GOLDWIND

Biodiversity Assessment Report

WHITE ROCK WIND FARM

AUGUST 2018

ngh environmental

Document Verification

Proposal Title:	White Rock Wind Farm Modification Biodiversity Assessment Report
Proposal Number:	16-321
Proposal File Name:	WRWF STAGE 2 BAR final v3 250718

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft V1	20/07/17	Mitch Palmer Matt Hingee	Brooke Marshall	Brooke Marshall
Draft V1.1	31/07/17	Mitch Palmer	Brooke Marshall	Brooke Marshall
Final 1.0	10/08/17	Mitch Palmer	Minor Changes	Minor Changes
Final 2.0	13/12/17	Mitch Palmer	Brooke Marshall	Brooke Marshall
Final 3.0	20/8/18	Shaun Lenehan Aleksei Atkin	Brooke Marshall	Brooke Marshall

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ACRONYMS AND ABBREVIATIONS

BBAM	BioBanking Assessment Methodology
BCC	BioBanking Credit Calculator
BOS	Biodiversity Offset Strategy
CEEC	Critically Endangered Ecological Community
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FBA	Framework for Biodiversity Assessment
ha	Hectares
km	Kilometres
m	Metres
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage
PCTs	Plant Community Types
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
sp/spp	Species/multiple species
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
WRWFPL	White Rock Wind Farm Pty Ltd
WRWF	White Rock Wind Farm

EXECUTIVE SUMMARY

White Rock Wind Farm Pty Ltd (WRWFPL) is planning for the modification of the White Rock Wind Farm which would involve additional turbines, turbines in locations not included in the original approval, larger turbines and associated changes to the track and cabling network to connect these turbines. This modification relates to Stage 2 of the project.

This Biodiversity Assessment Report (BAR) has been prepared by NGH Environmental on behalf of WRWFPL. The aim of this BAR is to address the requirements of the Framework for Biodiversity Assessment (FBA), developed for Major Projects, including requirements under the NSW Biodiversity Offsets Policy for Major Projects, and to address the biodiversity matters. This BAR will be used to inform an Environmental Impact Assessment as part of the modification application for a Major Project under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The FBA underpins the Biodiversity Offsets Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to assess impacts and provide offset guidance for Major Projects. This report follows the BAR format required by the FBA. Specifically, this assessment uses the *'multiple fragmentation impact development'* assessment methodology, in accordance with Appendix 5 of the FBA for major proposals.

Field surveys of the study area identified two Endangered Ecological Communities (EEC): White Box Yellow Box Blakely's Red Gum Grassy Woodland (7.95 ha) listed under the *Threatened Species Conservation Act 1995* (TSC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion (64.60 ha) listed under the TSC Act. Other non-EEC vegetation that provides threatened species habitat will be impacted by the development. The Biobanking Credit Calculator (BCC) returned a total of 4,547 ecosystem credits for total removal of both EEC and threatened species habitat.

Three threatened species were recorded during the surveys however, all are ecosystems credits species within the vegetation communities listed within the BAR. Surveys were conducted for species credit species generated by the BCC. None were identified within the proposal site however two could not be ruled out as survey timing was not appropriate. These two species were the subject of additional habitat assessment and an expert report and it was verified by these means that no impacts would result for:

Booroolong Frog	*Litoria booroolongensis*
Pale headed Snake	*Hoplocephalus bitorquatus*

It is noted that, as of 8 August, 2018, NSW Office of Environment and Heritage is in the process of confirming the status of Mr Phil Spark (author of Appendix J) as an expert for the Boorolong Frog and Pale-headed Snake. Should the OEH confirmation process extend beyond the point of project approval, safeguards have been included to ensure that these two species are adequately surveyed for, and offset if required, prior to commencement of habitat clearing.

Additional surveys within impact areas added since the field surveys have been recommended to confirm assumptions regarding vegetation community and threatened species (if results are in conflict with the assumptions of this BAR, the credit calculations must be updated to reflect additional offset requirements).

Vegetation mapping of the study area was provided to WRWFPL to guide design of relevant infrastructure with the intention of avoiding and minimising impacts to vegetation constituting the highest ecological value, such as forming components of CEECs, EECs and providing threatened flora and fauna habitat. There is an opportunity within the final design phase to further reduce impacts to native vegetation, in particular EEC vegetation.

Mitigation and management measures will be put in place to adequately address impacts associated with the project, both direct and indirect.

An existing offset package is being developed for the White Rock Wind Farm development. It is intended that the additional credit requirement required by the modification would be included in this package. It is noted there may be further opportunities in the final design phase to minimise impacts to native vegetation, and in particular EEC vegetation, that will avoid and minimise impacts as well as reduce offsetting requirements.

1 INTRODUCTION

This Biodiversity Assessment Report (BAR) has been undertaken to support a Modification Application for the White Rock Wind Farm (WRWF). The WRWF was approved under Section 75J of the Environmental Planning and Assessment Act 1979 on July 10, 2012 (MP10_160). It is a Major Project and State Significant Development (SDD). White Rock Wind Farm Pty Ltd (WRWFPL) is the proponent for the Modification Application.

The modification would involve additional turbines, turbines in locations not included in the original approval, larger turbines and associated changes to the track and cabling network to connect these turbines. This modification relates to Stage 2 of the project. The previously approved Stage 1 of the project, involving the installation of 70 wind turbines, associated infrastructure and ancillary facilities, commenced construction in May 2016. Construction was completed on the 19 March 2018 and Stage 1 is now operational. Stage 2 involves 28 of the remaining 49 approved turbine locations, adds 20 new turbine locations, and includes the option to replace Stage 2 turbines with a larger turbine model (and therefore requires greater areas of clearing).

This Biodiversity Assessment Report (BAR) assesses the additional native vegetation clearing required for the modification, in accordance with the NSW Framework for Biodiversity Assessment (FBA) for Major Projects, and provides advice on the additional offset requirements for the project. It is noted that operational risks, such as potential for bird and bat collisions, are being considered separately and are not addressed in this report.

1.1 THE PROPOSAL

1.1.1 Site location

WRWF is located within the New England Tablelands approximately 20km west of Glen Innes and 40km east of Inverell. The WRWF is located at the junction of the Glen Innes, Inverell and Guyra local government area (LGA). The WRWF is south of the Gwydir Highway with the main site entrance accessed directly off the Gwydir Highway, on the northern site boundary. Access to the southern site boundary, and majority of the development within the Stage 2 modification, is located off Kelleys Road in the Maybole locality.

Refer to Figure 1-1 Site map.

1.1.2 Proposal description

The proposed Stage 2 modifications to the approved WRWF development, MP10_160, are summarised as follows:

- Up to 48 turbines (the existing approval allows for 49 approved turbines sites), of which 20 would be new locations not consented under the original approval;
- A larger turbine model GW140 is being considered for all 48 sites in this assessment;
- Variations to the on-site 33kV/132kV grid connection facility located south of White Rock Mountain, involving a marginally extended 132kV switchyard and 33kV/132kV substation. This includes an additional 33kV/132kV transformer, switchgear and other components;
- Some additional access tracks for the new turbine sites and minor modifications to approved access track routes to improve constructability;

- Additional 33kV collections circuits, including six overhead 33kV lines (four assessed under the original approval) and either an upgrade to or a potential parallel line installation for the existing 33kV overhead line between T62 and T35, for the new wind turbine sites.

In terms of the location of the additional infrastructure, four additional properties would be required, adjacent to the existing proposal site. Three are additional private land holdings. One of these would only involve an access easement and is owned by WRWF.

A summary of proposed impacts included in the is BAR is as follows;

- Cut-and-Fill Batters (plus 5m disturbance buffer)
- Access Tracks (6m width, plus 5m disturbance buffer)
- Hardstands, blade laydown and crane erection area (50 x 80m)
- Blade Laydown/Assembly Overhang (70m blade, 85m blade would be single blade lift)
- Reticulation (12m + 3m per extra parallel cable)
- OHL (24m for full clearance, or tower cone clearance for spanning large gullies)
- OHL Towers (20 x 20m)
- OHL Tower Access Tracks (5m, upgrade of existing farm tracks).

The infrastructure layout assessed in this report is provided in Figure 1-2. This is shown over broader OEH vegetation mapping in Figure 1-3.

The field data used in this assessment was collected over several field programs in response to changes in the infrastructure layout. Some modifications to the layout have placed some infrastructure outside the areas of the field surveys. These areas have been assessed via desktop and compared to adjacent areas which have been surveyed. Vegetation mapping was then extrapolated from areas that have been surveyed using a precautionary approach and only where confidence of vegetation communities was high. However, these areas have not been surveyed for targeted threatened flora and fauna or ground validated, with the intention for further surveys to be undertaken during the relevant spring survey periods. These areas are identified in Figures 3-9 and 3-10 and Figure 3-10 and discussed further in Section 4.

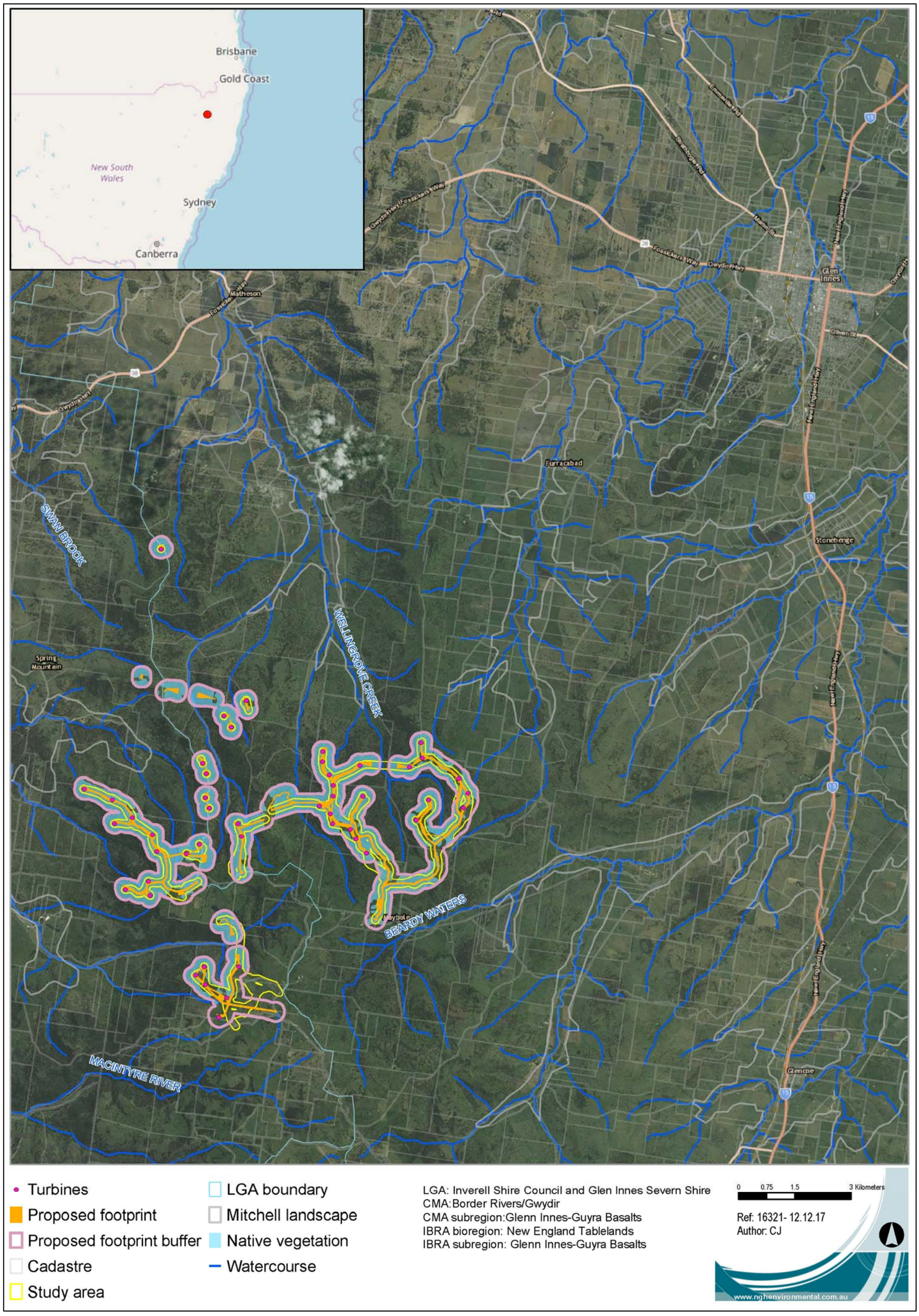

Figure 1-1 Location Map, showing proximity to Glenn Innes

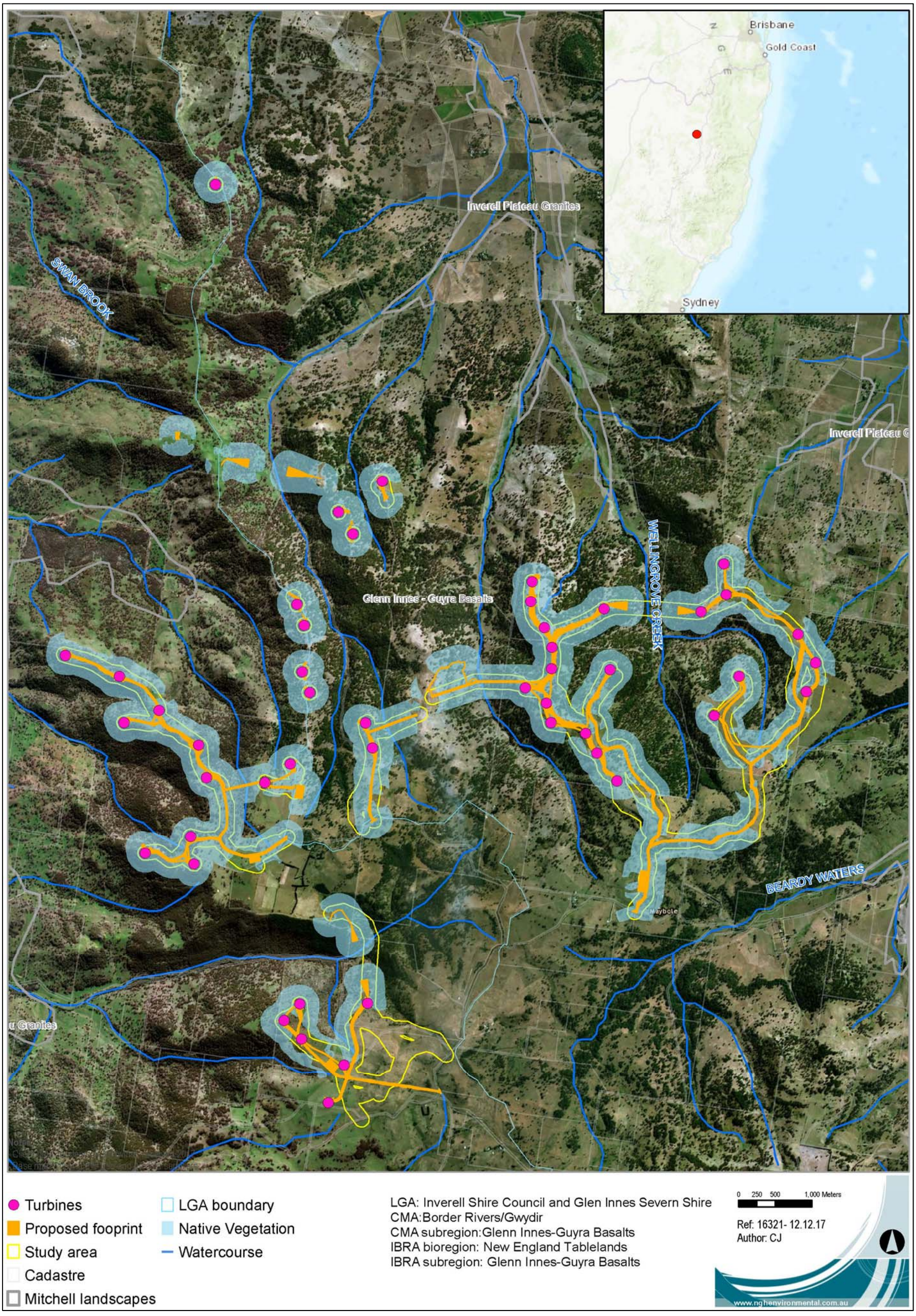

Figure 1-2 Site Map, showing impact areas

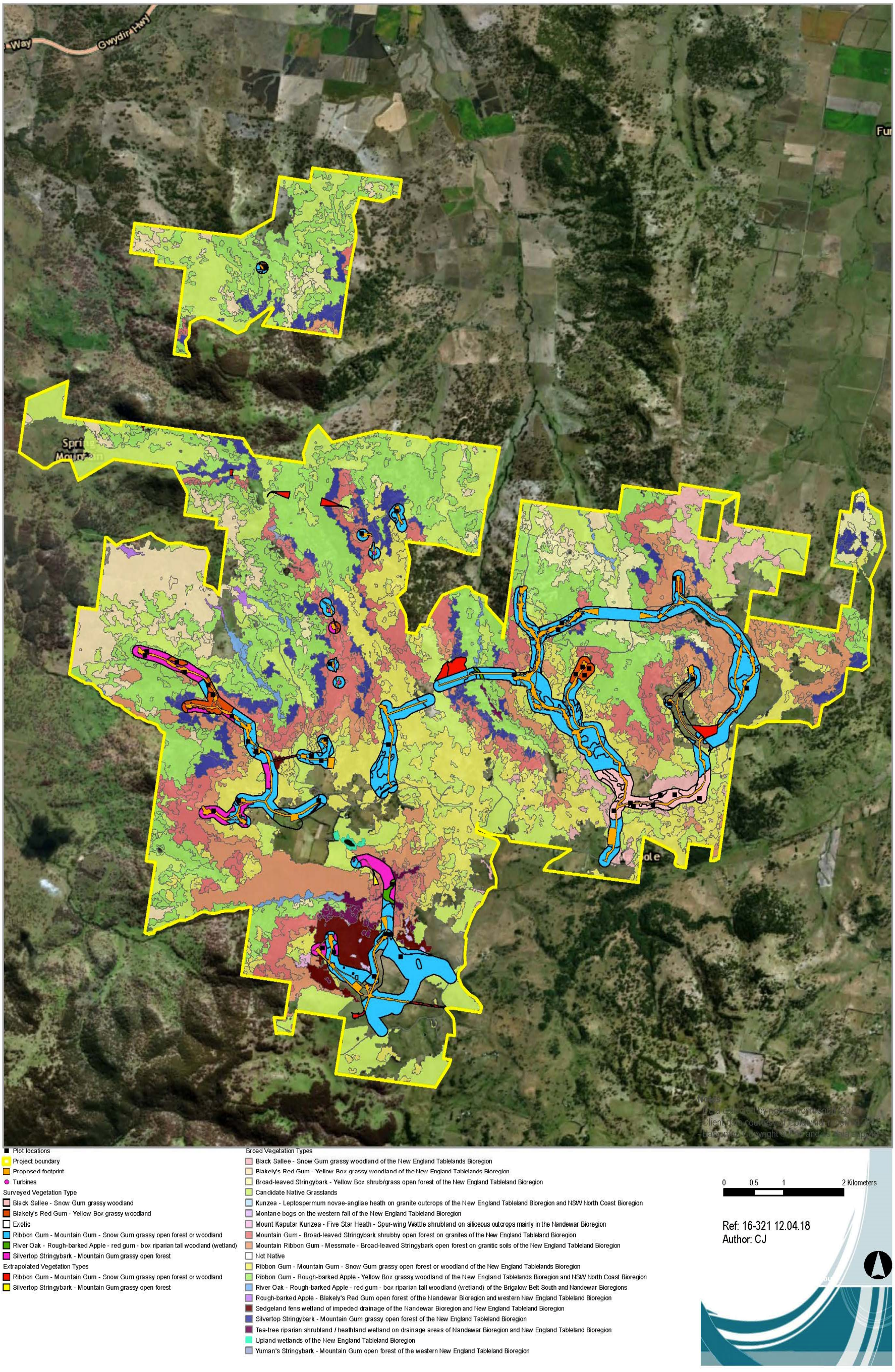

Figure 1-3 Broad vegetation mapping to project boundary

1.2 STUDY AIMS

This BAR has been prepared by NGH Environmental on behalf of Goldwind Australia, one of the owners of WRWF.

The aim of this BAR is to address the requirements of the FBA, developed for Major Proposals, as directed by Office of Environment and Heritage (OEH).

This BAR assesses all additional impact areas required for the modification. This includes:

- New turbine, cabling and track locations, not assessed under the existing approval.
- Increased impact areas, for larger turbine footing requirements, in areas assessed under the existing approval[1].

1.3 REPORT STRUCTURE

This BAR follows the reporting requirements of Sections 1 and 2 of the FBA, including the following:

1. Assessment of all additional turbine sites / impact areas consistent with the requirements of the FBA, developed for Major Projects. The reporting requirements of Sections 1 and 2 of the FBA is followed, namely:
    - Identification of biodiversity values subject to the proposed major development (the proposal) – Chapter 2 (Landscape Features), Chapter 3 (Native Vegetation), Chapter 4 (Threatened Species).
    - Impacts of the project on biodiversity as part of an application for approval to undertake a Major Project under the NSW planning legislation - Chapter 6 (Avoid and Minimise Impacts), Chapter 7 (Impact Summary).
2. Recalculation of impact areas based on larger turbine footings (section 3)

1.4 SOURCES OF INFORMATION USED

The following information sources were used in the preparation of this report:

- Aerial maps, proposal layers and environmental layers provided by Goldwind and OEH.
- Australian Government's Species Profiles and Threats database (SPRAT) http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Species Profiles and Threats Database (SPRAT).
- NSW OEH's BioBanking credit calculator (http://www.environment.nsw.gov.au/bbccapp/ui/mynews.aspx).

[1] This has been undertaken as a GIS exercise by Goldwind. The Stage 2 layout has been clipped using the Stage 1 layout, to ensure only the additional areas required for Stage 2 area assessed.

- NSW OEH's threatened species database http://www.threatenedspecies.environment.nsw.gov.au/index.aspx.
- OEH Threatened Species Profiles.
- Office of Environment and Heritage (OEH) (2007). Mitchell Landscapes with per cent cleared estimates.
- OEH Vegetation Information System (VIS) Classification Database (OEH 2016).
- Office of Environment and Heritage (OEH) (2014). Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Proposals. Published by Office of Environment and Heritage for the NSW Government.

1.5 OEH CONSULTATION

Consultation was undertaken with OEH on the 28th November and 20 December 2016 regarding the biodiversity assessment, landscape assessment approach and mapping of Endangered Ecological Communities (EECs). Correspondence is provided in Appendix A and summarised as follows:

OEH advice		Addressed in this BAR
Biodiversity Assessment		
1.	For the proposed biodiversity surveys, all impact areas associated with the Modification (new infrastructure in areas not previously assessed, new infrastructure in areas previously assessed, approved infrastructure with proposed larger footprints in areas previously assessed) must have their vegetation mapped as per the OEH NE Region Guidance Material for mapping woodland endangered ecological communities.	Updated vegetation mapping for all impact areas in accordance with OEH advice is provided in Section 3 and Section 4, Figure 3-9 and 3-10.
2.	For the assessment of the proposal, the Framework for Biodiversity Assessment (FBA) must be used to assess areas to be impacted by the proposed Modification. However, for offset calculations any existing approved impacts should be subtracted. For example, if an approved turbine footprint is 400m2 and the new footprint arising from the proposed Modification is 900m2, then vegetation would be mapped for the Modification as per Attachment 1 and only the increase in area (900-400=500m2) would be used for offset calculations. This acknowledges that the existing approved footprint can be cleared and offset in accordance with the existing approval and biodiversity offset strategy.	Biodiversity assessment for vegetation clearing follows the FBA BAR requirements (this document). Impact areas required for the modification are set out in Section 5 and Section 7, showing the total amount of new clearing required. The credits generated by this area are set out in Section 8.

OEH advice	Addressed in this BAR
Landscape Assessment Approach	
We have reviewed the map provided which illustrates the location of the proposed additional wind turbines across the landscape. Based on these maps, we are of the view that it would be best if you conduct the landscape assessment of the impacts according to the methodology for 'multiple fragmentation impact development', provided at Appendix 5 of the Framework for Biodiversity Assessment (FBA). This assessment methodology is appropriate for developments like wind farms, given the dispersed nature of turbine locations that are linked by an associated network of development including roads, tracks and transmission lines, and clustered as arrays.	The 'multiple fragmentation impact development' method has been used.
EEC Mapping	
Based on previous ecological assessments undertaken at White Rock Wind Farm, we are aware that two main vegetation types occur. These include the Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland and the White Box - Yellow Box - Blakely's Red Gum Woodland. Both of these vegetation types are listed as EECs. To ensure that the credit requirement generated for impacts on these EECs is accurate, the mapping of these EECs should be broad enough to ensure that all areas of the site where these communities occur are identified… *Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland EEC*	
To assist in the identification of the Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland EEC, the OEH recommends that the following identification logic be adopted: 1. Trees up to 15m apart with exotic or native grassland or bare earth between them - map all as EEC (N.B. this could be up to 30m given the observed canopy diameters in highly fertile sites but 15m was chosen as the average canopy diameter to be pragmatic as it captures the woodland state that can have native or exotic grassland or bare earth trees). 2. Trees between 15m and 100m apart with all native grassland between them - map all as EEC (N.B. this is a derived open woodland state but limiting the state to native grassland in between accords with the ability of the EEC to be mapped as derived native grassland). 3. Trees between 15m and 100m apart with all exotic grassland between them - map trees as EEC. 4. Trees between 15m and 100m apart with patches of native and exotic grassland between them - map trees as EEC and any areas of native grassland in between as EEC but exclude exotic grassland areas. 5. Trees more than 100m apart with patches of native and exotic grassland between them- map trees as EEC and the areas of native grassland in between as EEC but exclude exotic grassland areas. *White Box - Yellow Box - Blakely's Red Gum Woodland EEC*	EEC mapping for all impact areas has been undertaken in accordance with OEH advice and is provided in Section 4 and Figure 3-10

OEH advice	Addressed in this BAR
To assist in the identification White Box - Yellow Box - Blakely's Red Gum Woodland EEC, OEH recommends that the following identification logic be adopted: 1. Trees up to 50m apart with exotic or native grassland or bare earth between them - map all as EEC (N.B. this could be up to 100m apart given the EEC can be an open woodland but 50m was chosen to be pragmatic given this condition state can have just exotics or even bare earth in between trees). 2. Trees between 50m and 100m apart with native grassland between them - map all as EEC (N.B. this could include exotic or bare earth given it can be an open woodland but limiting the state to native grassland in between was chosen in order to be pragmatic). 3. Trees between 50m and 100m apart with exotic grassland between them -map trees as EEC. 4. Trees between 50m and 100m apart with patches of native and exotic grassland between them -map trees as EEC and any areas of native grassland in between as EEC but exclude exotic grassland areas. 5. Trees more than 100m apart with patches of native and exotic grassland between them - map trees as EEC and the areas of native grassland in between as EEC but exclude exotic grassland areas. For both EEC identification processes set out above, native grassland is defined as areas of grassland comprising at least 50% native species.	EEC mapping for all impact areas has been undertaken in accordance with OEH advice and is provided in Section 4 and Figure 3-10
FBA BAR requirements	
Further information was requested by OEH on 22 March 2018, via the DPE, to address the FBA (see Appendix A). Information requested included: 1. The assessment should be amended to consider the Black-throated Finch, Boorolong Frog, Pale-headed Snake and *Callistemon pungens.* 2. The assessment should include the location of assessment circles, all rivers and streams including stream order classifications, extent of native vegetation. Information requirements were clarified in follow up correspondence with Rachel Lonie, Senior Conservation Planning Officer North East Branch, April 2018.	Included in Section 4.2, 4.5 and updated credit requirement, where relevant. The assessment is linear and so assessment circles are not required. Additional mapping is provided in Figures 1.4 (broad vegetation mapping) and Appendix B.1 (stream orders).

2 LANDSCAPE FEATURES

WRWFPL proposes to develop additional infrastructure both within the existing WRWF site boundaries and on an additional four freehold properties, one of which is already owned by the proponent. These areas are bounded by agricultural land, with mix of native and exotic pastures used for grazing purposes. The majority of the land to be impacted has been cleared and 'pasture improved' with the introduction of exotic temperate grasses and fertilised accordingly. This has led to many of the introduced species invading surrounding areas of remnant vegetation and influencing groundcover composition.

2.1 IBRA BIOREGIONS AND SUBREGIONS

Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The proposal is located within The New England Tablelands Bioregion and the Glen Innes-Guyra Basalts Subregion (IBRA v.7 2012). The geology of the region is Silurian to Triassic (443 million years) in age, with landforms described as mountain ranges, dissected plateaus, hills, and undulating plains. The dominant pre-European vegetation type is considered to be Eucalyptus Woodlands dominated by *Eucalyptus albens* and *E. melliodora* (ASRIS accessed 27/3/17).

The dominant IBRA subregion affected by the project is the Glen Innes-Guyra Basalts Subregion. This was entered in the Biobanking Credit Calculator (BCC) assessment for the project.

2.2 NSW LANDSCAPE REGIONS (MITCHELL LANDSCAPES)

Two Mitchell Landscapes occur within the study area; Glen Innes – Guyra Basalts and Inverell Plateau Granites (Figure 1-2).

- Glen Innes – Guyra Basalts occurs throughout the majority of the study area. The per cent cleared estimate for this landscape is currently 82% (OEH 2016).
- Inverell Plateau Granites occurs to the east and west of the study area and crosses a small section of the study area in the northeast. The per cent cleared estimate for this landscape is currently 37% (OEH 20016).

The Mitchell Landscape descriptions are provided below.

Mitchell Landscape
Glen Innes – Guyra Basalts (311369.53 ha)
Undulating to stepped hilly plateau with broad ridges, wide shallow valleys and high rounded peaks on Tertiary basalt, general elevation 700 to 1510m, local relief 300m, average level of the landscape 1300m. Brown structured stony loam and clay loam, on slopes, occasional red structured loam with gradational profiles and deep dark self-mulching sticky clay on the valley floors. Open woodland with snow gum (*Eucalyptus pauciflora*), black sallee (*Eucalyptus stellulata*), manna gum (*Eucalyptus viminalis*), silvertop stringybark (*Eucalyptus laevopinea*), and New England peppermint (*Eucalyptus cinerea*) in higher areas grading to woodland of white box (*Eucalyptus albens*), yellow box (Eucalyptus melliodora), roughbarked apple (*Angophora floribunda*) with manna gum (*Eucalyptus viminalis*) along streams in lower areas. Extensive grassy understorey.

Mitchell Landscape
Inverell Plateau Granites (890307.02 ha)
Widely distributed and defined undulating plateau with domed peaks on Permian New England granites and granodiorites. Several intrusions have distinctive contact ridges of metamorphosed sedimentary rocks. The area includes Permian acid volcanics and pyroclastics and some undifferentiated Permo-Carboniferous mudstone and lithic sandstone. General elevation 900 to 1500m, local relief 200m. The highest elevations are along the eastern edge above the Great escarpment, most of the plateau lies ate 900 to 1200m. As mapped this is a large landscape and it might require subdivision on the basis of vegetation. Domed rock outcrop is common with tors. Shallow gritty loam thickens downs lope to red or yellow earthy sand and red, red-yellow and yellow texture-contrast soil on lower slopes and valley floors. Wide valleys may have deep dark clay deposits in swampy streamlines. The vegetation varies with topography, soil, drainage and temperature. In dry areas open forest of; silvertop stringybark (*Eucalyptus laevopinea*), broad-leaved stringybark (*Eucalyptus caliginosa*), Blakely's red gum (*Eucalyptus blakelyii*), narrow-leaved peppermint (*Eucalyptus radiata*), yellow box (*Eucalyptus melliodora*), apple box (*Eucalyptus bridgesiana*), red ironbark (*Eucalyptus sideroxylon*), Caley's ironbark (*Eucalyptus caleyi*), rough-barked apple (*Angophora floribunda*) and black cypress pine (*Callitris endlicheri*). In moist areas open forest of; New England peppermint (*Eucalyptus nova-angelica*), manna gum (*Eucalyptus viminalis*), mountain gum (*Eucalyptus dalrympleana*), New England blackbutt (*Eucalyptus andrewsii ssp. campanulat*a), diehard stringybark (*Eucalyptus cameronii*), Deane's gum (*Eucalyptus deanei*), messmate (*Eucalyptus obliqua*), privet-leaved stringybark (*Eucalyptus ligustrina*), Youman's stringybark (*Eucalyptus youmanii*), swamp gum (*Eucalyptus camphora*), Gibraltar rock blackbutt (*Eucalyptus pyrocarpa*), tumbledown red gum (*Eucalyptus dealbata*) and orange gum (*Eucalyptus prava*) sometimes with closed forest species in the understorey especially in the eastern parts of the landscape. In cold areas snow gum (*Eucalyptus pauciflora*), black sallee (*Eucalyptus stellulata*) woodlands are the norm with manna gum and mountain gum along some streams. Most granite peaks have specialised joint crevice heath communities typically with about 100 plant genera and almost always containing local endemic species. In this landscape the following communities are recognised; *Gonocarpus teucriodes - Isotoma axillaris* herbfield with black cypress pine, orange gum, tumbledown red gum, Caley's ironbark, and western New England blackbutt. *Babingtonia densifolia-Homoranthus prolixus* shrubland with black cypress pine, orange gum, tumbledown red gum, and *Acacia neriifolia.* New England tea tree - *Brachyloma saxicola* heath on the escarpment of the Gibraltar Range with New England mallee ash (*Eucalyptus approximans*), diehard stringybark, apple box, forest oak (*Allocasuarina torulosa*), black cypress pine and orange gum.

The dominant Mitchell Landscape affected by the proposal is Glen Innes – Guyra Basalts and this was entered into the BCC for the proposal.

2.3 NATIVE VEGETATION EXTENT

The landscape assessment utilised the 'multiple fragmentation impact development' method, provided at Appendix 5 of the FBA. This assessment methodology for linear shaped developments is the most appropriate methodology due to the nature of the turbines locations and the network of access tracks and transmission lines throughout the development. Using GIS, a 550m buffer from the outer edge of the impact areas was established. As the natural vegetation that occurs within the proposal site is woodland and grassland derived from woodland, native vegetation mapping used over-storey as a surrogate for native vegetation cover. This is considered conservative as this would include non-native vegetation, such as pine trees and wind breaks. No natural grasslands are relevant to the study area.

The total area of native vegetation mapped within the 550m buffer is 1689.2 ha Refer to Figure 2-2.

2.4 EXOTIC AREAS

Throughout the proposal site, areas that have been cleared of overstorey and midstorey vegetation are primarily used for improved pasture grazing purposes and provide non-optimal habitat for native fauna. As above, the majority of these have been pasture improved. Highly disturbed and modified vegetation community occupies a small proportion of the site and is found where there is complete (100%) dominance of exotic flora species that make up the groundcover (Figure 2-1). Within the proposed development envelope, the groundcover consisted of exotic species used for livestock grazing and was dominated by Phalaris (*Phalaris aquatic*), Medow Fescue (*Fescuta pratensis*), White Clover (*Trifolum repens*), Red Clover (*Trifolium pratense*) and Prairie Grass (*Bromus catharticus*). Areas within the proposal site that comprise complete exotic vegetation are those not mapped as native vegetation on Figure 3-9.

As this vegetation has no native component in any strata, then in accordance with the FBA, this vegetation does not need to be assessed further.

Figure 2-1 An example of exotic-dominated (grazing) vegetation within the proposal site

2.5 RIVERS AND STREAMS

There are approximately nine (9) ephemeral tributaries that are within the proposal site, however, only one of these is a named stream. The Wellingrove Creek is Strahler order 4 stream and runs through the east of the proposal site in a northerly direction for approximately 40kms draining into the Severn River.

Many first order streams are mapped as occurring near to ridge lines but these have been verified onsite as being largely ephemeral and not able to provide permanent aquatic habitat. Refer to Appendix B.1 stream order mapping for the site and Appendix B.2, which is the results of the on-ground verification of

permanent streams in the impact area (a 100m buffer on the proposed footprint has been used to show where the proposal would impact habitat within 100m of mapped waterways).

2.6 WETLANDS

Naturally occurring areas of inundation may occur within the lower lying area of the proposal site, forming ephemeral wetlands. These areas are considered likely to provide suitable foraging habitat for groups such as wading birds and ducks, in addition to suitable breeding habitat for frogs, although they are generally considered low quality due to a sparse covering of aquatic vegetation.

There are numerous man-made dams within the proposal site, however not within the impact areas, with the primary function of providing water to stock, however they provide important habitat values and provide refuge for native wildlife.

The closest wetland to the proposal site is the RAMSAR listed Little Llangothlin Lagoon and Nature reserve, located approximately 25 km to the south east of the proposal site.

2.7 STATE OR REGIONALLY SIGNIFICANT BIODIVERSITY LINKS

State significant biodiversity links, regionally significant biodiversity links, very large area biodiversity links, large area biodiversity links or local area biodiversity links are defined in the FBA. To date, no biodiversity corridor plans have been approved by the Chief Executive of the OEH.

No state or regionally significant biodiversity links occur within the proposal site and within the buffer area.

2.8 LANDSCAPE VALUE SCORE COMPONENTS

A BCC assessment was completed for this proposal. The proposal ID for the assessment is 0035/2016/4082MP Version 1 and the assessment type was selected as 'Major proposal'. This section summarises the values entered into the Landscape values section of the BCC assessment.

2.8.1 Method applied

The project conforms to the definition of a multiple fragmentation impact development according to the FBA;

> '*a development such as wind farms and coal seam gas extractions that require multiple extraction points or turbines and a network of associated development including roads, tracks, gathering systems/flow lines and transmission lines'*.

As a result, the multiple fragmentation impacts assessment methodology has been used in the assessment, in accordance with Appendix 5 of the FBA for major proposals.

2.8.2 Percent native vegetation cover in the landscape

The following steps were completed in accordance with Appendix 5 of the FBA. They were completed based on the proposal site as of July 2017.

Assessing percent current extent of native vegetation cover

Using a GIS, a 550 m buffer was established from the outer boundary of the proposal site (Figure 2-2).

- The total area of the buffer, including the development footprint, is 2,099.3 ha.
- The total area of native vegetation mapped within the buffer, including the development footprint, is 1,689.2 ha.
- Current native vegetation cover is therefore 80.46%
- In accordance with Table 16 of the FBA, the score for the percent current extent of native vegetation cover was determined to be 13.4.

Assessing percent future extent of native vegetation cover

Using then same 550 m buffer along each side of the centre line of the development footprint:

- The total area of the buffer, including the development footprint, is 2,099.3 ha
- The area of native vegetation mapped within the buffer, excluding the development footprint, is 1,561.46
- Future native vegetation cover is therefore 74%
- In accordance with Table 16 of the FBA, the score for the percent future extent of native vegetation cover was determined to be 13.

2.8.3 Connectivity value

A connecting link is when native vegetation on the site adjoins native vegetation surrounding the site and the native vegetation:

- is in moderate to good condition, and
- has a patch size >1 ha, and
- is separated by a distance of <100 m (or <30 m for non-woody ecosystems), and
- is not separated by a large water body, dual carriageway, wider highway or similar hostile link.

The moderate to good vegetation on the site is well connected to adjacent vegetation. No connecting links occur at the proposal site.

Extract from the FBA Table 17: Connectivity value scores for multiple fragmentation impact based development

Category of connecting link	Defining criteria
State significant biodiversity link	An area identified as being part of a state significant biodiversity link in a plan approved by the Chief Executive, OEH OR A riparian buffer 50 m either side of a 6th order stream or greater OR A riparian buffer 50 m around an important wetland or an estuarine area
Regionally significant biodiversity link	An area identified as being part of a regionally significant biodiversity link and in a plan approved by the Chief Executive, OEH OR A riparian buffer 20 m either side of a 4th or 5th order stream Or A riparian buffer 30 m around a regionally significant wetland
Very large area biodiversity link	Links areas of native vegetation in moderate to good condition that are >5000 ha in total AND Width of vegetation in moderate to good condition that is connecting the area >500m

Category of connecting link	Defining criteria
Large area biodiversity link	Links areas of native vegetation in moderate to good condition that are >1000 ha and < 5000 ha in total, or areas >5000 in total AND Width of vegetation in moderate to good condition that is connecting the area >100m and <500m
Local area biodiversity link	Links areas of native vegetation in moderate to good condition that are >250ha and < 1000 ha in total, or areas >1000 in total AND Width of vegetation in moderate to good condition that is connecting the area >300m and <100m

Connectivity value

The development would not impact on any connecting links or state or regional biodiversity links, however would impact a large biodiversity link and therefore a connectivity value class of 5 was attributed.

2.8.4 Area to perimeter ratio

For a multiple fragmentation development, an assessment of the change in area to perimeter ratio of patch size areas must be undertaken. Before development the area/perimeter ratio score is 15 whilst after development is 11, and therefore a proportional change percentage of 26.7%. As per table 19 in Appendix 5 of the FBA, a score of 3 is achieved.

2.8.5 Patch size

For a development that is linear shaped or a multiple fragmentation development, the assessor must assess the patch size for each Mitchell landscape in which the development occurs. The results are as follows:

Mitchell landscape 1:

Glen Innes – Guyra Basalts 82% cleared

Largest patch size: >100 ha

Table 18 score: 12.5

The final patch size score is 12.5.

2.8.6 Landscape value score

Entering the data documented above into the BCC returned a landscape value score of 20.9.

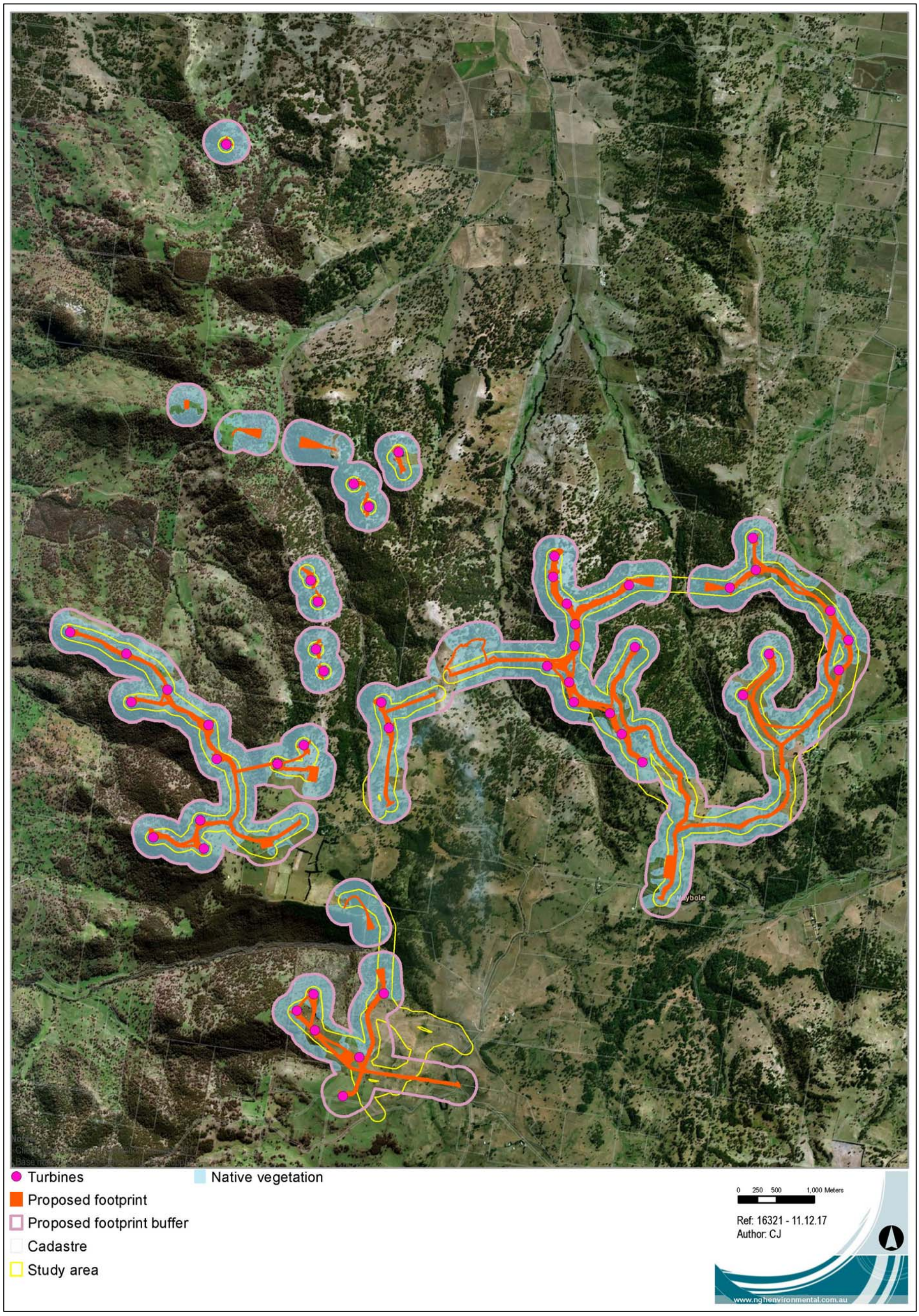

Figure 2-2 Native vegetation cover (linear based development)

3 NATIVE VEGETATION

3.1 PLANT COMMUNITY TYPES

3.1.1 Endangered Ecological Communities (EECs)

Two EECs would be impacted by the modification. These are;

- White Box, Yellow Box, Blakely's Red Gum Grassy Woodland (TSC Act and EPBC Act)
- Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion (TSC Act)

NGH environmental consulted with OEH regarding how these EECs should be mapped (set out in Section 1.6). Refer to Figure 3-10 for the resulting EEC mapping.

3.1.2 Vegetation communities

Five Plant Community Types (PCT's) were identified in the proposal site. These include

- Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion (PCT 510)
- Ribbon Gum – Mountain Gum – Snow Gum grassy open forest or woodland of the New England Tableland Bioregion (PCT 554)
- Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion (PCT 565)
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (PCT 84)
- Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion (PCT 507)

Exotic areas that were completely dominated by non-indigenous vegetation were not considered to be native vegetation. They have not been assigned to any PCT and are not considered to provide habitat for threatened species or communities. They are not considered further in the BCC calculations.

Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion (PCT 510)

Within the proposal site, PCT 510 occurred as:

- Several discrete patches (7.95 ha) of moderate to good woodland vegetation within the proposal site
- Woodland vegetation within the proposal site with 0.51 ha in low condition.

The distribution of this vegetation type at the proposal site is shown on Figure 3-9 and a summary of the key details provided in Table 3-1.

This PCT was determined during the survey on the basis of plot data collected within the development envelope and on surveys conducted in adjacent less disturbed vegetation. This PCT is listed as an Endangered Ecological Community (EEC) under the TSC and EPBC Act – White Box Yellow Box Blakely's Red Gum Woodland. This vegetation community is also listed as a Critically Endangered Ecological Community

(CEEC) under the EPBC Act - White Box Yellow Box Blakely's Red Gum Woodland. It should be noted that this community does not meet the EPBC Act requirements in instances where this this community is in a highly modified state and classed as in low condition.

The overstorey was characteristically dominated by Yellow Box (*Eucalyptus meliodora*). The midstorey consisted of shrubs including Blackthorn (*Bursaria spinosa*). In areas where this community was in low condition, the ground cover was heavily invaded with exotic annuals, perennial grasses and forbs including Medow Fescue (*Fescuta pratensis*), Perennial Rye Grass (*Lollium perene*), Phalaris (Phalaris aquatic), White Clover (*Trifoilum repens*) and Chickweed (*Stellaria media*). Where this community was in moderate to good condition the groundcover was dominated by native species including, Native Geranium (*Geranium solanderi),* Snowgrass (*Poa sieberiana*), Weeping Grass (*Microleana stipoides*) and Stinking Pennywort (Hydrocotyle laxifolia).

A range of other native shrub, grass and forb species were also recorded during the plot surveys. All species recorded are included in Appendix C. Percentage cover and other plot parameters are included in Table 3-7.

Table 3-1 Summary of Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion in the proposal site.

Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion		
Vegetation formation	Grassy woodlands	
Vegetation class	New England Grassy Woodlands	
Vegetation type	**Plant Community Type (PCT) ID**	510
	Biometric Vegetation Type ID	BR272, HU681, NA258
	Common Community Name	Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion
Approximate extent within proposal	This vegetation community occurs as discrete patches of native vegetation within the proposal site of which 8.46 ha is proposed to be cleared (Figure 3-1 & Figure 3-2).	
Condition	Moderate to good and low condition woodland.	
Survey Effort	6 biometric plots within mod/good condition 3 biometric plots within mod/good condition	
Conservation Status	**This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act and a critically endangered ecological community (CEEC) under the EPBC Act known as White Box Yellow Box Blakely's Red Gum Woodland.** It is noted that this community does not meet the EPBC Act requirements in instances where this this community is in a highly modified state and classed as in low condition.	
Estimate of percent cleared	80%	
Threatened plant species habitat	This community provides habitat for threatened flora species, including, Bluegrass (*Dicanthium setosum*), Hawkweed (*Picris evae*), Silky Swainson-pea (*Swainsona sericea*) and Snake Orchid (*Diuris pedunculata*)	

Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion	
Fauna Habitat	This vegetation community provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (if present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground cover plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.
Examples	 Figure 3-1 Example of moderate to good condition Blakely's Red Gum – Yellow Box grassy woodland of the New England Tableland Bioregion in the proposal site. Figure 3-2 Example of low condition Blakely's Red Gum – Yellow Box grassy woodland in the proposal site.

Ribbon Gum – Mountain Gum – Snow Gum grassy open forest or woodland of the New England Tableland Bioregion (PCT 554)

Within the proposal site, PCT 554 was the most abundant vegetation community and occurred as:

- Discrete patches (61.92 ha) of moderate to good woodland vegetation within the proposal site
- Woodland vegetation within the proposal site with 77.7 ha in low condition.

The distribution of this vegetation type at the proposal site is shown on Figure 3-9 and a summary of the key details provided in Table 3-2.

This PCT was determined during the survey on the basis of plot data collected within the development envelope and on surveys conducted in adjacent less disturbed vegetation. This PCT is listed as an Endangered Ecological Community (EEC) under the TSC Act – Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion.

The overstorey was characteristically dominated by Mountain Gum (*Eucalyptus dalrympleana subsp. heptantha*), with subdominant overstorey species including Ribbon Gum (*E.* viminalis). The midstorey was sparse and consisted of shrubs including Blackthorn (*Bursaria spinosa*). In areas where this community was in low condition, the ground cover was heavily invaded with exotic annuals, perennial grasses and forbs including Meadow Fescue (*Fescuta pratensis*), Perennial Rye Grass (*Lollium perene*), Phalaris (Phalaris aquatica) and Sweet Vernal Grass (*Anthoxanthum odoratum*). Where this community was in moderate to good condition the groundcover was diverse and dominated by native species including, Native Geranium (*Geranium solanderi),* Bidge-widgee (*Acaena novae-zelandiae*), Slender Tick-trefoil (*Desmodium varians*) and Stinking Pennywort (Hydrocotyle laxifolia).

A range of other native shrub, grass and forb species were also recorded during the plot surveys. All species recorded are included in Appendix C. Percentage cover and other plot parameters are included in Table 3-7.

Table 3-2 Summary of Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion in the proposal site.

Ribbon Gum – Mountain Gum – Snow Gum grassy open forest or woodland of the New England Tableland Bioregion		
Vegetation formation	Grassy woodlands	
Vegetation class	Tableland Clay Grassy Woodlands	
Vegetation type	**Plant Community Type (PCT) ID**	554
	Biometric Vegetation Type ID	BR329, HU708, NA331
	Common Community Name	Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion
Approximate extent within proposal	This vegetation community occurs as remnant patches of native vegetation throughout the proposal site of which 139.62 ha is proposed to be cleared (Figure 3-3 & Figure 3-4).	
Condition	Moderate to good and low condition woodland.	

Ribbon Gum – Mountain Gum – Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	
Survey Effort	12 biometric plots within mod/good condition 8 biometric plots within low condition
Conservation Status	**This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act known as Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion.**
Estimate of percent cleared	70%
Threatened plant species habitat	This community provides habitat for threatened the flora species, Thesium australe (*Austral Toadflax*), Bluegrass (*Dicanthium setosum*) and Snake Orchid (*Diuris pedunculata*)
Fauna Habitat	This vegetation community provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (if present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground cover plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.
Examples	 Figure 3-3 Example of moderate to good condition Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion in the proposal site.

Ribbon Gum – Mountain Gum – Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	

Figure 3-4 Example of low condition Ribbon Gum – Mountain Gum – Snow Gum grassy open forest in the proposal site.

Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion (PCT 565)

Within the proposal site, PCT 565 occurred as discrete patches (12.33 ha in total) of moderate to good woodland vegetation along the western extent of proposal site.

The distribution of this vegetation type at the proposal site is shown on Figure 3-9 and a summary of the key details provided in Table 3-3. This PCT is not listed as an Endangered Ecological Community (EEC) under the TSC or the EPBC Act.

This PCT was determined during the survey on the basis of plot data collected within the development envelope and on surveys conducted in adjacent less disturbed vegetation. The overstorey was characteristically dominated by Silvertop Stringybark (*Eucalyptus laevopinea*). The midstorey was sparse and consisted of shrubs including Blackthorn (*Bursaria spinosa*). The groundcover was consisted of native species including Bidge-widgee (*Acaena novae-zelandiae*), Slender Tick-trefoil (*Desmodium varians*), Stinking Pennywort (Hydrocotyle laxifolia) and introduced species including White Clover (*Trifolium repens*), Prarie Grass (*Bromus catharticus*), Phalaris (Phalaris aquatic) and Sweet Vernal Grass (*Anthoxanthum odoratum*).

A range of other native shrub, grass and forb species were also recorded during the plot surveys. All species recorded are included in Appendix C. Percentage cover and other plot parameters are included in Table 3-7.

Table 3-3 Summary of Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion in the proposal site.

Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion		
Vegetation formation	Dry Sclerophyll Forest Shrub/grass sub-formation	
Vegetation class	New England Dry Sclerophyll Forests	
Vegetation type	**Plant Community Type (PCT) ID**	565
	Biometric Vegetation Type ID	BR332, NA353
	Common Community Name	Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion
Approximate extent within proposal	This vegetation community occurs as remnant patches of native vegetation along the western extent of proposal site, of which 12.33 ha is proposed to be cleared (Figure 3-5).	
Condition	Moderate to good woodland.	
Survey Effort	8 biometric plots	
Conservation Status	This vegetation community is not listed as an endangered ecological community (EEC) under the TSC or the EPBC Act.	
Estimate of percent cleared	45%	
Threatened plant species habitat	This community provides habitat for threatened flora species, including, Small snake Orchid (*Diuris* pedunculata) and McKie's Stringybark (*Eucalyptus mckieana*).	
Fauna Habitat	This vegetation community provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (if present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground cover plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.	

Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion	
Examples	Figure 3-5 Example of moderate to good condition Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion in the proposal site.

River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (PCT 84)

Within the proposal site, PCT 84 occurred as isolated patches (0.14 ha in total) of moderate to good woodland vegetation restricted to riparian zones within the proposal site.

The distribution of this vegetation type at the proposal site is shown on Figure 3-9 and a summary of the key details provided in Table 3-4. This PCT is not listed as an Endangered Ecological Community (EEC) under the TSC or the EPBC Act.

This PCT was determined during the survey on the basis of plot data collected within the development envelope and on surveys conducted in adjacent less disturbed vegetation. The overstorey was characteristically dominated by River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*). The midstorey consisted of shrubs including Blackthorn (*Bursaria spinosa*), Hickory Wattle (*Acacia implexa*) and Tree Violet (*Melicytus dentatus*). The groundcover was consisted of native species including Weeping Grass (*Microleana stipoides*), Slender Tick-trefoil (*Desmodium varians*), *Acaena* ovina, Snow Grass (Poa sieberiana), and introduced species including White Clover (*Trifolium repens*), Rye Grass (*Lollium perene*), and Verbena (*Verbena boronariensis*).

A range of other native shrub, grass and forb species were also recorded during the plot surveys. All species recorded are included in Appendix C. Percentage cover and other plot parameters are included in Table 3-7.

Table 3-4 Summary of River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion in the proposal site

River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion		
Vegetation formation	Dry Sclerophyll Forest Shrub/grass sub-formation)	
Vegetation class	New England Dry Sclerophyll Forests	
Vegetation type	**Plant Community Type (PCT) ID**	84
	Biometric Vegetation Type ID	BR194, NA191
	Common Community Name	River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion
Approximate extent within proposal	This vegetation community occurs as isolated patches of native vegetation restricted to riparian zones within the proposal site, of which 0.14 ha is proposed to be cleared (Figure 3-6).	
Condition	Moderate to good woodland.	
Survey Effort	1 biometric plot	
Conservation Status	This vegetation community is not listed as an endangered ecological community (EEC) under the TSC or the EPBC Act.	
Estimate of percent cleared	60%	
Threatened plant species habitat	This community provides habitat for threatened flora species, including, Hawkweed (*Picris evae*), Narrow Goodenia (*Goodenia macbarronii*) and Prasophyllum (*Prasophyllum sp. Wybong*).	
Fauna Habitat	This vegetation community provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (if present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground cover plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.	

River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	
Examples	Figure 3-6 Example of River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion

Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion (PCT 507)

Within the proposal site, PCT 507 occurred as:

- Discrete patches (2.67 ha) of moderate to good woodland vegetation along the proposal
- Woodland vegetation along the proposal with 5.34 ha in low condition.

The distribution of this vegetation type at the proposal site is shown on figure 3-9 and a summary of the key details provided in Table 3-5. This PCT is not listed as an Endangered Ecological Community (EEC) under the TSC or the EPBC Act.

This PCT was determined during the survey on the basis of plot data collected within the development envelope and on surveys conducted in adjacent less disturbed vegetation. The overstorey was characteristically dominated by Black sallee (*Eucalyptus stellulata*) and snowgum (*E. puciflora*). The midstorey was sparse and consisted of shrubs including Blackthorn (*Bursaria spinosa*). In areas where this community was in low condition, the ground cover was heavily invaded with exotic annuals, perennial grasses and forbs including Medow Fescue (*Fescuta pratensis*), White Clover (*Trifolium repens*), Phalaris (Phalaris aquatic) and Green Pigeon Grass (*Setaria viridis*). Where this community was in moderate to good condition the groundcover was diverse and consisted of native species including, Weeping Grass (*Microleana stipoides),* Snowgrass (*Poa sieberiana*), Kidney Weed (*Dichondra repens*) and Bluebell (*Wahlenbergia stricta*).

A range of other native shrub, grass and forb species were also recorded during the plot surveys. All species recorded are included in Appendix C. Percentage cover and other plot parameters are included in Table 3-7.

Table 3-5 Summary of Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion in the proposal site.

Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion		
Vegetation formation	Grassy Woodlands	
Vegetation class	Tableland Clay Grassy Woodlands	
Vegetation type	**Plant Community Type (PCT) ID**	507
	Biometric Vegetation Type ID	BR269, HU679, NA251
	Common Community Name	Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion
Approximate extent within proposal	This vegetation community occurs as remnant patches of native vegetation within the extent of proposal site, of which 8.02 ha is proposed to be cleared (Figure 3-7 & Figure 3-8).	
Condition	Moderate to good and low condition woodland.	
Survey Effort	4 biometric plots within mod/good condition 3 biometric plots within low condition	
Conservation Status	**This vegetation community is listed as an endangered ecological community (EEC) under the TSC Act known as Ribbon Gum – Mountain Gum – Snow Gum grassy open forest of the New England Tableland Bioregion.**	
Estimate of percent cleared	85%	
Threatened plant species habitat	This community provides habitat for threatened flora species, including *Thesium australe* (Austral Toadflax), Narrow-leaved Black Peppermint (*Eucalyptus nicholii*) and Small Snake Orchid (*Diuris pedunculata*)	
Fauna Habitat	This vegetation community provides numerous habitat types for fauna. Canopy trees provide foraging and nesting/resting for birds and arboreal fauna. The mid-storey (if present) provides foraging and nesting for smaller birds, as well as refuge for small-medium sized mammals and reptiles. Ground cover plants, logs and fallen leaves provide shelter and foraging for terrestrial fauna as well. Where hollow-bearing trees are present, it may provide daytime resting habitat for bats and mammals, and roosting habitat for birds.	

Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	
Examples	 Figure 3-7 Example of moderate to good condition Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion in the proposal site. Figure 3-8 Example of low condition Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion in the proposal site.

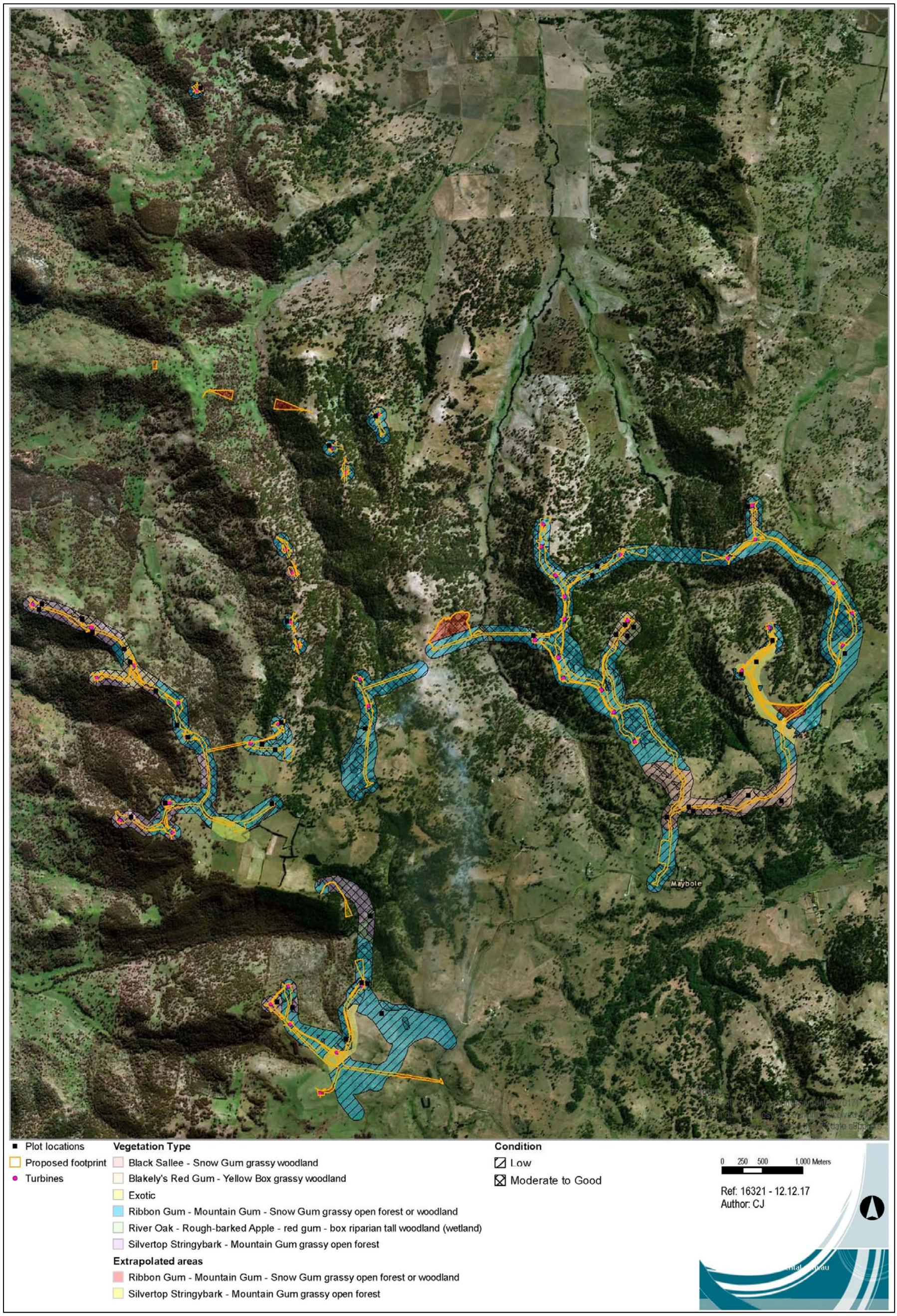

Figure 3-9 PCTs at the proposal site

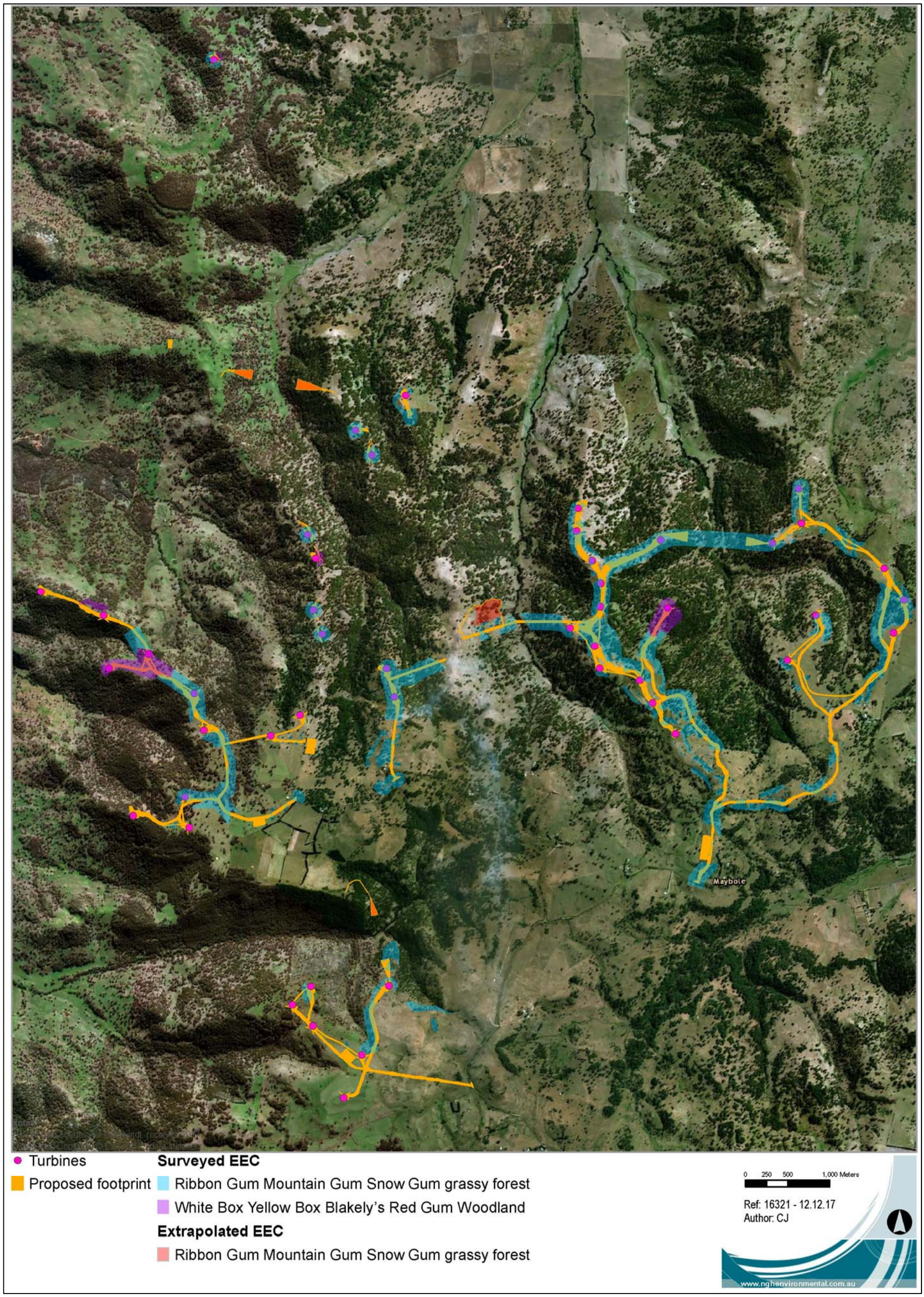

Figure 3-10 EECs at the proposal site

3.1.3 Vegetation zones in the BCC

The vegetation zones that would be impacted by the proposal, as entered into the BCC, their condition class, number of biometric plots undertaken within them and their current site value score, as determined by the BCC, are listed in Table 3-6 below.

Table 3-6 Vegetation zones for the proposal site (*EEC italicised*)

Zone ID	Vegetation zones	Condition class	Area (ha) within proposal site	Survey effort (number of plots)	Site value score (current)
1	*PCT #510* *BVT BR272 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion*	*Moderate – good*	*7.95*	*6*	*72.4*
2	*PCT #510* *BVT BR272 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion*	*Low*	*0.51*	*3*	*17.19*
3	*PCT #554* *BVT BR329 Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion*	*Moderate – good*	*61.92*	*12*	*67.21*
4	PCT #554 BVT BR329 Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	Low	77.70	8	13.66
5	PCT #565 BVT BR352 Silvertop Stringybark – Mountain Gum grassy open forest of the New England Tableland Bioregion	Moderate – good	12.33	8	42.53
6	PCT #84 BVT BR194 River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	Moderate – good	0.14	1	41.15

Zone ID	Vegetation zones	Condition class	Area (ha) within proposal site	Survey effort (number of plots)	Site value score (current)
7	*PCT #507* *BVT269 Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion*	*Moderate – good*	*2.68*	*4*	*71.04*
8	PCT #507 BVT269 Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	Low	5.34	3	13.66
Total			**168.57**	**45**	

Notes:

- Threatened species subzones / management zones were entered equivalent to the vegetation zones. No additional polygons were mapped.

3.1.4 Site values (plot data entered into BCC)

The following plot data was collected in November 2016, January 2017 and February 2017 for vegetation zones 1 to 8 (Table 3-7). The locations of each survey plot is shown in Figure 3-9.

Table 3-7 Plot data

Zone 1: PCT #510 BVT BR272 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion Moderate to good condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q13	16	20.5	11.5	4	6	44	46	3	1	16	365598	6695992	56
Q14	15	22	4	6	6	40	48	1	1	21	365520	6695876	56
Q19	25	10.5	8	48	2	34	54	1	0	2	358693	6696073	56
Q22	16	14.5	0	4	0	48	48	0	0	29	359315	6695553	56
Q42	19	13.5	1	24	0	24	42	0	0	4	367092	6697431	56
Q31	14	12.5	0	10	0	46	44	2	1	7	360195	6702724	56

Zone 2: PCT #510 BVT BR272 Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion Low condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q21	13	0	0	10	0	10	80	0	0	0	359240	6695720	56
Q16	10	13.5	0	0	0	0	100	0	0	7	365379	6695899	56
Q15	10	0	0	16	0	14	70	0	0	27	365489	6696022	56

Zone 3: PCT #554 BVT BR329 Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion Moderate to good condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q1	9	14	0	26	0	16	58	4	0	8	361123	6694453	56
Q2	6	1	0	4	0	16	80	0	0	12	360959	6694524	56
Q4	12	10	0	10	0	32	58	0	1	4	377789	6708670	56
Q5	9	12.5	6	20	0	32	48	0	0	0	362277	6691540	56
Q7	10	10	0	4	0	24	72	2	1	0	361083	6693782	56

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q11	3	16.5	0	10	0	10	50	0	0	12	367331	6695820	56
Q12	3	14	0	10	0	14	76	3	1	0	366945	6695403	56
Q17	12	10	0	64	0	18	18	0	0	0	365153	6696746	56
Q18	12	3.5	0	10	2	34	54	1	1	2	465018	6696630	56
Q35	23	7	0	86	0	2	6	1	1	20	361798	6698255	56
Q32	20	25	0	52	0	10	2	2	1	4	361273	6696069	56
Q39	23	0	0	42	0	12	44	0	1	0	364347	6695889	56

Zone 4: PCT #554 BVT BR329 Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion Low condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q3	4	0	0	6	0	26	68	0	0	0	361201	6694803	56
Q6	4	0	0	10	0	10	80	0	0	0	362203	6691552	56
Q24	7	0	0	10	0	10	72	0	0	0	359901	6694767	56
Q25	13	0	0	10	0	34	52	0	0	0	360035	6694609	56
Q43	4	0	0	6	0	8	86	0	0	0	368232	6695664	56
Q34	11	0	0	14	0	14	68	0	0	0	362380	6698628	56
Q30	5	0	0	16	0	18	66	0	0	0	362452	6691169	56
Q33	11	0	0	10	0	6	74	0	0	0	362243	6694721	56

Zone 5: PCT #565 BVT BR352 Silvertop Stringybark – Mountain Gum grassy open forest of the New England Tableland Bioregion Moderate to good condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q8	6	0	0	30	0	22	48	0	0	0	358177	6696214	56
Q9	17	5.5	0	16	0	34	50	0	0	0	358174	6696291	56
Q20	27	10.5	0	16	0	38	8	0	1	6	358841	6695931	56
Q23	16	24	9	16	6	12	22	0	0	29	359634	6695194	56
Q26	9	24.5	0	4	0	4	76	0	0	0	359749	6693789	56
Q28	17	2	0	30	0	54	14	0	1	0	361146	6691313	56
Q29	19	23	5	12	0	56	0	0	1	25	361341	6691246	56
Q46	23	14	0	30	0	12	40	0	1	6	359325	6693615	56

Zone 6: PCT #84 BVT BR194 River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion Moderate to good condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q27	16	11	0	8	0	34	50	0	1	0	362299	6692350	56

Zone 7: PCT #507 BVT269 Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion Moderate to good condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q40	20	14	1	14	0	30	48	2	1	14	366667	6693714	56
Q41	14	10.5	6.5	8	2	36	50	1	1	20	366786	6693877	56
Q36	15	13	0	16	0	14	70	0	1	6	366013	6693616	56
Q37	15	7	0	12	0	12	50	1	1	4	366341	6693693	56

Zone 8: PCT #507 BVT269 Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion Low condition

Plot name	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
Q44	5	0	0	4	0	4	92	0	0	0	367443	6693818	56
Q45	7	0	0	4	0	24	72	0	0	0	367030	6693887	56
Q38	6	0	0	48	0	24	14	0	0	0	366286	6693744	56

4 THREATENED SPECIES

4.1 TARGETED SURVEYS OVERVIEW

Flora and fauna field surveys were undertaken specific to the Modification Application in November 2016, January 2017, February 2017 and May 2018. In addition to vegetation mapping and the collection of plot data, approximately 90-person hours were spent on targeted flora surveys. Approximately 20-person hours were spent on targeted fauna / fauna habitat surveys over this period. The methods are discussed specific to the candidate species below. However, additional fauna habitat assessment surveys and incidental observations were also recorded.

In addition to the surveys undertaken for the Modification Application, WRWF has been subject to an ecological assessment carried out in 2010 (RPS, 2011). These surveys were carried out in habitats considered representative of the local area, some of which were similar to the habitat occurring in the proposal site.

Additionally, pre-construction bird and bat utilisation surveys are currently being undertaken by Brett Lane and Associates to inform the approved Bird and Bat Adaptive Management Program (BBAMP) for the White Rock Wind Farm. Where relevant, these are cited below.

As mentioned in Section 1.1.2, additional areas outside of the survey area have been included in this BAR. These areas have not been surveyed for targeted threatened flora and fauna and are identified in Figure 3-9 and Figure 3-10 in the legends as 'extrapolated areas'. While the vegetation types have been confidently extrapolated, discussions and conclusions made in the following sections of this BAR regarding targeted surveys do not include or account for these additional areas. A requirement to confirm survey results in these areas is included as a mitigation strategy.

Weather conditions during the field surveys

Weather conditions during the surveys ranged from fine with mild night time and warm daytime temperatures for the November 2016 and January 2017 surveys to fine and cold for the May 2018 surveys (habitat assessment only). Rainfall was recorded during the February surveys however this predominantly fell via a passing storm to the north of the survey area towards Glen Innes. It was also noted evidence of recent rainfall and storm activity was observed prior to the January 2017 survey period. Table 4-1 lists the weather conditions as recorded at Glen Innes (approximately 20km north east of the site) over the survey periods.

Table 4-1 Weather conditions during the field surveys, recorded at Glen Innes

Date	Temperature min (°C)	Temperature max (°C)	Rain (mm)	Wind speed @ 9am (km/h)
21/11/2016	10	26	0	11
22/11/2016	9.5	25	0	20
23/11/2016	8.5	23	0	6
16/01/2017	16.5	27	0	22
17/01/2017	16	29.5	0	6
18/01/2017	17	31	0	20

Date	Temperature min (°C)	Temperature max (°C)	Rain (mm)	Wind speed @ 9am (km/h)
20/01/2017	17	26.5	0	19
21/01/2017	19	29	29.2	11
22/01/2017	14.5	26	0	22
29/05/2018	4	16	0	11
30/05/2018	-2	18	0.5	11

4.2 GEOGRAPHIC/HABITAT FEATURES

Seven (7) geographic/habitat features suitable for ecosystem credit species were generated by the BCC. These features and whether they would be impacted by the proposal are shown in Table 4-2 below. All features are relevant to the impact areas, as shown below.

Table 4-2 Geographic / habitat features

Impact	Common name	Scientific name	Feature
Yes	Austral Toadflax	*Thesium australe*	Coastal headlands, grassland, grassy open forest or woodland on fertile or moderately fertile soils
Yes	Hawkweed	*Picris evae*	Grassy forest or woodland on fertile or moderately fertile soils
Yes	Black-throated Finch (southern subspecies)	*Poephila cincta subsp. cincta*	Seeding native grasses within 100 m of water
Yes	Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Shallow or infertile soils
Yes	Booroolong Frog	*Litoria booroolongensis*	Land within 100 m of stream or creek banks
Yes	Pale-headed Snake	*Hoplocephalus bitorquatus*	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber
Yes	*Callistemon pungens*	*Callistemon pungens*	Along rocky watercourses with sandy granite or basalt creek beds

Note:

In March 2018 correspondence, OEH requested that further consideration be given to four species initially selected as 'no impact' in the table above. These four species are: Black-throated Finch (southern subspecies), Booroolong Frog, Pale-headed Snake and *Callistemon pungens* (refer Appendix A OEH correspondence). The habitat features for these species are now selected as being impacted and additional consideration is documented in Section 1.5.

Additionally, a habitat assessment was undertaken to verify the permanence and condition of water ways within 100m of the development footprint. This assisted to narrow down areas of potential habitat and undertake targeted surveys therein, where appropriate.

4.3 HOLLOW BEARING TREES

A total of 45 hollow-bearing trees were identified within and adjacent to the proposal site (Figure 4-1). 13 of these trees would be removed by the proposal. Further information is provided in Appendix D.

Hollows potentially provide roosting habitat for some species of microbats, parrots, owls and arboreal mammals. Hollow-dependant fauna species are likely to be impacted due to the proposal. However, the impacts on hollow-dependent fauna in the proposal site is likely to be low, as hollow abundance within vegetation surrounding the site is considered likely to be greater than that within the proposal site. Mitigation measures have been recommended to address the clearing risks to resident species (Section 6).

The number of hollows to be impacted is assessed within the BCC, via the plot data collected for each vegetation zone. This data adds to the value of the habitat to be removed, thereby requiring a greater number of credits to be retired. No specific requirement to offset hollows has been identified.

4.4 ECOSYSTEM CREDIT SPECIES

The following species are all species predicted by the BCC to occur, based on the data entered for the landscape assessment and vegetation zones in the assessment. These constitute all species which will generate ecosystem credits in the credit calculations.

Table 4-3 Ecosystem credit species predicted to occur.

Common name	Scientific name	TS offset multiplier
Barking Owl	*Ninox connivens*	3.0
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis subsp. gularis*	1.3
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus subsp. victoriae*	2.0
Diamond Firetail	*Stagonopleura guttata*	1.3
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2.2
Flame Robin	*Petroica phoenicea*	1.3
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	1.8
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2.2
Hooded Robin (south-eastern form)	*Melanodryas cucullata subsp. cucullata*	1.7
Little Eagle	*Hieraaetus morphnoides*	1.4
Little Lorikeet	*Glossopsitta pusilla*	1.7
Scarlet Robin	*Petroica boodang*	1.3
Speckled Warbler	*Chthonicola sagittata*	2.7
Spotted Harrier	*Circus assimilis*	1.4
Spotted-tailed Quoll	*Dasyurus maculatus*	2.6

Common name	Scientific name	TS offset multiplier
Square-tailed Kite	*Lophoictinia isura*	1.4
Turquoise Parrot	*Neophema pulchella*	1.8
Varied Sittella	*Daphoenositta chrysoptera*	1.3
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2.2

4.5 SPECIES CREDIT SPECIES PRESENT

4.5.1 Candidate species summary

The following species were returned by the BCC as 'requiring survey'. Targeted surveys were undertaken for all species in accordance with the Draft Threatened Species Survey Guidelines (DECC 2004) and timing specified in the BCC (detailed in Section 4.3.2). The exceptions to this were:

- *Prasophyllum sp. Wybong* and *Diuris pedunculata* - survey timing in December and January was not appropriate for these species (BCC requirements state October and Spring, respectively).
- Koala - habitat assessment and random searches only.
- *Callistemon pungens* – targeted surveys outside of flowering period justified based on the conspicuous appearance of Callistemon species.
- Booloorong Frog – Habitat assessment only.
- Pale-headed Snake – Habitat assessment only.

Extrapolated areas demonstrated on Figure 3-9 and 3-10.

Table 4-4 summarises whether each species was detected during surveys and furthermore, if they are expected to be impacted by the proposal and therefore are required to be offset.

Table 4-4 Threatened species requiring survey

Common name	Scientific name	Surveys	Present/presumed present	Survey date	Affected by the proposal
Austral Toadflax	*Thesium australe*	Not detected during targeted survey	No	20-22 February 2017	Unlikely
Black-throated Finch (southern subspecies)	*Poephila cincta subsp. cincta*	Not detected during targeted survey	No	Spring 2016 and Autumn 2017 and 2018	Unlikely
Bluegrass	*Dichanthium setosum*	Not detected during targeted survey	No	20-22 February 2017	Unlikely
Hawkweed	*Picris evae*	Not detected during targeted survey	No	20-22 February 2017	Unlikely

Common name	Scientific name	Surveys	Present/presumed present	Survey date	Affected by the proposal
Koala	*Phascolarctos cinereus*	Not detected during survey	Proposal site occurs within potential habitat for this species however not recorded within the proposal site during targeted surveys – could occur on occasion	November 2016 January 2017	Unlikely
McKie's Stringybark	*Eucalyptus mckieana*	Not detected during targeted survey	No	20-22 February 2017	Unlikely
Narrow Goodenia	*Goodenia macbarronii*	Not detected during targeted survey	No	20-22 February 2017	Unlikely
Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	Not detected during targeted survey	No	20-22 February 2017	Unlikely
Prasophyllum sp. Wybong	*Prasophyllum sp. Wybong*	Not detected however timing not suitable for targeted surveys for this species	No – marginal and poor quality habitat present	N/A	Unlikely
Regent Honeyeater	*Anthochaera phrygia*	Not detected during targeted survey	No– not recorded within the proposal site, only one recording within 20km, and minimal clearance of marginal habitat.	November 2016 February 2017	Unlikely
Silky Swainson-pea	*Swainsona sericea*	Not detected during targeted survey	No	November 2016 20-22 February 2017	Unlikely
Small Snake Orchid	*Diuris pedunculata*	Timing not suitable for targeted surveys for this species	No – elevation above species range, marginal and poor quality habitat present closest record more than 50km south.	N/A	Unlikely

Common name	Scientific name	Surveys	Present/presumed present	Survey date	Affected by the proposal
Callistemon pungens	*Callistemon pungens*	Not detected during targeted survey	No Callistemon of any sort identified during survey.	May 2018	No
Booloorong Frog	*Litoria booloorongensis*	Timing not suitable for targeted surveys for this species	Presumed present in subset of potential habitat type	May 2018	Possible
Pale-headed Snake	*Hoplocephalus torquatus*	Timing not suitable for targeted surveys for this species	Presumed present in subset of potential habitat type	May 2018	Possible

4.5.2 Survey timing and effort

Threatened flora species – suitable survey timing

Bluegrass, Austral toadflax, Hawkweed, Silky Swainson-pea, McKies stringybark, Narrow goodenia and Narrow-leaved black peppermint

Targeted surveys were undertaken for Bluegrass (*Dichanthium setosum*), Austral toadflax (*Thesium austral*,) Hawkweed (*Picris evae*), Silky Swainson-pea (*Swainsona sericea*), McKies stringybark (*Eucalyptus mckieana),* Narrow goodenia *(Goodenia macbarronii,*Narrow-leaved black peppermint *(Eucalyptus nicholii)* and *Callistemon pungens.*

Within the proposal site, where habitat was deemed most suitable for the above listed threatened species, targeted searches were carried out by conducting parallel transects at distances of approximately 10 m (depending on vegetation density), covering as much of the vegetation patch as was accessible. This predominantly included areas that would be impacted by proposed access tracks, turbine locations and ancillary facilities. Three persons were involved in the searches giving a coverage of 30m per pass.

Additionally, random meander searches (after Cropper 1993) were undertaken on foot throughout the proposal site where habitat was deemed less that optimal for the above mentioned threatened species. This method provides a comprehensive approach in terms of detecting the species and variation within vegetation types, and improves opportunities for detecting significant or sparsely distributed plant species.

Approximately 30 hours per person (90 hours in total) were spent surveying for threatened flora species.

Threatened flora species – unsuitable survey timing

Small Snake Orchid and *Prasophyllum sp. Wybong*

For the Small Snake Orchid (*Diuris pedunculata*) and *Prasophyllum sp. Wybong,* survey timing was not suitable. Outside of the suitable survey timing (October and Spring, respectively) these species are considered extremely difficult to detect.

The assessment as to whether these species have potential to occur and be affected by the proposal has been informed by the results of the targeted surveys, local records and the nature of the development. This discussion is provided in Section 4.4.3.

Callistemon pungens

While the survey timing in May 2018 was not suitable to identify Callistemon to species level, it was expected that if no Callistemons were identified at all, being a conspicuous genus, the occurrence of *Callistemon pungens* could be confidently ruled out.

The Bionet Threatened Species Profile Database lists the species as being associated with one PCT located within the study area - River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (PCT 84). 0.14 ha of this PCT occurs within the site. However, in the absence of detailed mapping of preferred soils, a field survey of all potential habitat within the development footprint buffer was undertaken. This was defined as within 100m of permanent drainage lines that crossed the development envelope (refer to Appendix B.2 for location of permanent waterways).

The survey comprised thirty person hours of walked transects aligned parallel to the subject drainage lines, on either bank 10m parallel to the drainage line, for the length of drainage line that fell within the search area (within 100m of permanent drainage lines that crossed the development footprint).

Threatened fauna – suitable survey timing

Regent Honeyeater

Four transect surveys as well as opportunistic observations during targeted flora surveys were supplemented by song meter surveys, specifically targeting the Regent Honeyeater. Two song meters were placed in suitable habitat, where Yellow box dominated patches of remnant woodland in good/moderate condition occurred. The song meters recorded during dawn and dusk periods over three nights. Approximately 30 hours was spent on the songmeter recording time and analysis in total. Additionally, approximately six person hours of survey was undertaken on 2ha transects and opportunistic surveys.

Numerous surveys have been undertaken previously by RPS (2011) and Brett Lane and Associates (2016). The results of these surveys have been considered in evaluating the presence and potential for impact on this species.

Koala

One of the dominant overstorey species within the proposal site, Ribbon Gum (*E.viminalis*), is listed as a primary food tree species for the Koala by the NSW OEH within the New England Tablelands. Ribbon Gum is also listed as a feed tree species on Schedule 2 of State Environmental Planning Policy (SEPP) 44 – Koala Habitat Protection. Numerous secondary feed trees including Snow gum (*E. pauciflora*) and Yellow box (*E. melliodora*) occur in abundance throughout the proposal site.

Due to the size of the survey area, random inspections of koala feed trees for scats and activity were undertaken, as well as inspections for scats and other Koala evidence where primary and secondary feed trees were located within biometric plot survey areas.

Approximately six person hours were spent on surveys for the Koala however surveys undertaken do not meet the draft threatened species survey guidelines.

Black-throated Finch (southern subspecies)

The habitat feature listed above for the Black-throated Finch is seeding native grasses within 100m of water. The study area was surveyed in May 2018 to distinguish permanent drainage lines from ephemeral watercourses. The results of this habitat assessment are included in Appendix B.2.

To date, extensive bird surveys have been conducted to inform base line bird utilisation by Brett Lane & Associates. Within the Stage 2 Modification area, 128 x 15-minute Bird Utilisation Surveys were undertaken by Brett Lane & Associates in Spring 2016; repeated in Autumn of 2017 and 2018. These surveys identified all birds within 200 m of survey points. The survey effort totals 96 person hours. The species, the number of birds and the height of the bird when first observed were documented. For all species of concern, the minimum and maximum flight heights were recorded.

Threatened fauna – unsuitable survey timing

Booroolong Frog and Pale-headed Snake

Habitat for these species includes:

- Land within 100 m of stream or creek banks – Booroolong Frog
- Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber - Pale-headed Snake

While it was initially considered that where these areas occurred within the proposed footprint, the water courses were highly ephemeral and degraded and thus did not provide real potential for impact on these species, a habitat investigation was completed to confirm this.

The survey, conducted in May 2018, was undertaken to establish the presence of suitable permanent streams and water bodies that represent potential habitat for the Booloorong Frog and the Pale-headed Snake. Approximately thirty person hours was spent investigating waterways and the adjacent areas within 100m of waterways. The timing of this survey fell in the cooler months of the year and, as such, was not expected to confirm or dismiss the actual presence of these species. It was used to refine waterway mapping and areas of potential habitat for these species. The results of this habitat assessment are included in Appendix B.2.

4.5.3 Targeted survey results

None of the candidate species were identified in the targeted surveys. Three threatened species listed under the NSW TSC Act were detected during the survey (Figure 4-2), including:

- Scarlett robin *Petroica boodang* – Vulnerable (TSC Act)
- Little lorikeet *Circus assimilis* - Vulnerable (TSC Act)
- Brown treecreeper *Climacteris picumnus victoriae* - Vulnerable (TSC Act)

These species are ecosystem credit species which are already accounted for in the assessment and do not generate species credits. The results of targeted surveys for the species requiring survey are detailed below.

Austral Toadflax

Austral toadflax (*Thesium australe*) has been recorded throughout the northern tablelands and is listed as vulnerable under the TSC Act and EPBC Act. The nearest records to the proposal site from the OEH BioNet database is approximately 17 kilometres southwest of the proposal site however, observations of this species were recorded within the Tangari Biobanking Site approximately 5km from the proposal site. Austral toadflax is often found in habitat containing open woodland and grassland dominated by a predominately native understorey, including a Kangaroo grass (*Themeda australis*), which does occur on occasion within the proposal site.

While the proposal site does contain some suitable habitat for Austral toadflax to occur and a number of individuals have been recorded approximately 950 m to the northwest of the proposal site (OEH Bionet data base 2016), considering the extensive survey effort with no plants recorded, and the narrow clearing footprint proposed over a broader area, it is unlikely that a population of Austral toadflax would be impacted by the proposal.

Bluegrass

Bluegrass (*Dicanthium setosum*) is listed as vulnerable under the TSC Act and EPBC Act. This species is associated with basaltic soils, Yellow Box (*E. melliodora*) and disturbed woodlands and open pastures on the New England Tablelands. Therefore, habitat for this species occurs within the proposal site. This species has been previously recorded approximately three (3) kilometres to the west of the proposal site. Extensive parallel transects and random meander searches were undertaken through the proposal site as it was determined that this species contained the highest risk of being present however this species was not recorded. In addition to this, this species was not recorded in similar habitat in previous surveys for WRWF (RPS, 2011).

While the proposal site does contain some suitable habitat for this species and an individual has been recorded approximately three (3) kilometres to the west of the proposal site, considering the extensive survey effort with no plants recorded, and the narrow clearing footprint proposed over a broader area, it is unlikely that a population of Bluegrass would be impacted by the proposal.

Hawkweed

Hawkweed (*Picris evae*) has been recorded within the New England Tablelands, predominately in areas around Inverell, as well as within the northwest slopes and plains and is listed as vulnerable under the TSC Act and EPBC Act. The nearest record of Hawkweed is along the Gwydir Highway approximately 17km north west of the proposal site. Hawkweed is often found in habitat containing open Eucalypt forest including a canopy of yellow box (*E. melliodora)* as well areas dominated with a *Dichanthium* grassy understory which occurs within the proposal site.

While the proposal site does contain some suitable habitat for Hawkweed to occur and a small number of individuals have been recorded approximately 17 kilometres to the northwest of the proposal site, considering the extensive survey effort with no plants recorded, and the narrow clearing footprint proposed over a broader area, it is unlikely that a population of Hawkweed would be impacted by the proposal.

Callistemon pungens

The habitat feature for *Callistemon pungens* is listed above as rocky watercourses with sandy granite or basalt creek beds. Their habitat and ecology is described by OEH in the threatened species profile database as follows:

- Habitats range from riparian areas dominated by Casuarina *cunninghamiana subsp. cunninghamiana* to woodland and rocky shrubland.
- Often in rocky watercourses, usually with sandy granite (occasionally basalt) creek beds
- Flowers over spring and summer, mostly in November.

It is noted the survey areas were all exposed to disturbance through livestock grazing and trampling. Across the study area, the groundlayer comprised improved pasture with sparse, if any, shrub layer.

No specimens of Callistemon of any genus were recorded either within the 100m permanent water way buffers or within the 0.14 ha of River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion (PCT 84) that occurs within the development footprint. As such, it can be concluded that *Callistemon pungens* does not occur and would not be impacted.

Koala

No Koala's or evidence of Koala activity were detected during the surveys. Although there are historical records surrounding the proposal site, none of these are recorded within the last 20 years and therefore shows a lack evidence that the proposal site contains a significant population. As such, the area is not considered to comprise *Core Koala Habitat* under SEPP44. However, as the dominant overstorey vegetation within the proposal site contains a high abundance of primary and secondary feed trees, it would be considered under Schedule 2 of SEPP44 and as *Potential Koala Habitat* under SEPP44.

Due to the lack of evidence that a significant koala population exists within or near the proposal site and the linear nature of the clearing areas, it is unlikely that a population of Koalas or the Koalas ability to inhabit the area in future would be adversely affected by the proposal.

McKies Stingybark

Mckies stringybark (*E. mckieana*) has been recorded within the New England tablelands, predominately in the drier western areas of the tablelands. This species is listed as vulnerable under the TSC Act and EPBC Act and often occurs in grassy open forest of poor soils and often along gentle sloping sites. This species is often associated with other Eucalypt species such as New England Blackbutt (*E.andrewsii*), Narrow-leaved peppermint (*E.nicholii*), Blakely's red gum (*E.blakeyi*) and Rough-barked apple (*Angophora floribunda*). Although these associated species occur sporadically throughout the proposal site, none dominate any areas of vegetation. The nearest records to the proposal site from the OEH BioNet database is approximately 14 kilometres southwest of the proposal site however, observations of this species were recorded within the Tangari Biobanking Site approximately 5km from the proposal site.

While the proposal site may contain some suitable habitat for Mckies stringybark to occur and this species has been recorded approximately 14 kilometres to the southwest of the proposal site, considering the extensive survey effort with no plants recorded, it is unlikely that a population of Mckies stringybark would be impacted by the proposal.

Narrow Goodenia

Although generated by the BCC as requiring survey, this species is no longer listed as threatened under the TSC Act or EPBC Act. Therefore, no targeted surveys were undertaken for this species and no assessment of impact was recorded for it.

Narrow leaved Black Peppermint

Narrow-leaved black peppermint (*E.nicholii*) has been recorded within the New England tablelands, predominately in the dry grassy woodland of infertile derived volcanic soils. This species is listed as vulnerable under the TSC Act and EPBC Act. The nearest record to the proposal site is approximately 18 kilometres southwest, however a small number as individuals were observed 10km east of the proposal site along Maybole Road. However, these individuals were most likely planted within some private revegetation works.

While the proposal site may contain some suitable habitat for Narrow-leaved black peppermint to occur and this species has been recorded approximately 18 kilometres to the southwest of the proposal site, considering the extensive survey effort with no plants recorded, it is unlikely that a population of Narrow-leaved black peppermint would be impacted by the proposal.

Prasophyllum sp. Wybong

Prasophyllum sp. Wybong is a terrestrial orchid and is listed as critically endangered under the EPBC Act. It is known to sporadically occur within NSW with main records within the Hunter Valley (Denman region) and north west slopes and plains (Manilla region) however, it is predicted to occur within the New England region, particularly the Ashford areas, north of Inverell. This species is often associated within open eucalypt woodland and grassland.

Targeted surveys were not undertaken for this species in February 2017, as it was not in flower during the surveys (October only) which makes the species almost undetectable. While marginal habitat for this species was recorded within the proposal site, it is considered very unlikely that the species would occur due to:

- Historic landuse at the site that includes improved pasture, cropping of areas and a history of grazing.

- No known recordings within 50km of the proposal site.

Based on the assessment above, it is considered unlikely that a population of the *Prasophyllum sp. Wybong* would be impacted by the proposal.

Regent Honeyeater

This species is highly nomadic and may occur on very rare occasions during periods of heavy eucalypt flowering within remnant woodland areas. This species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Despite targeted surveys in areas of potential habitat, this species was not recorded in the proposal site, nor were any potential nests. Furthermore, this species was not recorded in similar habitat in the recent and nearby WRSF southern potential sites or WRWF surveys (RPS, 2011) or Brett Lane and Associates (2016). The removal of approximately 7.61 ha habitat suitable for the regent honeyeater in a linear pattern within the proposal site when compared to the amount within the broader area it is unlikely that the regent honeyeater would be impacted by the proposal. Additionally, previous construction and operational impacts determined by RPS (2011) and Brett Lanes and Associates (2016) on the Regent Honeyeater was determined to be low due to their rare occurrence.

Black-throated Finch (southern subspecies)

The habitat feature listed above for the Black-throated Finch is seeding native grasses within 100m of water. Their habitat and ecology is described by OEH in the threatened species profile database as follows:

- Black-throated Finches inhabit dry, open, grassy woodlands, often along watercourses. They have been recorded in riparian Ti-tree and Melaleuca thickets surrounded by open grassy areas in the Inverell district.
- Mainly granivorous, consuming primarily native grass seed, although insects will also be taken. Typically forage in small flocks on the ground.
- Considered to be sedentary but may move in response to drought.

An analysis of OEH Bionet records indicates that the species has only been recorded at two locations within 100 km of the site, with the closest being approximately 9 km to the west of the site. These records date from 1989 and 1994.

This species has not been recorded in any of the extensive multi-seasonal bird surveys conducted within suitable habitats both within the study area and in the adjacent Stage 1 area; the Black-throated Finch (Southern subspecies) was not detected during any of the BLA base line surveys, or during bird surveys undertaken for the preparation of this BAR. Additionally, correspondence with OEH has noted that the Black-throated finch (southern sub species) is considered extinct in NSW (pers. Comm. R. Lonie Senior Conservation Planning Officer, North East Branch, Regional Operations Division, OEH 5 April 2018).

As such, the species is considered adequately surveyed, and would not be affected by the proposal.

Silky Swainson-pea

The Silky Swainson-pea (*Swainsona sericea*) has been recorded on New England grassy woodlands which occur in the proposal site and is listed as vulnerable under the TSC Act. However, it has not been previously recorded within 40 kilometres of the proposal site. Although targeted, this species was not recorded during the current surveys. In addition to this, this species was not recorded in similar habitat in previous surveys for WRWF (RPS, 2011).

While the proposal site may contain some marginal habitat for this species, considering the extensive survey effort with this species not being recorded and no previous recordings within 40 kilometres of the proposal site, it is unlikely that a population of a Silky Swainson-pea (*S. sericea*) would be impacted by the proposal.

Small Snake Orchid

The Small Snake Orchid (*Diurus pedunculata*) is listed as endangered under the TSC Act and the EPBC Act. This conspicuous orchid is confined to northeast NSW on grassy slopes or flats between 50 and 900 metres altitude (Quinn *et al.* 1995). Targeted surveys were not undertaken for this species in February 2017, as it was not in flower during the surveys (flowers from August to October only) which makes the species almost undetectable. The closest previous recording of the Small Snake Orchid is approximately 50 kilometres to the south of the proposal site. While marginal habitat for this species was recorded within the proposal site, it is considered very unlikely that the species would occur at the proposal site due to;

- Proposal site is above 900m sea level
- Historic landuse at the site that includes improved pasture, cropping of areas and a history of grazing.
- No known recordings within 50km of the proposal site

Based on the assessment above, it is considered unlikely that a population of the Small Snake Orchid (*Diurus pedunculata*) would be impacted by the proposal.

Booloorong Frog

The habitat feature listed above for Booroolong Frog is land within 100m of stream or creek banks. Their habitat and ecology are described by OEH in the threatened species profile database as follows:

- Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.
- Adults occur on or near cobble banks and other rock structures within stream margins.
- Shelter under rocks or amongst vegetation near the ground on the stream edge.
- Sometimes bask in the sun on exposed rocks near flowing water during summer.
- Breeding occurs in spring and early summer and tadpoles metamorphose in late summer to early autumn.
- Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools.

NSW Bionet records of the species within a 100 km radius of the site indicate only three locations where the species has been detected. These locations date from 1965 to 1974. However, a record on the Atlas of Living Australia dates from 1999 at Inverell, approximately 50 km west of the site.

The May 2018 habitat surveys identified that some of the waterways within the proposal footprint are permanent, although largely degraded by stock access. The range of permanent water drainage lines observed and mapped, included:

- 1st and 2nd order streams feeding into flowing streams
- spring fed drainage lines
- farm dams.

The areas within 100m of permanent waterways that intersected the proposal footprint were mapped as provide habitat for this species (Appendix B.2 and Figure 4-2). The area totalled 4.56 ha.

Given the presence of suitable habitat in the form of permanent waterbodies, it is assumed that the Booloorong Frog has the potential to occur and could potentially be affected by the proposal. An expert report was sought to verify the habitat for this species onsite. The expert report, appended in Appendix J, stated that the species was not recorded in nearby habitat that would be more suitable than the study area. As such, the expert report verified that no impact to the species would result and no offset is generated for this species.[2]

Pale-headed Snake

Habitat features for the Pale-headed Snake are listed as land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber. Their habitat and ecology is described by OEH in the threatened species profile database as follows:

- The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows.
- Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest.
- In drier environments, it appears to favour habitats close to riparian areas.
- Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees.
- The main prey is tree frogs although lizards and small mammals are also taken.
- The Pale-headed Snake is relatively unusual amongst elapid snakes in that it is well adapted to climbing trees.

No records of the species exist in the NSW Bionet database within 100 km of the site. Two records of the species exist within the Atlas of Living Australia, one in Glen Innes and one in Inverell, both dated from 1999. The scarcity of records is not considered to be an adequate predictor of species occurrence in this instance, as the species is highly cryptic and often not identified without targeted surveys.

The May 2018 habitat surveys identified that some of the waterways within the proposal footprint are permanent, although largely degraded by stock access. Areas within 40m of waterways that intersected the proposal footprint were considered to provide habitat for this species. The range of permanent water drainage lines observed and mapped, included:

- 1st and 2nd order streams feeding into flowing streams
- spring fed drainage lines
- farm dams.

Areas within 40m of permanent waterways that intersected the proposal footprint were considered to provide potential habitat for this species. These areas total 1.32 ha within the development footprint, refer Figure 4-3.

Given the presence of potential habitat in the form of permanent waterbodies, it was assumed that the Pale headed Snake had the potential to occur and could potentially be affected by the proposal. An expert report was sought to verify the habitat for this species onsite. The expert report, appended in Appendix J,

[2] As of 8 August, 2018, it is understood that the NSW Office of Environment and Heritage is in the process of confirming the status of Mr Phil Spark (author of Appendix J) as an expert for the Boorolong Frog and Pale-headed Snake.

states that the Pale-headed Snake does not occur at high elevations; on the western slopes it occurs below 600m. The Pale-headed Snake would not occur in the area, as the elevation of the area is over 1200m. As such, the expert report verified that no impact to the species would result and no offset is generated for this species.

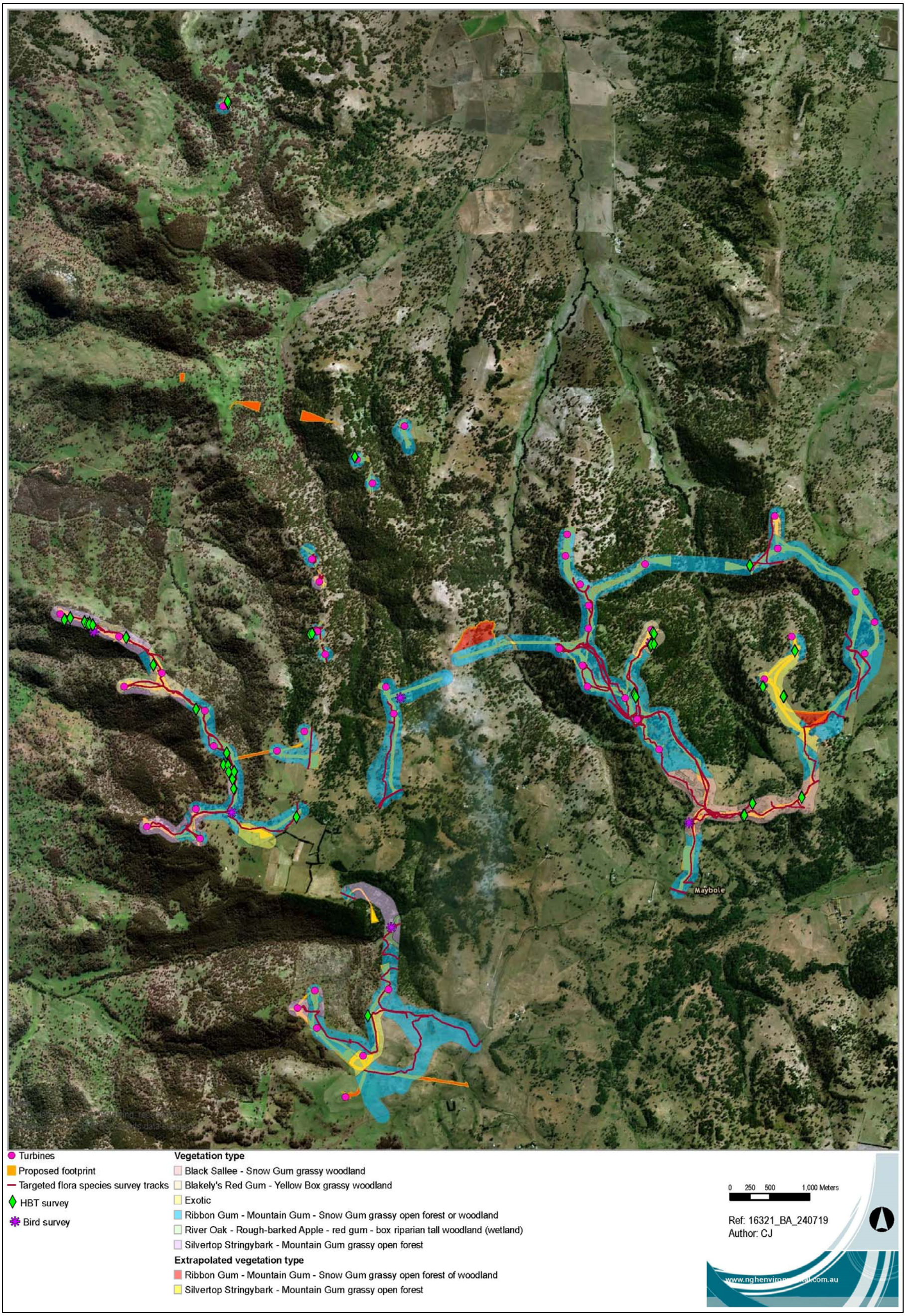

Figure 4-1 Fauna survey results

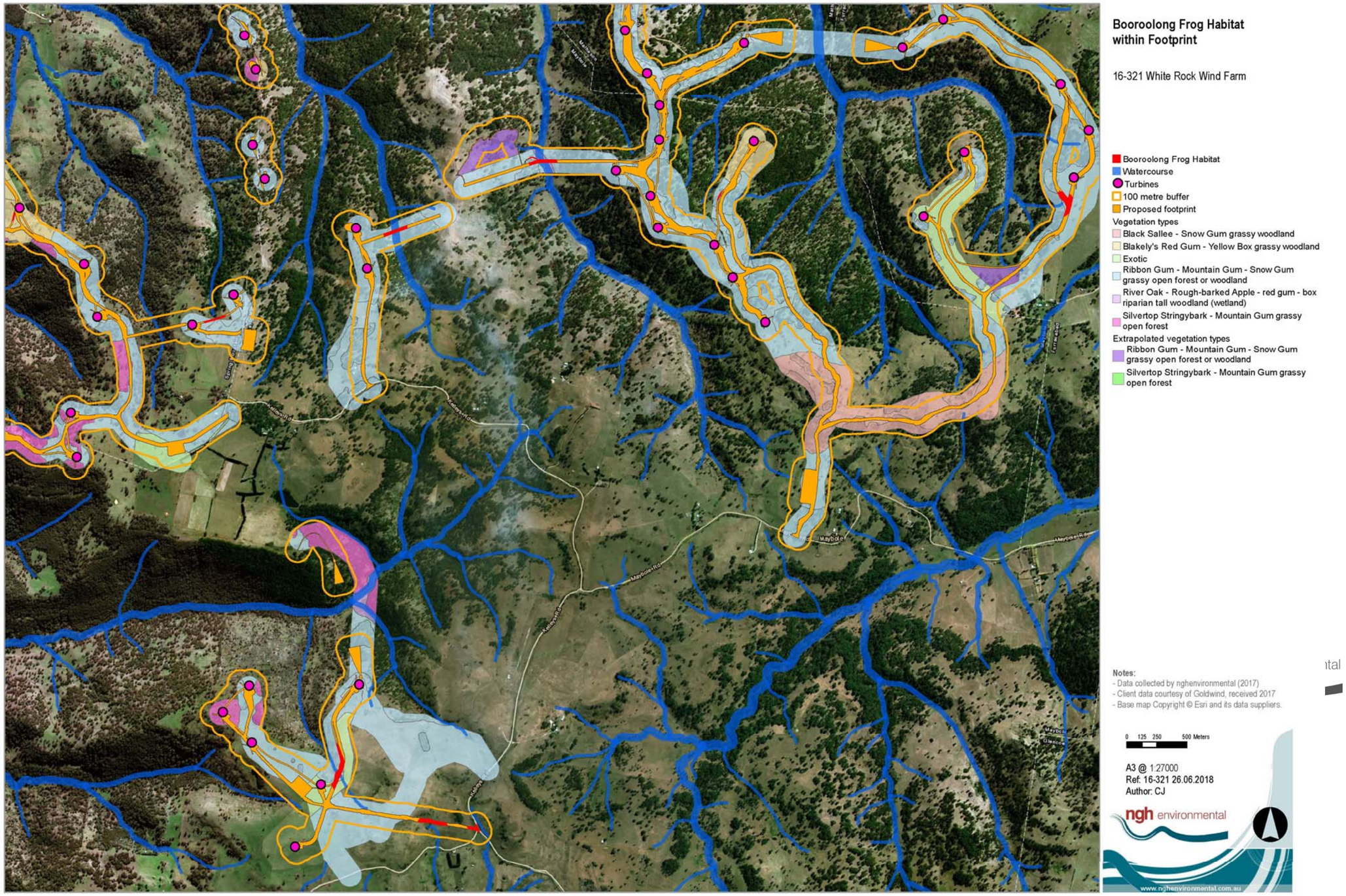

Figure 4-2 Fauna survey result – potential habitat for Booroolong Frog, investigated by expert report.

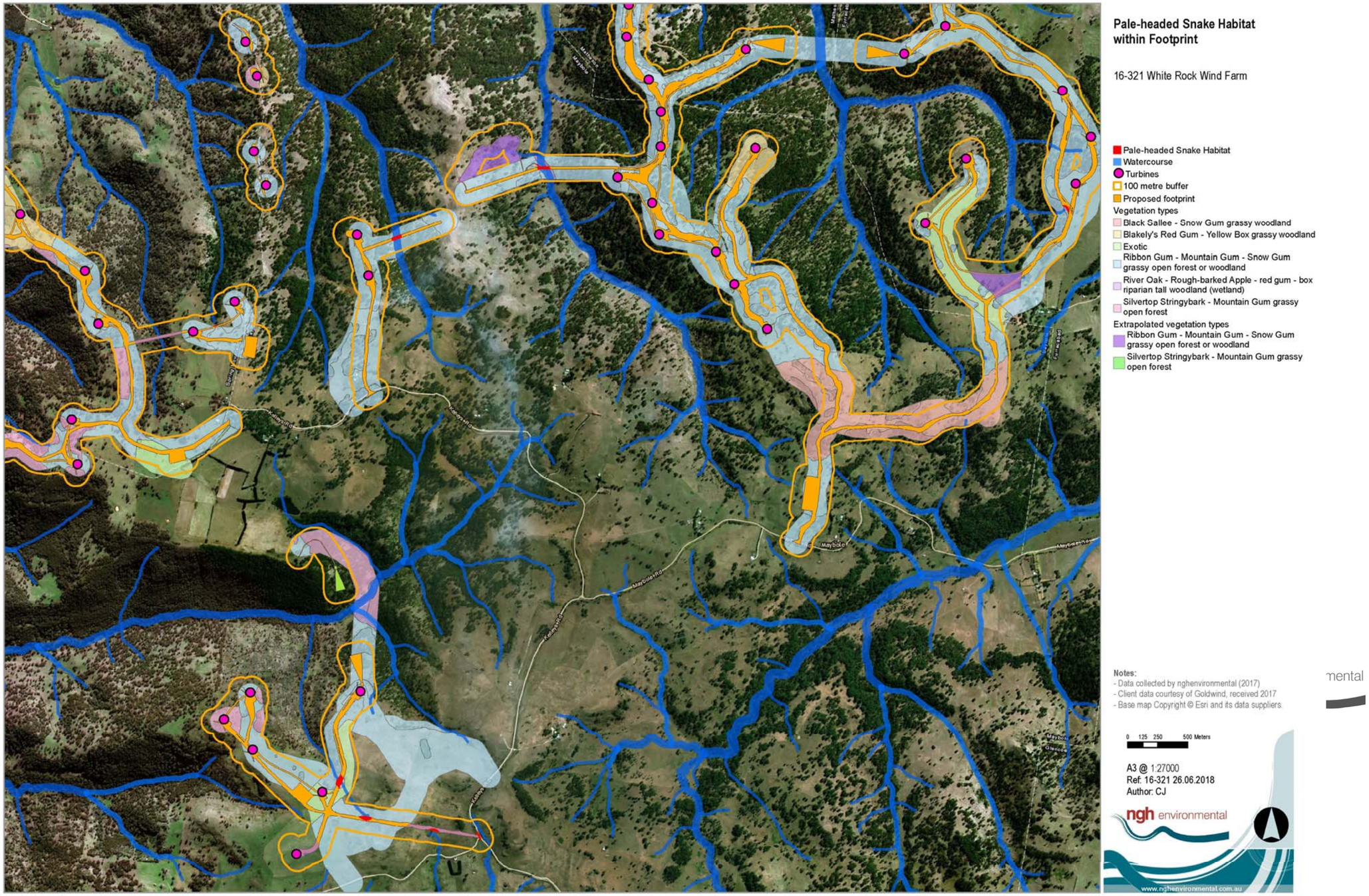

Figure 4-3 Fauna survey result – potential habitat for Pale headed Snake, investigated by expert report.

4.5.4 Summary of species credit species

In summary, applying the above information to the BCC assessment, the following data were entered into the BCC.

Table 4-5 Threatened species that may generate species credits.

Common name	Scientific name	Impacted by development?	ID method	Loss (ha)
Austral Toadflax	*Thesium australe*	No	Survey	0.00
Bluegrass	*Dichanthium setosum*	No	Survey	0.00
Booroolong Frog	*Litoria booroolongensis*	No	Expert report	0.00
Hawkweed	*Picris evae*	No	Survey	0.00
Koala	*Phascolarctos cinereus*	No	Survey	0.00
McKie's Stringybark	*Eucalyptus mckieana*	No	Survey	0.00
Narrow Goodenia	*Goodenia macbarronii*	No	Survey	0.00
Narrow-leaved Black Peppermint	*Eucalyptus nicholii*	No	Survey	0.00
Pale-headed Snake	*Hoplocephalus bitorquatus*	No	Expert report	0.00
Prasophyllum sp. Wybong	*Prasophyllum sp. Wybong*	No	Survey	0.00
Regent Honeyeater	*Anthochaera phrygia*	No	Survey	0.00
Silky Swainson-pea	Swainsona sericea	No	Survey	0.00
Small Snake Orchid	*Diuris pedunculata*	No	Survey	0.00
Callistemon pungens	*Callistemon pungens*	No	Survey	0.00
Black-throated Finch (southern subspecies)	*Poephila cincta subsp. cincta*	No	Survey	0.00

Note, as identified in Section 4.1, this result is specific to the surveyed areas. The 'extrapolated areas' have not been surveyed for threatened species and a requirement to confirm survey results in these areas is included as a mitigation strategy.

5 EPBC MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

An EPBC protected matters report was undertaken on the 6th April 2017 (50km buffer of the proposal site) to identify Matters of National Environmental Significance (MNES) that have the potential to occur within the proposal site (refer to Appendix E). Relevant to Biodiversity these include:

- Wetlands of International Importance
- Threatened Ecological Communities
- Threatened species
- Migratory species

The potential for these MNES to occur at the site are discussed below.

5.1 WETLANDS OF INTERNATIONAL IMPORTANCE

Five wetlands of international importance were returned from the protected matters report. The nearest of these (within 50km of the proposal site) is the Little llangothlin nature reserve. The Little llangothlin nature reserve occurs approximately 30km southeast of the proposal site. Additionally, the Gwydir wetlands is approximately 150km northwest of the proposal site. Both of these sites are listed as RAMSAR and would not be impacted by the proposal.

5.2 THREATENED ECOLOGICAL COMMUNITIES

Six threatened ecological communities were returned from the protected matters report. One of these, the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC occurs within the proposal site and would be impacted. Assessment of significance pursuant to the EPBC Act concluded that a total of 7.95 ha of this CEEC meets the EPBC determination. As this CEEC occurs within the proposal site as small to moderate patches of intact vegetation with large contiguous patches absent, it may be considered likely to exacerbate impacts to the point that it would constitute a substantial reduction in the quality or integrity of the CEEC within the proposal site and therefore referral to the Commonwealth is required. This is currently being completed and will be submitted upon finalisation of the BAR. As the NSW EEC listing includes all areas of CEEC that would be impacted, all impacts in these areas would be offset under the NSW Biobanking scheme.

Another threatened ecological community with the potential to occur within the broader region of the proposal but not within the proposal site is the New England Peppermint (*Eucalyptus nova-anglica*) Grassy Woodlands. Although the New England peppermint was recorded on occasion with in the proposal site, it did not dominant areas and where located, was within areas of highly abundant exotic groundcover and therefore would not meet the criteria of the threatened ecological community listing.

5.3 THREATENED SPECIES

61 threatened flora and fauna species were returned from the protected matters report and habitat assessments were undertaken (Appendix E). As a result, no EPBC referral is being undertaken and no Commonwealth offsets are proposed for this project for threatened species.

5.4 MIGRATORY SPECIES

Ten listed migratory species were returned from the protected matters report. Some migratory species of are considered likely to occur at the site on occasion however impacts from the proposal are considered negligible due to the linear nature of the impacts, suitable habitat for these species in the study area generally occurring outside the impact areas and that breeding habitat for these species is unlikely to occur within the impact areas. A referral to the Commonwealth is therefore not considered to be warranted in relation to migratory species.

6 AVOID AND MINIMISE IMPACTS

6.1 DIRECT IMPACTS

This section assesses the additional native vegetation clearing required for the modification. It is noted that it does not assess:

- Any areas of clearing allowed for under the existing approval.
- The operational risks of the project, such as potential for bird and bat collisions. These are being considered separately and are not addressed in this report.

6.1.1 Design phase

Vegetation mapping of the study area was provided to WRWFPL to guide design of relevant infrastructure with the intention of avoiding and minimising impacts to that vegetation which constitutes the highest ecological value, such as forming components of CEECs, EECs and providing threatened flora and fauna habitat.

It is noted that there may be further opportunities within the final design phase to minimise impacts to native vegetation, in particular EEC vegetation. This is consistent with the principles of avoiding and minimising biodiversity impacts, as outlined under the FBA and may also reduce offset requirements for the project.

6.1.2 Construction phase

The construction phase of the proposal has the potential to impact a number of biodiversity values of the site through habitat clearance, refer to Table 6-1 below.

Table 6-1 Potential direct impacts to biodiversity during the construction phase

Impact	Frequency	Intensity	Duration	Consequence
Habitat clearance for permanent and temporary construction facilities (e.g. wind farm infrastructure, transmission lines, compound sites, stockpile sites, access tracks)	Regular	High	Construction phase	• Direct loss of native flora and fauna habitat: 168.57 ha, including 13 hollow-bearing trees • Injury and mortality to fauna during clearing of fauna habitat • Introduction and spread of noxious weeds and pathogens • Disturbance to fallen timber, dead wood and bush rock

A range of mitigation measures will be implemented to ensure that impacts on biodiversity during the construction phase are avoided where possible, and minimised where they cannot be avoided. The mitigation measures that would be employed during the construction phase are provided in Table 6-2. Mitigation measures have considered methods of clearing, clearing operations, timing of construction and other measures that would minimise impacts of the proposal on biodiversity values.

Table 6-2 Measures proposed to avoid and minimise direct impacts of the proposal during the construction phase

Impact	Consequence	Measures to be implemented	Timing	Outcome
Habitat clearance	• Direct loss of native flora and fauna habitat	• Consider opportunities to further minimise impacts on higher conservation value areas, during detailed design.	Pre-construction phase	Minimise the impacts on identified EEC and threatened flora and fauna habitat
Removal or degradation of threatened and/or migratory species habitat	• Impacts to threatened flora	• Additional surveys of extrapolated areas for confirmation of vegetation community and targeted threatened flora searches. If results are in conflict with the assumptions of this BAR, the credit calculations must be updated to reflect additional offset requirements.	Pre-Construction phase	All clearing impacts are offset in accordance with the FBA
	• Impacts to threatened fauna	• Additional surveys of potential habitat for Broad-headed Snake and Booroolong Frog in November and/or December, prior to commencement of vegetation clearing. If results are in conflict with the assumptions of this BAR, the credit calculations must be updated to reflect additional offset requirements.	Pre-Construction phase	All clearing impacts are offset in accordance with the FBA
	• Impacts to hollow dependant fauna	• Hollow-bearing trees within the proposal site would not be cleared between June and January • If clearing outside of this period cannot be achieved, pre-clearing surveys would be undertaken to ensure these species do not occur.	Construction phase	Impacts to threatened hollow dependent species are minimised

Impact	Consequence	Measures to be implemented	Timing	Outcome

Habitat clearance	• Direct loss of native flora and fauna habitat	• Updating of a Flora and Fauna Management Plan (FFMP) that would incorporate protocols relevant for Stage 2 including:
		  • Protection of native vegetation to be retained
		  • Best practice removal and disposal of vegetation
		  • Staged removal of hollow-bearing trees and other habitat features such as fallen logs with attendance by an ecologist
		  • Relocation of cleared hollows suitable for habitation by the Broad-headed Snake to adjacent non-impacted vegetation.
		  • Weed management
		  • Unexpected threatened species finds
		  • Rehabilitation of disturbed areas
			Pre-construction phase
			Construction phase
				Minimise the impacts of habitat removal on native flora and fauna

	• Potential over clearing and/or damage of habitat outside of the proposal site.	• Stockpiling materials and equipment and parking vehicles will be avoided within the dripline (extent of foliage cover) of any native tree. • Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be clearly demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.	Construction phase	Prevention of over-clearing

6.1.3 Operational phase

The operational phase and associated risks, such as potential for bird and bat collisions, are currently being considered independently and are not addressed in this report.

6.2 INDIRECT IMPACTS

Vegetation and habitat removal are considered *direct impacts* of the proposal. *Indirect impacts* could occur as a consequence of the clearing and excavation proposed, and can include impacts such as soil and water contamination, creation of barriers to fauna movement, or the generation of excessive dust, light or noise. A number of indirect impacts to biodiversity during construction and operation have been identified in Table 6-3 below.

6.2.1 Construction phase

Indirect impacts on biodiversity values during the construction phase of the proposal are outlined in Table 6-3 below. Measures to avoid and minimise these impacts are detailed in Table 6-4.

Table 6-3 Indirect impacts on biodiversity during the construction phase.

Impact	Frequency	Intensity	Duration	Consequence
Accidental spills and contamination from construction activities (including compound sites)	Rare	Moderate	Construction phase	Pollution of soils and dams
Earthworks	Regular	Moderate	Construction phase	Erosion and sedimentation and/or pollution of soils, dams and downstream habitats
Noise	Regular	Low	Construction phase	Construction machinery and activities may disturb local fauna
Dust generation	Regular	Low	Construction phase	Inhibit the function of plant species and communities, soils and dams
Light spills during night works	Rare	Low	Construction phase	Night works may alter fauna activities/movements
General construction activities	Regular	Moderate	Construction phase	Feral pest, weed and/or pathogen encroachment
Increased Vehicle Traffic	Regular	Low	Operational phase	Increase potential for fauna mortality through vehicle strike

Table 6-4 Measures proposed to avoid and minimise indirect impacts of the proposal during the construction phase

Impact	Measures to be implemented	Timing	Outcome	Responsibility
Accidental spills and contamination from construction activities	• Carry out refuelling of plant and equipment, chemical storage and decanting off site or at least 50 m away from waterways and farm dams in impervious bunds. • Ensure that dry and wet spill kits are readily available.	Construction phase	Prevent/minimise pollution of ephemeral waterways and dams, and sensitive adjacent habitat	Contractor
Earthworks	• Stage 1 Erosion and Sediment Control Plan must be updated in conjunction with the final design of Stage 2 and will be implemented.	Construction phase	Prevent/minimise erosion and sedimentation of ephemeral waterways and dams, and sensitive adjacent habitat	Contractor
Dust generation	• The Stage 1 Construction Environmental Management Plan must be updated in conjunction with the final design of Stage 2 to prevent dust spreading to nearby habitats.	Construction phase	Prevent dust inhibiting the function of plant species and communities, ephemeral waterways and dams.	Contractor
Light spill	• Avoid nightworks. • If night work is unavoidable, ensure any floodlights are directed away from vegetation where possible.	Construction phase	Prevent disturbance to local fauna.	Contractor
General construction activities	• The Stage 1 Weed Management Plan must be updated in conjunction with the final design of stage 2	Construction phase	Prevent feral pest, weed and/or pathogen encroachment into vegetation adjoining proposal site.	Proponent Contractor
Increased vehicle traffic	• Awareness training during site inductions, enforcement of site speed limits.	Operational phase	Minimise fauna strikes	Proponent Contractor

6.2.2 Operational phase

As stated in Section 6.1.2, the operational phase and associated risks, such as potential for bird and bat collisions, are not within the scope of the BAR and are currently being considered independently and are not addressed in this report.

6.3 CUMULATIVE IMPACTS

The clearing of native vegetation, which is a key threatening process at both State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 per cent of the native vegetation in NSW has been cleared or highly modified since European settlement (NSW Scientific Committee 2001), and the removal of vegetation for this proposal is contributing to this process. The cumulative impact of projects, particularly where EECs are involved, can be considerable given that many poorly-conserved vegetation communities have a substantial portion of their extents represented on private land where the majority of renewable energy projects are proposed. Small losses of such communities, which may be insignificant at a project level, may accumulate over time to cause a significant reduction in the extent of remnant patches.

Cumulative impacts are considered best managed by avoiding and minimising impacts on a case by case basis. Where avoidance is not possible, the impacts of each contributing proposal is assessed according to approved methodologies such as the FBA. Long term mechanisms like offsetting through the FBA, are structured to address these ongoing impacts.

The proposal will impact upon 168.57 ha of vegetation which would result in the loss of approximate 4% of the native vegetation within the proposal site. This includes 64.60 ha (40%) of EEC vegetation. However, of the total native vegetation impacted, 94.88 ha (56%) is highly modified low condition and exotic dominated vegetation. This is in addition to the clearing impacts carried out during the construction of Stage 1. However, the proposed clearing is linear in nature with impacts on connectivity and fragmentation minimised and therefore limiting potential impacts on native flora and fauna.

Impact's to EEC and threatened species habitat are required to be offset. Credits requiring offset from this BAR will either be incorporated into the existing offset area, or an additional BOP will be prepared depending on the timing of the construction of Stage 2.

7 IMPACT SUMMARY

7.1 AREAS NOT REQUIRING ASSESSMENT / OFFSETS

In accordance with Section 9.5 of the FBA, areas without native vegetation or aquatic features do not need to be assessed further. Within the proposal site, these include treeless paddock areas with an understory of completely dominated by exotic flora species. The total area of land within the proposal site not requiring further assessment is approximately 11.33 ha.

In accordance with Section 9.4 of the FBA, offsets are not required to be determined for impacts:

a) in a vegetation zone with a site value score of <17, and the PCT has not been identified as a CEEC or EEC
b) not associated with threatened species habitat according to Section 6.4, and are not identified as a CEEC or EEC.

As set out in Table 4-5, no species habitat polygons have been assigned and no impacts to species credit species are anticipated.

7.2 AREAS NOT REQUIRING AN OFFSET

7.2.1 Impacts on native vegetation

Offsets are not required where the proposal would impact on PCTs that:

a) Have a site value score of <17; or
b) Are not identified as a Critically Endangered Ecological Community (CEEC) or EEC.

Impacts are also not required for PCTs that are not associated with threatened species habitat and are not identified as CEECs/EECs.

As such, all impacts to native vegetation within the proposal site that has a site value score of <17 and is not a CEEC or EEC and associated with threatened species habitat do not require offsets.

7.2.2 Impacts on species and populations

Offsets are not required where the proposal:

a) Impacts on non-threatened species and populations that do not form part of a CEEC or EEC; or
b) Impacts on threatened species habitat associated with a PCT within a vegetation zone with a site value score of <17.

As for native vegetation, the habitat provided by the low condition PCT 554 and PCT 507 do not require an offset as the site value scores are <17 and the vegetation is therefore not classified as part of a CEEC or EEC.

Species credit species

As discussed in Section 4.5.3, the following species credit species are considered not to be impacted:

- Austral Toadflax
- Black throated Finch
- Bluegrass
- Hawkweed
- *Callistemon pungens*
- Koala
- McKies Stingybark
- Narrow Goodenia
- Narrow leaved Black Peppermint
- Prasophyllum sp. Wybong
- Regent Honeyeater
- Silky Swainson-pea
- Small Snake Orchid
- Booroolong Frog
- Pale headed Snake

Impacts to these species are unlikely and offsets are not required.

7.3 PCTS AND SPECIES POLYGONS REQUIRING AN OFFSET

7.3.1 Impacts on native vegetation

Offsets are required where the proposal would impact on any native vegetation that:

a) is identified as a CEEC that is specifically nominated in the SEARs for the Major Project as a CEEC for which an impact does not require further consideration;
b) is identified as an EEC that has a site value score ≥ 17, unless it is an EEC that is specifically nominated in the SEARs for the proposal as an EEC for which an impact requires further consideration; or
c) is associated with threatened species habitat and in a vegetation zone that has a site value score ≥ 17.

The proposal would have a direct impact on three vegetation communities that form two listed EEC under the TSC Act, and which has generated ecosystem credits and therefore require offsetting. The proposal would have a direct impact on two non-EEC vegetation communities with a site value score >17 that provide threatened species habitat.

Table 7-1 Extent of vegetation communities within the proposal site and their impact areas

Vegetation Community	Threatened Ecological Community (TSC Act or EPBC Act)?	PCT Id	Biometric vegetation condition	Site value score	Extent of vegetation (ha) impacted in proposal site
Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	YES	PCT #510	Moderate – good	72.4	7.95
Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	NO	PCT #510	Low	17.19	0.51
Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	YES	PCT #554	Moderate – good	67.21	61.92
Silvertop Stringybark – Mountain Gum grassy open forest of the New England Tableland Bioregion	NO	PCT #565	Moderate – good	42.53	12.33
River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	NO	PCT #84	Moderate – good	41.15	0.14
Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	YES	PCT #507	Moderate – good	71.04	2.68
Total Vegetation	-	-	-		**85.53**

7.3.2 Impacts on species and populations

Offsets are required where the proposal would impact on:

a) Any critically endangered species;
b) A threatened species or population that was not specifically nominated in the SEARs as a species or population for which an impact requires further consideration; or
c) Threatened species habitat associated with a PCT in a vegetation zone with a site value score of ≥17.

Ecosystem credit species

The BCC found that 12 threatened ecosystem credit fauna species were predicted to occur within vegetation communities within the proposal site and thus require offsets, including:

Barking Owl	*Ninox connivens*
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis subsp. gularis*
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus subsp. victoriae*
Diamond Firetail	*Stagonopleura guttata*
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*
Flame Robin	*Petroica phoenicea*
Glossy Black-Cockatoo	*Calyptorhynchus lathami*
Greater Broad-nosed Bat	*Scoteanax rueppellii*
Hooded Robin (south-eastern form)	*Melanodryas cucullata subsp. cucullata*
Little Eagle	*Hieraaetus morphnoides*
Little Lorikeet	*Glossopsitta pusilla*
Scarlet Robin	*Petroica boodang*
Speckled Warbler	*Chthonicola sagittata*
Spotted Harrier	*Circus assimilis*
Square-tailed Kite	*Lophoictinia isura*
Turquoise Parrot	*Neophema pulchella*
Varied Sittella	*Daphoenositta chrysoptera*
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*

Species credit species

The following species credit species could not be ruled out on account of survey and an expert report has been obtained which states these species are not likely to occur (Appendix J):

Booroolong Frog	*Litoria booroolongensis*
Pale headed Snake	*Hoplocephalus bitorquatus*

Therefore, no species credit species are relevant to the project.

7.4 IMPACTS REQUIRING FURTHER CONSIDERATION

This section considers matters raised under Section 9 of the FBA.

7.4.1 Impacts on landscape features

Impacts reducing width of riparian buffer of important rivers, streams and estuaries

Further consideration is required where the proposal would impact on areas of native vegetation within:

a) 20 m either side of a 4th and 5th order stream;
b) 50 m either side of a 6th order stream;
c) 50 m around an estuarine area.

No 4th, 5th or 6th order streams, or estuarine areas will be impacted by the proposal.

Impacts on species movements along corridors

No state significant biodiversity links as defined by the FBA are known to occur within the proposal site, therefore the proposal does not trigger the requirement for further consideration to impacts on species movement along corridors.

7.4.2 Impacts on native vegetation

Further consideration is required where there will be impacts to native vegetation that are likely to cause the extinction of an EEC/CEEC from an IBRA subregion or significantly reduce its viability. No further consideration of impacts on native vegetation is required.

7.4.3 Impacts on threatened species

Further consideration is required where the proposal would impact:

a) Any critically endangered species;
b) A threatened species or population that is specifically nominated in the SEARS as a species or population that is likely to become extinct or have its viability significantly reduced in the IBRA subregion if it is impacted on by the development; or
c) a threatened species that has not previously been recorded in the IBRA subregion according to records in the NSW Wildlife Atlas.

No critically endangered species would be impacted by the proposal. No threatened species not previously recorded for the IBRA subregion were recorded during the surveys. No further consideration of impacts on threatened species is required.

7.4.4 Impacts to EPBC Listed Species

No EPBC listed species was recorded during the surveys.

The EPBC Referral Guidelines for the Koala (DoE 2014) documents the 'Koala habitat assessment tool' to assist proponents in determining if a proposal may impact on habitat critical to the survival of the Koala. The tool is provided as Table 7-2 below as it applies to the proposal. Impact areas that score five or more using the habitat assessment tool contain habitat critical to the survival of the Koala. The assessment in Table 7-2 resulted in a score of 8 and as such habitat within the study area is considered to be critical to

the survival of the Koala and an assessment of significant impact according to the EPBC Act significant impact criteria is required (Appendix F).

Table 7-2: Koala habitat assessment tool for coastal areas (DoE 2014)

Attribute	Score	Inland	Applicable to the proposal?
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 2 years.	
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.	
	0 (low)	None of the above.	✓
Vegetation composition	+2 (high)	Has forest or woodland with 2 or more known koala food tree species, OR 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	✓
	+1 (medium)	Has forest or woodland with emerging trees with only 1 species of known koala food tree present.	
	0 (low)	None of the above.	
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 500 ha.	✓
	+1 (medium)	Area is part of a contiguous landscape < 5000 ha, but ≥ 300 ha.	
	0 (low)	None of the above.	
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	✓
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence	

Attribute	Score	Inland	Applicable to the proposal?
		and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	✓
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
Total	**8**	**Decision: Habitat critical to the survival of the Koala—assessment of significance required**	

An assessment of significant impact was completed for the Koala (Appendix F). The assessment concluded that *although a substantive amount of vegetation is being removed for the proposal, the proposal is considered unlikely to significantly impact the species due to the lack of evidence that a significant koala population exists within or near the proposal site and the linear nature of the clearing areas. It is therefore unlikely that a population of Koalas or the Koalas ability to inhabit the area in future would be impacted to the extent that a population utilising the proposal site as habitat would decrease in size in the long-term. Existing and additional offset areas relating to proposal will ensure extent of habitat for this is improved or maintained.* An EPBC referral is not considered necessary.

Other EPBC Act listed entities with the potential to occur at the site is the critically endangered regent honeyeater (*Anthochaera Phrygia*). The vegetation clearing associated with the proposal is considered unlikely to significantly impact regent honeyeater, as no known individuals or populations of the species exist within the proposal site, the proposal will not impact on any known populations, and any population occurring within the proposal site is not considered likely to constitute an important population of the species. An EPBC referral is not considered necessary.

EPBC Offset requirement

One EPBC listed CEEC, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC, was identified within the proposal areas of which 7.95ha would be to be impacted by the

development. The proposal will impact upon 7.95 ha of the CEEC, particularly through the construction of the access tracks and turbine sites. This is may be considered likely to generate a significant impact to the community such that it would no longer remain viable within the proposal site or locality. As such, a referral is recommended. Offsets in accordance with the EPBC Offsets Policy are likely to be required.

7.5 DETERMINING OFFSET REQUIREMENTS

Ecosystem credits

A total of 4,547 ecosystem credits have been generated for the proposal site (BCC Major Project 0035/2016/4082MP). The BCC full credit report is provided in Appendix I.

The ecosystem credits required are summarised in Table 7-3.

Species credits

No species credit species are required to be offset.

Table 7-3 Credit requirements

Ecosystem credits

Vegetation Management Zone	Biometric veg code / PC type code	Plant community type name	Management zone area (ha)	Loss in Landscape Value	Loss in site value score	EEC Offset Multiplier	Credits required for Threatened species	Threatened Species with highest credit requirements	TS offset multiplier	Ecosystem credits required
1	*PCT #510*	*Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion*	*7.95*	*20.9*	*72.4*	*3.0*	*473*	*Barking Owl*	*3.0*	*473*
2	*PCT #510*	*Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion*	*0.51*	*20.9*	*17.19*	*3.0*	*0*	*N/A*	*0.0*	*9*
3	*PCT #554*	*Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion*	*61.92*	*20.9*	*67.21*	*3.0*	*3445*	*Barking Owl*	*3.0*	*3445*
5	PCT #565	Silvertop Stringybark – Mountain Gum grassy open forest of the New England Tableland Bioregion	12.33	20.9	42.53	1.0	458	Barking Owl	3.0	458
6	PCT #84	River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	0.14	20.9	41.15	1.0	5	Barking Owl	3.0	5
7	*PCT #507*	*Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion*	*2.68*	*20.9*	*71.04*	*3.0*	*0*	*N/A*	*0.0*	*157*

8 BIODIVERSITY OFFSET STRATEGY

An existing offset package is being developed for the White Rock Wind Farm development. It is intended that the additional credit requirement required by the modification would be included in this package.

The existing package includes 184.30 ha in total and includes the following vegetation types:

Table 8-1 Existing offset credits

Vegetation zones	EEC	Area (ha)	Credits required Stage 1	Credits generated	Surplus/ deficit credits	Surplus/ deficit credits (total matching)
PCT #590 *BR391 White Box grassy woodland on the Inverell basalts mainly in the Nandewar Bioregion*	***White Box - Yellow Box - Blakely's Red Gum grassy woodland***	*25.3*	*168*	*272*	*104*	*104*
PCT #508 *BR270 Blakely's Red Gum - Stringybark - Rough-barked Apple open forest of the Nandewar Bioregion and western New England Tablelands Bioregion*		*6.61*	*0*	*78*	*78*	*78*
PCT #599 *BR271 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South and Nandewar Bioregion*		*5.84*	*56*	*59*	*3*	
PCT #510 BR272 *Blakely's Red Gum - Yellow Box grassy woodland of the New England Tablelands Bioregion*		0	38	0	-38	
PCT #571 BR330 *Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tableland Bioregion and NSW North Coast Bioregion*		121.41	27	1178	1151	

Vegetation zones	EEC	Area (ha)	Credits required Stage 1	Credits generated	Surplus/ deficit credits	Surplus/ deficit credits (total matching)
PCT #554 BR329 *Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion*	***Ribbon Gum - Mountain Gum - Snow Gum grassy open forest/ woodland of the New England Tableland Bioregion***	12.49	980	144	-836	*280*
PCT #564 *BR394 White Cypress Pine - Silver-leaved Stringybark - Caley's Ironbark open forest of the central Nandewar Bioregion and western New England Tablelands Bioregion*		*7.76*	*0*	*75*	*75*	*75*
PCT #84 BVT194 *River Oak - Rough-barked Apple - Red Gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion*		1.12	0	10	10	10
Cleared areas (dams, tracks, etc)	-	3.77	-	-		-
		184.30	**127.74**	**45**	**547**	**547**

Using the OEH credit conversion tool to convert the credit requirement (final biobanking report in Appendix I) for the Stage 2 Modification to an area estimate, it is estimated that an additional 498.40 ha will be required to be offset for the modification. Within the existing offset package, 462 surplus credits can be utilised to offset impacts of the stage 2 development. This equates to approximately 50.75 ha. Therefore, the total estimated required hectares remaining to be offset is approximately 447.65 ha.

The final offsets will be identified, secured and managed in perpetuity to ensure that habitats are enhanced in the future, either as part of the existing Stage 1 offset package or a new BOP to be prepared and submitted for approval at an appropriate time.

Table 8-2 Credit conversion

Vegetation Management Zone	Biometric veg code / PC type code	Plant community type name	Management zone area (ha)	Ecosystem credits required	Area estimate (using credit conversion tool) (ha)
1	*PCT #510*	*Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion*	*7.95*	*473*	*51.9*
2	*PCT #510*	*Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion*	*0.51*	*9*	
3	*PCT #554*	*Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion*	*61.92*	*3445*	*370.4*
5	PCT #565	Silvertop Stringybark – Mountain Gum grassy open forest of the New England Tableland Bioregion	12.33	458	*49.2*
6	PCT #84	River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	0.14	5	*1*
7	*PCT #507*	*Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion*	*2.68*	*157*	*16.9*
Total (rounded)			**85.53**	**4547**	**498.40**

9 CONCLUSION

NGH Environmental has prepared this BAR on behalf of White Rock Wind Farm Pty Ltd (WRWFPL) to support the Modification Application for the stage 2 White Rock Wind Farm development (WRWF). The purpose of this BAR was to address the requirements of the FBA, developed for Major Projects, and to address the biodiversity matters. In this BAR, biodiversity impacts have been assessed through:

- Comprehensive mapping and assessment completed in accordance with the requirements in Appendix 4 of the FBA;
- The identification of two EECs within the proposal site and adjacent vegetation, the impacts to which have been adequately assessed;
- Mitigation measures which have been outlined in Section 6 to reduce the impacts to biodiversity; and
- The generation of 4,547 ecosystem credits within the proposal site.

As of 8 August, 2018, it is understood that the NSW Office of Environment and Heritage is in the process of confirming the status of Mr Phil Spark (author of Appendix J) as an expert for the Boorolong Frog and Pale-headed Snake. While the outcome of this determination cannot be pre-empted, discussions with OEH staff indicate that the qualifications and experience of the author with respect to these species should confer expert status for the purpose of this report. Should the OEH confirmation process extend beyond the point of project approval, safeguards have been included to ensure that these two species are adequately surveyed for, and offset if required, prior to commencement of habitat clearing.

To address areas included after the completion of field surveys, additional surveys of these extrapolated areas for confirmation of vegetation community and targeted threatened flora and fauna searches have been recommended. These additional surveys will be undertaken prior to the start of construction. If results are in conflict with the assumptions of this BAR, either positively or negatively, then credit calculations will be updated to reflect updated offset requirements.462 surplus credits from the existing offset package will be utilised to offset a portion of the required Stage 2 development. An additional offset area of approximately 447 ha will be required to generate the remaining 4,085 credits for Stage 2.

The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Proposals, and will be achieved by:

(a) acquiring or retiring credits under the BioBanking scheme in the TSC Act;
(b) making payments into an offset fund that has been established by the NSW Government; or
(c) providing suitable supplementary measures.

Obtaining physical onsite offsets are the preferred option. Once identified and secured, this offset will be managed in perpetuity to ensure that threatened species habitats are enhanced in the future.

It is noted there may be further opportunities in the final design phase to minimise impacts to native vegetation, and in particular EEC vegetation, that will avoid and minimise impacts as well having potential to reduce offsetting requirements.

10 REFERENCES

Cropper, S.C. (1993). *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.

DECC (2002) Descriptions for NSW (Mitchell) Landscapes Version 2. NSW Department of Environment and Climate Change.

DoE (2016). Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: http://www.environment.gov.au/sprat.

DoE (2014) EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory), Commonwealth Department of Environment, 2014.

Environment Australia (2001) A Directory of Important Wetlands in Australia. 3rd Edition. Environment Australia, Canberra.

NSW Scientific Committee (2001). Clearing of native vegetation – key threatening process listing.

OEH (2016) NSW Vegetation Information System Classification Database. Accessed online via secure login at: http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx.

OEH (2014). Framework for Biodiversity Assessment: NSW Biodiversity Offsets Policy for Major Proposals. Published by Office of Environment and Heritage for the NSW Government.

(OEH) (2016). Threatened species profiles. [Online]. Available from: http://www.environment.nsw.gov.au/threatenedSpeciesApp.

Spaven Consulting (2011). Solar Photovoltaic Energy Facilities: Assessment of potential for impact on aviation. Report prepared January 2011, for RPS Planning and Development.

APPENDIX A CONSULTATION

NSW GOVERNMENT | Office of Environment & Heritage

Our Ref: DOC16/611006
Your Ref: e-mail dated 28 November 2016

Brooke Marshall
ngh Environmental
PO Box 470
Bega NSW 2550

Dear Ms Marshall

Re: White Rock Wind Farm Modification – FBA Assessment of Clearing Impacts

Thank you for your e-mail dated 28 November 2016 seeking comments from the Office of Environment and Heritage (OEH) on the assessment of biodiversity impacts resulting from the modification of the White Rock Wind Farm. I appreciate the opportunity to provide input.

Our advice is set out in Attachment 1 to this letter and covers the approach for landscape assessment under the Framework for Biodiversity Assessment (FBA) and our recommended approach for the mapping of woodland endangered ecological communities.

As recommended within the FBA, we encourage you to consult with the OEH on the outcomes of Stage 1 - Biodiversity Assessment, prior to the commencement of Stage 2 - Impact Assessment.

If you have any further questions about this issue, Ms Nicky Owner, Conservation Planning Officer, Regional Operations, OEH, can be contacted on 6659 8254 or at nicky.owner@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 9 December 2016

DIMITRI YOUNG
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6659 8254

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Attachment 1: Detailed OEH Comments – White Rock Wind Farm Modification – FBA Assessment of Clearing Impacts

Landscape Assessment Approach

We have reviewed the map provided which illustrates the location of the proposed additional wind turbines across the landscape. Based on these maps, we are of the view that it would be best if you conduct the landscape assessment of the impacts according to the methodology for '*multiple fragmentation impact development*', provided at *Appendix 5* of the Framework for Biodiversity Assessment (FBA).

This assessment methodology is appropriate for developments like wind farms, given the dispersed nature of turbine locations that are linked by an associated network of development including roads, tracks and transmission lines, and clustered as arrays.

EEC Mapping

We would also like to take this opportunity to provide guidance on the assessment and mapping of Endangered Ecological Communities (EECs). Based on previous ecological assessments undertaken at White Rock Wind Farm, we are aware that two main vegetation types occur. These include the Ribbon Gum – Mountain Gum – Snow Gum Grassy Forest/Woodland and the White Box – Yellow Box – Blakely's Red Gum Woodland. Both of these vegetation types are listed as EECs.

To ensure that the credit requirement generated for impacts on these EECs is accurate, the mapping of these EECs should be broad enough to ensure that all areas of the site where these communities occur are identified. We recognise that this is not a simple task given these EECs can have various growth forms and condition states, due to past disturbances, soil fertility and seasonal factors. The various growth forms and condition states are outlined in the Final Determinations of the NSW Scientific Committee for these EECs.

To assist in the identification of the Ribbon Gum – Mountain Gum – Snow Gum Grassy Forest/Woodland EEC, the OEH recommends that the following identification logic be adopted:

1. Trees up to 15m apart with exotic or native grassland or bare earth between them – map all as EEC (N.B. this could be up to 30m given the observed canopy diameters in highly fertile sites but 15m was chosen as the average canopy diameter to be pragmatic as it captures the woodland state that can have native or exotic grassland or bare earth trees).

2. Trees between 15m and 100m apart with all native grassland between them – map all as EEC (N.B. this is a derived open woodland state but limiting the state to native grassland in between accords with the ability of the EEC to be mapped as derived native grassland).

3. Trees between 15m and 100m apart with all exotic grassland between them - map trees as EEC.

4. Trees between 15m and 100m apart with patches of native and exotic grassland between them - map trees as EEC and any areas of native grassland in between as EEC but exclude exotic grassland areas.

5. Trees more than 100m apart with patches of native and exotic grassland between them– map trees as EEC and the areas of native grassland in between as EEC but exclude exotic grassland areas.

For White Box – Yellow Box – Blakely's Red Gum Woodland EEC, we recommend that the following identification logic be applied:

1. Trees up to 50m apart with exotic or native grassland or bare earth between them – map all as EEC (N.B. this could be up to 100m apart given the EEC can be an open woodland but 50m was chosen to be pragmatic given this condition state can have just exotics or even bare earth in between trees).

2. Trees between 50m and 100m apart with native grassland between them – map all as EEC (N.B. this could include exotic or bare earth given it can be an open woodland but limiting the state to native grassland in between was chosen in order to be pragmatic).

3. Trees between 50m and 100m apart with exotic grassland between them –map trees as EEC.

4. Trees between 50m and 100m apart with patches of native and exotic grassland between them –map trees as EEC and any areas of native grassland in between as EEC but exclude exotic grassland areas.

5. Trees more than 100m apart with patches of native and exotic grassland between them – map trees as EEC and the areas of native grassland in between as EEC but exclude exotic grassland areas.

For both EEC identification processes set out above, native grassland is defined as areas of grassland comprising at least 50% native species.

Please be aware that when we review the vegetation mapping for the proposal, it will be considered with reference to the Final Determinations of the NSW Scientific Committee for these EECs.

NSW GOVERNMENT | Office of Environment & Heritage

Our Ref: DOC16/649472
Your Ref: Letter dated 20/12/2016

NGH Environmental
PO Box 470
Bega NSW 2550

Attention: Ms Brooke Marshall

Dear Ms Marshall

Re: White Rock Wind Farm Modification for Revised Stage 2 - Proposed Biodiversity Assessment Approach

Thank you for your letter dated 20 December 2016 about the proposed biodiversity assessment approach for the White Rock Wind Farm Modification for Revised Stage 2, seeking comments from the Office of Environment and Heritage (OEH). I appreciate the opportunity to provide input.

We have reviewed the proposed biodiversity assessment approach and discussed it with you and the Department of Planning and Environment by telephone.

In summary, the OEH recommends the following for the biodiversity assessment of the proposed Modification for Revised Stage 2:

1. For the proposed biodiversity surveys, all impact areas associated with the Modification (new infrastructure in areas not previously assessed, new infrastructure in areas previously assessed, approved infrastructure with proposed larger footprints in areas previously assessed) must have their vegetation mapped as per the OEH NE Region Guidance Material for mapping woodland endangered ecological communities provided in **Attachment 1** to this letter.

2. For the assessment of the proposal, the Framework for Biodiversity Assessment (FBA) must be used to assess areas to be impacted by the proposed Modification. However, for offset calculations any existing approved impacts should be subtracted. For example, if an approved turbine footprint is 400m^2 and the new footprint arising from the proposed Modification is 900m^2, then vegetation would be mapped for the Modification as per Attachment 1 and only the increase in area (900-400=500m^2) would be used for offset calculations. This acknowledges that the existing approved footprint can be cleared and offset in accordance with the existing approval and biodiversity offset strategy.

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You have advised that surveys will be undertaken in January 2017 although this is not the ideal time for native grassland surveys. To address this survey limitation, where there is uncertainty you have proposed that areas of grassland may just be assumed to be derived native grassland and that benchmark data may be used to assign a condition to that area of assumed derived native grassland. We recognise that whilst this is not the most accurate approach for grassland surveys, the precautionary method proposed is likely to address survey limitations without necessitating lengthy project delays.

If you have any further questions about this issue, please contact me on 6659 8272 or at dimitri.young@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 13 December 2017

DIMITRI YOUNG
Senior Team Leader Planning, North East Region
Regional Operations

Enclosure: Attachment 1 – OEH North East Region Guidance Material – Mapping Woodland Endangered Ecological Communities

Attachment 1: OEH North East Region Guidance Material - Mapping Woodland Endangered Ecological Communities

Underpinning Considerations from Hnatiuk, Thackway and Walker (see Tables 6 and 7 below)

1. Open Forest has crowns touching or slightly separated – up to 0.25 crown widths apart
2. Woodland has crowns clearly separated – up to 1 crown width apart
3. Open Woodland has crowns well separated – up to 20 crown widths apart
4. Isolated trees are about 100m or more apart

Table 6: Visual estimation of crown cover class

Code	Criteria assessed in field	Described as	Crown separation ratio	Crown cover %	Foliage cover %
D	Crowns touching to overlapping	Closed or dense	<0	>80%	>70%
M	Crowns touching or slightly separated	Mid-dense	0–0.25	50–80%	30–70%
S	Crowns clearly separated	Sparse or open	0.25–1	20–50%	10–30%
V	Crowns well separated	Very sparse	1–20	0.25–20%	0.2–10%
I	Isolated plants: for trees about 100 metres apart, shrubs about 20 m apart	Isolated plants	>20	<0.25%	<0.20%
L	Isolated clumps of 2 to many plants about 200 metres apart	Isolated clumps	>20	<0.25%	<0.20%
E	Emergent	Emergents	>3	<5% of total crown cover	<3% of total foliage cover

Table 7: Converting crown separation ratio to crown cover

	Overlap		Touching		Crowns separate																				
Crown separation ratio	-.01	-.05	-.02	0	.05	0.1	0.15	0.2	0.25	0.3	0.4	0.5	0.6	0.75	1.0	1.25	1.5	2.0	3.0	4.0	8.0	10	15	20	30
Percentage crown cover (%)	100	89	84	81	73	67	60	56	52	48	41	34	31	26	20	16	13	9	5	3	1	0.6	0.3	0.2	0.1

Other Considerations

- The distances below are based on average estimates of canopy widths and could be varied with site specific data.
- Native grassland comprises greater than 50% native species cover

Decision Logic for Box Gum Woodland EEC based on NSW Scientific Committee Final Determination (N.B. This EEC can be a woodland, open woodland or derived native grassland)

1. Trees up to 50m apart with exotic or native grassland or bare earth between them – map all as EEC (N.B. this could be up to 100m apart given the EEC can be an open woodland but 50m was chosen to be pragmatic given this state can have just exotics or even bare earth in between trees).

2. Trees between 50m and 100m apart with native grassland between them – map all as EEC (N.B. this could include exotic or bare earth given it can be an open woodland but limiting the state to native grassland in between was chosen to be pragmatic).

3. Trees between 50m and 100m apart with exotic grassland between them –map trees as EEC.

4. Trees between 50m and 100m apart with patches of native and exotic grassland between them –map trees as EEC and any areas of native grassland in between as EEC but exclude exotic grassland areas.

5. Trees more than 100m apart with patches of native and exotic grassland between them – map trees as EEC and the areas of native grassland in between as EEC but exclude exotic grassland areas.

Decision Logic for Ribbon Gum Mountain Gum Snow Gum Grassy Open Forest/Woodland EEC based on NSW Scientific Committee Final Determination (N.B. This EEC can be an open forest, woodland or derived native grassland)

1. Trees up to 15m apart with exotic or native grassland or bare earth between them – map all as EEC (N.B. this could be up to 30m given the observed canopy widths in highly fertile sites but 15m was chosen as the average canopy diameter to pragmatic as it captures the woodland state that can have native or exotic grassland or bare earth between).

2. Trees between 15m and 100m apart with all native grassland between them – map all as EEC (N.B. this is a derived open woodland state but limiting the state to native grassland in between accords with the ability of the EEC to be mapped as derived native grassland).

3. Trees between 15m and 100m apart with all exotic grassland between them - map trees as EEC.

4. Trees between 15m and 100m apart with patches of native and exotic grassland between them - map trees as EEC and any areas of native grassland in between as EEC but exclude exotic grassland areas.

5. Trees more than 100m apart with patches of native and exotic grassland between them– map trees as EEC and the areas of native grassland in between as EEC but exclude exotic grassland areas.

Office of Environment & Heritage

Our Ref: DOC18/74075
Your Ref: MP10_160 – Stage 2 MOD 6

Ms Phillipa Duncan
Resource and Energy Assessments, Planning Services
Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

Attention: Mr Tim Stuckey, Environmental Assessment Officer

Dear Ms Duncan

Re: White Rock Wind Farm project - Modification Proposal MP10_0160 MOD 6

Further to my letter dated 15 March 2018 on this matter the Office of Environment and Heritage (OEH) provides the following updated response, which supersedes that letter.

Thank you for your email dated 6 February 2018 about a further modification to the White Rock Wind Farm project (MP10_0160) seeking comments from the OEH. I appreciate the opportunity to provide input.

We have reviewed the documents supporting the proposed modification including the Biodiversity Assessment Report (BAR), Biodiversity Offset Package (BOP), Bird and Bat Impact Assessment (B&BIA) and Aboriginal Cultural Heritage Assessment (ACHA). Detailed OEH comments are provided in **Attachment 1** to this letter.

Our review of the BAR and associated mapping as submitted via the Biobanking assessment methodology (BBAM) tool indicates that, overall, the vegetation mapping adequately captures the extent and condition of endangered ecological communities (EECs) in accordance with the OEH advice provided to the proponent's ecological consultants. The OEH also supports the recommendations provided in the BOP and ACHA. However, there are some aspects of the BAR and B&BIA that require further clarification and these should be addressed.

In summary, the OEH recommends that:

1. Prior to determination of the application:

    a. The assessment undertaken under the Framework for Biodiversity Assessment (FBA) should be amended to consider the black-throated finch, Boorolong frog, pale-headed snake and *Callistemon pungens* as species credit species according to habitat features present across the site (as per 6.5.1.7 in the FBA).

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b. The Biodiversity Assessment Report should be amended to include information on:
   i. The location of assessment circles (3.2.1.3);
   ii. All rivers and streams that occur within the development site and outer assessment circle including stream order classifications (4.1.1.9);
   iii. The extent of native vegetation (5.1.1.1).

c. Additional bird and bat surveys should be undertaken, particularly in the new turbine location areas, to further inform the Bird and Bat Impact Assessment and subsequent Bird and Bat Adaptive Management Plan for Stage 2.

d. An assessment should be undertaken of alterations to bird and bat movement patterns/flights paths resulting from the new turbine locations including demonstrating how the project has been sited to avoid and/or minimise such impacts.

e. An assessment of the roosting and nesting sites for aerial species (including the Wedge-tailed Eagle) should be undertaken including an assessment of distances of nests from turbines and associated impacts and demonstrating how the project has been sited to avoid and/or minimise such impacts.

f. The Bird and Bat Impact Assessment should further consider the impacts on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma, including the potential nature/extent of impacts, significance of such impacts on threatened species and mitigation measures). This should include consideration of only using the GW140 turbine models to reduce potential impacts on birds and bats by maximising the rotor ground clearance.

2. Following determination of the application:

   a. The OEH should be given an opportunity to review the draft Flora and Fauna Management Plan (FFMP), Bird and Bat Adaptive Management Plan and other relevant draft post approval documents that address mitigation measures for the Stage 2 development and provide comment on the adequacy of proposed mitigation measures.

   b. The risks to threatened bat species should be reassessed once data has been collated from the two-year monitoring phase for the Stage 1 project, and this re-assessment should be used to inform the Bird and Bat Adaptive Management Plan for Stage 2.

   c. Recommendation 11 of the ACHA concerning an on-site meeting with the registered Aboriginal parties to discuss heritage management issues and the ongoing development of the project should be implemented.

If you have any further questions about this issue, Ms Rachel Lonie, Senior Conservation Planning Officer, Regional Operations, OEH, can be contacted on 6650 7130 or at rachel.lonie@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 22 March 2018

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Regional Operations

Contact officer: RACHEL LONIE
6650 7130

Enclosure: Attachment 1: Detailed OEH Comments – Modification to the White Rock Wind Farm project (MP10_0160 MOD 6)

Attachment 1: Detailed OEH Comments – Modification to the White Rock Wind Farm project (MP10_0160 MOD 6)

1.0 Overall Impacts of the Modification Application

The Office of Environment and Heritage (OEH) has been requested to provide comment on the proposed modification to the White Rock Wind Farm project (MP10_0160 MOD 6). The application has been made under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (now repealed). As the application was submitted on 24/01/2018 it was within the "two-month window" following the passage of the EP&A Amendment Bill.

As this is a transitional Part 3A Project no SEARs have been issued by the Department of Environment and Planning (DPE). However, the OEH provided previous advice to the proponent's ecological consultants on request in November and December 2016 about the biodiversity and landscape assessment approach for the proposal and the mapping of endangered ecological communities as referenced in the Biodiversity Assessment Report.

The current project approval covers a total of 119 turbines (49 turbines in the Stage 2 development) and the proposed modification for the White Rock Wind Farm (WRWF) involves:

- reducing the overall number of Stage 2 turbines from 49 to 48;
- relocation of 20 of the 48 Stage 2 turbines and minor changes to nine of the Stage 2 turbines
- increasing Stage 2 turbine dimensions including:
  - a maximum tip height of up to approximately 200 m
  - larger turbine rotor blades of up to approximately 85 m in length
  - a distance of between 30 – 59 metres above ground level to the blade tip
  - hub heights of up to approximately 130 m
- increasing the overall project area to 15,078 ha to remove one and include four additional properties
- additional access tracks for relocated turbine sites and additional temporary construction facilities including construction compounds, laydown areas and rock crushing and concrete batching plants
- increasing the approved native vegetation clearing limit from 28 ha to 90 ha to enable the Stage 2 development (i.e. additional clearing of 62 ha of native vegetation).

A significant change to the current consent is to seek approval to use different turbine models for Stage 2. Features of the different models under consideration are summarised below:

Table 1. Turbine dimensions for Stage 1 and potential Stage 2 Turbine models

Wind Turbine Parameter	GW121 – 2.5MW (Stage 1)	GW140 – 3.0-3.5MW (Stage 2)	GW170 Indicative (Stage 2)
Max Tip Height (approx.)	150 m	200 m	200 m
Max Hub Height (approx.)	89.5 m	130 m	115 m
Rotor diameter (approx.)	121 m	140 m	170 m
Clearance below rotor to ground level (approx.)	29 m	59 m	30 m

For the purposes of the assessment undertaken by the proponent, a Goldwind turbine model GW140 has been used as an indicative and suitable turbine model. However, an alternative turbine model GW170, with greater blade lengths and lower clearance to the ground level, is also considered. As described in Table 1 above, the increase in rotor diameter for the GW140 model is approximately 16.5 % greater than the model approved for Stage 1, whilst for the GW170 model it is approximately 40% greater than the model approved for Stage 1. Although this modification involves reducing the number of approved turbines by one, the longer blade lengths is likely to result in a greater impact on birds and bats as discussed below.

Comparison of the original Wind Farm layout and the proposed modification reveals a large change in development footprint, as set out in the map below, which shows the new locations for Stage 2 turbines (red dots) and tracks (connecting yellow lines). Turbines 121 through to 130 are in new locations in the western area of the subject site, as are Turbines 132, 133, 134, 135, 136, 137 in the eastern part of the site and Turbines 120, 138 and 139 in the south.

Although the number of turbines has not increased, the area of operation has been considerably expanded eastward and westward. In addition, the native vegetation clearing due to the new turbine locations, associated infrastructure and engineering details is over 220% greater than was originally approved. The increase is reportedly due to the original impact calculations under-estimating the impacts of tracks with the associated cut and fill and batter structures on steep slopes.

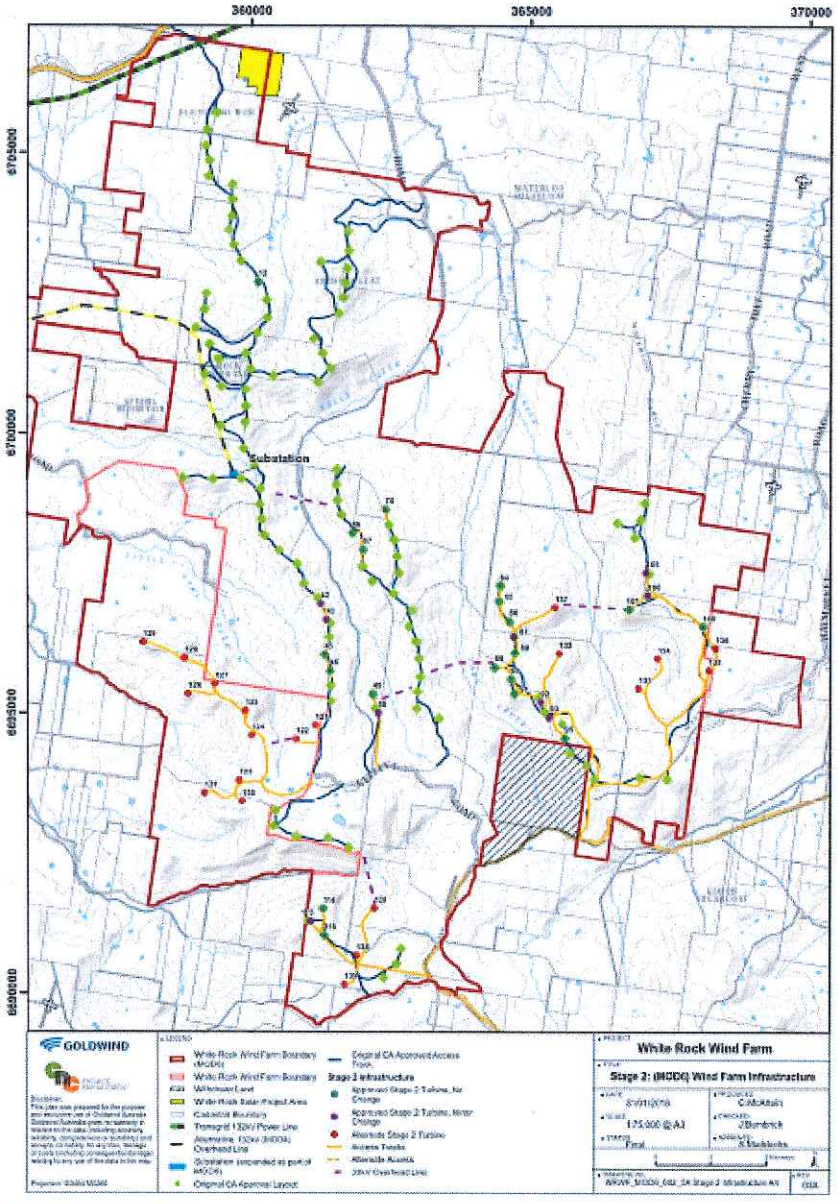

Figure 2.1 **WRWF Indicative Stage 2 layout**

Attachment 1: Detailed OEH Comments – Modification to the White Rock Wind Farm project (MP10_0160 MOD 6)

1.0 Overall Impacts of the Modification Application

The Office of Environment and Heritage (OEH) has been requested to provide comment on the proposed modification to the White Rock Wind Farm project (MP10_0160 MOD 6). The application has been made under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (now repealed). As the application was submitted on 24/01/2018 it was within the "two-month window" following the passage of the EP&A Amendment Bill.

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- reducing the overall number of Stage 2 turbines from 49 to 48;
- relocation of 20 of the 48 Stage 2 turbines and minor changes to nine of the Stage 2 turbines
- increasing Stage 2 turbine dimensions including:
  - a maximum tip height of up to approximately 200 m
  - larger turbine rotor blades of up to approximately 85 m in length
  - a distance of between 30 – 59 metres above ground level to the blade tip
  - hub heights of up to approximately 130 m
- increasing the overall project area to 15,078 ha to remove one and include four additional properties
- additional access tracks for relocated turbine sites and additional temporary construction facilities including construction compounds, laydown areas and rock crushing and concrete batching plants
- increasing the approved native vegetation clearing limit from 28 ha to 90 ha to enable the Stage 2 development (i.e. additional clearing of 62 ha of native vegetation).

A significant change to the current consent is to seek approval to use different turbine models for Stage 2. Features of the different models under consideration are summarised below:

Table 1. Turbine dimensions for Stage 1 and potential Stage 2 Turbine models

Wind Turbine Parameter	GW121 – 2.5MW (Stage 1)	GW140 – 3.0-3.5MW (Stage 2)	GW170 Indicative (Stage 2)
Max Tip Height (approx.)	150 m	200 m	200 m
Max Hub Height (approx.)	89.5 m	130 m	115 m
Rotor diameter (approx.)	121 m	140 m	170 m
Clearance below rotor to ground level (approx.)	29 m	59 m	30 m

For the purposes of the assessment undertaken by the proponent, a Goldwind turbine model GW140 has been used as an indicative and suitable turbine model. However, an alternative turbine model GW170, with greater blade lengths and lower clearance to the ground level, is also considered. As described in Table 1 above, the increase in rotor diameter for the GW140 model is approximately 16.5 % greater than the model approved for Stage 1, whilst for the GW170 model it is approximately 40% greater than the model approved for Stage 1. Although this modification involves reducing the number of approved turbines by one, the longer blade lengths is likely to result in a greater impact on birds and bats as discussed below.

Comparison of the original Wind Farm layout and the proposed modification reveals a large change in development footprint, as set out in the map below, which shows the new locations for Stage 2 turbines (red dots) and tracks (connecting yellow lines). Turbines 121 through to 130 are in new locations in the western area of the subject site, as are Turbines 132, 133, 134, 135, 136, 137 in the eastern part of the site and Turbines 120, 138 and 139 in the south.

Although the number of turbines has not increased, the area of operation has been considerably expanded eastward and westward. In addition, the native vegetation clearing due to the new turbine locations, associated infrastructure and engineering details is over 220% greater than was originally approved. The increase is reportedly due to the original impact calculations under-estimating the impacts of tracks with the associated cut and fill and batter structures on steep slopes.

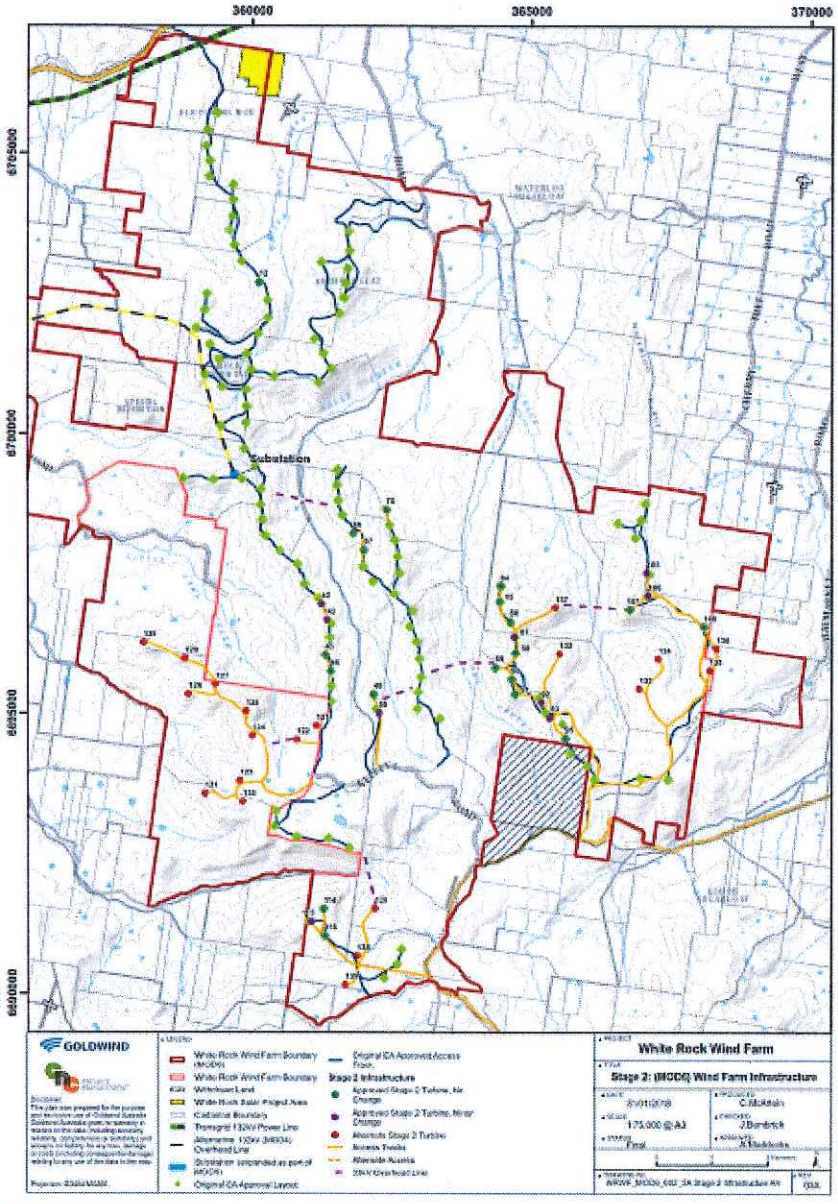


Figure 2.1 **WRWF Indicative Stage 2 layout**

2.0 Biodiversity

2.1 Assessment under the Framework for Biodiversity Assessment

The proposed modification has been assessed in accordance with the Framework for Biodiversity Assessment (FBA) including the requirements of the NSW Biodiversity Offsets Policy for Major Projects. A Biodiversity Assessment Report (BAR), Biodiversity Offset Package (BOP) and Bird and Bat Impact Assessment (B&BIA) have been prepared as part of the environmental assessment.

The OEH has reviewed the BAR and associated mapping as submitted via the Biobanking assessment methodology (BBAM) tool. Overall, the vegetation mapping adequately captures the extent and condition of endangered ecological communities (EECs) in accordance with the OEH advice provided to the consultants.

The locations of turbines and tracks appear to have avoided, where possible, the moderate to good condition EECs in favour of low condition EECs. In terms of clearing there will be a direct loss of 168.7 ha of native vegetation which includes the following EECs:

- 8.45 ha of PCT 510 Blakely's Red Gum– Yellow Box grassy woodland of the New England Tableland Bioregion,
- 61.92 ha of PCT 554 Ribbon Gum – Mountain Gum – Snow Gum grassy open forest or Woodland of the New England Tableland Bioregion
- 2.68 ha of PCT 507 Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion.

The consultants do not appear to have accurately used the BBAM tool to predict species credit species based on habitat features present in order to identify them for a targeted survey (as per 6.5.1.7 of the FBA). The black-throated finch, Boorolong frog, pale-headed snake and *Callistemon pungens* should be selected as candidate species based on the habitat features present. If these are not able to be surveyed due to the time of year or seasonal conditions, then an expert report may be provided by a suitable expert in consultation with OEH.

Other information that should be provided in the BAR is as follows:

- The location of assessment circles (3.2.1.3)
- All rivers and streams that occur within the development site and outer assessment circle including stream order classifications (4.1.1.9)
- Extent of native vegetation (5.1.1.1)

Measures proposed to avoid and minimise the direct impacts of the proposal in the BAR in accordance with section 8.3 of the FBA during the construction phase appear to lack detail. The BAR proposes that the existing Flora and Fauna Management Plan (FFMP) will be updated to incorporate protocols for pre-construction and construction phases for Stage 2. No measures appear to be proposed for the operational stage.

The BAR states the associated risks such as potential for bird and bat collisions are currently being considered independently and are not addressed in the report. As these impacts are proposed to be addressed in post approval documents, OEH requests the opportunity to review the draft Flora and Fauna Management Plan (FFMP), Bird and Bat Adaptive Management Plan and other relevant draft post approval documents that address mitigation measures for the Stage 2 development to comment on the adequacy of proposed mitigation measures.

The BAR states that the nearest record for McKies Stringybark (*Eucalyptus mckieana*) is approximately 14 km southwest of the proposal site. This does not appear to be accurate as a 2016 record of this listed species occurs 1 km to the west of the impact area near the proposed location for Turbine 129 in a Stringybark Forest community in the proposed biobank site. However, the species is known to occur on granite soils and is therefore unlikely to occur in the impact area (pers. com. Greg Steenbeeke 13/03/2018).

OEH Recommendations

1. The assessment undertaken under the Framework for Biodiversity Assessment (FBA) should be amended to consider the black-throated finch, Boorolong frog, pale-headed snake and *Callistemon pungens* as species credit species according to habitat features present across the site (as per 6.5.1.7 in the FBA).

2. The BAR should be amended to include information on:
   - The location of assessment circles (3.2.1.3)
   - All rivers and streams that occur within the development site and outer assessment circle including stream order classifications (4.1.1.9)
   - Extent of native vegetation (5.1.1.1).

3. OEH should be given the opportunity to review the draft Flora and Fauna Management Plan (FFMP), Bird and Bat Adaptive Management Plan and other relevant draft post approval documents that address mitigation measures for the Stage 2 development and provide comment on the adequacy of proposed mitigation measures.

2.2 Bird and Bat Strike Impact Assessment

The potential impacts of the modified WRWF Stage 2 development on birds and bats have been assessed separately to the FBA. The Bird and Bat Impact Assessment (B&BIA) by Brett Lane and Associates (BL&A) (Appendix 6 August 2017) states it has considered the changes to blade tip heights (up to 200 m) and blade lengths (up to 85 m) as well as changes to turbine locations and additional turbine sites.

Birds

The B&BIA uses data from bird surveys in Spring 2016 and Autumn 2017 that collected bird flight height data. There are six bird survey locations within a large impact area and there do not appear to be surveys of some of the new turbine locations, particularly in the eastern area. Also, this assessment was only undertaken to a height of 120 m and the turbine models now under consideration would have a tip height at 200 m. Hence, this may not be an adequate dataset to assess the impacts on birds arising from the new turbine locations and the OEH recommends further survey work as described below.

Bats

For bats, the B&BIA states the proposed modification with larger and higher turbines is unlikely to cause significant adverse impacts to the populations of threatened and non-threatened bat species. This is because the threatened species (Eastern Bent-wing Bat, Eastern False Pipistrelle, Eastern Freetail Bat and Eastern Cave Bat) are at very low numbers, and likely to fly mostly at or below the new Rotor Swept Area (RSA) height minimum. The B&BIA also asserts on page 4 that most bat species are known to fly below 50 m in height but this claim does not appear to be supported by any references or data.

A 2017 study conducted by OEH in southern NSW used bat detectors mounted on helium filled balloons to sample bats flying 70-130 m above the ground and compared this to detectors mounted in trees sampling bats flying within 30m of the ground. The study found that bat activity was 1.3 times greater closer to the ground (1,319 passes) than at 70-130 m above the ground (1,008 passes).

All bat species in the study area including the smallest were recorded flying at elevation however, the relative proportion of bat species activity varied with elevation. This is consistent with bat strike data from Australia and overseas which indicates that a broad range of species may encounter turbine blades.

The bat assessment is based on the results of a previous 2015 bat survey by BL&A. The OEH did not receive a copy of the 2015 report (referenced as the *White Rock Wind Farm Bat Pre-construction Surveys 2015* by BL&A 2016) as it was not part of the exhibition package. The B&BIA describes the survey locations as being distributed evenly across representative habitats near planned turbines but does not appear to map these locations. Hence, it appears unlikely that surveys were undertaken in the new turbine areas given that these had not been identified in 2015. Data was collected at ground level only and not within the RSA. Also, the report does not list the bat species recorded on each occasion including threatened species.

The OEH has been notified by BL&A that the carcass of a yellow-bellied sheathtail bat (YBSB) (*Saccolaimus flaviventris*), a threatened species in NSW, was found near Turbine 65 on 16/02/2018. BL&A has advised that the individual's injuries were consistent with blade strike. The YBSB was not identified in the 2015 study and was not included as a likely species in the B&BIA for the Stage 2 modification.

Five of the threatened bats (YBSB, Eastern Bent-wing Bat, Eastern False Pipistrelle, Eastern Freetail Bat and Eastern Cave Bat) are known (or have the potential) to fly at the RSA height. The B&BIA does not appear to have adequately surveyed for bats in the new turbine locations or adequately addressed the impacts of the change in RSA, particularly on these threatened bats.

The OEH has identified an apparent typographic error on page 9 of the B&BIA where it is stated that under the proposed modification there will be an increase of the total area of RSA between 30-40 m with an associated decrease in the risk to birds flying at that height. This error should be corrected.

Wedge-tailed Eagles

Although they are not a threatened species, Wedge-tailed Eagles (WTE) are known to be at risk from wind farm impacts. The B&BIA acknowledges there may be an increased risk of collision by WTEs, other high-flying raptors and White-throated Needletails which are a listed migratory species under Commonwealth biodiversity legislation. The B&BIA concludes the risk is low given the low numbers of birds likely to be flying over the site, the low frequency with which these flights occur, and the non-threatened status of these species in mainland Australia.

The B&BIA states that there are possibly two WTEs nests on the site however their potential locations have not been mapped. There are measures in the BBAMP to address impacts on WTEs concerning lambing season, feeding of stock and feral animal control that could be applied for the Stage 2 development.

The OEH has compiled blade-strike data that shows impacts on WTEs are disproportionately greater than other species given their large range and low density in the landscape compared to other species. They are also long-lived and are thought to mate for life. Established breeding pairs are territorial and fiercely defend their nest sites. WTEs are most at risk when young and when first flying. They also appear to be at high risk when sub-adults are dispersing from their natal territories. Courtship displays and defending territories can result in them striking turbines, and this is anecdotally more likely to happen around nest sites.

The loss of raptors should be averted, as these species regulate the food chain and maintain a stable equilibrium in nature. Predator-prey relationships can be complex, and losses of top order predators can create imbalances in ecosystems. In addition, cumulative impacts of numerous wind farms in a region could lead to WTE's becoming regionally threatened, like the Tasmanian WTE.

2.3 Assessment Requirements

The original Major Project (MP) SEARs required the Environmental Assessment (EA) to assess the impacts on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma, including the potential nature/extent of impacts, significance of such impacts on threatened species and mitigation measures), and alteration to movement patterns/flight paths resulting from the turbines

to be assessed and demonstrating how the project has been sited to avoid and/or minimise such impacts. That EA was also to consider roosting and nesting sites for aerial species and if any of the bird or bat species were likely to be impacted by the wind turbines then the significance assessment for each of the species had to consider impacts from the wind turbines as well as impacts from habitat loss. The cumulative impacts of other wind farms were also to be identified.

The EA for this modification should address the original MP SEARs and should provide the following information:

- an assessment of alteration to movement patterns/flights paths resulting from the new turbine locations including demonstrating how the project has been sited to avoid and/or minimise such impacts

- an assessment of the roosting and nesting sites for aerial species (including the Wedge-tailed Eagle) including an assessment of distances from turbines and associated impacts and demonstrating how the project has been sited to avoid and/or minimise such impacts.

In addition, further consideration should be given to the impacts on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), including the potential nature/extent of impacts, significance of such impacts on threatened species and mitigation measures.

2.4 Bird and Bat Adaptive Management Plan

A *Bird and Bat Adaptive Management Plan* (BBAMP) dated April 2017 prepared by BL&A was approved by the DPE in July 2017 for Stage 1. We also note the Stage 1 BBAMP has assigned a 'negligible' risk to five of the threatened bats (YBSB, Eastern bent-wing bat, Eastern false pipistrelle, Eastern freetail bat and Eastern cave bat) even though these are known (or having the potential) to fly at the RSA height of the Stage 1 turbines. However, discovery of the YBSB carcass suggests that the level of risk may be higher than that anticipated. The BBAMP should reassess risks once more data is collected.

OEH Recommendations

The OEH recommends that:

4. Additional bird and bat surveys should be undertaken, particularly in the new turbine location areas to further inform the Bird and Bat Impact Assessment and subsequent Bird and Bat Adaptive Management Plan for Stage 2.

5. An assessment should be undertaken of alteration to bird and bat movement patterns/flights paths resulting from the new turbine locations including demonstrating how the project has been sited to avoid and/or minimise such impacts.

6. An assessment of the roosting and nesting sites for aerial species (including the Wedge-tailed Eagle) should be undertaken including an assessment of distances from turbines and associated impacts and demonstrating how the project has been sited to avoid and/or minimise such impacts.

7. The Bird and Bat Impact Assessment should further consider the impacts on birds and bats from blade strikes, low air pressure zones at the blade tips (barotrauma), including the potential nature/extent of impacts, significance of such impacts on threatened species and mitigation measures. This should include consideration of the Stage 2 proposal only using the GW140 turbine models to reduce potential impacts on birds and bats by maximising the rotor ground clearance.

8. The risks to threatened bat species should be reassessed once data has been collated from the two-year monitoring phase for the Stage 1 project and this used to inform a Stage 2 Bird and Bat Adaptive Management Plan.

3.0 Aboriginal cultural heritage

The OEH has reviewed the documentation provided and notes inconsistencies between the EA main document (page 90) and the recommendations of the Aboriginal Cultural Heritage Assessment (ACHA) prepared by NGH Environmental dated December 2017 (pages iv, v & 47). The OEH supports the 11 recommendations listed on Page 47 of the ACHA but notes that while Point 8 on page 90 of the EA may capture the intent of both Recommendations 1 and 9 of the ACHA, Recommendation 11 of the ACHA is not reflected in the EA. This inconsistency should be corrected.

Recommendation 11 concerns conducting an onsite meeting with the registered Aboriginal parties to discuss heritage management issues and the ongoing development of the project. This recommendation is important as the management of known and unknown Aboriginal cultural heritage within the development area is dependent on the Cultural Heritage Management Plan (CHMP) and any potential update of the CHMP to include the expanded Stage 2 area. The draft proposed amended CHMP that will include Stage 2 should be informed by the proposed on-site meeting with all the registered Aboriginal Parties.

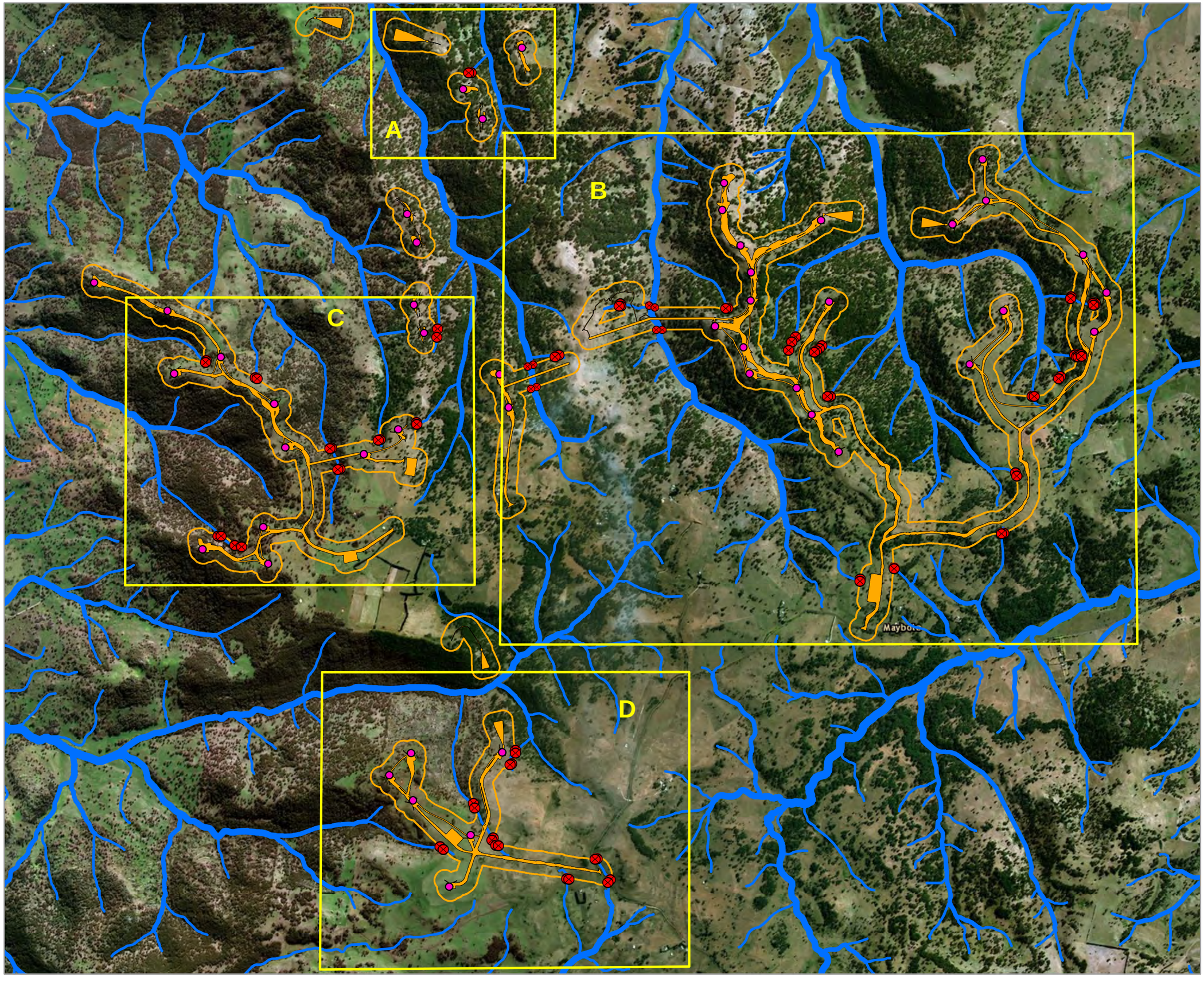
The OEH welcomes the opportunity to comment on the draft amended CHMP.

OEH Recommendation

9. Recommendation 11 of the ACHA concerning an on-site meeting with the registered Aboriginal parties to discuss heritage management issues and the ongoing development of the project should be implemented.

APPENDIX B STREAM ORDER MAPPING

B.1 STREAM ORDER MAPPING



Streams and Infrastructure Overview

16-321 White Rock Wind Farm

- Turbines
- Proposed footprint
- 100 metre buffer
- Streams
- Streams within 100 metres of footprint

Notes:
- Data collected by nghenvironmental (2017)
- Client data courtesy of Goldwind, received 2017
- Base map Copyright © Esri and its data suppliers.

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Streams and Infrastructure
Map A

16-321 White Rock Wind Farm

- Streams within 100 metres of footprint
- Turbines
- Proposed footprint
- 100 metre buffer

Vegetation types
- Black Sallee - Snow Gum grassy woodland
- Blakely's Red Gum - Yellow Box grassy woodland
- Exotic
- Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland)
- Silvertop Stringybark - Mountain Gum grassy open forest

Extrapolated vegetation types
- Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland
- Silvertop Stringybark - Mountain Gum grassy open forest

Strahler Stream Order
- Strahler Order 1 - 10 metre buffer width
- Strahler Order 2 - 20 metre buffer width
- Strahler Order 3 - 30 metre buffer width
- Strahler Order 4 - 40 metre buffer width
- Strahler Order 5 - 40 metre buffer width

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Streams and Infrastructure
Map B

16-321 White Rock Wind Farm

- Streams within 100 metres of footprint
- Turbines
- Proposed footprint
- 100 metre buffer

Vegetation types
- Black Sallee - Snow Gum grassy woodland
- Blakely's Red Gum - Yellow Box grassy woodland
- Exotic
- Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland)
- Silvertop Stringybark - Mountain Gum grassy open forest

Extrapolated vegetation types
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- Silvertop Stringybark - Mountain Gum grassy open forest

Strahler Stream Order
- Strahler Order 1 - 10 metre buffer width
- Strahler Order 2 - 20 metre buffer width
- Strahler Order 3 - 30 metre buffer width
- Strahler Order 4 - 40 metre buffer width
- Strahler Order 5 - 40 metre buffer width

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Streams and Infrastructure
Map C

16-321 White Rock Wind Farm

- Streams within 100 metres of footprint
- Turbines
- Proposed footprint
- 100 metre buffer

Vegetation types
- Black Sallee - Snow Gum grassy woodland
- Blakely's Red Gum - Yellow Box grassy woodland
- Exotic
- Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland)
- Silvertop Stringybark - Mountain Gum grassy open forest

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- Silvertop Stringybark - Mountain Gum grassy open forest

Strahler Stream Order
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- Strahler Order 3 - 30 metre buffer width
- Strahler Order 4 - 40 metre buffer width
- Strahler Order 5 - 40 metre buffer width

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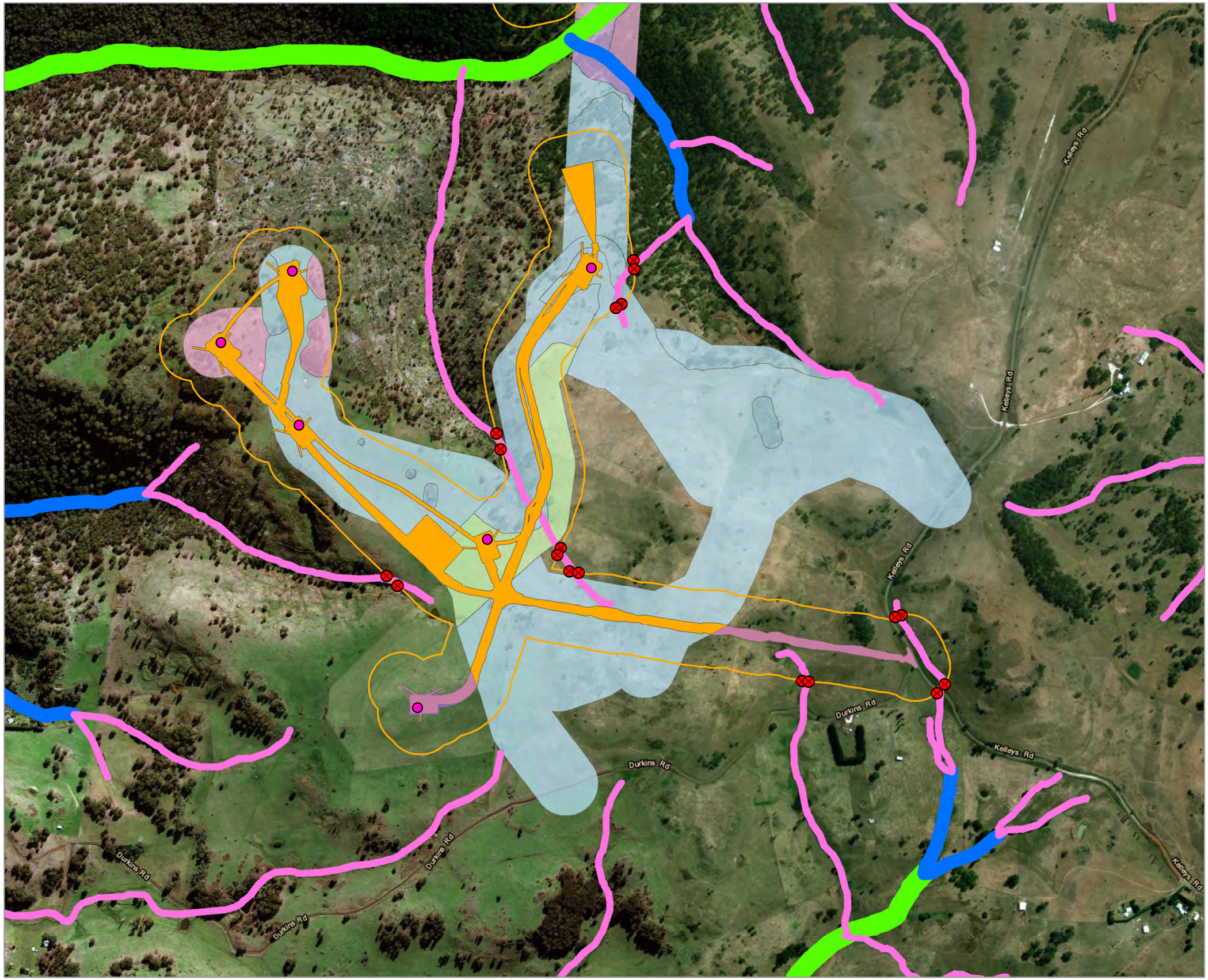

Streams and Infrastructure
Map D

16-321 White Rock Wind Farm

- Streams within 100 metres of footprint
- Turbines
- Proposed footprint
- 100 metre buffer

Vegetation types
- Black Sallee - Snow Gum grassy woodland
- Blakely's Red Gum - Yellow Box grassy woodland
- Exotic
- Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland
- River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland)
- Silvertop Stringybark - Mountain Gum grassy open forest

Extrapolated vegetation types
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- Silvertop Stringybark - Mountain Gum grassy open forest

Strahler Stream Order
- Strahler Order 1 - 10 metre buffer width
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- Strahler Order 3 - 30 metre buffer width
- Strahler Order 4 - 40 metre buffer width
- Strahler Order 5 - 40 metre buffer width

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B.2 HABITAT ASSESSMENT RESULTS: PERMANENT STREAMS IN IMPACT AREAS

Streams and Infrastructure Map B

16-321 White Rock Wind Farm

Perm_water
- Dam
- No
- Yes
- Streams within 100 metres of footprint
- Turbines
- 100 metre buffer

Extrapolated vegetation types
- Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland
- Silvertop Stringybark - Mountain Gum grassy open forest
- Proposed footprint

Strahler Stream Order
- Strahler Order 1 - 10 metre buffer width
- Strahler Order 2 - 20 metre buffer width
- Strahler Order 3 - 30 metre buffer width
- Strahler Order 4 - 40 metre buffer width
- Strahler Order 5 - 40 metre buffer width

Vegetation types
- Black Sallee - Snow Gum grassy woodland
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- Silvertop Stringybark - Mountain Gum grassy open forest

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APPENDIX C SPECIES LISTS

Scientific name	Family	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46
Tricoryne elatior	Anthericaceae																																														X
Dichopogon fimbritus	Anthericaceae																					X	X																									X
**Cyclospermum leptophyllum*	Apiaceae									X				X		X	X							X												X											X
Daucus glochidiatus	Apiaceae														X					X	X		X						X			X	X						X		X	X					X
Hydrocotyle laxiflora	Araliaceae							X		X				X	X	X	X	X			X	X	X		X	X			X							X	X		X	X	X	X					X
Bulbine bulbosa	Asphodelaceae				X																X	X				X																					X
**Cirsium vulgare*	Asteraceae	X	X		X		X	X		X			X	X	X		X	X	X				X				X	X	X	X		X	X		X	X	X	X	X		X	X	X	X	X	X
Taraxacum officinale	Asteraceae	X	X	X					X														X	X	X			X	X				X	X	X							X	X		X		X
**Sonchus oleraceus*	Asteraceae	X	X			X	X													X							X																				X
**Conyza bonariensis*	Asteraceae													X		X		X														X		X	X				X	X			X		X	X	X
Vittadinia muelleri	Asteraceae																																		X												X
Euchiton involucratus	Asteraceae									X																														X				X			X
Brachyschome nova-angelica	Asteraceae				X																X								X	X					X											X
Ammobium alatum	Asteraceae				X	X			X															X			X																				X
**Hypochaeris radicata*	Asteraceae				X	X		X	X		X			X							X	X		X	X	X									X	X			X	X			X	X	X
**Sonchus asper*	Asteraceae							X	X					X		X	X			X														X			X				X			X	X	X
**Carthamus lanatus*	Asteraceae									X																																					X
**Bidens pilosa*	Asteraceae									X														X						X	X		X													X
Chrysocephalum apiculatum	Asteraceae									X																						X														X
Senecio diaschides	Asteraceae																	X	X																	X											X
Cymbonotus lasonianus	Asteraceae																			X	X																										X
Calotis cuneifolia	Asteraceae																										X		X	X																X
**Tagetes minuta*	Asteraceae																											X	X															X			X
**Centaurea solstitialis*	Asteraceae																															X														X
Calotis lappulacea	Asteraceae																															X		X	X		X	X		X				X			X
Microseris lanceolata	Asteraceae																																X														X
**Heliotropium amplexicaule*	Boraginaceae																												X																		X
**Brassica rapa*	Brassicaceae									X		X	X	X		X																																X
**Capsella bursa-pastoris*	Brassicaceae																						X						X																		X
Wahlenbergia stricta	Campanulaceae		X							X								X	X	X	X										X		X		X		X			X		X	X				X
Wahlenbergia gracilis	Campanulaceae																					X																										X
Wahlenbergia comunis	Campanulaceae																									X										X											
**Stellaria media*	Caryophyllaceae	X	X	X	X	X					X	X		X	X	X	X			X	X			X		X		X			X													X	X				
**Petrorhagia nanteuilii*	Caryophyllaceae		X	X		X	X		X	X				X		X	X	X	X	X	X		X			X	X		X			X		X						X			X	X			
Casuarina cunninghamiana	Casuarinaceae																											X																			
Dichondra repens	Convolvulaceae				X	X		X						X	X	X				X	X		X			X			X	X		X	X	X	X	X	X		X	X	X					
Carex inversa	Cyperaceae									X				X		X	X			X	X		X	X	X	X										X										
Cyperus gracilis	Cyperaceae																																							X							
Pteridium esculentum	Dennstaedtiaceae				X			X								X												X	X	X				X			X	X		X	X	X			X	
Acacia melanoxylon	Fabaceae																																							X							
Desmodium varians	Fabaceae				X	X		X		X				X					X	X	X			X								X	X			X				X						
Glycine tabacina	Fabaceae																																X										X				
**Trifolium repens*	Fabaceae	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X		X		X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	
**Medicago lupulina*	Fabaceae		X	X	X	X	X			X	X		X		X	X	X	X	X	X			X	X	X	X	X	X	X			X	X	X		X	X				X	X	X	X	X	
**Trifolium pratense*	Fabaceae	X	X						X		X	X				X	X		X				X					X	X			X	X							X				X		
Glycine clandestina	Fabaceae					X				X				X	X					X	X			X						X		X				X		X		X		X	X			
**Trifolium arvense*	Fabaceae									X	X								X	X		X			X	X															X					
**Vicia sativa*	Fabaceae											X	X	X	X	X		X	X	X													X					X		X	X					
Hardenbergia violaceae	Fabaceae														X																															
Kenedia rubicunda	Fabaceae																	X																												
**Trifulium dubidum*	Fabaceae																			X	X			X	X	X		X	X			X									X					
Acacia implexa	Fabaceae																				X							X																		
**Medicago polymorpha*	Fabaceae																																							X						
Acacia dealbata	Fabaceae																																									X				
**Centaurium erythraea*	Gentianaceae																																X			X										
Geranium solanderi	Geraniaceae	X	X	X											X	X	X	X	X	X	X		X	X		X		X	X	X		X	X	X		X	X	X	X	X	X	X	X				

| | | |

| | | |

FAUNA SPECIES RECORDED AT THE SITE

Common name	Scientific name	Observation
Aves		
Brown Thornbill	*Acanthiza pusilla*	Observed, Call
Eastern Spinebill	*Acanthorhynchus tenuirostris*	Observed, Call
Brown Goshawk	*Accipiter fasciatus*	Observed
Grey Teal	*Anas gracilis*	Observed
Red Wattlebird	*Anthochaera carunculata*	Observed, Call
Wedge-tailed Eagle	*Aquila audax*	Observed
Sulfur-crested Cockatoo	*Cacatua galerita*	Observed, Call
Australian Wooduck	*Chenonetta jubata*	Observed
Brown Treecreeper (eastern subspecies) (V-TSC Act)	***Climacteris picumnus subsp. victoriae***	**Observed, Call**
Grey Shrike-thrush	*Colluricincla harmonica*	Observed, Call
White-bellied Cuckoo Shrike	*Coracina papuensis*	Observed, Call
White-throated Treecreeper	*Cormobates leucophaea*	Observed, Call
Australian Raven	*Corvus coronoides*	Observed, Call
Pied Butcherbird	*Cracticus nigrogularis*	Observed, Call
Australia Magpie	*Cracticus tibicen*	Observed, Call
Grey Butcherbird	*Cracticus torquatus*	Observed, Call
Galah	*Eolophus roseicapilla*	Observed, Call
Yellow Robin	*Eopsaltria australis*	Observed, Call
Brown Falcon	*Falco berigora*	Observed
Nankeen Kestrel	*Falco cenchroides*	Observed, Call

Crested Shrike-tit	*Falcunculus frontatus*	Observed, Call
White-throated Gerygone	*Gerygone olivacea*	Call
Musk Lorikeet	*Glossopsitta concinna*	Observed, Call
Little Lorikeet (V-TSC Act)	***Glossopsitta pusilla***	**Observed, Call**
Yellow-faced Honeyeater	*Lichenostomus chrysops*	Observed, Call
White-plumed Honeyeater	*Lichenostomus penicillatus*	Observed, Call
Brown Honeyeater	*Lichmera indistincta*	Observed, Call
Superb Fairy-wren	*Malurus cyaneus*	Observed, Call
Noisy Miner	*Manorina melanocephala*	Observed, Call
Spotted Pardalote	*Pardalotus punctatus*	Observed, Call
Striated Pardalote	*Pardalotus striatus*	Call
Tree Martin	*Petrochelidon nigricans*	Observed
Scarlett Robin (V-TSC Act)	***Petroica boodang***	**Observed, Call**
Little Friarbird	*Philemon citreogularis*	Observed, Call
Noisy Friarbird	*Philemon corniculatus*	Observed, Call
Crimson Rosella	*Platycercus elegans*	Observed, Call
Eastern Rosella	*Platycercus eximius*	Observed, Call
Grey Fantail	*Rhipidura albiscapa*	Observed, Call
Willie Wagtail	*Rhipidura leucophrys*	Observed, Call
Pied Currawong	*Strepera graculina*	Observed, Call
Rainbow Lorikeet	*Trichoglossus moluccanus*	Observed, Call
Mammals		
*Cattle	*Bos taurus*	Observed
*Fallow Deer	*Dama dama*	Observed
Eastern Grey Kangaroo	*Macropus giganteus*	Observed
Red-necked Wallaby	*Macropus rufogriseus*	Observed
*European Rabbit	*Oryctolagus cuniculus*	Observed

Echidna	*Tachyglossus aculeatus*	Observed
*European Fox	*Vulpes vulpes*	Observed
Swamp Wallaby	*Wallabia bicolor*	Observed

APPENDIX D HOLLOW-BEARING TREE DATA

E	N	ID	Species	Height (m)	DBH (cm)	Small Trunk	Medium Trunk	Large Trunk	Small Limb	Medium Limb	Large Limb	Small Fissure	Medium Fissure	Large Fissure	Image
361955	6691207	HBT 1	E. nova anglica	14	60					1					384
361061	6693701	HBT 2	Stag	12	50							2			385
358145	6696197	HBT 3	Stag	10	30				1				1		386
358218	6696222	HBT 4	Stag	12	50							5			387
358394	6696172	HBT 5	E. laevopinea	15	80		2		3	2		2			390
358433	6696145	HBT 6	E. laevopinea	14	50	1				2					391
358456	6696162	HBT 7	E. laevopinea	12	50					1					392
358451	6696141	HBT 8	Stag	10	40					1					393
358502	6696133	HBT 9	Stag	12	50					2					394
358919	6695978	HBT 10	E. laevopinea	15	70				1						397
359796	6695068	HBT 11	Stag	14	60		4	4							398
367324	6695809	HBT 12	E. dalrympleana subsp. heptantha	15	100		1		2	4					399
366925	6695348	HBT 13	E. dalrympleana subsp. heptantha	15	80		2			2					400
367182	6695224	HBT 14	E. dalrympleana subsp. heptantha	14	70				2						401
367190	6695230	HBT 15	E. dalrympleana subsp. heptantha	14	70				2						402
365539	6696033	HBT 16	E. melliodora	14	70		1								403
365559	6696018	HBT 17	Stag	12	40	1									404

E	N	ID	Species	Height (m)	DBH (cm)	Small Trunk	Medium Trunk	Large Trunk	Small Limb	Medium Limb	Large Limb	Small Fissure	Medium Fissure	Large Fissure	Image
365514	6695866	HBT 18	E. dalrympleana subsp. heptantha	16	90		2		1	2					405
365519	6695886	HBT 19	Stag	80	40							3			406
365557	6695888	HBT 20	Stag	12	40							2	2		407
365312	6695264	HBT 21	E. dalrympleana subsp. heptantha	14	70		2			2					410
365312	6695243	HBT 22	E. dalrympleana subsp. heptantha	14	90		2			2		1			411
365325	6695221	HBT 23	E. dalrympleana subsp. heptantha	15	80		3		3	2					412
360267	6694064	HBT 24	E. nova anglica	16	50		1			1					N/A
359262	6695624	HBT 25	Stag	8	50		2								N/A
360179	6694516	HBT 26	Stag	14	70	2	3								415
360139	6694367	HBT 27	E. laevopinea	14	90			2		2					416
360198	6694364	HBT 28	Stag	14	50			1							417
360255	6694191	HBT 29	E. laevopinea	16	90	3	2		3						418
366744	6696913	HBT 30	E. melliodora	12	60	1			1						N/A
360211	6694284	HBT 31	E. nova anglica	16	80	2	1			1					420
360277	669428	HBT 32	E. nova anglica	12	80			2						1	419

E	N	ID	Species	Height (m)	DBH (cm)	Small Trunk	Medium Trunk	Large Trunk	Small Limb	Medium Limb	Large Limb	Small Fissure	Medium Fissure	Large Fissure	Image
360197	6702738	HBT 33	E. melliodora	10	40	1						1			739
360195	6702763	HBT 34	E. melliodora	12	50						1				740
361230	6696018	HBT 35	Stag	6	30						1	1			741
361259	6696027	HBT 36	E.viminalis	7	40				1	1					742
361787	6698265	HBT 37	E. dalrympleana subsp. heptantha	10	20		1			1					743
366676	6693720	HBT 38	E.pauciflora	10	40					1					744
366690	6693724	HBT 39	E. stellulata	8	50					1					745
366793	6693873	HBT 40	Stag	10	50					1					746
367412	6693951	HBT 41	E. stellulata	10	50				1			1			747
361246	6697062	HBT 42	E. melliodora	15	70		1			1					748
359455	6693479	HBT 43	E. laevopinea	17	80		1		2	1					752
359178	6693567	HBT 44	Stag	8	40								2		750
359172	6693564	HBT 45	Stag	12	40				2				1		749

APPENDIX E EPBC PROTECTED MATTERS SEARCH

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

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

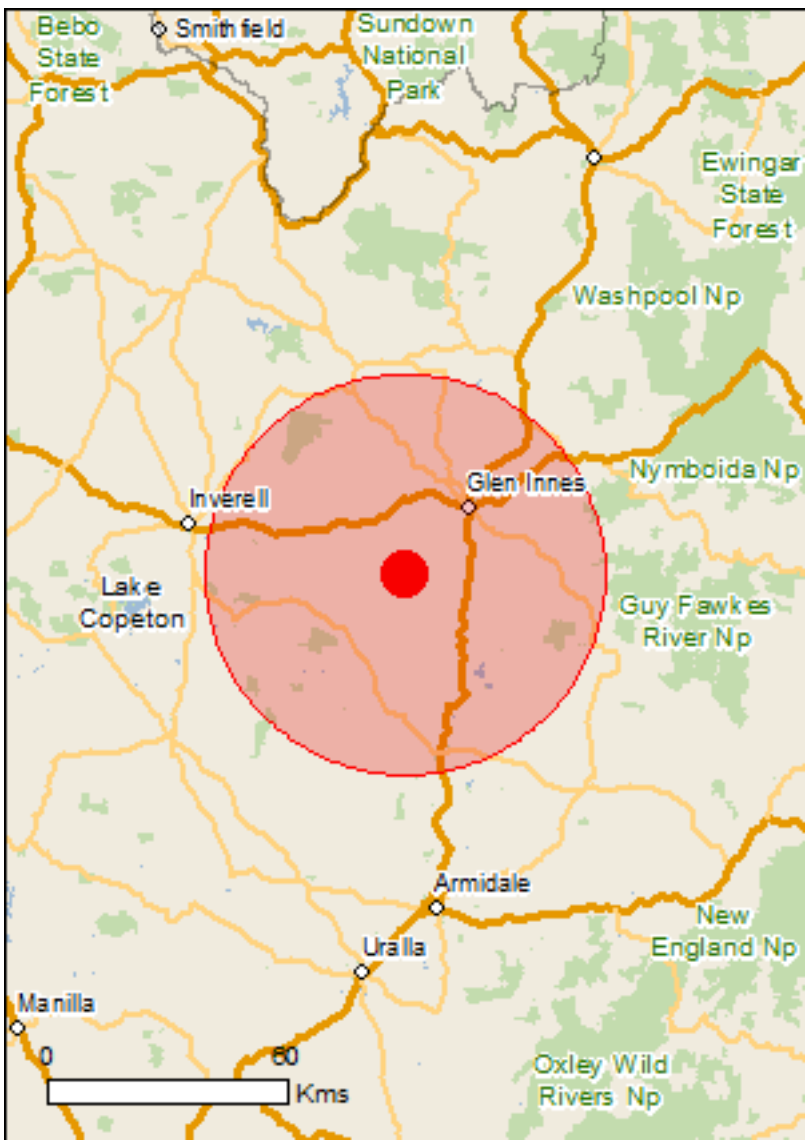
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 06/04/17 15:53:46

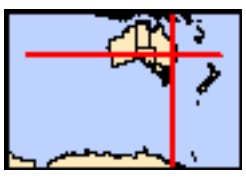
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 50.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	5
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	61
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	4
Commonwealth Heritage Places:	1
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	19
Regional Forest Agreements:	1
Invasive Species:	37
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Banrock station wetland complex	1100 - 1200km
Gwydir wetlands: gingham and lower gwydir (big leather) watercourses	150 - 200km upstream
Little llangothlin nature reserve	Within Ramsar site
Riverland	1000 - 1100km
The coorong, and lakes alexandrina and albert wetland	1200 - 1300km

Listed Threatened Ecological Communities		[Resource Information]

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

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	Critically Endangered	Community likely to occur within area
New England Peppermint (Eucalyptus nova-anglica) Grassy Woodlands	Critically Endangered	Community likely to occur within area
Upland Wetlands of the New England Tablelands (New England Tableland Bioregion) and the Monaro Plateau (South Eastern Highlands Bioregion)	Endangered	Community likely to occur within area
Weeping Myall Woodlands	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		
Maccullochella peelii Murray Cod [66633]	Vulnerable	Species or species habitat may occur within area
Frogs		
Litoria booroolongensis Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area
Litoria castanea Yellow-spotted Tree Frog, Yellow-spotted Bell Frog [1848]	Endangered	Species or species habitat likely to occur within area
Litoria piperata Peppered Tree Frog [1827]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Nyctophilus corbeni Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Pseudomys oralis Hastings River Mouse, Koontoo [98]	Endangered	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
Acacia macnuttiana McNutt's Wattle [10711]	Vulnerable	Species or species habitat likely to occur within area
Acacia pubifolia Velvet Wattle [19799]	Vulnerable	Species or species habitat likely to occur within area
Acacia ruppii Rupp's Wattle [7559]	Endangered	Species or species habitat may occur within area
Almaleea cambagei Torrington Pea [56308]	Vulnerable	Species or species habitat likely to occur within area
Astrotricha roddii [56312]	Endangered	Species or species habitat likely to occur within area
Boronia granitica Granite Boronia [18598]	Endangered	Species or species habitat likely to occur within area
Callistemon pungens [55581]	Vulnerable	Species or species habitat likely to occur within area
Callitris oblonga Pygmy Cypress-pine, Pigmy Cypress-pine, Dwarf Cypress-pine [66687]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat known to occur within area
Diuris ochroma Pale Golden Moths [64565]	Vulnerable	Species or species habitat likely to occur within area
Diuris pedunculata Small Snake Orchid, Two-leaved Golden Moths, Golden Moths, Cowslip Orchid, Snake Orchid [18325]	Endangered	Species or species habitat known to occur within area
Eucalyptus caleyi subsp. ovendenii Ovenden's Ironbark [56193]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus mckieana McKie's Stringybark [20199]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus nicholii Narrow-leaved Peppermint, Narrow-leaved Black Peppermint [20992]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus rubida subsp. barbigerorum Blackbutt Candlebark [64618]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Grevillea beadleana Beadle's Grevillea [22002]	Endangered	Species or species habitat likely to occur within area
Haloragis exalata subsp. velutina Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat likely to occur within area
Homoranthus prolixus [55198]	Vulnerable	Species or species habitat likely to occur within area
Lepidium peregrinum Wandering Pepper-cress [14035]	Endangered	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Micromyrtus grandis [64647]	Endangered	Species or species habitat may occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
Picris evae Hawkweed [10839]	Vulnerable	Species or species habitat likely to occur within area
Prasophyllum petilum Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Prostanthera staurophylla a mint-bush [20898]	Vulnerable	Species or species habitat likely to occur within area
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat likely to occur within area
Tasmannia glaucifolia Fragrant Pepperbush [21975]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Tylophora linearis [55231]	Endangered	Species or species habitat may occur within area
Tylophora woollsii [20503]	Endangered	Species or species habitat likely to occur within area
Zieria ingramii Ingram's Zieria [56734]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
[Uvidicolus sphyrurus](#)		
Border Thick-tailed Gecko, Granite Belt Thick-tailed Gecko [84578]	Vulnerable	Species or species habitat likely to occur within area
[Wollumbinia belli](#)		
Bell's Turtle, Western Sawshelled Turtle, Namoi River Turtle, Bell's Saw-shelled Turtle [86071]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#)		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Hirundapus caudacutus](#)		
White-throated Needletail [682]		Species or species habitat known to occur within area
[Monarcha melanopsis](#)		
Black-faced Monarch [609]		Species or species habitat known to occur within area
[Motacilla flava](#)		
Yellow Wagtail [644]		Species or species habitat may occur within area
[Myiagra cyanoleuca](#)		
Satin Flycatcher [612]		Species or species habitat known to occur within area
[Rhipidura rufifrons](#)		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Calidris ferruginea](#)		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
[Gallinago hardwickii](#)		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
[Pandion haliaetus](#)		
Osprey [952]		Species or species habitat may occur within area
[Tringa nebularia](#)		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Telstra Corporation Limited

Commonwealth Heritage Places [Resource Information]

Name	State	Status

Name	State	Status
Historic		
Glen Innes Post Office	NSW	Listed place

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Barayamal	NSW
Boorabee and The Willows	NSW
Booroolong	NSW
Fladbury	NSW
Goonoowigal	NSW
Guy Fawkes River	NSW
Indwarra	NSW
Kings Plains	NSW
Little Llangothlin	NSW
Mann River	NSW
Mother Of Ducks Lagoon	NSW
Single	NSW
Tarriwa Kurrukun	NSW
The Basin	NSW
Tingha Plateau	NSW
UNE Special Management Zone No1	NSW
UNE_LNE_OldGrowth	NSW
Warra	NSW
Wattleridge	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf		Species or species habitat likely to occur

Name	Status	Type of Presence
Madeiravine, Potato Vine [2643]		within area
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cytisus scoparius		
Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana		
Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma		
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Senecio madagascariensis		
Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium		
Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Ulex europaeus		
Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Little Llangothlin Lagoon	NSW
New England Wetlands	NSW

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-29.86924 151.59362

Acknowledgements

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

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

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

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

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APPENDIX F EPBC ACT ASSESSMENTS OF SIGNIFICANCE

The *Environment Protection and Biodiversity Conservation Act* 1999 specifies factors to be taken into account in deciding whether a development is likely to significantly affect Endangered Ecological Communities, threatened species and migratory species, listed at the Commonwealth level. The following assessment assesses the significance of the likely impacts associated with the proposed works on:

- White Box – Yellow Box – Blakeley's Red Gum – Grassy Woodland and Derived Native Grassland CEEC;
- Bluegrass *Dichanthium setosum;*
- Regent Honeyeater *Anthochaera Phrygia; and*
- Koala *Phascolarctos cinereus.*

Different significant impact criteria apply depending on the level at which a species or community is listed (i.e. vulnerable, endangered, critically endangered etc.). The appropriate criteria have been applied to the entities listed above.

In the context of the assessments below, 'the action' refers to 'the proposal' as described in Section 1.

SIGNIFICANT IMPACT CRITERIA

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

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

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

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

F.1.1 White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community

a) reduce the extent of an ecological community?

The EPBC Act listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (YBGW) is slightly different to the TSC Act listing of White Box-Yellow Box-Blakely's Red Gum Woodland Endangered Ecological Community. Areas that are part of the CEEC must have either:

- An intact tree layer with a predominantly native understorey containing 12 or more native understorey species present (excluding grasses) with at least one important species present; or
- An intact native ground layer with a high diversity of native plant species but no remaining tree layer.

The occurrence of Yellow box woodland within of the proposal site is considered to conform to the EPBC Act definition of the community, as the areas contain a floristic make up of that listed within the scientific determination. YBGW occurs within the proposal site as small to moderate patches of intact vegetation with large contiguous patches absent and surrounded by other vegetation communities. Areas containing a higher proportion of native understory species and a native canopy cover include turbine locations and access tracks have been avoided where possible however, approximately 7.95 ha of YBGW consistent with the EPBC Act definition will be removed as a result of the proposal. Existing and additional offset areas relating to proposal will ensure extent of this CEEC is improved or maintained.

b) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The YBGW occurring within the proposal site exists within highly connected patches of remnant vegetation that has been utilised for historical agricultural landuse. Whilst some areas have been cleared previously as well as the introduction of exotic improved pastures, connectivity through the proposal site is high. Due to the linear nature of the proposal, associated infrastructure with proposal would result in the minor fragmentation of this habitat.

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

Whilst surface flows will be altered during construction, with mitigation measures implemented, it is considered unlikely that suitable abiotic habitat will be impacted as such that the ecological communities survival is at risk from the proposal.

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

The proposal will remove an area of approximately 7.95 ha of intact YBGW. These areas are influenced by the invasion of exotic improved pasture species but contain enough native understorey to be considered as CEEC. As such, it will remove and modify the composition of the community. However, due to the linear of the proposal, areas of a higher quality can be avoided and although minor fragmentation would occur, the majority of the community will be retained and remain intact. This is considered likely to ensure that the species complexity and composition of the community remains similar within the proposal site, and within the locality. Existing and additional offset areas relating to project will ensure extent and condition of this CEEC in the broader locality is improved or maintained.

e) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

• **assisting invasive species, that are harmful to the listed ecological community, to become established, or** • **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or** • **interfere with the recovery of an ecological community**
The proposal is not considered likely to generate an increase in invasive species harmful to the ecological community. Mitigation measures implemented during a construction will strictly manage and restrict weed movement through the proposal site. It is considered unlikely that proposal would kill or inhibit the growth of the CEEC from the regular mobilisation of fertilisers, herbicides or other chemicals. As YBGW occurs within the proposal site as small to moderate patches of intact vegetation with large contiguous patches absent, the proposal is may be considered likely to interfere with the recovery of the CEEC. The proposal may also be considered likely to exacerbate this impact to the point that it would constitute a substantial reduction in the quality or integrity of the CEEC within the proposal site.

Conclusion

The proposal will impact upon 7.95 ha of the CEEC, particularly through the construction of the access tracks and turbine sites. This is may be considered likely to generate a significant impact to the community such that it would no longer remain viable within the proposal site or locality, therefore referral is recommended. Existing and additional offset areas relating to proposal will ensure extent of this CEEC is improved or maintained. Potential indirect impacts such as altered hydrology are not considered likely to impact the community.

F.1.2 Bluegrass Dichanthium setosum

a) Lead to a long-term decrease in the size of an important population of a species?
An important population is defined as one that is necessary for a species' long-term survival and recovery, and includes: A key source population either for breeding or dispersal; A population that is necessary for maintaining genetic diversity, and/or A population that is near the limit of the species' distribution range. Initial environmental risk assessments for threatened species deemed *Dichanthium setosum* as having the highest potential and risk of being present within the proposal site. However, following targeted surveys, it is considered unlikely that a population of *Dichanthium setosum* exists within the proposal site. Targeted threatened species searches have been conducted during the flowering period of the species, and the species was not found. Further, any population occurring within the proposal site is not considered an important population, as the number of individuals would likely be low (based on the lack of detections during searches of the proposal site), indicating that it is not a key source population for dispersal or necessary for the maintenance of genetic diversity. As such, the population is not considered to constitute an important population of the species.
b) Reduce the area of occupancy of an important population
The species was not recorded within the proposal site. Any population of the species occurring within the proposal site is not considered to constitute an important population, therefore the proposal is not considered likely to reduce the area of occupancy of an important population.
c) Fragment an existing important population into two or more populations;

The species was not recorded within the proposal site. Any population of the species occurring within the proposal site is not considered to constitute an important population, therefore the proposal is considered unlikely to fragment an existing important population into two or more populations.

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

The proposal will permanently impact approximately 72.55 ha of moderate/good condition habitat in addition to an area of approximately 83.55 ha of low condition and non-optimal habitat. This habitat is not considered critical to the survival of the species, as the species has a wide distribution and a higher abundance within the New England Tablelands region. Further, critical habitat has not been declared for the species. As a result, the impacts to a these area for the species range are not considered likely to adversely affect habitat critical to the survival of a species.

e) Disrupt the breeding cycle of an important population

The species was not recorded within the proposal site. Any population of the species occurring within the proposal site is not considered to constitute an important population, therefore the proposal is not considered likely to disrupt the breeding cycle of an important population.

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

The extent of habitat modification and removal is not considered likely to occur to the extent that the species is likely to decline. Habitat for the species will be retained within the higher quality portion within the proposal site. Existing and additional offset areas relating to project will ensure extent and condition of this habitat in the broader locality is improved or maintained.

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

The proposal is considered unlikely to generate an increase in invasive species harmful to the species. The proposal is not considered likely to exacerbate this impact to the point that it would constitute a substantial reduction in the quality or integrity of the species habitat within the proposal site. Additionally, the proposal is not considered likely to generate an increase in feral herbivores such as Rabbits.

h) Introduce disease that may cause the species to decline;

The proposal is considered unlikely to introduce disease that may cause the species to decline.

i) Interfere substantially with the recovery of the species;

The proposal is considered unlikely to interfere with the recovery of the species, as the species is considered unlikely to occur within the proposal site, and the proposal will not impact on any known populations of the species.

Conclusion

The proposal is considered unlikely to significantly impact the species, as no known individuals or populations of the species exist within the proposal site, the proposal will not impact on any known populations, and any population occurring within the proposal site is not considered likely to constitute an important population of the species. Existing and additional offset areas relating to proposal will ensure extent of habitat for this is improved or maintained.

F.1.3 Regent Honeyeater Anthochaera phrygia

a) Lead to a long-term decrease in the size of a population?

The Regent Honeyeater is listed as critically endangered. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and She-oaks and mistletoe. It is a generalist forager mainly feeding on nectar from Eucalypts. The species inhabits dry open forest and woodland, particularly Box-

Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. The species has been recorded within the broader region but not within the study locality. The proposal will remove some potential foraging habitat for this species, however the extent of removal (approximately 7.95 ha) is considered unlikely to occur to the extent that a population utilising the proposal site as habitat would decrease in size in the long-term.

b) reduce the area of occupancy of the species

The proposal will reduce the area of available suitable habitat by approximately 7.95 ha. The area of habitat to be removed is considered unlikely to significantly reduce the area of occupancy of the species, as a larger area of intact vegetation will be retained outside of proposal site. This area of vegetation contains a higher proportion of mature native canopy species. Further, the species is highly mobile and would likely only utilise the site on occasion.

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

No population of the species is known from the site, however there is potential for the species to forage within the site on occasion. Habitat will be retained within the proposal site, and the proposal is therefore considered unlikely to fragment an existing population into two or more populations. Further, the species is highly mobile and would likely only utilise the site on occasion.

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

The proposal will remove some potential foraging habitat for this species, however the extent of habitat removal (approximately 7.95 ha) is considered unlikely to adversely affect habitat critical to the survival of the species, as an area of suitable habitat will be retained within the proposal site. Additionally, no critical habitat for the species has been declared or occurs within the proposal site.

e) disrupt the breeding cycle of a population

It is considered unlikely that the species would breed within the proposal site. As such, the proposal is considered unlikely to disrupt the breeding cycle of a population.

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

The extent of habitat modification and removal is considered unlikely to occur to the extent that the species is likely to decline. Habitat for the species will be retained within the higher quality portion of foraging habitat within the proposal site.

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

The proposal is considered unlikely to generate an increase in invasive species harmful to the species. The proposal is not considered likely to exacerbate this impact to the point that it would constitute a substantial reduction in the quality or integrity of the species habitat within the proposal site. Additionally, the proposal is not considered likely to generate an increase in feral herbivores such as Rabbits.

h) Introduce disease that may cause the species to decline;

The proposal is not considered likely to introduce disease that may cause the species to decline.

i) Interfere substantially with the recovery of the species;

The proposal is considered unlikely to interfere with the recovery of the species, as the species is considered unlikely to occur within the proposal site, and the proposal will not impact on any known populations of the species.

Conclusion

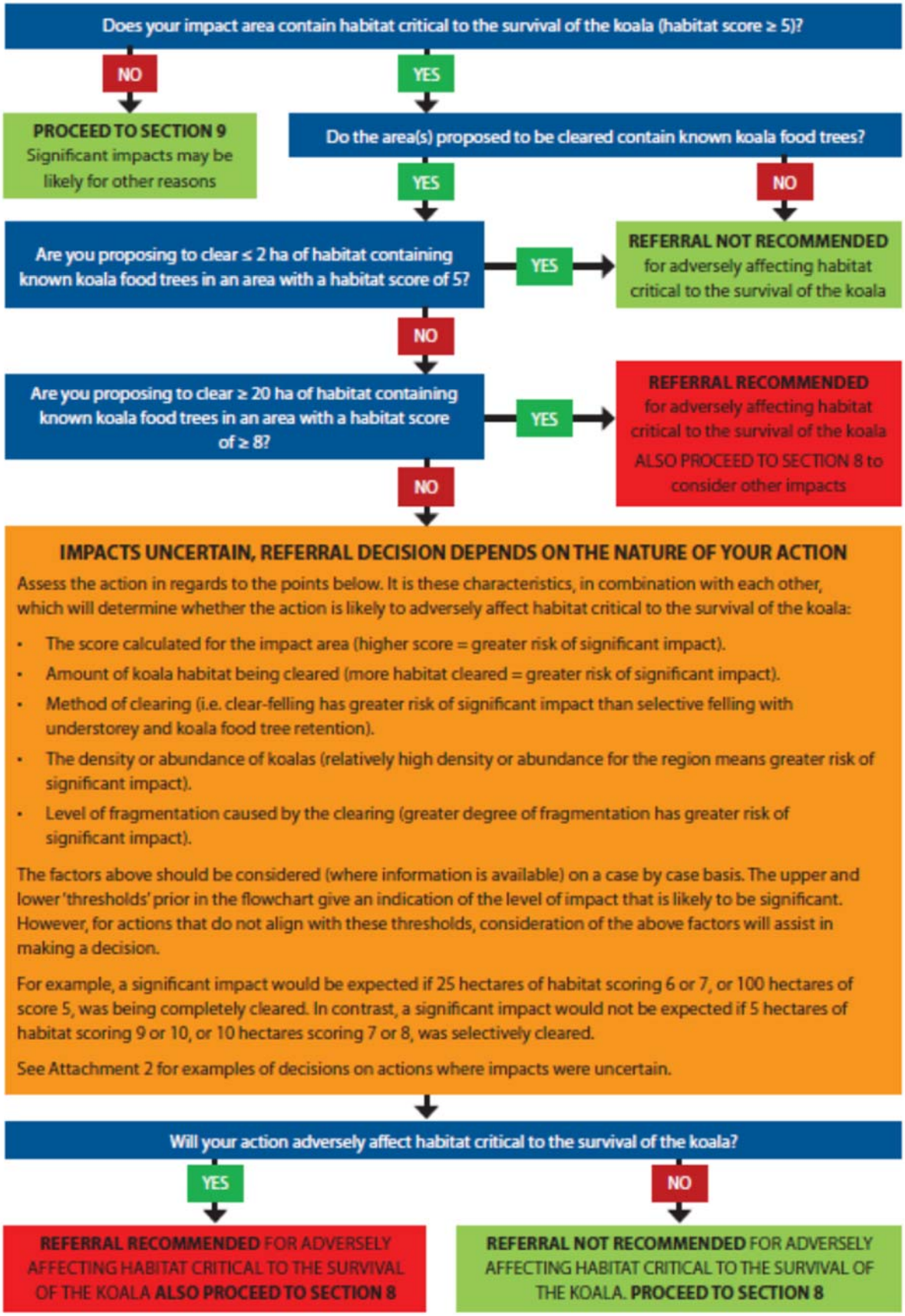
The proposal is considered unlikely to significantly impact the species, as the species is considered likely to only utilise the proposal site as a foraging resource on occasion, and the highest quality remnant of foraging habitat

will be avoided and retained where possible. Existing and additional offset areas relating to proposal will ensure extent of habitat for this is improved or maintained.

F.1.4 Koala Phascolarctos cinereus

a) Lead to a long-term decrease in the size of a population?
Although there are historical records surrounding the proposal site, none of these are recorded within the last 20 years and therefore shows a lack evidence that the proposal site contains a significant population. No Koala's or evidence of Koala activity were detected during the surveys. Due to the lack of evidence that a significant koala population exists within or near the proposal site and the linear nature of the clearing areas, it is unlikely that a population of Koalas or the Koalas ability to inhabit the area in future would be impacted to the extent that a population utilising the proposal site as habitat would decrease in size in the long-term. Existing and additional offset areas relating to project will ensure extent and condition of this koala habitat in the broader locality is improved or maintained.
b) reduce the area of occupancy of the species
As discussed above, due to the lack of evidence that a significant koala population exists within or near the proposal site and the linear nature of the clearing areas, it is unlikely that a population of Koalas or the Koalas ability to inhabit the area in future and therefore would not reduce the occupancy of this species. Existing and additional offset areas relating to project will ensure extent and condition of this koala habitat in the broader locality is improved or maintained.
c) Fragment an existing important population into two or more populations;
As discussed above, although there are historical records surrounding the proposal site, none of these are recorded within the last 20 years and therefore shows a lack evidence that the proposal site contains a significant population. No Koala's or evidence of Koala activity were detected during the surveys. Due to the lack of evidence that a significant koala population exists within or near the proposal site and the linear nature of the clearing areas, it is unlikely that a population of Koalas or the Koalas ability to inhabit the area in future would be impacted or fragmented in separate populations. Existing and additional offset areas relating to project will ensure extent and condition of this koala habitat in the broader locality is improved or maintained.
d) Adversely affect habitat critical to the survival of a species
The EPBC Act referral guidelines for the vulnerable koala (DoE, 2014) focus on the impacts of proposals to habitat critical to the survival of the koala. Table 4 of the guidelines provide a habitat assessment tool that allows for a flowchart to be followed in determining impacts to habitat critical to the survival of the species. This tool has been utilised in Section 7.4.4 of this BAR, and has determined that the habitat on site generates a score of 8. This score is higher than the minimum threshold of not constituting impacts to the species. Following the flowchart detailed below due, with the amount of vegetation being removed, it is considered likely that the proposal will adversely affect habitat critical to the survival of the koala, and indicates that a referral is recommended. However, due to the linear nature of the clearing and minimal fragmentation of habitat, and due to the lack of evidence that a significant koala population exists within or near the proposal site, in case a referral is not required. Existing and additional offset areas relating to project will ensure extent and condition of this koala habitat in the broader locality is improved or maintained.

Figure 2: Assessing adverse effects on habitat critical to the survival of the koala



e) disrupt the breeding cycle of a population

As discussed above, the site is not considered to support an important population of the species. As such, the proposal is not considered likely to disrupt the breeding cycle of an important population. If a population was to occur within the locality it is considered likely to persist, as connectivity will be retained within the proposal site, and connectivity between patches enhanced in the long-term. Existing and additional offset areas relating to project will ensure extent and condition of this koala habitat in the broader locality is improved or maintained.

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

The extent of habitat modification and removal is considered unlikely to occur to the extent that the species is likely to decline. Existing and additional offset areas relating to project will ensure extent and condition of this koala habitat in the broader locality is improved or maintained.

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

The proposal is considered unlikely to generate an increase in invasive species harmful to the species. The proposal is not considered likely to exacerbate this impact to the point that it would constitute a substantial reduction in the quality or integrity of the species habitat within the proposal site. Additionally, the proposal is not considered likely to generate an increase in feral herbivores such as Rabbits.

h) Introduce disease that may cause the species to decline;

The proposal is not considered likely to introduce disease that may cause the species to decline.

i) Interfere substantially with the recovery of the species;

The EPBC Act referral guidelines for the vulnerable koala (DoE, 2014) list several potential impacts that could interfere substantially with the recovery of the species, including:

• Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.

• Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.

• Facilitating the introduction or spread of disease or pathogens for example *Chlamydia* or *Phytophthora cinnamomi*, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.

• Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.

• Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.

The proposal will aim to avoid koala mortality through the establishment of environmental no-go areas within remnant patches, setting site speed limits, implementing hygiene protocols for plant and equipment, and through ensuring that hydrological regimes remain unaltered as far as is practical to ensure that adjacent remnant vegetation remains.

Conclusion

Although a substantive amount of vegetation is being removed from the proposal, the proposal is considered unlikely to significantly impact the species due to the lack of evidence that a significant koala population exists within or near the proposal site and the linear nature of the clearing areas. It is therefore unlikely that a population of Koalas or the Koalas ability to inhabit the area in future would be impacted to the extent that a population utilising the proposal site as habitat would decrease in size in the long-term. Existing and additional offset areas relating to proposal will ensure extent of habitat for this is improved or maintained.

APPENDIX G EPBC HABITAT ASSESSMENT TABLE

The tables present the habitat evaluation for threatened species, ecological communities and endangered populations within 10 kilometres of the proposal site in the *Atlas of NSW Wildlife*[2] and those identified as potentially occurring in the area according to the Commonwealth EPBC *Protected Matters Search Tool*[3]. Databases were searched on 24 November 2015.

The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat:

Present: Potential or known habitat is present within the study area

Marginal: Some suitable or non-preferred habitat present within the study area

Absent: No potential or known habitat is present within the study area

Likelihood of occurrence

None: Species has never or is never likely to occur in the study area

Unlikely: Species known or predicted within the locality but unlikely to occur in the study area

Possible: Species could occur in the study area

Present: Species was recorded during the field investigations

Possible to be impacted

No: The proposal would not impact this species or its habitats. No Assessment of Significance (AoS) is necessary for this species

Yes: The proposal could impact this species or its habitats. An AOS has been applied to these entities.

[2] The *Atlas of NSW Wildlife* is administered by the NSW Department of Environment, Climate Change and Water (OEH) and is an online database of fauna and flora records that contains over four million recorded sightings.

[3] This online tool is designed for the public to search for matters protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It is managed by the Commonwealth Department of the Environment, Water, Heritage and the Arts.

Species	TSC Act/ FM Act	EPBC Act	Description of habitat4	Number of records (Bionet)	Presence of habitat	Likelihood of occurrence	Possible impact?
Plants							
Acacia macnuttiana Mcnutt's wattle	V	V	*Acacia macnuttiana* grows in shallow, rocky soils derived from leucogranite acid volcanics. The vegetation ranges from heath on rocky outcrops to dry sclerophyll forest on deeper soils. Altitudes range from approximately 500 to 1100 m above sea level. Flowering is mostly from August to September with occasional late flushes in October. Associated species include *Allocasuarina littoralis*, *Angophora floribunda, Bursaria spinosa*, *Callistemon flavovirens*, *Eucalyptus biturbinata*, *Leptospermum brachyandra*, *Lophostemon confertus* and *Pomaderris sp*. (Quinn et al. 1995; Sheringham & Westaway 1995).	0	Absent	None	No
Acacia pubifolia Velvet wattle	E	E	Velvet Wattle is a shrub or small tree 3 - 8 m tall with golden yellow flowers and dark-grey bark. The leaves are hairy and feel like velvet. The adult leaves are straight or slightly curved, 2 - 10 cm long and 8 - 30 mm wide, with prominent veins and a rounded tip. Its flowers are clustered together in a long tube or spike 2 - 5 cm long and appear during September-October. Velvet Wattle generally grows in dry shrubby woodland on granite and metasediment soils.	0	Absent	Unlikely	No
Acacia ruppii Rupp's wattle	E	E	Rupp's Wattle is an erect, open shrub, 1 – 2 m in height and spread, with spindly arching branches. It has smooth grey bark and flattened hairy branchlets. The leaves are crowded, about 1 – 2 cm long and 1 – 2 mm wide, and have a prominent midvein and a small point at the tip. The round flower heads are golden yellow, and are followed by flat seed pods 4 – 11 cm long. Grows in the understorey below Needlebark Stringybark (*Eucalyptus planchoniana*), Red Bloodwood (*Corymbia gummifera*) and Smudgy Apple (*Angophora woodsiana*).	0	Absent	None	No

[4] Information sourced from species profiles on NSW OEH's threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

OEH threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Almaleea cambagei Torrington pea	E	E	Torrington Pea is a short, spindly shrub up to 2 m tall, with small leaves and orange-yellow pea flowers. The leaves are 3 - 10 mm long and 0.5 -1.5 mm wide with rounded tips. They have a minutely warty or rough underside and are pressed against the stems. The stems are covered with soft hairs. The brightly coloured flowers are about 5mm wide and grow at the end of the stems, but plants may be quite inconspicuous when not in flower. Small seed pods, 3 - 5 mm long, follow the September-November flowering period. Usually grows in wet heath and acid swamp areas and along watercourses on granite, above 900 m altitude.	0	Absent	None	No
Astrotricha roddii	E	E	Rodd's Star Hair is an upright, sparsely-branched shrub 1 - 3 m tall. The shiny, narrow leaves are 11 - 18 cm long and 1 - 2.5 cm wide with long pointed tips and hairy underside. The stems are covered with dense woolly hairs. The dull purplish flowers grow on stems up to 40 cm long, and appear during October-February. Rod's Star Hair is thought to be only short-lived, with a life-span of possibly less than 10 years. Rodd's Star Hair usually grows in low dry woodland and shrublands on granite and acid volcanic outcrops, often in rock crevices.	0	Absent	None	No
Boronia granitica Granite boronia	V	E	*Granite Boronia* is a medium-sized shrub 0.6 - 2 m tall. Its leaves are divided into nine to eleven leaflets with each leaflet about 2 - 14 mm long and 1 - 2.5 mm wide. When crushed, the leaves have a pungent scent. The leaflets and stems are covered with soft white hairs. Bright pink flowers 6 - 10 mm long appear from July to October. *Granite Boronia* occurs in scattered localities on the New England Tablelands and North West Slopes north from the Armidale area to the Stanthorpe district in southern Queensland. It can be locally common in appropriate habitat. Grows on granitic soils amongst rock outcrops, often in rock crevices, and in forests and woodlands on granite scree and shallow soils	0	Absent	None	No
Callistemon pungens		V	*Callistemon pungens* is a distinct shrub or small tree ranging from 2-5 m tall. The leaves are 2-3 cm long with a pungent tip 1-2 mm long. The flower spike is 5-6 cm long and 2.5-4.5 cm in diameter. Habitats range from riparian areas dominated by *Casuarina cunninghamiana subsp. cunninghamiana* to woodland and rocky shrubland. The species is characterised by its purple stamens and small, pungent leaves.	0	Marginal	None	No
Callitris oblonga Pygmy pine	V	V	Pygmy Cypress Pine is a bushy shrub, to about 5 m tall but usually less with a pine or 'Christmas tree' appearance. It has pale green foliage and grey-brown cones about 12 to 15 mm in diameter. It is generally smaller and grows in wetter, more easterly habitats than the more common Black Cypress Pine *C. endlicheri*	0	Absent	None	No

			or White Cypress Pine *C. glaucophylla.* Usually grows in sand along watercourses in shrubland and open woodland in granite country; it also occurs in drier sites, including exposed ridges				
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	The Leafless Tongue Orchid has no leaf. It produces an upright flower-stem to 45 cm tall, bearing five to 10 flowers between November and February. This species has inconsistent flowering, with individuals not always flowering each season. It has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). In NSW there are Leafless Tongue-orchid populations of unknown size in Washpool, Gibraltar Range, Ku-ring-gai Chase, Ben Boyd, Meroo, Morton, Murramarang, Jervis Bay and Lake Conjola National Parks as well as Cambewarra Range and Triplarina Nature Reserves. Brown (2007) indicates that this species is also present in Red Rocks (Yuraygri) National Park and is located on the Red Rocks Plateau in Cambewarra Range Nature Reserve. Also recorded at Nelson Bay, Wyee, Nowendoc State Forest, and two large populations near Bulahdelah. The species occurs mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. It prefers open areas in the understorey of forested communities. The soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Little is known about the ecology of the species; being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material. In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site.	0	Absent	None	No
Dichanthium setosum Bluegrass	V	V	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Associated with heavy basaltic black soils and red-brown loams	1	Present	Possible	No – not detected during surveys.

			with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat. Associated species include *Eucalyptus albens*, *Eucalyptus melanophloia*, *Eucalyptus melliodora*, *Eucalyptus viminalis*, *Myoporum debile*, *Aristida ramosa*, *Themeda triandra*, *Poa sieberiana*, *Bothriochloa ambigua*, *Medicago minima*, *Leptorhynchos squamatus*, *Lomandra aff. longifolia*, *Ajuga australis*, *Calotis hispidula* and *Austrodanthonia*, *Dichopogon*, *Brachyscome*, *Vittadinia*, *Wahlenbergia* and *Psoralea* species. Locally common or found as scattered clumps in broader populations. The extensive distribution and wide environmental tolerances make predictions about suitable habitat difficult.				
Diuris ochroma	E	E	Terestrial orchid with 3-4 linear leaves to 30 cm long. Plants have pale yellow flowers (about 25 mm across) with reddish-purple striations, on a stem to 40 cm long. Flowers from November to December, although flowering times are thought to be variable. Open grassy woodland of *Eucalyptus viminalis / E. pauciflora* or *E. pauciflora* / *E. parvula* (or secondary grassland).	0	Absent	Unlikely	No - not detected during surveys.
Diuris pedunculata	E	E	The Small Snake Orchid is a member of the 'Donkey' orchid group, with bright yellow striped flowers and two drooping side petals. The flowering stem is less than 10 cm tall and has one or two flowers with dark stripes. The top petal is more orange than the rest of the flower and has a bright purple centre. The two thin leaves are up to 16cm long. Also on shale and trap soils, on fine granite, and among boulders. It flowers during August-October.	0	Marginal	Unlikely	No - not detected during surveys.
Eucalyptus caleyi subsp. ovendenii	*V*	*V*	*Eucalyptus caleyi* is one of a group of related rough-barked species which have concolorous (uniform in colour) adult leaves. It is a medium-sized tree 25 m tall with grey-black, hard, rough and deeply corrugated bark. Its leaves are dull blue-green. The adult leaves are narrower than the juvenile leaves, being 1 - 4 cm wide and 5 - 10 cm long. The gumnuts are egg- or pear-shaped, 6 - 12 mm long and 5 - 7 mm in diameter, and grow in groups of seven. Ovenden's Ironbark is distinguished from the closely related Caley's Ironbark (*Eucalyptus caleyi subsp. caleyi)* by its four-angled buds and gumnuts. Associated species include *Eucalyptus melliodora, Eucalyptus dealbata, Eucalyptus albens, Eucalyptus melanophloia* and *Geijera parviflora.* Preferred altitudes are 610 to 820 m, on	0	Marginal	Unlikely	No

			granitic substrates. Ovenden's Ironbark occupies a higher geographical range than that of subspecies *caleyi*, occurring on the crests of broad high ridges and replacing subspecies *caleyi* inhabiting the lower slopes in the same general area				
Eucalyptus mckieana Mckie Stingybark	V	V	A medium sized tree about 25 m tall with red-brown stringy or fibrous bark extending to the ends of the branches. The juvenile leaves are bristly and very narrow, and adult leaves are glossy or grey-green, 6 - 9 cm long and 1 - 2 cm wide. The gumnuts are ball-shaped, 5 - 7 mm wide, and grow clustered in groups of eleven or more. Associated species at Northern Tablelands sites include *Angophora floribunda, Eucalyptus amplifolia, Eucalyptus andrewsii, Eucalyptus bridgesiana, Eucalyptus youmanii, Eucalyptus nicholii, Eucalyptus blakelyi* and *Eucalyptus conica,* and at North Western Slopes sites *Eucalyptus andrewsii, Eucalyptus stannicola, Eucalyptus prava* and *Angophora floribunda*.	8	Present	Unlikely	No - not detected during surveys.
Eucalyptus nicholii Narrow-leaved Black Peppermint	V	V	A medium-sized tree 15 – 20 m tall with rough, thick, grey-brown bark which extends to the larger branches. This species is widely planted as an urban street tree and in gardens but is quite rare in the wild. It is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. It occurs in grassy or sclerophyll woodland in association with many other eucalypts that grow in the area, including *E. andrewsii* and many of the stringybarks, such as *E. caliginosa.* Grows on shallow relatively infertile soils on shales and slates; Niangala to Glen Innes. The species is reserved in Single National Park and also in Oxley Wild Rivers National Park. The distribution of this species overlaps with the following EPBC Act-listed threatened ecological communities: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland, and Upland Wetlands of the New England Tablelands and the Monaro Plateau.	15	Present	Unlikely	No - not detected during surveys.
Eucalyptus rubida subsp. barbigerorum	V	V	A large tree to 40 m tall. It has thick, black bark on the lower trunk and powdery, white, grey, red or pink bark on the upper trunk and branches, which is shed in long ribbons. Its juvenile leaves are oval and dull blue-green. The adult leaves are narrower, dull green to grey, 9 - 15 cm long and 1 - 2.5 cm wide. The gumnuts are cylindrical or ball-shaped, 4 - 6 mm long and 5 -7 mm wide, and grow in groups of three to seven. Grassy woodland on medium or high fertility soils	0	Present	Unlikely	No - not detected during surveys.
Grevillea beadleana	E	E	Beadle's Grevillea is a spreading shrub, up to 2.5 m tall and wide. It has dissected and rather soft leaves about 12 - 16 cm long. There are short hairs on the upper surface and the lower surface is thickly felted with curled hairs. The scarlet flowers are the 'tooth-brush' type and are held prominently at the ends of the branchlets. The fruit is a hairy capsule that splits into two at maturity. Known	0	Absent	Unlikely	No

			from four separate areas, all in north-east NSW: the Torrington area west of Tenterfield, Oxley Wild Rivers National Park, Guy Fawkes River National Park and at Shannon Creek south-west of Grafton. Historical records suggest it was also once found near Walcha. It is usually found on steep granite slopes at high altitudes, although the population at Shannon Creek is at a lower elevation on sandstone				
Haloragis exalata subsp. velutina	V	V	Tall Velvet Sea-berry is a shrub to 1.5 m high. The stems are ribbed and square in section. The velvety leaves are opposite, 50 - 60 mm long, 6 - 8 mm wide and have finely toothed margins. The three to seven small yellowish green flowers form where the leaf joins the stem and are followed by tiny pear-shaped fruit 2 mm long. This subspecies also occurs in woodland on the steep rocky slopes of gorges	0	Absent	Unlikely	No
Homoranthus prolixus	V	V	Granite Homoranthus is a horizontally spreading shrub about 80 cm high with the ends of the branches growing upwards. The dull, blue-green leaves are paired on the stem, with successive pairs at right angles to each other, and 3 - 6 mm long and 0.5 - 1 mm wide, with a tapered tip. The red to yellow flowers are about 5 mm long and grow in the upper part of the branches, with one to six flowers on each branch. *Homoranthus prolixus* is characterised by the low spreading habit and short and more or less glaucous (dull blue green in colour with whitish bloom) leaves. *Homoranthus prolixus* grows in heath patches, in skeletal soil among crevices of granite outcrops	0	Absent	Unlikely	No
Lepidium peregrinum	E	E	A spreading soft-stemmed perennial herb to sub-shrub 10 - 80 cm tall but sometimes ascending to 2 m in surrounding vegetation. At the base of the plant are divided leaves 15 cm long with the leaf edges fringed with eyelash-like hairs. The leaves higher up the stem are toothed, 2 - 6 cm long and 1 - 8 mm wide, with a pointed tip. The small flowers are less than 1 mm long, growing off a horizontal or drooping, hairy flowering stem. Associated species at the Clifton site are dominated by *Eucalyptus camaldulensis* and *Casuarina cunninghamiana*, with a variably dense shrubby understorey of *Hymenanthera dentata, Bursaria spinosa, Acacia fimbriata, Acacia floribunda, Callistemon viminalis* and *Leptospermum brachyandrum. Lepidium peregrinum* was most abundant in the tussock grassland fringe of the riparian open forest, comprising *Poa* species, *Lomandra longifolia* and *Paspalum dilatatum.*	0	Absent	Unlikely	No
Macadamia integrifolia		V	The Macadamia Nut is a medium-sized tree which can grow to approximately 20 m in height with a similar crown width, giving the tree a rounded shape (Barry & Thomas 1994; Queensland CRA/RFA Steering Committee 1997; Ryan 2006;	0	Absent	Unlikely	No

			Stanley & Ross 1986). The leaves are simple, narrow-elliptical to narrow-oblong in shape, tough, dark green and occur on branchlets in groups of three. Leaves are 10–15 cm long (Barry & Thomas 1994; Gross 1995; Ryan 2006). Juvenile leaves have a serrated edge but mature leaves have a smooth margin (Ryan 2006). The flowers are cream or creamy-white in colour and occur on racemes up to 30 cm long (Barry & Thomas 1994; Gross 1995; Forster et al. 1991; Ryan 2006; Stanley & Ross 1986). The racemes originate at the leaf axil (Barry & Thomas 1994). The fruit are a hard brown nut encased in a green leathery outer shell with a 2–3 cm diameter (Barry & Thomas 1994; Ryan 2006). The smooth brown nut contains an edible kernel (Ryan 2006). Does not grow naturally in NSW.				
Micromyrtus grandis		*E*	Severn River Heath-myrtle is an upright shrub 1 -4 m tall, with paired leaves. Its leaves are smooth or finely toothed, 0.5 - 4 mm long and 0.5 - 1.5 mm wide, with obvious oil dots (visible when the leaf is held up against the light). The tiny cream to pink flowers appear during July-September, growing in the upper part of the branches. Severn River Heath-myrtle is distinguished by its overall size which is the largest yet known in the genus and by the 5-ribbed fruit, stalked flowers and broader leaves compared to other species in its range. Associated species within low woodland include *Eucalyptus crebra, Allocasuarina inophloia, Acacia sp. aff. pubifolia, Xanthorrhoea johnsonii*; in heath the association comprises *Leptospermum novae-angliae, Micromyrtus sessilis and Leucopogon neo-anglicus*	0	Absent	Unlikely	No
Prasophyllum petilum	E	E	Natural populations are known from a total of five sites in NSW. These are at Boorowa, Captains Flat, Ilford, Delegate and a newly recognised population c.10 k SE of Muswellbrook. It also occurs at Hall in the Australian Capital Territory. This species has also been recorded at Bowning Cemetery where it was experimentally introduced, though it is not known whether this population has persisted. Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock *Poa labillardieri*, Black Gum *Eucalyptus aggregata* and tea-trees *Leptospermum* spp. at Captains Flat and within the grassy groundlayer dominated by Kanagroo Grass under Box-Gum Woodland at Ilford (and Hall, ACT).	0	Absent	Unlikely	No
Picris evae Hawkweed	V	V	Hawkweed is a soft-stemmed annual plant to 130 cm tall with most of the leaves growing around the base of the plant. The leaves are sometimes toothed, have a pointed tip, and are sparsely hairy with split-end hairs (the hairs divided into	1	Present	Unlikely	No - not detected during surveys.

			two for half their length). Leaves are 2.5 - 15 cm long and 4 - 30 mm wide. The small, yellow flowers grow in dense heads 8 - 10 mm wide at the ends of the stems. Its main habitat is open Eucalypt forest including a canopy of Eucalyptus melliodora, E. crebra, E. populnea, E. albens, Angophora subvelutina, Allocasuarina torulosa , and/or Casuarina cunninghamiana with a Dichanthium grassy understory				
Prasophyllum sp. Wybong		CE	Prasophyllum sp. Wybong is a terrestrial orchid that grows to approximately 30 cm high. It has a single dull-green basal leaf that is tubular and fleshy. The single flower spike has numerous fragrant flowers. Known to occur in open eucalypt woodland and grassland	0	Present	Unlikely	No - not detected during surveys.
Prostanthera staurophylla	E	E	Torrington Mint-bush is an upright shrub 0.4 -1.5 m tall. It has light green leaves with numerous glands and curled under edges. The leaves are either narrow like pine needles or deeply divided into lobes, each lobe 5 - 14 mm long and 1 mm wide. The purple, blue or white flowers are 8 - 12 mm long. Torrington Mint-bush has a strong minty smell when crushed. Within its only current known population, the species occurs in shallow skeletal soil in rock crevices. The site is an exposed granite outcrop near the mountain summit, with skeletal gritty loam soil	0	Absent	Unlikely	No
Rutidosis heterogama Heath wrinklewort	V	V	A perennial herb with decumbent (reclining to lying down) to erect stems, growing to 30 cm high. Scattered coastal locations between Wyong and Evans Head, and on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes. Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides. Occurs on moist sites in open forest and in sedgeland/heathland within shrubby open forest and woodland, at 860–1040 m above sea level, on granitic substrates in podsolic and lithosolic soils. Flowers are borne March to April, chiefly in Autumn or November to January.	0	Marginal	Unlikely	No
Tasmannia glaucifolia	V	V	A bushy shrub growing up to 3 m tall. It has glossy deep green leaves 4 - 6 cm long and 4 - 15 mm wide, with fine lumps on the underside, and maroon branches. The small white flowers are followed by shiny, deep purple-black berries which are held in groups of one to three. When crushed, the leaves have a spicy or peppery smell. Known from several locations at high altitude in north east NSW, including the Ben Halls Gap, Point Lookout and Barrington Tops areas. Usually grows in or near Antarctic Beech Nothofagus moorei rainforest along streams in mountain areas at altitudes of between 1200 and 1500 m altitude.	0	Absent	Unlikely	No

Thesium australe Austral Toadflax	V	V	An erect perennial herb to 40 cm high. Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland or grassy woodland, often found in damp sites in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrients from other plants, especially Kangaroo Grass. Flowering is predominantly in spring and summer.	12	Present	Possible	No - not detected during surveys.
Tylophora linearis	E	E	Slender, almost hairless twiner with a clear sap. Leaves dark green, linear, 1-5 cm long, 0.5-3 mm wide. Flowers purplish, 3-6 mm in diameter, in radiating groups of 3-8. Fruit is cigar shaped, up to 100mm long and approximately 5 mm diameter, hairless. Majority of records occur in the central western region. Records from Goonoo, Pillaga West, Pillaga East, Bibblewindi, Cumbil and Eura State Forests, Coolbaggie NR, Goobang NP and Beni SCA. Also has been recorded Hiawatha State Forest near West Wyalong in the south and there are old records as far north as Crow Mountain near Barraba and near Glenmorgan in the western Darling Downs. Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla and Allocasuarina luehmannii.*	0	Absent	Unlikely	No
Tylophora woollsii	E	E	Grows in wet sclerophyll forest and rainforest in the Clouds Creek area near Nymboida and in sclerophyll forest near Parramatta	0	Absent	Unlikely	No
Zieria ingramii	E	E	Slender, spindly shrub to 0.6 m high, with ridged branches. Leaves composed of 3 narrow leaflets, each 9-19 mm long and 1-3 mm wide, dotted with oil glands above. Flowers with 4 white to pale pink petals about 3 mm long, hairy outside and hairless inside. Fruit composed of 4 slightly warted fruitlets. Associated and understorey species include *Eucalyptus crebra, E. fibrosa, E. dwyeri, E. beyeriana, E. microcarpa, Callitris endlicheri, Allocasuarina diminuta, A. distyla, A. verticillata, Leptospermum divaricatum, L. parvifolium, Acacia triptera, Acacia gladiiformis, Acacia brownii, Grevillea floribunda, G. triternata, Hakea decurrens, Boronia glabra, Philotheca salsolifolia, Leucopogon attenuatus, Melaleuca uncinata, M. erubescens, Kunzea parvifolia, Calytrix tetragona, Brachyloma daphnoides, Melichrus urceolatus, Cassinia aculeata, Dodonaea viscosa subsp. spatulata, D. peduncularis, D. heteromorpha, Dillwynia sericea*, *Hibbertia riparia, Dampiera lanceolata, Dianella longifolia, Prostanthera* species and *Goodenia* species. Known predominately from Goonoo SCA, about 40 km north-east of Dubbo. An old record exists from a locality east of Mogriguy on the Mendooran	0	Absent	Unlikely	No

			Road, however searches of the area have not relocated the species. One record also occurs within Kings Plains National Park, 48 km south of Inverell.				
Endangered Ecological Communities							
New England Peppermint (Eucalyptus nova-anglica) Woodland on Basalts and Sediments in the New England Tableland Bioregion	CEEC	CE	This woodland community is dominated by trees of New England Peppermint (*Eucalyptus nova-anglica*) and occasionally Mountain Gum (*E. dalrympleana* subsp*. Heptantha*), and is usually 8-20 metres tall. The woodland has a predominantly grassy understorey with few shrubs. The species present at a site will vary according to recent rainfall or drought condition and the degree of disturbance (including fire). In NSW all sites are within the New England Tablelands. This community is or has been known to occur in the Armidale Dumaresq, Guyra, Inverell, Severn and Tenterfield Local Government Areas, but may occur elsewhere on the New England Tablelands. It has recently been identified in eastern portions of Namoi CMA on the tablelands. Reserves containing the community include Bolivia Hill, Boorolong, Mount Duval, Yina and Imbota Nature Reserves and Warra National Park. The community occurs primarily in valley flats subject to cold air drainage. The valley flats are composed of basaltic soils, fine-grained sedimentary and acid volcanic substrates with poorly drained loam-clay soils.	N/A	Present	Unlikely	No
Upland Wetlands of the Drainage Divide of the New England Tableland Bioregion	EEC	E	This community is composed of a series of high altitude wetlands in the New England Tablelands of Northern NSW. The wetlands have small local catchments, and range from shallow and temporary to near-permanent wetlands. Vegetation is usually a combination of sedges, rushes, spike-rushes, grasses and other aquatic plants, occurring either on the shores of open water or extending across shallow or dry wetland beds, and can die back during dry periods. These wetlands are important habitat for a range of native wildlife. Known to occur between the Tenterfield and Uralla Local Government Areas but may occur elsewhere within the New England Tablelands. Generally above 900m altitude and associated with basalt soils. Not connected to river systems by floodplains.	N/A	Absent	Unlikely	No
White Box Yellow Box Blakely's Red Gum Woodland	EEC	CE	Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW. Characterised by the presence or prior occurrence of White Box, Yellow Box and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. Commonly co-occurring eucalypts include Apple Box (*E. bridgesiana*), Red Box (*E. polyanthemos*), Candlebark (*E. rubida*), Snow Gum (*E. pauciflora*), Argyle Apple	N/A	Present	Present	AoS completed

			(*E. cinerea*), Brittle Gum (*E. mannifera*), Red Stringybark (*E. macrorhyncha*), Grey Box (*E. microcarpa*), Cabbage Gum (*E. amplifolia*) and others.				
Aves							
Anthochaera Phrygia Regent Honeyeater	CE	CE	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years non-breeding flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises *E. maculata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, Corymbia gummifera, E. mckieana, E. macrorhyncha, E. laevopinea,* and *Angophora floribunda*. Nectar and fruit from the mistletoes *A. miquelii, A. pendula* and *A. cambagei* are also eaten during the breeding season. When nectar is scarce lerp and honeydew comprise a large proportion of the diet. A shrubby understorey is an important source of insects and nesting material. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria.	**0**	Present	Unlikely	AoS completed
Apus pacificus Fork-tailed Swift		M	This species breeds in the north-east and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the	0	Absent	Unlikely	No

		Pilbara and Eucla in November and in the south-west land division in mid-December, and leaving by late April. It is common in the Kimberley, uncommon to moderately common near north-west, west and southeast coasts and rare to scarce elsewhere. They never settle voluntarily on the ground and spend most of their lives in the air, living on the insects they catch in their beaks.				
Ardea alba Great Egret	M	The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. The species usually frequents shallow waters. Eastern Great Egrets usually nest in colonies and rarely as solitary pairs. In Australia, breeding sites are located in wooded and shrubby swamps including mangrove forests (the main habitat of the species in the Top End), *Melaleuca* swamps (on the eastern coast of Australia and south-western Western Australia) and mixed eucalypt/acacia/lignum swamps (in the Channel Country and Murray-Darling Basin). The Eastern Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammal.	0	Present	Possible	No
Ardea ibis Cattle Egret	M	The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock. The Cattle Egret is partially migratory, moving during winter. The Cattle Egret prefers grasshoppers, especially during breeding season, but eats many other invertebrates. It also eats frogs, cane toads, lizards and some small mammals. Its sharp bill is used in a lunging and stabbing manner. It often feeds by following large animals such as cattle, grabbing insects and worms that they disturb with their feet. They also will sit on cattle to look out for insects. Cattle Egret pairs are monogamous for the breeding season, and they breed in colonies, usually with other waterbirds. Their shallow platform nests are made in wetland areas in trees and bushes, usually as high up as possible. Both parents build the nest and incubate the eggs, with one brood per season being raised.	0	Present	Possible	No

Botaurus poiciloptilus Australasian Bittern	E	E	In NSW, this species occurs along the coast and is frequently recorded in the Murray-Darling Basin, notably in floodplain wetlands of the Murrumbidgee, Lachlan, Macquarie and Gwydir Rivers. Occurs in permanent freshwater wetlands with tall, dense vegetation. Favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, , Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate. Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch. In Australia, the Bittern occurs with the Australian Painted Snipe *Rostratula benghalensis australis.*	0	Absent	Unlikely	No
Calidris ferruginea Curlew Sandpiper	E	M,CE	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species does not breed in Australia. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.	0	Absent	Unlikely	No
Dasyornis brachypterus Eastern Bristlebird	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. The estimated population size is less than 2000 individuals occupying a total area of about 120 sq km. There are now only four populations in the southern Queensland/northern NSW area with a total of 35 birds, compared to 15 years ago when 14 populations and 154 birds were recorded. This population once extended as far south as at least Dorrigo and has recently been identified as a separate ultrataxon (*monoides)* but further research is being	0	Absent	Unlikely	No

			undertaken to determine the validity of this. The remaining populations are the nominate ultrataxon (*brachypterus*) and once extended at least to what is now the Sydney urban area. The Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. The southern population in Nadgee Nature Reserve and Howe's Flat is around 200 birds. Further surveys are required in parts of Ben Boyd National Park and Sydney Catchment Authority lands to determine whether further populations of the Eastern Bristlebird occur in these areas. Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously. Shy and cryptic and rarely flies, although can be seen scampering over the ground; when approached, may move to a lookout perch 1 m or more above the ground, then retreat into dense vegetation. Feeds on a variety of insects, particularly ants. Nests are elliptical domes constructed on or near the ground amongst dense vegetation. Suitable habitat is present in upland swamps and heaths.				
Erythrotriorchis radiates Red Goshawk	CE	V	The Red Goshawk is a large, reddish-brown hawk with long and broad wings, deeply 'fingered' wing-tips, and heavy yellow legs. The species is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	0	Absent	Unlikely	No

Gallinago hardwickii Latham's Snipe		M	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's Snipe does not breed within Australian jurisdiction. Latham's Snipe is an omnivorous species that feeds on seeds and other plant material (mainly from species in families such as Cyperaceae, Poaceae, Juncaceae, Polygonaceae, Ranunculaceae and Fabaceae), and on invertebrates including insects (mainly flies and beetles), earthworms and spiders and occasionally molluscs, isopods and centipedes.	1	Absent	Unlikely	No
Geophaps scripta scripta Squatter Pigeon (southern)	CE	V	In New South Wales, the Squatter Pigeon (southern) is thought to have formerly occurred in woodlands dominated in the overstorey by Eucalyptus species, intersected with patches of Acacia species and stands of Cypress Pine (*Callitris columellaris*) and which have a groundcover of grasses and herbs. The species are restricted to habitats that are mostly dominated in the overstorey by *Eucalyptus, Corymbia, Acacia* or *Callitris* species and within 3 km of water bodies or courses.	0	Marginal	Unlikely	No
Grantiella picta Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches**.**	0	Marginal	Unlikely	No
Hirundapus caudacutus White-throated Needletail		M	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed	0	Marginal	Unlikely	No

			that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.				
Lathamus discolour Swift Parrot	E	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Return to home foraging sites on a cyclic basis depending on food availability.	0	Present	Unlikely	No
Merops ornatus Rainbow Bee-eater		M	The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed. The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels. Southern populations move north, often in huge flocks, during winter; northern populations are present year round. Rainbow Bee-eaters eat insects, mainly catching bees and wasps, as well as dragonflies, beetles, butterflies and moths. They catch flying insects on the wing and carry them back to a perch to beat them against it before swallowing them. Bees and wasps are rubbed against the perch to remove the stings and venom glands.	0	Present	Unlikely	No
Monarcha melanopsis Black-faced Monarch		M	The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Resident in the north of its range, but is a summer breeding migrant to coastal south-eastern Australia,	0	Marginal	Unlikely	No

			arriving in September and returning northwards in March. The Black-faced Monarch forages for insects among foliage, or catches flying insects on the wing. The Black-faced Monarch builds a deep cup nest of casuarina needles, bark, roots, moss and spider web in the fork of a tree, about 3 m to 6 m above the ground. Only the female builds the nest, but both sexes incubate the eggs and feed the young.				
Motacilla flava Yellow Wagtail		M	This species occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra. In the north of its range it is also found in large forest clearings. It breeds from April to August, although this varies with latitude. The nest is a grass cup lined with hair and placed on or close to the ground in a shallow scrape. Normally it lays four to six eggs. It feeds on a wide variety of terrestrial and aquatic invertebrates as well as some plant material, particularly seeds.	0	Absent	Unlikely	No
Myiagra cyanoleuca Satin Flycatcher		M	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher is a migratory species, moving northwards in winter to northern Queensland and Papua New Guinea, returning south to breed in spring. The Satin Flycatcher takes insects on the wing, foraging actively from perches in the mid to upper canopy.	0	Absent	Unlikely	No
Pandion cristatus Eastern Osprey	V	M	The breeding range of the Eastern Osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in NSW. In NSW, the breeding population occurs from the Queensland border (contiguous with the Queensland population) south to Gosford and recently (2005-2007) to Sydney, with a more recent (2008) breeding attempt recorded further south at Ulladulla, where a bird has been observed nest-building (Clancy 2008, 2009). Vagrants occur south to and beyond the Victorian border. Forages over clear estuarine and inshore marine waters and coastal rivers, and nests in tall (usually dead or dead-topped) trees in coastal habitats from open woodland to open forest, within 1-2 km of water. Build a large stick bowl usually in the top of a dead or partly dead tree, from isolated trees in open country to open forest, with	0	Absent	Unlikely	No

			prominent emergent perches nearby (*e.g.* dead trees). The species is increasingly seen making use of artificial structures for nest sites and lookout perches (*e.g.* power pylons, towers, bridges) and purpose-built nest platforms on poles. A clutch of usually three eggs is laid in winter, with a single attempt per season. The incubation period is about 38 days, the nestling period 9-11 weeks, and the post-fledging dependence period lasts two to three months. Breeding productivity is 0.9-1.1 young per pair per year in NSW. Feed mostly on surface-swimming, schooling fish caught by diving into water. Highly mobile and dispersive.				
Poephila cincta cincta Southern Black-throated Finch		E	The Black-throated Finch (southern) occurs at two general locations: in the Townsville region, where it is considered to be locally common at a few sites around Townsville and Charters Towers; and at scattered sites in central-eastern Queensland. The Black-throated Finch (southern) occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus, Corymbia* and *Melaleuca*, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water.	1	Marginal	Unlikely	No
Rhipidura rufifrons Rufous Fantail		M	The Rufous Fantail is found in northern and eastern coastal Australia, being more common in the north. It is also found in New Guinea, the Solomon Islands, Sulawesi and Guam. The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Strongly migratory in the south of its range, it moves northwards in winter, and virtually disappears from Victoria and New South Wales at this time. The Rufous Fantail feeds on insects, which it gleans from the middle and lower levels of the canopy. It is a very active feeder and constantly fans tail and flicks wings and body while foraging.	0	Marginal	Unlikely	No
Rostratula australis Australian Painted Snipe	E	E	Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms, molluscs and crustaceans. Most records of Australian Painted Snipe are from temporary or infrequently filled freshwater wetlands and although they have occurred at many sites, no site can be identified in which they are resident or regular in occurrence. This may suggest the species is nomadic but the extent to which its cryptic behaviour may contribute to this belief is uncertain. The birds are able to remain hidden in rank vegetation, but many	0	Absent	Unlikely	No

			reports are of birds not being secretive, but rather still and unobtrusive. Primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW. In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland.				
Tringa nebularia Greenshank		M	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees. It was once recorded with Black-winged Stilts (*Himantopus himantopus*) in pasture, but are generally not found in dry grassland.	0	Absent	Unlikely	No
Amphibians							
Litoria booroolongensis *Booroolong Frog*	E	E	The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi catchment. The species is rare throughout most of the remainder of its range. Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins. Shelter under rocks or amongst vegetation near the ground on the stream edge. Sometimes bask in the sun on exposed rocks near flowing water during summer.	0	Absent	Unlikely	No

Litoria castanea Yellow-spotted Tree Frog	CE	E	Historically, this species occurred in two separate highland ranges: on the New England Tableland, and on the southern and central tablelands from Bathurst to Bombala. The species require large permanent ponds or slow flowing 'chain-of-ponds' streams with abundant emergent vegetation such as bulrushes and aquatic vegetation. Adults are active during spring and summer and bask on sunny days and move and forage at night on grassy banks or float on the water's surface. Males call at night from the open water and breeding generally occurs during or following rain. Eggs are laid amongst aquatic vegetation. Shelter during autumn and winter under fallen timber, rocks, other debris or thick vegetation.	0	Absent	Unlikely	No
Litoria piperata Peppered Tree Frog	CE	V	The Peppered Tree Frog has been recorded from five streams on the Northern Tablelands and is distributed from the Gibraltar Ranges to south of Armidale. This species has been found in streamside vegetation and under rocks and fallen timber along rocky streams flowing eastward from the Tablelands at altitudes of 800 to 1120 m.	0	Absent	Unlikely	No
Mixophyes balbus Stuttering Frog	E	V	Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only *Mixophyes* species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. The species is found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor and feed on insects and smaller frogs. The species breed in streams during summer after heavy rain. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. As the tadpoles grow they move to deep permanent pools and take approximately 12 months to metamorphose.	0	Absent	Unlikely	No
Mammals							
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo arie*l), frequenting low to mid-	0	Present – Foraging only	Unlikely	No

			elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.				
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground. The home-range of this species is unknown, but estimates are between 800ha and 20km^2. Usually traverse their ranges along densely vegetated creek lines. They need suitable den sites and abundant food, requiring large areas of intact vegetation for foraging. Use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl.	2	Present	Unlikely	No
Nyctophilus corbeni Corben's Long-eared Bat	V	V	The south eastern form of the Greater Long-eared Bat is also known as Eastern Long-eared Bat and has recently been described as new species Corben's Long-eared Bat (*N. corbeni*). Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. The species inhabits a variety of vegetation types, including mallee, bulloke *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. Slow flying agile bat, utilising the understorey to hunt non-flying prey - especially caterpillars and beetles - and will even hunt on the ground. Mating takes place in autumn with one or two young born in late spring to early summer.	0	Present	Unlikely	No

Petrogale penicillata Brush-tailed Rock-wallaby	E	V	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. The species' range is now fragmented, particularly in the south where they are now mostly found as small isolated populations dotted across their former range. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Throughout their range, Brush-tailed Rock-wallabies feed on a wide variety of grasses and shrubs, and have flexible dietary requirements. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night.	1	Absent	Unlikely	No
Phascolarctos cinereus Koala	V	V	Occurs in eastern Australia, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. The koala inhabits a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. Examples of important shelter trees are cypress pine and brush box. The quality of forest and woodland communities as habitat for koalas is influenced by a range of factors, such as; species and size of trees present; structural diversity of the vegetation; soil nutrients; climate and rainfall; size and disturbance history of the habitat patch. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Breeding season for the koala peaks between September and February.	5	Present	Possible	AoS completed
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland)	V	V	In NSW it is generally restricted to the east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. The main habitat requirements would appear to be access to some form of dense vegetation for shelter and the presence of an	0	Absent	Unlikely	No

			abundant supply of fungi for food. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha. Breeding peaks typically occur in late winter to early summer.				
Pseudomys novaehollandiae New Holland Mouse		V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Lives predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha. Breeding typically occurs between August and January, but can extend into autumn. The species peaks in abundance during early to mid-stages of vegetation succession typically induced by fire. Nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal.	0	Absent	Unlikely	No
Pseudomys oralis Hastings River Mouse	E	E	The Hastings River Mouse is a brownish-grey rodent with a greyish-white belly. Populations of the Hastings River Mouse are widely distributed although isolated in areas over 500 m above sea level. The main factors determining the species' presence appear to be an open canopy and shrub layer between 410 and 1100m elevation. Ground cover varies from almost no cover to a dense, rank cover of grasses, herbs and sedges. Sedges, particularly *Carex, Juncus* and *Cyperus* spp. are common to most sites. This habitat occurs beside creeks (permanent and ephemeral) and soakages, but is also found on ridges and grassy plains.	0	Absent	Unlikely	No
Pteropus poliocephalus Grey-headed Flying-fox	V	V	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high	0	Present	Unlikely	No

			with some camps being used for over a century. Foraging habitat available in flowering eucalypts of the study area. No camps located within the study area.				
Reptilia							
Delma torquate Adorned Delma		V	This species occurs in south-eastern Queensland, Australia, and was previously restricted to 13 localities, including areas in the Brigalow Belt. Its range may now be further reduced as it is only known from four of these sites; Mount Crosby, Lake Manchester, Karana Downs and the Bunya Mountains. This species occurs on rocky outcroppings in dry, open eucalyptus-acacia woodlands with an under-storey of grass and shrubs. It is known to inhabit leaf litter and has also been found under logs and stones.	0	Absent	Unlikely	No
Uvidicolus sphyrurus Border Thick-tailed Gecko	V	V	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. Occurs at sites ranging from 500 to 1100 m elevation. This species often occurs on steep rocky or scree slopes, especially granite. Recent records from basalt and metasediment slopes and flats indicate its habitat selection is broader than formerly thought and may have extended into areas that were cleared for agriculture. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey. These Geckos are active at night and shelter by day under rock slabs, in or under logs, and under the bark of standing trees.	0	Absent	Unlikely	No

E TSC = listed as Endangered under Schedule 1 of the NSW *Threatened Species Conservation Act 1995*

E EPBC = listed as Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

V TSC = listed as Vulnerable under Schedule 2 of the NSW *Threatened Species Conservation Act 1995.*

V EPBC = listed as Vulnerable under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

M EPBC = listed as Migratory and/or Marine under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

CE EPBC = listed as Critically Endangered under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999.*

CAMBA = Chinese-Australia Migratory Bird Agreement

JAMBA = Japan-Australia Migratory Bird Agreement

APPENDIX H BLA SURVEY REPORTS

WHITE ROCK WIND FARM

PRE-CONSTRUCTION BIRD UTILISATION SURVEY
Spring 2016 & Autumn 2017

White Rock Wind Farm Pty Ltd

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June 2017

Report No. 15009 (4.2)

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1. INTRODUCTION

Goldwind Australia on behalf of White Rock Wind Farm Pty Ltd (WRWFPL) engaged BL&A to implement the pre-construction surveys outlined in the draft Bird and Bat Adaptive Management Program for the White Rock Wind Farm (BL&A 2017). This investigation was commissioned to provide additional baseline data on the pre-construction utilisation by birds of the wind farm site.

The bird utilisation survey (BUS) was undertaken consistent with the requirements for a "Level One" bird risk assessment in accordance with 'Wind Farms and Birds - Interim Standards for Risk Assessment' issued by the Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the latest Best Practice Guidelines (Clean Energy Australia 2013).

Two pre-construction bird utilisation surveys were undertaken by experienced zoologists in Spring 2016 and Autumn 2017; in different seasons to account for seasonal differences in bird activity and presence of species (due to migration). The dates and surveyors are detailed below.

Spring:	4th – 8th November 2016	(Curtis Doughty and Peter Lansley)
Autumn:	27th February – 4th March 2017	(Curtis Doughty)

This report is divided into the following sections:

Section 2 provides the methods of the bird utilisation surveys

Section 3 provides the results of the bird utilisation surveys

Section 4 provides the conclusions from the bird utilisation survey.

It is noted that construction was progressing in the northern part of the project area and survey areas avoided the location of construction works.

This investigation was undertaken by a team from BL&A, comprising Peter Lansley (Senior Ecologist), Curtis Doughty (Senior Zoologist), Bernard O'Callaghan (Senior Ecologist & Project Manager) and Brett Lane (Principal Consultant).

2. METHODS

2.1. Fixed-point bird count method

The fixed-point bird count method involved an observer stationed at a survey point for 15 minutes. The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (Brett Lane and Associates Pty. Ltd., unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey.

During this period, all bird species and numbers of individual birds observed within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), the minimum and maximum heights were recorded.

Flight height is presented as below, at or above rotor swept area height (RSA height):

- A = Below RSA (< 30 metres above ground)
- B = At RSA (30 – 150 metres above ground)
- C = Above RSA (> 150 metres above ground).

Table 1 indicates when each point was counted on each survey day. This schedule ensured that all points were visited equally at different times of day to allow for time-of-day differences in bird movements and activity. Every survey point (impact and reference) was visited eight times over the survey period (Figure 1).

Table 1: Times when points were counted for each fixed-point bird count survey day

Time	Day 1	Day 2	Day 3	Day 4	Day 5
8:00		2	1	6	4
8:30		3	2	1	R2
9:00		R1	3	2	5
9:30		4	R1	3	6
10:00		R2	4	R1	1
10:30	1	5	R2	4	2
11:00	2	6	5	R2	3
11:30	3	1	6	5	R1
12:30	R1	2	1	6	4
13:00	4	3	2	1	R2
13:30	R2	R1	3	2	5
14:00	5	4	R1	3	6
14:30	6	R2	4	R1	
15:00	1	5	R2		
15:30		6	5		

Note: See Figure 1 for survey point locations. The prefix 'R' refers to reference points

2.1.1. Locations of survey points

Over the two survey periods, eight fixed survey points were established; six impact points and two reference points. Impact points were located near proposed turbine locations and reference points were located at least 400 metres away from impact points in areas of similar habitat.

The locations of some of the survey points changed from the spring survey to the autumn survey due to construction activities being undertaken at the original points. This was unavoidable and related to construction activities human traffic that would impact bird behaviour. The new points were positioned in areas of similar habitat in the proposed development footprint. These substituted points were considered as similar in nature to the points that they replaced.

The survey points were distributed as evenly as possible (subject to access constraints) across the southern portion of wind farm to maximise coverage in areas where wind turbines are likely to be sited (Figure 1) in the current stage and in future stages. Impact points were positioned as far as possible on elevated ground, allowing a clear view in all directions.

Table 2 below provides a description of the habitats associated with each of the 8 survey points (6 impact and 2 reference points).

Table 2 Habitat associated with each survey point

Survey Point	Habitat description	Latitude	Longitude
1	Located on top of a plateau in an open area. A few scattered trees in the outer area. Native tussock grass and introduced grass, rocks present.	-29.9078	151.5774
2	Located on top of a plateau in woodland. Dominant trees are gum trees, grassy rocky areas.	-29.8779	151.5473
3A	Located on top of a plateau in an open area with a few scattered trees about. Dominant trees are gum trees with grassy and rocky areas.	-29.8665	151.5814
3B	Located along a ridge in open woodland. Dominant trees are gum and peppermint. Some blackberry bushes with mixed native and introduced grasses.	-29.8673	151.5739
4A	Located along a ridge in open woodland. Trees along the west facing ridge, quite open on the east facing ridge. Grassy and rocky underfoot.	-29.8554	151.5811
4B	On top of a plateau, open area with scattered trees. Dominant trees are gum and Blackwood. Some eucalypt woodland further down the slope, grazed by cattle.	-29.8791	151.6218
5	Located on a plateau in an open area with some trees about. Dominated by gum trees and Blackwood.	-29.879	151.6139
6	Located along ridge with some woodland in the area. Dominated by gum trees with one farm dam in the area.	-29.8679	151.6049
R1A	Located along a ridge in a woodland area. Dominated by gum trees and grassy ground layer.	-29.8741	151.5871
R1B	Located along a ridge in an open woodland area. Gum and box are the dominant trees here. Grazed for cattle, with a mixture of native and introduced grass species.	-29.8722	151.5734
R2A	Located on top of plateau in an open area. Some scattered trees about.	-29.8858	151.6125
R2B	Located along the ridge in an open area. Some trees in search area dominated by Blackwood and gum trees. Rocky in some areas.	-29.8798	151.6178

2.2. Incidental observations

In addition to the observations during formalised, fixed-point counts, incidental observations of birds of concern (threatened species, raptors, and waterbirds) were made whilst travelling throughout the White Rock Wind Farm site. Notes were also made on woodland birds observed in remnant woodlands and any early morning and evening roosting movements. Emphasis was placed on observing birds that were moving through the site at RSA height.

2.3. Limitations

The bird utilisation survey was undertaken during two different seasons in 2016 and 2017. This was undertaken to collect a range of data and include migratory birds that may only occur at certain times of the year.

Due to construction activities already underway during the bird utilisation survey, survey activities were focused on areas in the south of the wind farm site. During the spring 2016 survey construction activities had commenced in the northern section so this area was excluded from the study as birds would not be displaying usual behaviour in these areas due to the disturbance.

During the 2017 autumn survey the construction zones had extended in to the southern section of the wind farm. Thus, some impact and reference survey points were moved from the original location to a revised location in similar habitats for the autumn surveys. These were:

- 3A moved to 3B;
- 4A moved to 4B;
- R1A moved to R1B; and
- R2A moved to R2B.

The utilisation rates and species abundances recorded during the current survey are considered to be representative of the site. They are also considered to provide a reasonable basis on which to assess the bird risks associated with the proposed White Rock Wind Farm.

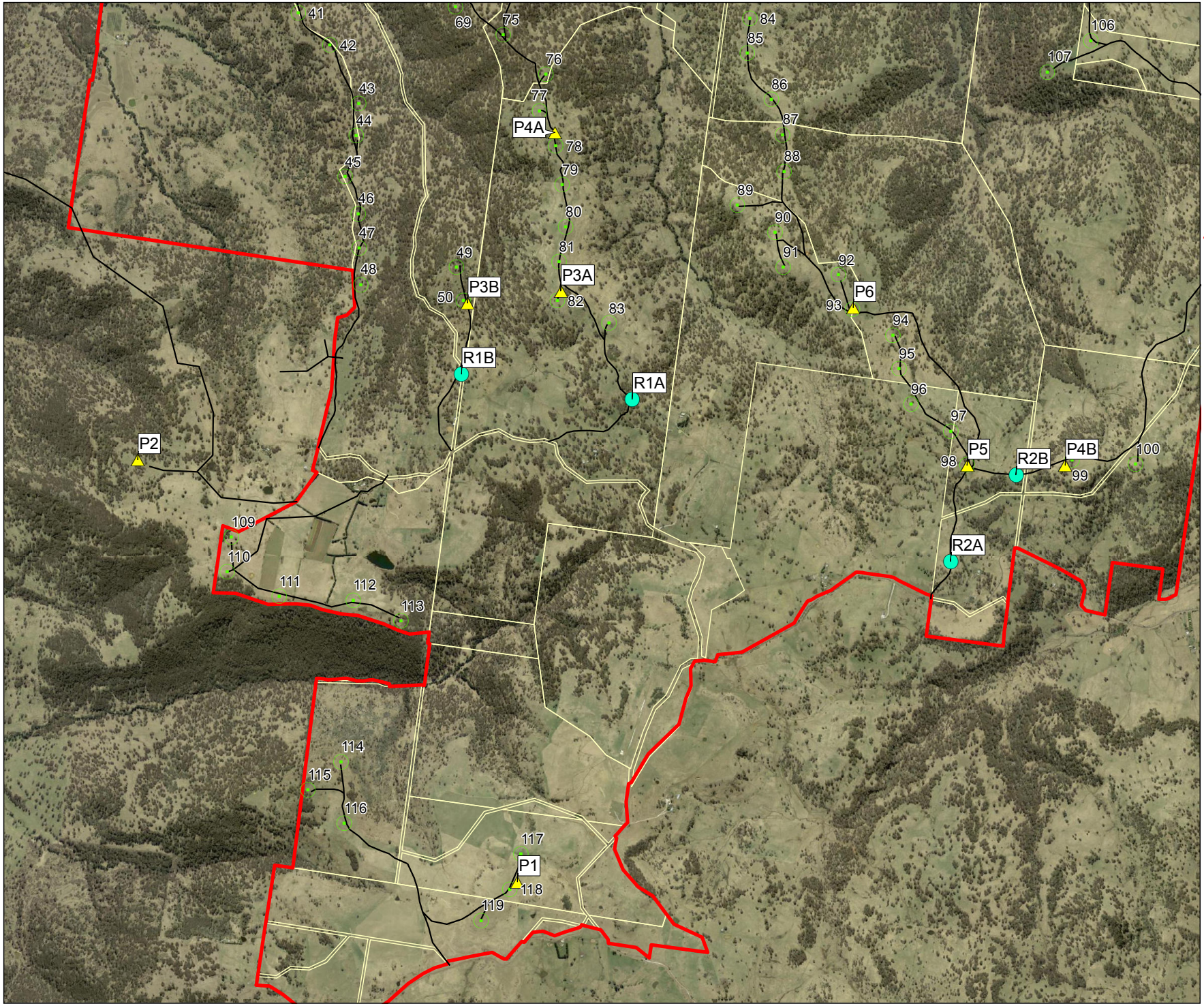

Figure 1: BUS survey points

Project: White Rock Wind Farm

Client: Goldwind Australia

Legend

- 119 turbine layout
- Tracks
- Wind Farm boundary
- Cadastre

BUS points

- Survey
- Reference

N

Metres

0 250 500

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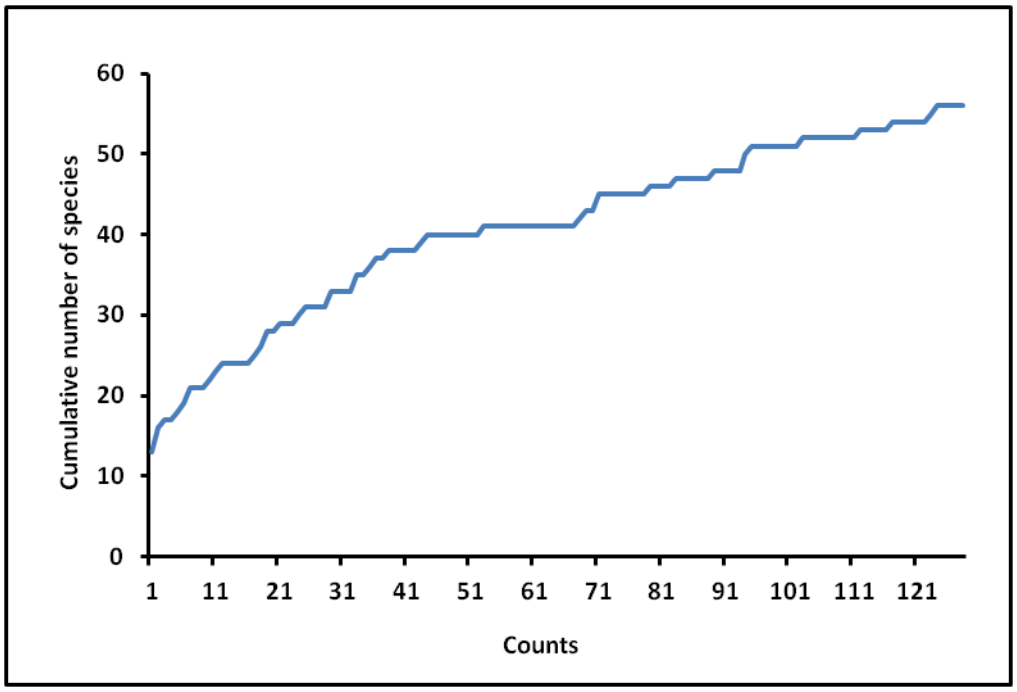
3. RESULTS

3.1. Representativeness of survey

Figure 2 presents the cumulative number of species observed during the survey. Results indicated that the number of new species observed at the wind farm sites was beginning to level off after approximately 45 counts (during the spring survey of 64 counts), after which an additional range of species was added in autumn (counts 65 to 128). The overall species count begins to level off after 95 counts, by which time over 90% of species were found. This suggested that the surveys collectively provided a representative picture of the diversity of bird species flying over the wind farm site during the survey period.

Figure 2: Cumulative number of bird species recorded



3.2. Species Composition

A total of 56 bird species were recorded during the combined two seasonal surveys (Table 3). A total of 55 species were recorded at the impact survey points and 35 at the reference survey points (Table 3). Species recorded were predominantly farmland and bushland species with some records of raptors and waterbirds. The raw data is presented in Appendix 1.

Species diversity varied between each season, diversity was highest in autumn (46 species) and lowest in spring (39 species). Species composition (diversity) differs between months due to seasonal changes in presence and abundance, activity, changes in foraging behaviour and seasonal distribution of birds among various habitats.

The five most common species at the impact and reference survey points are presented below.

Impact survey points (5 most common species)

- Australian Magpie
- Red Wattlebird
- Crimson Rosella
- Australian Wood Duck
- Yellow-faced Honeyeater

Reference survey points (5 most common species)

- Noisy Miner
- Eastern Rosella
- Australian Magpie
- Red Wattlebird
- Tree Martin

These five species comprised 51% of all birds recorded at the impact survey points and 60% at the reference survey points. The total number of birds observed during the surveys varied between 495 at survey point R1, to 169 at survey point R2. Bird diversity was higher at the impact points (54 versus 35 species), but abundance at the two reference points was higher and lower respectively than all six of the impact points.

3.3. Flight Heights

Bird heights for the purpose of this report were classified as below (< 30 metres), at (30–150 metres), and above (> 150 metres) RSA height. Detailed results of the number of birds recorded at the different flight heights are presented in Table 4. Please note there were no birds recorded flying above 150 metres. The raw data are presented in Appendix 1.

Table 3: Summary of birds recorded at the three flight heights

Flight Height	Impact survey points		Reference survey points	
	Number of birds	Percentage of all birds	Number of birds	Percentage of all birds
A (below RSA)	1994	94.8%	647	97.4%
B (at RSA)	109	5.2%	17	2.6%
C (above RSA)	0	0.0%	0	0.0%
Total birds recorded	**2103**	**100**	**664**	**100**

The five most abundant species flying at RSA are detailed below.

Impact survey points

Australian Magpie
Australian Wood Duck
Australian Raven
Wedge-tailed Eagle
Silvereye

Reference survey points

Australian Magpie
Tree Martin
Australian Raven
Silvereye
Galah

These accounted for 4.3% of the total birds observed at impact survey points, and 2.6% at reference survey points.

The distribution of birds flying at RSA heights at each of the survey points was varied. Birds were not prone to flying at RSA heights at one point more than others.

Table 4: Number and height distribution of bird species at survey points during two seasons surveys at White Rock Wind Farm site

	P1			P2			P3			P4			P5			P6			Total Impact Sites			R1			R2			Total Reference Sites			Grand Total
Species	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Australasian Pipit	13																		13												13
Australian Magpie	173	5		19			23	11		29			51			89	13		384	29		35			44	3		79	3		495
Australian Raven	55	6		4				3		1			5	4			5		65	18		8			4	6		12	6		101
Australian Wood Duck													22			95	20		117	20											137
Black-faced Cuckoo-shrike	5			13			11			6			3			11			49			4			5			9			58
Brown Falcon	5									1									6												6
Brown Goshawk				1															1												1
Brown Thornbill				2									5						7						7			7			14
Buff-rumped Thornbill				5									29						34						6			6			40
Common Myna	4																		4												4
Common Starling	20						13									7			40						2			2			42
Crimson Rosella	13			10			35			19			27			47			151			28			8			36			187
Dusky Woodswallow																5			5												5
Eastern Rosella	10			16			33			3			12			19			93			80			6			86			179
Eastern Spinebill							4			2						1			7						1			1			8
Galah	5			2			1												8				1						1		9
Grey Butcherbird				1			2						4			6			13			8			2			10			23
Grey Fantail				8															8						2			2			10
Grey Teal													9			13			22												22
Laughing Kookaburra				2			3						4			3			12			8						8			20
Leaden Flycatcher				1															1												1
Little Raven										3									3			2						2			5
Magpie-lark													4			7			11												11
Mistletoebird				1			9			2			1			2			15			3			1			4			19
Musk Lorikeet				32			2						4			7			45			20			10			30			75
Nankeen Kestrel	8	2			1		2	1		1	2		2			9	3		22	9		2						2			33
Noisy Friarbird	10			5			1			2			11			3			32			2			3			5			37
Noisy Miner							16						3			2			21			108						108			129
Olive-backed Oriole							2												2						1			1			3
Peregrine Falcon								1												1												1
Pheasant Coucal							1												1												1
Pied Currawong				3			15			18	4		5						41	4		10			1			11			56
Rainbow Lorikeet				15			2	2					2						19	2		3						3			24
Red Wattlebird	6			98			65			24			13			49			255			67			13			80			335
Red-browed Finch							2												2												2
Silvereye				20	10		7			12			1						40	10			2						2		52
Spotted Pardalote	1			47			22			19			2			4			95			11			5			16			111
Straw-necked Ibis																	1			1											1
Striated Pardalote	7			3			28			11			8			13			70			21			19			40			110
Striated Thornbill				10															10						6			6			16
Sulphur-crested Cockatoo										1									1			4						4			5
Superb Fairy-wren				10			29			13									52						2			2			54
Tree Martin							5												5			38	5					38	5		48
Varied Sittella				20															20												20
Wedge-tailed Eagle	2	1			1						4						8		2	14											16
Welcome Swallow	1									2			18						21			4			6			10			31

White-browed Scrubwren							10			1									11											11
White-eared Honeyeater				1			10												11											11
White-naped Honeyeater				1						2									3											3
White-throated Needletail													3	1					3	1										4
White-throated Treecreeper				15			2			2									19						1			1			20
White-winged Chough																						17						17			17
Willie Wagtail													1						1						1			1			2
Yellow-faced Honeyeater	4			34			42			15			1			11			107			4			4			8			115
Yellow-rumped Thornbill	4												5						9												9
Yellow-tailed Black Cockatoo													5						5												5
Grand Total	**346**	**14**	**0**	**399**	**12**	**0**	**397**	**18**	**0**	**189**	**10**	**0**	**260**	**5**	**0**	**403**	**50**	**0**	**1994**	**109**	**0**	**487**	**8**	**0**	**160**	**9**	**0**	**647**	**17**	**0**	**2767**

3.4. Threatened Species

The majority of birds found to utilise the proposed wind farm site were common birds. Of the species recorded during the bird utilisation surveys the following species were listed as vulnerable under the *NSW Threatened Species Conservation Act 1995*:

- Dusky Woodswallow- recorded on one occasion during the survey in spring; and
- Varied Sittella- recorded on one occasion during the survey in autumn

The Dusky Woodswallow is listed as Vulnerable in New South Wales under the Threatened Species Conservation (TSC) Act (NSW Scientific Committee 2016). It is a partly migratory species that occurs in spring and summer in dry forest and woodland habitats in south-eastern Australia although some birds may be resident in northern New South Wales (Higgins et al. 2006). The species forages aerially in and around foliage and by sallying and screening and will join flocks of other aerial foragers such a White-browed Woodswallows *Artamus superciliosus* and Welcome Swallows *Hirundo neoxena*; it is known to sometimes forage at "great height" but this has not been quantified (Higgins et al. 2006). It is likely to forage at RSA height, putting it at risk from a collision with a turbine. Nevertheless, given its low frequency of occurrence at White Rock Wind Farm, its regional population would appear to be at little risk from the adverse affects of turbine mortality.

The Varied Sittella is listed as Vulnerable in New South Wales under the Threatened Species Conservation (TSC) Act (NSW Scientific Committee 2016). It is a sedentary species that occupies a territory of approximately 13 to 20 hectares year round. Limited movements beyond this may occur particularly outside the breeding season (Higgins and Peter 2002). A group of 20 individuals was recorded in early March 2017 at the White Rock Wind Farm. Since this is a forest and woodland dweller that forages along the trunks and bark of trees (Higgins and Peter 2002) it is not considered to fly at RSA height regularly. Therefore it is not expected to be at risk from the colliding with operating wind turbines at the proposed wind farm.

3.5. Raptors

Five raptor species were recorded during the surveys, comprising 57 observations in total (Table 5). The presence of these raptors varied between the seasons and generally they were recorded in low numbers. The raw data are presented in Appendix 1.

Nankeen Kestrel was the most abundant raptor species at White Rock Wind Farm with 33 observations (0.01% of all records). It was seen regularly throughout the study area with a small number of Kestrels frequently utilising the White Rock Wind Farm site (16 spring and 17 summer).

The Wedge-tailed Eagle was observed in low numbers (16 observations 0.006% of birds observed). It was often recorded at RSA heights with 87.5% of Wedge-tailed Eagle flights observed at RSA height. The Wedge-tailed Eagle is considered as a vulnerable species to collision with operating turbines because of their soaring habits while foraging.

The number of raptors was low in relation to the total number of birds recorded during the survey. However raptors formed approximately 19% of birds seen at RSA height (Table 5). This was mainly due to the presence of Nankeen Kestrels and Wedge-tailed Eagles in the study area during both spring and autumn. Based on the lower utilisation rate by other raptors at the impact points, risks to them are likely to be low.

3.6. Waterbirds

Three waterbird species were recorded during the surveys, comprising 160 observations in total (6% of all birds). Of these, 137 individuals were Australian Wood Duck (Table 5).

The Australian Wood Duck is a very common farmland waterbird that usually roost along the edges of farm dams and forage in farm dams and open paddocks next to the dams during day and night. They are gregarious birds, known to move and forage in flocks. Flocks of this species were observed at several farm dams throughout the proposed wind farm site. This species was not regularly observed flying at RSA heights.

The remaining waterbirds recorded at impact points were common species, including Grey Teal and Straw-necked Ibis.

The proposed White Rock Wind Farm site contained only a few small farm dams and a low number of natural occurring wetlands. Dams generally lacked aquatic vegetation with bare and trampled edges. Many of the turbines will be placed on higher ridges thus avoiding wetland areas. None of the waterbirds observed at White Rock Wind Farm were threatened species, under either national or state conservation legislation.

Table 5: Raptor and Waterbird species recorded at survey points during two seasons surveys at White Rock Wind Farm

Raptors	Autumn			Spring			Grand Total	Total at RSA	Total Raptor Flights (%)	Flights at RSA (%)	Flights recorded at RSA compared with all bird flights at RSA (%)	Flights recorded at RSA compared with all bird flights observed (%)
	A	B	C	A	B	C						
Nankeen Kestrel	17	0	0	7	9	0	33	9	58	27.3	7.1	0.3
Wedge-tailed Eagle	0	3	0	2	11	0	16	14	28	87.5	11.1	0.5
Brown Falcon	6	0	0	0	0	0	6	0	11	0	0.0	0
Brown Goshawk	0	0	0	1	0	0	1	0	2	0	0.0	0
Peregrine Falcon	0	1	0	0	0	0	1	1	2	100	0.8	0.04
Total raptors	**23**	**4**	**0**	**10**	**20**	**0**	**57**	**24**	**100**	**42.1**	**19.0**	**0.84**
Waterbirds	**A**	**B**	**C**	**A**	**B**	**C**	**Grand Total**	**Total at RSA**	**Total Waterbird Flights (%)**	**Flights at RSA (%)**	**Flights recorded at RSA compared with all bird flights at RSA (%)**	**Flights recorded at RSA compared with all bird flights observed (%)**
Australian Wood Duck	98	20	0	19	0	0	137	20	85.6	12.5	15.9	0.7
Grey Teal	20	0	0	2	0	0	22	0	13.8	0	0.0	0
Straw-necked Ibis	0	1	0	0	0	0	1	1	0.6	0.6	0.8	0.04
Total waterbirds	**118**	**21**	**0**	**21**	**0**	**0**	**160**	**21**	**100**	**13.1**	**16.7**	**0.76**
Total All Birds Observed	**1583**	**97**	**0**	**1058**	**29**	**0**	**2767**	**126**		**16.7**	**100.0**	**1.6**

A= below rotor swept area (RSA) height (<30 m); **B=** at RSA height (30-150 m); **C**= above RSA height (>150 m).

4. CONCLUSIONS

The conclusions from the pre-construction BUS of the White Rock Wind Farm are presented below:

- Survey effort included 1-2 ecologists over 10 survey days in Spring 2016 and Autumn 2017. The survey was undertaken at 12 points and 2,769 observations were recorded;
- The study area is largely made of cleared hilly farmland with scattered remnant trees or small copses and supported a low diversity and abundance of common, predominantly farmland birds;
- The study area supports very few raptors or waterbirds, groups considered vulnerable to collision with operating wind turbines;
- The most abundant raptor was the Nankeen Kestrel (33 observations - 16 spring and 17 summer (0.01% of all records));
- The Wedge-tailed Eagle was observed in low numbers (16 observations, i.e. 0.006% of birds observed). It was often recorded at RSA heights with 87.5% of Wedge-tailed Eagle flights observed at RSA height;
- Waterbirds species accounted for 160 observations (0.06% of all observations) and the Australian Wood Duck accounted for almost 86% of waterbirds recorded;
- Abundance of bird species was higher during autumn due to flocking of bird species including ravens, magpies, starlings, and cockatoos.
- The number of individual birds recorded was higher in autumn (1,680), compared to 1,087 in spring. The lower activity in spring was mainly attributed to birds contracting into woodlands to nest, whereas in autumn there is often a general dispersal of young birds into more open country when exploring for foraging grounds.
- The diversity of birds was similar across seasons with common farmland birds dominating the species list. However, 39 species were recorded in spring, while 46 species were recorded in the autumn survey.
- The list of birds recorded flying at RSA heights differed in the two seasons with higher utilisation rates in spring for raptors observed flying at RSA, with only three non-raptor species recorded flying at RSA in this season. Contrastingly, autumn had a wider diversity of birds flying at RSA, including Australian Magpies and Australian Ravens. The Wedge-tailed Eagle and Nankeen Kestrel dominated the flights at RSA height in spring surveys.
- The utilisation rate of the Wedge-tailed Eagle averaged at 0.040 eagles per hectare per hour average across the two seasons, spring and autumn. The maximum seasonal rate was in spring at 0.065 eagles per hectare per hour.
- The utilisation rate of other raptors and waterbirds was also found to be low, e.g. Nankeen Kestrel, 0.082 birds per hectare per hour and Australian Wood Duck, 0.34 birds per hectare per hour. Other raptors and waterbirds were at lower utilisation rates.
- Due to the identified presence of and moderate risk to the Wedge-tailed Eagle and in accordance with recommendations of the Bird and Bat Management Plan for White

Rock Wind Farm (BL&A 2017), it is recommended any lambing is to be done at least 200 metres away from turbines, to deter any eagles that are scavenging on dead lambs away from turbines. Removal at least weekly of carcasses from within 200 metres of turbines is also required (BL&A 2017). This activity will also help to reduce the number of Wedge-tailed Eagles scavenging near turbines once operations commence.

- Waterbirds were found to be largely confined to farm dams and were in low abundance with the exception of the Australian Wood Duck, which is a common farmland waterbird.
- Two species of threatened birds were recorded utilising the study area. The utilisation rate in the investigation area by these threatened species was found to be low. Therefore the collision risk to threatened species from operating turbines is consequently low.
- The two seasonal surveys adequately described bird life at the proposed wind farm and further pre-construction work is not required.

The pre-construction bird utilisation survey has satisfied the requirement for 'obtaining pre-construction baseline bird (and bat) utilisation data' outlined in Table 11 of the Bird and Bat Adaptive Management Program (BL&A 2017).

This report should be considered together with the Bat Pre-construction surveys (BL&A 2016) that provided additional insights into the utilisation of the site by bats.

5. REFERENCES

Australian Wind Energy Association (AusWEA) 2005, Wind farms and Birds: Interim Standards for Risk Assessment, Report prepared by: Brett Lane and Associates and AIRA Professional Services, Report No. 2003.35(2.2), July 2005.

Brett Lane and Associates (BL&A) 2016, White Rock Wind Farm Stage 1, Bat Pre-construction surveys; BL&A Report 15009 (3.1).

Brett Lane and Associates (BL&A) 2017, White Rock Wind Farm Stage 1, Bird and Bat Adaptive Management Program. BL&A Report 15009 (2.7).

Clean Energy Council 2013, Best Practice Guidelines – for implementation for wind energy projects in Australia.

Appendix 1: Raw data from the bird utilisation surveys

Spring 2016 survey impact points 1 - 3

Site	1												2										3								
Replicate	1		2	3	4	5		6		7	8		1	2	3	4	5		6	7		8	1	2	3	4	5	6	7		8
Species/Height Class	A	B	A	A	A	A	B	A	B	A	A	B	A	A	A	A	A	B	A	A	B	A	A	A	A	A	A	A	A	B	A
Australasian Pipit			1	2		2		1		1	3																				
Australian Magpie	4		7	4	2	1		12		2	16					1	2			1		1	1		2		4	2	4		1
Australian Raven	2	6	2	12	5	2		1			4						2			2											
Black-faced Cuckoo-shrike																	1			2											2
Brown Goshawk															1																
Common Myna				2		2																									
Common Starling				2	1	1				4	1												3		3	1	2	1	2		1
Crimson Rosella				1				2		3					2	3						2					1				
Eastern Rosella										4	2		2	2			4		1	4		3			1	4	5	2	6		8
Eastern Spinebill																												1	1		
Galah										1																	1				
Laughing Kookaburra																1															
Musk Lorikeet															1				2										2		
Nankeen Kestrel	1					1			1	1		1						1						1	1					1	
Noisy Friarbird																	2														
Pied Currawong																									1	1					
Rainbow Lorikeet																											2				
Red Wattlebird										1			4	5	8	4	7		4	5		5	1		1	1	4	4	4		1
Spotted Pardalote													2	1	4	2	2		2	3		1									
Striated Pardalote				1	1	1				3	1		1										3		3	4	5	1	5		6
Superb Fairy-wren																							1	1	1		1	2	2		2
Tree Martin																									2			3			
Wedge-tailed Eagle	1						1			1											1										
Welcome Swallow										1																					
White-naped Honeyeater																				1											
White-throated Treecreeper															1																
Yellow-faced Honeyeater						1				1	1		4	1	3	2	4		3	7		3			1	1	3	1	5		4
Grand Total	8	6	10	24	9	11	1	16	1	23	28	1	13	9	20	13	24	1	12	25	1	15	9	2	16	12	28	17	31	1	25

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 150m.

Spring 2016 survey impact points 4 - 6

Site	4											5								6												Total of all impact points
Replicate	1	2	3		4	5		6		7	8	1	2	3	4	5	6	7	8	1		2		3		4		5	6	7	8	
Species/Height Class	A	A	A	B	A	A	B	A	B	A	A	A	A	A	A	A	A	A	A	A	B	A	B	A	B	A	B	A	A	A	A	
Australasian Pipit																																10
Australian Magpie	2					3		6		4	1	6	3	6		2		1	1	4				5		2		2	6	2	6	129
Australian Raven												2																				40
Australian Wood Duck																						9							5	3	2	19
Black-faced Cuckoo-shrike																		1														6
Brown Goshawk																																1
Brown Thornbill														1																		1
Buff-rumped Thornbill												10	10	2	1	2	1	2	1													29
Common Myna																																4
Common Starling																						2		2				1	1		1	29
Crimson Rosella			1			1							4		2	2	2	2	3	6				4		2			4	4	2	53
Dusky Woodswallow																														5		5
Eastern Rosella		1				1					1	2	2				2			2				4				2	2			67
Eastern Spinebill								1		1																		1				5
Galah																																2
Grey Butcherbird												1						1		2												4
Grey Teal																												1	1			2
Laughing Kookaburra																				1												2
Little Raven											3																					3
Magpie-lark																				2		1						2	2			7
Musk Lorikeet																	1		3	1												10
Nankeen Kestrel				1	1		1						1								1				2							16
Noisy Friarbird								1		1		1	1	1			2			1									2			12
Pied Currawong								2				1	1	1			1															8
Rainbow Lorikeet																																2
Red Wattlebird					1	6		5		6	3	1	2			1		1	1	3				4		1			1		4	99
Silvereye								1					1																			2
Spotted Pardalote	1				1	2		2		1	4																				2	30
Striated Pardalote						1		1			2	4						1	1	5				1		1		1	2	1	2	58
Sulphur-crested Cockatoo			1																													1
Superb Fairy-wren																																10
Tree Martin																																5
Wedge-tailed Eagle									1												4		1		2		1					13
Welcome Swallow					1						1		2		2	2	2	2	8													21
White-naped Honeyeater										2																						3
White-throated Treecreeper																																1
Willie Wagtail																	1															1
Yellow-faced Honeyeater					1	4		2		3	4									2				1				2		2	4	70
Yellow-rumped Thornbill															1																	1
Grand Total	3	1	2	1	5	18	1	21	1	18	19	28	27	11	6	9	12	11	18	29	5	12	1	21	4	6	1	12	26	17	23	781

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 150m.

Spring 2016 survey Reference points

Site	R1										R2								Grand Total
Replicate	1	2	3	4		5	6	7		8	1	2	3	4	5	6	7	8	
Species/Height Class	A	A	A	A	B	A	A	A	B	A	A	A	A	A	A	A	A	A	
Australian Magpie	1		2	4		2				4	6	1	4	3	2	2	2	1	34
Australian Raven													2	1					3
Common Starling													1	1					2
Crimson Rosella	4	2	1	2		2	6	5		2				2			1		27
Eastern Rosella	7	4		11		6	8	4		10					1	2	1	2	56
Galah					1														1
Grey Butcherbird		1					1												2
Laughing Kookaburra	2	1				2	1												6
Little Raven						2													2
Musk Lorikeet			4			1		2										5	12
Noisy Friarbird							1				1								2
Noisy Miner	7	9	8	4		8	12	4		10									62
Pied Currawong	2		1	1		1		2										1	8
Red Wattlebird	5	2	4	4		3	1			6		1						1	27
Silvereye									2										2
Spotted Pardalote						1		1		1									3
Striated Pardalote	2		4	2		3	4	3		3	2	1	1	1	3	3	1	2	35
Welcome Swallow											1							2	3
White-winged Cough				5		3	1	2		6									17
Yellow-faced Honeyeater											1				1				2
Totals	30	19	24	33	1	34	35	23	2	42	11	3	8	8	7	7	5	14	306

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 150m.

Autumn 2017 survey impact points 1 - 3

Site	1									2									3										
Replicate	1	2	3		4	5	6	7	8	1	2	3	4	5		6	7	8	1	2	3	4		5	6	7	8		
Species/Height Class	A	A	A	B	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	B	A	A	B	A	A	A	A	B
Australasian Pipit			1		1			1																					
Australian Magpie	10	4	10	5	25	20	4	14	38		1	1	4	2		2	2	2	3	1	1	2					3	10	
Australian Raven		2	3			15		2	5														1				2		
Black-faced Cuckoo-shrike			1				2		2			2	2			2	2	2	1				2		2	2	2		
Brown Falcon						1	1	2	1																				
Brown Thornbill														2															
Buff-rumped Thornbill																		5											
Common Starling	2		3					6																					
Crimson Rosella	1				3			3			2	1							12	4		12			2	4			
Eastern Rosella			2					2															2			5			
Eastern Spinebill																						1				1			
Galah								2	2					2															
Grey Butcherbird																	1									1		1	
Grey Fantail														3				5											
Laughing Kookaburra																		1		1							2		
Leaden Flycatcher																		1											
Mistletoebird														1						1			1			2	3	2	
Musk Lorikeet											4	6	14	5															
Nankeen Kestrel	1		1			1	2																						
Noisy Friarbird			10								2	1														1			
Noisy Miner																				3					2	5	2	4	
Olive-backed Oriole																			2										
Peregrine Falcon																													1
Pheasant Coucal																									1				
Pied Currawong																1	2					2			1		2	8	
Rainbow Lorikeet												4	4	7									2						
Red Wattlebird			1					2	2		6	10	10	10		6	9	5	6	6		8	10		6	6	2	5	
Red-browed Finch																											2		
Silvereye														20	10							6					1		
Spotted Pardalote			1								1	6	2	16			4	1	2	6		2			2	8		2	
Striated Pardalote														2						1									
Striated Thornbill																		10											
Superb Fairy-wren										5								5		3		8					8		
Varied Sittella														20															
White-browed Scrubwren																						4			2		4		
White-eared Honeyeater													1						4			2		1	2		1		
White-throated Treecreeper											1	3	1	3		2	2	2		1							1		
Yellow-faced Honeyeater									1			2		2				3	4			2	8		4	6		3	
Yellow-rumped Thornbill		2							2																				
Grand Total	14	8	33	5	29	37	9	34	53	5	17	36	38	95	10	13	22	42	34	27	1	27	45	3	21	45	14	44	13

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 150m.

Autumn 2017 survey impact points 4 – 6

Site	4												5										6										Total of all impact points
Replicate	1	2		3	4	5	6		7		8		1	2		3		4	5	6	7	8		1		2		3	4	5	6	8		
Species/Height Class	A	A	B	A	A	A	A	B	A	B	A	B	A	A	B	A	B	A	A	A	A	A	B	A	B	A	B	A	A	A	A	A	B	
Australasian Pipit																																		3
Australian Magpie	3	1		2	1	4					2		5	7		2		2	4	4	4	4		17	5	10		1	18	8	5	3	8	284
Australian Raven				1											3				3				1				5							43
Australian Wood Duck													2								20				20	20		20	8		18	10		118
Black-faced Cuckoo-shrike						1	2		2		1										2									8	3			43
Brown Falcon					1																													6
Brown Thornbill																			2			2												6
Buff-rumped Thornbill																																		5
Common Starling																																		11
Crimson Rosella	4	7		4					2					4		1			4	1	2					2		2	14	2	5			98
Eastern Rosella																2				2		2		4							2	3		26
Eastern Spinebill																																		2
Galah																																		6
Grey Butcherbird																				1	1			1				1	1		1			9
Grey Fantail																																		8
Grey Teal													3					4		2				4						1	2	4		20
Laughing Kookaburra																4															2			10
Leaden Flycatcher																																		1
Magpie-lark																2						2												4
Mistletoebird									2										1									1	1					15
Musk Lorikeet																												6						35
Nankeen Kestrel																					1					1		1	2	1	2	2		15
Noisy Friarbird														4		1						1												20
Noisy Miner																				3								2						21
Olive-backed Oriole																																		2
Peregrine Falcon																																		1
Pheasant Coucal																																		1
Pied Currawong	4	2		1	2		1		6	4										1														37
Rainbow Lorikeet													2																					19
Red Wattlebird							2		1				1	1					1		4			4		4		3	8	3	10	4		156
Red-browed Finch																																		2
Silvereye						6	3		2																									48
Spotted Pardalote				2					4		2											2								2				65
Straw-necked Ibis																									1									1
Striated Pardalote				2					2		3											2												12
Striated Thornbill																																		10
Superb Fairy-wren		2		3			3				5																							42
Varied Sittella																																		20

Site	4												5												6										Total of all impact points
Replicate	1	2		3	4	5	6		7		8		1	2		3		4	5	6	7	8			1		2		3	4	5	6	8		
Species/Height Class	A	A	B	A	A	A	A	B	A	B	A	B	A	A	B	A	B	A	A	A	A	A	B		A	B	A	B	A	A	A	A	A	B	
Wedge-tailed Eagle			1					1				1																							3
White-browed Scrubwren							1																												11
White-eared Honeyeater																																			11
White-throated Needletail																3	1																		4
White-throated Treecreeper						1			1																										18
Yellow-faced Honeyeater						1												1																	37
Yellow-rumped Thornbill														2								2													8
Yellow-tailed Black Cockatoo													2	2							1														5
Grand Total	11	12	1	15	4	13	12	1	22	4	13	1	15	20	3	15	1	7	15	14	35	17	1		30	26	37	5	28	60	26	50	26	8	1322

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 150m.

Autumn 2017 survey reference points

Site	R1									R2									Grand Total
Replicate	1	2	3		4	5	6	7	8	1		2	3	4	5	6		7	8	
Species/Height Class	A	A	A	B	A	A	A	A	A	A	B	A	A	A	A	A	B	A	A	
Australian Magpie			2		2	8	2	6	2	1		2	6		8	1	3	2	3	**48**
Australian Raven		2				2		4			6		1							**15**
Black-faced Cuckoo-shrike			2					2											5	**9**
Brown Thornbill													1			2		4		**7**
Buff-rumped Thornbill																		6		**6**
Crimson Rosella					2		2					2		2					1	**9**
Eastern Rosella		2			6	2	6	12	2											**30**
Eastern Spinebill																		1		**1**
Grey Butcherbird		1			2	1	2					1	1							**8**
Grey Fantail																		1	1	**2**
Laughing Kookaburra									2											**2**
Mistletoebird		1						2							1					**4**
Musk Lorikeet						2	5		6					5						**18**
Nankeen Kestrel	1				1															**2**
Noisy Friarbird						1							2							**3**
Noisy Miner		6	5		5	6	8	10	6											**46**
Olive-backed Oriole																			1	**1**
Pied Currawong		1							2											**3**
Rainbow Lorikeet									3											**3**
Red Wattlebird	2	6	2		12		6	8	6			1	1	1	1			5	2	**53**
Spotted Pardalote		1			2		4		1									4	1	**13**
Striated Pardalote													2					2	1	**5**
Striated Thornbill																		6		**6**
Sulphur-crested Cockatoo		2							2											**4**
Superb Fairy-wren										2										**2**
Tree Martin	18		20	5																**43**
Welcome Swallow	2					2				3										**7**
White-throated Treecreeper										1										**1**
Willie Wagtail																		1		**1**
Yellow-faced Honeyeater					2		2								2					**6**
Grand Total	**23**	**22**	**31**	**5**	**34**	**24**	**37**	**44**	**32**	**7**	**6**	**6**	**14**	**8**	**12**	**3**	**3**	**32**	**15**	**358**

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 150m.

WHITE ROCK WIND FARM
STAGE TWO

PRE-CONSTRUCTION BIRD UTILISATION SURVEY
Autumn 2018

Goldwind Australia

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June 2018

Report No. 15009 (10.0)

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1. INTRODUCTION

White Rock Wind Farm Pty Ltd.engaged Brett Lane & Associates Pty Ltd (BL&A) to undertake pre-construction surveys outlined in the draft Bird and Bat Adaptive Management Program for the White Rock Wind Farm (BL&A 2016). This investigation was commissioned to provide additional baseline data on the pre-construction utilisation of Stage 2 of the wind farm by birds.

The bird utilisation survey (BUS) was undertaken consistent with the requirements of a "Level One" bird risk assessment in accordance with 'Wind Farms and Birds - Interim Standards for Risk Assessment' issued by the Australian Wind Energy Association (AusWEA 2005). This approach has been endorsed in the latest Wind Energy Industry Best Practice Guidelines (Clean Energy Australia 2013).

Two pre-construction bird utilisation surveys were undertaken by experienced zoologists in Spring 2016 and Autumn 2017; to account for seasonal differences in bird activity and presence of species. This report summarises findings of an additional survey in Autumn 2018, which gathered baseline data on bird utilisation in the area impacted by Stage 2 of the wind farm.

This report is divided into the following sections:

Section 2 provides the methods of the bird utilisation survey

Section 3 provides the results of the bird utilisation survey

Section 4 provides the conclusions from the bird utilisation survey.

This investigation was undertaken by a team from BL&A, comprising Ahmad Barati (Field Zoologist), Peter Lansley (Zoologist), Bernard O'Callaghan (Senior Ecologist & Project Manager) and Brett Lane (Principal Consultant).

2. METHODS

2.1. Fixed-point bird count method

The fixed-point bird count method involved an observer stationed at a survey point for 15 minutes. The adequacy of using 15 minutes as an interval to record the presence of birds during bird utilisation surveys was investigated in an earlier study at another wind farm site (Brett Lane and Associates Pty. Ltd., unpublished data). This showed that 82 to 100 percent (average 88 percent) of species actually seen in one hour of surveying were seen in the initial 15 minutes of observation. Based on this result, the period of 15 minutes used in the formal bird utilisation surveys was considered adequate to generate representative data on the bird species in the area during the survey.

The bird utilisation survey was undertaken during from 21st – 28th April 2018. At each survey point, all bird species and numbers of individual birds observed within 200 metres were recorded. The species, the number of birds and the height of the bird when first observed were documented. For species of concern (threatened species, waterbirds and raptors), the minimum and maximum flight heights were recorded.

In this report, rotor swept area (RSA) is defined as the zone encompassing the area of an operating wind turbine within which the blades rotate, defined in terms of an upper "maximum" and lower "minimum" RSA height, and a total circular swept area of the RSA. We understand the turbines proposed for Stage 2 are for turbines with a rotor swept area (RSA) between 30 metres and 200 metres above the ground, with a blade diameter of 170 metres.

Flight height is presented as below, at or above rotor swept area height (RSA height):

- **A =** Below RSA (< 30 metres above ground)
- **B =** At RSA (30 – 200 metres above ground)
- **C =** Above RSA (> 200 metres above ground).

Table 1 indicates when each point was counted on each survey day. This schedule ensured that all points were visited equally at different times of day to allow for time-of-day differences in bird movements and activity. Every survey point (impact and reference) was visited eight times over the survey period (Figure 1).

Table 1: Times when points were counted for each fixed-point bird count survey day

Time	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
7:00			REF		4			
8:00			1				5	
8:30		2	2		3			6
9:00	3	REF*			5			
9:30	4	6					6	1
10:00	3				REF			
10:30					1			
11:00	4	5						2
11:30					2		3	6
12:00				1	5		4	REF
12:30								
13:00		6		2	5		4	6
13:30	1	1		REF			3	REF
14:00	2							3
14:30		4					5	
15:00						2	5	4
15:30		3				1		
16:00	6			4		REF	1	
16:30			3				2	5
17:00							REF	6

* REF refers to the reference point.

2.1.1. Locations of survey points

During this survey period, seven fixed survey points were established; six impact points and one reference point. Impact points were located near proposed turbine locations and the reference point was located at least 400 metres from turbine sites in an area of similar habitat (see Figure 1).

The survey points were distributed (subject to access constraints) across the Stage 2 wind farm site to maximise coverage in areas where wind turbines are proposed to be sited (Figure 1). Impact points were positioned as far as possible on elevated ground, allowing a clear view in all directions.

Table 2 below provides a description of the habitats associated with each impact and reference point.

Table 2 Habitat associated with each survey point

Survey Point	Habitat description
1	Located on top of a plateau along a ridge, near some woodlands in an open area. Some blackberry bushes.
2	Located in a wide flat area, highly fragmented near the road. Scattered trees including a variety of eucalypt species.
3	Close to a valley but in a relatively flat area. One side of the site is a flat, fragmented area but other side verges on relatively dense eucalypt trees. Grassy areas in some parts which is grazed by cattle.
4	Located on the top of a small valley dominated with eucalypts. Some blackberry bushes with mixed native and introduced grasses. Highly fragmented.
5	Located along a ridge close to open woodland. Trees along the east-facing slope, quite open on the west-facing slope. Clear understory.
6	On top of a low plateau; open with a few scattered trees at the edge of the search area. High grass coverage. Some eucalypt woodlands further down the slope but beyond the search area. Grazed by sheep.
REF*	Located near the road, dominated by eucalypt woodland on the sides of the road. Some grassy areas but generally clear understory.

* REF refers to the reference point.

2.2. Incidental observations

In addition to the observations during formalised, fixed-point counts, incidental observations of birds of concern (threatened species, raptors, waterbirds) were made whilst travelling between the fixed points throughout the Stage Two area. Notes were also made on birds observed in remnant woodlands and any early morning and evening roosting movements. Emphasis was placed on observing birds that were moving through the site at RSA height.

2.3. Limitations

These surveys were concentrated in the southern portion of the wind farm where Stage 2 is planned. During the surveys, the main constraints were accessibility to some of the sites and the distance between the sites. Some sites were difficult to access due to the owners' requirements (e.g. site number 6), which required a close collaboration with owners and induced some limitations in terms of timing and schedule. Further, sites 3 and 4 were located in areas that did not have access from the main wind farm road and thus needed extra travelling time to get access via Glen Innes. These issues did not ultimately affect the balanced sampling design which achieved even coverage in the four key periods of the day across all survey sites (see Table 1).

Overall, the utilisation rates and species abundances recorded during the current survey are considered to be representative of the site. They are also considered to provide a sound basis on which to assess the bird impacts associated with the proposed second stage of the White Rock Wind Farm.

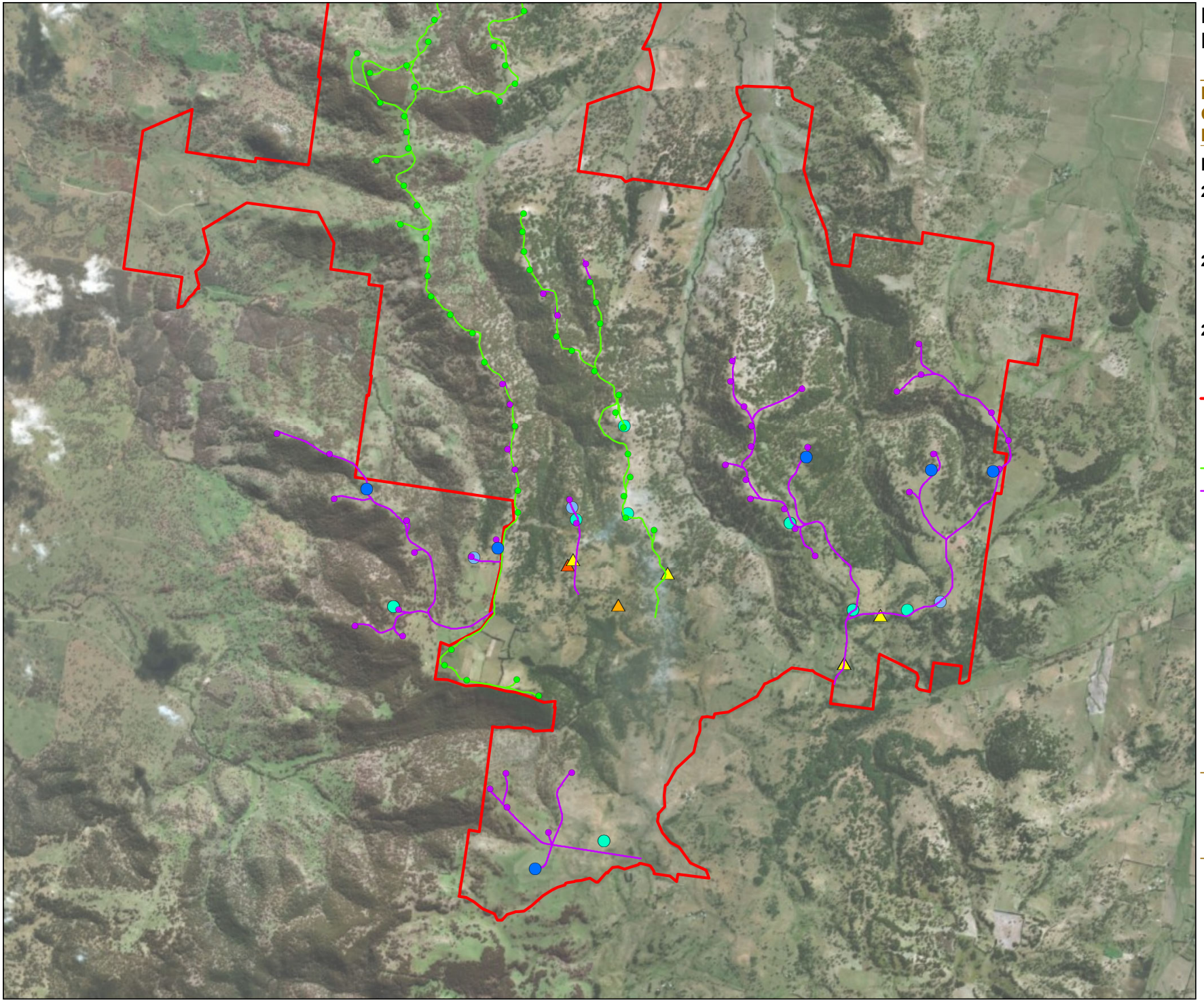

Figure 1: 2016 - 2018 BUS points

Project: White Rock Wind Farm
Client: Goldwind Australia
Date: 5/06/2018

Legend

2018 BUS points
- Reference
- BUS

2017 BUS points
- Reference
- Survey

2016 BUS points
- Reference
- Survey
- Wind Farm boundary
- Phase 1 turbines
- Phase 2 turbines
- Phase 1 tracks
- Phase 2 tracks

N

Metres
0 750 1,500

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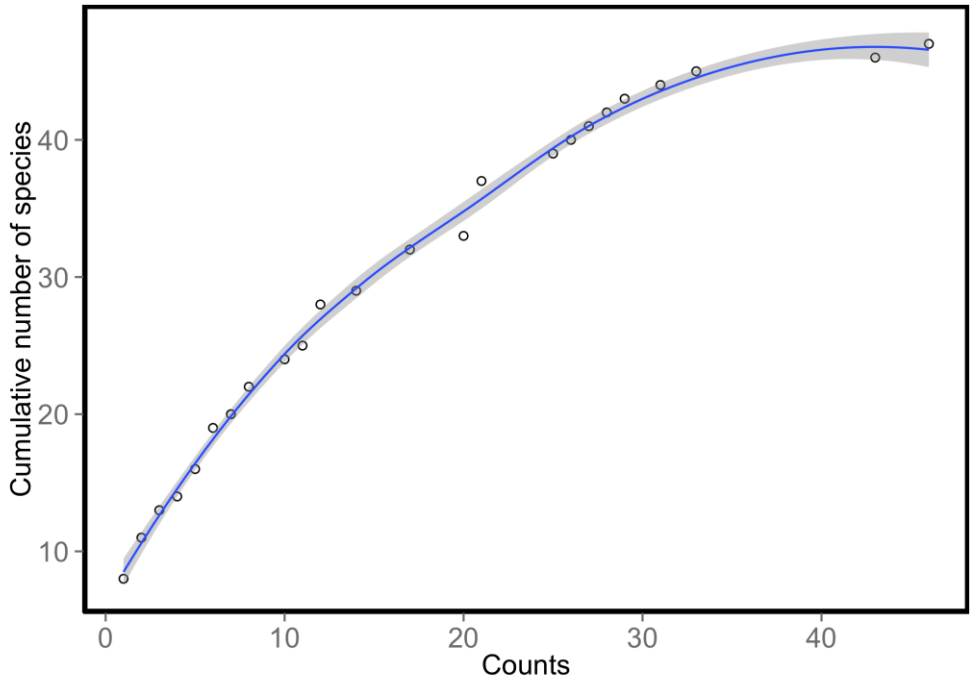
3. RESULTS

3.1. Representativeness of survey

Figure 2 presents the cumulative number of species observed during the survey. Results indicated that the number of new species observed at the wind farm sites was beginning to level off after approximately 35 counts (overall 45 species were recorded), by which time over 95% of species were recorded. This suggested that the surveys collectively provided a representative picture of the diversity and relative abundance of bird species flying over the wind farm site during the survey period.

Figure 2: Cumulative number of bird species recorded



3.2. Species Composition

A total of 45 bird species was recorded during current surveys (Table 3). Of this, all species were recorded at the impact survey points and 15 species were recorded at the reference survey point (Table 3). Bird species that were recorded in this survey are predominantly farmland and woodland species, including some records of raptor and waterbird species. The raw data are presented in Appendix 1.

The five most common species at the impact and reference survey points are presented below.

Impact survey points:

- Australian Magpie
- Noisy Miner
- Red Wattlebird
- Australian Raven
- Superb Fairy-wren

Reference survey points:

- Noisy Miner
- Australian Magpie
- Crimson Rosella
- Laughing Kookaburra
- Eastern Rosella

When all impact and reference points were combined, the most common species recorded during the survey were Australian Magpie, Noisy Miner, Red Wattlebird, Australian Raven and Crimson Rosella. Overall, these five species comprised 46% of all birds recorded at the impact survey points and 60% at the reference survey points. Overall, both bird diversity and abundance were higher at the impact points (45 versus 15 species), reflecting the much larger number and wider geographical spread of such points

3.3. Flight Heights

Birds' flight heights were classified as below 30 meters, between 30 and200 metres, and above 200 meters height above the ground. This corresponds respectively to below, at and above rotor swept area (RSA) height. Detailed results of the number of birds recorded at the different flight heights are presented in Table 4. The raw data are presented in Appendix 1.

Table 3: Summary of birds recorded at the three flight heights

Flight Height	Impact survey points		Reference survey points	
	Number of birds	Percentage of all birds	Number of birds	Percentage of all birds
A (below RSA)	909	94.3%	121	95.2%
B (at RSA)	53	5.5%	6	4.8%
C (above RSA)	1	0.02%	0	0.0%
Total birds recorded	**963**	**100**	**127**	**100**

The five most abundant species flying at RSA are detailed below.

Impact survey points:

- Australian Raven
- Wedge-tailed Eagle
- Nankeen Kestrel

Reference survey points:

- Australian Raven
- Whistling Kite

These accounted for 5.2% of the total birds observed at impact survey points, and 4.8% at reference survey points. The distribution of birds flying at RSA heights at each of the survey points was varied. Birds were not observed flying at RSA heights at one point more than others.

Table 4: Number and height distribution of bird species at survey points at White Rock Wind Farm site

	Site1			Site2			Site3			Site4			Site5			Site6			Total Impact			REF			Grand Total
Species	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Australian Magpie	20			24			49			24			17			38			172			24			**196**
Australian Pipit							2									9			11						**11**
Australian Raven	2	6		2			5				7			4			15		9	32			5		**46**
Australian Wood Duck				15			15			18									48						**48**
Black Kite								2												2					**2**
Black-faced Cuckoo-shrike																2			2						**2**
Brown Falcon				1				1								1			2	1		2			**5**
Common Starling				15			20									122			157						**157**
Crested Pigeon				6			5			2						3			16						**16**
Crimson Rosella	2			9			10			3			3			4			31			23			**54**
Eastern Rosella	10			5			5			5			5						30			6			**36**
Galah				13			5												18						**18**
Grey Butcherbird	2									1			2						5			2			**7**
Grey Shrike-thrush	2																		2						**2**
Laughing Kookaburra	2						3			1			5						11			5			**16**
Little Eagle											1									1					**1**
Magpie-Lark							4												4						**4**
Musk Lorikeet	3						2			5									10			15			**25**
Nankeen Kestrel					2			1			1						7			11			1		**11**
Noisy Friarbird							6			2			1						9						**9**
Noisy Miner	21			8			35			16			18			1			99			28			**127**
Pied Butcherbird							4			2									6			5			**11**
Pied Currawong	3						7												10						**10**
Red Wattlebird	11			11			1			10			8			2			43			4			**47**
Rufous Songlark				2															2						**2**
Rufous Whistler							1						3						4			1			**5**
Scarlet Robin	2																		2						**2**
Silvereye	5									20			10						35						**35**
Speckled Warbler	2																		2						**2**
Spotted Pardalote	1																		1						**1**
Straw-necked Ibis				30			5												35			4			**39**
Striated Pardalote	1																		1						**1**
Sulphur-crested Cockatoo				5															5						**5**
Superb Fairy-wren	3			5			3			10			8						29						**29**
Wedge-tailed Eagle		3									1			5	0		7	1		14	3				**17**
Welcome Swallow				16									5			15			36						**36**
Whistling Kite													2			1			3				1		**4**
White-eared Honeyeater	1																		1						**1**
White-faced heron				1			1												2			1			**3**
White-necked heron				1															1						**1**
White-throated Treecreeper	1												1						2						**2**
Willie Wagtail				5						5									10						**10**
Yellow Robin	2						1			1			1						5						**5**

	Site1			Site2			Site3			Site4			Site5			Site6			Total Impact			REF			Grand Total
Species	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Yellow-rumped Thornbill	23												3						26						**26**
Yellow-tailed Black Cockatoo													2						2						**2**
Grand Total	119	9		174	2		189	4		125	10		94	9	0	198	29	1	899	61	3	120	7		**1090**

3.4. Threatened Species

3.4.1. NSW listed birds

The majority of birds found to utilise the proposed wind farm site were common bird species. Of the species recorded during the bird utilisation surveys the following species were listed as threatened under the *NSW Biodiversity Conservation Act 2016* (BC Act):

- Little Eagle – recorded on one occasion during the survey.
- Scarlet Robin – recorded on two occasions during the survey.
- Speckled Warbler – recorded once during the survey.

The Little Eagle is listed as Vulnerable in New South Wales under the BC Act (NSW Scientific Committee 2016). The main reason for listing Little Eagle as a 'Vulnerable' species is a degradation in the foraging and breeding habitat and secondary poisoning, as well as loss of genetic diversity. The migration and movement patterns of this species are varied in that adult breeding birds are resident but juveniles are dispersive, sometimes over long distances of up to *c.* 2,900 km (Marchant and Higgins 1993, Debus 1998, 2017). Little Eagles nest in eucalypt trees and usually select nest sites in canopy trees located in sheltered sites, often with a southerly aspect (Debus 2017). The Little Eagle was recorded once during the surveys and thus may be an irregular, occasional visitor to the site. It has only been observed once during the regular vantage point monitoring as part of the regular BBAMP implementation. During the surveys, no evidence of old eagle nests has been found.

The Scarlet Robin is listed as Vulnerable in NSW under the BC Act (NSW Scientific Committee 2016). It occurs in a wide distribution from southeast Queensland to South Australia as well as in Tasmania and Western Australia. This species is considered to be partly migratory and inhabits dry eucalypt forest and woodlands, occasionally wet forests and wetlands (Higgins and Peter 2002). During present surveys, it was recorded on two occasions at site number 1. In both cases, the bird was a female at a height of below four meters. This species is considered unlikely to fly at RSA height regularly and is not expected to be at risk from colliding with operating wind turbines at the proposed wind farm.

The Speckled Warbler is listed as Vulnerable in New South Wales under the BC Act (NSW Scientific Committee 2016). The species is found from central Queensland to western Victoria, in dry sclerophyll forest and eucalypt-dominated woodlands with an open grassy or shrubby ground layer, often with high quantities of coarse woody debris. The Speckled Warbler is a ground forager that also nests close to, or on the ground (Higgins and Peter 2002). It is considered very unlikely to fly at RSA height and therefore is at minimal risk from the proposed Stage Two wind turbines.

3.4.2. EPBC listed birds and NSW listed species

Two additional species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been raised as potential species of concern at White Rock Wind Farm.

The **Regent Honeyeater** is listed as Critically Endangered on the EPBC Act and Endangered on the BC Act. This strikingly patterned honeyeater is patchily distributed from south-east Queensland to Victoria, but its known breeding sites are now largely restricted to box-ironbark, and river sheoak and mistletoe woodlands of the inland slopes of the Great Divide – Chiltern (north-east Victoria), Capertee Valley (NSW central tablelands), and

Bundarra-Barraba (NSW north-western slopes). Occasional breeding is known from Warrumbungle National Park, Pilliga Forest, Munghorn Gap Nature Reserve, Hunter Valley, the Central Coast of NSW, and the south-east Queensland granite belt west of Warwick (OEH 2011; DES 2018).

WRWF is therefore within the current distribution, but approximately 75 km north-east of the nearest regular breeding site in the Bundara-Barraba area. The species is known to comprise a single genetic population from which long-distance movements occur (Kvistad et al. 2015) in response to foraging resources (e.g. Franklin et al. 1989).

There were no records of Regent Honeyeater from the near vicinity of Glen Innes and WRWF on the Birdata search (BirdLife Australia 2018) although there is a record from near Emmaville approximately 40 km to the north.

The Regent Honeyeater was not recorded in the study area during the BUS surveys or carcass searches conducted by BL&A from 2015 to 2018, or earlier by RPS (2011) and the species has not been recorded within 40 km of the local area.

Thus, the Regent Honeyeater is not known to occupy the site. Much existing potential habitat at the proposed stage 2 wind farm site is already degraded in that many trees have been removed historically for agricultural purposes. Further habitat removal for this action is expected to be limited (documented elsewhere in the EIS) and would mostly comprise scattered trees. WRWF is not a known breeding site for this species.

The **Swift Parrot** is listed as Critically Endangered under the EPBC Act and Endangered on the BC Act. This rapid flying, colourful parrot breeds in Tasmania and migrates to mainland south-eastern Australia to spend autumn and winter. It mainly inhabits drier forests on the inland slopes of the Great Divide but also in some years (when drought inland) coastal forest such as the central coast of NSW (Higgins 1999). The population was estimated at around 2000 mature birds in 2010 (Garnett et al. 2011).

White Rock Wind Farm (WRWF) is within the current distribution, but there were no records in Birdata (BirdLife Australia 2018) close to WRWF or Glen Innes – the closest are between Armidale and Guyra and north-west of Ashford; these sites are a minimum of 50 km from WRWF.

The Swift Parrot was not recorded in the study area during the BUS surveys or carcass searches conducted by BL&A from 2015 to 2018, or earlier by RPS (2011) and the species has not been recorded within 50 km of the local area. Given this, it would occur very rarely on the WRWF site. Therefore, the action is not expected to lead to a long-term decrease in the size of a population.

3.5. Raptors

Six raptor species were recorded during the surveys, comprising 37 observations (3.8 % of all observations) - see Table 5. The frequency of raptors recorded in this survey varied among different species. Frequency and flight height patterns of raptors are summarised in Table 5.

Nankeen Kestrel and Wedge-tailed Eagle were the most abundant raptor species at White Rock Wind Farm. Nankeen Kestrel was seen regularly throughout the study area and is also the most abundant species during post-construction observations at other parts of the wind farm.

The second most abundant raptor species was the Wedge-tailed Eagle. Some Wedge-tailed Eagle flights were observed at RSA height (Table 5). The Wedge-tailed Eagle is considered

vulnerable to collision with operating turbines because of their soaring habits while foraging. During five months of post-construction carcass searches (November 2017-April 2018), one Wedge-tailed Eagle carcass was found, showing that, although Wedge-tailed Eagle is an abundant species on the project site, the collision rate to-date is not of concern given the large population of this species.

Although raptors comprised only about 3.8% of the total bird numbers recorded. However, raptors formed approximately 47.5% of birds seen at RSA height, making them more vulnerable to collision with wind turbines than other bird groups.

3.6. Waterbirds

Four waterbird species were recorded during the surveys, comprising 91 observations in total (about 4.9% of birds). Of these, 48 individuals were Australian Wood Duck (Table 5).

The Australian Wood Duck is a common farmland waterbird that usually roosts along the edges of farm dams and forages in farm dams and open paddocks next to the dams during both day and night. They are gregarious birds, known to move and forage in flocks. Flocks of this species were observed at several farm dams throughout the proposed wind farm site. This species was not regularly observed flying at RSA heights.

The remaining waterbirds recorded at impact points were common species, including Straw-necked Ibis, and White-necked and White-faced herons.

The proposed second stage of White Rock Wind Farm site contained a few small farm dams and a low number of naturally occurring wetlands. The dams were close to impact points 2,3 and 4. Dams generally lacked aquatic vegetation with bare, stock-trampled edges. Many of the turbines at the second stage of the wind farm will be placed on higher ridges thus avoiding wetland areas. None of the waterbirds observed at White Rock Wind Farm were threatened species, under either national or state conservation legislation. No waterbird was observed flying at RSA height.

Table 5: Raptor and Waterbird species recorded at survey points at White Rock Wind Farm

	Total Impact			Grand Total	Total at RSA	Percntage of total Raptor Flights (%)	Flight at RSA(%)	Flights recorded at RSA compared to all flights observed (%)
Raptors	A	B	C					
Black Kite	0	2	0	2	2	5.4%	100.0	0.21%
Brown Falcon	2	1	0	3	1	8.1%	33.3	0.10%
Little Eagle	0	1	0	1	1	2.7%	100.0	0.10%
Nankeen Kestrel	0	11	0	11	11	29.7%	100.0	1.14%
Wedge-tailed Eagle	0	16		17	16	45.9%	94.1	1.45%
Whistling Kite	3	0	0	3	0	8.1%	0.0	0.00%
Total Raptors	**5**	**31**	**1**	**37**	**31**	**100.0%**	83.4	3.01%
	A	**B**	**C**	**Grand Total**	**Total at RSA**	**Total Waterbird Flights (%)**	**Flight at RSA(%)**	**Flights recorded at RSA compared to all flights observed (%)**
Waterbirds								
Australian Wood Duck	48	0	0	48	0	55.8%	0	0
Straw-necked Ibis	35	0	0	35	0	40.7%	0	0
White-faced heron	2	0	0	2	0	2.3%	0	0
White-necked heron	1	0	0	1	0	1.2%	0	0
Total Waterbirds	**86**	**0**	**0**	**86**	**0**	**100.0%**	0	0
	A	**B**	**C**	**Grand Total**	Total at RSA		Flight at RSA(%)	Flights recorded at RSA compared to all flights observed (%)
Total All Birds	**899**	**63**	**1**	**963**	**63**		6.5%	6.5%

A= below rotor swept area (RSA) height (<30 m); **B=** at RSA height (30-200 m); **C**= above RSA height (>200 m).

4. CONCLUSIONS

The conclusions from the BUS of the White Rock Wind Farm are presented below.

- The wind farm site is largely cleared, hilly farmland with scattered remnant trees or small copses and it supported a low diversity and abundance of common, predominantly farmland and woodland birds.
- Overall, 45 species were recorded in this survey and some species were clearly more abundant that others, including Australian Magpie, Noisy Miner, Red Wattlebird and Australian Raven and Crimson Rosella.
- The diversity of birds that were recorded in this survey is generally similar to the previous survey at the White Rock Wind Farm in 2017. However, the species composition is slightly different between the two surveys probably due to conducting the surveys at different sites across the wind farm.
- The most abundant raptors were Wedge-tailed Eagle and Nankeen Kestrel, comprising 45.9% and 29.7% respectively of all raptor observations during this survey. The mortality monitoring of WRWF Stage 1 to-date (November 2017 and April 2018) has recorded one Wedge-tailed Eagle and the 3 Nankeen Kestrel fatalities. Given that the monitoring is in its first six-months, it is too early to draw conclusions on overall collision risks with turbines. The finding that the Wedge-tailed Eagle and Nankeen Kestrel were the most abundant raptors at White Rock Wind Farm is consistent with previous surveys at White Rock Wind Farm, which were conducted during 2016-2017. These species are both secure from a conservation perspective in the landscape and thus the loss of a few individuals is not of conservation concern.
- The Little Eagle and Black Kite were not recorded regularly but were flying at RSA height. This potentially means that if these species do fly close to turbines, there may be the risk of collision. Their low level of activity indicates a lower risk of collision at the WRWF compared with the other two more abundant raptors.
- The utilisation rate of the Wedge-tailed Eagle in the current survey was 0.113 eagles per hectare per hour.
- The utilisation rate of other raptors and waterbirds was also found to be low, e.g. Nankeen Kestrel, 0.056 birds per hectare per hour and Australian Wood Duck, 0.22 birds per hectare per hour. Other raptors and waterbirds were at lower utilisation rates.
- Due to the identified presence of and moderate risk to the Wedge-tailed Eagle and other raptors, and in line with recommendations of the BBAMP for WRWF (BL&A 2016), lambing is encouraged to be at least 200 metres away from turbines to deter any eagles that are scavenging on dead lambs from approaching turbines.
- The most abundant waterbird species in this survey was Australian Wood Duck, which appeared to be largely confined to farm dams. Other waterbird species were generally in low abundance with the exception of the Straw-necked Ibis, which was sometimes observed in flocks.
- Three species of NSW BC Act-listed threatened birds were recorded utilising the study area.
    - The Little Eagle was recorded once and is considered an irregular visitor to the WRWF. Thus, the collision risk to this listed threatened species from operating turbines is consequently very low.

- Scarlet Robin was recorded on two occasions. The Scarlet Robin typically occurs close to the ground and in the lower branches of trees and thus there is low risk of collision with operating turbines; and
- The Speckled Warbler is a ground forager that also nests close to, or on the ground (Higgins and Peter 2002) so it is considered very unlikely to fly at RSA height and therefore is at minimal risk of collision with operating wind turbines.

5. REFERENCES

Australian Wind Energy Association (AusWEA) 2005, Wind farms and Birds: Interim Standards for Risk Assessment, Report prepared by: Brett Lane and Associates and AIRA Professional Services, Report No. 2003.35 (2.2), July 2005.

Brett Lane and Associates (BL&A) 2016, White Rock Wind Farm Stage 1, Bird and Bat Adaptive Management Program. BL&A Report 15009 (2.6).

Clean Energy Council 2013, Best Practice Guidelines – for implementation for wind energy projects in Australia.

Debus S 1998, *The Birds of Prey of Australia: A Field Guide*, Oxford University Press, Melbourne.

Debus S 2017, *Australasian Eagles and Eagle-like Birds,* CSIRO Publishing, Clayton South, Victoria.

DES (Department of Environment & Science, Qld) 2018, Regent Honeyeater, https://www.ehp.qld.gov.au/wildlife/animals-az/regent_honeyeater.html, viewed 23 May 2018.

Franklin, DC, Menkhorst, PW and Robinson, JL 1989, Ecology of the Regent Honeyeater *Xanthomyza phrygia*, *Emu* 89:140-154.

Higgins, PJ, & Peter, JM (eds) 2002, *Handbook of Australian, New Zealand and Antarctic Birds Vol. 6 Pardalotes to Shrike-thrushes*, Oxford University Press, Melbourne.

Kvistad L, Ingwersen D, Pavlova A, Bull JK, Sunnucks P, 2015, 'Very Low Population Structure in a Highly Mobile and Wide-Ranging Endangered Bird Species.PLoSONE10(12):e0143746.doi:10.1371/ journal.pone.0143746

Marchant S and Higgins PJ (eds) 1993, *Handbook of Australian, New Zealand and Antarctic Birds, Vol. 2 Raptors to Lapwings*, Oxford University Press, Melbourne.

OEH (Office of Environment & Heritage, NSW) 2011, Regent Honeyeater *Anthochaera phrygia* – critically endangered species listing, NSW Scientific Committee final determination, http://www.environment.nsw.gov.au/determinations/regenthoneyeaterFD.htm, viewed 23 May 2018.

Appendix 1: Raw data from the bird utilisation surveys. Autumn 2018 survey impact points 1 – 3

Site	1											2										3											Total of all Ipact Points
Replicate	1	2	3	4		5	6		7	8		1	2	3	4		5	6	7	8		1		2		3	4	5	6	7		8	
Species/Height Class	A	A	A	A	B	A	A	B	A	A	B	A	A	A	A	B	A	A	A	A	B	A	B	A	B	A	A	A	A	A	B	A	
Australian Magpie	5	3	3	3		1	1		2	2		2	5	2	3		5	2	2	3		10		10		3	18	1	2	2		3	**93**
Australian Pipit																								2									**2**
Australian Raven					5	2					1	2												5									**15**
Australian Wood Duck															5			3	5	2									10	5			**30**
Black Kite																							2										**2**
Black-faced Cuckoo-shrike																																	**0**
Brown Falcon														1											1								**2**
Common Starling																	15											10	10				**35**
Crested Pigeon																	1	5										5					**11**
Crimson Rosella										2								1	3	5								5				5	**21**
Eastern Rosella	3		2	5								3							2								5						**20**
Galah												10						3									5						**18**
Grey Butcherbird										2																							**2**
Grey Shrike-thrush		1							1																								**2**
Laughing Kookaburra				1			1															1				2							**5**
Little Eagle																																	**0**
Magpie-Lark																												2		2			**4**
Musk Lorikeet	3																									2							**5**
Nankeen Kestrel																1					1										1		**3**
Noisy Friarbird																						1										5	**6**
Noisy Miner			2	15		2	1		1				3	2				3				10		3		5	5	5	3	2		2	**64**
Nankeen Kestrel																																	**0**
Pied Butcherbird																						2				2							**4**
Pied Currawong			2							1																				4		3	**10**
Red Wattlebird	3	2	2			1	2		1			2	2	1	2		1	2	1										1				**23**
Rufous Songlark															2																		**2**
Rufous Whistler																						1											**1**
Scarlet Robin							1			1																							**2**
Silvereye										5																							**5**
Speckled Warbler		1							1																								**2**
Spotted Pardalote			1																														**1**
Straw-necked Ibis												3	1				10	4	2	10									3			2	**35**
Striated Pardalote			1																														**1**
Sulphur-crested Cockatoo												5																					**5**
Superb Fairy-wren							1			2				3					2			3											**11**
Wedge-tailed Eagle					1			1			1																							**3**
Welcome Swallow													5	6			5																	**16**
Whistling Kite																																	**0**
White-eared Honeyeater						1																											**1**
White-faced Heron															1															1			**2**
White-necked Heron																	1																**1**
White-throated Treecreeper									1																								**1**

Site	1											2										3											Total of all Ipact Points
Replicate	1	2	3	4		5	6		7	8		1	2	3	4		5	6	7	8		1		2		3	4	5	6	7		8	
Species/Height Class	A	A	A	A	B	A	A	B	A	A	B	A	A	A	A	B	A	A	A	A	B	A	B	A	B	A	A	A	A	A	B	A	
Willie Wagtail													3						2														**5**
Yellow Robin				1		1																							1				**3**
Yellow-rumped Thornbill		3							10	10																							**23**
Yellow-tailed Black Cockatoo																																	**0**
Grand Total	14	10	13	25	6	8	7	1	17	25	2	27	19	15	13	1	38	23	19	20	1	28	2	20	1	14	33	29	29	16	1	20	**497**

Notes: A = below RSA height - <30m; B = At RSA height – 30- 200m.

Raw data from the bird utilisation surveys. Autumn 2018 survey impact points 4 – 6 **Notes:** A = below RSA height - <30m; B = At RSA height – 30 – 200m.

Site	4												5											6														Grand Total
Replicate	1		2	3	4		5		6		7	8	1	2		3	4	5	6	7	8			1		2		3		4		5		6	7		8			
Species/Height Class	A	B	A	A	A	B	A	B	A	B	A	A	A	A	B	A	A	A	A	A	A	B	C	A	B	A	B	A	B	A	B	A	B	A	A	B	A	B	C	
Australian Magpie	3		4	3	2		3		5		2	2	2			1	3	2	3	2	4			3		7		3		2				3			20			**79**
Australian Pipit																															3		2	3		1			**9**
Australian Raven		3				3				1					3						1				3							2			5		5		**26**
Australian Wood Duck							5		10			3																											**18**
Black-faced Cuckoo-shrike																															2								**2**
Brown Falcon																											1												**1**
Common Starling																								30		10				20		2			20		40			**122**
Crested Pigeon												2																			3									**5**
Crimson Rosella	3												1	2																	2		2							**10**
Eastern Rosella							2				3		2					3																						**10**
Grey Butcherbird												1					2																							**3**
Laughing Kookaburra											1					2				1	2																			**6**
Little Eagle		1																																					**1**
Musk Lorikeet							5																																**5**
Nankeen Kestrel								1																						1		1			2		2		**7**
Noisy Friarbird											1	1								1																			**3**
Noisy Miner			5	5	3		2					1	3	4		2		2	3	2	2												1						**35**
Nankeen Kestrel																										1													**1**
Pied Butcherbird							2																																**2**
Red Wattlebird			2	3			1		2		1	1		1		1	2		2	1	1												2						**20**
Rufous Whistler														1				1	1																				**3**
Silvereye				10	10														5	5																		**30**
Superb Fairy-wren	3		3		2						2			2			2	1	1		2																		**18**
Wedge-tailed Eagle						1									3							2					2		2		3							1	**14**
Welcome Swallow														5												15														**20**
Whistling Kite																					2														1					**3**
White-throated Treecreeper																					1																			**1**
Willie Wagtail							1		2			2																												**5**
Yellow Robin											1						1																							**2**
Yellow-rumped Thornbill																				3																				**3**
Yellow-tailed Black Cockatoo													2																											**2**
Grand Total	**9**	**4**	**14**	**21**	**17**	**4**	**21**	**1**	**19**	**1**	**11**	**13**	**10**	**15**	**6**	**6**	**10**	**9**	**15**	**15**	**14**	**3**	**0**	**33**	**3**	**32**	**3**	**4**	**2**	**22**	**4**	**12**	**3**	**10**	**24**	**7**	**61**	**7**	**1**	**466**

Raw data from the bird utilisation surveys. Autumn 2018 Reference points **Notes:** A = below RSA height - <30m; B = At RSA height – 30 – 200m.

Replicate	1	2	3	4	5	6	7	8	Grand Total
Species/Height Class		A	A	A	A	A	A	A	
Australian Magpie	3	10	3	5	2		1		**24**
Brown Falcon			1				1		**2**
Crimson Rosella	15	2				2		4	**23**
Eastern Rosella			2			2		2	**6**
Grey Butcherbird					1			1	**2**
Laughing Kookaburra		2		1		1	1		**5**
Musk Lorikeet								15	**15**
Noisy Miner	5	3	10	2	3	1	2	2	**28**
Pied Butcherbird	3		2						**5**
Red Wattlebird					1	2	1		**4**
Rufous Whistler				1					**1**
Straw-necked Ibis	1	2			1				**4**
White-faced heron								1	**1**
Grand Total	**27**	**19**	**18**	**9**	**8**	**8**	**6**	**25**	**120**

Notes: A = below RSA height - <30m; B = At RSA height – 30 – 200m.

APPENDIX I FINAL CREDIT REPORT

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0035/2016/4082MP
Proposal name :	White rock wind farm mod
Assessor name :	Brooke Marshall
Assessor accreditation number :	0035
Tool version :	v4.0
Report created :	25/07/2018 10:07

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
white rock	20.90	BR272_Moderate/Good	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Moderate/Good	Yes	mz1	7.95	72.40	0.00	72.40	473	473	Barking Owl	66.67	3.00	473
white rock	20.90	BR272_Low	Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	Low	No	mz1	0.51	17.19	0.00	17.19	9	0		0.00	0.00	9
white rock	20.90	BR329_Moderate/Good	Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	Moderate/Good	Yes	mz1	61.92	67.21	0.00	67.21	3,445	3,445	Barking Owl	100.00	3.00	3,445
white rock	20.90	BR329_Low	Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	Low	No	mz1	77.70	13.66	0.00	13.66	1,202	0		0.00	0.00	0
white rock	20.90	BR352_Moderate/Good	Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion	Moderate/Good	Yes	mz1	12.33	42.53	0.00	42.53	0	458	Barking Owl	38.89	3.00	458
white rock	20.90	BR269_Low	Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	Low	No	mz1	5.34	13.66	0.00	13.66	83	0		0.00	0.00	0
white rock	20.90	BR269_Moderate/Good	Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	Moderate/Good	Yes	mz1	2.68	71.04	0.00	71.04	157	0		0.00	0.00	157
white rock	20.90	BR194_Moderate/Good	River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	Moderate/Good	Yes	mz1	0.14	41.15	0.00	41.15	0	5	Barking Owl	44.44	3.00	5

BioBanking Credit Calculator

Species credits

Proposal ID :

Proposal name :

Assessor name :

Assessor accreditation number :

Tool version : v4.0

Report created : 25/07/2018 10:07

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
			No					

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 25/07/2018 Time: 10:09:44AM Calculator version: v4.0

Major Project details

Proposal ID:	0035/2016/4082MP
Proposal name:	White rock wind farm mod
Proposal address:	Suite 2, Level 23, 201 Elizabeth Street Sydney NSW 2370
Proponent name:	Goldwind Australia Pty Ltd
Proponent address:	Suite 2, Level 23, 201 Elizabeth Street 1 NSW 2000
Proponent phone:	0499156665
Assessor name:	Brooke Marshall
Assessor address:	1/216 Carp St Bega NSW 2250
Assessor phone:	64928333
Assessor accreditation:	0035

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	8.02	156.79
Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion	8.46	482.46
Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion	139.62	3,445.00
River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	0.14	5.00
Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion	12.33	458.00
Total	168.57	4,547

Credit profiles

1. Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion, (BR269)

Number of ecosystem credits created	157
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion, (BR269) Candlebark - Ribbon Gum grassy woodland of the New England Tableland Bioregion, (BR279) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion, (BR319) Mountain Gum - Ribbon Gum open forest of drainage lines of the southern New England Tableland Bioregion, (BR307)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion, (BR269)

Number of ecosystem credits created	0
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion, (BR269) Candlebark - Ribbon Gum grassy woodland of the New England Tableland Bioregion, (BR279) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion, (BR319) Mountain Gum - Ribbon Gum open forest of drainage lines of the southern New England Tableland Bioregion, (BR307)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion, (BR272)

Number of ecosystem credits created	473
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion, (BR272) Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion, (BR121) Rough-barked Apple - Cabbage Gum grassy woodland of the New England Tableland Bioregion, (BR334) Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion, (BR330)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion, (BR272)

Number of ecosystem credits created	9
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Broad-leaved Stringybark - Blakely's Red Gum grassy woodlands of the New England Tableland Bioregion, (BR121) Blakely's Red Gum - Yellow Box grassy woodland of the New England Tableland Bioregion, (BR272) Rough-barked Apple - Cabbage Gum grassy woodland of the New England Tableland Bioregion, (BR334) Ribbon Gum - Rough-barked Apple - Yellow Box grassy woodland of the New England Tableland Bioregion and NSW North Coast Bioregion, (BR330)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion, (BR329)

Number of ecosystem credits created	3,445
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion, (BR329) Black Sallee grassy woodland of the New England Tableland Bioregion, (BR112) Manna Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tableland Bioregion and NSW North Coast Bioregion, (BR153) Snow Gum - Black Sallee grassy woodland of the New England Tableland Bioregion, (BR218) Snow Gum - New England Peppermint grassy open forest of the New England Tableland Bioregion, (BR220) Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion, (BR269) Candlebark - Ribbon Gum grassy woodland of the New England Tableland Bioregion, (BR279) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion, (BR319) Mountain Gum - Ribbon Gum open forest of drainage lines of the southern New England Tableland Bioregion, (BR307)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion, (BR329)

Number of ecosystem credits created	0
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Black Sallee grassy woodland of the New England Tableland Bioregion, (BR112) Manna Gum - Rough-barked Apple - Yellow Box grassy woodland/open forest of the New England Tableland Bioregion and NSW North Coast Bioregion, (BR153) Snow Gum - Black Sallee grassy woodland of the New England Tableland Bioregion, (BR218) Snow Gum - New England Peppermint grassy open forest of the New England Tableland Bioregion, (BR220) Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion, (BR269) Candlebark - Ribbon Gum grassy woodland of the New England Tableland Bioregion, (BR279) New England Peppermint grassy woodland on sedimentary or basaltic substrates of the New England Tableland Bioregion, (BR319) Ribbon Gum - Mountain Gum - Snow Gum grassy open forest or woodland of the New England Tableland Bioregion, (BR329) Mountain Gum - Ribbon Gum open forest of drainage lines of the southern New England Tableland Bioregion, (BR307)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

7. Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion, (BR352)

Number of ecosystem credits created	458
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
Silvertop Stringybark - Mountain Gum grassy open forest of the New England Tableland Bioregion, (BR352) Broad-leaved Stringybark - Mountain Gum - Apple Box open forest of the New England Tableland Bioregion, (BR122) Broad-leaved Stringybark - Mountain Ribbon Gum - Messmate open forest of the NSW North Coast Bioregion and New England Tableland Bioregion, (BR123) Mountain Gum - Broad-leaved Stringybark shrubby open forest on granites of the New England Tableland Bioregion, (BR158) Narrow-leaved Peppermint - Mountain Ribbon Gum grassy open forest of the eastern New England Tableland Bioregion, (BR165) Narrow-leaved Peppermint - Wattle-leaved Peppermint shrubby open forest of the New England Tableland Bioregion, (BR166) New England Blackbutt grassy open forest of the eastern New England Tableland Bioregion, (BR174) New England stringybarks - peppermint open forest of the New England Tableland Bioregion, (BR177) Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion, (BR309) Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (BR355) Stringybark - Rough-barked Apple - cypress pine shrubby open forest of the eastern Nandewar Bioregion and western New England Tableland Bioregion, (BR361) Youman's Stringybark - Mountain Gum open forest of the western New England Tableland Bioregion, (BR402) Broad-leaved Stringybark shrub/grass open forest of the New England Tableland Bioregion, (BR277) Silvertop Stringybark - Bendemeer White Gum - Ribbon Gum open forest in the Kaputar area of the Nandewar Bioregion, (BR351) Mountain Gum - Blakely's Red Gum open forest on metasediments of the Torrington area of the New England Tableland Bioregion, (BR306) Narrow-leaved Black Peppermint open forest mainly on acid volcanics in the western New England Tableland Bioregion, (BR314)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

8. River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion, (BR194)

Number of ecosystem credits created	5
IBRA sub-region	Glen Innes-Guyra Basalts

Offset options - Plant Community types	Offset options - IBRA sub-regions
River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion, (BR194)	Glen Innes-Guyra Basalts and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

APPENDIX J EXPERT REPORT

Prepared by Phil Spark specific to the potential occurrence of Pale-headed Snake and Booroolong Frog.

NORTH WEST ECOLOGICAL SERVICES

FLORA AND FAUNA SURVEYS
ENVIRONMENTAL MONITORING
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Review of the potential impact of Stage 2 White Rock Wind Farm proposal on the Booroolong Frog and Pale-headed Snake, prepared for NGH Environmental by Phil Spark

Experience to justify review expert status for both species.

Booroolong Frog

I was requested by OEH to be on the expert panel to review this species habitat requirements and conservation status on two occasions.

I am presently working as a consultant to OEH monitoring the Booroolong Frog Saving Our Species project in the Cockburn and Peel catchments.

To varying extents I have surveyed all of the western slopes streams north of Tamworth to the Queensland Border, including the Macintyre River below Paradise to Elsmore and the Severn River above and below Strathbogie. No Booroolong Frogs were recorded at those sites.

I have surveyed all the Atlas records for Booroolong Frogs in the headwater streams in the Namoi River catchment from the lowest known records to the highest records on the Tablelands. I reported the decline of the species in that catchment. I found they are locally extinct at high altitude which was consistent with the high elevation declines documented elsewhere across the species range.

I have done surveys of high elevation streams in the Gwydir catchment where the Booroolong Frog was known to occur and found the same local extinction associated with high altitudes above 800m. The Booroolong Frog is no longer considered to occur in the Gwydir, Macintyre and Severn river catchments.

Pale-headed Snake

I was requested by OEH to be on the expert panel to review this species habitat requirements and conservation status on two occasions.

I surveyed all of the northern tablelands and eastern ranges for the CRA Regional Biodiversity Assessment in the late 1990's and the western slopes and plains for the WRA Regional Biodiversity Assessment 2000 – 2003. No Pale-headed Snakes were recorded for the eastern ranges, tablelands or mid to upper western slopes. All of the locations that I have recorded them are on the lower slopes and plains of the western slopes. Within that area they are present in woodland and open forest remnants of box, ironbark and cypress, and most common in riparian zones associated with large River Red gums.

Description of the study area

The Stage 2 of the White Rock Wind Farm is located on the edge of the Tablelands south west of Glen Innes in the headwaters of the Macintyre and Severn River catchments. The bulk of the works proposed are on the tablelands between 1200m and 1400m.

Fig 1. Regional location of proposed Stage 2 White Rock Wind Farm study area at Maybole

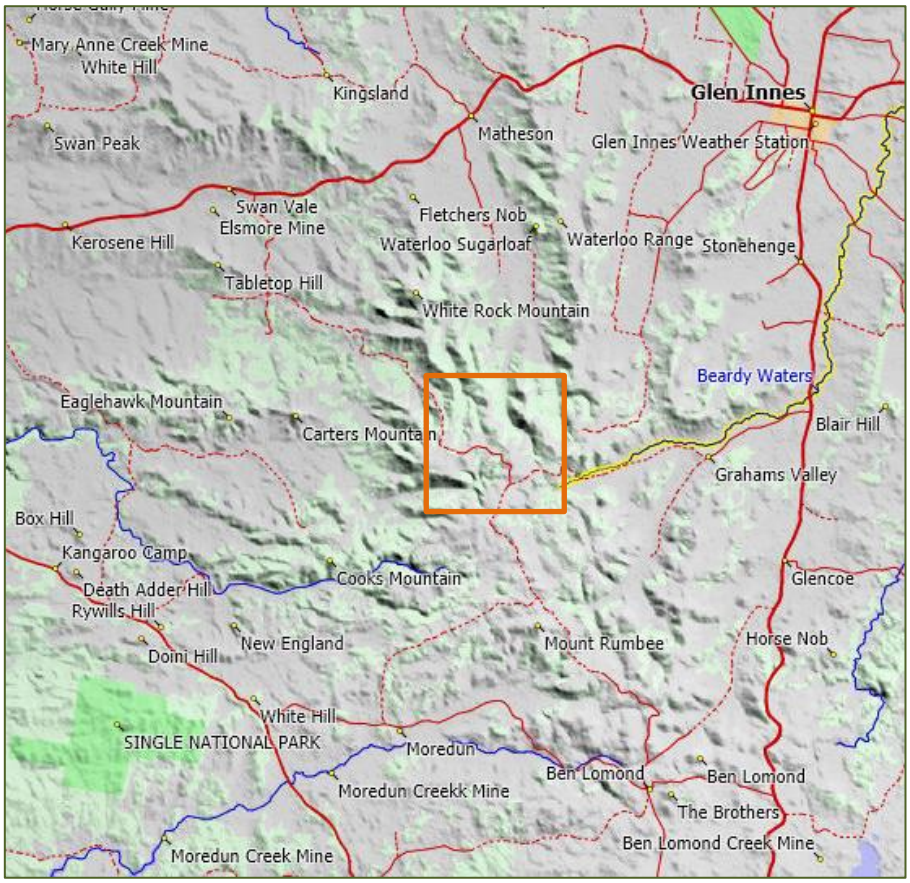
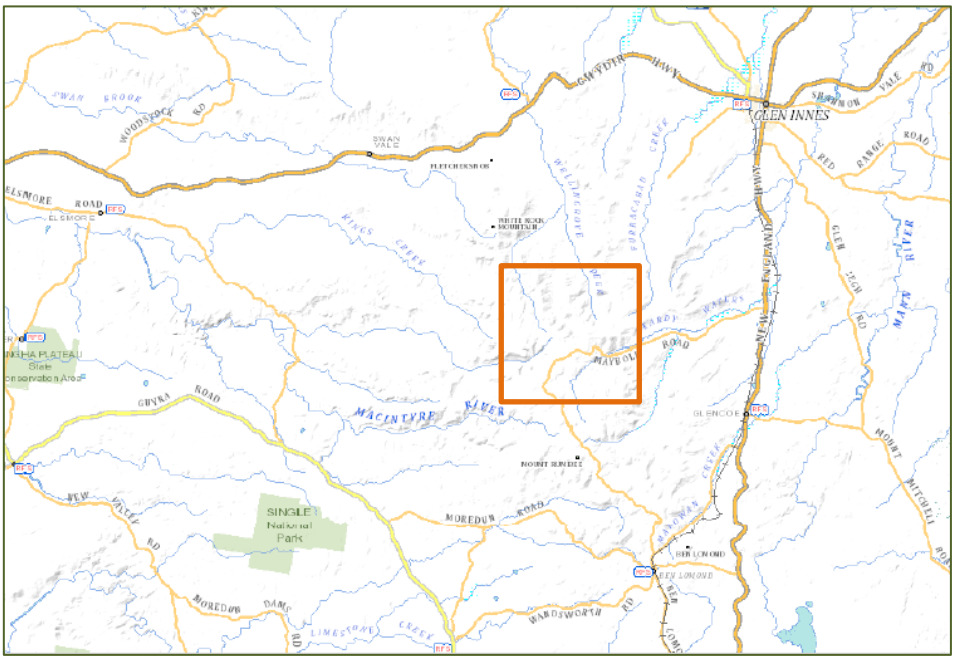
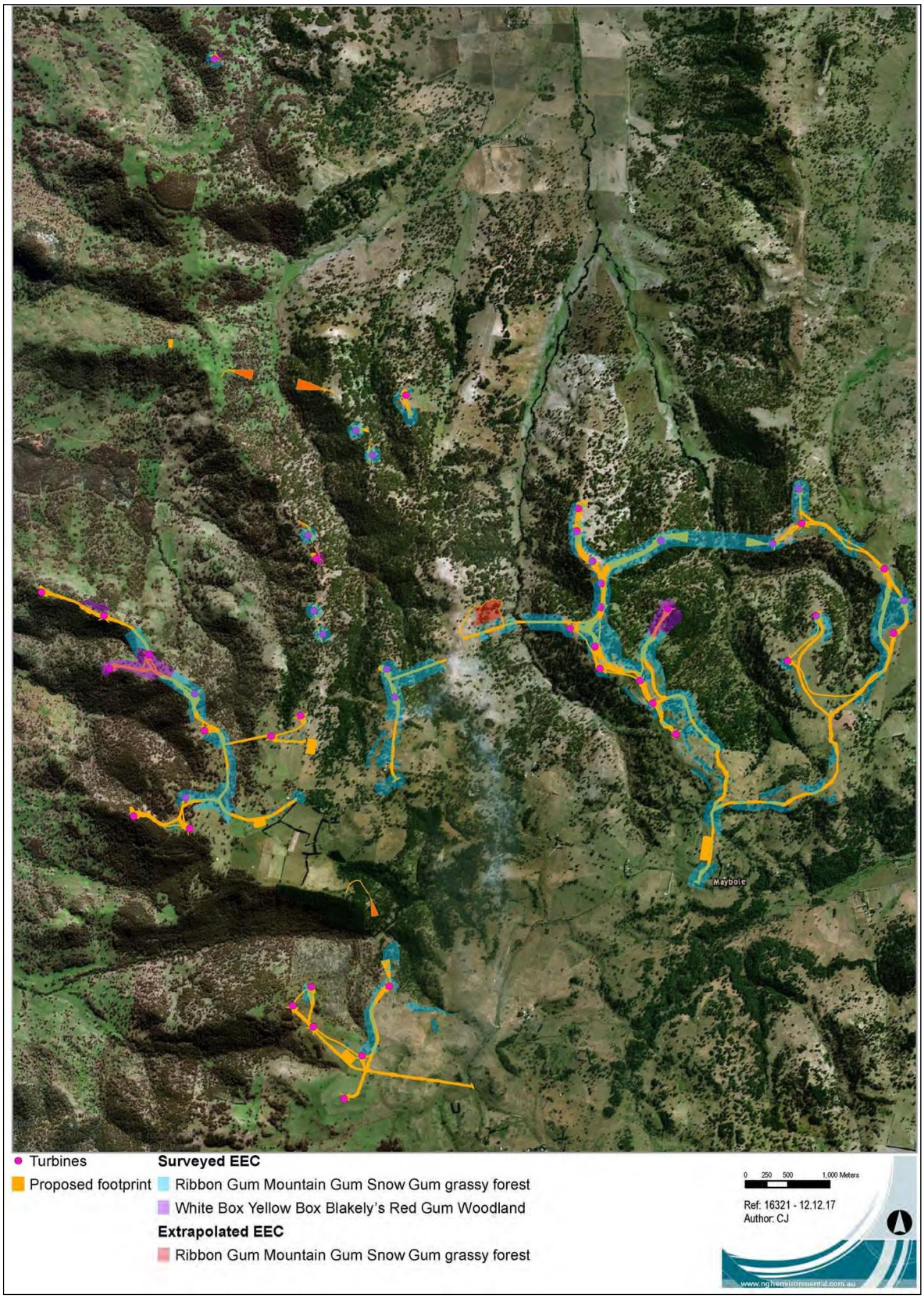


Fig 2. Major rivers and creeks that drain the study area at Maybole



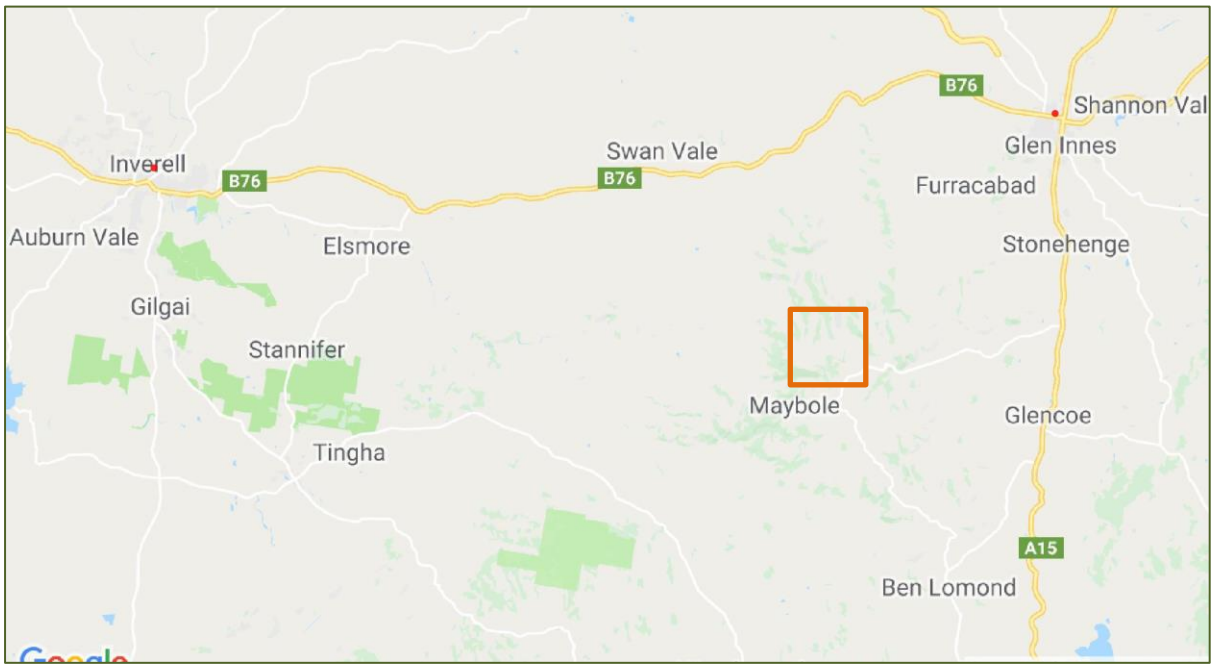
The NGH vegetation map below indicates the location has cold winters with Snow Gum, Ribbon Gum and Black Sallee being the dominant association on the ridge lines.

Fig 3. NGH Map of the study area tower locations, and vegetation communities.



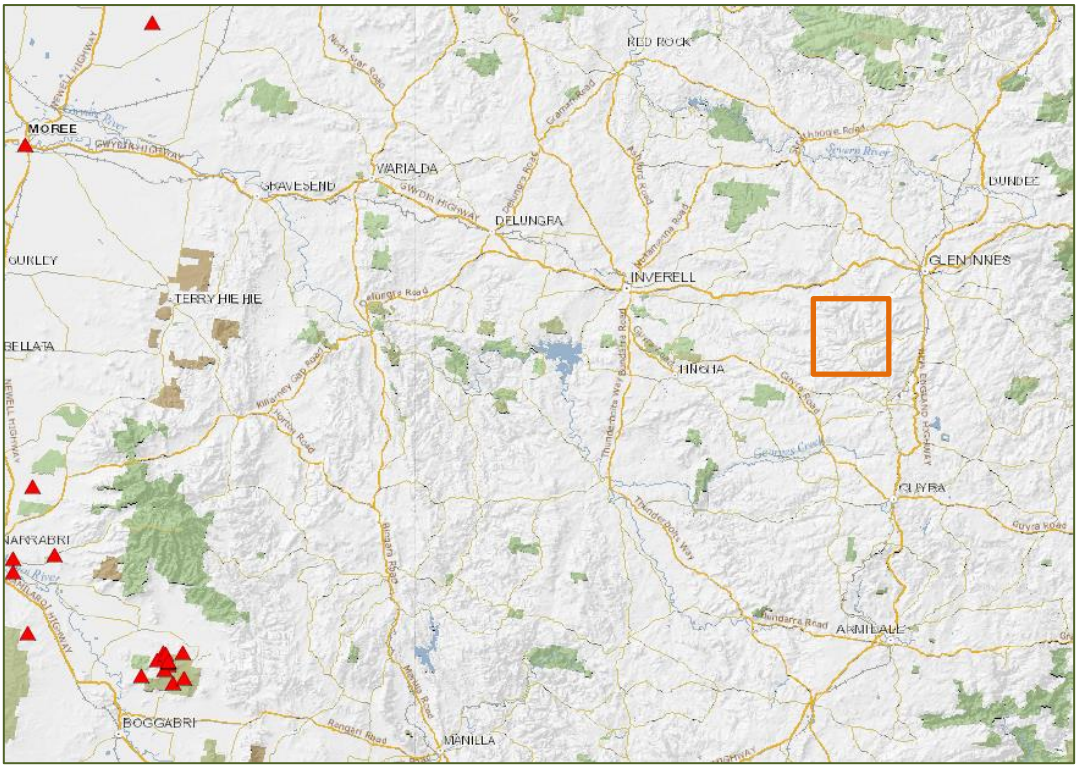
The map below shows two Atlas of Living Australia records of the Pale-headed Snake at Inverell and Glen Innes.

Fig 4. Living Atlas records of Pale-headed Snake – *Hoplocephalus bitorquatus*



The Office of Environment and Heritage have obviously quarantined those two records as they do not show in the Bionet map of Pale-headed Snake records below.

Fig 5. Bionet Atlas records of Pale-headed Snake – *Hoplocephalus bitorquatus*



Should the Pale-headed Snake be considered for potential impact at the study area

According to all my experiences with the Pale-headed Snake it would not occur in the Stage 2 White Rock Wind Farm study area.

As the Bionet records show the snakes preferred habitat is the lower slopes and plains of the North West where it occurs in forest and woodland remnants and riparian zones.

This snake could not cope with the cold climate of the study area; it prefers the temperate climates of the inland plains and coastal regions.

It is highly likely the two records shown for Inverell and Glen Innes were old specimens that were collected elsewhere and sent to the museum for identification without precise locations as was often the case, and often the personal address of the collector was used for the reference location.

Hence there is no need to conduct further surveys during optimal seasonal conditions, and there is no need to consider the Pale-headed Snake in the Biobanking credit calculator.

Should the Booroolong Frog be considered for potential impact at the study area

It is highly likely that prior to 1980 the Booroolong Frog occurred in all the western slopes and tablelands streams, the few record locations in the 1970's indicate they were widespread in that era. Early frog researchers (John De Bavay and Michael Mahoney) indicate that they were often the most commonly recorded frogs along streams.
Unlike other stream frogs the Booroolong Frog appears to be restricted to riparian zones of permanent streams with cobble riffles and rapids. It would not venture away from streams to the ridges like most frogs do out of the breeding season.

Figure 7. NSW Bionet records of Booroolong Frogs shows three locations greater than 100 km from the study area. Two of those locations are old from 1965 to 1974 and the Cockburn River records are recent and 140km away.

Figure 6. Shows the Atlas of Living Australia records for the regions, which appear to be all reputable records with specimens held in the Australian Museum.
The nearest record is at Moredun Creek with no collection date given, but the Collector Witten lodged others in the area in 1972.
The second nearest is at Ben Lomond in 1972
The third nearest is at Swan Vale in 1975
The fourth nearest is at Wandsworth no date given but the same collector Webb lodged others in the area in 1971
The fifth nearest is at Elsmore in 1972
And the sixth nearest is at Swan Brook creek on Kings Plains Road in 1972.

None of those records are since Chytrid infecting the population before 1980.The Elsmore site and the Moredun Creek sites I have revisited, and the Booroolong frogs no longer occur. The extinction at high elevation is typical of what has occurred elsewhere, most likely due to a cooler and moister environment that favoured the growth of Chytrid.

According to all of my experiences with the Booroolong Frog it would not occur at the study area, hence there is no need to conduct further surveys during optimal seasonal conditions, and there is no need to consider the Booroolong Frog in the Biobanking credit calculator.

Fig 6. Living Atlas records of Booroolong Frog – *Litoria booroolongensis* are the scattered red dots across the region. Whereas the Bionet Atlas records below that shows no records for the northern tablelands region, the nearest > 100km away.

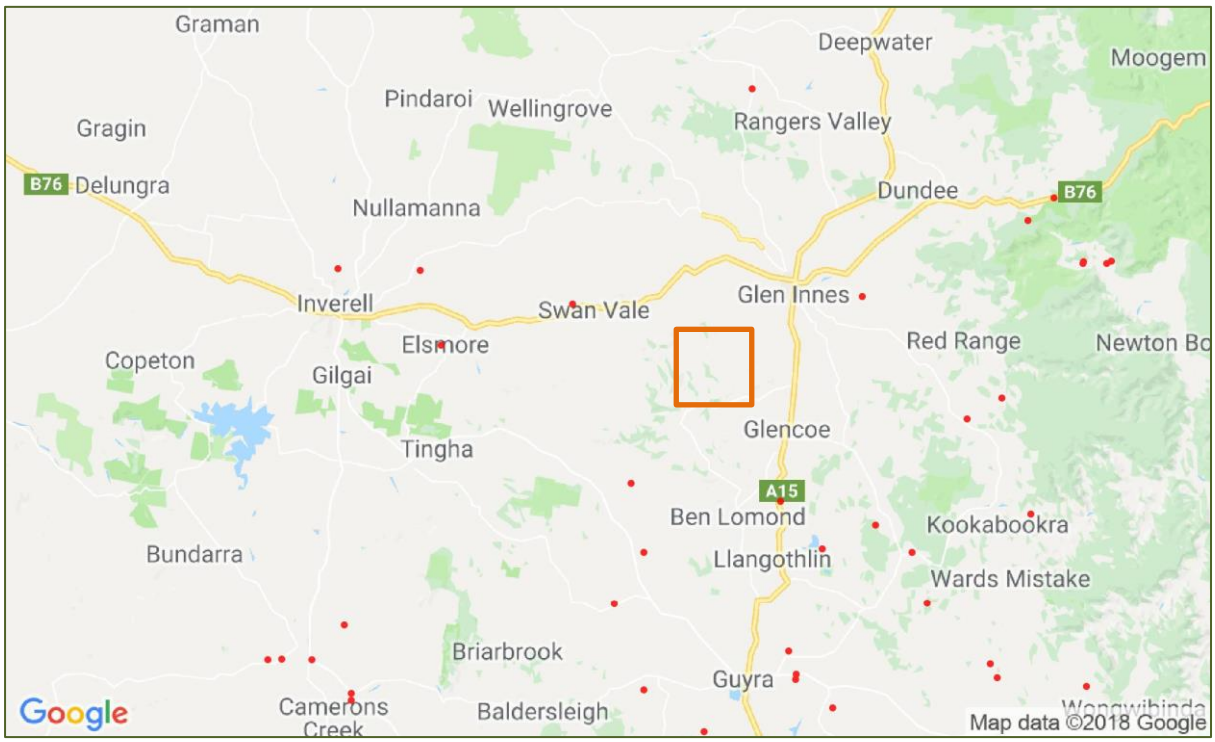


Fig 7. Bionet Atlas records of Booroolong Frog – *Litoria booroolongensis* > 100km away