and s.4.2 of the Report.

Approximately 46 ha of EPBC Box Gum Grassy Woodland occurs in the Project Boundary, and a total of 16.48 ha will be cleared, comprising 0.27 ha of Derived Native Grassland and 16.21 ha of woodland.

Approximately 221 ha of EPBC Box Gum Grassy Woodland will be conserved in offsets, compromising of 49 ha of woodland and 173 ha of derived grasslands, which will be restored back to woodland.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

A.2.3 Habitat for EPBC Threatened Species' Known in the Lithgow LGA to be Cleared and Habitat to be Conserved in Offsets

i. Broad-headed Snake

The Broad-headed Snake (*Hoplocephalus bungaroides*) is listed as Vulnerable under the EPBC Act and as Endangered under the TSC Act. It has been recorded in close proximity to the Project Boundary and eight records of this species have been made in the Lithgow LGA.

The species has been documented to move varying distances between summer and winter habitats. Webb and Shine (1997) recorded a mean of 318m and (DECC (NSW) 2005) suggest about 200m. During habitat mapping all Pagoda Rock Sparse Shrubland and Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest (on ridgelines and plateaus only) in the Project Boundary and Blue Mountains Escarpment Complex in offsets affords potential winter habitat. This is based on observations in the field of niche habitat these communities occupy (rock escarpments, rocky plateaus and ridgelines). It was also predicted that summer habitats in the Project Boundary and offsets occur in forest and woodland below these winter habitats. This is based on a requirement of large tree hollows needed in these lower forests and woodlands (DECC (NSW) 2005). An average extent of 318 m was used in predicting the species' summer habitat range from the predicted winter habitat range.

Approximately 1,212 ha of predicted habitat occurs in the Project Boundary, and a total of 561 ha will be cleared, comprising 309 ha of predicted winter habitat and 252 ha of summer habitat.

Potential summer and winter habitat is available in the rocky escarpments and lower forests of Hyrock Hartley. The same rationale explained above was used to predict potential habitat extents in offsets. Approximately 188 ha of predicted habitat occurs in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

ii. Brush-tailed Rock Wallaby

The Brush-tailed Rock-wallaby *(Petrogale penicillata*) is listed as Vulnerable under the EPBC Act and as Endangered under the TSC Act. It has not been detected in the Project Boundary; however 15 records of this species have been made in the Lithgow LGA.

The Brush-tailed Rock Wallaby has two habitat types that it moves between for food and refuge. The species is considered nocturnal; during daylight hours the species shelters or sun bakes on refuge sites of steep rocky slopes, cliffs, rock stacks and boulder piles (DECC (NSW) 2008a) The vegetation on or below cliffs is a source of food and shelter (Wong 1993). Throughout their range, the wallaby's feed on a wide variety of grasses and shrubs, and has flexible dietary requirements, though grasses and forbs make up the bulk of their diet (DECC (NSW) 2008a). Predation is thought to have a significant, if not the greatest, impact on Brush-tailed Rock Wallaby populations, especially juvenile and sub adults that fall into the critical weight range of predators (DECC (NSW) 2008a) Fox management has showed promising affects on rock wallaby populations (Sharp 1999).

No individuals were detected in the Project Boundary despite suitable habitat being present, suggesting fox populations could be high in the area. It is likely that the species has occurred in the Project Boundary historically. The species varies in its habitat use and forage behaviour depending on predation pressures, fire and vegetation composition (Kinnear et al. 1988, DECC (NSW) 2008a). This may imply that the wallaby adapts to different habitats accordingly. Therefore to estimate potential habitat extent without a population to radio-track or conduct long-term monitoring is made more difficult. Based on the literature available, potential habitat for this species in the Project Boundary was predicted to comprise a strip 300m wide along the clifflines. This consisted of a 200m buffer from the base of steep cliff lines. This distance adequately extended into grassy forests and woodlands containing grasses and forbs (which make up the bulk of their diet). Two metre contours lines of the Project Boundary were used to define the lower extent of refuge habitat. Refuge habitat was then estimated to extend upslope 100m from the base of cliff lines.

Although not known in the locality of the Project offsets, potential refuge and forage habitat is available in the rocky escarpments and lower forests of the Hyrock Hartley property. The same rationale explained above was used to predict potential habitat in offsets.

Approximately 868 ha of predicted habitat occurs in the Project Boundary, and a total of 445 ha will be cleared, comprising 45 ha of predicted refuge and shelter habitat and 400 ha of predicted forage and shelter habitat.

Approximately 153 ha of predicted habitat occurs in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

iii. Koala

The Koala (*Phascolarctos cinereus*) is listed as Vulnerable under the EPBC Act and the TSC Act. It has not been detected in the Project Boundary; however 25 records occur in the Lithgow LGA.

This species inhabits eucalypt woodland and forest (DECC (NSW) 2008b). The species almost feeds exclusively on the leaves of more than 66 eucalypt species (DECC (NSW) 2008b) and six non eucalypt species (Phillips 2000), but in any one area will select primary species (DECC (NSW) 2008b). The closest record occurs at Wolgan State Forest, around eight km north-east of the Project Boundary.

Habitat assessment indicates that some portions of the Project Boundary support primary food trees (*Eucalyptus viminalis*) and secondary food trees (*E. blakelyi, E. bridgesiana, E. dalrympleana, E. mannifera, E. melliodora and E. pacuiflora*). NSW Atlas records indicate that the distribution of the Koala within the Lithgow LGA is scattered and restricted to Newnes State Forest and Wollemi National Park.

Approximately 224 ha of potential habitat occurs in the Project Boundary, and a total of 142.16 ha will be cleared, comprising 94 ha of forest and woodland containing primary food trees and 48 ha of forest and woodland containing secondary food trees.

Approximately 886 ha of potential habitat occurs in offsets, comprising 44.96 of forest and woodland containing primary food trees and 841 ha of forest and woodland containing secondary food trees. Another 672 ha of grassland will be restored back to 42 ha of forest and woodland containing primary food trees and 630 ha of forest and woodland containing secondary food trees.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

iv. Regent Honeyeater

The Regent Honeyeater (*Anthochaera phrygia*) is listed as Endangered under both the EPBC Act and the TSC Act. It has not been detected in the Project Boundary; however 597 records occur in the Lithgow LGA.

Regent Honeyeaters are a nomadic species that will move to areas where food is abundant; however, the exact nature of these movements is still poorly understood. The majority of records within the Lithgow LGA are confined to areas of low relief in the Capertee and Wolgan Valleys to the north and northeast of the Project Boundary. These valleys are

known breeding locations for this species. The species prefers box-ironbark eucalypt associations and it seems to prefer wetter, more fertile sites within these associations, such as along creek flats, broad river valleys and lower slopes (Department of Environment and Conservation NSW 2004). This is manifested through the majority of records being located in these valleys of Lithgow LGA.

Among the documented tree species favoured by the species, *Eucalyptus melliodora* and *Eucalyptus blakelyi* have been recorded in one vegetation community, Capertee Rough-barked Apple Red Gum Yellow Box Woodland in the Project Boundary. The Project Boundary also provides insect forage which is an important diet for nestlings and during times when nectar is scarce (DEC (NSW) 2005h).

Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

All areas of forest and woodland in the Project Boundary have been considered to comprise habitat for this species. Similar forest and woodland habitats are represented in the offset areas, including box woodland of the Yarran View property in the Bylong Valley. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

v. Spotted-tail Quoll

Spotted-tailed Quoll *Dasyurus maculatus maculatus* is listed as Endangered under the EPBC Act and as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 31 records are present in the Lithgow LGA.

A number of records exist for this species within the Lithgow LGA including some near to the Project Boundary. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline (NSW NPWS 1999a). This species creates dens in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields or rocky-cliff faces (DEC (NSW) 2005i). Numbers of the Spotted-tail Quoll are low, and males of the species are known to have extensive home ranges up to 3500 ha [or 35km2] (NSW NPWS 1999a).

The Project Boundary would provide potential forage, den and breeding habitat for the Spotted-tail Quoll. Approximately 1,622 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Open forest, woodland, heath and riparian forest with tree hollows, hollow logs, rocky outcrops, caves and rock crevices were recorded and have been considered in offsets, including Hyrock Hartley. Fifteen records of the Spotted-tail Quoll have been recorded in the locality of Hyrock Hartley. Two of these records, dating from 2004 are located in the property.

Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.1 and Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

vi. Swift Parrot

The Swift Parrot (*Lathamus discolor*) is listed as Endangered under both the TSC Act and the EPBC Act. It has not been detected in the Project Boundary; however 30 records occur in the Lithgow LGA.

This species breeds in Tasmania during spring and summer, migrating between March and September to south-eastern Australia (Swift Parrot Recovery Team 2000). They will return to some foraging sites on a cyclic basis depending on food availability. Their principle habitat is box-ironbark forest including grassy white box and grassy grey box communities. Principle food trees include *Eucalyptus sideroxylon, E. microcapra* and *E. albens* (Swift Parrot Recovery Team 2001). This is manifested through the distribution of the species in the Lithgow LGA, as all records are confined to areas of low relief in the Capertee Valley. The Project Boundary does not contain principle forage habitat for the Swift Parrot. Under the assumption that the species chooses principle food trees over other trees, unless nectar is scarce, the Swift Parrot may utilise flowering eucalypts within the Project Boundary irregularly or to supplement their diet, particularly when the dominant trees are not profusely flowering during winter months.

As highlighted in **Appendix C**, the dominant eucalypt species within the Project Boundary do not convincingly cover the months of March to September when compared to principle food trees. Nevertheless, a precautionary approach was taken and all forest and woodland within the Project Boundary was considered as potential habitat.

Approximately 1,589 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Similar forest and woodland including their preferred grassy white box woodland has been considered in offsets, including Yarran View, dominated by winter-flowering white box. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.1 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

A.2.4 Habitat for TSC Threatened Species Observed in the Project Boundary to be Cleared and Habitat to be Conserved in Offsets

i. Brown Treecreeper

The Brown Treecreeper (*Climacteris picumnus victoriae*) is listed as Vulnerable under the TSC Act. It has been detected in Capertee Rough-barked Apple – Red Gum – Yellow Box Woodland in the north of the Project Boundary (Cumberland Ecology 2012) and there are 279 records in the Lithgow LGA.

This species is well known in the LGA and occupies eucalypt woodlands, particularly open woodland lacking a dense understorey (NSW Scientific Committee 2004c) which is particularly important during breeding (Doer *et al.* 2006). The species requires the following habitat features (NSW Scientific Committee 2004c):

- Relatively undisturbed grassy woodland with native understorey;
- Large living and dead trees which are essential for roosting and nesting sites and for foraging; and
- Fallen timber which provides essential foraging habitat.

This species was recorded in vegetation that is considered by Doer *et al.* (2006) as breeding habitat. All forest and woodland within the Project Boundary provides habitat for this species, particularly grassy woodlands, which would offer breeding habitat.

Approximately 1,589 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Numerous sightings of this species have been recorded in the locality of the offsets. Eucalypt forest and woodlands similar to that in the Project Boundary, including grassy woodlands at Yarran View have been considered in offsets. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

ii. Gang Gang Cockatoo

The Gang Gang Cockatoo (*Callocephalon fimbriatum*) is listed as Vulnerable under the TSC Act. It has been detected in Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland of the Project Boundary (Cumberland Ecology 2012) and there are 236 records of this species from the Lithgow LGA.

This species was observed on numerous occasions across the Project Boundary. In October 2009 individuals were observed examining hollows in tall trees, indicating a search

for suitable nest sites within the Project Boundary. Breeding usually occurs in tall mature sclerophyll forests that has a dense understorey (NSW Scientific Committee 2005).

All forests and woodlands in the Project Boundary have been considered forage habitat and tall gully forests, as breeding habitat. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded on Yarran View and in the locality (5 km radius) of other offsets (s.6.4 of the Report). Offsets contain suitable habitats including mature wet sclerophyll mountain forest and open forest and box woodland on the lower valleys will be conserved. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands on fertile slopes will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

iii. Greater Broad-nosed Bat

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is listed as Vulnerable under the TSC Act. It has been detected in the Project Boundary (OEH 2012) and 25 records exist in the Lithgow LGA.

The Greater Broad-nosed Bat utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest (NSW Scientific Committee 2004h). It forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m (DEC (NSW) 2005g). Although this species usually roosts in tree hollows, it has also been found in buildings (DEC (NSW) 2005g).

The forest and woodland communities within the Project Boundary provide roosting, breeding and foraging habitat for this species, particularly the tall gully forests. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded on Yarran View and in the locality (5 km radius) of other offsets (s.6.4 of the Report). Offsets contain suitable habitats including mature wet sclerophyll mountain forest and open forest and box woodland on the lower valleys will be conserved. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

iv. Eastern Bentwing Bat

The Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) is listed as Vulnerable under the TSC Act. It has been detected in Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest of the Project Boundary (Cumberland Ecology 2012) and there are 34 records of this species in the Lithgow LGA.

The Eastern Bent-wing Bat is an insectivorous species that forages above the canopy of forest and woodland (DEC (NSW) 2005d) and almost exclusively roost in caves and artificial constructions such as mines along the east coast of Australia (Churchill 2008) It requires very specific conditions in terms of temperature and humidity for maternity sites (Van Dyck and Strahan 2008), which house up to 150,000 individuals (DEC (NSW) 2005d).

The sandstone escarpments and pagodas of the Project Boundary would provide niche roosting habitat for this species. The forest and woodland would provide forage for the Eastern Bent-wing Bat. No direct impacts are expected to occur to roosting habitat as all open cut operations will be set back 50m from all rocky escarpments. Surface subsidence from highwall mining is estimated to be minimal at less than 20 mm (GEONET 2011).

The forest and woodland communities within the Project Boundary provide foraging habitat for this species, particularly the tall gully forests. Approximately 1,622 ha of habitat occurs in the Project Boundary, and a total of 835 ha of forage habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Roosting and breeding habitat is available in the rocky escarpments of Hyrock Hartley and all forest and woodland in offsets offer forage habitat for the species as it is known to travel up to 65km a night (Dwyer 1966). Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

v. Eastern False Pipistrelle

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is listed as Vulnerable under the TSC Act. There is a probable detection of this species in the Project Boundary by Wildsearch (1997) and 50 records occur in the Lithgow LGA.

This species generally prefers moist habitats, with trees taller than 20 m (DEC (NSW) 2005e). Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings (NSW Scientific Committee 2004e).

These habitat features are limited to mainly gully forests in the Project Boundary. The Project Boundary provides roosting habitat within tall gully forests and foraging habitat throughout all forest and woodland. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain wet sclerophyll mountain forest as well as open forest and woodland. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands on fertile slopes will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

vi. Eastern Freetail Bat

The Eastern Freetail-bat (*Mormopterus norfolkensis*) is listed as Vulnerable under the TSC Act. It has been detected in the Project Boundary (OEH 2012) and there are 10 records of this species in the Lithgow LGA.

The Eastern Freetail-bat is a solitary, insectivorous bat most commonly found in open spaces in dry sclerophyll forests, woodland and swamp forests in eastern NSW. The species mainly roost in spout hollows of large mature trees and sometimes under bark or in man-made structures (NSW NPWS 2004). They tend to forage in gaps in upper-slope vegetation and over larger waterways.

The forest and woodlands throughout the Project Boundary provides roosting and foraging habitat. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain dry sclerophyll forests and woodland as well as watercourse forage habitat. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands on fertile slopes will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

vii. Eucalyptus cannonii

Eucalyptus cannonii (Capertee Stringybark) is listed as Vulnerable under both the TSC Act and the EPBC Act. It has been detected throughout the Project Boundary and 129 records of this species have been made in the Lithgow LGA.

From observations in the field, the species was found to occur sporadically over much of the Project Boundary. This is consistent with findings from Hunter & White (1999) and Hall & Brooker (1973). Where recorded in the Project Boundary, the density varied between vegetation communities and was generally more common on mid to lower slopes and valley floors, as found by Hall & Brooker (1973). Vegetation communities which recorded the highest densities were Tableland Gully Ribbon Gum Blackwood – Apple Box Forest and

Cox's Permian Red Stringybark - Brittle Gum Woodland. Densities within Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland were variably different. The species was not recorded within Exposed Blue Mountains Sydney Peppermint – Silvertop Ash Shrubby Woodland and was rarely found in Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest (usually close to community transitional zones). Following the findings of surveys in the Project Boundary the species was presumed to occupy all habitats that it was recorded in, albeit in different densities.

Approximately 278 ha of habitat for this species will be removed from within the Project Boundary.

The species has been recorded in undisturbed habitat in offsets. Approximately 327 ha of potential habitat for this species is present in the proposed offset lands. In addition, 450 ha of derived grasslands of vegetation communities it has been recorded in will also be restored and the species will be planted as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

viii. Large-eared Pied Bat

The Large-eared Pied Bat (*Chalinobus dwyeri*) is listed as Vulnerable under both the EPBC Act and the TSC. It was possibly detected within the Project Boundary (Cumberland Ecology 2012), and 71 records occur in the Lithgow LGA.

This species appears to roost in caves and overhangs in sandstone cliffs and forages in fertile woodland valley habitat within close proximity of each other as almost as records occur within kilometres of rocky terrain (SEWPaC 2011). This species has been recorded foraging in a range of vegetation types, including dry and wet sclerophyll forest, grassy woodland, *Callitris* dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland and sandstone outcrop country (SEWPaC 2011).

The sandstone escarpments of the Project Boundary are likely to support roosting and breeding habitat while the forests and woodlands, particularly on valley floors would provide optimal forage for the Large-eared Pied Bat. No direct impacts are expected to occur to roosting/breeding habitat as all open cut operations will be set back 50m from all rocky escarpments. Surface subsidence from highwall mining is estimated to be minimal at less than 20 mm (GEONET 2011). Roosting and breeding habitat is available in the rocky escarpments of Hyrock Hartley and all forest and woodland in offsets would offer forage habitat for the species.

Approximately 1,622 ha of habitat occurs in the Project Boundary, and a total of 835 ha of forage habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4.2 of the Report). Knowing the species does not travel too far from roost sites to forage on fertile valleys, it is likely that the species roosts in rocky escarpments nearby offsets in Wollemi National Park,

Ben Bullen State Forest and Blue Mountains National Park. Although not known in the locality of Hyrock Hartley, this property provides potential roost and foraging habitat as its position in the landscape is similar to the Project Boundary. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands on fertile slopes will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

ix. Persoonia marginata

Persoonia marginata (Clandulla Geebung) is listed as Vulnerable under the TSC Act. A large population of this species has been recorded in the northern part of the Project Boundary, and 29 records occur in the Lithgow LGA.

Persoonia marginata was observed to occupy discrete habitat that could be mapped accurately by walking habitat boundaries using a GPS. Examination of the geological profile at each subpopulation in the Project Boundary suggests that this population may be closely associated with the Upper Irondale Seam (comprised of coal, oil shale, minor shale and sandstone) and the Irondale Seam (contains coal and minor shale), which belong to Shoalhaven Group (NSW National Parks and Wildlife Service 1999). The populations were rarely found above these seams within the skeletal sandstone soil along the plateaus or at lower landscape positions such as in gullies containing deeper wetter soils and denser groundcover (NSW National Parks and Wildlife Service 1999). The population may also be strongly influenced by aspect, with individuals in the Project Boundary subpopulations recorded exclusively on western slopes. All three subpopulations were also recorded on sloping and relatively flat land facing west in dry sclerophyll forest or woodland with a sparse understorey (NSW National Parks and Wildlife Service 1999). The vegetation in which these subpopulations have been recorded has been classified as Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest.

Approximately 16.19 ha of habitat occurs in the Project Boundary, and 3.09 ha will be cleared. Another 33.58 ha occurs outside the Project Boundary in Ben Bullen State Forest.

The species has been recorded in undisturbed habitat in offsets (s.6.4.1 of the Report). Approximately 86 ha of potential habitat for this species is present in the proposed offset lands.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

x. Powerful Owl

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under the TSC Act. It has been detected within the Project Boundary (Wildsearch 1997) and there are 74 records of this species from the Lithgow LGA.

This species roosts in dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls in a variety of trees of which She-oaks *Allocasuarina* spp. and eucalypts are found in the Project Boundary (DEC (NSW) 2006b). The species nests in old hollow eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines, in trees at least 80 cm diameter at breast height with hollows greater than 45 cm diameter and greater than 100 cm deep (DEC (NSW) 2006b).

These specific breeding habitat features are limited in the Project Boundary as sheltered gullies are ephemeral and do not have permanent streams. Further, these gullies show evidence of forestry practices and past clearing, thus reducing the availability of large trees with large hollow. The understorey structure of these gully forests are typically grassy and open which may reduce the suitability for nesting and roosting in large trees described by DEC (NSW) (2006). No white-wash or pellets were observed in the gullies to indicate a used hollow site as breeding pairs are generally faithful to a traditional nesting hollow or hollows in alternate gullies (DEC (NSW) 2006b).

All forest and woodland represent forage habitat in the Project Boundary as this species is a wide ranging species. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain sheltered gullies for roosting and breeding as well as broad areas of forest and woodland for forage. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xi. Scarlet Robin

The Scarlet Robin (*Petroica boodang*) is listed as Vulnerable under the TSC Act. It has been detected in Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland and Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest within the Project Boundary (Cumberland Ecology 2012). There are 175 records of this species in the Lithgow LGA.

The Scarlet Robin occupies open forests and woodlands from the coast to the inland slopes and breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas (DECCW (NSW) 2010).

This species was observed on several occasions within the Project Boundary, all of which occurred on slopes and ridges suggesting the Project Boundary provides breeding habitat (DECCW (NSW) 2010). Therefore all forest and woodland would provide forage habitat with

communities on slopes and ridges offering breeding habitat. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded on Gulf Mountain and in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain open forests and woodlands on slopes with open understories for breeding. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xii. Speckled Warbler

The Speckled Warbler (*Chthonicola sagittata*) is listed as Vulnerable under the TSC Act. It has been detected in Capertee Rough-barked Apple – Red Gum – Yellow Box Woodland in the north of the Project Boundary (Cumberland Ecology 2012) and 61 records of this species have been made from the Lithgow LGA.

Speckled Warblers inhabit both grassy and shrubby woodlands, often on ridges or gullies feeding on insects and seeds (NSW Scientific Committee 2004k, Gardner and Heinsohn 2007).

The sighting within the Project Boundary is consistent with habitat descriptions by NSW Scientific Committee (2004b). Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared

The species has been recorded in the locality (5 km radius) of offsets including numerous records in the locality of Yarran View (s.6.4 of the Report). Offsets contain open forests and woodlands in gullies and vary in understorey structure. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xiii. Square-tailed Kite

The Square-tailed Kite (*Lophoictinia isura*) is listed as Vulnerable under the TSC Act. It has been detected foraging over Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest within the Project Boundary (Cumberland Ecology 2012); and there are six records of this species from the Lithgow LGA.

The species is a wide ranging species with large home ranges of up to 50km^2 (Lutter et al. 2004) and forages over a variety of habitats (NSW Scientific Committee 2004l). Being a specialist hunter of passerines, particularly honeyeaters, it is likely that the blossom periods

of dominant trees within the Project Boundary would attract prey species for the Square-tailed Kite.

It is likely that the Square-tailed Kite utilises the Project Boundary for foraging and that it is a component of a much larger home range. All forest and woodland would provide habitat for this species. These habitats will be conserved within offsets.

Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species is a wide ranging species utlising a matrix of different habitats. Offsets contain open forests and woodlands with an abundance of prey. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xiv. Squirrel Glider

The Squirrel Glider (*Petaurus norfolcensis*) is listed as Vulnerable under the TSC Act. It has been detected in Tableland Gully Ribbon Gum Blackwood Applebox Forest within the Project Boundary (Cumberland Ecology 2012) and there are 16 records of this species from the Lithgow LGA.

The Squirrel Glider inhabits dry sclerophyll forest and woodland with an abundance of hollow-bearing trees and a mix of eucalypts, acacias and banksias (NSW NPWS 1999b). Within a suitable vegetation community at least one flora species should flower heavily in winter and one or more of the eucalypts should be smooth-barked (NSW NPWS 1999b). Prime habitat occurs on richer soils and gentle terrain (NSW Scientific Committee 2004m).

The sighting of this species is consistent with findings from NSW Scientific Committee (2004d); however the dominant trees in Tableland Gully Ribbon Gum Blackwood Applebox Forest. The dominant tree of this community does not flower profusely throughout the winter months, reducing forage suitability in winter (**Appendix C**). Despite this, the Project Boundary would provide habitat within the tall gully forests. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain open forests and woodlands including gully forests. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xv. Varied Sittella

The Varied Sittella (*Daphoenositta chrysoptera*) is listed as Vulnerable under the TSC Act. It has been detected within the Project Boundary (AES 2003) and there are 71 records in the Lithgow LGA.

The Varied Sittella inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (NSW Scientific Committee 2010b). The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy (NSW Scientific Committee 2010b).

All forest and woodland within the Project Boundary and offsets would provide habitat for this species. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded on Gulf Mountain and in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain eucalypt forests and woodlands, with rough-barked species and mature smooth-barked gums. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

A.2.5 Habitat for TSC Threatened Ecological Community Observed in the Project Boundary to be Cleared and Habitat to be Conserved in Offsets

i. Box Gum Woodland

Box Gum Woodland is listed as an EEC under the TSC Act and as a CEEC under the EPBC Act. The rationale for determining the extent of Box Gum Woodland has been explained within the Report. For more information please refer to s.2.3., s.3.2 and s.4.2 of the Report.

Approximately 48 ha of TSC Act listed Box Gum Woodland occurs in the Project Boundary, and a total of 18.44 ha will be cleared, comprising 2.23 ha of Derived Native Grassland and 16.21 ha of woodland.

Approximately 221 ha of TSC Act listed Box Gum Woodland will be conserved in offsets, comprising of 49 ha of woodland and 173 ha of derived grasslands, which will be restored back to woodland. These areas to do not include approximately 37 ha of Box Gum Woodland low diversity derived grassland on Yarran View that will be restored to a condition equivalent to the TSC Act listed Box Gum Woodland.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

A.2.6 Habitat for TSC Threatened Species' Known in the Lithgow LGA to be Cleared and Habitat to be Conserved in Offsets

i. Barking Owl

The Barking Owl (*Ninox connivens*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 43 records occur in the Lithgow LGA.

The species occupies forest and woodland typically dominated by eucalypts (NSW NPWS 2003, DEC (NSW) 2005a). Although, Barking Owls have been recorded in remnants of forest and woodland and in clumps of trees at farms, towns and golf courses (NSW NPWS 2003), their primary habitat is woodland (NSW Scientific Committee 2004a). Barking Owls usually roost in or under dense foliage in including rainforest species of streamside gallery forests, River She-oak *Casuarina cunninghamiana*, other *Casuarina* and *Allocasuarina* species, eucalypts, *Angophora* or *Acacia* species, often near watercourses or wetlands (NSW NPWS 2003). The species typically breeds in hollows of large eucalypts or paperbarks, usually near watercourses or wetlands (NSW NPWS 2003).

Some of these specific habitat features occur in the Project Boundary, though evidence of forestry practices and past clearing has reduced the current availability of suitable hollow sites. Further, a lack of wetlands or watercourses in the Project Boundary precludes optimal nesting habitat. No evidence of white-wash or pellets were recorded which could indicate roosting or breeding. The taller gully forests generally have a grassy understorey. All forest and woodland represent potential forage habitat for this wide ranging species.

All forest and woodland represent forage habitat in the Project Boundary as this species is a wide ranging species. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain sheltered gullies for roosting and breeding as well as broad areas of forest and woodland for forage. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

ii. Black-chinned Honeyeater

The Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 65 records occur in the Lithgow LGA.

This blossom dependant bird relies heavily on nectar and pollen from mistletoes and trees from the Myrtaceae family in particular the *Eucalyptus sp., Corymbia sp* and *Melaleuca sp* (DEC (NSW) 2005b). In NSW, the species is mainly found in woodlands containing box-ironbark eucalypts (NSW Scientific Committee 2004b).

Despite the Project Boundary affording no ironbark species and very low abundance of box eucalypt species, all forest and woodland within the Project Boundary would provide potential foraging, shelter and breeding habitat for this species to some extent. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

All areas of forest and woodland in the Project Boundary have been considered to comprise habitat for this species. Similar forest and woodland habitats have been considered in offsets, including box woodland of Yarran View Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

iii. Broad-headed Snake

The Broad-headed Snake (*Hoplocephalus bungaroides*) is listed as Vulnerable under the EPBC Act and as Endangered under the TSC Act. It has been recorded in close proximity to the Project Boundary and 8 records of this species have been made in the Lithgow LGA.

The species has been documented to move varying distances between summer and winter habitats. Webb and Shine (1997) recorded a mean of 318m and (DECC (NSW) 2005) suggest about 200m. During habitat mapping all Pagoda Rock Sparse Shrubland and Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest (on ridgelines and plateaus only) in Project Boundary and Blue Mountains Escarpment Complex in offsets affords potential winter habitat. This is based on observations in the field of niche habitat these communities occupy (rock escarpments, rocky plateaus and ridgelines). It was also predicted that summer habitats in the Project Boundary and offsets occur in forest and woodland below these winter habitats. This is based on a requirement of large tree hollows needed in these lower forests and woodlands (DECC (NSW) 2005). An average extent of 318 m was used in predicting the species' summer habitat range from the predicted winter habitat range.

Approximately 1,212 ha of predicted habitat occurs in the Project Boundary, and a total of 561 ha will be cleared, comprising 309 ha of predicted winter habitat and 252 ha of summer habitat.

Potential summer and winter habitat is available in the rocky escarpments and lower forests of the offset property Hyrock Hartley. The same rationale explained above was used to predict potential habitat extents in offsets. Approximately 188 ha of predicted habitat occurs in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

iv. Brush-tailed Rock Wallaby

The Brush-tailed Rock-wallaby *(Petrogale penicillata*) is listed as Vulnerable under the EPBC Act and as Endangered under the TSC Act. It has not been detected in the Project Boundary; however 15 records of this species have been made in the Lithgow LGA.

The Brush-tailed Rock Wallaby has two habitat types that it moves between for food and refuge. The species is considered nocturnal; during daylight hours the species shelters or sun bakes on refuge sites of steep rocky slopes, cliffs, rock stacks and boulder piles (DECC (NSW) 2008a) The vegetation on or below cliffs is a source of food and shelter (Wong 1993). Throughout their range, the wallaby's feed on a wide variety of grasses and shrubs, and has flexible dietary requirements, though grasses and forbs make up the bulk of their diet (DECC (NSW) 2008a). Predation is thought to have a significant, if not the greatest, impact on Brush-tailed Rock Wallaby populations, especially juvenile and sub adults that fall into the critical weight range of predators (DECC (NSW) 2008a) Fox management has showed promising affects on rock wallaby populations (Sharp 1999).

No individuals were detected in the Project Boundary despite suitable habitat being present, suggesting fox populations could be high in the area. It is likely that the species was occurred in the Project Boundary. The species varies in its habitat use and forage behaviour depending on predation pressures, fire and vegetation composition (Kinnear et al. 1988, DECC (NSW) 2008a). This may imply that the wallaby adapts to different habitats accordingly. Therefore to estimate potential habitat extent without a population to radio-track or conduct long-term monitoring is made more difficult. Based on the literature available potential habitat was predicted in the Project Boundary to be a 300m wide strip along the steep cliff lines. This consisted of a 200m buffer from the base of steep cliff lines. This distance adequately extended into grassy forests and woodlands containing grasses and forbs (which make up the bulk of their diet). Two metre contours lines of the Project Boundary were used to define the lower extent of refuge habitat. Refuge habitat was then estimated to extend upslope 100m from the base of cliff lines.

Although not known in the locality of offsets potential refuge and forage habitat is available in the rocky escarpments and lower forests of the offset property Hyrock Hartley. The same rationale explained above was used to predict potential habitat in offsets.

Approximately 868 ha of predicted habitat occurs in the Project Boundary, and a total of 445 ha will be cleared, comprising 45 ha of predicted refuge and shelter habitat and 400 ha of predicted forage and shelter habitat.

Approximately 153 ha of predicted habitat occurs in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

v. Diamond Firetail

The Diamond Firetail (*Stagonopleura guttata*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 101 records occur in the Lithgow LGA.

The Diamond Firetail occupies eucalypt woodlands, forests and mallee where there is a grassy understorey (NSW Scientific Committee 2004d). They forage on largely for grass seeds and other plant material, but also insects (DEC (NSW) 2005c).

The species has been recorded nearby at Baal Bone Colliery. All forest and woodland within the Project Boundary provides potential habitat for this species, particularly grassy woodlands and forest. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Numerous sightings of this species have been recorded in the locality of the offsets (s.6.4 of the Report). Eucalypt forest and woodlands similar to that in the Project Boundary, including grassy woodlands at Yarran View have been included in offsets. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

vi. Eastern Pygmy Possum

The Eastern Pygmy-possum (*Cercartetus nanus*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary, however there are eight records in the Lithgow LGA.

In NSW, the species extends from the coast to the western slopes and is most commonly found in rainforest, sclerophyll forest and woodland, and heath (DEC (NSW) 2005c). The species shelters in tree hollows, rotten stumps, shredding bark, holes in the ground, abandoned bird-nests, Possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females. Forage resources are primarily nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits and insects are important where flowers are less abundant (NSW Scientific Committee 2004f).

Despite the fact that no Banksia and bottlebrush were recorded, the shrubland, forest and woodland in the Project Boundary would provide potential habitat for this species. Approximately 1,622 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Although not known in the locality of offsets, suitable habitat comprising heath, forest and woodland occurs. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

vii. Flame Robin

The Flame Robin (*Petroica phoenicea*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 57 records are present in the Lithgow LGA.

In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey (NSW Scientific Committee 2010a). In winter it migrates to more open lowland habitats (NSW Scientific Committee 2010a).

All forest and woodland within the Project Boundary provides potential habitat for this species, particularly grassy woodlands and forest. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Offsets contain suitable habitat forests and woodlands with ridges and slopes with areas of open understorey as well as low open lowland habitats. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of lowland grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

viii. Glossy Black Cockatoo

The Glossy Black Cockatoo (*Calyptorhynchus lathami*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 89 records occur in the Lithgow LGA.

The Glossy Black Cockatoo inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m (DEC (NSW) 2005f) and feeds exclusively on she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) (NSW Scientific Committee 2004g), seeds from eucalypts, Hakea and sometimes insects (DEC (NSW) 2005f). The other major requirement is for large nesting hollows of old eucalypts. Of the preferred trees, *Eucalyptus viminalis* occurs in the Project Boundary. It appears the species prefers nest site where its main food trees are common *(*NSW Scientific Committee 2004f).

The Project Boundary supports limited habitat as the species generally prefers forest and woodland with an abundance of food trees and large hollows. This is not the case in the Project Boundary; she-oaks occur in low abundance and large hollows are uncommon, a

result of historical forestry practices, particularly in the gullies. Despite this, shrublands, forest and woodland in the Project Boundary offer some potential habitat for the species. Approximately 1,622 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Although not known in the locality of offsets, suitable habitat occurs comprising heath, forest and woodland. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

ix. Grey-crowned Babbler

The Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 14 records occur in the Lithgow LGA.

Grey-crowned Babblers occupy open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs (NSW Scientific Committee 2004i). The species occupies woodlands on fertile soils of plains and undulating terrain though is considered less common at higher altitudes of the tablelands (NSW Scientific Committee 2004i).

All forest and woodland within the Project Boundary provides habitat for this species, particularly grassy woodlands. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Offsets contain suitable habitat of open grassy forest and woodlands dominated by mature eucalypts, on undulating fertile soils. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

x. Hooded Robin

The Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 70 records occur in the Lithgow LGA.

They occupy a wide range of eucalypt woodlands, Acacia shrublands and open forests (NSW Scientific Committee 2004j). In temperate woodlands, the species favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover (NSW Scientific Committee 2004j).

All forest, woodland within the Project Boundary provides potential habitat for this species, particularly grassy woodlands and forest. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

This species is known to occur in the locality offsets (s.6.4 of the Report). Forest and woodland, including grassy woodlands have been considered in offsets. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xi. Koala

The Koala (*Phascolarctos cinereus*) is listed as Vulnerable under the EPBC Act and the TSC Act. It has not been detected in the Project Boundary; however 25 records occur in the Lithgow LGA.

This species inhabits eucalypt woodland and forest (DECC (NSW) 2008b). The species almost feeds exclusively on eucalypt leaves of more than 66 eucalypt species (DECC (NSW) 2008b) and six non eucalypt species (Phillips 2000), but in any one area will select primary species (DECC (NSW) 2008b). The closest record occurs at Wolgan State Forest, around 8 km north-east of the Project Boundary.

Habitat assessment indicates that some portions of the Project Boundary support primary food trees (*Eucalyptus viminalis*) and secondary food trees (*E. blakelyi, E. bridgesiana, E. dalrympleana, E. mannifera, E. melliodora and E. pacuiflora*). NSW Atlas records indicate that their distribution within the Lithgow LGA is scattered and restricted to Newnes State Forest and Wollemi National Park.

Approximately 224 ha of potential habitat occurs in the Project Boundary, and a total of 142.16 ha will be cleared, comprising 94 ha of forest and woodland containing primary food trees and 48 ha of forest and woodland containing secondary food trees.

Approximately 886 ha of potential habitat occurs in offsets, comprising 44.96 of forest and woodland containing primary food trees and 841 ha of forest and woodland containing secondary food trees. Another 672 ha of grassland will be restored back to 42 ha of forest and woodland containing primary food trees and 630 ha of forest and woodland containing secondary food trees.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xii. Little Lorikeet

The Little Lorikeet (*Glossopsitta pusilla*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however 107 records occur in the Lithgow LGA.

This blossom dependant bird relies heavily on nectar and pollen from mistletoes and trees from the Myrtaceae family in particular the *Eucalyptus sp., Corymbia sp* and *Melaleuca sp.* Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands (NSW Scientific Committee 2009). They have been recorded in remnant woodland patches and roadside vegetation on the western slopes (NSW Scientific Committee 2009).

All forest and woodland within the Project Boundary are dominated by eucalypts and would provide potential foraging, shelter and breeding habitat for this species. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Numerous sightings of this species have been recorded in the locality of the offsets containing dry, open eucalypt forests and woodlands (s.6.4 of the Report). Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xiii. Masked Owl

The Masked Owl (*Tyto novaehollandiae*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however there are six records in the Lithgow LGA.

Habitat for this forest owl is widespread throughout the dry eucalypt forests of the tablelands, western slopes and the undulating wet-dry forests of the coast (DEC (NSW) 2006b). Optimal habitat includes an open understorey and a mosaic of grassy and shrubby ground cover on gentle terrain (DEC (NSW) 2006b). Roost and nest sites can be in a variety of topographic positions, from dense foliage in gullies to upper slopes. Nest sites require large hollows (greater than 40 cm wide and greater than 100 cm deep) and do not require proximity to streams (DEC (NSW) 2006b).

These habitat features are limited to mainly gully forests and upper slopes to some extent, the valley floors show evidence of forestry practices and past clearing, thus reducing potential nest sites. No evidence to suggest roosting or breeding was observed in the Project Boundary as a pair is generally faithful to a traditional nesting hollow or alternate between hollows nearby gullies (DEC (NSW) 2006b).

The Project Boundary provides potential roosting/nesting habitat within tall gully forests. All forest and woodland represent forage habitat. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Although this wide ranging species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report), offsets contain sheltered gullies for roosting and breeding as well as broad areas of forest and woodland for forage. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xiv. Painted Honeyeater

The Painted Honeyeater (*Grantiella picta*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however there are 3 records in the Lithgow LGA.

This species is not well known in the Lithgow LGA. This blossom dependant bird relies heavily on nectar and pollen from mistletoes and trees from the Myrtaceae family in particular the *Eucalyptus sp., Corymbia sp* and *Melaleuca sp* (DEC (NSW) 2006a), particularly on fertile soils (DEC 2005).

Although the majority of forest and woodland occur on less fertile soils, all forest and woodland within the Project Boundary would provide potential foraging, shelter and breeding habitat for this species. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Similar forest and woodland habitats dominated by eucalypts have been considered in offsets, including box woodland on fertile slopes of Yarran View. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xv. Regent Honeyeater

The Regent Honeyeater (*Anthochaera phrygia*) is listed as Endangered under both the EPBC Act and the TSC Act. It has not been detected in the Project Boundary; however 597 records occur in the Lithgow LGA.

Regent Honeyeaters are a nomadic species that will move to areas where food is abundant; however, the exact nature of these movements is still poorly understood. The majority of records within the Lithgow LGA are confined to areas of low relief in the Capertee and Wolgan Valleys to the north and northeast of the Project Boundary. These valleys are known breeding locations for this species. The species prefers box-ironbark eucalypt associations and it seems to prefer wetter, more fertile sites within these associations, such as along creek flats, broad river valleys and lower slopes (Department of Environment and Conservation NSW 2004). This is manifested through the majority of records being located in these valleys of Lithgow LGA.

Among the documented tree species favoured by the species, *Eucalyptus melliodora* and *Eucalyptus blakelyi* have been recorded in one vegetation community, Capertee Rough-barked Apple Red Gum Yellow Box Woodland in the Project Boundary. Notwithstanding the Project Boundary also provides insect forage which is an important diet for nestlings and during times when nectar is scarce (DEC (NSW) 2005h).

Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

All areas of forest and woodland in the Project Boundary have been considered to comprise habitat for this species. Similar forest and woodland habitats have been considered in offsets, including box woodland of Yarran View in the Bylong Valley. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xvi. Rosenberg's Goanna

Rosenberg's Goanna (*Varanus rosenbergi*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however there are five records in the Lithgow LGA.

This goanna is known to associate with sandstone environments, and is usually found in heath and woodlands where it shelters in burrows, hollow logs and rock crevices (Cogger 2000).

Potential habitat in the Project Boundary would include shrubland, forest and woodland. Approximately 1,622 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Forest, woodland and heath and have been considered in offsets, including Hyrock Hartley. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xvii. Turquoise Parrot

The Turquoise Parrot (*Neophema pulchella*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however there are 57 records in the Lithgow LGA.

The Turquoise Parrot inhabits eucalypt and cypress-pine open forests and woodlands (commonly box or box-ironbark) with native grasses, sometimes with a low shrubby

understorey, often in undulating or rugged country, or on footslopes (NSW Scientific Committee 2004n). It also lives in open woodland or riparian gum woodland, and often near ecotones between woodland and grassland, or coastal forest and heath (NSW Scientific Committee 2004n). The richer habitat types on creek or river flats and foothills are preferred (DEC (NSW) 2005j). The Turquoise Parrot nests hollows of live or dead trees or stumps and feeds mostly on seeds of grasses, forbs and native shrubs, taken on or near the ground; also on some flowers, nectar, fruits, leaves and scale-insects (NSW Scientific Committee 2004n).

Despite the species preferring richer habitats, it is known to occur in rugged country. All forest and woodland within the Project Boundary provides potential habitat for this species, particularly grassy woodland and forest in the valleys and footslopes. Approximately 1,589 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Similar forest and woodland including both rugged country and their preferred grassy woodlands on richer soils have been considered in offsets. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xviii. Spotted-tail Quoll

Spotted-tailed Quoll *Dasyurus maculatus maculatus* is listed as Vulnerable under the TSC Act and as Endangered under the EPBC Act. It has not been detected in the Project Boundary; however 31 records are present in the Lithgow LGA.

A number of records exist for this species within the Lithgow LGA including some near to the Project Boundary. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline (NSW NPWS 1999a). This species creates dens in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields or rocky-cliff faces (DEC (NSW) 2005i). Numbers of the Spotted-tail Quoll are low, and males of the species are known to have extensive home ranges up to 3500 ha [or 35km2] (NSW NPWS 1999a).

The Project Boundary would provide potential forage, den and breeding habitat for the Spotted-tail Quoll. Approximately 1,622 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Open forest, woodland, heath and riparian forest with tree hollows, hollow logs, rocky outcrops, caves and rock crevices were recorded and have been considered in offsets, particularly Hyrock Hartley. Fifteen records of the Spotted-tail Quoll have been recorded in the locality of Hyrock Hartley. Two of these records, dating from 2004 are located in the property.

Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xix. Swift Parrot

The Swift Parrot (*Lathamus discolor*) is listed as Endangered under both the TSC Act and the EPBC Act. It has not been detected in the Project Boundary; however 30 records occur in the Lithgow LGA.

This species breeds in Tasmania during spring and summer, migrating between March and September to south-eastern Australia (Swift Parrot Recovery Team 2000). They will return to some foraging sites on a cyclic basis depending on food availability. Their principle habitat is box-ironbark forest including grassy white box and grassy grey box communities. Principle food trees include *Eucalyptus sideroxylon, E. microcapra* and *E. albens* (Swift Parrot Recovery Team 2001). This is manifested through the distribution of the species in the Lithgow LGA, as all records are confined to areas of low relief in the Capertee Valley. The Project Boundary does not contain principle forage habitat for the Swift Parrot. Under the assumption that the species chooses principle food trees over other trees, unless nectar is scarce, the Swift Parrot may utilise flowering eucalypts within the Project Boundary irregularly or to supplement their diet, particularly when the dominant trees are not profusely flowering during winter months.

As highlighted in the table of **Appendix C** the dominant eucalypts within the Project Boundary do not convincingly cover the months of March to September when compared to principle food trees. Nevertheless, all forest and woodland within the Project Boundary was considered as potential habitat to some extent.

Approximately 1,589 ha of potential habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

Similar forest and woodland including their preferred grassy white box woodland has been considered in offsets, including Yarran View, dominated by winter-flowering white box. Approximately 2,302 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available on proposed offsets.

xx. Yellow Bellied Glider

The Yellow-bellied Glider (*Petaurus australis*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however there are 64 records in the Lithgow LGA.

The Yellow-bellied Glider inhabits mixed eucalypt forests along the escarpment and coastal plain of eastern mainland Australia (NSW Scientific Committee 2004o). OEH (2012) records portray their distribution to continue further west of the Great Divide on the tablelands. Yellow-bellied Gliders feed predominately on eucalypt sap (NSW Scientific Committee 2004o). An individual glider feeds from only a small number of selected trees. The diet also includes nectar, arthropods and insect exudates (DEC (NSW) 2005k). Wet sclerophyll forest has been described by NPWS (2000) as prime habitat.

The Project Boundary would provide potential habitat within the tall gully forests, particularly at gully heads, which are generally more sheltered and moister. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report). Offsets contain open forests and woodlands including wet sclerophyll forest and gully forests. Approximately 2,349 ha of potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

xxi. Yellow-bellied Sheathtail Bat

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is listed as Vulnerable under the TSC Act. It has not been detected in the Project Boundary; however there are 2 records in the Lithgow LGA.

Very little is known about this species of bat (DEC 2006). Fertile low-elevation forests and woodlands of plains and valleys are the likely to be the preferred habitat of the Yellow-bellied Sheathtail-bat (DEC 2006); though the species has been recorded in cleared grazing areas (Shelley 2004). The species forages for airborne insects (mainly beetles and moths) above the tree canopy, although in more open habitats also feeds closer to the ground (DEC 2006). It usually roosts in tree hollows (DEC (NSW) 2005l).

The Project Boundary would provide potential habitat within the forest and woodland with preference to the gully forests and grassy woodlands. Approximately 1,589 ha of habitat occurs in the Project Boundary, and a total of 835 ha of habitat will be cleared.

The species has been recorded in the locality (5 km radius) of offsets (s.6.4 of the Report) comprising low-elevation forest and woodland on fertile soils. Approximately 2,349 ha of

potential habitat for this species is present in the proposed offset lands. In addition, 677 ha of grasslands will also be restored as part of woodland restoration in offsets.

Table B.2 shows the quantum of habitat to be removed and retained in the Project Boundary as well as the amount of current habitat available and habitat to be restored on proposed offsets.

A.3 Assessing Condition of Habitat

The vegetation communities have been ranked into two condition classes in the Project Boundary and offsets. The condition of each vegetation community has been used as a surrogate to assess habitat quality for threatened species. This is explained in more detail below.

A.3.1 Condition of Flora and Fauna Habitat

i. Condition of Forest and Woodland (Current)

The condition of each vegetation community was used as a surrogate to assess the habitat quality for flora and fauna. Vegetation communities were ranked into low and good/moderate condition classes according to the following criteria:

- Grasslands = Low (L): Grassland within the Project Boundary and offsets is generally the result of disturbance (including clearing) of what was originally a forest or woodland. Therefore, from a habitat perspective derived grasslands are not in good condition as they are missing structural integrity (trees and shrubs). Grassland condition in the Project Boundary was considered poor quality habitat as it generally contained sparse paddock trees of the original vegetation community and variable native and weed species richness and cover.

- Shrublands, Forests and Woodland = Good/Moderate (G/M): Following the same criteria as above, areas of shrubland, forest or woodland were considered to be in moderate or good condition, due to the canopy layer and sub layers still present.

Grasslands in the Project Boundary do not represent preferred habitat for most threatened species due to their poor condition and the amount of forest and woodland available nearby. A breakdown of habitat condition in the Project Boundary and the offset land is provided in **Table B.1** and **Table B.2.**

ii. Condition of Restored Forest and Woodland in Offsets (Condition in 50 years)

The future condition of restored woodland and forest (former grassland) after 50 years has been estimated for offsets only. As outlined in Section A.1.3 these areas do not include mine rehabilitation, although the same principles would apply. The amount of habitat that these restored ecosystems will provide will vary between species depending on their specific habitat requirements. There are several broad patterns of bird species responses to growth of replanted vegetation. These have been described for birds and arboreal mammals by

Vesk and MacNally (2006); however the principles are likely the same for all fauna groups which require similar resources. Some species will benefit from revegetation because both foraging and breeding resources are provided quickly by the growth and maturation of shrubs and trees. Insectivores feeding on insects on leaves or in the air and nesting in foliage of small trees are good examples. Such species include the Hooded Robin, Scarlet Robin, Speckled Warbler, Varied Sittella and Diamond Firetail. For other species that require tree hollows to nest in (e.g. Gang Gang Cockatoo, Forest Owls, Brown Treecreeper, Little Lorikeet, Squirrel Glider), foraging resources are likely to be present soon after restoration begins but suitable hollows for breeding develop slowly and will take longer to form.

By applying the same rationale used for current condition, the habitat after 50 years is considered likely to be good/moderate as shrub and tree layer vegetation will be present as well as a well developed understorey. The restored habitat after 50 years is likely to provide forage habitat for most species and breeding habitat for those that are not large hollow obligates. Large hollows will not have developed, thereby limiting habitat for species that need these resources, however these are expected to develop over time.

A summary of the estimated habitat condition likely to be present in restored forest and woodland after 50 years is provided in **Table B.1** and **Table B.2.**

A.3.2 Condition of Box Gum Woodland

The condition classes described in the EPBC Act Listing Advice (Threatened Species Scientific Committee 2006) and identification guidelines published by the NSW National Parks and Wildlife Service (NSW NPWS 2005) were used to map the condition of Box Gum Woodland and Derived Native Grasslands occurring in Project Boundary and the offsets.

The EPBC Act qualitative condition classes used are:

- 'A' – An overstorey of eucalypt trees exists, but there is no substantial native understorey;
- 'B' – A native understorey exists, but the trees have been cleared; and
- 'C' – Both a native understorey and an overstorey of eucalypts exists in conjunction.

Reference to the identification guidelines published by the NSW National Parks and Wildlife Service was also made (NSW NPWS 2005) (**Table A.3**). Condition classes 1 and 2 shown in the table below are considered to be equivalent to the EPBC Act condition class C; condition classes 3 and 4 are considered to be equivalent to the EPBC Act condition class B; and condition class 5 is equivalent to EPBC Act condition class A.

Table A.3 Identification Guidelines for Box Gum Woodland based on Condition (published by NSW NPWS)

Condition Class	Description
1. Multi-aged overstorey with a grassy herb-rich understorey	Remnants in this condition are very scarce and are generally confined to travelling stock reserves, roadside vegetation, cemeteries, some national parks and the occasional private property
2. Partially cleared/thinned stands with a mixture of native and exotic understorey species	This condition is far more common than the above; however its long-term future is often insecure due to inadequate regeneration of overstorey species. Often current management (e.g. set-stocking) is inconsistent with tree regeneration.
3. Stands where White Box, Yellow Box or Blakely's Red Gum have been killed and other species dominate the canopy	This condition occurs where the characteristic trees occur in conjunction with White Cypress Pine. The understorey is often in reasonable to very good condition.
4. Grasslands (secondary or derived grasslands), where the tree overstorey has been removed and only the Box-Gum Woodland understorey is present	This condition is likely to be reasonably common in some areas and is likely to be relatively easy to rehabilitate if appropriate management strategies are implemented.
5. Degraded remnants that have few, if any, native species in the understorey	This condition is typical of Box-Gum Woodland where agricultural practices have been more intensive (e.g. pasture improvement over long periods).

SEWPaC considers condition class B vegetation to represent low to moderate condition examples of Box Gum Woodland and class C to represent an example of this community in good condition. Vegetation conforming to condition class 5 (NPWS) and condition class A (EPBC Act) vegetation do not meet the EPBC Act definition for Box Gum Woodland and Derived Native Grasslands, which require a predominantly native understorey.

The condition assessments requested by OEH and SEWPaC which have been prepared by Cumberland Ecology to respond to the submissions are considered to be a metric assessment that is independent of this condition assessment for Box Gum Woodland.

Table B.1 provides the areas and condition of EPBC Act listed Box Gum Grassy Woodland recorded in the Project Boundary and offsets.

Table B.2 provides the areas and condition of TSC Act listed Box Gum Woodland recorded in the Project Boundary and offsets.

A.4 Conclusion

The Project would have a substantial impact on the ecology of the local area if no mitigation and compensation measures were proposed, removing 835 ha of native forest and woodland that provides habitat for a range of threatened species. At least 35 threatened species listed by the TSC Act and/or the EPBC Act, were recorded or are likely to occur within the Project Boundary. Other listed species also have potential to occur.

In recognition of the potential ecological impacts of the Project, a substantial rehabilitation and offsetting package is proposed and will be implemented by Coalpac. In response to key concerns of inadequate size of offsets, the proponent has reviewed the proposed offset package and made provisions to increase the size of offsets. All forest and woodland areas to be cleared by Project mining operations will be rehabilitated to forest and woodland in the long term using local native species. In addition to this, 3,029.69 ha of forest, woodland, watercourses, swamps and grassland habitat within the offset lands will be permanently conserved for wildlife. This includes 47.23 ha of shrubland and heath, 3.38 ha of swamp (not included in summary table as it provides habitat for non impacted fauna and threatened ecological communities), 432.21 ha of intact forest, 1,869.89 ha of intact woodland and 676.98 ha of grasslands to be restored back to forest and woodland. More specifically, the offsets strategy will conserve 221 ha of EPBC Act Box Gum Grassy Woodland and Derived Native Grassland, 327 ha of known *Eucalyptus cannonii* habitat and 450 ha of suitable *Eucalyptus cannonii* habitat to be rehabilitated and 86 ha of *Persoonia marginata* habitat. The package will provide habitat for all species estimated to be impacted by the Project, with particular gains for woodland and blossom dependant birds.

In the long term, the 173 ha of EPBC Act listed Derived Native Grassland within the offset sites will be regenerated to EPBC Act listed Box Gum Grassy Woodland. The ratio of EPBC Act listed Box Gum Woodland conserved to that cleared will exceed 13:1 for the Project, excluding areas to be rehabilitated within the Project Boundary. The offset package will provide a total offset of 3,029.69 of native vegetation at a ratio of 3.6:1.

When the mitigation and offsetting package are considered, the Project will have a significant ecological benefit in the long term. It will substantially increase the area of forest and woodland under conservation tenure in the region, thereby providing large areas of habitat for threatened flora and fauna species and will add substantial areas of Box Gum Woodland and Derived Native Grassland.

A.5 List of Reference

Churchill, S. 2008. Australian Bats. Second edition. Allen & Unwin, Crowes Nest, NSW.

Cogger, H. G. 2000. Reptiles and Amphibians of Australia. Reed New Holland Publishers.

DEC. 2005. The Vertebrate Fauna of Northeastern Wollemi National Park. Unpublished report funded by the Central Branch Parks and Wildlife Division Biodiversity Survey Priorities Program by NSW Department of Environment and Conservation, Information and Assessment Unit, Metropolitan Branch, Environment Protection and Regulation Division.

DEC. 2006. The Vertebrate Fauna of Northwestern Wollemi National Park. Unpublished report funded by the Central Branch Parks and Wildlife Division Biodiversity Survey Priorities Program by NSW Department of Environment and Conservation, Information and Assessment Section, Metropolitan Branch, Environment Protection and Regulation Division.

DEC (NSW). 2005a. Barking Owl - profile. Department of Environment and Conservation (NSW), Hurstville.

DEC (NSW). 2005b. Black-chinned Honeyeater - profile. Department of Environment and Conservation (NSW), Hurstville, NSW.

DEC (NSW). 2005c. Diamond Firetail - profile. Department of Environment and Conservation (NSW), Hurstville.

DEC (NSW). 2005d. Eastern Bentwing-bat - profile. Department of Environment and Conservation (NSW), Hurstville, NSW.

DEC (NSW). 2005e. Eastern False Pipistrelle - profile. Department of Environment and Conservation (NSW), Hurstville, NSW.

DEC (NSW). 2005f. Glossy Black-cockatoo - Profile. Department of Environment and Conservation (NSW), Hurstville, NSW.

DEC (NSW). 2005g. Greater Broad-nosed Bat - profile. Department of Environment and Conservation (NSW), Hurstville, NSW.

DEC (NSW). 2005h. Regent Honeyeater - profile. Department of Environment and Conservation (NSW), Hurstville.

DEC (NSW). 2005i. Spotted-tailed Quoll - profile. Department of Environment and Conservation, Hurstville, NSW.

DEC (NSW). 2005j. Turquoise Parrot - profile. Department of Environment and Conservaiton (NSW), Hurstville, NSW.

DEC (NSW). 2005k. Yellow-bellied Glider - profile. Department of Environment and Conservation (NSW).

DEC (NSW). 2005l. Yellow-bellied Sheathtail-bat - profile. Department of Environment and Conservation (NSW), Hurstville, NSW.

DEC (NSW). 2006a. Painted Honeyeater - profile. Department of Environment and Conservation (NSW), Hurstville.

DEC (NSW). 2006b. Recovery Plan for the Large Forest Owls: Powerful Owl *Ninox strenua;* Sooty Owl *Tyto tenebricosa;* Masked Owl *Tyto novaehollandiae*. Department of Environment and Conservation (NSW), Hurstville.

DECC (NSW). 2005. Threatened Species Information: Broad-headed Snake. NSW Department of Environment and Climate Change, Hurstville.

DECC (NSW). 2008a. Approved Recovery plan for the brush-tailed rock-wallaby (Petrogale penicillata). Department of Environment and Climate Change, Sydney.

DECC (NSW). 2008b. Recovery Plan for the Koala (*Phascolarctos cinereus*). Department of Environment and Climate Change, Sydney, NSW.

DECCW (NSW). 2010. Scarlet robin - profile. Department of Environment, Climate Change and Water, Hurstville, NSW.

Department of Environment and Conservation NSW. 2004. Regent Honeyeater (Xanthomyza phrygia) National and NSW Recovery Plan. NPWS & Department of Environment and Conservation, Hurstville NSW.

Doerr, V, Doerr, E & Jenkins, S 2006, 'Habitat selection in two Australasian treecreepers: what cues should they use?', *Emu*, vol. 106, no. , pp. 93-103.

Dwyer, P. D. 1966. The population Pattern of Miniopterus Schreibershii (Chiroptera) in North-Eastern New South Whales. Aust. J. Zool. **14**:1073-1137.

Gardner, J. L. and R. G. Heinsohn. 2007. Probable consequences of high female mortality for speckled warblers living in habitat remnants. Emu **135**:473-483.

GEONET 2011. Assessment of Stability and Subsidence SHM Highwal Mining, Coolac Consolidation Project. GEONET Consulting Group. Taringa.

Hall, N & Brooker, I 1973, 'Cannons Stringybark; Eucalyptus cannonii', Forest Tree Series, vol. 124.

Hunter, JT & White, M 1999, 'Notes on the distribution and conservation status of *Eucalyptus cannonii* R.T. Baker', *Cunninghamia*, vol 6, pp. 389-394.

Ironstone Community action Group Inc v NSW Minister for Planning and Duralie Coal Pty. Ltd [2011/ NSWLEC 195]

Kinnear, J. E., M. L. Onus, and R. N. Bromilow. 1988. Fox Control and Rock-Wallaby Population Dynamics. Australian Wildlife Research **15**:435-450.

Lutter, H., M. Lutter, A. B. Rose, and S. J. S. Debus. 2004. Breeding Biology and Diet of the Square-tailed Kite on the Mid-north Coast of New South Wales. Australian Field Ornithology **21**:141-157.

NPWS 2000. 'Modelling areas of habitat significance for vertebrate fauna and vascular flora in the southern CRA region. A report undertaken for the NSW CRA/RFA Steering Committee.' New South Wales National Parks and Wildlife Service, Queanbeyan, ACT.

NSW National Parks and Wildlife Service. 1999. Threatened Species Information - Persoonia marginata. NSW NPWS, Hurstville, NSW.

NSW NPWS. 1999a. Threatened Species Information: Spotted-tailed Quoll. NSW National Parks and Wildlife Service, Hurstville.

NSW NPWS. 1999b. Threatened Species Information: Squirrel Glider. NSW National Parks and Wildlife Service, Hurstville.

NSW NPWS. 2003. Draft Recovery Plan for the Barking Owl (*Ninox connivens)*. NSW National Parks and Wildlife Service, Hurstville.

NSW NPWS. 2004. Eastern Freetail-bat (*Mormopterus norfolkensis*). NSW National Parks and Wildlife Service Northern Directorate, Coffs Harbour.

NSW NPWS. 2005. Identification Guidelines for Endangered Ecological Communities: White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland). National Parks and Wildlife Service, Hurstville NSW.

NSW Scientific Committee. 2004a. Barking Owl - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004b. Black-chinned Honeyeater (eastern subspecies) - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004c. Brown Treecreeper (eastern subspecies) - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004d. Diamond Firetail - vulnerable species listing. NSW National Parks and Wildlife Service, Hurstville.

NSW Scientific Committee. 2004e. Eastern false pipistrelle - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004f. Eastern pygmy-possum - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004g. Glossy black-cockatoo - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004h. Greater broad-nosed bat - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004i. Grey-crowned babbler (eastern subspecies) - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004j. Hooded robin (south-eastern form) - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004k. Speckled Warbler - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004l. Square-tailed kite - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004m. Squirrel glider - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004n. Turquoise parrot - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2004o. Yellow-bellied glider - vulnerable species listing. Department of Environment and Conservation (NSW), Hurstville.

NSW Scientific Committee. 2005. Gang-gang cockatoo - vulnerable species listing. NSW National Parks Wildlife Service, Hurstville.

NSW Scientific Committee. 2009. Little Lorikeet - vulnerable species listing. Department of Environment and Climate Change, Hurstville, NSW.

NSW Scientific Committee. 2010a. Flame robin - vulnerable species listing. Department of Environment, Climate Change and Water, Hurstville, NSW.

NSW Scientific Committee. 2010b. Varied Sittella - vulnerable species listing. Department of Environment, Climate Change and Water, Hurstville, NSW.

OEH. 2012. Atlas of NSW Wildlife.

Phillips, S. 2000. Tree species preferences of the Koala as a basis for the determination of Management Units for recovery planning in NSW., National Parks and Wildlife Service.

SEWPaC. 2011. National recovery plan for the large-eared pied bat Chalinolobus dwyeri. Department of Environment and Resource Management, Brisbane QLD.

SEWPaC. 2012. *Myiagra cyanoleuca* in Species Profile and Threats Database. Department of Sustainability, Environment, Water, Population and Communities, , Canberra.

Sharpe A 1999, 'The NSW yellow-footed rock-wallaby recovery program; Background and history of the project', unpublished report to the NSW National Parks and Wildlife Service, Sydney

Swift Parrot Recovery Team. 2000. Swift Parrot Recovery Plan 2001-2005. Department of Primary Industries, Water and Environment, Hobart.

Swift Parrot Recovery Team. 2001. Swift Parrot Recovery Plan. Department of Primary Industries, Water and Environment, Hobart, TAS.

Threatened Species Scientific Committee. 2006. Commonwealth Listing Advice on White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland. Department of Environment and Heritage, Canberra.

Van Dyck, S. and R. Strahan, editors. 2008. The Mammals of Australia, 3rd edition. Reed New Holland , Sydney.

Vesk, P. and Mac Nally R. 2006., The clock is ticking - Revegetation and habitat for birds and arboreal mammals in rural landscapes of southern Australia. Agriculture, Ecosystems and Environment, 112: 356-366.

Webb, J.K. & R. Shine (1997). A field study of spatial ecology and movements of a threatened snake species, *Hoplocephalus bungaroides*. *Biological Conservation*. 82:203-217.

Wildsearch. 1997. Feldmast Environmental Impact Statement.*in* International Environmental Consultants, editor. Fauna Survey Proposed Feldmast Coal Project Cullen Bullen, NSW. International Environmental Consultants.

Wong V 1993, 'The brush-tailed rock-wallaby (*Petrogale penicillata*) in southern New South Wales – distribution and abundance management recommendations', unpublished report to NSW National Parks and Wildlife Service.

Appendix B

Project Impact and Proposed Offset Summary Tables

Table B.1 EPBC Act Project Summary Table

Scientific Name	Common Name	Status		Macro Habitat	Detected in the Project Boundary	Direct Habitat Removal in Project Boundary (ha)									Retention in Project Boundary (ha)										Current Habitat within Offset lands (ha) [A]										Future Habitat to be restored / enhanced within Offset lands in 50 years (ha) [B]										Total Habitat including restoration after 50 years [C]=[A]+[B]
		TSC	EPBC			Condition								TOTAL (ha)	Condition								TOTAL (ha)	Condition								TOTAL (ha)	Condition								TOTAL (ha)	
FLORA																																													
Eucalyptus cannonii	Capertee Stringybark	V	V	F, W	Y	G/M								**278.00**	G/M								**630.00**	G/M								**326.63**	G/M								**449.57**	**776.20**
Persoonia marginata	Clandulla Geebung	V	V	W	Y	G/M								**3.09**	G/M								**13.10**	G/M								**85.69**										**85.69**
		TSC	EPBC			Winter Habitat	Winter Habitat Condition	Summer Habitat	Summer Habitat Condition					TOTAL (ha)	Winter Habitat	Winter Habitat Condition	Summer Habitat	Summer Habitat Condition					TOTAL (ha)	Winter Habitat	Winter Habitat Condition	Summer Habitat	Summer Habitat Condition					TOTAL (ha)	Winter Habitat	Winter Habitat Condition	Summer Habitat	Summer Habitat Condition					TOTAL (ha)	
FAUNA																																													
Reptiles																																													
Hoplocephalus bungaroides	Broad-headed Snake	V	V	S, F, W	N	308.69	G/M	252.43	G/M					**561.12**	321.51	G/M	329.58	G/M					**651.08**	20.2117	G/M	167.765	G/M					**187.98**									**0.00**	**187.98**
		TSC	EPBC			Shrubland (S)	Shrubland Condition	Forest (F)	Forest Condition	Woodland (W)	Woodland Condition	Grassland (G)	Grassland Condition	TOTAL (ha)	Shrubland (S)	Shrubland Condition	Forest (F)	Forest Condition	Woodland (W)	Woodland Condition	Grassland (G)	Grassland Condition	TOTAL (ha)	Shrubland (S)	Shrubland Condition	Forest (F)	Forest Condition	Woodland (W)	Woodland Condition	Grassland (G)	Grassland Condition	TOTAL (ha)	Shrubland (S)	Shrubland Condition	Forest (F) (grassland resorted to forest)	Forest Condition	Woodland (W) (grassland restored to woodland)	Woodland Condition	TOTAL (ha)	
Birds																																													
Myiagra cyanoleuca	Satin Fly-catcher		M	F, W	Y			411.09	G/M	423.49	G/M			**834.58**		G/M	346.61	G/M	407.65	G/M			**754.26**			432.21	G/M	1869.89	G/M			**2,302.10**			467.35	G/M	209.63	G/M	**676.98**	**2979.08**
Xanthomyza phrygiai	Regent Honeyeater	CE	E, M	F, W	N			411.09	G/M	423.49	G/M			**834.58**		G/M	346.61	G/M	407.65	G/M			**754.26**			432.21	G/M	1869.89	G/M			**2,302.10**			467.35	G/M	209.63	G/M	**676.98**	**2979.08**
Lathamus discolor	Swift Parrot	E	E, M	F, W	N			411.09	G/M	423.49	G/M			**834.58**		G/M	346.61	G/M	407.65	G/M			**754.26**			432.21	G/M	1869.89	G/M			**2,302.10**			467.35	G/M	209.63	G/M	**676.98**	**2979.08**
Mammals																																													
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	S, F, W	Y	0.05	G/M	411.09	G/M	423.49	G/M			**834.63**	32.83	G/M	346.61	G/M	407.65	G/M			**787.08**	47.23	G/M	432.21	G/M	1869.89	G/M			**2,349.33**			467.35	G/M	209.63	G/M	**676.98**	**3026.31**
Dasyurus maculatus	Spotted-tail Quoll	E	E	S, F, W	N	0.05	G/M	411.09	G/M	423.49	G/M			**834.63**	32.83	G/M	346.61	G/M	407.65	G/M			**787.08**	47.23	G/M	432.21	G/M	1869.89	G/M			**2,349.33**			467.35	G/M	209.63	G/M	**676.98**	**3026.31**
		TSC	EPBC			Refuge and Shelter Habitat	Refuge and Shelter Habitat Condition	Forage and Shelter Habitat	Forage and Shelter Habitat Condition					TOTAL (ha)	Refuge and Shelter Habitat	Refuge and Shelter Habitat Condition	Forage and Shelter Habitat	Forage and Shelter Habitat Condition					TOTAL (ha)	Refuge and Shelter Habitat	Refuge and Shelter Habitat Condition	Forage and Shelter Habitat	Forage and Shelter Habitat Condition					TOTAL (ha)	Refuge and Shelter Habitat	Refuge and Shelter Habitat Condition	Forage and Shelter Habitat	Forage and Shelter Habitat Condition					TOTAL (ha)	
Petrogale penicillata	Brush-tailed Rock Wallaby	V	E	S, F, W	N	44.7412	G/M	400.23	G/M					**444.97**	265.84	G/M	157.63	G/M					**423.47**	20.21	G/M	133.03	G/M					**153.24**									**0.00**	**153.24**
		TSC	EPBC			Primary Forage	Primary Forage Condition	Secondary Forage	Secondary Forage Condition					TOTAL (ha)	Primary Forage	Primary Forage Condition	Secondary Forage	Secondary Forage Condition					TOTAL (ha)	Primary Forage	Primary Forage Condition	Secondary Forage	Secondary Forage Condition					TOTAL (ha)	Primary Forage	Primary Forage Condition	Secondary Forage	Secondary Forage Condition					TOTAL (ha)	
Phascolarctos cinereus	Koala	V	V	F, W	N	93.94	G/M	48.22	G/M					**142.16**	18.77	G/M	63.49	G/M					**82.26**	44.96	G/M	841.17	G/M					**886.13**	42.25	G/M	629.86	G/M					**672.11**	**1558.24**
		TSC	EPBC			Woodland (W)	Woodland Condition	Grassland (G)	Grassland Condition					TOTAL (ha)	Woodland (W)	Woodland Condition	Grassland (G)	Grassland Condition					TOTAL (ha)	Woodland (W)	Woodland Condition	Grassland (G)	Grassland Condition					TOTAL (ha)	Woodland (W) (grassland restored to woodland)	Woodland Condition							TOTAL (ha)	
Ecological Communities																																													
	Box Gum Woodland and Derived Native Grassland	E	CE		Y	16.21	C	0.27	B					**16.48**	29.97	C							**29.97**	48.54	C	173.11	B					**221.65**	173.11	C							**173.11**	**221.65**

Notes: Quantity of Persoonia marginata habitat to be retained in Project Boundary does not include 33.58 ha occurring outside Project Boundary in Ben Bullen State Forest
Quantity of Box Gum Woodland includes areas of vegetation that conform to EPBC Act
Total offset does not include 3.38 ha of Temperate Highland Peat Swamps on Sandstone, an EEC listed under the EPBC Act

Table B.2 TSC Act Project Summary Table

Scientific Name	Common Name	Status		Macro Habitat	Detected in the Project Boundary	Direct Habitat Removal in Project Boundary (ha)										Retention in Project Boundary (ha)										Current Habitat within Offset lands (ha) [A]										Future Habitat to be restored / enhanced within Offset lands in 50 years (ha) [B]										Total Habitat including restoration after 50 years [C]=[A]+[B]
		TSC	EPBC			Condition									TOTAL (ha)	Condition									TOTAL (ha)	Condition									TOTAL (ha)	Condition									TOTAL (ha)	
FLORA																																														
Eucalyptus cannonii	Capertee Stringybark	V	V	F, W	Y	G/M									**278.00**	G/M									**630.00**	G/M									**326.63**	G/M									**449.57**	**776.20**
Persoonia marginata	Clandulla Geebung	V	V	W	Y	G/M									**3.09**	G/M									**13.10**	G/M									**85.69**											**85.69**
		TSC	**EPBC**			**Winter Habitat**	**Winter Habitat Condition**	**Summer Habitat**	**Summer Habitat Condition**						**TOTAL (ha)**	**Winter Habitat**	**Winter Habitat Condition**	**Summer Habitat**	**Summer Habitat Condition**						**TOTAL (ha)**	**Winter Habitat**	**Winter Habitat Condition**	**Summer Habitat**	**Summer Habitat Condition**						**TOTAL (ha)**	**Winter Habitat**	**Winter Habitat Condition**	**Summer Habitat**	**Summer Habitat Condition**						**TOTAL (ha)**	
FAUNA																																													
Reptiles																																													
Hoplocephalus bungaroides	Broad-headed Snake	V	V	S, F, W	N	308.69	G/M	252.43	G/M						**561.12**	321.51	G/M	329.58	G/M						**651.08**	20.2117	G/M	167.765	G/M						**187.98**										**0.00**	**187.98**
		TSC	**EPBC**			**Shrubland (S)**	**Shrubland Condition**	**Forest (F)**	**Forest Condition**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**		**TOTAL (ha)**	**Shrubland (S)**	**Shrubland Condition**	**Forest (F)**	**Forest Condition**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**		**TOTAL (ha)**	**Shrubland (S)**	**Shrubland Condition**	**Forest (F)**	**Forest Condition**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**		**TOTAL (ha)**	**Shrubland (S)**	**Shrubland Condition**	**Forest (F) (grassland resotred to forest)**	**Forest Condition**	**Woodland (W) (grassland restored to woodland)**	**Woodland Condition**		**TOTAL (ha)**	
Varanus rosenbergi	Rosenberg Goanna	V		S, F, W	N	0.05	GM	411.09	GM	424.49	G/M				**835.63**	32.83	G/M	346.61	G/M	407.65	G/M				**787.08**	47.23	G/M	432.21		1869.89	G/M				**2349.33**			467.35	G/M	209.63	G/M				**676.98**	**3026.31**
		TSC	**EPBC**			**Shrubland (S)**	**Shrubland Condition**	**Forest (F)**	**Forest Condition**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**		**TOTAL (ha)**	**Shrubland (S)**	**Shrubland Condition**	**Forest (F)**	**Forest Condition**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**		**TOTAL (ha)**	**Shrubland (S)**	**Shrubland Condition**	**Forest (F)**	**Forest Condition**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**		**TOTAL (ha)**	**Shrubland (S)**	**Shrubland Condition**	**Forest (F) (grassland resotred to forest)**	**Forest Condition**	**Woodland (W) (grassland restored to woodland)**	**Woodland Condition**		**TOTAL (ha)**	
Birds																																													
Daphoenositta chrysoptera	Varied Sittella	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Pyrrholaemus saggitatus	Speckled Warbler	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Climacteris picumnus victoriae	Brown Treecreeper	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Xanthomyza phrygiai	Regent Honeyeater	CE	E, M	F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Petroica boodang	Scarlet Robin	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Callocephalon fimbriatum	Gang Gang Cockatoo	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Calyptorhynchus lathami	Glossy Black Cockatoo	V		S, F, W	N	0.05	G/M	411.09	G/M	423.49	G/M				**834.63**	32.83	G/M	346.61	G/M	407.65	G/M				**787.08**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Lophoictinia isura	Square-tailed Kite	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Ninox strenua	Powerful Owl	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Lathamus discolor	Swift Parrot	E	E, M	F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Glossopsitta pusilla	Little Lorikeet	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Grantiella picta	Painted Honeyeater	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Melithreptus gularis gularis	Black-chinned Honeyeater	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Neophema pulchella	Turquoise parrot	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Melanodryas cucullata cucullata	Hooded Robin	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Petroica phoenicea	Flame Robin	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Stagonopleura guttata	Diamond Firetail	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Tyto novaehollandiae	Masked Owl	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Ninox connivens	Barking Owl	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Mammals																		346.61		407.65																											
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	S ,F, W	Y			411.09	G/M	423.49	G/M				**834.58**	32.83	G/M	346.61	G/M	407.65	G/M				**787.08**	47.23	G/M	432.21	G/M	1869.89	G/M				**2349.33**			467.35	G/M	209.63	G/M				**676.98**	**3026.31**
Petaurus norfolcensis	Squirrel Glider	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Miniopterus schreibersii oceanensis	Eastern Bentwing Bat	V		S, F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Dasyurus maculatus	Spotted-tail Quoll	E	E	S, F, W	N	0.05	G/M	411.09	G/M	423.49	G/M				**834.63**	32.83	G/M	346.61	G/M	407.65	G/M				**787.08**	47.23	G/M	432.21	G/M	1869.89	G/M				**2349.33**			467.35	G/M	209.63	G/M				**676.98**	**3026.31**
Petaurus australis	Yellow-bellied Glider	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Cercartetus nanus	Eastern Pygmy Possum	V		S, F, W	N	0.05	G/M	411.09	G/M	423.49	G/M				**834.63**	32.83	G/M	346.61	G/M	407.65	G/M				**787.08**	47.23	G/M	432.21	G/M	1869.89	G/M				**2349.33**			467.35	G/M	209.63	G/M				**676.98**	**3026.31**
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Mormopterus norfolkensis	Eastern Free-tail Bat	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Saccolaimus flaviventris	Yellow-bellied Sheathtailbat	V		F, W	N			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
Scoteanax rueppellii	Greater Broad-nosed Bat	V		F, W	Y			411.09	G/M	423.49	G/M				**834.58**			346.61	G/M	407.65	G/M				**754.26**			432.21	G/M	1869.89	G/M				**2302.10**			467.35	G/M	209.63	G/M				**676.98**	**2979.08**
		TSC	**EPBC**			**Refuge and Shelter Habitat**	**Refuge and Shelter Habitat Condition**	**Forage and Shelter Habitat**	**Forage and Shelter Habitat Condition**						**TOTAL (ha)**	**Refuge and Shelter Habitat**	**Refuge and Shelter Habitat Condition**	**Forage and Shelter Habitat**	**Forage and Shelter Habitat Condition**						**TOTAL (ha)**	**Refuge and Shelter Habitat**	**Refuge and Shelter Habitat Condition**	**Forage and Shelter Habitat**	**Forage and Shelter Habitat Condition**						**TOTAL (ha)**	**Refuge and Shelter Habitat**	**Refuge and Shelter Habitat Condition**	**Forage and Shelter Habitat**	**Forage and Shelter Habitat Condition**						**TOTAL (ha)**	
Petrogale penicillata	Brush-tailed Rock Wallaby	V	E	S, F, W	N	44.7412	G/M	400.23	G/M						**444.97**	265.844	G/M	157.626	G/M						**423.47**	20.21	G/M	133.03	G/M						**153.24**										**0.00**	**153.24**
		TSC	**EPBC**			**Primary Forage**	**Primary Forage Condition**	**Secondary Forage**	**Secondary Forage Condition**						**TOTAL (ha)**	**Primary Forage**	**Primary Forage Condition**	**Secondary Forage**	**Secondary Forage Condition**						**TOTAL (ha)**	**Primary Forage**	**Primary Forage Condition**	**Secondary Forage**	**Secondary Forage Condition**						**TOTAL (ha)**	**Primary Forage**	**Primary Forage Condition**	**Secondary Forage**	**Secondary Forage Condition**						**TOTAL (ha)**	
Phascolarctos cinereus	Koala	V	V	F, W	N	93.94	G/M	48.22	G/M						**142.16**	18.77	G/M	63.49	G/M						**82.26**	44.96	G/M	841.17	G/M						**886.13**	42.25	G/M	629.86	G/M						**672.11**	**1558.24**
		TSC	**EPBC**			**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**						**TOTAL (ha)**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**						**TOTAL (ha)**	**Woodland (W)**	**Woodland Condition**	**Grassland (G)**	**Grassland Condition**						**TOTAL (ha)**	**Woodland (W) (grassland restored to woodland)**	**Woodland Condition**								**TOTAL (ha)**	
Ecological Communities	Box Gum Woodland and Derived Native Grassland	E	CE	W	Y	16.21	1	2.23	4						**18.44**	29.97	1	0.03	4						**30.00**	**48.54**	2	**173.11**	4						**221.65**	**173.11**	1								**173.11**	**221.65**

Notes: Quantity of Persoonia marginata habitat to be retained in Project Boundary does not include 33.58 ha occurring outside Project Boundary in Ben Bullen State Forest

Quantity of Box Gum Woodland includes vegetation that conforms to EPBC Act and TSC Act. There is an additional 1.96 ha of derived native grassland that conforms only to the TSC Act.

Total offset does not include 3.38 ha of Blue Mountain Swamps of the Sydney basin Bioregion, listed as Vulnerable under the TSC Act

Appendix C

Winter Flowering Trees of the Project Boundary

Below is a list of trees recorded in the Project Boundary as well as their indicative flowering periods for consideration with Squirrel Glider, Swift Parrot and other blossom dependant birds such as Regent Honeyeater, Black-chinned Honeyeater, Painted Honeyeater and Little Lorikeet.

Table C.1 Flowering Times of Principle Eucalypts and Eucalypts Recorded in the Project Boundary

Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Principle Food Trees for Swift Parrot (Western Slopes)												
Eucalyptus albens (White Box)												
Eucalyptus microcarpa (Inland Grey Box)												
Eucalyptus sideroxylon (Mugga Ironbark)												
Eucalypts in the Project Boundary												
Eucalyptus aggregata (Black Gum)												
Eucalyptus blakelyi (Blakely's Red Gum)												
Eucalyptus blaxlandii (Blaxland's Stringybark)*												
Eucalyptus bridgesiana (Apple Box)												
Eucalyptus cannonii (Capertee Stringybark)												

Table C.1 Flowering Times of Principle Eucalypts and Eucalypts Recorded in the Project Boundary

Scientific Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eucalyptus dives (Broad-leaved Peppermint)*									■	■		
Eucalyptus macrorhyncha (Red Stringybark)*	■	■	■	■								
Eucalyptus dalrympleana (Mountain Gum			■	■	■							
Eucalyptus goniocalyx			■	■	■	■	■					
Eucalyptus mannifera (Brittle Gum)*	■	■										
Eucalyptus melliodora (Yellow Box)	■	■							■	■	■	■
Eucalyptus piperita (Sydney Peppermint)*	■	■									■	■
Eucalyptus rossii (Inland Scribbly Gum)*	■	■										■
Eucalyptus sieberi (Silvertop Ash)*	■	■	■						■	■	■	■
Eucalyptus stricta	■	■	■	■								■
Eucalyptus sparsifolia (Narrow-leaved Stringybark)*	■	■	■	■								

Table C.1 Flowering Times of Principle Eucalypts and Eucalypts Recorded in the Project Boundary

Scientific Name	Jan	Feb	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	Oct	Nov	Dec
Eucalyptus viminalis (Ribbon Gum)												

Appendix D

Breakdown of Vegetation Communities in the Project Boundary and Proposed Offsets

The table below shows the vegetation communities recorded in the Project Boundary and offsets, as well as their flora and fauna habitat condition and grouping into broad habitat form as per **Table B.1** and **Table B.2.**

Table D.1 Vegetation Communities, Condition and Broad Faunal Habitat Form

Vegetation Community	Shrubland	Forest	Woodland	Grassland	Swamps
Vegetation Communities Recorded in the Project Boundary					
Pagoda Rock Sparse Shrubland	G/M				
Tableland Gully Ribbon Gum Blackwood Applebox Forest		G/M			
Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest		G/M			
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest		G/M			
Tableland Gully Snow Gum - Ribbon Gum Grassy Forest		G/M			
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest		G/M			
Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland (EPBC)			G/M		
Capertee Rough-barked Apple - Red Gum - Yellow Box Woodland: non grassy			G/M		
Tableland Broad-leaved Peppermint - Brittle Gum – Red Stringybark Grassy Woodland			G/M		
Cox's Permian Red Stringybark - Brittle Gum Woodland			G/M		
Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland			G/M		
Capertee Rough-barked Apple - Red Gum - Yellow Box Grassy Woodland Derived Native Grassland (CEEC)				L	
Capertee Rough-barked Apple Red Gum Yellow Box Woodland Derived Native Grassland (EEC)				L	
Tableland Gully Ribbon Gum Blackwood Applebox Forest Derived Native Grassland				L	
Tableland Broad-leaved Peppermint - Brittle Gum – Red Stringybark Grassy Woodland Low Diversity Derived Native Grassland				L	
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest Derived Native Grassland				L	
Tableland Gully Mountain Gum Broad-leaved Peppermint Grassy Forest Derived Native Grassland				L	
Tableland Gully Mountain Gum Broad-leaved Peppermint				L	

Table D.1 Vegetation Communities, Condition and Broad Faunal Habitat Form

Vegetation Community	Shrubland	Forest	Woodland	Grassland	Swamps
Grassy Forest Low Diversity Derived Native Grassland					
Tableland Gully Snow Gum - Ribbon Gum Grassy Forest Low Diversity Derived Native Grassland				L	
Vegetation Communities Recorded in Offsets					
Blue Mountains Escarpment Complex	G/M				
Blue Mountains Heath and Scrub	G/M				
Blue Mountains Riparian Complex		G/M			
Montane Gully Forest		G/M			
Sheltered Ribbon Gum Open Forest		G/M			
Riparian River Oak Forest		G/M			
Eucalyptus oreades Open-forest/Tall Open-forest		G/M			
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest		G/M			
Tableland Scribbly Gum – Narrow-leaved Stringybark Shrubby Open Forest		G/M			
Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Open Forest		G/M			
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest		G/M			
Tableland Gully Mountain Gum - Broad-leaved Peppermint Grassy Forest		G/M			
Tableland Gully Snow Gum - Ribbon Gum Grassy Forest		G/M			
Capertee Rough-barked Apple – Red Gum – Yellow Box Woodland (CEEC)			G/M		
Eucalyptus sieberi - Eucalyptus piperita			G/M		
White Box Shrubby Woodland			G/M		
Box Gum Woodland (CEEC)			G/M		
Scribbly Gum - Red Stringybark Grassy Woodland			G/M		
Cox's Permian Red Stringybark - Brittle Gum Woodland			G/M		
Exposed Blue Mountains Sydney Peppermint - Silvertop Ash Shrubby Woodland			G/M		
Broadleaved Peppermint -Brittle Gum Woodland			G/M		
Scribbly Gum Woodland			G/M		
Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Open Forest Derived Native Grassland				L	

Table D.1 Vegetation Communities, Condition and Broad Faunal Habitat Form

Vegetation Community	Shrubland	Forest	Woodland	Grassland	Swamps
Tableland Broad-leaved Peppermint - Brittle Gum - Red Stringybark Grassy Open Forest Low Diversity Derived Native Grassland				L	
Tableland Gully Snow Gum - Ribbon Gum Grassy Forest Derived Native Grassland				L	
Capertee Rough-barked Apple – Red Gum – Yellow Box Woodland Derived Native Grassland (CEEC)				L	
Box Gum Woodland Derived Native Grassland (CEEC)				L	
Low Diversity Native Grassland/Exotic				L	
Tableland Slopes Brittle Gum – Broad-leaved Peppermint Grassy Forest Derived Native Grassland				L	
Modified Bushland				L	
Blue Mountains Swamps (EEC)					G/M

APPENDIX G

Economic Impact Assessment Peer Review

Mr Dorian Walsh
Hansen Bailey

E: dwalsh@hansenbailey.com.au

Dear Mr Walsh,

RE: Coalpac Consolidation Economic Assessment

In response to your request for an independent evaluation of the economic assessment of the Coalpac Consolidation Project undertaken by Gillespie Economics, I have now examined the relevant documentation. The purpose of this letter is therefore to provide you with my review.

Gillespie Economics uses two techniques to assess the economic impacts of the proposed Coalpac Consolidation Project (hereafter referred to as the Project): Cost Benefit Analysis (CBA) and Input Output Analysis (IOA). CBA is used to assess the Project's impacts on economic efficiency and the IOA to predict the changes to the structure of the regional and state economies that will result from the Project expenditures. Both of these techniques are appropriate to the tasks they address.

The CBA uses the Project's 'net production benefits' as its primary component. This amounts to the economic value of the coal less the costs of production. This represents an approximation of the producer surplus generated by the Project and is a valid inclusion in the CBA calculus.

The economic value of coal in the net production benefit is estimated on the basis of the projected world price of coal rather than the (lower) price that will be paid by the power station. This approach recognises the scarcity value of the coal resource as is required in an analysis of economic efficiency.

The costs included comprise capital and operating costs through the life span of the mine and incorporate the opportunity costs of land through the inclusion of the price of the land to be used, including the land already owned by the project proponent. This is the conceptually correct approach. The inclusion in the Gillespie Economics analysis of the value associated with forestry and agricultural alternative land uses demonstrates the value of the land used for the Project but correctly, is not included in the CBA. That would amount to double counting of the costs associated with the land resource used.

Also included as costs within the 'net production benefit' element are the expenditures incurred in 'internalising' the environmental 'externalities' caused by the Project. The assumption made here is that expenditures on operations such as noise and dust control are at least equal to the costs to the local residents of these environmental impacts. Expenditures of this type are of two varieties.

First there are the costs associated with nuisance minimisation (dust and noise suppression). Second, there are the costs of purchasing neighbouring properties that would experience noise and dust impacts above the established thresholds. The latter involves the assumption that the prices paid for the adjacent properties are greater than the environmental costs that would be incurred if the residents stayed in their properties. Given that the contribution to property value of the environmental characteristics associated with dust and noise are likely to be a fraction of the overall property price this is a reasonable assumption and one that is likely to over state the true environmental damage costs.

Also included in the costs are the expenditures committed to the provision of environmental offsets. On the basis of government legislation that requires offsets to be environmentally enhancing, it can be assumed that the net position of the mine with regard to biodiversity is positive: That is, after the offsets have been made, the Project will involve a net improvement in biodiversity. Hence, by including the costs of the offsets, the CBA does not need to incorporate any biodiversity costs. The Gillespie Economics approach is thus acceptable in this regard.

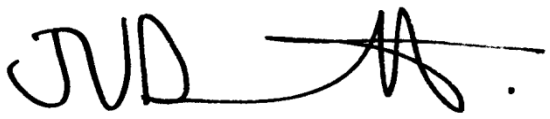
Greenhouse gas (GHG) emissions costs are also included in the Gillespie Economics assessment. Only those GHGs which are created in the mining operation are included in the analysis. Each tonne of GHG emissions is costed using the tax rate being implemented in the Federal Government's climate change policy. The approach taken to the volume of GHGs is appropriate. The GHGs emitted during the burning of the coal should be a factor in the consideration of the investments involved in power generation. The treatment of the unit cost of GHG emissions is likely to overestimate the extent of the costs involved given that the tax rate planned for Australia is currently well in excess of the prices of carbon permits traded both in the US and Europe. Projecting those prices into the future is necessarily risky so the conservative approach taken by Gillespie economics is appropriate.

Ideally, a CBA of the Project would involve any residual environmental costs to be estimated and subtracted from the 'net production benefits' to determine if the Project yields a positive net present value. That would indicate that the Project would generate an improvement in the well being of Australians relative to the case of not going ahead with the Project. The Gillespie Economics assessment does not use this approach due to constraints of time and other resources. Rather it adopts the threshold value approach. This involves the estimation of the net production benefits (inclusive of the 'internalised' environmental costs) and setting that value as a 'threshold' against which the residual environmental costs can be compared. If those residual environmental costs are considered by the decision makers to be worth more than the net production benefits, the implication is that the Project would not enhance the well being of Australians. Alternatively, if the residual environmental costs are considered to be less than the 'threshold' of net production benefits, then proceeding with the Project would be economically efficient.

Given the constraints faced by the assessment, this approach is appropriate. It provides decision makers with the appropriate information on which to judge the relative merits of the Project. It is important therefore that decision makers consider the Gillespie Economics assessment alongside the bio-physical assessments of environmental impacts of the mine that have not been 'internalised' by the inclusion of costs in the 'net production benefits'. This will provide the appropriate information to allow the consideration of the threshold value test. An example of this would be any potential impacts of the mine on areas of the Gardens of Stone proposal.

The IOA is used to predict changes in the structure of the economy resulting from the Project. It relies on the use of input-output tables that reflect the current structure of the economy. Necessarily, the impact analysis is thus predicated on the current conditions. Given this caveat to the Gillespie economic assessment, the use of the technique is appropriate to the task. However, it is important for decision makers to recognise this limitation. The results of the analysis show that there will be increases in employment and other expenditures over the period of the mine's life. This information is useful to those with responsibilities particularly for planning public infrastructure provision. The analysis does not provide an evaluation of the project as does the CBA but rather predicts expenditure impacts. This analysis appears to have been conducted in a competent manner by Gillespie Economics.

In summary, the Gillespie Economics analysis has used conceptually sound techniques that are appropriate to the tasks addressed. The analysis has been performed competently within the bounds of the constraints to data collection. Decision makers who are to judge the merits of the Project should feel confident of this analysis as a basis for their deliberations.



Professor Jeff Bennett
Principal

1 June 2012