

## CHAPTER 10

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### Flora and Fauna Assessment

## 10. FLORA AND FAUNA ASSESSMENT

Eco Logical Australia Pty Ltd (ELA) was commissioned to undertake an ecological assessment of the area proposed to be affected by the Boco Rock Wind Farm. The full report is in **Appendix 10**.

This chapter draws from that report and summarises aspects of the methods used to capture data and the nature of the existing ecological features of the Project site. More pertinently an assessment of potential impacts, proposed avoidance, mitigation and management measures and an offset strategy with respect to those impacts are also summarised.

### 10.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

A Referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was submitted to the Department of Environment, Water, Heritage and the Arts (DEWHA) in May 2009 addressing the likely impacts of the Project on the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) (GED) and Natural Temperate Grassland (NTG). Negotiations were held between the Proponent and DEWHA in an attempt to minimise impacts on NTG and threatened species. A decision to deem the Project a Controlled Action under the EPBC Act was made on 18<sup>th</sup> August 2009.

Consequently, Department of Planning (DoP) has requested that the assessment for the Project under Part 3A is subject to a one-off accredited assessment process and agreed that the assessment would be subject to the general administrative steps outlined in the New South Wales (NSW) Bilateral Assessment administrative procedures. Subsequently, DEWHA have provided the Proponent with supplementary Director-General's Requirements (DGR's) on the 18<sup>th</sup> September 2009, which apply to the accredited assessment process.

The supplementary DGR's specifically focus on matters of National Environmental Significance (NES), in particular the controlling provision of '*Threatened Species and Threatened Ecological Communities*'. The supplementary DGR's state that:

*"The description and assessment of these issues in the Environmental Assessment must be integrated as far as practicable with the description and assessment of the other flora and fauna impacts of the project. However, a separate stand alone chapter or summary specifically addressing impacts on the relevant protected matters/controlling provisions under the EPBC Act, together with any commitments or proposed measures to mitigate such impacts, should also be included in the Environment Assessment."*

Due to the high level of integration and overlap between issues of interest at both the Commonwealth and NSW level, a separate chapter or summary (as described above) has not specifically been included in the EA, in agreement with DEWHA. However, matters relating to threatened species and communities are addressed in this chapter and in **Appendix 10**. The full list of DGR's are included in **Appendix 3** and **Table 5.2** in **Chapter 5** Planning Context has been provided to ensure ease of reference and to demonstrate compliance with the supplementary DGR's.

## 10.2 Methods

To determine the nature of the existing environment and any potential impacts, ELA conducted a literature review, site reconnaissance, vegetation mapping and flora and fauna surveys of the study area.

### 10.2.1 Literature Review

A review of all readily available literature and database records pertaining to the ecology of the study area and surrounding locality provided important background information which formed the basis of future assessment work. A full reference list is available in **Appendix 10**.

### 10.2.2 Site Reconnaissance

Site reconnaissance was undertaken on 20<sup>th</sup> to 24<sup>th</sup> October 2008 prior to the detailed field surveys, to verify site access, broad vegetation types and condition, fauna habitat present on-site and to select locations for the detailed surveys. This information was then used in conjunction with the DGR's to determine the requirements for the detailed surveys.

### 10.2.3 Vegetation Mapping

Due to current drought conditions, vegetation mapping surveys were delayed until the area had experienced a reasonable amount of rainfall, followed by a warm spell, to increase the likelihood that herbs and forbs would be in flower at the time of survey. This occurred following rainfall in late December 2008 with vegetation mapping undertaken between early January 2009 and February 2009. Vegetation boundaries were subsequently mapped using a number of tools including, aerial photographs, ground-truthing, visual observations and predictions.

### 10.2.4 Flora and Fauna Surveys

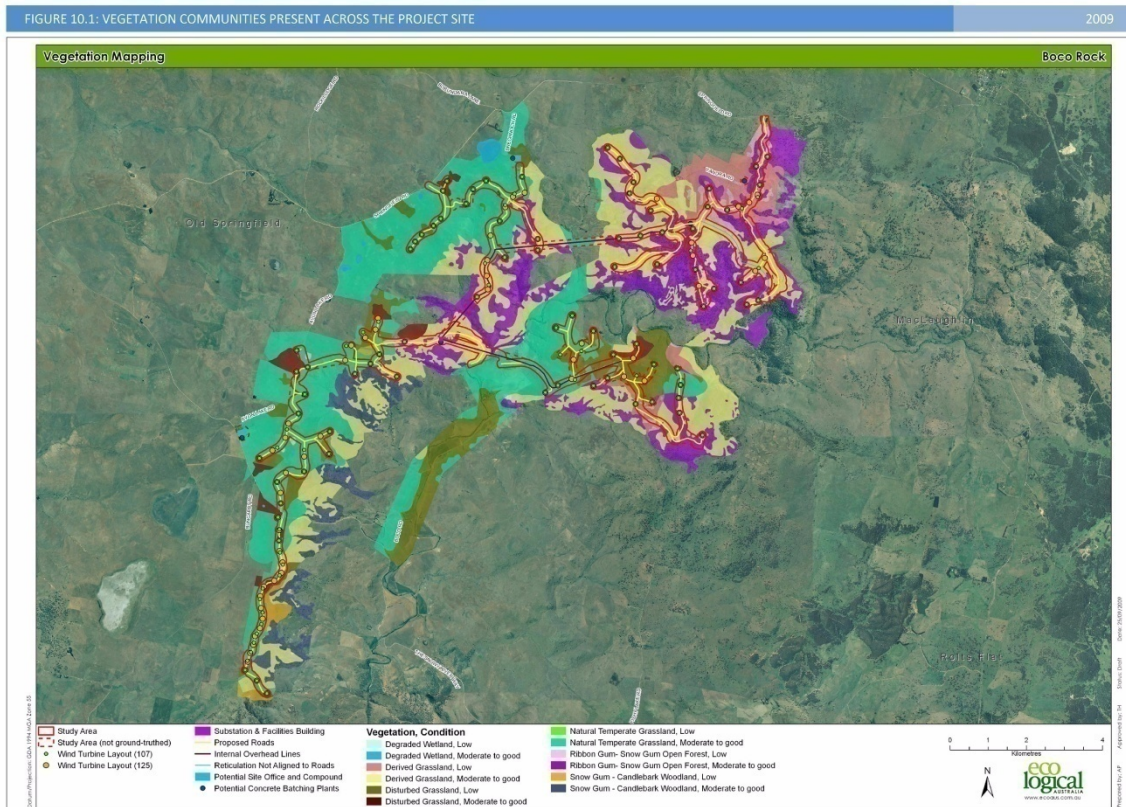
Detailed flora and fauna surveys were undertaken across the study area between 3<sup>rd</sup> November 2008 and 4<sup>th</sup> May 2009 in accordance with Department of Environment and Conservation (DEC) *Threatened Biodiversity Survey and Assessment Guidelines Working draft* (DEC 2004) and the DGR's. Survey periods were designed to target species when most active or in flower, as described in **Appendix 10**.

## 10.3 Existing Situation

### 10.3.1 Vegetation Communities

Six vegetation communities are present across the Project site, as displayed in **Figure 10.1** including:

- Ribbon Gum (*Eucalyptus viminalis*) – Snow Gum Woodland (*Eucalyptus pauciflora*);
- Snow Gum – Candlebark (*Eucalyptus rubida*) Woodland (SGW);
- Natural Temperate Grassland;
- Disturbed Grassland;
- Derived Grassland; and
- Degraded Wetland.



**Figure 10.1 Vegetation communities present across the Project site**  
*(An A3 size version of this Figure is displayed in Volume 2)*

NTG is the most extensive endangered community listed under the *EPBC Act* found throughout the western part of the Project site. The condition of this community across the landscape varied according to the grazing intensity. Therefore the assessment undertaken illustrates a snap shot in time. As a general rule, condition will vary according to the presence or absence of grazing, period of spelling, and rainfall. Further description of the dominant species can be found in **Appendix 10**.

Given the study area is used for agricultural purposes these vegetation types are impacted by weed invasion, grazing intensity and soil disturbance to varying degrees, depending on the land use practices implemented on each property.

### 10.3.2 *Flora*

The study area possesses 129 recorded general flora species, potential habitat for five threatened flora species and whilst there is the potential for four Rare or Threatened Australian Plant (RoTAP) flora to occur within the study area, only one was recorded. While there is no formal list of regionally significant plant species or communities for the Cooma-Monaro or Bombala Local Government Areas (LGA) (personal communication Cooma-Monaro and Bombala Councils), Benson (1994) has compiled a list of regionally rare species on the Tableland tract of the Monaro. There are two recorded flora species found on-site. **Table 10.1** below provides a brief overview of flora species in the area, while full details are presented in **Appendix 10**.

**Table 10.1 Flora present within the study area**

Category	Species
General flora	Snow Gum, Ribbon Gum, <i>Poa</i> aff. <i>sieberiana</i> , <i>Austrostipa bigeniculata</i> , Speargrass ( <i>Austrostipa scabra</i> ), Ringed Wallaby Grass ( <i>Austrodanthonia caespitosa</i> ) and Knob Sedge ( <i>Carex inversa</i> )
Threatened flora	Mauve Burr-daisy ( <i>Calotis glandulosa</i> ), Trailing Hop-bush ( <i>Dodonaea procumbens</i> ), Monaro Golden Daisy ( <i>Rutidosia leiolepis</i> ), Silky Swainson-pea ( <i>Swainsona sericea</i> ) and Austral Toadflax ( <i>Thesium australe</i> )
Rare or Threatened Australian Plant flora	Hairy Anchor Plant ( <i>Discaria pubescens</i> )
Regionally significant flora	<i>Swainsona monticola</i> and <i>Swainsona behriana</i>

Note: Not all species have a 'common name'.

**Noxious Weeds:** Three weed species listed as noxious weeds under the NSW *Noxious Weeds (NW) Act 1993* for the Cooma-Monaro and Bombala LGA's were recorded within the study area and one species listed as a Weed of National Significance (WoNS). However, it is likely that other noxious weed species occur.

Weeds accounted for approximately 31 % of all species recorded across the study area and often occur in localised patches in paddocks where clearing or spraying had been undertaken. Exotic species common throughout the study area included Serrated Tussock (*Nassella trichotoma*), Saffron Thistle (*Carthamus lanatus*), Scotch Thistle (*Onopordum acanthium*), Hairy Brassica (*Hirschfeldia incana*), Dwarf Mallow (*Malva neglecta*), Phalaris (*Phalaris aquatica*), Barley Grass (*Hordeum leporinum*) and Common Storksbill (*Erodium cicutarium*).

### 10.3.3 Fauna Habitat

While the vegetation communities limit the types of fauna habitat across the site, the landscape does support unique habitat features such as grasslands and extensive rock areas which provide habitat for ground-dwelling mammals, some arboreal (tree dwelling) mammals and reptiles. A full list is provided in **Appendix 10**, with **Figures 10.2** and **10.3** displaying general faunal habitat and habitat specific to the GED present across the Project site.



FIGURE 10.2: FAUNA HABITAT PRESENT ACROSS THE PROJECT SITE

2009

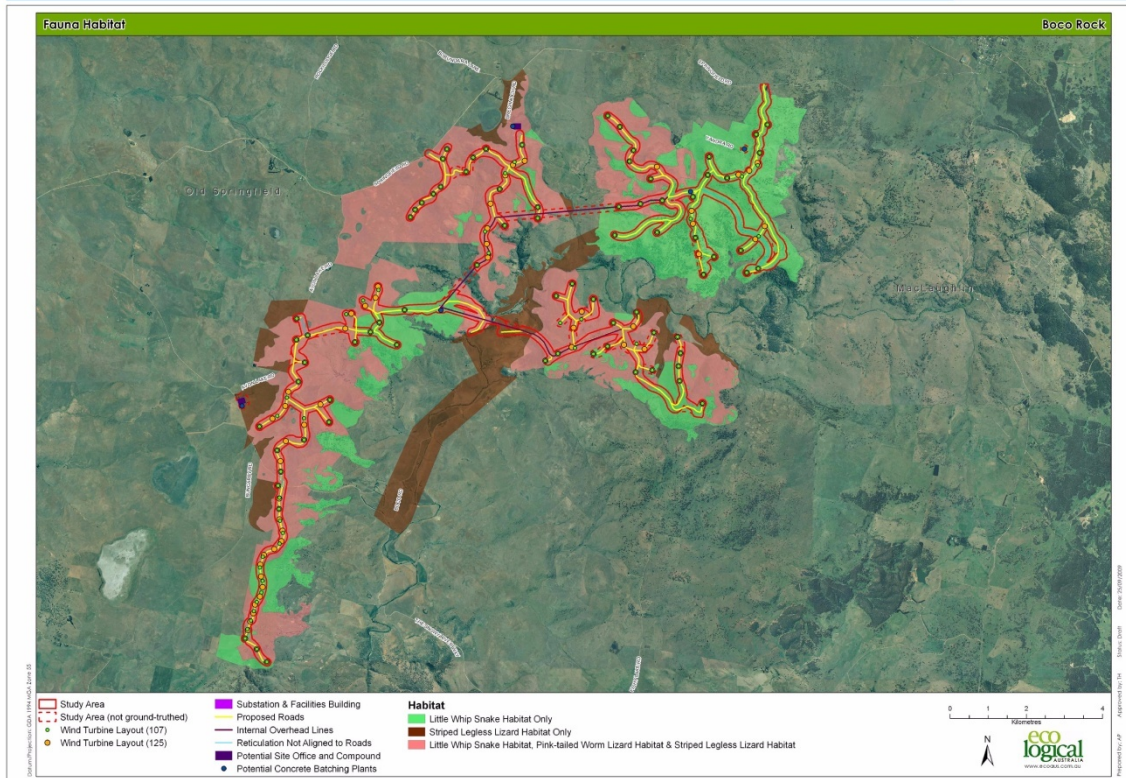


Figure 10.2 Fauna habitat present across the Project site

FIGURE 10.3: GRASSLAND EARLESS DRAGON HABITAT PRESENT ACROSS THE PROJECT SITE

2009

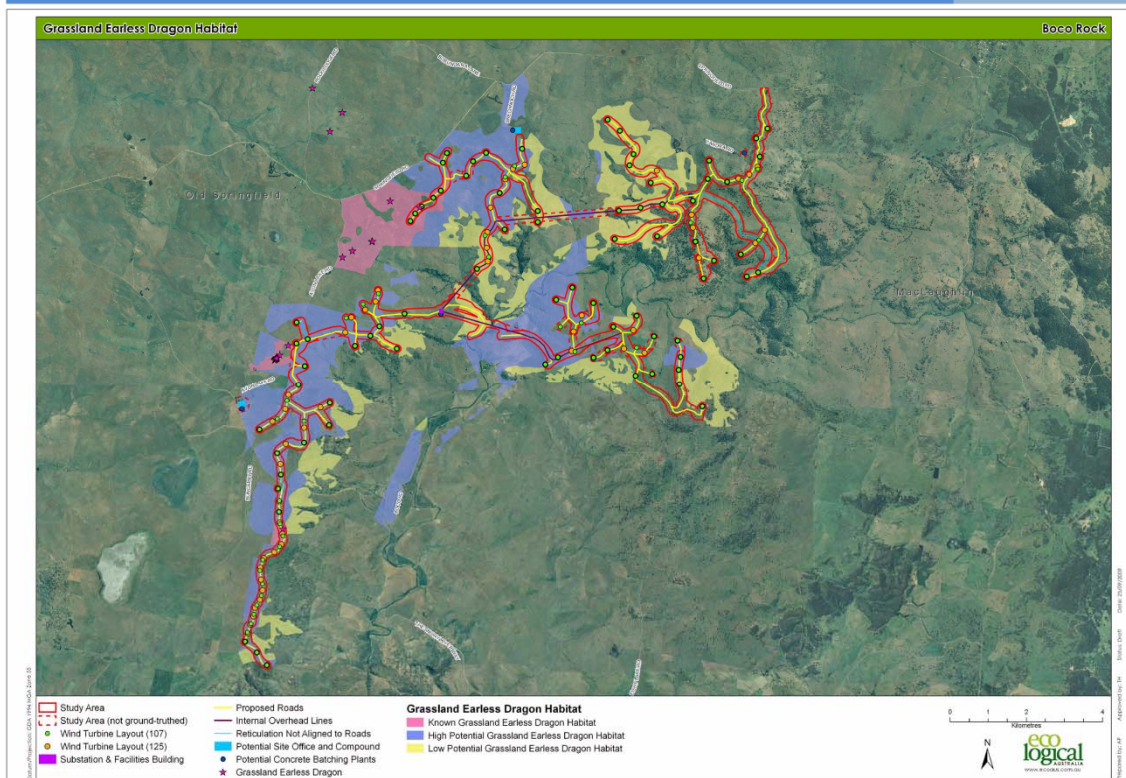
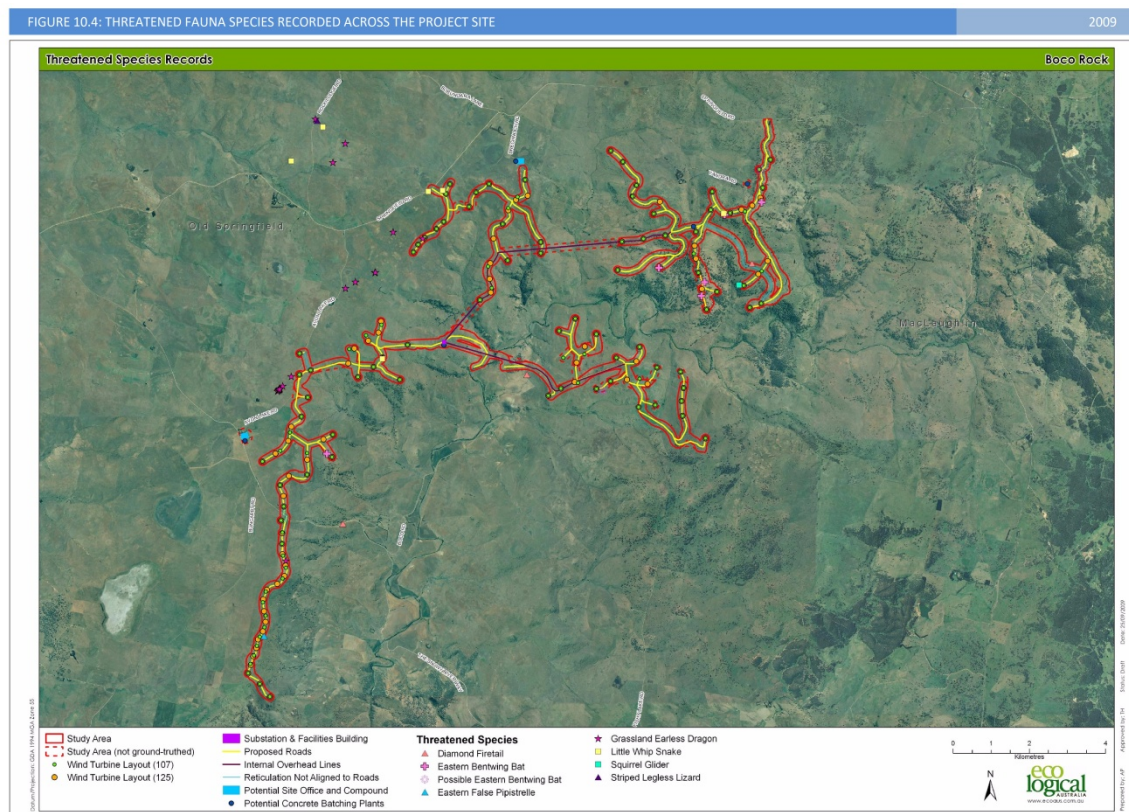


Figure 10.3 Grassland Earless Dragon habitat present across the Project site  
 (A3 size versions of these Figures are displayed in Volume 2)



### 10.3.4 Fauna Groups

A number of fauna groups were recorded across the study area, including avifauna, ground-dwelling and arboreal mammals, bats, amphibians and reptiles. From these groups, a variety of threatened species have also been recorded within the locality. Those species previously recorded (Department of Environment and Climate Change (DECC) 2009; Birds Australia 2009) or considered to have the potential to occur (Department of Environment, Water, Heritage and the Arts (DEWHA) 2009) are listed in **Appendix 10** together with their conservation status and an assessment of the likelihood of occurrence. **Figure 10.4** provides the locations of each recorded threatened species across the Project site.



**Figure 10.4 Threatened fauna species recorded across the Project site**  
**(An A3 size version of this Figure is displayed in Volume 2)**

**Bats:** Although no threatened bat species were listed on the database searches for the area (DECC 2009, DEWHA 2009), potential habitat for some species is present and two State threatened species were recorded within the study area (the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*). The Eastern Bentwing-bat was recorded a number of times across the study area, primarily in woodland or on the fringes of woodland, and the Eastern False Pipistrelle was recorded in derived grassland on the southern area of the Sherwins Cluster. Although not recorded within the study area, potential habitat is also present throughout the study area for the Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*). All of these species are listed as vulnerable under the *Threatened Species Conservation (TSC) Act 1995*.

**Reptiles:** A number of threatened reptiles have the potential to occur within the Project site, of which two were recorded within the study area and one species off-site. The areas of potential habitat are mapped in **Figures 10.2** and **10.3**.

The GED (*Tympanocryptis pinguicolla*) is listed as Endangered under both the *TSC Act* and *EPBC Act* and was recorded in the southern area of the Sherwins Cluster and Springfield Cluster (**Figures 10.3** and **10.4**). This species has also been recorded in areas adjacent to the study area and north of Springfield Road. A total of 15 GED's were recorded across the study area, although a number of these records are likely to be recaptures.

The Little Whip Snake (*Suta flagellum*) listed as Vulnerable under the *TSC Act* was recorded at four locations within the Project site and at two locations within a potential offset site north of the Project site, as shown in **Figure 10.4**. This species was recorded under large rocks during the spring surveys, which means the majority of the study area would provide potential habitat for this species.

Although the Striped Legless Lizard (*Delma impar*), listed as Vulnerable under both the *TSC Act* and *EPBC Act* has not been recorded within the study area, it was recorded during surveys of potential offset sites to the north of the Project site (**Figure 10.4**). Potential habitat for this species is present throughout the study area in areas of NTG and derived grassland (**Figure 10.2**). Despite intensive rock-rolling, this species was not detected. However, this is a cryptic species that is difficult to detect and therefore there is the potential for this species to be present throughout the study area.

**Migratory Fauna:** There are four migratory species that have the potential to utilise the study area, however only the White-bellied Sea Eagle (*Haliaeetus leucogaster*) was recorded in the south-eastern part of the study area along the MacLaughlin River. This species is listed as a migratory species under the *EPBC Act*. The White-bellied Sea Eagle has the potential to forage across the study area although it is likely that this species would remain in the vicinity of the MacLaughlin River for the majority of the time. No nesting sites were recorded within the study area although potential habitat is present.

## 10.4 Potential Impacts

### 10.4.1 Construction

**Vegetation Clearance:** Although the Project involves the removal of vegetation across a large area, impacts are primarily restricted to a narrow, linear pathway with clearance occurring in narrow bands throughout an open woodland and grassland landscape (**Figure 10.1**). The Project is comprised of both permanent and temporary vegetation removal with areas such as underground reticulation requiring trenching for installation which can then be filled and revegetated to prevent weed invasion and erosion once installed.

As detailed in **Chapter 3** Project Description, two road layout options are being investigated in order to reduce the likely vegetation clearance required for the Project:

- Roads requiring a 12 m wide clearance area which will undergo revegetation back to 6 m following construction; and
- Roads requiring a 6 m wide clearance area with intermittent passing bays 12 m wide.



Both road layouts have been designed according to civil engineering requirements and with respect to minimising all unavoidable native vegetation clearance. All remaining impacts have been quantified through the use of the Biobanking credit calculator (see **Section 10.4**) and in accordance with 'improve or maintain' principles.

**Table 10.2** summarises the proposed vegetation clearance for each component of the Project for each turbine layout option and **Table 10.3** lists the total area of permanent and temporary vegetation loss for each vegetation type and condition.

**Table 10.2 Proposed impact areas for each layout option**

Project component	Estimated impact area – 107 layout				Estimated impact area - 125 layout			
	Permanent (ha)		Temporary (ha)		Permanent (ha)		Temporary (ha)	
	6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road
Turbine footings and assembly	27.25	15.75			31.75	18.44		
Substation	1.01	1.01			1.01	1.01		
Facilities building	0.02	0.02			0.02	0.02		
Roads	47.49	86.59	85.29	85.99	47.30	86.14	89.40	88.19
Underground cabling on-site (where cables do not align with new or upgraded roads)			1.82	1.82			1.82	1.82
Internal overhead electrical interconnection / easement	1.93	1.93			1.93	1.93		
<b>Temporary construction facilities</b>								
Concrete batching plants (2)			1.00	1.00			1.00	1.00
Site office			0.40	0.40			0.40	0.40
Construction compound			3.00	3.00			3.00	3.00
<b>Total</b>								
Total site area (ha)	11750.18				11750.18			

Project component	Estimated impact area – 107 layout				Estimated impact area - 125 layout			
	Permanent (ha)		Temporary (ha)		Permanent (ha)		Temporary (ha)	
	6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road
Total impact area from individual Project components	169.21	197.51			177.63	201.95		
Permanent impact area from individual Project components	77.7	105.3			82.02	107.54		
Total development footprint #	64.86	105.14	90.45	91.90	68.12	106.75	94.41	93.40
<p># Aspects of the impact from individual Project components will overlap, for example where roads intersect with hardstand areas, where underground cables lay within the road network and where the turbine footings lay within the hardstand areas. As a result the development footprint has been calculated with respect to the combined impact through use of geographical information system program and therefore is presented as area less than the sum of the Project component parts.</p> <p>The impact area should not be confused with the area of native vegetation to be impacted (refer <b>Table 10.4</b>)</p>								

Table 10.3 Estimated clearance of each vegetation type under current Project

Vegetation Community	Condition	Estimated Impact Area – 107 layout				Estimated Impact Area – 125 layout			
		Permanent (ha)		Temporary (ha)		Permanent (ha)		Temporary (ha)	
		6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road
Ribbon Gum / Snow Gum Open Forest	Moderate to good	8.87	14.21	16.03	15.72	9.02	14.20	16.06	15.72
	Low	2.42	3.86	4.26	3.85	2.41	3.86	4.26	3.85
Snow Gum Candle Bark Woodland	Moderate to good	0.05	0.08	0.05	0.06	0.05	0.08	0.05	0.060
	Low	0.15	0.41	0.12	0.10	0.15	0.42	0.12	0.10
Derived Grassland	Moderate to good	15.47	24.77	25.95	26.61	15.24	25.13	26.36	26.73

Vegetation Community	Condition	Estimated Impact Area – 107 layout				Estimated Impact Area – 125 layout			
		Permanent (ha)		Temporary (ha)		Permanent (ha)		Temporary (ha)	
		6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road	6 m Road	12 m Road
	Low	3.30	5.37	5.68	5.71	3.45	5.52	5.73	5.74
Natural Temperate Grassland	Moderate to good	26.33	41.65	28.48	28.76	27.01	43.00	30.15	29.66
Disturbed Grassland	Moderate to good	2.01	3.11	1.62	2.12	2.23	3.32	2.19	2.18
	Low	7.26	11.68	9.26	9.21	7.15	11.26	9.48	9.33
<i>Note: Grassland vegetation in low condition under the biometric is considered the same as cleared land and therefore has not been included here</i>									

The Project involves the permanent removal of up to 43 ha of NTG. This community is listed as endangered under the *EPBC Act* and is extensive throughout the western parts of the Project site. Only a relatively small proportion of the NTG present within the Project site will be impacted by the Project (1.8 %).

An accurate assessment of the total original extent of NTG is not possible, although the following estimates have been made:

- Less than 386,000 ha (Thomas et al. 2000);
- More than 480,000 ha (Rehwinkel 1997);
- Probably less than 3 % of the original grassland remains with high ecological integrity (Environment ACT 2005); and
- In NSW, at least 7,000 ha in moderate-to-good condition are known to exist and a similar additional amount is thought to exist on private land (Environment ACT 2005).

Taking the final point as a benchmark and assuming approximately 14,000 ha of moderate-to-good condition NTG remains and that the Project is impacting on those areas considered to be moderate-to-good, the Project would result in the removal of (0.3%) of the total remaining NTG in NSW.

**Loss of Riparian Vegetation:** The Project involves the establishment of a permanent crossing of part of the MacLaughlin River near the Boco dwelling. An assessment of the impacts of this crossing is included in **Chapter 3** Project Description and **Chapter 17** Water. The establishment of the crossing will involve the removal of a small amount of riparian vegetation. However, given the landscape is highly modified and riparian vegetation primarily consists of a grassy ground layer with no over-storey; the impacts of the crossing upgrade on riparian vegetation are likely to be minimal. Furthermore, in the majority of areas where tree cover is present along the MacLaughlin River, this is comprised of Willows (*Salix* spp.)

**Flora and Fauna Habitat Removal:** Habitat for a variety of threatened flora and fauna species is present across the study area, with the removal of 200 ha of potential habitat for a variety of species. One RoTAP species was recorded within the study area, although this species was on the edge of the slope within the Boco Cluster and in an area that would not be directly impacted by the Project. Therefore given the Project is linear in structure with no large, consolidated areas of clearing and no recorded threatened flora species across the study area that are likely to be impacted by the Project, the proposed habitat removal is expected to have a minimal impact on flora and fauna habitat.

**Eastern False Pipistrelle/Eastern Bentwing Bat:** A number of turbines are present within the Ribbon Gum Open Forest in the eastern portion of the site. A calculation of the number of trees to be impacted upon and/or removed cannot be made at this stage as micro-siting decisions are made during the detailed construction design phase of the Project. The Project will aim to minimise tree removal and in particular hollow-bearing tree removal wherever possible. The removal of any hollow-bearing trees would result in a small decrease in potential roosting habitat for the Eastern False Pipistrelle, however there will still be numerous hollow-bearing trees still present across the Project site after construction.

**Grassland Earless Dragon:** The Project will result in the removal of known and potential habitat for the GED. This species was recorded at three locations across the study area. Due to feasibility constraints presented by wind turbine layouts and the extent of habitat across the site, it is not possible to avoid all habitat for the GED. However, measures have been implemented to reduce impacts wherever possible (**Section 10.4**) and the Project will not isolate any areas of potential habitat for this species. A relocation strategy to transplant the GED from within the construction zone to nearby habitat has been prepared in consultation with Dr. Will Osborne from the University of Canberra and is included in **Appendix 10**. This is a draft document that will be finalised in consultation with DECC and Dr. Will Osborne pending Development Approval.

When considering the greatest impact scenario (Layout Option 1 using 12 m wide roads) the Project will result in the permanent removal of approximately 3.6 ha of known habitat within the study area or 2.25 % of known habitat within the Project site (for detailed calculations see **Appendix 10**). All unavoidable habitat clearance for this species will be offset using areas of known habitat and complemented by a suite of mitigation and management measures (**Section 10.4**).

**Little Whip Snake:** Habitat for the Little Whip Snake is present across much of the Project site. It has been estimated that the Project will result in the permanent removal of approximately 86.9 ha (1.37 %) of potential mapped habitat within the Project site for the 107 layout and 110.57 ha (1.74 %) for the 125 layout. All unavoidable habitat clearance for this species will be offset using areas of known habitat and complemented by a suite of mitigation and management measures (**Section 10.4**).

**Striped Legless Lizard:** The Striped Legless Lizard was not recorded at the site but has the potential to occur on-site as it was recorded on the adjacent lands north of Springfield Road. It has been estimated that the Project will result in the permanent removal of approximately 66.79 ha (1.46 %) of potential mapped habitat within the Project site for the 107 layout and 67.96 ha (1.48 %) for the 125 layout. All unavoidable habitat clearance for this species will be offset using areas of known habitat and complemented by a suite of mitigation and management measures (**Section 10.4**).



**Blue-billed Duck:** Potential habitat for the Blue-billed Duck (*Oxyura australis*) is not present within the direct impact area, however water for the Project is to be sourced from a dam located between the Yandra and Springfield Clusters which may provide habitat for this species. Water levels will therefore be maintained at a level that would allow the dam to be used for the Project, but still provide suitable habitat for the Blue-billed Duck.

**Corridor Values/Movement Pathways:** A large proportion of the turbines are located on the western side of the Project site within extensive grassland areas, however small areas of woodland are scattered across the landscape. Given the open structure of the woodland across the Project site, the placement of turbines and roads throughout these areas will not result in large breaks in vegetation nor fragmentation. Potential movement pathways for woodland species across the site include between the woodlands on the Boco and Yandra Clusters and from these areas east to more vegetated areas.

Movement between wetlands and water bodies is also likely throughout the Project site and surrounds. However, the majority of wetlands are located to the west of the study area and therefore movement between these wetlands (when present with water) is unlikely to be impeded by the Project.

Given the size of the proposed turbine footprints, roads and reticulation, it is unlikely that movement for ground-dwelling reptiles would be obstructed by the Project as all species would be expected to cross the proposed access roads and potentially bask on them.

**Indirect Impacts:** Indirect impacts relate to matters during the construction phase that are created as a consequence of the primary impact. A summary of the anticipated indirect impacts is provided below with further information contained within **Appendix 10** and, where indicated, the respective chapters of the Environmental Assessment (EA).

- Runoff, sedimentation and erosion (**Chapter 17** Water and **Chapter 18** General Environmental Assessment);
- Hydrological changes (**Chapter 17** Water and **Chapter 18** General Environmental Assessment);
- Wildfire (**Chapter 16** Fire and Bushfire);
- Edge effects/increased weed invasion; and
- Noise.

Weed management measures will be implemented during and post-construction to ensure weed invasion and edge effects do not increase across the study area. These will include the control of runoff that may contain seeds and the washing down of vehicles to prevent the transportation of weeds between areas when a significant weed risk has been identified. Revegetation of disturbed areas and ongoing weed management for a period of three years is also proposed. Two road layout designs are currently being investigated in an attempt to minimise areas of temporary vegetation clearance as these areas will be susceptible to weed invasion.

Construction activities will generate noise that may disturb some fauna. The response of fauna to noise is inconsistent between and within species. Therefore, while noise may displace some fauna, the impact will be short term.

#### 10.4.2 *Operation*

**Collisions with Wind Turbines:** Impacts on bird and bat species are likely to occur during the operational phase. Impacts include the potential for birds and bats to accidentally collide with towers and moving turbine blades, especially in poor weather conditions. Many studies have produced literature regarding the potential impacts of wind farms on birds and bats, with most of the studies undertaken outside Australia. The impacts appear to be dependent on a number of factors including:

- Proximity to bird concentrations and location of migratory pathways (Brett Lane & Associates 2005);
- Wind farm layout, spacing between turbines and type of wind turbine used (Brett Lane & Associates 2005; Department of Environment and Heritage (DEH) Australian Greenhouse Office 2006);
- Type of habitat and surrounding area, in particular proximity to forested areas and wetlands (Kevin Mills & Associates 2005; DEH Australian Greenhouse Office 2006);
- Lighting used on turbines (Brett Lane & Associates 2005) (see **Chapters 8** Landscape and Visual and **13** Aviation for further assessment of turbine lighting); and
- Turbines located on forested ridges (Arnett 2005).

Further discussion on these subject areas in relation to the affected species as a result of the proposed Boco Rock Wind Farm are contained within **Appendix 10**.

**Bats:** Based on the results of literature reviews and an understanding of bat behaviour, those species considered most likely to come into contact with turbine blades during the operation of the wind farm include those which forage above the canopy, are migratory or have large foraging areas and may roost in trees across the study area.

A risk matrix has been prepared by ELA to assess the likelihood that bats present within the study area would be impacted by the Project and is shown in **Appendix 10**. Of the species recorded across the study area, the White-striped Freetail Bat was the only species considered to have a high potential for strike due to its migratory nature and foraging behaviour. However, given the landscape is extremely open and structured fly ways are not present the likelihood of strike is somewhat reduced.

Impacts of the Project on the Eastern False Pipistrelle and Eastern Bentwing-bat are likely to be largely during operation. Measures to prevent bat strike wherever possible will be implemented, however based on the findings of past studies, it is likely that some collisions will be unavoidable even with mitigation measures. The Eastern False Pipistrelle is known to roost in hollow-bearing trees, which are extensive throughout woodland and open forest areas of the site. Given the turbines on the western portion of the Project site are primarily located in grassland or derived grassland, impacts on this species on the western side are anticipated to be minimal. However, there is the potential for strikes on bats foraging across the woodland given this species feeds above or just-below the canopy, or when dispersing to nearby feeding areas should they be roosting in the adjacent woodland areas. The Eastern Bentwing-bat does not roost in hollows and therefore the potential for collisions is somewhat reduced. However, given this species forages above the canopy and is migratory there is the potential for strike during these activities.

**Birds:** Migratory birds have been listed amongst the species most commonly impacted by wind turbines. Whilst wind turbines are likely to be below the flight altitude of most migratory species, weather and other factors have been suggested to potentially reduce flight height and therefore may result in collisions by migratory birds (Erickson *et al.* 2001).

A risk matrix anticipating the likelihood of collision with turbines has been prepared by ELA for those species most commonly recorded within the study area (**Table 10.4**). Factors such as the flight character, distribution across the site and whether the species is migratory have been considered when determining the likely risk. Those species considered to be at greatest risk are those that fly at high altitudes, at speed and are migratory. Based on the risk matrix, it considered unlikely that many of the species common to the study area would be likely to collide with turbines, although the risk is considered to be slightly higher for raptors and birds of prey which may collide with turbines whilst hunting prey.

**Table 10.4 Risk of turbine collision by bird species common throughout the study area**

Scientific name	Common name	No. of records	Flight characteristics	Migratory	Distribution across site	Risk of collision with turbines or overhead cables
<i>Pardalotus striatus</i>	Striated Pardalote	26	Moderate to low	N	Woodlands	Low
<i>Anthochaera carunculata</i>	Red Wattlebird	35	Moderate to low	N	Woodlands	Low
<i>Gymnorhina tibicen</i>	Australian Magpie	54	Moderate to low	N	Woodlands & grasslands	Low
<i>Anthus novaeseelandiae</i>	Richards Pipit	29	Low	N	Grasslands	Low
<i>Cacatua roseicapilla</i>	Galah	31	Moderate to low	N	Woodlands & grasslands	Low
<i>Cacatua galerita</i>	Sulfur-crested Cockatoo	35	Moderate to low	N	Woodlands	Low
<i>Sturnus vulgaris</i>	Common Starling	33	Moderate to low	N	Woodlands	Low
<i>Platycercus elegans</i>	Crimson Rosella	29	Fast, moderate to low flight	N	Woodlands	Low
<i>Falco berigora</i>	Brown Falcon	2*	High, soaring	N	Grassland	Moderate
<i>Aquila audax</i>	Wedge-tailed Eagle	9*	High, soaring	N	Grassland	Moderate
<i>Falco cenchroides</i>	Nankeen Kestrel	13*	High, soaring	Partially	Grassland	Moderate
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	1**	High, soaring	N	MacLaughlin River	Low - moderate
* these species were encountered on a regular basis and therefore not always documented; the true number of records is likely to be much higher						
** this species was recorded flying along the MacLaughlin River and not within parts of the study area where turbines are proposed.						

**Indirect Impacts:** Indirect impacts relate to matters during the operation phase that are created as a consequence of the primary impact. A summary of the anticipated indirect impacts, with further information contained in **Appendix 10**, includes:

- Predation by feral animals;
- Wildfire (**Chapter 16** Fire and Bushfire); and
- Displacement of birds.

No specific studies on the displacement of non-migratory birds from wind turbines in Australia were found during this assessment. However, overseas studies, such as Devereux *et al.* (2008), on wintering farmland birds in Europe can be used. By comparing similar species, such as seed-eaters and corvids, results may be applicable to Australian farmlands. Given the extensive nature of vegetation types across the study area and available habitat, bird species are unlikely to become displaced as a result of the wind turbines.

Studies of White-bellied Sea-eagles at wind farm sites conducted by Biosis Research also support this conclusion as White-bellied Sea-eagles have been known to continue to occupy operational wind farm sites in southern Australia, including the Bluff Point Wind Farm in Tasmania (Smales 2005). Furthermore, through post-construction monitoring of the Klondike, Oregon Wind Farm Johnson *et al.* (2003) found that avian and bat fatality rates were minimal, and that the wind farm did not appear to have resulted in displacement of breeding raptors.

Therefore based on the findings of these studies, and given potential habitat is widely spread across the Project site, it is considered unlikely that the proposed wind farm would permanently displace any local bird species.

#### 10.4.3 **Decommissioning**

Indirect impacts anticipated from the decommissioning works, as discussed in **Chapter 3** Project Description, at the end of the life of the wind farm are likely to include:

- Disturbance of vegetation adjacent to turbines from machinery during deconstruction, cutting back of tower bases, and storing of turbine components prior to removal from site;
- Soils disturbance resulting in sedimentation and erosion;
- Spread of weeds through site disturbance;
- Accidental fire during cutting back; and
- Disturbance of fauna habitat from machinery and storing of turbine components prior to removal from site.

#### 10.4.4 **Cumulative Impacts**

An assessment of cumulative environmental impacts considers the potential impact of a Project in the context of existing developments and future developments to ensure that any potential environmental impacts are not considered in isolation. The main sources of ecological impacts within the Project site are from farming activities; primarily grazing and livestock management. The proposed Boco Rock Wind Farm may have an impact on stock levels and/or management regimes



with respect to the construction phase; however this is likely to result in a reduction in stock levels during this phase and as such cumulative impact will be minimised.

The output of the wind farm will connect to a new 132 kV double-circuit overhead transmission line requiring an easement 40 to 45 m in width. This new line and associated switchgear at the point of connection to the existing Country Energy line is not included as part of this assessment. However the transmission connection will contribute to the removal of a small amount of additional native vegetation.

Given the majority of the transmission easement passes through open areas, vegetation clearance for the transmission connection is likely to be restricted to small areas (the size of the power pole foundations) of groundcover, spread at regular intervals along the transmission line route. It is not anticipated that clearance of the transmission line would be extensive and hence would not extensively increase the amount of vegetation clearance as a consequence of the Project.

## **10.5 Avoidance, Management and Mitigation**

### **10.5.1 Avoidance Measures**

The Proponent has made a number of amendments to the proposed layout to minimise and avoid impacts on the ecological values of the site. Given the extensive areas of NTG across the site area, particularly across the Sherwins Range, and the requirement for turbines to be placed on ridge tops, the opportunities to avoid all impacts on NTG are limited. However, whilst it is not possible to completely avoid placing turbines in any areas supporting woodland as this would impact upon the Project feasibility, a number of amendments have been made to minimise impacts in these areas. The linear layout of turbines along ridgelines, required for the wind farm to function at maximum capacity and be economically feasible, in some cases limits the areas to which turbines can be moved to avoid impacts.

The avoidance measures that will or have been implemented to minimise impacts on the ecological integrity of the site whilst maintaining the engineering and economic feasibility of the wind farm are summarised below:

#### **General:**

- Access roads have been designed to follow current tracks and roads present within the study area where possible to minimise additional vegetation clearance for access;
- Electrical cables will be placed underground and within the road footprint where possible to allow for temporary rather than permanent disturbance; and
- Electrical cables will pass overhead across significant gullies and waterways to reduce impacts.

**Natural Temperate Grassland:** NTG is present across much of the western portion of the site. Whilst it is not possible to avoid areas of NTG completely, the following has been undertaken to minimise and avoid impacts on this community:

- Road layouts have been placed outside areas of NTG so as to minimise fragmentation of NTG where feasible;

- Potential locations for concrete batching plants have been sited in disturbed and sown areas to avoid further impacts on NTG; and
- Temporary construction facilities will be located in disturbed areas and within the current development envelope wherever possible. Although the exact location of these facilities is still to be determined, **Figure 10.1** (in addition to **Figures 3.1** to **3.6**) shows the locations currently being considered.

**Grassland Earless Dragon:** Specific avoidance measures have been formulated in consultation with DECC, DEWHA and independent specialists with respect to the GED species and their habitat; these are addressed below in detail. These have been separated into avoidance measures implemented during the planning phase of the Project and those that will be undertaken immediately prior to or during construction.

Avoidance measures undertaken/proposed during planning and detailed design:

- Two turbines and associated road and electrical infrastructure located in the west of the Project site where a number of GED's were recorded have been removed from the Project. This will prevent the Project impacting on the largest known population of GED within the Project site;
- Further removal of turbines from the Project (other than the two proposed) will decrease the economic feasibility and energy production of the Project. As such turbine micro-siting will be used to avoid other known locations of GED, such as those within the Springfield and Sherwins Clusters (see **Figure 10.4**). For these individuals the road and reticulation design has been altered to allow for a minimum 50 m buffer from the recorded GED location;
- The road and reticulation layout has been rationalised and modified in response to the findings of the ecological assessment and has been designed to follow current tracks throughout the site wherever possible in order to minimise the effects on GED habitat;
- Further, where existing tracks do not exist, roads and reticulation have been routed along the edges of the known habitat of the GED to reduce any fragmentation that may occur to the habitat. For example, within the Sherwins Cluster, the proposed route of the road and reticulation follows the eastern boundary between mapped known GED habitat and low potential habitat (primarily observed on the steeper slopes of the range);
- Consideration was given to following the fence line with the neighbouring property to the west as this marks the boundary of mapped known GED habitat; with roads and reticulation to take the form of spurs leading to each of the individual turbine locations. However, this approach was considered likely to result in increased fragmentation of known and high potential habitat, beyond that which is mapped within the site area to the west and therefore was not implemented;
- Relocation of turbines is more difficult where extensive areas of known GED habitat have been mapped, such as on the Springfield Cluster and therefore shifting turbines east or west would not remove them from an area of known GED habitat within this Cluster. In these areas pre-clearance surveys will be important to identify any GED's that may need relocating (see below); and
- In order to further minimise impacts from the Project two road options are being considered. The current road layout involves clearing of up to 12 m in width for the roads with the revegetation back to 6 m in some areas following construction. However, an alternative road

option may be adopted subject to final turbine selection and crane availability. This option involves constructing a 6 m wide road with intermittent passing bays to 12 m wide, located where possible in cleared or highly modified areas. Should this option be feasible it would further reduce impacts of the Project to both NTG and GED habitat.

Avoidance measures proposed during construction:

- To minimise impacts of the Project on sensitive lifecycle stages of the GED (i.e. mating, laying and incubation period), development will not occur on the Sherwins and Springfield Clusters during this time (November to January). These Clusters are considered the most likely to support the GED;
- Given GED's were not recorded at the Boco Cluster despite spider tube surveys, and that the potential habitat on the Yandra Cluster is considered highly marginal, construction in these areas during all seasons is proposed;
- Significant movement of turbines is not possible after the detailed design phase has been completed nor where topographic constraints preclude the movement of infrastructure and, therefore, the ability to implement avoidance measures in response to pre-clearance survey results is limited. In response to this, a relocation strategy for the GED is proposed in an attempt to remove dragons from the proposed construction area prior to clearing as part of the Project mitigation measures. In order to have the opportunity to implement adaptive management based on findings and lessons from the initial relocations, the Sherwins and Springfield Clusters will be constructed separately. This would mean that the proposed relocation method could be adapted (if necessary) to allow the lessons learnt from one Cluster to be implemented in the second Cluster should GED relocations be required; and
- For electrical connection and construction plant mobilisation reasons, if the Yandra and Springfield Clusters are constructed simultaneously it will be necessary for the Substation cluster (refer to **Chapter 3**) to be constructed at this time, primarily to provide access to the substation but also to allow construction of a minimum of five turbines from within this area for economic reasons. This area would also be subject to the same constraints as the Springfield Cluster and, therefore, construction would not take place between November and January.

**Snow Gum Woodland and Ribbon Gum Open Forest:** Impacts on woodland areas have been avoided where possible and the open nature of the landscape means that through careful planning much of the potential tree removal can be avoided. Avoidance measures within woodland areas include:

- Placement of turbines such that tree clearing is avoided where possible;
- Hollow-bearing trees have been avoided where possible and will be further avoided during the detailed design phase through the provision of a buffer of 30 m between all turbines and hollow-bearing trees where practical (as agreed with DECC); and
- Where possible, turbines have been placed in woodland areas where ground layer disturbance has previously taken place (e.g. sown areas).

**Little Whip Snake:** Although this species was recorded in a number of locations across the Project site, only one record fell within the proposed construction area. In order to avoid impacts on this species, the road layout has been amended to provide a 50 m buffer between the road and this

location. Pre-clearance surveys within known and potential habitat, within the construction area, will be undertaken for this species within three weeks of construction activities commencing. Where found, relocation will occur in adjacent areas 150 to 200m from the construction area boundaries.

**Concrete Batch Plants:** Five possible locations have been identified for concrete batching plants. Each has been selected with operational requirements and environmental constraints in mind and all are located in disturbed areas or paddocks that have been sown and therefore ecological impacts are likely to be minimal.

#### 10.5.2 *Mitigation/Recommendations*

In order to protect the ecological values of the site a number of management and mitigation measures have been proposed. Given their extent, and to avoid duplication, these are outlined in **Chapter 20** Statement of Commitments together with the Project stage during which each would be implemented, as well as **Appendix 10**. A number of species-specific mitigation measures are included and it is envisaged that some of these would be implemented at both the proposed impact site and offset site with full details provided in the Construction Environmental Management Plan, Operation Environmental Management Plan and the Weed Management Plan post approval.

#### 10.5.3 *Offset Strategy*

Three alternative offset packages have been proposed to compensate for the impacts of the Project that cannot be ameliorated through avoidance and mitigation measures. There is also the potential for these to be modified in negotiation with the relevant authorities and a combination of options to be provided, if required. Each of the proposed offset options has been discussed with DECC and DEWHA and are listed below, whilst further details regarding these options can be found in **Appendix 10**.

**Option 1:** Biobank (or equivalent) agreements with adjacent landowners to the Project. **Figure 10.5** illustrates those lands within which offsets could be provided to ensure the in-perpetuity protection of each of these vegetation types:

- 160 to 250 ha NTG (includes the GED offset requirement)
- 225 to 285 ha Ribbon Gum Open Forest
- Up to 10 ha Snow Gum Woodland

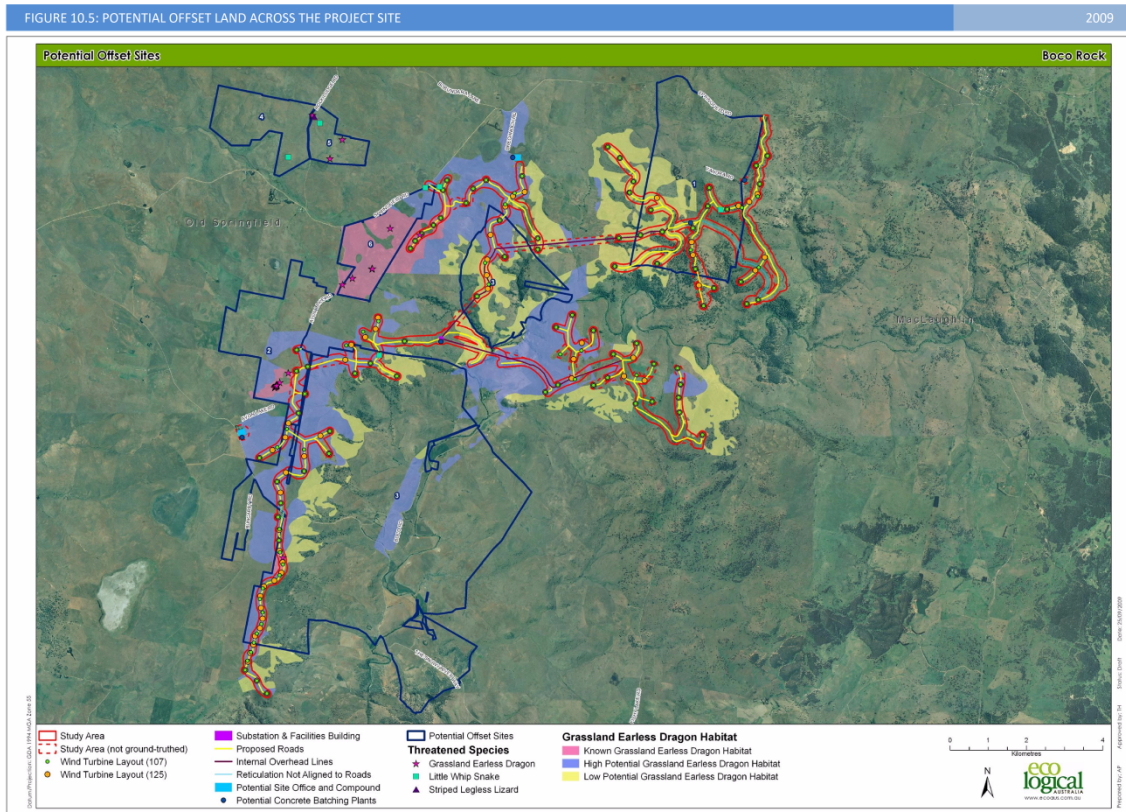
**Option 2:** Biobank (or equivalent) agreements with adjacent landowners to protect up to 500 ha of NTG. Under this option, a combination of lands would be provided to protect up to 500 ha of NTG. Should consolidation of offset sites be preferred, it is likely that the following combination of lands would be the most suitable options (**Figure 10.5**):

- Offset sites 4, 5 and 6; or
- Offset sites 2 and 3.

Given proposed offset site 5 supports good quality NTG as well as known records of the GED, Little Whip Snake and Striped Legless Lizard, this site should be considered as a priority for conservation.



**Option 3:** Three year monitoring program including survey of GED distribution and habitat and relocation studies. The potential exists to link funding opportunities between the proposed research and the key objectives in the National Recovery Plan for the GED. The University of Canberra has expressed interest in conducting the research should this option be incorporated into the offset package.



**Figure 10.5 Potential offset land across the Project site**  
*(An A3 size version of this Figure is displayed in Volume 2)*

**DECC Advice:** DECC has advised that their preference would be **Option 2** due to the recent decline of GED which would afford greater priority to the protection of a larger area of known habitat for this species than the proposed areas of Snow Gum Woodland and Ribbon Gum Open Forest.

It is noted that all of the vegetation communities being impacted are 'Red Flagged' due to either being listed as endangered ecological communities or vegetation types in moderate-good condition that are greater than 70 % cleared in the Southern Rivers Catchment Management Authority (CMA) region. The GED is not red flagged. Therefore consistent with the principles for varying red flags, it is proposed that additional credits could be purchased and retired including surplus credits generated for the GED and Striped Legless Lizard.

## 10.6 Summary

Under Part 3A of the *EP&A Act*, the Project is required to meet the principles of the 'maintain and improve' test. Whilst complete avoidance of all impacts on threatened species, their habitat and areas of native vegetation is not possible, a number of avoidance measures including the removal of turbines from the original proposed layout have been implemented. Furthermore, mitigation

measures will be implemented as part of the Project and will further reduce potential impacts from the Project.

For those impacts that cannot be mitigated or avoided, a variety of offset options have been proposed that will make a substantial contribution to the protection of Endangered Ecological Community (EEC's), threatened species and their habitat on the Monaro through in-perpetuity protection of large, viable offset areas.

Through the suite of avoidance, mitigation and offset measures outlined in this chapter, with further detail in **Chapter 20** Statement of Commitments and **Appendix 10**, the principles of the 'maintain and improve test' are upheld.

### 10.7 Proposed Transmission Line

The proposed transmission line will be assessed apart from this EA under Part 5 of the *EP&A Act*. An ecological constraints assessment will be undertaken with specific objectives to:

- Identify ecological values potentially constraining development of the route options, particularly pertaining to matters of NES as listed under the *EPBC Act* and threatened species, populations and communities listed under the *NSW TSC Act*; and
- Identify a range of measures and strategies that should be considered for avoiding and minimising potential impacts on the identified ecological values.

A summary of typical measures to minimise impacts are provided below which is better understood with reference to the summary of the impacts from the proposed transmission line provided in **Chapter 3** Project Description:

- Locate infrastructure in a manner which avoids and minimises impacts to sensitive vegetation particularly high condition;
- Where avoidance is not practicable, locate infrastructure in areas of lower condition vegetation;
- Maximise pole spacing wherever practicable to minimise on-ground impacts associated with pole installation;
- Utilise existing road network, including sealed, unsealed and farm tracks wherever possible;
- Utilise rubber-tracked and rubber-wheeled vehicles for construction. This will minimise disturbance to the vegetation, soil surface and seed bank;
- Minimise construction of new access tracks;
- Hardstand and other storage areas should be located outside of areas of high condition sensitive vegetation, as together with new track construction (if required), these are likely to have the greatest impact;
- Minimise fragmentation of sensitive vegetation; and
- Survey hollow bearing trees in proximity to the route and avoid in final planning of the pole locations. Trees should be lopped rather than cleared;

The location of the switching substation comprising an area of up to 4 ha is yet to be defined, however the recommendations provided above (in addition to further field studies) will provide guidance on final site selection.

Further detailed surveys are required in relation to a preferred route alignment. There is the potential that habitat is present for a number of threatened flora and fauna species and these will be targeted in further investigations of the selected route.

#### 10.7.1 *Cumulative Impacts*

The proposed transmission line development will occur in parallel with the planned upgrade to the existing 66 kV network as described in **Chapter 3** Project Description and the Boco Rock Wind Farm. Given the nature of the transmission line infrastructure, and with respect to the guideline mitigation measures above, ecological impacts are anticipated to be minimal. The greatest single impact will result from the siting and construction of the switching substation. This will comprise an area of 4 ha and be located close to the existing lines. However with respect to the management and mitigation measures outlined above for construction works and negligible operational maintenance, cumulative impacts are not considered a significant impact. However, if necessary, an assessment will be included in the Review of Environmental Factors for the transmission line.

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