

Glen Innes

7

Flora and Fauna Issues



7. Flora and Fauna

This chapter of the Environmental Assessment provides:

- a description of the existing ecological characteristics of the Glen Innes Wind Farm locality
- the potential impacts of the project on the flora and fauna
- the controls to be integrated in the project to mitigate the potential impacts

7.1 Introduction

The potential ecological impacts of the wind farm development relate to the construction activities associated with clearing native vegetation and habitat disturbance and the operational impacts that are predominantly associated with potential for avifauna to strike the rotating turbine blades. The assessment of these potential impacts and the significance of any impacts required the input of relevant specialists.

Accordingly, ecology specialists were engaged to assess the potential impact of the project on the natural ecosystems of the area including native vegetation and native fauna and to provide relevant background information to enable informed planning decisions to be made. The specialists were chosen on the basis of their knowledge of the issues presented by wind farm projects and advanced standing in their specialty field.

Kevin Mills and Associates (KMA) was engaged to assess the flora and fauna, excluding bat fauna. A comprehensive field survey was conducted by KMA at the beginning of April, 2007 and relevant databases and literature were also reviewed. A follow-up site visit was undertaken in August 2007 to review changes to the project layout since the April survey.

Greg Richards and Associates (GRA) was engaged to assess bat species. GRA undertook a preliminary desktop assessment for the site in August 2007 based on his considerable knowledge of bat species and extensive database of species distribution. The desktop assessment included a review of habitat of the site based on a set of representative site photos supplied by Connell Wagner. Based on the results of the desktop assessment, on-site monitoring for bat species was recommended and a survey was undertaken in December 2007 when temperatures were suitable for bat species to be active.

As part of the assessments, both ecologists have related their findings to relevant databases and the ecological features of the site. Each specialist completed an assessment report and these are attached as Appendices F & G. The assessments have included the full extent of the site including turbine sites, substation site and possible routes for new access tracks and underground cables. The findings of the assessment reports are summarised in the following sections.

The assessment by KMA was undertaken in accordance with the NSW *Threatened Species Conservation (TSC) Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. In respect of the TSC Act, KMA concluded that:

“the development of the wind farm is not likely to have a significant impact on any threatened species, populations or communities listed under the Threatened Species Conservation Act 1995, or their habitats, and the preparation of a Species Impact Statement (SIS) is not warranted.”

In respect of the EPBC Act, KMA concluded that:

“the development of the wind farm is not likely to have a significant impact on any threatened species, migratory species or communities listed under the EPBC Act, 1999. Referral to the Minister for assessment and approval is therefore not warranted.”

The KMA report (Appendix F) contains a set of recommendations that are aimed at avoiding and limiting the impact on the natural environment. These are especially aimed at protecting the remnant woodland and other important habitats found in the project area. The set of recommendations presented in the KMA Report has been used to prepare the mitigation measures set out at the end of this Chapter. These measures are also incorporated in the Project's 'Statement of Commitments' as set out in Chapter 15.

Based on the 2007 desktop assessment and subsequent survey of the bat fauna present at the site, GRA concluded

“that there would be little likelihood that the proposed wind farm would impact upon bat populations, especially threatened species”.

7.2 Flora

This section draws on the flora information reported by KMA. The flora assessment interpreted the remnant native vegetation on the Waterloo Range as indicating that the large stands of Ribbon Gum *Eucalyptus viminalis* Woodland/Forest once occurred on the basalt of the slopes and ridges while Yellow Box *Eucalyptus melliodora* Woodland/Forest covered the alluvium on the broad valley floors. Additionally, Mountain Gum *Eucalyptus dalrympleana* and New England Peppermint *Eucalyptus neo-anglica* appeared to have also been scattered throughout the area.

Much of the project area has been cleared many years ago. The large areas that have been cleared to create grazing land now include a mixture of native grassland, native pasture and exotic grassland. Nevertheless significant stands of remnant woodland are still present particularly on the steep western slope of Waterloo Range.

The structure of the original vegetation would have included open woodland to woodland, open forest with perhaps areas of savannah woodland in the valleys. The understorey would have been grassland composed of species such as Red-leg Grass *Bothriochloa macra*, Tussock Grass *Poa sieberiana*, Kangaroo Grass *Themeda australis*, Spear-grasses *Austrostipa* spp., Wallaby Grasses *Austrodanthonia* spp. and Weeping Grass *Microlaena stipoides*, with patches of shrubs on rocky slopes.

The following vegetation communities have been listed as endangered ecological communities under the NSW TSC Act:

- Ribbon Gum – Mountain Gum – Snow Gum Grassy Forest/Woodland of the New England Bioregion was listed in 2005.
- White Box – Yellow Box – Blakely's Red Gum Woodland was listed in 2002.

KMA undertook a database review and floristic survey for the project area and its surrounds to identify as many as possible of the native plant species present. The resulting list of species (Appendix F) is comprehensive and includes 106 native plant species and 85 exotic (introduced species). Floristic diversity in the project area is considered to have been significantly reduced due to extensive grazing. Nearby locations that have been subject to less grazing such as the Sinclair Lookout access road reserve, retain a greater diversity due to exclusion of grazing. The former highway alignment also retains a significant corridor of trees on either side of the old roadway but grazing on the adjacent land within the Wattle Vale Travelling Stock Route (TSR) no. 67474 does occur and the grasslands appear there heavily grazed.

The vegetation communities identified in the project area are listed in Table 7.1. These include woodland/forest, rock outcrop scrub, native grassland/pasture and exotic grassland.

The distribution of the remaining stands of forest and woodland relative to the site are shown in Figure 7.1.

Table 7.1 - Vegetation communities of the project area

Community	Key species	Occurrence
Woodland/Forest	<i>Eucalyptus viminalis</i> <i>Eucalyptus melliodora</i> <i>Eucalyptus dalrympleana</i> <i>Eucalyptus ne-anglica</i>	Woodland and forest occur throughout the project area. There are remnants on the hills and in the valleys, forming a mosaic pattern with open grassland.
Rock Outcrop Scrub	<i>Jasminium suavissimum</i> <i>Scutellaria humilis</i> <i>Imperata cylindrica</i> <i>Clematis aristata</i>	A scrubby community occurs on some of the rock outcrops in the area, usually on ridges. This community has sometimes persisted, even though the trees have been removed.
Native Grassland - Native Pasture	<i>Poa sieberiana</i> <i>Austrostipa</i> spp. <i>Microlaena stipoides</i> <i>Bothriochloa macra</i> <i>Austrodanthonia</i> spp.	Grassland with a predominance of native species covers large areas on the northern part of the Waterloo Range. Although native plant species diversity is low, the coverage is usually high.
Exotic Grassland	<i>Phalaris aquatica</i> <i>Paspalum dilatatum</i> <i>Plantago lanceolata</i> <i>Cirsium vulgare</i>	Exotic grassland is common in the valleys and on the ridges in the southern part of the project area.

The quality of the woodland in the project area varies greatly from one location to another. There are good quality stands with a native grassland understorey and a vigorous regeneration of eucalypts and degraded stands with little native ground cover and virtually no regeneration. Most of the grassland in the project area is a mixture of native grassland and native pasture. The condition of the native grassland is highly variable; the best sites have a high diversity and coverage of native plant species and a low number and coverage of exotic species.

Plant species recorded in or near the project area have been listed in Appendix F and include a total of 106 natives and 85 exotics recorded during the site survey. Ten noxious weed species were also recorded in the project area as shown in Table 7.2.

Table 7.2 - Noxious weeds of the project area

Common name	Taxonomic name	Control category ¹
Bathurst Burr	<i>Xanthium spinosum</i>	4
Blackberry	<i>Rubus fruticosus</i> species aggregate	4
Fountain Grass	<i>Pennisetum setaceum</i>	5
Long-style Feather Grass	<i>Pennisetum villosum</i>	4
Mintweed	<i>Salvia reflexa</i>	4
Oxalis	<i>Oxalis articulata</i>	5
Paterson's Curse	<i>Echium plantagineum</i>	4
St. John's Wort	<i>Hypericum perforatum</i>	3
Sweet Briar	<i>Rosa rubiginosa</i>	4
Willow	<i>Salix</i> sp.	5

¹See Appendix F- 4 for an explanation of the control categories.

The vegetation present for each of the wind turbine groups, the substation site and cable and overhead line routes is described in the following sections.

7.2.1 Northern Turbine sites and substation site

The northern turbine sites, T1-T9, stretch from north to south along a ridge over a distance of about 3.5 kilometres of cleared land. The substation is located at the northern end of this group of turbines. Descriptions are provided in Table 7.3.

Table 7.3 - Vegetation associated with the substation and northern group of turbines

Project component and site features	Description of vegetation for site (refer Appendix F – Mills, 2007)
Substation: Cleared flat land covered by native grassland and native pasture. Stands of trees occur around the site.	Characterised by native grasses, particularly Corkscrew Speargrass <i>Stipa scabra</i> and Red-leg Grass <i>Bothriochloa macra</i> , as well as Tussock Grass <i>Poa sieberiana</i> , Kangaroo Grass <i>Themeda australis</i> , Wallaby Grasses <i>Austrodanthonia</i> spp. and Weeping Grass <i>Microlaena stipoides</i> . Forbs are uncommon, but include native Common Woodruff <i>Asperula conferta</i> , Swamp Dock <i>Rumex brownii</i> and Small Crumbweed <i>Chenopodium pumilio</i> , and exotics such as Spear Thistle <i>Cirsium vulgare</i> and Chilean Whitlow Wort <i>Paronychia brasiliiana</i> .
Northern Turbine Group (1 to 9)	
Turbines 1 to 5: Cleared land. A mixture of native grassland and native pasture with exotic plant species and rock outcrops in some places. Occasional Ribbon Gum along access route.	The characteristic native grassland species include Red-leg Grass <i>Bothriochloa macra</i>, Corkscrew Speargrass <i>Stipa scabra</i>, Tall Spear-grass <i>Stipa bigeniculata</i>, Wallaby Grass <i>Danthonia racemosa</i>, Windmill Grass <i>Chloris truncata</i>, Couch Grass <i>Cynodon dactylon</i>, Bluebell <i>Wahlenbergia luteola</i>, Swamp Dock <i>Rumex brownii</i> and Stinging Nettle <i>Urtica incisa</i>. Native plant species diversity is low, but the coverage is generally high. The exotics include Spear Thistle <i>Cirsium vulgare</i>, Ribbed Plantain <i>Plantago lanceolata</i>, Fleabane <i>Conyza</i> sp. and Phalaris <i>Phalaris aquatica</i>. Occasional Ribbon Gum <i>Eucalyptus viminalis</i> trees along the access route between the turbine sites and near the monitoring tower M1 vary in height; some are tall and have occasional small hollows. These will be avoided by the construction works. Rock outcrops in places, for example T2 and T4, and in several locations along the access route. Between T4 and T5, for example, there is a large outcrop of boulders on the western side of the fence. The areas of large rock outcrops support more native plants.
Turbines 6 to 9: Cleared land. Mostly a mixture of native grassland and native pasture with some rocky areas and mature trees nearby.	T6 is characterised by native grasses, for example Spear-grasses <i>Austrostipa</i> spp. and Red-leg Grass <i>Bothriochloa macra</i>, and non-natives such as Spear Thistle <i>Cirsium vulgare</i>. Several large trees occur in close proximity to T6. T7, T8 and T9 are characterised by native species such as Couch Grass <i>Cynodon dactylon</i>, Red-leg Grass <i>Bothriochloa macra</i> and Stinging Nettle <i>Urtica incisa</i>, and exotics such as Phalaris <i>Phalaris aquatica</i>, Spear Thistle <i>Cirsium vulgare</i> and White Clover <i>Trifolium repens</i>. On T7, native Spear-grasses <i>Austrostipa</i> spp. and Saffron Thistle <i>Carthamus lanatus</i> are also common. There are two Ribbon Gum <i>Eucalyptus viminalis</i> trees near T7 on the upper slopes of Ross Hill. Small rocky areas around T8 and T9 support introduced Chilean Whitlow Wort <i>Paronychia brasiliiana</i> and Dwarf Mallow <i>Malva neglecta</i>.

7.2.2 Eastern turbine sites and access tracks

The eastern group of turbines comprising T10 and T20B, T21B and T22B is located on two separate ridges that can be reached by crossing the upper Reddestone Creek Valley from the main range. The exact location of the access route has not yet been defined but extends from the saddle between Turbine sites 9 and 10B to the saddle between Turbine 10 on the northern side and Turbines 20B, 21B and 22B on the southern side.

The final route will be selected after consultation with the landowner and consideration of the practicalities of crossing Reddestone Creek. The route passes through cleared pasture mostly devoid of trees. The eastern end of the route passes through areas having scattered trees and given the spacing of these trees the route can be adjusted to avoid clearing them. Vegetation associated with the eastern group of turbines is shown in Table 7.4.

Table 7.4 – Vegetation associated with the eastern group of turbines

Project component and site features	Description of vegetation for site (refer Appendix F – Mills, 2007)
Access to eastern group of turbines:	Access from the western ridge to the eastern ridge where Turbines 10, 20B, 21B and 22B are located is across the upper part of Reddestone Creek Valley that has been extensively cleared. There are few mature trees except in places for the eastern part of the route. Due to the spacing of these trees it should be possible to select a suitable route that avoids clearing of trees.
Turbine 10: Flat site on top of a knoll surrounded by steep rocky slopes. The site is exotic grassland with woodland surrounding the site. A cleared access route exists but some further track work and clearing is required to negotiate the steep and wooded slopes.	The site comprises exotic grassland with <i>Phalaris aquatica</i>, Stinking Roger <i>Tagetes minuta</i>, Spear Thistle <i>Cirsium vulgare</i> and <i>Brassica</i> sp. Stinging Nettle <i>Urtica incisa</i> and Blackthorn <i>Bursaria spinosa</i> are the main natives; the latter grows in patches here and there. The site is on the edge of Ribbon Gum <i>Eucalyptus viminalis</i> woodland. There are many live and dead trees in the surrounding area. The access route to T10 passes through trees at the foot of the knoll, mostly Ribbon Gums, and then up the side of the knoll. The trees have a shrubby understorey in some places. Turbine site T10 has been included in the assessment but presents a number of challenges in terms of access and may not be developed
Turbines 20B to 22B: Flat sites on top of a knoll. Each site is in cleared grassed areas with surrounding large trees. Access to sites T20B to T22B is via cleared grassland on the northern slope to the ridge. Access between each of the sites is via cleared grassland.	Turbine site T20B has been located on top of the knoll in a cleared grassed area with surrounding large trees. The woodland surrounding site T20B and T21B is dominated by Ribbon Gum <i>Eucalyptus viminalis</i> and thickets of Blackthorn <i>Bursaria spinosa</i>. The woodland at T21B is set further back from the turbine site than for T20B. The access track from T21B to T22B is exotic grassland dominated by <i>Phalaris aquatica</i>. The introduced species on this site also include <i>Brassica</i> sp., Crowsfoot Grass <i>Eleusine indica</i>, Purpletop <i>Verbena bonariensis</i>, Perennial Ryegrass <i>Lolium perenne</i>, Curled Dock <i>Rumex crispus</i> and Spear Thistle <i>Cirsium vulgare</i>. Native species diversity and abundance are low. Stinging Nettle <i>Urtica incisa</i>, Common Sedge <i>Carex inversa</i> and Austral Crane's-bill <i>Geranium solanderi</i> are the main natives. There are about 10 dead trees near T22B, on the eastern side of the hill.

7.2.3 Southern turbine sites and access tracks

The southern group of turbines extends along the western ridge for about 5 kilometres and incorporates several groups of turbines on discrete topographical features. All sites are within cleared land but in some cases the sites are constrained by adjacent remnant woodland. Details of vegetation for the turbine sites and access tracks within the southern group of turbines are provided in Table 7.5.

Table 7.5 – Vegetation associated with the southern group of turbines

Project component and site features	Description of vegetation for site (refer Appendix F – Mills, 2007)
Turbine 10B: Crest of a small ridge supporting exotic grassland with scattered rocky areas.	Prominent exotic species include <i>Phalaris Phalaris sp.</i> , Stinging Nettle <i>Urtica urens</i> , Chilean Whitlow Wort <i>Paronychia brasiliensis</i> , Clover <i>Trifolium sp.</i> , and small herbs such as Wild Sage <i>Salvia verbenaca</i> , Crowfoot <i>Erodium sp.</i> , and Red-flowered Mallow <i>Modiola caroliniana</i> . There are a few natives such as Corkscrew Speargrass <i>Stipa scabra</i> , Kidney-weed <i>Dichondra repens</i> and Swamp Dock <i>Rumex brownii</i> .
Turbine 11: Small cleared area on the end of a ridge. Native pasture. Mature trees nearby. Some rocky areas. Access to this site is through	Native pasture characterised by native Corkscrew Spear-grass <i>Austrostipa scabra</i> , Red-leg Grass <i>Bothriochloa macra</i> , Bluebell <i>Wahlenbergia luteola</i> , Burr-daisy <i>Calotis dentata</i> , Slender Tick-trefoil <i>Desmodium varians</i> , Oxalis <i>Oxalis exilis</i> and Stinging Nettle <i>Urtica incisa</i> , and introduced Chilean Whitlow Wort <i>Paronychia brasiliensis</i> and Spear Thistle <i>Cirsium vulgare</i> . Site is small and to avoid impacting the adjacent woodland vegetation, the hardstand will need to be constrained. Dense Ribbon Gum <i>Eucalyptus viminalis</i> and Yellow Box <i>Eucalyptus melliodora</i> trees occur nearby, to the south-east, along the proposed access route. The understorey to the trees is composed mainly of exotics, although native pasture occurs in some places. There are few shrubs, except on steep ridges. An ecologist should be present when the route to the site is selected and to advise the limits of the hardstand area.
Turbine 11B: Cleared heavily grazed exotic grassland surrounded by trees	Exotic heavily grazed grassland. Exotics included Spear Thistle <i>Cirsium vulgare</i> , Stinging Nettle <i>Urtica urens</i> , Crowfoot <i>Erodium sp.</i> and <i>Melilotus Melilotus sp.</i> , with the native Couch Grass <i>Cynodon dactylon</i> being quite common. Trees in the vicinity of the site are Yellow Box <i>Eucalyptus melliodora</i> and Manna Gum <i>Eucalyptus viminalis</i> .
Turbine 12B: North of a rocky knoll in cleared grazing land	Closely grazed native pasture dominated by native Couch Grass <i>Cynodon dactylon</i> , with Common Woodruff <i>Asperula conferta</i> , Weeping Grass <i>Microlaena stipoides</i> and other natives, and introduced species such as Spear Thistle <i>Cirsium vulgare</i> , Feathertop <i>Pennisetum villosum</i> and Chilean Whitlow Wort <i>Paronychia brasiliensis</i> .
Turbine 12C: Flat cleared site that is closely grazed	The site is flat and in cleared and heavily grazed paddock. A rocky knoll occurs to the north west of the site. The access route from T12B to T12C and then T14B crosses exotic grassland, avoiding treed areas.
Turbine 14B: The site has been moved to the west onto a cleared ridge.	As a result of field investigations, T14 has been moved out of woodland dominated by Yellow Box <i>Eucalyptus melliodora</i> to the cleared land to the west, to location T14B. This area is a heavily grazed paddock dominated by exotic grassland. Some mature trees remain on the ridge and will be avoided in selecting the turbine site.

Project component and site features	Description of vegetation for site (refer Appendix F – Mills, 2007)
Turbine 13: Fairly flat ridge top site that has been closely grazed. Mature trees occur nearby.	Dominated by native Couch Grass <i>Cynodon dactylon</i> . Natives other than Couch Grass are rare, although Red-leg Grass <i>Bothriochloa macra</i> , Weeping Grass <i>Microlaena stipoides</i> and occasional Tree Violet <i>Hymenanchera dentata</i> shrubs are also present. The introduced species on the site include Spear Thistle <i>Cirsium vulgare</i> , Paspalum <i>Paspalum dilatatum</i> and White Clover <i>Trifolium repens</i> . Ribbon Gum <i>Eucalyptus viminalis</i> and Yellow Box <i>Eucalyptus melliodora</i> trees occur nearby.
Turbine 13B: Small flat site at end of ridge. Exotic and native pasture. Trees on slopes adjacent to site.	The site itself supports exotic grassland and some native pasture, dominated by Red-leg Grass <i>Bothriochloa macra</i> . Other plants noted were Stinging Nettle <i>Urtica urens</i> , Crowfoot <i>Erodium</i> sp. and the native Fuzzweed <i>Vittadinia cuneata</i> . Trees on the nearby slopes include Manna Gum <i>Eucalyptus viminalis</i> . Shrubs of Manna Gum <i>Hymenanchera dentata</i> occur here and there.
Access from T14B/13 to Turbine 15: Partly cleared. Route will need to be selected to avoid mature trees.	The route passes through patches of woodland and scattered trees with an understorey of native grassland and native pasture. Exotic ground cover species dominate but natives are common; patches of Red-leg Grass <i>Bothriochloa macra</i> and Weeping Grass <i>Microlaena stipoides</i> occur here and there, especially near the trees.
Turbine 15: Broad flat grassland site to the south of a stand of Ribbon Gum and Yellow Box.	The grassland is native pasture, dominated by tussocks of Poa Tussock <i>Poa sieberiana</i> and Red-leg Grass <i>Bothriochloa macra</i> . Typical exotics include Spear Thistle <i>Cirsium vulgare</i> , Clover <i>Trifolium</i> sp., Perennial Grass <i>Lolium</i> sp. and Ribbed Plantain <i>Plantago lanceolata</i> . The native Corkscrew Speargrass <i>Stipa scabra</i> also occurs.
Access Turbine 15 to Turbines 16B & 16C	This access route is partly on existing track and partly through grassland.
Turbines 16B and 16C: Generally flat hilltop with exotic grassland. One or two turbines may be located here.	The hilltop is characterised by exotic grassland composed largely of introduced species such as Phalaris <i>Phalaris aquatica</i> , Prairie Grass <i>Bromus cartharticus</i> , Chilean Whitlow Wort <i>Paronychia brasiliensis</i> , Buchan Weed <i>Hirschfeldia incana</i> , Spear Thistle <i>Cirsium vulgare</i> and Dwarf Mallow <i>Malva neglecta</i> . Natives such as Wheatgrass <i>Elymus scaber</i> , Wallaby Grass <i>Austrodanthonia racemosa</i> , Stinging Nettle <i>Urtica incisa</i> and Corkscrew Spear-grass <i>Austrostipa scabra</i> are also present. Ribbon Gum <i>Eucalyptus viminalis</i> trees occur nearby on slopes flanking the hilltop.
Access T16 to T17:	Access follows steep slope down from sites T16B and T16C onto grassland area with scattered large trees.
Turbine 17: Flat site on ridge in exotic grassland. Tall Ribbon Gum are scattered through the grassland surrounding the site	Exotic grassland dominated by White Clover <i>Trifolium repens</i> , Spear Thistle <i>Cirsium vulgare</i> , Perennial Ryegrass <i>Lolium perenne</i> , Paspalum <i>Paspalum dilatatum</i> , Prairie Grass <i>Bromus cartharticus</i> , Brassica sp. and Ribbed Plantain <i>Plantago lanceolata</i> . Natives are uncommon, but those present include Red-leg Grass <i>Bothriochloa macra</i> , Tussock Grass <i>Poa sieberiana</i> , Common Woodruff <i>Asperula conferta</i> , Bidgee-widgee <i>Acaena novae-zelandiae</i> , Austral Crane's-bill <i>Geranium solanderi</i> and Fuzzweed <i>Vittadinia cuneata</i> . Tall Ribbon Gum <i>Eucalyptus viminalis</i> trees surround the site.

Project component and site features	Description of vegetation for site (refer Appendix F – Mills, 2007)
Access T17 to 19: Valley and creek crossing. Grassland with scattered trees that can be avoided.	The access crosses a valley with scattered Ribbon Gum <i>Eucalyptus viminalis</i> , Rough-barked Apple <i>Angophora floribunda</i> and New England Peppermint <i>Eucalyptus neo-anglica</i> trees, although the latter is uncommon. The understorey is exotic grassland characterised by natives such as Red-leg Grass <i>Bothriochloa macra</i> and Tussock Grass <i>Poa sieberiana</i> , and introduced species <i>Paspalum dilatatum</i> .
Turbine 19: Ridgetop south of M3. Cleared rocky ridgetop with large trees on slopes flanking the ridgetop.	The site has been moved north, further from monitoring tower M3 and onto the flat cleared ridgetop that has less native species. Characteristic species at this location are Phalaris <i>Phalaris aquatica</i>, Paterson's Curse <i>Echium plantagineum</i>, Saffron Thistle <i>Carthamus lanatus</i>, Spear Thistle <i>Cirsium vulgare</i>, Prairie Grass <i>Bromus cartharticus</i>, Horehound <i>Marrubium vulgare</i>, Wireweed <i>Polygonum aviculare</i>, Dwarf Mallow <i>Malva neglecta</i> and Chilean Whitlow Wort <i>Paronychia brasiliensis</i>. The few natives include Swamp Dock <i>Rumex brownii</i> and Stinging Nettle <i>Urtica incisa</i>. The steep sides of the ridge on which T18 and T19 are located are generally well treed but will not be impacted. However, dead trees are common in this area and where close to turbines these should be cleared to remove roost sites.
Access T19 to T18:	The track from T19 to T18 crosses mainly exotic grassland; the native species found along the route include Red-leg Grass <i>Bothriochloa macra</i> , Windmill Grass <i>Chloris truncata</i> , Purslane <i>Portulaca oleracea</i> , Stinging Nettle <i>Urtica incisa</i> and Weeping Grass <i>Microlaena stipoides</i> .
Turbine 18: Flat narrow cleared ridgetop covered by exotic grassland with trees on steep slopes flanking the ridge top.	Cleared flat ridgetop with thin soils and exotic grassland. The turbine site has been moved south, out of thickets of native shrubs, Tree Violet <i>Hymenanthera dentata</i> and Blackthorn <i>Bursaria spinosa</i>, and further from many large dead trees. Ribbon Gum <i>Eucalyptus viminalis</i> woodland occurs nearby, on the flanking slopes.

7.2.4 Former Gwydir Highway alignment

This proposed access route to the northern end of the project area follows the old Gwydir Highway alignment to the east of Sinclair Lookout. The road is well formed with a rock base and hard surface. A few overhanging trees may need to be pruned back to allow passage of large trucks and equipment during construction. The access route would leave the old highway alignment in the vicinity of the substation site described above. This would mean crossing part of the adjacent Wattle Vale Travelling Stock Route (TSR) for up to 200 metres off a made road to reach the adjacent private land. Inspection of the area found several options for such an access road that largely avoided the need for tree removal. Use of the TSR for access during construction has been approved by the New England Rural Lands Protection Board (RLPB) the custodian of the TSR. Installation of the short section of track from the former roadway to the wind farm site would be undertaken in consultation with the RLPB.

The western end of the TSR contains woodland about 25 metres tall, dominated by Ribbon Gum *Eucalyptus viminalis* occurring with Rough-barked Apple *Angophora floribunda*. A few of the trees are old growth trees with a massive girth and hollows. The understorey is a mixture of native grassland and native pasture composed of native species such as Red-leg Grass *Bothriochloa macra*, Variable Glycine *Glycine tabacina*, Slender Tick-trefoil *Desmodium varians*, Kidney-weed *Dichondra repens* and Tall Ammobium *Ammobium alatum*, and introduced species such as Ribbed Plantain *Plantago lanceolata*, Flatweed *Hypochaeris radicata* and African Lovegrass *Eragrostis curvula*. The understorey is grazed.

7.2.5 Rose Hill access road

An alternative access road to the wind farm is the Rose Hill Road which runs from the Gwydir Highway for a distance of about 2.5 kilometres to the south, as far as the woolsheds on the Rose Hill property. The road is within a wide road reserve. There is a group of Ribbon Gum *Eucalyptus viminalis*, New England Peppermint *Eucalyptus nova-anglica* and Yellow Box *Eucalyptus melliodora* trees at the northern end of Rose Hill Road, some of which may need to be cleared if the road were used by large vehicles during the construction phase.

Native grassland occurs along the first 1.3 kilometres of the route. It is quite diverse, with native species such as Red-leg Grass *Bothriochloa macra*, Tussock Grass *Poa sieberiana*, Kangaroo Grass *Themeda australis*, Common Woodruff *Asperula conferta*, Small St John's Wort *Hypericum gramineum*, Curved Rice-flower *Pimelea curviflora*, Willowherb *Epilobium billardierianum*, Stinking Pennywort *Hydrocotyle laxiflora*, Pink Bindweed *Convolvulus erubescens* and Narrow-leaf New Holland Daisy *Vittadinia muelleri*. The quality of the grassland is variable, the best being along the northernmost 200 metres of the road; after that, there are more and more introduced species and the quality deteriorates.

Further south, exotic species such as Paspalum *Paspalum dilatatum*, Chicory *Cichorium intybus*, Spear Thistle *Cirsium vulgare*, Speargrass *Stipa* sp. and Phalaris *Phalaris aquatica* become more dominant, trees become fewer, and some sections are virtually treeless. Red-leg Grass *Bothriochloa macra* is the most common native along this part of the road.

After passing the woolsheds, the route follows a farm track to the repeater tower near Mt Ross, a distance of about 2.5 kilometres. T1-T6 are to the north, T7-T9 to the south. The track is used by the landowner to access paddocks on the range, Telstra to gain access to the repeater station and surveyors using the Ross Trig Station. Due to its suitable grade and gentle curvature, limited upgrading would involve its widening if large construction vehicles were to access the site via this route.

A possible alternative access route to the southern turbine sites is via Rose Hill Road initially and then a deviation off the farm track, about 500 metres south of the woolsheds. The route heads to the east and then directly south along the valley on the western side of Reddestone Creek for about three kilometres before forking to the west to top of the range providing access to T10B-T19 and to the eastern ridge to T10 and T20-T22. The use of the Reddestone Creek route would require a considerable amount of track development and can be avoided by construction of a short section of road down a steep grade between turbine sites T9 and T10B thereby directly linking the southern and northern groups. Providing the access between T9 and T10B can be developed the alternative Reddestone Creek route will not be required.

7.2.6 Sinclair Lookout access road

Sinclair Lookout Road was also considered as a possible access to the wind farm. It also leads off the southern side of the Gwydir Highway and is a narrow winding unsealed road that leads to a turning circle that represents Sinclair Lookout. The road appears to have little use. The route to the wind farm site, if used, would follow the lower part of the road for a distance of about 750 metres, as far as the sharp bend near the gate to the Wattle Vale Travelling Stock Route (TSR). The route would then enter the TSR or the adjoining farm paddock, and proceed towards the substation site.

Sinclair Lookout Road passes through woodland dominated by Ribbon Gums *Eucalyptus viminalis* about 25 metres tall. Hickory Wattle *Acacia implexa*, Rough-barked Apple *Angophora floribunda* and Native Cherry *Exocarpos cupressiformis* are the other main tree species. There are numerous trees not far from the edge of the road, especially on the sharp bend near the gate into the TSR. A few trees overhang the road.

Except near the very edge of the road, the woodland is in a fairly natural condition; it has a grassy understorey composed almost solely of natives and it contains occasional large trees with hollows. Weeds

such as *Paspalum dilatatum*, Veined Verbena *Verbena rigida*, African Lovegrass *Eragrostis curvula*, Cobbler's Pegs *Bidens pilosa* and Ribbed Plantain *Plantago lanceolata* are common along the edge of the road, where disturbance has occurred, as well as a few natives such as Red-leg Grass *Bothriochloa macra* and Queensland Bluegrass *Dichanthium sericeum*.

The TSR contains woodland about 25 metres tall, dominated by Ribbon Gum *Eucalyptus viminalis* occurring with Rough-barked Apple *Angophora floribunda*. A few of the trees are old growth trees with a massive girth and hollows. The understorey is a mixture of native grassland and native pasture composed of native species such as Red-leg Grass *Bothriochloa macra*, Variable Glycine *Glycine tabacina*, Slender Tick-trefoil *Desmodium varians*, Kidney-weed *Dichondra repens* and Tall Ammobium *Ammobium alatum*, and introduced species such as Ribbed Plantain *Plantago lanceolata*, Flatweed *Hypochaeris radicata* and African Lovegrass *Eragrostis curvula*. The understorey is grazed.

7.2.7 Access from the south east of the project area

The southern part of the wind farm can also be accessed from the Furracabad Valley via Hillside Road which extends across of Waterloo Range to Wellingrove Valley. A review of that access has shown that it is not suitable in its current form for access by long vehicles to the wind farm site. The availability of the access via the former highway alignment and the linkage of the northern group access track to the southern group reduces the need for the access by Hillside Road and the potential for disturbance to rural residents in the western part of Furracabad Valley.

7.3 Fauna

Fauna surveys (excluding bats) were undertaken by Kevin Mills and Associates (KMA) over four days in early April, 2007 during conditions where most animals are active. The survey methods are described in Appendix F and the findings are summarised below.

In addition to the surveys of flora and fauna by KMA, a brochure obtained from the Glen Innes Visitor Information Centre describes birds seen at various locations within the Glen Innes Severn area. One of the locations described in the brochure is Sinclair Lookout that is close the northern end of the wind farm site and some 14 bird species are listed as having been seen from the Lookout. The brochure has been prepared by members of Birds Australia – Northern NSW Group.

Bat fauna were assessed separately by Greg Richards and Associates (GRA) with a desktop bat fauna assessment undertaken in August 2007 and a survey of bat species at the site in December 2007.

7.3.1 Summary of fauna survey methods

KMA undertook a fauna survey from 1st to 4th April 2007 at the same time as the flora survey. The weather was fine and warm with occasional periods of light wind and cloud cover. The survey period was preceded by good spring and summer rains. The fauna survey concentrated on the vertebrate fauna; ie mammals, birds, frogs and reptiles and utilised a range of techniques.

Mammals were identified on sight or sounds and by interpreting evidence of their presence, such as scats, tracks and diggings. As few native mammals occur in open paddocks, the search for mammals focused on woodland and forest.

Birds are identified on sight and by interpreting calls with focus on the following areas:

- woodland and forest (to detect small threatened woodland bird species such as Brown Treecreeper, Diamond Firetail, Hooded Robin and Speckled Warbler)
- the broader landscape, to detect birds of prey wheeling high above the ridges, hills and valleys and birds flying in flocks
- the farm dams where waterfowl tend to congregate

- tree canopies were scanned for stick nests used by birds of prey

Reptile searches were conducted at turbine sites, the substation site and in the vicinity of access tracks where suitable conditions such as in rocky locations as well as incidental observations made elsewhere on the properties.

Moist areas and habitat niches where present, were searched for frogs, especially in rocky locations and near farm dams but habitat was rare.

Targeted surveys and investigations were undertaken for the groups of animals listed above. The list of fauna species recorded during the survey were augmented with records from the NSW Wildlife Atlas, which is maintained by the Department of Environment, Conservation and Climate Change (DECC) to include additional species known to occur within 10 kilometres of the project area.

The bat fauna present at the site was assessed by GRA using echolocation monitoring and analysis and a review of available habitat at the site.

7.3.2 Fauna habitat

The fauna habitats within the project area are typical of the grazing country on the New England Tablelands of New South Wales. They consist of remnant woodland, grassland with occasional trees, occasional rock outcrops, a creek (Reddestone Creek) and minor drainage lines. The habitats are described below:

(i) Remnant woodland/forest

Although extensive clearing has been undertaken on the Waterloo Range to establish grazing land, large areas of remnant woodland and forest still exist. Most of the woodland in the project area is on the steep land to the west of the project area, within parts of the project area and more commonly on the steeper slopes of the range that are less suitable for grazing.

Some of the woodland trees contain hollows that are probably used for breeding purposes; the woodland in the Travelling Stock Route, for example, at the northern end of the site, contains several important habitat trees. Due to the general lack of woodland habitats in the project area, it is an objective of the project to minimise impact on such areas. Where these areas may be impacted by access tracks and turbine siting the actual locations of these facilities will be subject to controls to ensure that the woodland habitat is not significantly impacted.

Shrubs are rare in this landscape. The understorey is almost invariably grassland, for virtually all shrubby areas were cleared many years ago and regrowth has been kept in check by constant grazing. Patches of shrubs have survived in only a few locations, e.g. on T13 and T14 where there are occasional native shrubs, to the north of T18 are thickets of shrubs, and here and there along the access routes between the turbine sites. The lack of a shrub understorey has led to a lack of small birds in this area.

(ii) Grassland with occasional trees

There are large areas of grassland in and around the project area, a mixture of native grassland, native pasture and exotic grassland. Native grassland and native pasture tend to occur as an understorey to the woodland and in areas less likely to have been ploughed, seeded and fertilized. Exotic grassland tends to occur in the broad open valleys; these areas attract few native animals other than kangaroos, because they lack food and provide little shelter.

(iii) Occasional rock outcrops

There are occasional rock outcrops throughout the project area, mostly on top of small knolls. Most of the rock outcrops are minor; there are no really large boulder fields and no rocky cliff lines. No turbines and access tracks have been sited on large rock outcrops, although there are sometimes large rock outcrops nearby, e.g. in the vicinity of T18. Rocky areas are important because they provide potential habitat for reptiles. It is intended that any disturbed rock habitat be relocated nearby in a manner to recreate the reptile habitat.

(iv) Watercourses and drainage lines

Reddestone Creek is the main watercourse in the project area. The creek flows after heavy rain but is mostly dry. Other than Reddestone Creek, there are only minor drainage lines and small farm dams in the project area. Erosion and sediment control measures will be incorporated to avoid impact on the wetland habitat.

7.3.3 Fauna species recorded during surveys

The fauna species recorded during the survey have been listed in Appendix 5 of Appendix F. Eleven (11) mammal species, 55 birds, four reptiles and one frog species were recorded including six introduced mammals and four introduced birds. Several migratory bird species were recorded, although the survey was undertaken fairly late in the summer breeding season. A survey of bat fauna in December 2007 and identified 12 bat species.

The species recorded, and the abundance of some and low numbers of others, is a reflection of the types of habitat available within the project area. Because of the lack of the shrubby habitat, for example, small woodland birds were found to be few in number and few species were recorded. Similarly because the project is in a relatively dry landscape, few frogs, wetland birds and waterbird species were recorded.

Additional fauna species would occur in the project area, especially in the woodland and forest. These would include additional birds, insectivorous bats, possibly a few more arboreal mammal species, reptile species in rocky locations.

Table 7.7 provides a list of the threatened fauna relevant to the Glen Innes Severn Local Government Area and an indication of the likelihood of the particular species to occur within the project area.

7.4 Conservation values of the project area

The species potentially present at the site have been reviewed by KMA (Appendix F) and GRA, (Appendix G1) against various conservation listings under the Threatened Species Conservation Act, 1995 (TSC Act) and the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Mills has also provided details of species recorded during the survey in early April, 2007. Richards, 2008 provides details of 12 bat fauna detected at the site including three listed as vulnerable under the NSW TSC Act. The following sections review the relevance of the listings of threatened flora and fauna, endangered populations and communities and migratory species for the proposed development.

7.4.1 Threatened flora

Threatened plant species are listed on schedules under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the TSC Act, they are classified either as “endangered” (Schedule 1, Part 1), “vulnerable” (Schedule 2) or “presumed extinct” (Schedule 1, Part 4). Under the EPBC Act, they are classified as “extinct”, “critically endangered”, “endangered” or “vulnerable”.

Information on the occurrence of threatened plant species in New South Wales can be obtained from the NSW Wildlife Atlas (DECC). A search of the Wildlife Atlas has revealed that 23 threatened plant species have been recorded in the Glen Innes Severn Local Government Area.

A list of threatened plant species with potential to occur in the project area was prepared and is provided in Appendix F, Table 4.

Of the 23 threatened plant species only three have been recorded within 10 kilometres of the project area as shown in Table 7.6.

Table 7.6 - List of threatened plant species for the project area

Species	Growth habit	Habitat	TSC Act	EPBC Act
<i>Eucalyptus Camphora</i> Subspecies relicta Warra Broad leaved Sally	Tree or mallee to 20 m	Scattered on open swampy flats, north east of Guyra	E	-
<i>Dicanthium Setosum</i> Bluegrass	Erect perennial grass	Woodland and grassland	V	V
<i>Thesium australe</i> Austral Toadflex	Erect perennial herb	Grassland or woodland, often on damp sites	V	V

* V = vulnerable, E = endangered, - = not listed.

A targeted search for these species was undertaken in areas of suitable habitat, but no specimens were found. No threatened plant species were found in the project area and they are unlikely to occur on cleared sites and in areas that have been heavily grazed and/or pasture improved. The occurrence of threatened species in stands of good quality woodland or native grassland cannot be ruled out on the basis of a single survey. As far as possible, areas of remnant woodland will be avoided by the project which will reduce the potential to impact threatened species that may be present.

7.4.2 Threatened fauna

Threatened fauna species are listed on schedules under the New South Wales *Threatened Species Conservation Act, 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). Under the TSC Act, they are classified as "endangered", "vulnerable" or "presumed extinct". Under the EPBC Act, they are classified as "extinct", "critically endangered", "endangered" or "vulnerable".

The NSW Wildlife Atlas indicates that 46 threatened fauna species have been recorded in the Glen Innes Severn LGA. These species have been listed in Table 5 of Appendix F, with their classification under the TSC and EPBC Acts, a note on their preferred habitat and an assessment of the potential for each species to occur in the project area. Only two threatened fauna species, the Koala and Black-necked Stork, have been recorded within 10 kilometres of the project area. Table 7.7 incorporates the information from Table 5 of Appendix F together with information on bat species taken from Appendix G.

No threatened fauna species were recorded in the project area during the April survey by KMA. Based on the results of the habitat assessment and information on the occurrence of threatened species in the local area, KMA concluded that a few could occur there from time to time. These include the Eastern Falsistrelle, Eastern Bentwing-bat and woodland birds such as the Diamond Firetail and Speckled Warbler. GRA identified three vulnerable bat fauna at the site including: the Large-eared Pied Bat, Eastern Falsistrelle and Yellow-bellied Sheathtail Bat.

Table 7. 7 – List of threatened fauna species for the Glen Innes Severn LGA

Species	TSC Act	EPBC Act	Potential to occur in the project area (Low, Medium, High)
Mammals (arboreal)			(See Mills, 2007)
Koala	V	-	Low, but possible , the project area contains potential habitat, however there have been no recent sightings and no evidence of their presence during the survey.
Eastern Pigmy possum	V	-	Low – The habitat of the project area is not particularly suitable. There have only been two records from the entire LGA.
Squirrel Glider	V	-	Low – The habitat of the project area is unsuitable and there have been no local sightings
Yellow-bellied glider	V	-	
Mammals (terrestrial)			(See Mills, 2007)
Brush-tailed phascogale	V	-	Low – Suitable habitat in project area, but only one sighting in entire LGA.
Brush-tailed Rock wallaby	V	-	Low – No suitable habitat in the project area. Known populations are well to the north and south of the site.
Eastern Quoll	E	-	Low – This species is now thought to be extinct on the mainland.
Hastings River Mouse	E	E	Low – No suitable habitat in the project area and records are limited.
Long-nosed potoroo	V	V	Low – No suitable habitat in the project area.
Parma wallaby	V	-	
Red-legged Pademelon	V	-	
Rufous Bettong	V	-	Low – Occurs east of the project area. No local records
Spotted-tail quoll	V	V	Low – Closest records are 12-15km to south. The woodland in the project area provides potential habitat.
Mammals (Bats)			(See Desktop and survey assessments - Richards, 2007/08)
Grey-headed Flying Fox	V	V	Moderate but infrequent – Infrequently expected in the project area when eucalypts are flowering.
Yellow-bellied sheath-tail	V	-	Low - moderate – Detected – Likely presence at large remnants which are mostly clear of the actual turbine sites.
Little Bentwing Bat	V	-	Low – At the edge of the species range. Unsuitable habitat
Eastern (Large) Bentwing Bat	V	-	High – No roosting sites in project area is expected to forage in large remnants near some of the turbine locations
Large-eared Pied Bat	V	V	Low – Detected – Type locality is Inverell. Colonies are usually small and can be found in crevices in cliffs.
Eastern Falsistrelle	V	-	High – Detected Roost in tree hollows in montane habitats. Forages above woodland or forested remnants.
Golden-tipped Bat	V	-	Unlikely – Closest record 70km to the east.
Greater Longeared Bats	V	V	Unlikely – Semi arid species. Nearest records for viable populations are for the Pilliga Scrub well to the west.

Species	TSC Act	EPBC Act	Potential to occur in the project area (Low, Medium, High)
Greater Broadnosed Bat	V	-	Low – Nearest record is 70km to the east.
Birds			(See Mills, 2007)
Australasian Bittern	V	-	Low – There are no suitable habitat in the area.
Black-necked Stork	E	-	
Blue-billed Duck	V	-	
Brown Treecreeper	V	-	Medium. These species all occur in woodland and there are large areas of suitable habitat, although the understorey is lacking in most places.
Diamond Firetail	V	-	
Speckled Warbler	V	-	
Regent Honeyeater	E	E	
Turquoise Parrot	V	-	
Olive Whistler	V	-	Low – Habitat is not particularly suitable.
Red Goshawk	E	V	Unlikely – Very rare and not likely to occur in the area
Square-tailed Kite	V	-	Low – Could occur in the area and nest there.
Glossy Black-Cockatoo	V	-	Low – There are no casuarinas in the project area.
Rose-crowned Fruit-Dove	V	-	Low – There is no suitable habitat in the area
Wompoo Fruit-Dove	V	-	
Rufous Scrub-bird	V	-	
Reptiles			(See Mills, 2007)
White-crowned Snake	V	-	Low – The species is not expected this far inland.
Stephens' Banded Snake	V	-	Low - There is no suitable habitat in the area
Amphibians			(See Mills, 2007)
Giant Barred Frog	E	E	Low - No suitable habitat in the project area
Glandular Frog	V	-	
Loveridge's Frog	E	-	
Peppered Frog	V	V	
Pouched Frog	V	-	
Stuttering Frog	E	V	
Sphagnum Frog	V	-	
+ V = vulnerable, E = endangered, CE = critically endangered, - = not listed.			

7.4.3 Migratory species

In addition to threatened species, the EPBC Act allows for the listing of internationally protected migratory species, i.e. species listed under the Japan - Australia Migratory Bird Agreement (JAMBA), the China - Australia Migratory Bird Agreement (CAMBA) and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Many common Australian birds have been listed as internationally protected migratory species under the EPBC Act, including all waders, ducks and diurnal birds of prey. Many internationally protected migratory species occur in the Glen Innes Severn LGA. A few were recorded in the vicinity of the project area during this study, e.g. the Australian Wood Duck, Pacific Black Duck, Black-shouldered Kite and Nankeen Kestrel.

7.4.4 Endangered populations

Endangered populations are listed under the TSC Act (Schedule 1, Part 2). The population of Tusked Frog in the Nandewar and New England Tableland has been listed as an endangered population. Tusked Frogs live in rainforest, wet sclerophyll forest and grasslands, usually under logs, rock and leaf litter near streams. This species would not occur in the project area; there is no suitable habitat.

7.4.5 Endangered ecological communities

Endangered ecological communities are listed under the TSC Act (Schedule 1, Part 3) and the EPBC Act. Virtually all of the remnant woodland in the project area is endangered.

Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland and White Box - Yellow Box - Blakely's Red Gum Woodland are both endangered ecological communities under the TSC Act. The latter community is also endangered under the EPBC Act, where it is referred to as White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

7.5 Impact of the proposal on flora and fauna

7.5.1 Summary of potential impact on native vegetation and fauna habitat

The development of the Glen Innes Wind Farm will involve clearing some areas of native vegetation and fauna habitat here and there across the five rural properties on which the project is to be located. No large scale clearing will be undertaken.

Clearing will be undertaken for the following purposes:

- to accommodate up to 27 wind turbines and provide a work area for the construction of each turbine
- to create a site for the substation and provide a works depot during the construction phase
- to establish access tracks to the turbines and to bury the cables linking the turbines

Most of the native vegetation to be cleared is grassland, a mixture of native grassland, native pasture and exotic grassland. The wind farm has been designed to avoid woodland and forest as much as possible, for this is where the biodiversity of the area is concentrated; however, some small areas of woodland/forest and scattered native trees will be removed. Rock outcrops have also been avoided, wherever possible, to protect reptile habitat. However, some small rocky areas will need to be disturbed and in these cases the habitat will be relocated.

Most of the wind farm components i.e. the turbines, substation and access routes will be sited on cleared land covered by a mixture of grassland types, including native grassland; however, there is no good quality grassland on any of the sites. Following assessment of the project area, KMA reported that the best native

grassland in the project area is along the northernmost 200 metres of Rose Hill Road although, even there, the floristic diversity of the native species is quite low and exotics are common. While Rose Hill Road was originally proposed as the main access to the site it has been replaced by the former highway alignment.

The footprint of the Glen Innes Wind Farm is relatively small, given the extent of the project and the large area over which it is dispersed. This is mainly because existing farm tracks are to be utilized for access purposes wherever possible and, elsewhere, the shortest possible routes have been selected to minimise clearing.

KMA considered that the amount of native vegetation and habitat to be cleared for the development of the wind farm to be negligible in a micro, local and regional context, and the impact on flora and fauna is expected to be correspondingly small. Nevertheless, various strategies were recommended to be implemented to further reduce the impact on flora and fauna. These have been addressed by the mitigation measures presented in Section 7.6.

7.5.2 Impact of blade-strike on birds

Wind farm developments in Europe, North America and more recently in Australia have been found to affect birds and it is expected that some birds will be impacted by the Glen Innes Wind Farm development. Impacts on birds may arise either from collisions by birds with operating wind turbines (referred to as blade-strike) or by disturbance of their natural habitat. This section of the Environmental Assessment deals the significance of blade-strike on bird species within the vicinity of the Glen Innes Wind Farm Project.

Although the overall impact of blade-strike on birds in Australia is thought to be generally low, Australian wind farms have had only a short history of operation, few large wind farms have yet been established and monitoring has not been carried out over a long period. Studies accurately predicting the impact of blade-strike on birds are limited. Additionally circumstances may vary significantly between individual wind farm sites so that each site must be assessed separately.

The development of wind farms along the southern coast of mainland Australia and in Tasmania has raised the issue of impacts on the endangered Orange Bellied Parrot which has a very small population that with further adverse impact could become extinct. As such the impact of wind farms on the Orange Bellied Parrots is a key issue for wind farms within the extent of that species.

Coastal areas also often have higher numbers of shorebirds and migrating species that can raise the potential for incidences of blade-strike. Surveys undertaken in Victoria along the southern coast line have detected incidences of blade-strike but these are statistically assessed as being of low magnitude. However, at the Woolnorth Wind Farm in Tasmania, 20 birds were killed by blade-strike during the first 14 months of operation (URS 2004).

In NSW, there is limited data on blade strike. The available data principally relates to the Crookwell and Blayney wind farms that involve 8 and 15 wind turbines respectively. Both sites were expected to have low incidences of blade strike. In the case of the Crookwell Wind Farm, no dead or injured birds or bats were found during surveys at selected turbine sites between August 1998 and January 1999 (PPI Environmental Services 1999). Similarly, a study of local bat populations before and after the Crookwell Wind Farm commissioning did not identify any decline in bat populations (Richards 1999). Monitoring at Blayney Wind Farm, following its commissioning, did not identify any incidences of dead or injured bats or birds.

The significance of the blade-strike issue at any site is dependent on a number of factors, including:

- the extent of the wind farm and its layout, number of turbines, size of the turbines, swept area for the turbine blades and whether or not lighting occurs on the turbines
- the habitat at the site and the species that are likely to inhabit the site or to pass through it

- whether the species is likely to fly within the zone swept by the turbine blades and any risk behaviours of the birds
- the conservation status of species present
- the mitigation measures to be applied to reduce potential for blade-strike
- weather conditions

The Australian Wind Energy Association publication (AusWEA, 2005) in its publication, "*Wind Farms and Birds: Interim Standards for Risk Assessment*" sets out a systematic and structured approach to the assessment of bird risk at individual wind farms. A hierarchy of studies has been identified involving three levels where the degree of investigation is increased in response to a lower level indicating a risk of significant impact on birds and necessitating further studies to be undertaken.

KMA has considered the potential impact on birds at the site by observing the species present and considering species that while not observed may be present from time to time. Table 7.7 lists the bird species potentially present at the site that are listed under either the TSC Act or the EPBC Act together with an assessment of their potential to occur in the project area. Of the 15 threatened species listed for the project area, only five woodland species have been assessed as having medium potential to occur in the project area. The other 10 threatened bird species were assessed as having low potential to occur within the project area.

The birds potentially at most risk from blade-strike are:

- wetland birds that form large flocks
- birds of prey
- species that flock and fly above the tree canopy.

As the Glen Innes Wind Farm site is distant from significant wetlands, wetland birds are expected to be at low risk from the development. Birds of prey, such as wedge-tailed eagles are indicated to be present within the vicinity of the wind farm but from observations during site visits they do not appear to have a consistent presence. Species that flock and fly above the tree canopies are likely to be most prominent in the vicinity of woodland areas but may transit between the woodland remnants. Those birds that fly at low levels such as canopy height will be below the lowest height of the area swept by the turbine blades which will range from about 30 to 130 metres in height.

In the context of the threatened species listed in Table 7.7, the third category, i.e. species that flock and fly above the tree canopy, appears the main category of relevance for the project site. Wedge tailed eagles may also be at risk from time to time, but this species is not listed under either the TSC or EPBC Acts. Additionally, some studies suggest that birds soon adapt to the presence of the turbines and actively avoid them.

Although most of the literature on this issue is based on overseas studies, the principles and findings are generally applicable to Australian conditions. The overseas studies have found that the magnitude of the impact is strongly influenced by the physical characteristics of the site, particularly the type of habitat on the site and in the surrounding area (Jacobs 1994; Curry 1994; Still, Little, Lawrence & Carver 1994; Harrison 1996).

While the Glen Innes Wind Farm site can be regarded as a generally low risk site in respect of the risk of blade-strike, a number of measures can be adopted to further minimise the risk as follows.

- removal of large dead trees providing potential resting sites for raptors or potential nest sites for threatened bird species
- no lambing to be allowed in the vicinity of turbines

- carcasses to be removed from areas around turbines so as not to attract birds of prey

It is likely that fewer birds will be killed by blade-strike at the Glen Innes Wind Farm than by collision with motor vehicles on the roads in the surrounding area. Studies overseas have also concluded that power lines are responsible for more bird deaths than are wind farms. The use of underground cables between the wind turbines avoids this risk within the site.

KMA expects that the impact of blade-strike on birds at the Glen Innes Wind Farm will be negligible; the project area is a dry upland location a considerable distance from any large water bodies and no turbines are in gaps between mountain ranges.

Should air safety lighting be required on the nacelles it will be installed with consideration of visual impact for surrounding rural residences and to minimise its potential to attract avifauna. Shielding of obstacle lights is permitted, provided it does not compromise their operational effectiveness. Shielding can restrict the downward component of light to 5% of nominal intensity is emitted at or below 5 degrees from horizontal and no light is emitted at or below 10 degrees below horizontal (section 10.4 of CASA AC 139-18 (0)). Due to the type of obstacle lighting used and the shielding to reduce its visibility the lights are unlikely to attract birds that could then be impacted by the blades.

7.5.3 Impact of blade strike on bats

There is limited knowledge about the extent of collision by Australian bats with wind turbines, however the preliminary information indicates that impact levels are low. Carcass surveys for the inland sites in NSW at Crookwell and Blayney wind farms did not identify any incidences of blade strike for bats. Bat species population studies (Richards, 1998/99) undertaken before and after the installation of the Crookwell Wind Farm also did not identify any adverse impact on bat populations in the vicinity of the wind farm.

Victorian studies have only show low levels of incidence. Monitoring surveys conducted between 2000 and 2003 at the Codrington Wind Farm (14 turbines) recorded only two individuals killed by collision and at the Toora Wind Farm (12 turbines), six White-striped Freetail Bats and one Chocolate Wattled Bat were killed. This equates to 0.04 and 0.14 bat deaths per turbine per year at Codrington and Toora respectively.

Monitoring of bat species at the Glen Innes Wind Farm site in December 2007 identified the presence of 12 bat species of which three are listed as vulnerable under the NSW TSC Act. However, the data shows that areas with open habitat, where turbines will be located, were not utilised by the threatened species present in the area. Studies of bat flight behaviour in the vicinity of turbines showed that only a small percentage are involved in collisions some exhibit avoidance behaviour and the bulk appear to stay clear of the turbines indicating an awareness of the turbines (Horn and Arnett, 2005 in GRA 2008).

7.5.4 Threatened Species Conservation Act

The New South Wales *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Conservation Act, 1995* and the *Threatened Species Conservation Amendment Act 2002*, requires that various factors be taken into account in deciding whether a proposed action, development or activity is likely to have a significant effect on threatened species, populations or communities, or their habitats and, hence, whether the preparation of a Species Impact Statement (SIS) is warranted.

These factors have been applied to the threatened species most likely to occur in the project area, namely:

- small threatened woodland bird species such as the Brown Treecreeper, Diamond Firetail, Speckled Warbler, Regent Honeyeater and Turquoise Parrot.
- the two endangered ecological communities occurring in the project area, i.e.
 - Ribbon Gum - Mountain Gum - Snow Gum Grassy Forest/Woodland
 - White Box - Yellow Box - Blakely's Red Gum Woodland.

The assessment of KMA in relation to these matters is set out below. KMA has indicated that no endangered populations occur on the land to be disturbed by the project.

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

The components of the wind farm have been specifically located to avoid the need to remove trees. The field surveys found that the treed areas, consisting largely of remnant trees in grazing paddocks, were the only likely areas where threatened fauna would be found. No doubt a few threatened species occur in the area from time to time, but these species would not depend upon the largely exotic and semi-natural grasslands that are affected by the wind farm proposal. The proposal is therefore unlikely to place a viable local population of any threatened fauna species at risk of extinction. No threatened plant species were found in the area and none are expected to occur on any site impacted by the proposed wind farm.

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

The proposed development is not likely to have an adverse effect on the life cycle of any endangered population. No endangered populations have been declared in the project area.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction
- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its occurrence is likely to be placed at risk of extinction

The remnant vegetation in the area is mostly part of the endangered ecological community known as Ribbon Gum – Mountain Gum – Snow Gum Grass Forest/Woodland of the New England Tableland Bioregion. Some lower sites with *Eucalyptus melliodora* may represent remnants of another endangered ecological community known as White Box – Yellow Box – Blakely's Red Gum Woodland.

As noted elsewhere, the components of the wind farm avoid the need to clear trees or impact on natural areas so that it is unlikely that the project could place either of the above communities at risk of local extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

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

As noted above, tree removal is avoided, so that the impact of the proposed wind farm on the endangered ecological communities and those threatened fauna species that may occur in the area from time to time would be negligible. Similarly, further fragmentation or isolation of the habitat of the community and threatened species is likely to be negligible. Thus, the importance of the habitat to be affected by the proposal is low.

Although spread over a fairly wide area, the total footprint of the wind farm is quite small, and can be readily positioned to avoid treed areas.

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

Critical habitat refers only to those areas of land listed in the Registers of Critical Habitat. No critical habitat has been declared in the project area.

- (f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Not applicable; recovery plans have not been prepared for the relevant threatened species, and no relevant threat abatement plans have been prepared.

- (g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The applicability of the key processes listed under the *Threatened Species Conservation Act, 1995* and the *Fisheries Management Act, 1994* has been summarised in Table 7.8.

Table 7.8 - Relevant key threatening processes

Relevant key threatening process	Relevance to proposal
Anthropogenic Climate Change	the use of renewable energy is promoted to counter climate change
Clearing of native vegetation	Minor
Removal of dead wood and dead trees	Dead trees near turbines may be removed in case they attract birds of prey

KMA concluded that the development of the proposed wind farm is not likely to have a significant impact on any threatened species, populations or communities listed under the *Threatened Species Conservation Act 1995*, or their habitats, and the preparation of a Species Impact Statement (SIS) is not warranted.

GRA undertook Part 5A assessments (Seven Part Test of Significance) (Appendix G2) in relation to the following threatened species

- Large-eared pied bat (*Chalinolobus dwyeri*)
- Eastern Falsistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*)

In each case, GRA found that the operating wind farm would not have a significant impact on these species and a Species Impact Statement was not warranted for any of the three species.

7.5.5 Environment Protection and Biodiversity Conservation Act

The Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* specifies that approval is required from the Commonwealth Minister for the Environment and Heritage for actions that have, will have or are likely to have a significant impact on a matter of "national environmental significance". Matters of national environmental significance are listed threatened species and communities, migratory species protected under international agreements, RAMSAR wetlands of

international importance, the Commonwealth marine environment, World Heritage properties, National Heritage places, and nuclear actions.

The Department of Environment and Heritage (2006) has produced *EPBC Policy Statement 1.1 Significant Impact Guidelines. Matter of National Environmental Significance* to assist proponents to determine whether an action should be referred to the Minister for assessment and approval.

Some of the criteria in the guidelines refer to the concept of "habitat critical to the survival of a species or ecological community". The guidelines state, "habitat critical to the survival of a species or ecological community . . . includes the critical habitat for any species or community identified in recovery plans for those species/communities and the critical habitat on the Register maintained by the Minister for the Environment under the Act. However, there may not be recovery plans in place for all listed species and communities, as plans take some time to prepare. Similarly, the Register may not be comprehensive. The absence of a recovery plan or the fact that an area may not be listed on the Register of Critical Habitat does not mean that there is no habitat critical to the survival of the species or community."

"Habitat critical to the survival of a species or ecological community may include areas that are necessary:

- for activities such as foraging, breeding, roosting, or dispersal,
- for succession,
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species/community."

"Habitat critical to the survival of a species or ecological community will depend largely on the particular requirements of the species/community in question. For example, areas only incidentally used by a vulnerable species, and which the species is unlikely to be dependent upon for its survival or recovery, are not areas of habitat critical to the survival of a species or ecological community."

"Some of the criteria below refer to actions likely to lead to a "long-term decrease" in the size of a population or a "long-term adverse effect" on a community. Depending on the level of endangerment and the nature of the action, not all actions which create an immediate decrease in the population of a naturally listed threatened species or impact on a community will have long-term consequences. For example, an act which causes injury or death to only one or a very small number of a species will not, except in the case of the most endangered of species, generally lead to a long-term or irreversible decrease in the population that normal processes, rates of mortality and recruitment could not buffer."

The *Significant Impact Guidelines* (DEH 2006) contain various criteria to assist in determining whether an action is likely to have a significant impact on threatened species, threatened communities and migratory species.

KMA applied these criteria to the Regent Honeyeater which, other than bats (see Richards 2007), is the nationally threatened species most likely to occur in the project area. The criteria have also been applied to migratory species and White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

Criteria for endangered species

An action has, will have, or is likely to have a significant impact on an endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of a population

- modify, destroy, remove, 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 critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
- interferes with the recovery of the species

KMA has assessed the proposed wind farm as not likely to have any of the above effects on the Regent Honeyeater, should it occur in the project area. The potential habitat of this species, primarily Yellow Box trees will not be removed.

Criteria for endangered ecological communities

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered ecological community if it does, will, or is likely to:

- lead to a long-term adverse affect on an ecological community
- reduce the extent of a community
- fragment an occurrence of the community
- adversely affect habitat critical to the survival of an ecological community
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the community's survival
- result in invasive species that are harmful to the critically endangered or endangered community becoming established in an occurrence of the community*
- interfere with the recovery of an ecological community

KMA assessed the development of the proposed wind farm as not likely to have any of the above effects on the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland endangered ecological community should it occur in the project area. None of this community will be removed.

Criteria for listed migratory species

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species
- result in invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining

KMA assessed the development of the proposed wind farm as not likely to have any of the above effects on internationally protected migratory species. The project area does not contain "important habitat" for these species or an "ecologically significant proportion" of a population of such species.

Conclusion, EPBC Act

KMA assessed the development of the proposed wind farm as not likely to have a significant impact on any threatened species, migratory species or communities listed under the *Environment Protection and*

Biodiversity Conservation Act, 1999. Referral to the Minister for assessment and approval is therefore not warranted.

The Large-eared pied bat (*Chalinolobus dwyeri*) is listed as vulnerable under the Commonwealth Environment Protection and Biodiversity Conservation Act. GRA has assessed that the project is not likely to have a significant impact on this species.

7.5.6 Fisheries Management Act

The *NSW Fisheries Management Act, 1994*, as amended by the *Fisheries Management Amendment Act 1997*, provides for the listing of threatened species, communities and populations, the designation of habitat as "critical", and the preparation and implementation of recovery and threat abatement plans. Threatened species are listed on schedules attached to the Act. Seven key threatening processes have been listed under the Act; none of these are applicable to the proposed wind farm development.

Eleven freshwater and saltwater endangered and vulnerable fish species, one snail, one shrimp and one dragonfly have been listed under the Act. Most of the species occur in inland waters and some have a restricted range. Two endangered ecological communities in the lower reaches of the Murray and Darling Rivers systems have been listed, and two endangered populations in the western parts of the state.

KMA assessed the proposed wind farm as not likely to have a significant impact on any of the above matters. No listed species, communities or populations would occur in the project area, the proposed turbine sites are high on ridges, the access roads and cable routes are well away from watercourses and the watercourses/drainage lines are ephemeral and unlikely to support threatened species.

Although the various components of the wind farm will not encroach on any watercourses, there is potential for sediment resulting from uncontrolled construction work to enter watercourses nearby. Accordingly, measures will be taken to mitigate this potential impact and implemented throughout the Project Construction Environmental Management Plan.

7.5.7 Koala habitat protection

The project area is within the Severn Local Government Area that is listed in Schedule 1 of *State Environmental Planning Policy No. 44 - Koala Habitat Protection* (SEPP 44) (New South Wales 1995), so that the Policy does apply to the Glen Innes Severn Shire and the wind farm site. SEPP 44 encourages the conservation and management of natural vegetation that provides habitat for Koalas, to ensure a permanent free-living population over the species' present range and to reverse the current trend of Koala population decline.

The site survey by KMA identified that the project contains potential habitat and discussions with a National Parks and Wildlife Service officer indicates that in the past there were frequent sightings of Koalas in the lands surrounding Waterloo Range. Of the ten Koala feed tree species listed under Schedule 2 of SEPP 44, *Eucalyptus Viminalis* is present on slopes and ridges of the wind farm site. There are no recent local records of Koalas on the NSW Wildlife Atlas and no evidence of their presence was observed during the site survey by KMA. KMA assessed the site as very unlikely to be 'core Koala habitat' as defined in SEPP44.

As very few trees will be removed as part of the project construction there will be an insignificant impact on potential Koala habitat.

7.5.8 Land dedicated for conservation purposes

There are no reserves managed by the NSW National Parks and Wildlife Service in or close to the project area. The Sinclair Lookout access road reserve and the former highway alignment that is within the Wattle

Vale Travelling Stock Route provide some degree of protection for parts of the remnant local native vegetation. These reserves contain good quality examples of the remnant woodland. The Sinclair Lookout access road reserve is outside the project area where facilities will be constructed. Temporary access to the site via the Wattle Vale Travelling Stock Route has been approved by the RLPB. There will be minimal impact on native vegetation by using this access route which has existing farm road. The impact is potentially less than for other access options considered.

7.6 Mitigation measures

The Glen Innes Wind Farm has been designed to utilise land that has been cleared and is currently used for grazing. As far as possible, the design aims to minimise further clearing of remnant woodland and to retain potential fauna habitat. These objectives have required that the siting of turbines and access tracks avoids sensitive areas and that a range of mitigation measures be incorporated in the project Environmental Management Plan.

Having regard to the recommendations of Mills (2007) and Richards (2007), it is proposed to adopt the following measures to protect the remaining native vegetation and significant habitat and to assess potential impacts on aerial fauna:

7.6.1 Specific layout design measures

The following design considerations will be adopted to minimise impacts on the site's ecological values.

- Construction vehicles will access the site via the former Gwydir Highway alignment and will not use the Sinclair Lookout Road
- Clearing of the few trees to gain access to the wind farm site from the former Gwydir Highway alignment within the Wattle Vale Travelling Stock Route will be undertaken in consultation with the Rural Lands Protection Board to ensure that clearing of native vegetation is minimised
- In the event that construction vehicles access the site via Rose Hill Road it may be necessary to trim or clear some of the 12 Ribbon Gums overhanging the northern end of the road as well as impacting the grassy understorey and numerous dead trees in the area. Accordingly, the former Gwydir Highway alignment is the preferred site access for large construction vehicles
- The substation and Turbine 1 will be sited on cleared land and avoid the patches of remnant woodland at this location.
- The rock outcrop at the site of Turbine 2 will be relocated nearby to retain habitat for reptiles. Similarly where the access route disturbs rock outcrop at other locations, the rock will be relocated and reptile habitat retained.
- The large old Kurrajong tree on the access route between Turbine 2 and Turbine 3 will be retained.
- The access route between Site 10B and Site 12B will be designed to avoid the scattered woodland remnants and rock outcrop scrub
- Clearing for the access route to Turbine 11 and at the site of Turbine 11 will be constrained and guided by a suitably qualified ecologist
- The micro siting of Turbines 14B and 13 will avoid the large scattered trees present at these locations

- The route between Turbine 14B and Turbine 15 will follow the cleared corridor beside the fence line and where it crosses the westerly continuation of Hillside Road it will follow the existing farm track to the east of Turbine 15
- Turbine 15 will be located in the cleared area to the west of the existing farm track and to the south of the stand of remnant woodland
- Turbine 17 will be located in cleared land and not require clearing of the scattered woodland vegetation
- Both Turbines 18 and 19 will be located on cleared land that is mainly exotic pasture. Dead trees in close proximity to the turbines will be removed to avoid birds roosting close to the turbines
- Clearing to gain access to Turbine 10 will be minimised by utilising an access route comprising the existing track and existing clearings on the upper slopes
- Access to Turbines 20B, 21B and 22B will be from the northern end of the ridge which has been cleared and will avoid further clearing of remnant woodland
- The dead trees near Turbine 22B on the eastern side of the hill should be removed

7.6.2 General mitigation measures

In addition to the site specific measures identified above, the proponent will adopt the following measures that are of a more general nature to ensure that impacts on the site's ecological values are minimised.

- Clearing woodland will be avoided wherever possible. Where avoidance is not possible, clearing and lopping will be kept to the bare minimum to maximise conservation of the woodland.
- A soil and water management plan will be prepared for the project, in consultation with the Department of Planning and Department of Environment and Climate Change.
- An environmental representative will be appointed for the construction phase of the project, whose role would be to ensure that appropriate environmental safeguards are implemented and to ensure the mitigation measures set out here are implemented.
- To reduce the potential impact on birds of prey:
 - the towers will be smooth, with no perching sites
 - dead animals, e.g. sheep carcasses and road kills, will be removed as soon as possible within a 200 metre radius of each turbine
 - lambing will not be allowed to occur in paddocks containing turbines
 - no lights, other than safety lights for aircraft, will be installed on the turbines in case they attract owls. Lighting at the substation facilities will also be minimised due to its proximity to turbine sites
 - no buildings, poles or other structures apart from meteorological masts should be constructed within 200 metres of a turbine because they provide perching opportunities for birds of prey
 - any dead trees near turbines will be removed for the same reason
 - no trees should be planted near turbines
- An avifauna impact monitoring program will be implemented once the project is operational. The monitoring program will be developed through reference to the Australian Wind Energy Association

(AWEA) July 2005 report 'Wind Farms and Birds: Interim Standards for Risk Assessment' and relevant specialists. Prior to its implementation, the proposed monitoring program will be submitted to the Department of Environment and Climate Change to assess its adequacy.

- In the event of bird or bat strike becoming a significant issue, installation of deterrent devices on the turbines will be considered. Should the proposed monitoring reveal substantial evidence of bird or bat strike, Glen Innes Wind Power will engage an appropriate specialist to assess the incidences and identify practical and effective mitigation measures.
- No large dams will be constructed on wind farmer properties within a one kilometre radius of a turbine; large dams could attract flocks of waterfowl and thereby increase their susceptibility to blade-strike.
- The exact location of the turbines and access tracks will be micro-sited in conjunction with the Environmental Representative during the construction phase of the project to avoid unnecessary impacts on native vegetation, flora and fauna. All turbine sites should avoid the need to clear large mature trees.
- The Environmental Representative will ensure that barriers are erected around sensitive vegetation to be retained and which may be impacted by construction works at nearby turbine sites or access tracks
- Rock outcrops will be avoided where practicable. Where there is a need to disturb rock outcrop the disturbed rock will be relocated and similar rocky habitat reconstructed nearby. Where batters are constructed using rock then these will be left in this form to provide reptile habitat and locations where rocky scrub can develop
- Measures must be incorporated in the Project Environmental Management Plan to restrict the introduction of weeds to the wind farm site and for post construction weed control measures to be applied for all areas disturbed by the project.

7.6.3 Native vegetation protection

While the project is being undertaken in cleared grazing land, this includes areas of native grassland, native pasture and exotic grassland. It is not possible to undertake the project without an impact on some native vegetation at this site but as far as practicable this impact will be minimised by limiting the area of disturbance and avoiding areas of greater sensitivity.

In addition to the measures proposed above, the proponent will consult with the landowners involved with the project to identify whether a suitable area could be fenced off for at least the duration of the project. Such an area would support native woodland conservation as a measure to compensate for the removal of a limited number of trees at several sites within the project area. Ideally, the area should be of relatively good natural quality, include representatives of Ribbor Gum and Yellow Box and be protected in the longer term, where possible. The conservation area for the purpose of compensating for the project's impacts on native vegetation would be selected by a botanist in consultation with the proponent and landowner.

Additional measures to address bats

To protect potential bat habitat, Richards, 2007 has recommended a pre-clearance survey of trees to be cleared to identify any potential roosts. Where applicable, the clearing will be undertaken to lay trees down with potential roosts facing skywards to enable bats or other fauna to depart at a later time.

